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August 21, 2009

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Subject: Final Data Summary Report, Formosa Mine Site

Dear Ms. Baker-Kircher,

CDM is pleased to submit the Final version of the Data Summary Report for Formosa Mine Site. CDM is submitting three copies to EPA with this deliverable. Additional copies (hard copy and/or electronic versions) have been sent to those on the copy list at your request.

If you have any questions or concerns, please call me at (720) 264-1121.

Very truly yours,

Dee Warren

Dee Warren, PMP
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Response Action Contract
for Remedial, Enforcement Oversight, and Non-Time Critical Removal Activities at Sites of Release or Threatened Release of Hazardous Substances in EPA Region 8

U.S. EPA Contract No. EP-W-05-049

Final Data Summary Report
Formosa Mine Superfund Site
Douglas County, Oregon

Work Assignment No. 221-RICO-10EL

June 30, 2009

Prepared for:

U.S. Environmental Protection Agency
Region 10
Seattle, Washington

Prepared by:

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June 30, 2009

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Acronyms

δ	delta
% R	percent recovery
°C	degrees celsius
ABA	acid base accounting
ABA, Inc	Aquatic Biology Associates
ACSGL	USGS Analytical Chemistry Services Group Laboratory
aka	also known as
amsl	above mean sea level
AP	acid potential
ASTM	American Society for Testing and Materials
ARD	acid rock drainage
$BaSO_4$	Barite
bgs	below ground surface
BLM	U.S. Bureau of Land Management
CAS	Columbia Analytical Services, Inc.
CDM	CDM Federal Programs Corporation
COPCs	compounds of potential concern
CPECs	compounds of potential ecological concern
$CaCO_3$	calcite
$CaMg(CO_3)_2$	dolomite
$CaSO_4 \cdot 2H_2O$	gypsum
Cu_2S	chalcocite
Cu_5FeS_4	bornite
$CuFeS_2$	chalcopyrite
DOGAMI	Department of Geology and Mineral Industries
DQOs	Data Quality Objectives
Dynamac	Dynamac Corp.
E&E	Ecology and Environment, Inc.
e.g.	for example
EPA	U.S. Environmental Protection Agency
EPT taxa	Ephemeropterans, plecopterans, and trichopterans (mayflies, stoneflies, and caddisflies, respectively)
ESL	Environmental Services Laboratory
Fe^{2+}	ferrous iron
Fe^{3+}	ferric iron
FEI	Formosa Exploration Inc.
FeS_2	pyrite
FPXRF	Field Portable X-Ray Fluorescence
FRC	Formosa Resources Corporation
FS	feasibility study
ft	feet
ft/s	feet/second

gal	gallons
gpm	gallons per minute
H^+	hydrogen
HC	Hart Crowser Inc.
HCI	hydrochloric acid
HDPE	high density polyethylene
HHEBRA	human health and ecological baseline risk assessment
ICPES	inductively coupled plasma emission spectrometry
i.e.	for example
in	inches
IRAM	Interim Remedial Action Measure
µm	micrometer
L	low bias qualifier
LCS	laboratory control sample
Mil	one-thousand of an inch
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mm	millimeter
MS/MSD	matrix spike/matrix spike duplicate
NARSC	North American Regional Science Council
NCA	North Creek analytical, Inc.
Norecol	Norecol Inc.
NOV	Notice of Violation
NP	neutralization potential
NP:AP Ratio	Neutralization Potential to Acid Potential Ratio
NNP	net neutralization potential
NPL	National Priorities List
NWQL	USGS National Water Quality Laboratory
OAR	Oregon Administrative Rule
ODEQ	Oregon Department of Environmental Quality
ODEQ Laboratory	Oregon Department of Environmental Quality Laboratory
ODFW	Oregon Department of Fish and Wildlife
ORP	oxidation reduction potential
OWEB	Oregon Watershed Enhancement Board
PbS	galena
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RA	removal assessment
RAC	remedial action contract
RBC	Risk based concentration
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
SA	site assessment
SAP	Sampling and Analysis Plan

Site	Formosa Mine Superfund Site
SLs	screening levels
SMOW	standard mean ocean water
SPLP	synthetic precipitation leaching procedure
START	Superfund Technical Assistance Response Team
TAL	Target Analyte List
$(Cu, Fe, Zn, Ag)_{12}As_4S_{13})$	tennantite
$(Cu, Fe, Zn, Ag)_{12}Sb_4S_{13})$	tetrahedrite
TCLP	toxicity characteristic leach procedure
TDS	total dissolved solids
t/kt $CaCO_3$ eq.	ton per kiloton calcium carbonate equivlent
TSS	total suspended solids
U	Non-detect qualifier
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UV	Ultraviolet Radiation
ZnS	sphalerite

Executive Summary

This report summarizes available information about the Formosa Mine Superfund Site that existed prior to the site being added to the U.S. Environmental Protection Agency's (EPA) National Priorities List in September 2007. This report compiles previous technical work conducted at the site into one document, evaluates the compiled information holistically to build on the interpretations developed by separate investigations or agencies, and develops recommendations for future work that EPA needs to complete to figure out the best way to clean up the site.

E.1 Introduction to the Formosa Mine Site:

The abandoned Formosa Mine, in southwest Oregon, discharges millions of gallons of acid rock drainage (ARD) and toxic metals into the upper reaches of Middle Creek and South Fork Middle Creek every year. Habitat for aquatic life in the Middle Creek Watershed, which once included endangered Coho salmon and other sensitive aquatic species, is absent or severely damaged for 18 miles downstream of the mine.

The Formosa Mine Superfund Site was added to the EPA's National Priorities List in 2007. EPA will develop a long-term remedy for the site in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

E.2 Data Compilation and Evaluation

Information on mine history, previous investigations, extent of mine workings, geology, surface water, groundwater, mine waste and contaminated soil was gathered from many federal, state, county, city, tribal and private sources. Data quality was assessed and those data meeting quality standards were compiled in this report. Findings include:

Mine History

After being established in the mid-1920's, the Formosa Mine operated intermittently until 1993 to produce copper, zinc, silver and gold. Major periods of mine activity include 1928 to 1931, 1936 to 1937, and 1990 to 1993, when substantial underground workings and other mine related infrastructure were developed. Reclamation of mine disturbance and construction of an ARD diversion pipeline were undertaken in 1993 and 1994. However, operation and maintenance of the ARD diversion pipeline between 1994 and 2009 is not preventing discharge of ARD into area surface water and groundwater.

Previous Investigations

Previous investigations include geology and environmental investigations in the mid to late 1980's; routine site inspections and reports completed during the early 1990's; and environmental investigations completed by ODEQ, USGS, and BLM in the late 1990's to early 2000's. Much of the information is usable for the on-going EPA investigation.

Extent of Mine Workings
The mine is approximately 700 feet deep, and consists of a network of underground tunnels and mining areas. Historical surface disturbance associated with the mine includes mine waste piles, portals into the underground workings, and mineral processing facilities. Existing maps and records provide a valuable overview in terms of defining the extent of underground mine workings and historical areas of surface disturbance but additional work is needed to fill data gaps and complete the picture.

Geology
A series of reports prepared in the 1980's provide information about the massive sulfide deposit that contained valuable metals such as copper, zinc, silver and gold. However, these deposits also contain large quantities of minerals that can lead to ARD when exposed to the atmosphere by the mining process.

Surface Water
ARD flows into Middle Creek, the South Fork Middle Creek and may flow into other streams from two reclaimed mine portals, numerous groundwater springs, and areas of mine waste on the surface. The ARD discharge rate is highest during high precipitation and snow-melt in the winter.

Groundwater
Groundwater quality has been impacted in the areas of previous mineral processing activities and the underground mine workings. Existing information is not sufficient to define the current extent of groundwater contamination.

Mine Waste and Contaminated Soil
Surface and near-surface mine waste is a source of ARD. In addition, natural soils contaminated by previous and on-going discharges of ARD represent secondary sources of toxic metals. The extent of surface and near-surface mine waste and contaminated soils is currently unknown.

E.3 Recommendations for Future Work

This report recommends specific additional work necessary to fill identified data gaps This future work will focus on physical characteristics, the nature and extent of contamination, and risk assessment aspects of the Site that were either not previously studied or that require additional follow-up studies.

Recommendations for further work related to physical characteristics include:

- Compile information on the **extent of underground mine workings**
- Determine the extent of **surface and near-surface ARD sources**
- Evaluate the **performance of existing reclamation**.
- Compile additional **climate data** and assess potential for repairs/modifications at the existing Silver Butte Peak weather station.

- Complete additional work needed to understand s**ite geology** in relation to potential ARD control methods.
- Collect additional information regarding seasonal fluctuations in **surface water flow rates** and contaminant transport in the Middle Creek watershed.
- Evaluate the role of **groundwater** in transporting ARD.
- Evaluate **site water balance** in order to understand the total volume of ARD that is generated, seasonal fluctuations in ARD discharge rates, and expected ARD volumes during particularly wet years.

Recommendations regarding nature and extent of contamination include:

- **Define the potential for sources** to generate ARD and release toxic metals. This includes primary sources such as exposed surface mine waste and backfilled waste within underground workings, plus secondary sources such as contaminated soils.
- Evaluate the **extent of contamination in groundwater**
- Evaluate the current **extent of contamination in surface water and stream sediments** to define the downstream extent of contamination.

Recommendations regarding risk assessment include:

- Complete a **human health and ecological risk assessment** for the site.
- Planning of future work related to **human health and ecological risk assessment** should be completed in the near future.

Conclusions and Acknowledgements

This data summary report is one of the first steps in this process of stopping ARD discharge from the Formosa Mine Superfund Site and cleaning up ARD related contamination. This report enables EPA to incorporate previous work completed by the ODEQ, BLM and others into the RI/FS process, focus future investigations and avoid duplication of effort between EPA and previous investigators.

EPA acknowledges valuable information and assistance provided by the state of Oregon; BLM; the city of Riddle; the Cow Creek Band of the Umpqua Tribe of Indians; and former Formosa mining engineer Jay Wilson. In addition, the U.S. Geological Survey provided technical review and CDM Federal Programs Inc. prepared the report under contract to EPA.

Section 1
Introduction

CDM Federal Programs Corporation (CDM) has prepared this data summary report for the U.S. Environmental Protection Agency (EPA) Region VIII for the Formosa Mine Superfund Site (Site) in Douglas County, Oregon. This work was conducted as Phase 1 of the remedial investigation/ feasibility study (RI/FS) process under the Region VIII remedial action contract (RAC) 2, number EP-W-05-049.

This data summary report provides a Site description and history, a description of previous investigations conducted, a review of quality assurance and quality control (QA/QC) protocols used during sampling investigations, a summary and analysis of the data set, and recommendations for the RI sampling program. The purpose of this report is to provide EPA and others with a summary of previous environmental sampling data, in order to provide the basis and recommendations for the RI.

This report is organized into the following sections:

- Section 1 – Introduction
- Section 2 – Previous Investigations
- Section 3 – Quality Assurance/Quality Control
- Section 4 – Data Summary
- Section 5 – Recommendations
- Section 6 - References

1.1 Site Location and Description

This section provides summary information related to the Site location and environmental setting.

1.1.1 Site Location

The Site is an abandoned mine located in southwest Oregon in Douglas County, approximately 25 miles south of Roseburg, Oregon and 7 miles south of Riddle, Oregon, within Sections 23, 26, and 27, Township 31 South, Range 6 West Willamette Meridian. It is located in the Coast Range Klamath Mountains at elevations between 3,200 and 3,600 ft (ft) above mean sea level (amsl) near Silver Butte Peak (3,973 ft amsl). Surface terrain is characteristic of steep mountains, narrow ridges, and deep canyons. The Site location is shown on Figure 1-1.

1.1.2 Land Ownership

The former mine area of the Site is mostly located on private land owned by Formosa Exploration Inc. (FEI), with some areas owned by U.S. Bureau of Land Management (BLM). BLM, as well as a mix of private timber companies, also owns some land adjacent to the mine area. Land ownership boundaries are shown on Figure 1-2.

1.1.3 Watersheds and Drainages

The Site is located within the South Umpqua Basin, one of three sub-basins in the Umpqua Basin, and is situated near the top of a mountain ridge that divides several sub-watersheds. The Russell Creek-Cow Creek sub-watershed lies to the North of the Site, the Middle Creek sub-watershed lies to the west and south, and the Canyon Creek sub-watershed lies to the southeast and east. Russell Creek and West Fork Canyon Creek are the main drainages in the Russell Creek-Cow Creek and Canyon Creek sub-watersheds that have headwaters near the Site. Within the Middle Creek sub-watershed, both upper Middle Creek and South Fork Middle Creek have headwaters near the Site. Watersheds and drainages are shown on Figure 1-3.

1.1.4 Vegetation

Native vegetation within the vicinity of the Site consists of old growth Douglas fir and western hemlock forest (i.e., greater than 80 years) and a mix of younger growth forest in various stages of re-growth after timber harvest. Old growth forest consists of large stands of Douglas fir and western hemlock and generally sparse undergrowth, with some deciduous trees such as golden chinkapin and Pacific madrone intermixed. Younger growth forest typically has more dense undergrowth of deciduous trees and brush, which is routinely slashed during later stages of growth of the merchantable coniferous timber.

1.1.5 Precipitation

Precipitation in Klamath Mountain region can vary between 40 inches and 120 inches per year, dependent on the elevation and distance from the ocean. Generally, precipitation can range from 50 inches to 120 inches per year at elevations greater than 3,200 ft amsl and from 40 inches to 55 inches at elevations less than 3,200 ft amsl (BLM 2002). Current data indicates precipitation near the Site ranges from 30 – 55 inches per year. The bulk of precipitation falls during the winter months (November through March), which brings a high surface water flow that generally peaks between January and February and declines through the remainder of the spring, summer, and fall. Precipitation during winter months may fall as snow in higher elevations, especially above 3,200 ft amsl. Additional detail on Site precipitation records is provided in Section 4.3.1.

1.1.6 Site Features

The main Site features include five reclaimed adit portals (Formosa 1, Formosa 2, Formosa 3, Silver Butte 1, and 1090), the 404 adit (not reclaimed), the former mill site, former crusher site, former million gallon tank site, former ore storage area, former water and tailings storage pond (now referred to as the encapsulation mound), various seeps located downslope from the encapsulation mound within the South Fork Middle Creek drainage basin, various seeps located downslope of the Formosa 1 adit (as also known as [aka] Formosa adit) within the Middle Creek drainage basin, access roads, various waste rock dumps and associated fills, and the Interim Remedial Action Measure (IRAM) adit water diversion pipeline (installed in 2000). These main

Site features are shown in Figure 1-4, with exception to seep locations. Note that only general locations of waste rock dumps and other former mine features are shown.

1.2 Site History

This section describes the history of the Site, starting from the first exploration in the early 1900s until present day. This section is limited to exploration, mining, and reclamation history. Detailed descriptions of sampling investigations are provided in Section 2.

1.2.1 Early Mining and Exploration

Geologic exploration activities in the area of the Formosa and Silver Butte Mines (formerly referred to together as the Silver Peak Mine) were first conducted in 1910 (Shenon 1933). Mineral rights to the Section 26 portion of the mine were obtained in 1912 with the purchase of a 160-acre patented timber claim. In 1920, the Oregon Exploration Company located lode claims in Section 23 and over part of the Section 26 timber claim. By 1926, the Oregon Exploration Company commenced underground mining and shipping of ore. Litigation ensued over property rights ownership until 1929 when all land claim rights were turned over to the Silver Peak Copper Company (later renamed the Silver Butte Mining and Milling Company). Mining discontinued for one year in 1927. Despite the litigation, mining and shipping of ore continued in 1928 through 1931, and again in 1936 through 1937. (Derkey 1982; Formosa Resources Corporation [FRC] 1987; Ramp 1972)

During this early period of mining, waste rock was dumped on the hillsides adjacent to the adit portals and roads, as was typical during that era of mining. Waste rock dumps from this era of mining are reported to be present beneath the current road and along the angle of repose slopes adjacent to the Formosa 1 and Silver Butte 1 adits (Wilson 2009). All mining was done above the Formosa 1 adit elevation, so that all new workings could be drained of water by gravity through the Formosa 1 adit. As a result, the Site was left with a legacy of acid rock drainage (ARD) that formed in the network of underground workings and then flowed out of the lower adits and into the headwaters of Middle Creek (Department of Geology and Mineral Industries [DOGAMI] 1994). Since the 1930s until modern mining, approximately 5 gallons per minute (gpm) to 20 gpm of ARD flowed out of the Formosa 1 adit and up to 10 gpm flowed out of the Silver Butte adit (DOGAMI 1994, 1996).

During the period 1926 through 1937, the Silver Peak Mine produced 6,620 short tons of ore, which yielded 735,600 pounds of copper, 231,980 ounces of silver, and 490 ounces of gold (Ramp 1972). Zinc was also present in the same ore body as sphalerite (ZnS), although zinc was not considered a marketable metal at the time. Between 1926 and 1931, smelters charged a penalty for high zinc levels present in shipped ore (Derkey 1982). As a result, ore with very high zinc content was left behind by the miners, and ore was shipped with as low zinc content as possible by blending ores from various parts of the mine (Derkey 1982).

1.2.2 Modern Exploration

Later development work was conducted in 1952 by the Umpqua Consolidated Mining Company, which involved rehabilitation of some of the underground mine workings (FRC 1987). Various geologic explorations were conducted over the later years. R.E. Derkey completed a doctoral dissertation on the geology of the Silver Peak Mine in 1982, which was the most extensive report published to date (Derkey 1982).

From 1976 to 1979 the mine and adjoining lands were under lease to Chevron Resources Company (FRC 1987). A series of geochemical and geophysical surveys were performed as well as drilling exploration, although Chevron did not pursue mining operations (FRC 1987). In 1984, FRC (formerly Rand Ventures Inc.) had acquired a portion of the mine and adjoining properties. From 1984 through 1989, FRC conducted an extensive geologic exploration program to further define the quantity and location of ore reserves. This work was first conducted both on claims that FEI owned and on claims leased from the Silver Butte Mining and Milling Company.

In May 1987, FRC (incorporated in Canada) established a subsidiary company called FEI based in Roseburg, Oregon in order to further conduct exploration activities (FRC 1988). In July 1987, the mineral claims owned by FRC and the mineral lease and option to purchase agreement with Silver Butte Mining and Milling Company were assigned to FEI.

1.2.3 Modern Mining

Based on the extensive exploration by FRC/FEI, significant ore reserves were determined to be present and the company began to pursue opening an active mining operation at the Silver Peak Mine around 1988. As part of the permitting process, FEI's contractor (Norecol Inc. [Norecol]) conducted a baseline environmental study in order to document conditions prior to initiation of modern mining activities. This work was conducted in 1988 and 1989.

In spring of 1990, Oregon DOGAMI approved FEI's mine operating permit. Underground mining was conducted by FEI from early summer 1990 until August 1993. During this modern period of mining, FEI mined copper and zinc ore at a rate of 350 tons to 400 tons per day. About 62,000 tons of ore and 25,000 tons of waste rock were removed from the Silver Peak Mine during this period of mining (DOGAMI 1995).

Ore was crushed, screened, and sent to a flotation mill located onsite to produce zinc and copper concentrates. Copper concentrates were shipped to Japan for smelting. Zinc concentrates were reportedly only created during early production, stockpiled onsite, but never shipped to a smelter due to the low volumes produced and low zinc prices (DOGAMI 1995). Waste tailings from the flotation process were stored onsite within the 2 acre lined water and tailings storage pond and were also backfilled into the mine workings as part of normal operation and later as part of reclamation activities. Waste tailings consisted of finely ground (i.e., less than 400 mesh) pyrite

and gangue minerals such as quartz, barite, and sericite. Trace amounts of chalcopyrite (copper-bearing sulfide) and sphalerite (zinc-bearing sulfide) not removed by the flotation process were also likely present. During later years of mining, when zinc processing was no longer profitable, tailings likely contained much higher amounts of finely ground sphalerite. FEI's operating permit required that backfilled tailings were to be mixed with cement for stabilization prior to placement; however, it has been reported that cement was not used during backfill of some of the workings (DOGAMI 1995; Wilson 2009). Larger sized waste rock (ore, lean ore, and non-reactive rock) was stored at various locations at the Site.

Onsite inspections in 1993 revealed several violations of FEI's permit conditions (DOGAMI 1990 – 1999). In January and July 1993, DOGAMI issued a Notice of Violation (NOV) to FEI for numerous violations of permit conditions (DOGAMI 1990 – 1999). By August 1993, DOGAMI had issued a Closure Notice for failing to correct the problems identified in the NOV within the 30 day compliance period (DOGAMI 1993). On August 1, 1993, the mine officially ceased operations (DOGAMI 1995).

1.2.4 Mine Reclamation (1993 – 1994)

The majority of reclamation at the Site by FEI was conducted from August 1993 through August 1994. Due to the repeated failure of the adit water diversion system and its required maintenance, reclamation at the Site has continued since the mine shutdown until present day. When mine operations ceased in 1993, the reclamation plan and bond money originally set forth in the 1990 operating permit was determined inadequate for current conditions at the Site (FEI 1995). As a result, the reclamation bond administered by DOGAMI was increased from $500,000 to $980,000 (DOGAMI 1995). Reclamation was conducted as a cooperative effort between DOGAMI, ODEQ, and BLM. The overall dollars spent by FEI is reported to be over $1,000,000, and the amount spent over the reclamation bond came from Formosa's Japanese investors (DOGAMI 1995). Summaries of reclamation activities are described below (DOGAMI 1990 – 1999, 1995, and 1996; Heenan 2000):

- *Removal of crusher* – The crusher and foundation were removed from its location next to the Formosa 1 adit. This work was completed by January 14, 1994.

- *Removal of stockpiled ore* - Approximately 750 tons of crushed ore was stockpiled to the north of the mill at the time of mine closure (former ore storage area). All of this material was reportedly backfilled into the underground workings by January 14, 1994. Approximately 17,000 tons of low-grade crushed ore was also relocated from the million-gallon storage tank area over to the south side of the tailings pond for placement into the pond. This work was completed by April 8, 1994.

- *Removal of zinc concentrate dump site* - Zinc concentrate was created during early milling operations but never shipped. During mining, the concentrate was stored in a covered shed on the west side of the water and tailings storage pond and then later dumped over an embankment on the east side of the mill site. The dumped

concentrate was then removed during reclamation and placed in the underground workings as described below.

- *Cleanup of diesel fuel spills* - Diesel was stored onsite and used for all operating equipment. FEI had not used any secondary containment structures or devices for collecting fuel spills during refueling; therefore fuel was spilled and uncontained in many areas. Contaminated soil was excavated from various spill areas and piled on the former million-gallon tank area. The pile was treated using a bioremediation process to break down the diesel fuel; however, the effectiveness of this process was slow due to the low soil pH. Some samples were collected from the bioremediation pile for total petroleum hydrocarbon diesel (TPH-g). Concentrations were reported to have decreased to 200 milligrams per kilogram (mg/kg) TPH-g, although the cleanup target was 100 mg/kg TPH-g. Oregon's Department of Environmental Quality (ODEQ's) permit for the diesel-contaminated soil cleanup had expired prior to the completion of the bioremediation, and in 1996 remaining reclamation bond funds were prioritized for the adit water diversion system (see Section 1.2.5 below). The pile was reportedly amended and seeded after bioremediation.

- *Removal of sulfide tailings from upper Middle Creek* - During mining operation, finely ground pyrite and other sulfide tailings materials generated at the crusher and from truck operations had washed from the crusher area and road into the Middle Creek headwaters. Approximately 20 tons of sulfide tailings materials were estimated to have spilled into upper Middle Creek. The approach to remove the sulfide materials included removal of down timber and brush, raking and washing the stream sediment into a funnel, and then transporting by 4-inch pipe to a collection basin near the sampling location MXR. The flatter stream gradient and road access at MXR provided conditions needed to build an adequate collection basin. Removal of tailings beyond location MXR was not conducted, although it was assumed at the time that the majority of tailings would have been captured at MXR because of the flatter stream gradient. Materials were then removed from the collection basin and trucked back up to the mine for disposal. The cleanup process was completed by May 6, 1994 and the pond was decommissioned and backfilled by June 1994.

- *Backfill of mine workings with crushed ore, tailings, and other materials* - Crushed ore stockpiled on the surface was placed in the workings below the Formosa 1 level. Zinc concentrate stockpiled at an illegal dump site was removed and backfilled into the 1090 raise. The mine openings above the Formosa 1 adit were filled mostly with tailings. Sulfide tailings materials collected from the upper Middle Creek cleanup were also backfilled into the underground workings. All backfill operations were completed by July 15, 1994.

- *Reclamation of mine portals* - Backfill at the Formosa 1 and Silver Butte 1 adit portals consisted of the following materials (in order of placement): a wooden and burlap bulkhead, crushed limestone backfill, an 8 in acid-resistant concrete cap, and an

outer rock cover. Three-inch high density polyethylene (HDPE) drainpipes were placed along the entire base of the backfill structures and were fitted with perforated cross drains spaced periodically along the pipelines. On the inside of the wooden bulkhead, vertical riser pipes with an open top were installed. Drainage pipes were constructed of 2-inch (-in) HDPE that directed adit water out of the adits, beneath the road, and over the embankment into drainfield areas. The drainfield areas were located downslope of the Formosa 1 and Silver Butte 1 adits. The backfill structure was similar for the Formosa 2 and Formosa 3 adits; however, no drainage pipe or bulkheads were installed in these adits and no limestone backfill was placed for the Formosa 3 adit. The fifth portal, the 1090 raise, was backfilled with zinc concentrate, non-reactive waste rock (non-acid generating), a 3-ft bentonite seal, a 6-in steel reinforced acid-resistant concrete cap, and a soil cover. All mine portal reclamation work was completed by August 4, 1994. The access road constructed to access all of the upper workings was also recontoured and revegetated.

- *Removal of crib wall fill and wood wall structures* – Various crib wall structures were built on the slopes on both sides of the mill site and water and tailings storage pond to increase the available surface area for mine operations. The walls were built of wood and steel rebar and fill material was placed behind the wall. The crib wall fill originated from the water and tailings storage pond excavation. The fill was also mixed with mine waste during placement in the crib walls. During reclamation, the crib walls were removed and the fill was excavated and placed over the mill foundation and used as the encapsulation mound cover, as described further below. Since mine waste was mixed with the crib wall fill, this material may be acid generating. After the fill and wall material was removed, an attempt to revegetate the slopes was made by adding straw, paper mulch, tacktifier, and seed.

- *Removal of the mill building and all processing equipment* - The process to remove the mill building and equipment began in 1994 and all material was sold or removed from the Site by June 1995; however, the building foundation was left in place. Sulfide materials were washed off of the foundation and crib wall fill was placed over the foundation. Revegetation efforts for the mill site area were apparently similar to that of the encapsulation mound area (described below).

- *Backfilling and capping of water and tailings storage pond* - During mining, the volume of workings available for backfilling was consistently smaller than the volume of tailings generated. As a result, a significant amount of tailings were stored in the water storage pond (now referred to as the encapsulation mound). During reclamation, the majority of tailings were placed in the underground workings; however, some tailings remained in the pond. These tailings were spread to act as bedding for the pond liner. Seventeen thousand tons of low-grade ore was backfilled onto the remaining tailings, followed by the Bentomat cover, and a 5 ft to 7 ft thick soil/rock cover. Fill placed behind the crib walls was used as the soil/rock cover material. Samples collected from various crib wall fills indicated that the material did contain some acid generating potential. Approximately 20 tons per

acre limestone (one quarter finely ground agricultural limestone and three quarter crushed limestone) were mixed into the top of the soil/rock cover in an attempt to prevent acid generation. After limestone treatment, approximately 42,000 gallons of biosolids from the Riddle wastewater treatment plant were tilled into the top of the cover, and the area was mulched (straw), seeded, and planted with blackberry cuttings and Douglas fir saplings. Down logs were also placed sporadically on the cover. Wood from the crib walls was also incorporated into the top of the cover. The encapsulation mound cover was completed in August 1994.

- *Million-gallon tank removal* - The million-gallon tank was built in spring 1993 and was used for process water storage during milling operations. The foundation for the tank was built on crushed ore. The tank was subsequently removed and sold during reclamation. Precipitation solids in the tank bottom were pumped into the underground workings. Details of reclamation of the crushed ore foundation or attempts at revegetation are unknown.

1.2.5 Adit Water Diversion System Observations and Maintenance (1995 – 1999)

By February 1995, the Formosa adit water diversion pipeline was documented to be plugged and seeps were observed flowing out of the fill rock covers of both the Formosa and Silver Butte adits. The seep water was observed flowing into the ditch and down into Middle Creek. In March 1995, rocks were removed from a section of the Formosa adit pipeline, which had caused the blockage. Water was flowing again in the Formosa adit pipeline; however, adit water was still seeping out of the rock fill. Further work was conducted through 1995 such as re-grading the road and adding water bars, in an attempt to route seeping adit water from both adits over the road and onto the hillside. (DOGAMI 1990 – 1999; Heenan 2000)

The high iron content of the adit water caused formation of iron precipitate scale in the drainage pipes, which soon became a difficult maintenance problem. Due to significant scale buildup very little water was observed flowing through the adit drainage pipes during the winter of 1995/1996. Attempts to clean out the scale proved to be futile and flow eventually ceased in the Formosa adit pipeline. All adit drainage flow was then a combination of subsurface flow and surface flow that ended up in Middle Creek. (DOGAMI 1996)

FEI officially abandoned the Site in April 1996. The amount of money left in the reclamation bond at this time was $40,370 (DOGAMI 1996). The remaining bond money was used for additional monitoring and repair to the Formosa adit water diversion system. The Formosa adit water diversion system was rebuilt in the fall of 1996. Fill material was removed near the adit portal, three 10-in perforated drainpipes were installed in parallel, coarse rock was backfilled onto the pipes, and a manhole was built to access the drainpipes for cleaning out precipitate (DOGAMI 1990 – 1999; Heenan 2000). A French drain was also installed below the perforated pipe (Heenan 2000). The remaining pipeline down to the drainfield was constructed of 6-in polyvinyl chloride (PVC) with cleanouts spaced at 75-ft intervals (DOGAMI 1990 –

1999). Some rehabilitation work was also conducted on the Silver Butte adit water diversion system during this time (DOGAMI 1990 – 1999).

DOGAMI inspections in 1997 indicated that the Formosa adit water diversion system was functioning, although new scale buildup was occurring, mostly near the drainfield (DOGAMI 1990 – 1999). Regular removal of scale was conducted through the cleanout ports to keep the pipe flowing, but the process was costly and difficult. In November 1997, a new 100-ft section of 6-in pipe was installed at the drainfield end and at a steeper gradient than the previous pipeline, with the idea that a faster flow caused by the steeper gradient would reduce scale buildup (DOGAMI 1990 – 1999).

Inspections in March and May 1998 documented a small seep flowing out of the backfill around the Formosa adit and into the ditchline down to Middle Creek, and that the collection piping system was clogging with precipitate scale (DOGAMI 1990 – 1999; Heenan 2000). Regular cleanout of scale was continued through 1998, and in September additional work (trenching and adding new coarse drainage rock) was conducted at the Formosa adit portal to fix the scaling and collection problems (DOGAMI 1990 – 1999). In 1998, the remaining Formosa bond money had been spent and other options were pursued to obtain funding for continued maintenance on the adit water diversion systems and for additional assessment at the Site. Also in 1998, some positive recovery of upper Middle Creek was noted; however, acidic groundwater was determined to be seeping into Middle Creek causing adverse affects (Heenan 2000). A detailed topographic survey was conducted in 1998 by BLM to identify the location and elevation of the groundwater seeps in relation to the underground workings (Heenan 2000).

Due to heavy winter snow (1998/1999) access to the Site was apparently not possible until April 1999 (Heenan 2000). At this time, the collection system had become completely plugged with scale, and a large flow of adit seep water was flowing into Middle Creek (Heenan 2000). Some surface work was conducted to divert water out of the road ditch and into the adit diversion system (Heenan 2000).

1.2.6 Baseline Remedial Investigation and IRAM

Starting in June 1999, BLM in cooperation with ODEQ began an extensive baseline RI at the Site. Through North American Regional Science Council (NARSC) funding, BLM also hired Dynamac Corp. (Dynamac) to conduct a site assessment (SA) in October 1999.

In March 2000, ODEQ declared the Site a State Orphan site, which is a designation in the State of Oregon for sites contaminated by a release of hazardous substances that pose serious threats to human health or the environment where the parties responsible for the contamination are either unknown - or unable or unwilling - to pay for needed remedial actions. Hart Crowser Inc. (HC) was hired by ODEQ to conduct an investigation at the Site and to design and build the IRAM adit water diversion and treatment system. A removal assessment (RA) report was prepared by HC in September 2000 (HC 2000), and construction of the adit water diversion system

portion of the IRAM began in the fall of 2000 and was completed by November. The intent of the IRAM was to collect and treat the adit water; however, the dispute over private land ownership prevented a passive wetland treatment system from being built as initially designed (HC 2001a). The IRAM construction completed in 2000 consisted of the following elements:

- Excavation of a 20 ft by 15 ft receiving basin at 5 ft deep, lined with bentonite and a layer of limestone. Both the Formosa and Silver Butte adit flows were directed into the basin.
- Installation of four gravity draining aeration tiers downgradient of the receiving basin, constructed of open top 24-in HDPE pipe, each placed with about 4 to 5 ft drop in elevation. Flow at the last tier transitioned to a 120 ft of limestone drain constructed of closed 12-in HDPE pipe.
- Construction of two concrete vaults for collection of precipitate placed in series along the flow path after the limestone drain. The first vault can hold 5,460 gallons (gal) of water and the second vault can hold 3,870 gal of water.
- Construction of remainder of drainage pipes to the new drainfield using 12-in HDPE. Flow was directed under the road after the second concrete vault and then along the hillside (minimum slope of 10 percent) down to a drainfield further to the south than the previous drainfield.
- Re-grading of encapsulation mound and placement of a geotextile layer and 10-mil thick plastic liner (10 one-thousands of an inch). Silt fence was placed along the eastern edge and stormwater ditches were constructed on both the north and south ends draining to the east.

Within a short time, the limestone channel became armored with iron precipitates and was no longer effective in raising pH. Over the following years, precipitate formation and plugging of the diversion pipeline remained a problem due to the high iron content of the adit water. The following observations and maintenance actions were obtained from ODEQ Time Critical Removal Incident Orders (ODEQ 2003 – 2006):

- In October 2003, it was observed that the adit water diversion pipeline had clogged with precipitate prior to the first concrete vault, and a section of pipe after the concrete vaults had been severed due to falling rocks. This resulted in about 5 gpm of adit water flowing into upper Middle Creek. Precipitate was subsequently removed from the plugged pipe sections and vaults, and the broken section of pipe was repaired. The limestone drain section of pipe was also removed and replaced with a new pipe that did not contain limestone.
- In October 2004 and September 2005, repair and maintenance was conducted on the adit water diversion pipeline. Further details on these maintenance visits are unavailable.

- In November 2005, rocks were removed from the adit water diversion pipeline.
- In January 2006, it was observed that runoff from recent rains had breached a surface water runoff control berm, allowing surface water runoff to flow from the road down the hillside causing a 3 ft deep gully to form beneath the adit water diversion pipeline. A support system was subsequently constructed along the eroded section beneath the pipeline, and repairs to the erosion berm and ditches along the road were made.
- In April 2006, it was observed that a pipeline joint had become separated, resulting in discharge of up to 48 gpm of adit water to upper Middle Creek. The pipeline joint was subsequently repaired, and additional support posts were added to the section of pipeline where the joint had failed.
- In December 2006, maintenance was conducted to repair a section of pipeline and clean out precipitate. Further details on this maintenance visit are unavailable.

Additional maintenance and repairs have since been conducted by EPA's removal program. This work is currently ongoing; however, reports of maintenance and repairs completed by EPA are not available at this time.

1.2.7 Additional Investigation and Current Site Status

A supplemental RI was conducted by HC after the BLM/ODEQ RI was completed in May 2000. The supplemental RI continued until June 2002. After the Supplemental RI was completed, HC completed a feasibility study (FS) and a human health and ecological baseline risk assessment (HHEBRA). Both the FS and HHEBRA were completed and their associated reports were published in 2004 (HC 2004a and 2004b).

For the HHEBRA, HC included evaluations of potential receptors and exposure routes for the contaminants present at the Site. For human health, HC investigated exposure to hikers and campers through ingestion and contact with soil, inhalation of soil particulates, and consumption of surface water. HC identified minimal risk to human health, primarily due to the limited exposure by users of the Site.

Ecological risks were evaluated for both aquatic and terrestrial receptors; for aquatic receptors, exposure routes included ingestion and contact with surface water, but potential additional routes also included ingestion and contact with sediment. For terrestrial receptors, primary exposure routes included ingestion and contact with soil, and consumption of surface water. Potentially complete exposure routes included ingestion and contact with sediment, contact with surface water, and inhalation of surface soil particulates. The ecological receptors were of particular importance due to the presence of federally threatened Oregon coast Coho salmon and Northern Spotted owl species; the Steelhead trout was also a candidate species for listing as federally threatened, and has since been named a species of concern. Results of the HHEBRA indicated that risks to terrestrial ecological receptors, including the Northern Spotted owl, were low due to poor habitat conditions and

limited use of resources present in the vicinity of the Site. The HHEBRA identified significant risks to aquatic receptors due to presence of high concentrations of heavy metals.

Since completion of the HHEBRA and FS by HC, sporadic surface water sampling has been conducted by ODEQ and BLM. In 2005, citizens petitioned the EPA to consider adding the Site to the National Priorities List (NPL). In 2006, the Site was proposed for listing on the NPL, and in 2007 was officially added to the NPL.

Section 2
Previous Investigations

This section describes investigations conducted at the Site during the era prior to modern day mining (1982 through 1990), during modern mining operations (1990 through 1993), during the post-modern mining reclamation phase (1993 through 1999), during the BLM/ODEQ RI and FS phase (1999 through 2005), and during the EPA Superfund Technical Assistance & Response Team 3 (START-3) investigation phase (2006).

This data summary report is primarily focused on describing existing Site conditions and identifying the data needs for the RI/FS. The data collected during the BLM/ ODEQ RI phase until present is most useful for achieving this goal; therefore, this report is focused on this set of data, as well as data from the U.S. Geological Survey (USGS) investigation conduction in 1998. Environmental data collected during the early investigations phase (1982 through 1998) is important for understanding and documenting the Site history and conditions; however, this data set is not discussed in this report, with exception to fish and macroinvertebrate sampling data and groundwater data. Geologic data collected as part of mine exploration activities by FEI are not discussed in this report, except where applicable for describing the Site geology and hydrogeology. Surface water quality data from the USGS investigation through 2005 is presented in Appendix A of this report. Data results are presented and discussed in Section 4.

Where applicable, the appropriate reference is provided below in the section header title that applies to that entire section. Additional references are provided with the section body as applicable.

2.1 Early Investigations

This section describes investigations conducted at the Site from the era prior to modern mining (1982 through 1990), during modern mining operations (1990 through 1993, and during the post-modern mining reclamation phase (1993 through 1999). Early investigation data is not summarized or presented in tables for this report, with exception to macroinvertebrate and fish sampling and groundwater data. Because macroinvertebrate and fish sampling data are vital for understanding water quality impacts prior to modern mining, this data are discussed quantitatively in comparison to BLM/ODEQ RI data. Groundwater data collected prior to modern mining is useful in understanding the Site hydrogeological framework.

2.1.1 Pre-Modern Mining (1982 – 1990)

This section describes sampling activities conducted at and near the Site prior to modern mining.

2.1.1.1 U.S. Forest Service Biotic Investigation (USFS 1982 – 1984)

The U.S. Forest Service (USFS) conducted biotic investigations of the Silver Butte area in 1982 and 1984. These biotic investigations included macroinvertebrate sample collection and fish electroshock sampling on Middle Creek and South Fork Middle Creek. Investigation was also completed for Martin Creek, a reference tributary to Middle Creek below the confluence with South Fork Middle Creek. These investigations were completed to determine any impacts the historic mining activities may have had on the Middle Creek watershed. The reference stream, Martin Creek, was included to provide a background value for comparison of the data. Approximate sampling locations on Middle Creek and South Fork Middle Creek are indicated on Figures 2-1a and 2-1b. Locations sampled include the following: M2.0, M7.9, M13.0, SF2.3, SF4.7, and Martin Creek 1982 for fish sampling, and M2.0, M7.9, M13.0, and SF2.3 for macroinvertebrate sampling.

2.1.1.2 FEI Investigations (1984 – 1989)

This section describes both geologic exploration and environmental sampling investigations that were conducted prior to the modern mining period. Starting in 1984, FEI (a subsidiary of FRC) conducted numerous geologic exploration studies near the Silver Peak Mine. Data collected from these studies are extensive and the known body of information exists in two publications from FRC:

- *Summary Report on the 1986 Exploration Work (Phase 1 of Second Stage Exploration) at the Silver Peak Kuroko Project, Douglas County Oregon* (FRC 1987); and
- *Formosa/Silver Butte Project (Kuroko), Douglas County, Oregon, Exploration, 1988 – 1989* (FRC 1988).

In 1988 and 1989, FEI's contractor (Norecol) completed environmental study in order to document conditions prior to initiation of mining activities. This investigation included gathering climate and hydrology data, rock sampling, surface water sampling, fish and macroinvertebrate sampling, and the installation and sampling of groundwater wells. This baseline-sampling program not only documented pre-modern mining conditions, but also established some of the surface water sampling locations that have been continuously sampled throughout the investigation history of the Site. Specific activities for the baseline study are further described below. Data from this baseline study are published in the following report:

- *Formosa Exploration Inc. - Silver Butte Project Baseline Environmental Studies Report* (Norecol 1989a).

Geologic Exploration (FRC 1987 and 1988)

Geologic exploration work was conducted on private land, unpatented mining claims that FEI owned, and on unpatented mining claims leased from the Silver Butte Mining and Milling Company. Exploration activities generally included surface mapping, underground mapping and sampling, a geochemical soil survey, a geophysical survey, regional mapping and prospecting, surface core drilling,

underground rehabilitation, and underground core drilling (FRC 1987 and 1988). The intent of this work was to document and estimate the ore reserves available for mining.

Geochemical Sampling (Norecol 1989a)
Geochemical sampling was conducted as part of exploration activities and as part of the baseline environmental study. For the baseline study, 25 samples of typical waste rock materials were collected and analyzed for acid base accounting (ABA) parameters. This work was conducted to determine the potential for these rock materials to generate acid. Rock types sampled included non-mineralized tuff (7 samples), ore (3 samples), oxidized tuff (4 samples), and quartz sericite pyrite tuff (11 samples).

Climate and Hydrology (Norecol 1989a)
Climatic data were also gathered from the National Climatic Data Center for the Riddle and Sexton Summit climate stations. The Sexton Summit climate station is most representative of the climate at the Formosa Mine because of its similar elevation. Climate records for the Silver Butte Fire Lookout Station (located on Silver Butte Peak) were also obtained for the period September 1988 to April 1989 from the regional BLM office in Roseburg, OR.

Regional stream flow data were obtained from two long-term USGS stream-gaging stations on Cow Creek (Stations 14309000 and 14310000). Baseline stream flow data were gathered with the installation of staff and crest gages on South Fork Middle Creek (location SF#1) and West Fork Canyon Creek (C1 - Norecol) in October 1988 and on Middle Creek (M1) in May 1989. In addition to these stream gage locations, stream flow measurements were also recorded at a location in St. John Creek (S1 - St. John), on Russell Creek (R1), and in an unnamed tributary to South Fork Middle Creek (X1).

Approximate sampling locations are shown on Figures 2-2a through 2-2c. Locations were estimated based on available maps from the Norecol report and DOGAMI files. Location M1 is synonymous with modern day sampling location M3.0 (on Middle Creek just upstream of South Fork Middle Creek confluence). Location SF#1 is comparable to modern day location SF4.7 (on South Fork Middle Creek just upstream of its confluence with Middle Creek); however, location SF#1 is about one-half mile upstream of SF4.7. Locations C1 - Norecol and R1 in West Fork Canyon Creek and Russell Creek appear to have been at different locations than any modern day locations but still adequately represent water flow and quality in those creeks, and are comparable to other modern day sampling locations. X1 was located on the same tributary to South Fork Middle Creek as modern day sample location SFREF1 and SFREF2. No subsequent flow measurements were collected from St. John's Creek after this baseline study.

Surface Water Sampling (Norecol 1989a)

Baseline surface water sampling was conducted from October 1988 through July 1989. Samples were collected initially in October 1988 at the Formosa adit, and locations on Middle Creek (M1), South Fork Middle Creek (SF#1), West Fork Canyon Creek (C1-Norecol), and Russell Creek (R1). Sampling events were conducted again in January 1989, February 1989, March 1989, May 1989, and July 1989; however, not all locations were sampled for each event. The Silver Butte adit was also sampled once in February 1989, and samples were collected from an unnamed tributary to South Fork Middle Creek (X1) in May and July 1989. In March 1989, water samples were also collected from within the Formosa adit at a distance of approximately 50 meters and 200 meters from the portal. The 200 meter sample is reported to have been collected from the ore zone. All water samples were analyzed for several dissolved and total metals, sulfate, nitrate, nitrite, ammonia, phosphorous, cyanide, alkalinity, turbidity, total dissolved solids (TDS), total suspended solids (TSS), hardness, conductivity, oxidation-reduction potential (ORP), temperature, and pH. Surface water sampling locations are shown on Figures 2-2a through 2-2c.

In May 1989, additional surface water locations were sampled to better understand how groundwater near the underground workings was affecting metals concentrations in Middle Creek surface water and at other locations. Surface water samples were collected at several locations along the stretch of upper Middle Creek starting at the headwaters near the Formosa adit and downstream approximately 1.6 miles, as well from seeps at other areas of the Site. The following locations were sampled within the vicinity of Middle Creek (listed in order of upstream to downstream): MA, MB, MC, MD, ME, MF, and MG. These samples were only analyzed for total metals; aluminum, barium, cadmium, copper, iron, manganese, and zinc. These locations shown on Figure 2-2c and described below.

Locations MA (aka Seep A) and MB (aka Seep B) are the two eastern most groundwater seeps that contribute to the headwaters to Middle Creek near the Formosa adit. These seeps are located in Township 31S, Range 6W, Section 23. During this investigation, Norecol and FEI had referred to the stretch of Middle Creek that seeps MA and MB contributed to as "Adit Creek" because the Formosa 1 adit drained directly into this portion of Middle creek.

MC and MD were located on two small tributaries to Adit Creek that entered at approximately 0.7 miles and 0.8 miles downstream, respectively. ME was located directly on Adit Creek, approximately 1.1 miles downstream, just prior to what was termed the confluence of Adit Creek and Middle Creek. At that time, the beginning of Middle Creek was presumed to be the stream reach that began in Township 31S, Range 6W, Section 22, and Adit Creek was termed a tributary to Middle Creek. MF was located on Middle Creek, just prior to this confluence. This location is approximately synonymous with modern day location MREF1. The last sample collected, MG, was located on another tributary to Middle Creek that entered at approximately 1.6 miles downstream from the beginning of Adit Creek.

Additional seep water samples termed S1, S2, S3, and S4 were also sampled in May 1989 (Figure 2-2c). S1 and S2 were located southwest of the mine area near the 404 adit. It is unknown if either of these samples were actually 404 adit drainage water, although both of these seeps enter into the tributary of South Fork Middle Creek that the 404 adit is currently known to drain. S3 and S4 were located on the west side of BLM Road 35.1, north-northwest of the former water and tailings storage pond and mill site. These samples were analyzed for the full list of constituents described above for locations such as M1 and SF1.

Fish and Macroinvertebrate Sampling (Norecol 1989a)
During October 1988, Norecol conducted a fisheries investigation at the request of FEI. Fish electroshock sampling was conducted at seven locations within the vicinity of the Site (SF#1, M1, R1, C1 - Norecol, C2 - Norecol, C3 - Norecol, and C4 - Norecol). Fish sample locations are shown on Figures 2-1a and 2-1b.

During 1989, to further evaluate aquatic communities, Norecol completed two macroinvertebrate sampling events. The first event was completed in the spring (May 10), and the second in fall (September 18). Three locations were sampled, with four replicates collected at each location. Sampling locations included M1, SF#1, and X1 (tributary to South Fork Middle Creek). Macroinvertebrate sampling locations are shown on Figures 2-1a and 2-1b. Each location was selected to have similar characteristics to minimize effects of habitat differences. Locations were situated in riffle-type habitats with water velocities of approximately 1.6 to 2 ft/second (ft/s) and a depth of approximately 0.6 to 1.3 ft, with algae-covered cobbles and pebbles as substrate. Samples were collected using a modified Hess-type sampler with 250-micron mesh size to minimize losses from current.

Groundwater Well Installation and Sampling (Norecol 1989a)
Between February and March 1989, four groundwater wells (T1, T2, T3, and T4) were installed at locations generally within the vicinity of where the water and tailings storage pond and mill site were built during mining operations (i.e., to the south-southwest of Formosa and Silver Butte adits). Approximate locations are shown on Figure 2-3. Groundwater well installation details and drilling logs are provided in Appendix B. Each well was drilled to a depth of approximately 150 ft below ground surface (bgs) using a diamond drill with core recovery. Wells were constructed of 1.5-in diameter PVC with 130 ft of screened interval. The screened interval was backfilled with 20 to 30 grade silica sand and the upper 20-ft interval was set with a mixture of bentonite and cement. Drilling logs and well installation details are provided in Appendix B. A dedicated WaTerra inertial pump and 5/8-in diameter HDPE tubing were installed in each well for sampling.

Water levels were measured in each well 1 to 3 times per month from March through September of 1989. Groundwater samples were collected once in March, May, July, and September 1989. All wells were purged prior to sampling. Grout was detected in Well T4 during the March sampling event, so this sample was discarded. Insufficient sample water volume or dry well conditions were observed at locations T2 and T3

during some of the sample events, so samples were not regularly collected for these locations. All groundwater samples were analyzed for the same parameters as listed above for surface water samples.

2.1.2 Modern Mining Operations (1990 – 1993)

This section describes sampling activities conducted at the Site during modern mining operations.

2.1.2.1 Surface Water Sampling

According to the FEI operating permit application (FEI 1990), quarterly surface water samples were planned to be collected by FEI from locations MA, MB, and S3 (seep location from Norecol report). It is unknown if samples were collected or if the data are available. Loose tables of water quality data have been located from samples collected in 1992 and 1993. Water samples were collected at a few locations on Middle Creek and the South Fork Middle Creek, and analyzed for water quality parameters and total metals (FEI 1994a). Generally samples were only collected at a few of the locations established during the 1988/1989 baseline sampling such as MA, MB, M1, and SF#1. A new Middle Creek location termed MXR (See Figure 2-2c) was also created and sampled during this time period, which later became the most frequently sampled surface water location at the Site. Water quality analysis generally included a few select total metals, TDS, TSS, pH, and conductivity.

2.1.2.2 1993 Fish Sampling (ODFW 1993)

In August and September 1993, the Oregon Department of Fish and Wildlife (ODFW) conducted a fish survey by electroshock method in the vicinity of Middle Creek. Four locations were sampled in Middle Creek (MID-6, MID-7, MID-8, and MID-9), four in South Fork Middle Creek (MID-10, MID-11, MID-12, and MID-13), three in Cedar Gulch (CED-1, CED-2, and CED-3), two in Buck Creek (BUC-1 and BUC-2), three in Martin Creek (MAR-1, MAR-2, MAR-3), and two in Peavine Creek (PEA-1 and PEA-2). Habitat types present at each location included rapids, riffles, glides, and pools. Data reports for this sampling event were obtained from DOGAMI files. Approximate fish sampling locations are shown on Figures 2-1a and 2-1b.

2.1.3 Mine Reclamation (1993 – 1999)

2.1.3.1 Surface Water Sampling

During mine reclamation, quarterly and sometimes monthly or weekly surface water sampling events were conducted in a cooperative effort by DOGAMI, BLM, and ODEQ, along with FEI while they were still present at the Site. Within DOGAMI files, loose tables of water quality data have been located from samples collected between 1993 and 1999. Water quality analysis generally included a few select total metals, sulfate, TDS, TSS, pH, and conductivity. Regular locations sampled included the Formosa adit, Seep A, Seep B, MXR, M1, and SF#1.

2.1.3.2 Macroinvertebrate Sampling (ABA, Inc. 1994a-c, 1995, 1996, and 1997)

During the period from 1994 through 1997, Aquatic Biology Associates, Inc. (ABA, Inc.) was contracted by DOGAMI to perform an analysis of the macroinvertebrate communities present in Middle Creek and South Fork Middle Creek. Samples were collected from locations M1 and SF#1 in early November of each year, although no sample was collected from SF#1 in 1997. Sampling methods included the use of a Surber sampler with 500-micron mesh size to collect specimens at each location. Three sub-samples were collected for each location; all locations were selected to be similar in habitat characteristics (riffle habitat type). ABA, Inc. completed a detailed bioassessment of the 1994 samples to determine impacts to the creeks, and performed comparison investigations to the 1989 samples collected by Norecol.

2.2 USGS Investigation (Hinkle 1999)

In August and September 1998, USGS conducted a water and streambed sediment study within various tributaries of the South Umpqua Basin. The purpose of this investigation was to provide a baseline analysis of the affects of naturally occurring ore deposits and abandoned mines within various streams of the South Umpqua Basin. Data collected during this investigation was published in Hinkle (1999).

Surface water and sediment samples were collected at 10 locations, and stream flow measurements were also collected. The investigation included two sample locations on Middle Creek (USGS-8 and USGS-10), one location on South Fork Middle Creek (USGS-9), and one location on Russell Creek (USGS-7). Specific sampling dates are provided on the sample location matrix table, shown as Table 2-1.

These locations are shown on Figures 2-2a through 2-2c for surface water and on Figure 2-4 for sediment. USGS-8 was located on upper Middle Creek above current location MXR, USGS-10 was located near current location M3.0. USGS-9 was located near current location SF4.7. Seven other locations within the South Umpqua Basin were also sampled, but are unrelated to the Site. All water samples were analyzed for dissolved metals, major anions and cations, and nutrients. Sediment samples were sieved and the minus 62 micrometer (µm) fraction was submitted to the laboratory for a total metals analysis. This study provides a good comparison of water and sediment concentrations in Middle Creek versus other reference tributaries in the South Umpqua Basin, and to other tributaries that have been affected by past-mining activities.

2.3 Site Assessment (Dynamac 2000)

Dynamac Corporation (Dynamac) was contracted by BLM to perform a SA at the Site. Sampling activities were conducted in October 1999, and included the collection of waste source (i.e., waste rock), soil, surface water, sediment, and groundwater samples. A summary of this sampling investigation is presented in the following subsections. A full report of the sampling activities and findings can be found in the *Final Site Assessment Report Formosa Mine Site Douglas County, Oregon* (Dynamac 2000).

2.3.1 Waste Source Sampling

A total of five waste source samples were collected on October 20, 1999. Samples were collected from the Formosa adit waste rock dump (SB-WS-1), Silver Butte adit waste rock dump (SB-WS-2), 404 adit waste rock dump (SB-WS-404), on top of the encapsulation mound (SB-WS-3), and from the fine material on the southeast corner of the encapsulation mound (SB-WS-4). All waste source samples were analyzed for metals (i.e., aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc), cyanide, synthetic precipitation leaching procedure (SPLP), and ABA. The horizontal and vertical extent of the sampled waste rock pile areas were estimated at the time of sampling using aerial imagery and field observations. The approximate sample locations are shown on Figure 2-5.

2.3.2 Soil Sampling

A total of five soil samples were collected on October 20, 1999. Samples were collected from suspected areas of contamination that include the following: 1) base of Silver Butte waste rock dump (SB-S-1); 2) outlet of the adit water diversion pipeline from the Formosa adit (SB-S-2); 3) inboard ditch along BLM road 31-6-13.1 (SB-S-3); 4) base of Encapsulation Mound approximately 85 ft from south edge (SB-S-4); and 5) north of the Site along BLM Road 31-6-13.1 (SB-S-BG). All soil samples were analyzed for TAL metals, cyanide, SPLP, and ABA. The approximate sample locations are shown on Figure 2-5.

2.3.3 Surface Water and Sediment Sampling

A total of six co-located surface water and stream sediment samples were collected from October 19 to 20, 1999. These samples were collected at the Formosa adit, 404 adit, A4, A9, SFU, and SFL. One additional location (Seep A) was sampled for surface water only. Table 2-1 shows these sample locations and dates. All surface water samples were analyzed for dissolved TAL metals, cyanide, and field pH, temperature, and conductivity. Three of the surface water samples were also analyzed for major anions (chloride, nitrate, nitrite, and sulfate), alkalinity, TDS, and laboratory pH. Sediment samples were analyzed for TAL metals and cyanide. Surface water locations are shown on Figure 2-2c and sediment locations are shown on Figure 2-4.

2.3.4 Groundwater Sampling

Three groundwater monitoring wells were installed at the Site during the investigation (Figure 2-3). Groundwater well installation details and drilling logs are provided in Appendix B. Monitoring well MW-1 was installed just below the southern edge of the encapsulation mound, at depth of approximately 87 ft bgs. This well was installed to determine potential effects on groundwater from the encapsulation mound. MW-2 was installed along BLM Road 31-6-13.1, near the Formosa adit. This well was completed at a depth of approximately 150 ft bgs in order to determine if contaminated water from the adit had infiltrated to groundwater. MW-3 was installed at a depth of approximately 80 ft bgs as a background well,

located along BLM Road 31-6-13.1 to the west of the 404 adit. Only MW-2 produced sufficient groundwater to allow for sampling after well development. This well was sampled in October 1999 using a pump from a depth of 110 ft bgs. The static water level at the time of sampling was 94.6 ft bgs. The groundwater sample was analyzed for metals, cyanide, major anions, alkalinity, TDS, laboratory and field pH, field temperature, and field conductivity.

2.4 Remedial Investigation (BLM/ODEQ 2000a)

BLM conducted a baseline RI at the Formosa Mine from 1999 to 2000, in conjunction with the Dynamic SA described previously. This study was conducted in cooperation with ODEQ. The RI focused on surface water quality, including water chemistry analysis and macroinvertebrate analysis. The RI data was presented in the *Formosa Abandoned Mine Land Site Remedial Investigation Report* (BLM/ODEQ 2000a). The BLM/ODEQ RI report includes sampling activities conducted by Dynamac, as well as additional surface water and macroinvertebrate sampling conducted in 1999 and 2000, and historical macroinvertebrate data. A summary of this sampling investigation is presented in the following subsections.

2.4.1 Surface Water Sampling

Surface water samples were collected from a number of locations within various sub-watersheds of the South Umpqua Basin. These sub-watersheds included the following (Figure 1-3):

- Middle Creek
- Riffle Creek – Cow Creek
- Bear Creek – West Fork Cow Creek
- Union Creek – Cow Creek
- Cattle Creek – Cow Creek
- Doe Creek – Cow Creek
- Russell Creek – Cow Creek
- Canyon Creek

The specific streams sampled during this investigation include the following:

- Middle Creek
- South Fork Middle Creek
- Buck Creek
- Cow Creek
- West Fork Cow Creek
- Cattle Creek
- Iron Mountain Creek
- Catching Creek
- Russell Creek
- West Fork Canyon Creek
- Canyon Creek

According to BLM/ODEQ data, West Fork Cow Creek, Cattle Creek, Iron Mountain Creek, Catching Creek, and Russell Creek are tributaries to Cow Creek that are not affected by ARD from the Site. Buck Creek is a tributary to Middle Creek that is considered a reference stream. West Fork Canyon Creek headwaters are on the east side of the Site, and are also not affected by ARD from the Site, according to BLM/ODEQ data.

All surface water sampling locations from the BLM/ODEQ RI are shown on Figures 2-2a through 2-2c. Table 2-1 shows each location and the dates of sample collection. A total of 39 locations were sampled for surface water quality parameters between June 1999 and March 2000. Sampling events were conducted on the following dates, however not all locations were sampled on each event:

- June 15-22, 1999 (spring flow)
- October 4-7, 1999 (fall low flow)
- October 19-20, 1999 (Dynamac)
- October 26, 1999 (initial major fall precipitation event)
- January 26, 2000 (winter storm event)
- February 14, 2000 (winter storm event)
- March 9, 2000 (between storms)
- March 21-25, 2000 (between storms)

All surface water samples were analyzed for metals, major cations and anions, total and dissolved organic carbon, TDS, TSS; and field pH, conductivity, and temperature. Metals analysis sometimes included both total and dissolved samples; however, for the most part only dissolved analyses were conducted. Stream flow was also measured at the time of sampling for some locations.

2.4.2 Macroinvertebrate Sampling

Macroinvertebrate sampling was conducted for the BLM/ODEQ RI on June 15-22 and October 4-7, 1999. Macroinvertebrate sampling was conducted at a number of locations, including M3.0, M3.1, M7.9, M9.8, M13.0, MREF1, SF1.0, SF1.7, SF3.0, SF4.7, SFREF1, C1, C2, C3, C4, Cattle Creek, Catching Creek, WFCC1.1, WFCC7.4, Russell Creek 0.9, and Russell Creek 5.5. These locations are shown on Figures 2-1a and 2-1b. The intent of the RI sampling was to characterize macroinvertebrate communities with respect to distance from the mine, and to gather information on background communities from several reference streams in the area. Samples were collected during two seasons to determine any seasonal trends in populations. Historical macroinvertebrate data were compared to the 1999 data in the report. As described in Section 2.1, historical macroinvertebrate sampling was conducted by the USFS in 1982 and 1984 (1 sampling event per year), by FEI in 1989 (2 sampling events), and by DOGAMI from 1994 through 1997 (1 sampling event per year).

2.4.3 Groundwater Sampling

One groundwater sampling event was conducted by BLM during the baseline RI. Groundwater wells installed by Dynamac were sampled in March 2000. Only wells

MW-2 and MW-3 were sampled, as MW-1 was dry at the time of sampling. Samples were analyzed for the same parameters as surface water samples.

2.5 Removal Assessment (HC 2000)

A RA of the Site was conducted by HC, under contract with ODEQ in 2000. This work was conducted following the completion of the BLM/ODEQ RI in March 2000. The intent of the RA was to identify appropriate and feasible technologies to address ARD impacts to Middle Creek near the Site. The 2000 RA tasks included an evaluation of existing data, site visits, an ARD treatability study, and preparation of an interim action FS. These tasks are summarized in the *Removal Assessment: Focused Engineering Evaluation and Cost Analysis, Formosa Abandoned Mine Land Site, Douglas County, Oregon* (HC 2000).

Specific sampling conducted as part of the HC RA was limited to surface water samples that were collected for the treatability studies. The specifics of the treatability studies are not discussed in this data summary report; however, the water quality data collected are discussed as they are a part of the useable water quality data set (see Section 3 for further information on the useable water quality data set). On April 26, 2000, water samples were collected from the Formosa adit and location MXR. On May 18, 2000, water samples were collected from the Formosa adit and two subsequent downgradient water pools along the Formosa adit water flow path. These pools were denoted as Pool 1 (25 ft from Formosa adit) and Pool 2 (75 ft from Formosa adit). These samples were analyzed for dissolved and total metals, acidity, alkalinity, hardness, chloride, sulfate, fluoride, nitrate, nitrite, and orthophosphate, and field temperature, conductivity, pH, dissolved oxygen, and ORP.

2.6 Data Evaluation (HC 2001b)

Hart Crowser prepared a data evaluation report in September, 2001, under contract with ODEQ. The purpose of the data evaluation report was to provide an update on additional sampling conducted since the RA report and the IRAM and present additional information regarding future potential remedial actions. The 2001 data evaluation tasks included the following:

- Reassess metals loading sources to Middle Creek and South Fork Middle Creek;
- Evaluate the effectiveness of the existing IRAM;
- Reassess economics of the location of the planned anaerobic treatment ponds;
- Estimate of the cost of removing adit fill and capping on the site; and
- Prepare the data evaluation.

These tasks are detailed in *Data Evaluation Report, Formosa Abandoned Mine Land Site, Douglas County, Oregon* (HC 2001b). Specifics regarding the IRAM evaluation and other potential remedial actions are not discussed in this report.

Specific sampling summarized in the HC 2001 data evaluation includes surface water data collected through May 2001 at a number of locations. These locations are shown

in Figures 2-2a through 2-2c. Table 2-1 shows each location and the dates of sample collection. Data from previous investigations (Dynamac SA, the BLM/ODEQ RI, and the Hart Crowser RA) and new sampling data are presented in the data evaluation report. New sampling data summarized in the data evaluation that was not included in previous reports includes data from the following dates: October 17 – 18, 2000, November 17 – 18, 2000, February 22 – 24, 2001, and April 30 – May 2, 2001. A round of sampling was also conducted in July 2000, although these data were not published in HC's data evaluation report. Most surface water samples were analyzed for pH, flow, and total and dissolved metals (i.e., aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc). Some samples were analyzed for dissolved metals only.

2.7 Supplemental Remedial Investigation (HC 2002)

Hart Crowser completed a supplemental RI report in December, 2002, under contract with ODEQ. The purpose of the supplemental RI was to build upon the baseline RI conducted by BLM/ODEQ and HC's data evaluation sampling by further defining the sources of contamination and transport pathways. Specific supplemental RI tasks included the following:

- Collect and analyze surface water and precipitate/sediment samples;
- Perform test pit excavation at the encapsulation mound and collect and analyze soil/waste rock samples;
- Construct three leach cells (i.e., waste rock material) to collect and analyze soil and leachate samples;
- Install and sample two groundwater monitoring wells;
- Collect continuous data on flow rate and field parameters at selected surface water locations local precipitation, and groundwater elevations; and
- Prepare the supplemental RI report.

These tasks are detailed in *Supplemental Remedial Investigation Report, Formosa Abandoned Mine Land Site, Douglas County, Oregon* (HC 2002). Summaries of these tasks are provided below.

2.7.1 Surface Water Sampling

The period of record for surface water sampling presented in the supplemental RI report extends from November 2001 through June 2002. Locations that were sampled regularly included the Formosa adit, End of Pipe, Seep A, A4, A9, A14, MXR, M3.0, M3.1, SF1.0, SF3.0, and SF4.7. The End of Pipe is located at the end of the IRAM adit water diversion pipeline. The other locations are on the Middle Creek and South Fork Middle Creek drainages. A one-time sampling event was conducted at locations T1,

T1A, T2, T2A, A19, and SFREF2. The Silver Butte adit was only sampled once due to lack of observable flow. These locations are shown on Figures 2-2b and 2-2c. Table 2-1 shows each location and the dates of sample collection.

Surface water sampling included measuring flow rates, measuring field parameters (pH, temperature, electrical conductivity, ORP, ferrous iron, and dissolved oxygen), and collecting samples for laboratory analyses. Laboratory analysis completed for surface water samples included dissolved metals (i.e., aluminum, arsenic, cadmium, copper, iron, lead, manganese, nickel, and zinc), TSS, hardness, sulfate, and sulfide. Total metals analyses were only completed on the initial sample event in November 2001.

Continuous monitoring of water level and selected field parameters (pH, temperature, and ORP) were also conducted at the Formosa adit and location MXR from January through May of 2002. The data were collected using a self-contained data logger (a transducer equipped with a water level [pressure], pH, temperature, and ORP sensor). The data logger was programmed to collect data at 15-minute intervals.

Monitoring the flow rate and field parameters at the Formosa adit was achieved by installing a 60 degree trapezoidal flume with a 2-inch stilling well within the first aeration channel tier piping (24-in diameter, half-cut HDPE). The data logger was inserted within the flume stilling well (2-in PVC pipe). At MXR, the flow rate and field parameters were measured with a data logger installed in a shallow pool in the creek. The monitoring was conducted concurrently with continuous monitoring of groundwater levels (monitoring well MW-4) and collection of precipitation data (Silver Butte weather station and Riddle, Oregon weather station).

2.7.2 Sediment, Precipitate, and Elutriate Source Water Sampling

Concurrent with surface water monitoring, sediment and precipitate samples were collected to assess if these materials act as a source or sink for metals in Middle Creek. During the initial surface water sampling event (November 3, 2001), mapping of the presence of sediment and precipitate on Middle Creek from the headwaters to the confluence was conducted. Physical parameters such as color, approximate grain size, thickness, and width (or stream width with an estimate of percent coverage) were recorded for both sediment and precipitate.

Based on a review of the physical parameter data, four surface water stations on Middle Creek (A6, A14, A19, and MXR) were selected for precipitate sampling, and one surface water station (MXR) was selected for sediment sampling. Sediment and precipitate samples were collected from stations located on Middle Creek only, with the assumption of Middle Creek and South Fork Middle Creek having similar occurrences of sediment and precipitate. MXR sediment samples were collected on February 7, 2002, April 4, 2002, April 22, 2002, May 29, 2002, and June 24, 2002. Precipitate samples were also collected on these same dates, although not all locations were sampled on each date. All precipitate and sediment samples were analyzed for

total metals. A selected set of sediment samples were analyzed for grain size using American Society for Testing and Materials (ASTM) D-421/422 (mechanical sieve and hydrometer). Sediment and precipitate sampling locations are shown on Figure 2-4.

Sediment and precipitate samples were also analyzed using the Corps of Engineers elutriate test methodology. For the elutriate test, sediment and precipitate samples were mixed with surface water collected at location M3.0 on Middle Creek at a concentration of 100 milligrams per liter (mg/L) total solids. After sufficient mixing, the solutions were aerated for one hour with compressed air and then allowed to settle for one hour. Water samples were extracted from each test container after settling for laboratory analysis. Both the elutriate source water used in the tests and the test extract samples were analyzed for dissolved metals (i.e., aluminum, arsenic, cadmium, copper, iron, lead, manganese, nickel, and zinc), TSS, hardness, sulfate, and sulfide. Field parameters (pH, temperature, electrical conductivity, ORP, ferrous iron, and dissolved oxygen) were also measured for the elutriate source water.

X-ray diffraction and digestion analyses were also conducted on the precipitate and sediment samples. These analyses were completed by BC Research Inc. The digestion methods used were different from the standard EPA 6010B digestion method, with an attempt to determine the total elemental assay of the samples. Analyses conducted by BC Research Inc. included the following: rinse pH, total carbon, carbonate-carbon, free moisture at 105 degrees Celsius (°C), loosely bound moisture (hydrates and hydroxides) at 500°C, and remaining chemically bound moisture and organics at 1,000°C, digestion by aqua regia and elemental analysis using inductively coupled plasma emission spectrometry (ICPES), digestion by hydrochloric acid (HCl) and elemental analysis using ICPES, and sulfate sulfur analysis of the HCl extract.

2.7.3 Encapsulation Mound Test Pit Exploration and Soil Sampling

Test pit explorations were performed at the encapsulation mound on November 19, 2001. The pits were completed to collect soil samples and to verify the presence of a low permeability cap. Three encapsulation mound test pits (N, S-1, and S-2) were completed at the locations shown on Figure 2-5. Two perimeter test pits (N and S-1) were positioned along the long axis of the mound (one each about 100 ft from each end of the mound). Based on information gathered from perimeter test pit explorations (the low permeability cap was encountered at S-1 but not at test pit N, apparently located north of the mound), an additional test pit (S-2) was completed at a location situated equally distant between the two perimeter test pits.

For each exploration, sandbags on the existing plastic cover were removed, the cover pulled back, and an excavator was used to excavate the test pit. The test pits were excavated until the low permeability cap was encountered or until equipment limitations prevented deeper excavation. Two soil samples were collected from test pit N at depths of 3 ft and 6 ft bgs (samples reported as N-1 and N-2, respectively). One soil sample each was collected from test pits S-1 and S-2 at depths of 2 ft and 3 ft bgs, respectively.

A low permeability cap (bentonite-geotextile composite) was encountered at encapsulation mound test pit exploration locations S-1 and S-2. The low permeability cap was encountered at approximately 3 to 4 ft bgs. Approximately 1-ft of ½ -in crushed rock was present over the low permeability cap. At these locations where the low permeability cap was encountered, a sample was collected from the soil situated above the cap. Groundwater was not encountered during test pit explorations at the encapsulation mound. Upon completion of test pit explorations, the pits were backfilled in reverse order (last out, first in) with the excavated soil. The plastic cover and sandbags were restored to their original conditions.

All soil samples collected from the encapsulation mound test pits were analyzed for total metals (aluminum, arsenic, cadmium, copper, iron, lead, manganese, nickel, and zinc) and SPLP.

2.7.4 Waste Rock and Leachate Sampling

Three waste rock leach cells (Cell 1[encapsulation mound], Cell 2 [Silver Butte waste rock dump], and Cell 3 [Formosa adit waste rock dump]) were constructed in the field to contain a composite sample of the waste rock and allow for subsequent leachate sampling. Construction of the leachate cells and analysis of leachate were conducted to assess if leachate from the respective waste rock piles were a significant source of metals loading to surface water and/or groundwater.

Each cell was constructed from 2 x 4 lumber to create a structural frame with nominal dimensions of 2 ft by 8 ft by 8 ft. A cushion geotextile consisting of 8 ounces per square yard, non-woven fabric (nominal dimensions of 8 ft by 8 ft) was placed on the ground surface within the interior of the structural frame. An impermeable membrane consisting of 10-mil, UV resistant plastic (nominal dimensions of 15 ft by 15 ft) was then draped over the structural frame and placed over the cushion geotextile. Another piece of cushion geotextile consisting of 8 ounce per square yard, non-woven fabric (nominal dimensions of 15 ft by 15 ft) was placed immediately on top of the impermeable membrane.

A sample port was constructed with 4 ft of 1-in slotted PVC pipe attached to 3 ft of 1-in PVC pipe with a valve. The pipe was inserted through the impermeable membrane/cushion geotextile at the bottom of one side of the cell and sealed with PVC glue and bentonite. The slotted portion was placed within the cell, and the valve was situated on the outside of the cell. The pipe was placed on the fabric within the cell and covered with pea gravel.

Waste rock was sampled at the three locations shown on Figure 2-5. At each waste rock location, 2 to 3 cubic yards of waste rock were excavated and placed in a leaching cell (depth of 1 to 1.5 ft, leaving about 6-in of freeboard). The waste rock excavations extended to a maximum of 4 ft bgs. A 5-point composite sample of the waste rock was collected from each leaching cell on November 19, 2001. Each sample was submitted for laboratory analysis of total metals (aluminum, arsenic, cadmium, copper, iron, lead, manganese, nickel, and zinc) and SPLP metals.

The leach cells were exposed to rainfall, and samples of leachate were periodically collected from the sample port. Each cell was sampled on February 21-22, 2002 and April 22, 2002. Samples were analyzed for field parameters (pH, temperature, electrical conductivity, ORP, ferrous iron, and dissolved oxygen) and submitted for laboratory analyses. Leachate samples were analyzed for total and dissolved metals (aluminum, arsenic, cadmium, copper, iron, lead, manganese, nickel, and zinc), TSS, hardness, sulfate, and sulfide.

Upon completion of the first sampling event, it was determined that a sufficient volume of leachate for sample analyses could not be obtained from precipitation entering the leachate cell. To artificially hydrate the leach cells, 5-gal buckets were placed near the individual leach cells to collect rainfall. Prior to the second sampling event, the collected rainwater was uniformly applied over the waste rock material. Cell sampling was conducted within 30 minutes in the manner described above.

2.7.5 Groundwater Sampling

Two groundwater wells (MW-4 and MW-5) were installed at the Site on February 19 and 20, 2002. These well locations are shown on Figure 2-3. Groundwater well installation details and drilling logs are provided in Appendix B. The wells were completed using an air-rotary drilling rig provided by Geo-Tech Explorations of Tualatin, Oregon, under subcontract to HC. Monitoring wells MW-4 and MW-5 were completed to depths of 270 and 100 ft bgs, respectively. The depth of well MW-4 was selected to best intercept groundwater from the mine workings as it moves toward Middle Creek. The depth of MW-5 was based on first encountered groundwater beneath the encapsulation mound area. The wells were constructed with 15 ft of screen (placed below the solid casing near the bottom of the well bore). Soil samples were not collected during monitoring well installations. After installation, all wells were developed by purging six casing volumes of groundwater from the well. Upon completion of purging activities, field parameters (pH, temperature, electrical conductivity, ORP, ferrous iron, and dissolved oxygen) were measured.

Groundwater samples were collected at MW-4 on February 26, 2002 and May 20, 2002. Samples were collected on these same dates from MW-5, as well as on April 23, 2002. In addition, samples were collected from MW-2 (Dynamac well) on the same dates as MW-5. Water level measurements were collected, wells were purged, and samples were collected. All samples were analyzed for total and dissolved metals, TSS, hardness, sulfate, sulfide, and field parameters (pH, temperature, electrical conductivity, ORP, ferrous iron, and dissolved oxygen). Samples were not collected from the remaining Dynamac wells because MW-1 was consistently dry and MW-3 was installed outside of the drainage area of the mine workings.

2.8 BLM Fish Sampling (BLM 2009)

In a joint effort between BLM and ODFW, several fish sampling events were completed between 1991 through 2007. These events included salmon spawning surveys and electroshock fish sampling. Salmon spawning surveys were completed to

estimate spring spawning run sizes in Middle Creek and South Fork Middle Creek. The creeks were divided into segments according to the distance from the Formosa Mine, including the following: upper Middle Creek (M0.9 - M5.2), central Middle Creek (M5.8 - M11.75), and lower Middle Creek (M11.75 - M13.0), and South Fork Middle Creek (SF4.0 – SF4.7).

The salmon spawning surveys were conducted by wading the stream reach moving in the downstream direction, and recording observations of the number of redds (fish egg sacs), live and dead fish (by species), and sample carcasses for gender, length, scales, fin clips, and tags. Spawning surveys for coho salmon were conducted from October through January for each year that measurements were collected because this is the period prior to hatching of the redds. Surveys were conducted for coho salmon at least once every 10 days during the October to January period. The total number of coho salmon redds observed during the October through January period were then later reported in April of the same year once all other spawning surveys were completed for other species such as chinook, chum, and steelhead (data not discussed). Coho salmon surveys were conducted on the following stream reaches and years (October of previous year to January of year shown):

- M0.9 – M5.2: 1998, 1999, 2000, 2001, and 2002
- M5.8 – M11.75: 1992, 1994, 1995, 1997, 1999, 2000, and 2001
- M11.75 – M13.0: 1991, 1995, 1996, and 2001
- SF4.0 – SF4.7: 1998 and 2001

During July 2000, 2003, and May and June 2007, fish electroshock sampling was completed at various Middle Creek and South Fork Middle Creek locations, as well as on Martin Creek as a reference. Locations sampled are M2.0, M3.0, M3.1, M5.5, M7.9, M9.8, M13.0, Martin Creek 2000 - 2007, SF1.7, SF3.0, and SF4.7. Note all locations were sampled during each year's sampling event. All of these locations are shown on Figures 2-1a and 2-1b. For the 2007 event, BLM also sampled Brush Creek and Smith Creek to provide additional reference stream information.

2.9 Post Supplemental RI Sampling

This section describes sampling activities conducted after the supplemental RI phase (i.e. post June 2002). Additional surface water sampling was conducted by ODEQ and BLM. Additional soil and waste rock sampling was conducted in 2006 by the START-3 team.

2.9.1 Surface Water

Surface water monitoring was conducted from 2003 to 2005. Samples were collected from various locations during the following years and months: 2003 – February; 2004 – April (2 sampling events), May, June, July, and August; and 2005 – June, July, and September. Table 2-1 shows each location and the dates of sample collection. All data were gathered from laboratory reports and has not been published in any formal reports, with exception to the June and July 2005 samples.

The June and July 2005 sampling was conducted by BLM in cooperation with the EPA Region 10 Superfund Technical Assessment and Response Team (START-3), and the total metals data were published in the *Formosa Mine Preliminary Assessment Report* (START-3 2006). Field pH and conductivity were also analyzed during this sampling event however the data are not available at this time. Samples collected during this short investigation included the Formosa adit, A4, A9, and a number of new sample locations established on the upper reaches of South Fork Middle Creek (SFB1, SFA1, SFA2, SFA3, SFA4, and SFA5). These locations are shown on Figure 2-2c. Locations SFA3, SFA4, and SFA5 were groundwater seep locations collected along the road cuts that wind down the west headwater branch of South Fork Middle Creek. The remaining locations were collected in South Fork Middle Creek, and sample SB1 was collected from the east headwater branch. Six samples were also collected on July 6, 2005, which were analyzed for stable isotopes of oxygen and hydrogen in water and oxygen in sulfate.

Analysis for the remaining post supplemental RI sampling events consisted of a number of metals. These samples were collected by BLM and ODEQ. Most sampling events analyzed for only dissolved metals, however for some events both total and dissolved metals were analyzed. Any field data (i.e., pH, conductivity, flow), if collected, is unavailable for these samples.

2.9.2 Soil and Waste Rock

As an additional part of the START-3 investigation (START-3 2007), soil and waste rock samples were collected between June and July 2006. Soil and waste rock samples were collected from the encapsulation mound and waste rock samples were collected near the former million-gallon tank and ore storage areas. Sampling work was conducted by Ecology and Environment, Inc. (E&E).

A total of five subsurface borings (EM01, EM02, EM03, EM04, and EM05) were drilled using direct-push techniques on the encapsulation mound. These locations are shown on Figure 2-5. Nine subsurface samples were collected from the borings. Except for EM01, two samples each were collected from each boring as composites of the length of sample core from approximately 0 ft to 4 ft bgs and 4 ft to 8 ft bgs. For each boring, samples collected from 0 ft to 4 ft bgs were cover soil, and samples collected from 4 ft to 8 ft bgs (below bentomat liner) were low-grade ore waste rock samples. Boring EM01 was only drilled to 4 ft bgs and a sample was only collected from the surface soil. Each sample was screened using a field portable X-Ray Fluorescence (FPXRF) analyzer, and five selected samples were submitted to Columbia Analytical Services, Inc. for further analysis. Two of the samples were submitted for total metals analysis, and three of the samples were submitted for toxicity characteristic leach procedure (TCLP) analysis.

A total of 7 subsurface borings (EX01, EX02, EX03, EX04, EX05, EX06, and EX07) were also drilled using direct-push near the former million-gallon tank ore storage areas. These locations are shown on Figure 2-5. A total of 16 subsurface samples were collected from the borings. Samples were collected at varying depths within each

boring hole based on visual observations. Borings EX01, EX02, and EX03 were only drilled between 3 ft to 4 ft; so only one sample was collected from these borings. A total of four samples were collected from boring EX04, and three samples each were collected from borings EX05, EX06, and EX07. Each sample was screened used a hand-held XRF analyzer, and 8 selected samples were submitted to Columbia Analytical Services, Inc. for further analysis. A mix of total metals, SPLP, and TCLP analysis were conducted on these samples, however, not all samples were analyzed using all three methods.

Section 3
Quality Assurance/Quality Control

This section describes the QA/QC for data that is published in this data summary report. This section follows the same general sequence of sampling investigations as presented in Section 2. For each investigation, reference is provided to sampling and analysis work plans or other documents governing the sampling effort, when available. A brief summary of the number of QA/QC samples such as duplicates, replicates, blanks, etc. is also provided, if available. Any modifications of sampling procedures and/or analysis methods from governing documents are only provided as available from published reports.

Analytical data published in this data summary report was obtained from a number of sources, in most cases from analytical laboratory reports. If analytical laboratory reports were not available, data were obtained from tables contained within published reports, or as loose tables provided by various sources. All data sources are referenced in each subsection below.

The usability of each data set is also discussed. Overall, data published in this data summary report are intended to present the historical trends and observations in environmental quality that exists for the Site. Most of the data presented achieves this purpose. As such, use of this data for the RI/FS process is intended to provide a basis of the historical trends and observations as they relate to the nature and extent of contamination, and provide a basis for planning the RI/FS process. Some biotic sampling data may also be usable for scoping the ecological risk assessment for the Site.

3.1 USFS Biotic Investigation (1982 – 1984)

This section describes the quality control sample collection and usability of the biotic data from the USFS biotic investigations conducted in 1982 and 1984.

3.1.1 Quality Control Sample Collection

Macroinvertebrate sample collection and fish sampling was conducted by the USFS between 1982 and 1984. Taxonomic analysis of macroinvertebrate samples were conducted by Aquatic Ecosystem Analysis Laboratory at Brigham Young University in Provo, Utah. No governing documents are available and actual sampling and analysis methods are unknown, except as provided within a later summary of macroinvertebrate sampling by ABA, Inc. According to ABA, Inc. (1994a, 1994b, and 1994c), field macroinvertebrate sampling was conducted using a 280 micron mesh Surber sampler and a salt flotation method, with three replicates collected for each location. Standard taxonomic analysis by Aquatic Ecosystem Analysis Laboratory included a genus-family level identification, although, chironomid midges were not identified (ABA, Inc. 1994a, 1994b, and 1994c). Fish sampling was conducted using an electroshocking method, although the exact sampling methodologies are unknown.

3.1.2 Data Usability

Data published in this report were obtained from the Aquatic Ecosystem Analysis Laboratory reports, field fish electroshock count forms, and analytical data summaries obtained from DOGAMI files (USFS 1982 – 1984). The readability of the 1982 macroinvertebrate laboratory results copies is poor; therefore, these data are not considered useable and are not published in this report. Macroinvertebrate data collected in 1984 is of much better quality and considered useable for purposes of documenting pre-modern mining biotic conditions in Middle Creek and South Fork Middle Creek. However, according to ABA, Inc. (1994), the methods employed during macroinvertebrate sampling and for laboratory analysis may have resulted in poor taxonomic resolution and an underestimate of population density. As a result, 1984 macroinvertebrate data is not directly comparable to later data. However, the 1984 data does provide useful information on what types of taxa were present in the streams at that time.

All 1982 and 1984 fish electroshock sampling data are of good quality and are considered useable for documenting fish populations in Middle Creek, South Fork Middle Creek, and Martin Creek prior to modern-mining, although direct comparison of this early data to later fish sampling should be cautioned given that sample collection methods are unknown for this sampling event. The fish data do provide useful information on the relative fish species richness and populations present in the creeks at that time.

3.2 Norecol Investigation (1988 – 1989)

This section describes the quality control sample collection and usability of the geologic, surface water, groundwater, and biotic data from the Norecol environmental study conducted in 1988 and 1989.

3.2.1 Quality Control Sample Collection

The baseline environmental study was conducted in accordance with the *Environmental Work Program Outline, Formosa Exploration Inc. Silver Peak Property, Douglas County, Oregon* (Norecol 1989b) and the water sampling protocol appendix from the *Formosa Exploration Inc. - Silver Butte Project Baseline Environmental Studies Report* (Norecol 1989a). A summary of QA/QC procedures for this investigation was not published in the baseline environmental studies report, however, some information regarding QA/QC can be obtained from the water sampling protocol appendix (Norecol 1989a). Analytical laboratory reports are not available for the baseline sampling to verify the results presented in the Norecol report.

Surface water samples were collected in-stream using adequate procedures so as to not disturb sediment in the area of the sample collected. Groundwater samples were collected using the dedicated WaTerra pump and tubing installed in each well. For dissolved metal analysis (both surface water and groundwater samples), water samples were filtered using a non-dedicated filtration funnel apparatus and disposable paper filters for each sample. The filtration funnel apparatus was

decontaminated after each filtration using deionized water and then rinsed again using a portion of the water from the next sample (this portion of water was discarded). Rinsate blanks were reportedly collected between each filtered sample and analyzed for the same metals parameters; however, sample results for rinsate blanks are not published in the Norecol report. All analytes were preserved according to the specified methods prior to analysis.

Groundwater wells were installed and developed by FEI and Norecol under supervision of Meyer Well Drilling, a licensed well drilling contractor in the State of Oregon. Wells were constructed in accordance with the requirements of the Oregon Water Resources Department. Drilling logs and well installation details are provided in Appendix B.

For macroinvertebrate sampling, four replicate samples (of 0.1 square meter sample area) were collected at each sample location. Samples were collected using a modified Hess-type sampler with 250-micron mesh size. The sampler net was made of Nitex mesh net which funneled into a collecting bottle. All macroinvertebrates were washed off the substrate into the sampler, placed into sample bags, and preserved with 10 percent formalin. Substrate was disturbed within the sampler to a depth of at least 4 inches with sufficient agitation and scraping to remove and dislodge the invertebrates. Macroinvertebrate samples were identified to the lowest practical taxonomic level. Fish sampling was conducted using a Coffelt BP4 backpack electroshocker set at 400 volts.

3.2.2 Data Usability

All data published in this data summary report were obtained from the baseline environmental studies report (Norecol 1989a). All data collected during the baseline environmental study are considered useable for the purposes of describing the environmental conditions present at the Site prior to modern-mining. Sampling procedures and well construction and development procedures detailed in the Norecol report were sufficient to produce a useable data set.

Groundwater, macroinvertebrate, fish, and geochemical data are presented in this data summary report. Although surface water data is useable, this data set is not presented in this data summary report because the main purpose of the surface water quality analysis is to define the current conditions. Because there is a lack of available groundwater data for the Site, the Norecol groundwater data is presented in Section 4. Fish and macroinvertebrate data are also presented in Section 4 because this data is helpful to document the aquatic communities prior to modern-mining. Sulfur lithogeochemical data is presented in Section 4 because this data is helpful to describe the potential for different geologic rock units and materials to generate acid.

3.3 Mining Operations through Mine Reclamation (1990 – 1999)

This section describes the quality control sample collection and usability of the surface water and biotic data from the various investigations conducted between 1990 and 1999.

3.3.1 Quality Control Sample Collection

3.3.1.1 Surface Water Sampling

During mining operations and mine reclamation, surface water sampling is presumed to have been collected in accordance with the original mine operating permit application (FEI 1990). The original operating permit details a quarterly sampling program for selected surface water locations and provides an analyte list, but does not provide a detail of sampling and analysis procedures. Other governing documents may include the *Proposal to Remove Sulfide Materials from Middle Creek* (FEI 1994a) and *Supplemental Plan for Remediation and Reclamation Activities Associated with the Closure of the Silver Butte Mine Site, Douglas County, Oregon* (FEI 1994b). Both of these documents were essentially revisions to the original reclamation plan from the DOGAMI mine operating permit application. In addition, there are several correspondence letters and memorandums between FEI, DOGAMI, and others that detail modifications to the reclamation plan. Correspondence may be the only source of some QA/QC related information for surface water sampling; however, not all of the correspondence material has been reviewed at this time. The *Proposal to Remove Sulfide Materials from Middle Creek* has an Exhibit A titled *Water Sampling Protocols for the Silver Butte Mine, Douglas County Oregon*. This exhibit details sampling and analysis protocols that are similar to the protocols provided in the Norecol baseline environmental studies report (Norecol 1989a). At this time, it is unknown if all sampling conducted at the Site during mining operations and reclamation had followed these procedures.

3.3.1.2 1993 Fish Sampling

Fish electroshock sampling was conducted by ODFW in August 1993. No governing documents or references are available that indicate sampling protocol utilized, although it is expected that the ODFW had followed appropriate sampling and analysis procedures in accordance with state and/or federal guidelines .

3.3.1.3 Macroinvertebrate Sampling

Macroinvertebrate sampling and analysis was conducted by ABA, Inc. in November of each year from 1994 through 1997. Reports and associated data were prepared for each year's sampling event by ABA Inc. (ABA, Inc. 1994a, 1994b, 1994c, 1995, 1996, and 1997). Sampling methods included the use of a Surber sampler with 500-micron mesh size to collect specimens at each location (1 square ft sample area). Three replicate samples were collected for each location.

3.3.2 Data Usability

3.3.2.1 Surface Water Sampling

Surface water quality data collected during the mining and post-modern mining period is not published in this data summary report. The usability of surface water data is currently questionable. Sources of data include but are not limited to letter and memorandum correspondence, analytical laboratory reports, and published and unpublished reports. Loose tables of 1992 through 1999 water quality data have been located in the project file record. Analytical laboratory reports are also available in the project file record, although the extent and quality of these records in relation to the loose tables is currently unknown. Further details on data usability will be available once the data are compiled and analyzed.

3.3.2.2 1993 Fish Sampling

Data reports and sampling locations for the 1993 fish electroshock sampling event were obtained from DOGAMI files. Data published in this data summary report were obtained from the summary of fish survey data sheets (ODFW 1993). 1993 fish electroshock sampling data is considered useable for documenting fish populations in Middle Creek, South Fork Middle Creek, and various reference creeks near the end of the period of modern-mining (i.e., August 1993). Although a unique set of locations were utilized for this sampling event, general locations are comparable to other data sets.

3.3.2.3 Macroinvertebrate Sampling

The ABA, Inc. reports and data were obtained from DOGAMI, ODEQ, and BLM files. Data published in this data summary report were obtained from the ABA, Inc. reports (ABA, Inc. 1994a - c, 1995, 1996, and 1997). Macroinvertebrate sampling data collected by ABA, Inc. is considered useable for documenting macroinvertebrate populations in Middle Creek and South Fork Middle Creek after the period of modern-mining and after the majority of reclamation at the Site had been conducted (including cleanup of upper Middle Creek tailings in 1994).

3.4 USGS Investigation (1998)

This section describes the quality control sample collection and usability of the surface water and sediment data from the USGS investigation conducted in 1998.

3.4.1 Quality Control Sample Collection

The purpose of this investigation was to provide a baseline analysis of the affects of naturally occurring ore deposits and abandoned mines on water quality within various streams of the South Umpqua Basin. Both surface water and sediment samples were collected at four locations near the Site as well as at other locations in the South Umpqua Basin (total of 10 sample locations).

Measurements of stream flow were made in accordance with standard USGS procedures (Rantz and others 1982). Surface water samples were collected and

processed using methods of Shelton (1994). Sediment samples were collected and processed using methods of Shelton and Capel (1994). Water samples were analyzed at the USGS National Water Quality Laboratory (NWQL) in Arvada, Colorado and sediment samples were analyzed by the USGS Analytical Chemistry Services Group Laboratory (ACSGL) in Denver, Colorado. The NWQL internal QA program is detailed in Pritt and Raese (1995) and the ACSGL internal QA program is detailed in Arbogast (1996) and Briggs and Meier (1999).

One field equipment rinsate blank was collected. Sampling equipment (i.e., water filtration equipment, sediment sampling equipment, etc.) was rinsed with blank water and submitted for analysis. Aqueous standard reference samples were also submitted for analysis to quantify analytical accuracy. Two of the ten stream sediment samples were split and submitted for analysis to evaluate precision.

3.4.2 Data Usability

Data published in this data summary report from the USGS study were downloaded electronically and compiled from the USGS Water-Quality Data for Oregon webpage (USGS 2009). This data can also be found in the published report by Hinkle (1999). All surface water and sediment sampling data collected by USGS is considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Note that USGS had used a more rigorous acid digestion method (total digestion) for the sediment total metals analyses compared to the normal total metals analyses conducted under EPA Method 6010B (partial digestion). Because the method employed dissolves all of the solid sample, results may be biased high compared to EPA Method 6010B total metals results (such as Dynamac or HC data).

Analysis of the field blank sample indicated that equipment decontamination procedures were adequate to prevent cross-contamination between samples. Analysis of standard reference samples demonstrated good analytical accuracy and analysis of split sediment samples demonstrated good analytical precision.

3.5 Dynamac Site Assessment (1999)

This section describes the quality control sample collection and usability of the surface water, sediment, groundwater, soil, and waste rock data from the Dynamac SA conducted in 1999.

3.5.1 Quality Control Sample Collection

The Dynamac SA was conducted in accordance with the criteria established in the Task Order BLM2-30R contract through BLM. The task order included a sampling and analysis plan (SAP) for the SA that was prepared by Dynamac and submitted to BLM (Dynamac 1999). The following general QA/QC information was obtained from the SAP (Dynamac 1999):

- All non-dedicated sampling equipment (i.e., hand tools) was decontaminated properly between sampling locations using standard EPA procedures.

- The drilling rig and related equipment were decontaminated between drilling and installation of each groundwater monitoring well. Decontamination consisted of gross debris removal followed by a steam cleaning rinse.

- Sample collection, preservation, handling, and identification were conducted using standard EPA contract laboratory program protocols.

Surface water, groundwater, sediment, soil, and waste source samples were analyzed by Precision Analytical Laboratories, Inc. A data validation report, prepared by Dynamac and provided as an attachment to the Dynamac SA report (Dynamac 2000), indicates the following:

- One field blank sample was collected using ASTM Type II reagent grade water. No field duplicate or rinsate samples were collected, although the SAP had indicated that field duplicates should have been collected at a rate of 10 percent of total samples collected and rinsates at a rate of one sample per day.

- All sampling results were reviewed according to the National Functional Guidelines for Inorganic Data Review (EPA 1994) in conjunction with the QA/QC requirements specified for the methods used.

Groundwater wells were installed in accordance with the Oregon well construction standards. Drilling logs and well installation details are provided in Appendix B.

3.5.2 Data Usability

All sampling data collected by Dynamac is considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Based on information detailed in the Dynamac SAP, procedures and methods for sampling and analyses, well construction, and QA/QC were adequate to produce a useable data set. Data published in this data summary report was obtained from analytical laboratory reports within the Dynamac SA report (Dynamac 2000). The following specific information was obtained from the data validation report appendix to the Dynamac SA report (Dynamac 2000):

- All analysis were completed within the required holding times, with exception to nitrite and nitrate in some samples. Results for those samples that exceeded the holding times for nitrite and nitrate were qualified as estimated with a low bias (L). The low bias qualifier has not been reported in the Appendix A tables (*Historical Results – Surface Water*) of this data summary report, but can be found in the data validation report appendix to the Dynamac SA report.

- No analytes were detected in the method blanks reported by the laboratory. Manganese and vanadium were detected in the field blank. The concentrations of

manganese and vanadium detected in the associated surface water samples were much greater than concentrations observed in the field blank; therefore, no qualification of data was necessary.

- For matrix spike/matrix spike duplicate (MS/MSD) results, the recoveries of all tested analytes were within the QC limits of 75-125 percent, with the exception of selenium and silver results in all surface water samples. These results were qualified as estimated with low bias (L). The low bias qualifier has not been reported in the Appendix A tables of this data summary report, but can be found in the data validation report appendix to the Dynamac SA report.

- The relative percent difference (RPD) between the analysis of matrix spike and matrix spike duplicate samples was within QC limits (0-20 percent RPD) for all tested analytes.

- Recoveries of analytes in the laboratory control sample were within QC limits (80-120 percent) for all analytes.

3.6 Remedial Investigation (1999 – 2000)

This section describes the quality control sample collection and usability of the surface water, groundwater, and macroinvertebrate data from the BLM/ODEQ RI conducted between 1999 and 2000.

3.6.1 Quality Control Sample Collection

BLM/ODEQ RI sampling for surface water and macroinvertebrates was conducted in accordance with *Oregon Plan for Salmon and Watersheds-Field Methods 1998* (Oregon Watershed Enhancement Board [OWEB] 1998), which specifies protocols for the collection of water and macroinvertebrate samples. Groundwater sampling was conducted in accordance with the *Abbreviated Sample Plan for Silver Butte Mine, Riddle – March 15, 2000* (ODEQ 2000). Water quality analyses were conducted by three different laboratories through the course of the RI sampling program: Oregon Department of Environmental Quality Laboratory (ODEQ Laboratory), Columbia Analytical Services Inc. (CAS), and North Creek Analytical, Inc. (NCA). Internal laboratory QA/QC results for this investigation were not published in the BLM/ODEQ RI report but can be found in the individual analytical laboratory reports (ODEQ Laboratories 1999 – 2000, CAS 2000, and NCA 2000). Based on a review of analytical laboratory reports for surface water and groundwater samples, field QC consisted of duplicate and blank samples submitted for analysis.

A review of the *Oregon Plan for Salmon and Watersheds-Field Methods 1998* (OWEB 1998) reveals that this document is more of a guide for field sampling protocols rather than a governing document that defines QA/QC procedures. However, the document does provide detailed procedures on collection of field water quality parameters (i.e., pH, conductivity, temperature, etc.) as well as a comprehensive stream macroinvertebrate sampling and analysis protocol. Macroinvertebrate samples were processed and analyzed by the Roseburg District BLM using software provided by ODEQ.

3.6.2 Data Usability

All sampling data collected during the BLM/ODEQ RI is considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program.

Data published in this data summary report were obtained from the BLM/ODEQ RI report (BLM/ODEQ 2000a), the BLM/ODEQ monitoring program report (BLM/ODEQ 2000b), and associated analytical laboratory reports for all surface water samples collected (ODEQ Laboratories 1999 – 2000, CAS 2000, and NCA 2000). Water quality data were compiled directly from analytical laboratory reports and from the RI report tables for field parameters (i.e., pH, flow, conductivity, etc.). Metals data were compiled from analytical laboratory reports rather than from the RI report tables because discrepancies were observed in the published RI report tables and not all metals analyses were available in the RI report tables. In some cases, sample data published in the BLM/ODEQ RI tables were reported as dissolved metals results, when the sample data were reported as total metals results in the analytical laboratory reports. Macroinvertebrate data were compiled from the appendix of the BLM/ODEQ monitoring program report (ODEQ/BLM 2000b).

Since analytical laboratory reports were utilized to compile data, actual or true sample locations had to be inferred from the reported locations on the analytical laboratory reports. Locations reported on chain of custodies and laboratory reports were inconsistent between sampling events and inconsistent with sampling maps and tables provided in the RI report. The interpretation of true locations was completed based on various maps showing surface water locations (BLM/ODEQ 2000a and 2000b) and the most logical judgment. Assumptions made were verified by cross checking with published data in the RI report tables and through personal communication with Eric Heenan of the Roseburg District BLM (Heenan 2009).

3.7 BLM Fish Sampling (1991 – 2007)

- This section describes the quality control sample collection and usability of the fish sampling data from the BLM surveys conducted between 1991 and 2007.

3.7.1 Quality Control Sample Collection

Salmon spawning surveys were conducted in accordance with the ODFW coastal spawning salmon survey procedures manual (Sipher 2009). The most recent version of this document is available as the *Coastal Spawning Salmon Survey Procedures Manual – 2007, Oregon Adult Salmonid Inventory and Sampling Project (OASIS)* (ODFW 2007). It is presumed that an older version of this document or a similar document was available in years past, as part of the OASIS conducted by ODFW. Fish electroshock sampling was conducted in accordance with the EPA rapid bioassessment methodology (EPA 1999).

3.7.2 Data Usability

Salmon spawning survey data and fish electroshock sampling data were obtained from electronic files provided by BLM (BLM 2009 and Sipher and Harvey 2007). BLM/ODFW fish sampling data is considered useable for documenting fish populations in Middle Creek, South Fork Middle Creek, and various reference creeks during the most recent period of environmental sampling.

3.8 Removal Assessment (2000)

This section describes the quality control sample collection and usability of the surface water data from the HC removal assessment conducted in 2000.

3.8.1 Quality Control Sample Collection

The HC removal assessment was conducted in accordance with the criteria established in the task order contract through ODEQ. No other governing documents (i.e., SAP) can be located in the project file record at this time.

Surface water samples were analyzed by NCA. No field duplicates or blanks were collected for the RA sampling, although only five surface water samples were collected during the two sample events. A QA review summary was provided as an appendix to the HC RA report (HC 2000). This appendix documents the results of the QA review of analytical data for surface water samples collected. The QA review included examination and validation of the laboratory's summary reports, including holding times, method blanks, laboratory control sample recoveries, MS/MSD recoveries and RPDs, laboratory duplicate RPDs, and reported detection limits.

3.8.2 Data Usability

All sampling data collected by HC during the removal assessment are considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Laboratory data published in this data summary report were obtained from the analytical laboratory reports provided as an appendix to the HC removal assessment report (HC 2000) and field data (i.e., pH, flow, conductivity, etc.) was obtained from tables published in the HC removal assessment report (HC 2000). The following specific information was obtained from the QA review summary appendix to the HC RA report (HC 2000):

- In general, the detection limits achieved the goals in the work plan. In some cases, the detection limit may have been raised due to high concentrations of analytes in the samples or matrix interferences.

- All metals data are acceptable for use. Laboratory duplicate precision was within method criteria for all sample results with a concentration greater than 5 times the reporting limit. A few matrix spike/ matrix spike duplicate recoveries were outside control limits due to matrix interferences and high concentrations of analytes in the sample. No qualifiers were assigned.

- The matrix spike recovery for hardness analyses was high because of the high concentration of the analyte in the sample. The data were not qualified and are acceptable for use.

- The matrix spike recovery could not be calculated for sulfate because of the high concentration of the analyte in the sample. No qualifiers were assigned since remaining recoveries were acceptable. The data are acceptable for use.

3.9 Data Evaluation (2000 – 2001)

This section describes the quality control sample collection and usability of the surface water data from the HC data evaluation conducted between 2000 and 2001.

3.9.1 Quality Control Sample Collection

The HC data evaluation was conducted in accordance with the criteria established in the task order contract through ODEQ. No other governing documents (i.e., SAP) can be located in the project file record at this time. Surface water samples were analyzed by NCA. Internal laboratory QA/QC results for this investigation were not published in the HC data evaluation report but can be found in the individual analytical laboratory reports (HC 2001b and NCA 2000). Based on a review of analytical laboratory reports for surface water samples, field QC samples consisted of the following (the actual "sample name" on the laboratory reports is provided in parenthesis):

- October 17 – 18, 2000: One "Blank" sample was collected. It is unknown if this was a rinsate blank or trip blank.

- November 17 – 18, 2000: One "DI Blank" sample was collected. It is unknown if this was a rinsate blank or trip blank.

- February 22 – 24, 2001: Three "DI Blank" samples were collected. It is unknown if these were rinsate blanks or trip blanks.

- April 30, 2001 – May 2, 2001: Three "DI Blank" samples were collected. It is unknown if these were rinsate blanks or trip blanks.

3.9.2 Data Usability

All sampling data collected by HC during the data evaluation phase is considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Although there is a lack of QA/QC documentation in the HC data evaluation report, it is expected that sampling and analysis protocols utilized were in accordance with appropriate state and/or federal guidelines for collection of data useable for regulatory purposes.

Data published in this data summary report were obtained from the analytical laboratory reports provided as an appendix to the HC data evaluation report (HC 2001b), tables published in the HC data evaluation report (HC 2001b), and other

analytical laboratory reports containing data not published in the HC data evaluation report (NCA 2000). Water quality data were compiled directly from analytical laboratory reports and from the data evaluation report tables for field parameters (i.e., pH, flow, conductivity). Additional surface water data not published in the HC data evaluation report includes samples collected on July 18, 2000 and November 9, 2000. Field water quality data such as pH and flow are not available for these sampling events.

Since analytical laboratory reports were utilized to compile data, actual or true sample locations had to be inferred from the reported locations on the analytical laboratory reports. Locations reported on chain of custodies and laboratory reports were inconsistent between sampling events and inconsistent with sampling maps and tables provided in the HC data evaluation report. The interpretation of true locations was completed based on various maps showing surface water locations (BLM/ODEQ 2000a and 2000b, and HC 2000, 2001b, 2002, 2004a, and 2004b) and the most logical judgment. Assumptions made were verified by cross checking with published data in the HC data evaluation report tables and through personal communication with Greg Aitken from ODEQ (Aitken 2009).

3.10 Supplemental Remedial Investigation (2001 – 2002)

This section describes the quality control sample collection and usability of the surface water, groundwater, sediment, precipitate, leachate, soil, and waste rock data from the HC supplemental RI conducted between 2001 and 2002.

3.10.1 Quality Control Sample Collection

The HC removal assessment was conducted in accordance with the criteria established in the task order contract through ODEQ, with some modifications as noted in the HC supplemental RI report (HC 2002). No other governing documents (i.e., SAP) can be located in the project file record at this time.

Solid material and water samples were analyzed for chemical parameters by Environmental Services Laboratory, Inc. (ESL) in Durham, Oregon. Selected precipitate/sediment samples were submitted to BC Research, Inc., in Vancouver, BC, Canada, for mineral species using x-ray diffraction. Selected sediment samples were submitted to the HC Geotechnical Laboratory, in Seattle, Washington, for grain size analysis. Drilling logs and well installation details are provided in Appendix B.

A summary of field and QA/QC procedures and exploration logs was provided as an appendix to the supplemental RI report (HC 2002). The following presents some general QC information obtained from the summary (HC 2002):

- All non-dedicated sampling equipment (i.e., hand tools) were decontaminated using Alconox solution, tap water rinse, and deionized water rinse.

- The drilling rig and related equipment were decontaminated between drilling and installation of each groundwater monitoring well. Decontamination consisted of gross debris removal followed by a steam cleaning rinse.
- After each test pit exploration, the excavator bucket was dry brushed to remove loose soil.
- Sample collection, preservation, handling, and identification were conducted using standard EPA/ODEQ protocols.
- Two groundwater monitoring wells were installed in accordance with Oregon administration rule (OAR) 690-240 and ODEQ guidance: *Groundwater Monitoring Well Drilling, Construction, and Decommissioning* (ODEQ 1992).
- Two groundwater field duplicate samples were collected.

The appendix summary did not document surface water field QC samples; however, a review of individual analytical laboratory reports revealed the following (the actual "sample name" on the laboratory reports is provided in parenthesis):

- One field duplicate surface water sample was collected on each of the following dates: 11/8/2001, 2/21/2002, 3/27/2002, and 4/23/2002.
- One equipment blank was collected on 11/8/2001.
- One "DI" sample was collected on 11/30/2001. It is unknown if this was a rinsate blank or trip blank.
- One "DI Blank" sample was collected on each of the following dates: 12/19/2001, 2/6/2002, 2/21/2002, 3/27/2002, 4/23/2002, and 5/28/2002. It is unknown if these samples were rinsate blanks or trip blanks.

A QA review and analytical laboratory reports appendix was also provided in the supplemental RI report (HC 2002). The QA review included examination and validation of the laboratories' summary reports, including analytical methods, detection limits, sample holding times, custody records, and surrogates, spikes, and blanks. Data qualifiers were assigned, as necessary, during this review. The QA review did not include a review of raw data.

3.10.2 Data Usability

All sampling data collected by HC during the supplemental RI phase are considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Data published in this data summary report was obtained from the analytical laboratory reports provided as an appendix to the HC supplemental RI report (HC 2002), from tables in the supplemental RI report (HC 2002), and from the Microsoft Access Formosa Mine Site sample results database provided by HC (HC 2008). The HC Access database was

utilized as the basis for developing an internal CDM database of Site historic sampling data. The Access database was originally developed by HC to complete the risk assessment for the Site. Since some data was not utilized for the risk assessment, HC's database did not include all available samples and/or not all available analyte results for particular samples. For example, the database may have contained dissolved metals results for a sample, but no total metals results, and/or not all dissolved metal analytes were included in the database. Also, some locations such as the Formosa adit were not included in the database. Therefore, portions of data had to be compiled directly from analytical laboratory reports and combined with the HC Access database.

The following specific information was obtained from the QA review and analytical laboratory reports appendix provided in the HC supplemental RI report (HC 2002):

- All samples were analyzed in accordance with accepted methods of EPA and/or ODEQ. Because similar or the same methods were used, the quality of the data collected are consistent for all data sets and are therefore comparable to other data sets.

- Detection limits: Detection limits for sulfate were frequently raised due to dilution necessary to analyze the collected water samples. Detection limits for other analytes were acceptable.

- Data completeness: Data completeness was 100 percent for all requested analyses, which consisted of 22 data packages produced by ESL for a total of 144 water samples and 22 solid samples (i.e., soil, waste rock, sediment, and precipitate).

- Sample handling and custody: HC collected samples in general accordance with industry standards. This included requirements for collection, containers, labeling, packaging, shipping, and storage. Compliance with these procedures is documented on chain of custody forms. Analysis of water samples for sulfide collected on 2/21/02 and 2/26/02 were not preserved and have been flagged as estimates.

- Holding times: Collection dates for all samples submitted are documented on the chain of custody forms. Collection and extraction/analysis dates are indicated on the laboratory reports. Holding time criteria were met for all analyses.

- Method blanks: Target compounds were not reported in any method blank.

- Matrix spikes: Over the various sample delivery groups, matrix spike and matrix spike duplicate recoveries were outside of accepted recovery limits for various elements as specified in the QA review. Matrix spike recoveries were typically out of limits due to high analyte concentrations. When applicable, analyte data were flagged as estimated. All data are considered acceptable for their intended use.

- Laboratory Control Samples: Laboratory control samples (LCS) were analyzed by the laboratory to assess the accuracy of the analytical process. The percent recoveries were within acceptability criteria for all samples, with the exception in a few instances for TSS. These results were flagged as estimated.

- Laboratory Duplicates: Laboratory duplicate RPDs for some analytes were outside of method criteria in select instances as detailed in the QA summary and the data were qualified as estimated.

Some discrepancies between published tables in the supplemental RI report and analytical laboratory reports were observed. For instance, all surface water tables provided in the report indicated that results for metals were a total analysis (i.e., not filtered), whereas analytical laboratory reports revealed that the majority of analyses were actually for dissolved metals. This was determined based on the sample names provided on the analytical laboratory reports that indicated a dissolved analysis. Sample names on the analytical laboratory reports would have been derived from the chain of custody forms and are assumed to be the most accurate record of actual sampling and analysis conducted. The text of the supplemental RI report also indicates that a dissolved metals analysis was conducted. Also for some soil, waste rock, precipitate, and sediment results, sample dates published in the supplemental RI report tables did not match sample dates provided in the analytical laboratory reports. Again, it was assumed that information on the analytical laboratory reports was the most accurate, and this information was used to compile data for this data summary report.

Since analytical laboratory reports were utilized to compile data, actual or true sample locations had to be inferred from the reported locations on the analytical laboratory reports in some cases. Locations reported on analytical laboratory reports were sometimes inconsistent between sampling events and inconsistent with sampling maps and tables provided in the supplemental RI report. The interpretation of true locations was completed based on various maps showing surface water locations (BLM/ODEQ 2000a and 2000b, and HC 2000, 2001b, 2002, 2004a, and 2004b) and the most logical judgment. Assumptions made were verified by cross checking with published data in the supplemental RI report tables.

3.11 Post Supplemental RI Sampling (2003 – 2006)

This section describes the quality control sample collection and usability of the surface water, soil, and waste rock data from various investigations conducted between 2003 and 2006.

3.11.1 Quality Control Sample Collection

3.11.1.1 Surface Water

Additional surface water sampling between 2003 and 2005 is assumed to have been conducted using the same procedures as outlined in the supplemental RI. Also, as provided by ODEQ, sampling was likely conducted in accordance with the *Revised*

Monitoring & Inspection Plan Formosa Acid Mine Drainage Diversion System, April 2005 (ODEQ 2005).

Surface water samples collected in 2003, 2004, and on September 19, 2005 were analyzed by NCA. Metals data for surface water samples collected in June and July 2005 were published in START-3 preliminary assessment report (START-3 2006). Analytical laboratory reports for this June and July sampling are not available at this time, so the actual laboratory that completed the metals analyses is unknown. Isotope analyses were also conducted on these samples. This work was reported to be completed by the University of Waterloo-Environmental Isotope Laboratory.

A summary of QA/QC and/or data validation results for surface water samples are not available, however, a review of the analytical laboratory reports (NCA 20003 – 2005) verifies internal laboratory QC analyses were conducted. Based on the analytical laboratory reports, the following field QC samples were collected (the actual "sample name" on the laboratory reports is provided in parenthesis)):

- One field duplicate surface water sample was collected on each of the following dates: May 20, 2003, February 23, 2004, and September 19, 2005.
- One "DI Blank" sample was collected on each of the following dates: May 20, 2003, February 23, 2004, April 29, 2004, June 17, 2004, July 14, 2004, and August 16, 2004. It is unknown if these samples were rinsate blanks or trip blanks.
- A "DI Water" sample was collected on May 13, 2004. It is unknown if this was a rinsate blank or trip blank.

3.11.1.2 Soil and Waste Rock

The START-3 removal assessment sampling and analysis was conducted in accordance with the *Formosa Mine Site-Specific Sampling Plan* (E&E 2006) and the *Generic Quality Assurance Project Plan for Removal Program Sampling* (E&E 2003). Soil and waste rock samples were analyzed by CAS. A detailed QA/QC section was provided in the removal assessment report (START-3 2007). The following presents some general QA/QC information obtained from this report (START-3 2007):

- Specific QC requirements for laboratory analyses were incorporated from the *Contract Laboratory Program Statement of Work for Inorganic Analyses* (EPA 2004a).
- Data from the laboratory (CAS) were reviewed and validated by a START chemist. Data qualifiers were applied as necessary according to the following guidance: EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004b) and *EPA Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures* (EPA 1990). In the absence of other QC guidance, method-specific QC limits also were utilized to apply qualifiers to the data.

- The data quality achieved during the field work produced sufficient data that meet the data quality objectives (DQOs) stated in the site-specific sampling plan (E&E 2006).

- One rinsate blank sample was collected for each 20 samples collected using non-dedicated sampling equipment. QC samples included MS/MSD samples for metals analyses at a rate of one MS/MSD per 20 samples per matrix.

3.11.2 Data Usability

3.11.2.1 Surface Water

All surface water sampling data collected between 2003 and 2005 is considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Although there is a lack of QA/QC documentation, it is expected that sampling and analysis protocols utilized were in accordance with appropriate state and/or federal guidelines for collection of data useable for regulatory purposes.

Data published in this data summary report from the 2003 to 2005 surface water sampling were obtained from the analytical laboratory reports (NCA 2003 - 2005) and START-3 preliminary assessment report (START-3 2006). Field water quality data such as pH and flow are not available for these sampling events.

3.11.2.2 Soil and Waste Rock

All soil and waste rock sampling data collected during the START-3 removal assessment are considered useable for the purposes of describing the environmental conditions present at the Site and developing the RI/FS sampling program. Data published in this data summary report from the START-3 sampling was obtained from electronic Microsoft Excel tables provided by E&E (E&E 2009) and from analytical laboratory reports provided as an attachment to the START-3 removal assessment report (START-3 2007).

A QA review summary was provided as an appendix to the START-3 removal assessment report (START-3 2007) with the following assessments:

- Precision: No sample results were qualified based on laboratory duplicate QC outliers. The DQO for precision of 85 percent was met.

- Accuracy: LCS and MS percent recoveries were all within criteria. The project DQO for accuracy of 85 percent was met.

- Completeness: All laboratory data were reviewed for data validation and usability. No data were rejected, therefore the project DQO for completeness of 90 percent was met.

- Representativeness: The number and selection of samples were sufficient to represent the Site.

- Comparability: Data produced followed applicable field sampling techniques and specific analytical methodology. The DQO for comparability was met.
- Sample handling and preservation was compliant and all samples were analyzed within holding times.
- Laboratory blank analyses were performed. Zinc was detected in the laboratory blanks for SPLP and TCLP metals. Associated sample results less than five times the blank concentrations were qualified as not detected (U).
- One rinsate blank sample was collected during the field event; meeting the required frequency of one per 20 samples collected using non-dedicated sampling equipment. Calcium (68.6 micrograms per liter [µg/L]), iron (46.2 µg/L), lead (0.20 µg/L), and sodium (430 µg/L) were detected in the metals rinsate blank sample. All sodium metals results were qualified as not detected (U) based on rinsate blank contamination.

FPXRF samples were collected and compared to the results from the commercial laboratory. A statistical analysis of FPXRF data versus laboratory data was completed as part of the QA review (START-3 2007). Further evaluation of this statistical analysis is presented in Section 4.5.1.

Section 4
Data Summary

This section summarizes the environmental, geologic, and hydrogeologic data available for the Site. The bulk of the data described stems from the BLM/ODEQ RI phase (1999-2000) until present. Additional historic data are presented from prior to 1999 on topics such as geology, groundwater, and aquatic biology.

Section 1.2 described the mining-related activities that occurred at the Site. Many of these activities have the potential to contribute to Site contamination. In general, previous investigations have focused on understanding the extent of contamination and the resulting effects to Site media and ecological receptors. Previous mining-related activities at the Site and potential contaminants that may result from those activities are summarized below to provide information regarding the context of the data that are summarized in this section.

- **Mineral extraction** activities involve tunneling, blasting, and excavation of naturally mineralized rock from the subsurface, hauling of this rock to the surface, and placement of rock into ore stockpiles or waste rock piles (waste rock is non-mineralized rock that must be excavated to access the ore). This process exposes rock that naturally contains high concentrations of potentially toxic metals and other contaminants. The surface exposure and particle size reduction inherent to this process has the potential to facilitate surficial alteration and dissolution of primary ore minerals, and release of contaminants contained within the ore minerals into the environment. Potential contaminants of concern include metals, metalloids, sulfate, and acidity. Nitrogen compounds may also be released into the environment as residual byproducts of ammonium nitrate fuel oil blasting agents.

- **Mineral beneficiation activities** are activities that focus on separating the payable metals in the ore from the worthless minerals (generally referred to gangue minerals in mining terminology). Mineral beneficiation activities include additional particle size reduction by crushing and grinding, and separation of payable metals from gangue using flotation. The beneficiation process produces ore concentrates and tailings, both of which can contribute to environmental contamination if improperly handled, transported, or stored. Other potential Site contaminants that could result from mineral beneficiation activities include residual mineral processing reagents.

- **Ancillary mining activities** include activities that are necessary to support mineral extraction and beneficiation. These activities are similar in many ways to activities that would occur at any large surface construction project such as petroleum product transportation and storage, and equipment maintenance activities. At the Silver Peak Mine, conventional electrical power was not available, and generators were necessary to provide electrical power to the mine. Other electrical infrastructure such as transformers would also have been present at the mine.

Potential contaminants that could result from these activities include benzene, toluene, ethylbenzene, xylene, and napthalene from spills of gasoline or diesel fuels; waste oil from mobile equipment; or solvents used in equipment maintenance activities.

- **Environmental management activities** are critical aspects of all modern metal mines because these activities are focused on mitigating potential effects of mining on the environment. Environmental management activities are critical in preventing transport and dispersion of mining-related contaminants into the environment. Much of the data collected at the Site to date is related to dispersion of mining-related contaminants into the environment such as surface water chemistry data, biological monitoring data, and groundwater chemistry data. The performance of mine waste management activities in preventing dispersion of mining-related contaminants into the environment is an important consideration in reviewing the available data from previous investigations.

This section is organized generally by media to facilitate understanding of available data in a more holistic manner than previously provided by the various independent reports. This section is organized as follows:

- Extent and Location of Mine Workings;
- Geology;
- Surface Water;
- Groundwater; and
- Soil and Waste Rock;

4.1 Extent and Location of Mine Workings

Data regarding the extent and location of existing underground mine workings at the Site is limited to one AutoCAD file and a series of drawings that were generated by Mr. Jay Wilson, a former mine engineer for FEI. A series of 1987 plan maps and sections prepared by FEI also exists, but the 1987 maps do not include underground mine development that was completed in the most recent period of underground mining. The AutoCAD file was obtained on CD from ODEQ files, and some compilation and analysis of the information contained within the file has been conducted for this data summary report. The information contained within the AutoCAD file and on hard-copy drawings are critical to understanding Site conditions, because access to the underground workings is not possible without a very substantial investment in reopening and rehabilitating the mine. Data also exist regarding the type and location of mine backfill on hard-copy drawings and on other AutoCAD drawings prepared by Mr. Wilson; however information located on hard-copy drawings has not yet been compiled and the other AutoCAD files are not available at this time.

Figures 4-1a though 4-1d present various renderings of the existing underground workings at the mine based on compilation of the AutoCAD data provided by Mr. Wilson. The original AutoCAD file is referenced in a local mine grid, which is a

common practice at mine sites in general. The local mine grid on the AutoCAD file is thought to be orientated at an azimuth of 055 degrees, and earlier hard-copy exploration maps and cross-sections (pre-1990) are thought to be orientated at an azimuth of 037 degrees (Wilson 2009). In order to understand specifically where the underground workings are located, it was first necessary to georeference the local mine grid to the existing grid system of the surface feature data. Accurately georeferencing the local mine grid to the surface coordinate system is critical to understand potential connections between the underground mine workings and areas of ARD discharge into Middle Creek and the South Fork of Middle Creek. The images presented in Figures 4-1 through 4-4 are based on an initial georeferencing of the mine grid to the surface grid using AutoCAD software, but this may be refined in the future as additional compilation work is completed.

Based on the current stage of compilation, the underground mine workings extend from an elevation of 2,860 ft amsl to approximately 3,510 ft amsl. The areal extent of the underground mine projected to the surface is relatively small as shown on Figure 4-1. This is a result of the relatively compact nature of the massive sulfide ore bodies excavated during the recent period of mining. Figures 4-2 through 4-4 show several features of the underground mine including a spiral ramp system accessing the lower levels of the mines and a series of mining stopes orientated along the steeply dipping lenses of massive sulfide mineralization.

The underground mining process consisted of tunneling along the strike length of the ore body at a given level. The ore was blasted, excavated, and hauled to the surface. The void space in the rock left by excavation of the ore was then backfilled by pumping a tailings and concrete slurry or a pure tailings slurry into the void space. A new cut through the massive sulfide lens was then completed on top of the previous cut using the backfilled tailings and concrete as a floor. At frequent intervals, a sub-horizontal pillar of undisturbed rock was left in place in order to prevent the underground workings from collapsing. Although this prevented a portion of the ore body from being mined, it was necessary to maintain ground support within the mine.

The hard-copy drawings also provide the location of various types of mine backfill in the underground workings. This backfill includes tailings pumped into mine voids as a slurry, waste rock and lean ore hauled into the mine from the surface, tailings and sediments removed from Middle Creek, and Gob (a mining term for waste rock mined underground and never hauled to the surface). Each of these backfill materials likely has different geochemical characteristics, but currently there is insufficient information to define the potential for most of the backfill materials to generate acid.

Two samples of tailings were submitted for ABA analysis during early testing on the metallurgical recovery of copper and zinc from Silver Peak Mine ore (Coastech Research Inc. 1990). These two ABA samples have total sulfur contents of 34.23 percent and 32.75 percent respectively, which corresponds to pyrite contents of approximately 68 percent and 66 percent respectively. The very high pyrite content of

the tailings coupled with the very fine grain size (-400 mesh or -0.037 millimeters) makes the tailings an extremely reactive acid generating material. It is unlikely that addition of cement in the backfill process would provide sufficient neutralization potential to prevent these tailings from generating acid.

4.2 Geology

Several good geology references are available that describe the Site geology and mineralogy (FRC 1987 and 1988, Derkey and Matsueda 1989, and Derkey 1981 and 1982). Although these reports focus primarily on the economic geology of the Silver Peak Mine, they provide excellent background information to understand the causes of acid generation and to understand aspects of the hydrogeological framework of the Site. This section summarizes pertinent information presented by FRC (1987), Derkey and Matsueda (1989) and focuses on:

- Relevant aspects of the regional geologic framework;
- Local geology in the vicinity of the mine;
- Ore mineralogy and mineralogy of rock units intersected by underground workings with respect to the potential to generate ARD; and
- Local structural geology pertinent to potential contaminant migration.

4.2.1 Regional Geology

The Silver Peak Mine is located in the Western Jurassic Belt of the Klamath Mountains. The Klamath Mountains consist of 4 belts of accreted Paleozoic and Mesozoic rocks. The Western Jurassic Belt is the westernmost of four accurate north-south trending lithologic belts. Each belt is bounded on the west by an easterly-dipping thrust fault (a low angle reverse fault usually with more horizontal compression rather than vertical displacement). The Western Jurassic Belt is bounded on the west by the Coast Range thrust, which separates Franciscan rocks of the Coast Range Province from the Western Jurassic Belt rocks. The Coast Range thrust trends generally northeast and is located approximately 800 meters west of the Silver Peak Mine (Derkey and Matsueda 1989, FRC 1987). A subsidiary sub-parallel thrust called the Silver Butte thrust is located just east of the Silver Peak Mine. The local structural geology of the Site is influenced by the major thrust faults, and the trend of lithological units, the bedding and foliation of the rocks, and the orientation of subsidiary structures is sub-parallel to these major fault units (FRC 1987). The locations of the Coast Range thrust and Silver Butte thrust are shown on Figure 4-2.

The Coast Range thrust also marks a major change in lithology, with primarily sedimentary rocks on the west side of the fault and metavolcanic rocks (metamorphic rock formed from volcanic rocks) on the east side. Rocks on the west side of the Coast Range thrust are primarily sedimentary rocks of the Dothan Formation, which includes litholgies such as mudstones, greywacke with local chert and pillow basalt. Rocks on the east side of the Coast Range thrust in the general vicinity of the mine consist of primarily metavolcanic rocks of the Rogue Formation including tuff, agglomerate, flow breccia and flows. A tuff is a volcanic rock formed of clastic grains

originating in a volcanic eruption. In contrast, flows are crystalline volcanic rocks formed by solidification of lava flows. Agglomerates and flow breccia are volcanic rocks that have been disturbed during crystallization and contain a mosaic of displaced grains. The contrast between primarily sedimentary rocks on the west side of the Coast Range thrust and primarily metavolcanic rocks on the east side of the Coast Range thrust may contribute to contrasting hydrogeological characteristics as well.

4.2.2 Local Geology

The rock units in the direct vicinity of the Silver Peak Mine were described by Derkey and Matsueda 1989, and consist of the following units:

- Basalt flows and tuffs;
- Dacite tuffs;
- Foliated tuff;
- Bedded tuff; and
- Basaltic tuff.

These rock units are generally composed of subaqueously deposited volcanic rocks that are spatially and genetically associated with the massive sulfide mineralization at the Silver Peak deposit. Derkey and Matsueda (1989) note that field delineation of many basaltic versus dacitic rocks is difficult where the rock units are weathered. Derkey and Matsueda (1989) utilized normative mineralogical analyses based on whole rock geochemistry to delineate the units. In contrast, the foliated tuff unit is a very characteristic unit that is readily identified in the field. This unit is present in the underground mine and hosts the massive sulfide mineralization (the ore body). Each of the units is described in the following sections. A local geological map is presented as Figure 4-2, and two geologic cross-sections are presented as Figures 4-3 and 4-4.

The basalt flows and tuffs are lowermost in the stratigraphic sequence, and are up to 600 meters thick. The basalt flows are crystalline rocks that are characterized by large augite phenocrysts (relatively large crystals) in a groundmass (relatively fine grained crystals) of albite, chlorite, and epidote. The rock is locally vesicular (containing holes formed from escaping gas) and is medium to light green in color.

The dacite dome and tuff generally overlies the basalt flows and tuffs. This unit is light grey to tan and consists of 5 percent altered plagioclase phenocrysts in a groundmass of fine grained submicroscopic quartz, epidote, chlorite and albite. This unit is interbedded with the basalt flows and tuffs unit in some areas, and contains common clots and veins of secondary quartz near the mine.

The foliated tuff unit is a foliated ash-flow tuff, which is host to ore mineralization at the Silver Peak Mine. The tuff matrix consists of chlorite, albite, quartz, and epidote. Tthe tuff matrix contains a high percentage of sericite near the ore bodies. A sericite-quartz-pyrite lithological variation is common near mineralized areas, with pyrite occurring as abraded lapilli (pyroclastic rock fragments generally between 2 and

64 millimeter (mm)). This unit will be discussed further in Section 4.2.3, which focuses on ore mineralogy.

The bedded tuff unit overlies the foliated tuff and is at least 300 meters thick in the Silver Butte Peak area. This unit ranges in color from pale grey to light green to light brown. Bedding ranges from thin bedded to massive bedded. Most occurrences of this unit are soft and weakly indurated. The term induration refers to the degree of hardening or consolidation of the rock caused by pressure or heat. Portions of the unit are well indurated and porcelaneous (having a smooth fracture surface). This unit is overlain by a basaltic tuff unit.

Several aspects of the local geology are important with respect to the environmental issues present at the Site. Firstly, the rock units include crystalline flows and indurated tuffs as well as soft weakly indurated tuffs. Variations in the degree of induration of the bedded tuff unit may affect the hydrogeological characteristics of the unit such as the degree to which water tends to move through primary intergranular porosity or secondary porosity related to fractures. In addition, no carbonate minerals are reported in any of the rock units, which indicates that these units would be unlikely to significantly buffer pH changes caused by ARD generation in the mine area.

4.2.3 Ore Mineralogy

The mineralogy of the ore bodies and associated rocks intersected by mine workings is an important aspect controlling ARD at the Site. The Silver Peak deposit is classified as a volcanogenic massive sulfide deposit. This type of deposit contains very high concentration of sulfide minerals, and therefore the deposit has a very high potential for acid generation. This is exacerbated by a lack of acid neutralizing carbonate minerals in the country rocks surrounding the mine. In order to understand the nature of the ARD source material at the Site, it is useful to examine the ore mineralogy data provided by FRC (1987) and Derkey and Matsueda (1989).

The ore bodies and portions of the foliated tuff unit contain high concentrations of numerous sulfide minerals including pyrite (FeS_2), chalcopyrite ($CuFeS_2$), sphalerite (ZnS), bornite (Cu_5FeS_4), tennantite ($(Cu, Fe, Zn, Ag)_{12}As_4S_{13}$), tetrahedrite ($(Cu, Fe, Zn, Ag)_{12}Sb_4S_{13}$), galena ($PbS$), and chalcocite ($Cu_2S$) (FRC 1987). Pyrite is a major contributor to ARD generation at mine sites worldwide, and it is important at the Silver Peak Mine both in terms of direct ARD generation by pyrite and the effect of the products of pyrite oxidation on oxidation of other sulfide minerals.

Pyrite generates acid by numerous reaction paths, but the following reaction paths are particularly important in understanding the affect of the ore mineralogy on ARD generation. The first important reaction is oxidation of pyrite to form ferrous iron (Fe^{2+}), sulfate and hydrogen (H^+)

$$FeS_2 + 3.5O_2 + H_2O \rightarrow Fe^{2+} + 2SO_4^{2-} + 2H^+$$

In an oxidizing environment such as surface exposures of mine waste and vadose portions of the underground mine, the ferrous iron may oxidize to ferric iron (Fe^{3+}) as follows:

$$Fe^{2+} + 0.25O_2 + H^+ \rightarrow Fe^{3+} + 0.5H_2O$$

In surficial mine waste, the ferric iron may precipitate as an amorphous to microcrystalline iron hydroxide or hydroxysulfate mineral (Nordstrom and Alpers 1999) or as one of a number of efflorescent ferrous and ferric sulfate minerals, which can quickly dissolve releasing stored acidity during periods of high precipitation. These pathways are likely occurring in areas of ARD generating mine waste exposed on the surface at the Site.

However, within the hydrogeological system of the underground mine, the dissolved ferric iron may further react with pyrite and other sulfide minerals. Sulfide minerals within the underground mine are present in backfilled tailings, waste rock, other mine waste, or they may be essentially in-situ within the walls of mine tunnels or in other exposed surfaces. Dissolved ferric iron is an aggressive oxidant that, when it reacts with sulfide minerals, generates significantly greater quantities of acid than generated by oxygen-driven oxidation alone (Plumlee 1999). Dissolved ferric iron may lead to acid generation and mineral dissolution within the saturated zone of the underground mine, in areas that are not exposed to oxygen in significant quantities.

Dissolved ferric iron may lead to increased acid generation from pyrite by the following reaction:

$$FeS_2 + 14Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2H_2O + 16H^+ + SO_4^{2-}$$

Other ore minerals present at the Silver Peak Mine including chalcopyrite, sphalerite, and galena also have the potential to generate acid if ferric iron is the oxidant. These reaction paths are described below based on the work of Plumlee (1999) and Seal and Hammarstrom (2003).

$$CuFeS_2 + 16Fe^{3+} + 8H_2O \rightarrow Cu^{2+} + 17Fe^{2+} + 2SO_4^{2-} + 16H^+$$

$$ZnS + 8Fe^{3+} + 4H_2O \rightarrow Zn^{2+} + 8Fe^{2+} + SO_4^{2-} + 8H^+$$

$$PbS + 8Fe^{3+} + 4H_2O \rightarrow Pb^{2+} + 8Fe^{2+} + SO_4^{2-} + 8H^+$$

Although chalcopyrite, sphalerite, and galena do not generate acid when oxidized by oxygen, they do oxidize when exposed to the surface environment. This reaction may lead to liberation of copper, zinc and/or galena from the solid mineral lattice, which creates a source of these toxic metals in the environment. These reactions are shown below.

$$CuFeS_2 + 2O_2 \rightarrow Cu^{2+} + Fe^{2+} + 2SO_4^{2-}$$

$$ZnS + 82O_2 \rightarrow Zn^{2+} + SO_4^{\ 2-}$$

$$PbS + 2O_2 \rightarrow Pb^{2+} + SO_4^{\ 2-}$$

Therefore, understanding the distribution of sulfide minerals within the mine in both the saturated and unsaturated zones are critical to understanding the Site.

There are four rock units containing sulfide mineralization at the Silver Peak deposit, all of which are contained within the foliated tuff unit defined by Derkey and Matsueda (1989). These units consist of:

- Quartz-sericite-pyrite foliated tuff;
- Quartz-sulfide tuff;
- Sulfide lapilli tuff; and
- Massive sulfide.

The quartz-sericite-pyrite foliated tuff is the thickest of the three units, and is up to 10 meters thick in the mine area (Derkey and Matsueda 1989). It is grey to white in color and consists of sand-sized grains of quartz and pyrite with varying amounts of platy sericite. Pyrite is detrital when it occurs in grains exceeding 0.1 millimeter in diameter, as evidenced by abraded textures. Trace chalcopyrite and sphalerite are also present in this unit (FRC 1987). Norecol (1989) provides estimates of the sulfide content of quartz-sericite-pyrite foliated tuff based on total sulfur analyses. Based on 11 samples, the estimated sulfur content ranges from 4.98 to 19.20 percent, which corresponds to a pyrite content in the rock ranging from approximately 10 to 40 percent. This rock is highly acid generating.

The quartz-sulfide tuff occurs in the ftwall of the massive sulfide zones. This unit is dense and siliceous and not strongly foliated. It contains sphalerite and chalcopyrite in addition to pyrite (FRC 1987), and is also acid generating.

Sulfide lapilli tuff is defined by Derkey and Matseueda (1989). It consists of cream colored tuff containing scattered lapilli size fragments of sulfides including pyrite, chalcopyrite, tennantite, and sphalerite. The sulfide lapilli tuff occurs in the hanging wall of the massive sulfide mineralization. This unit contains up to 10 percent sulfide minerals in a fine grained well-indurated matrix, which causes this unit to be acid generating.

Massive sulfide at the Silver Peak Mine occurs in 4 distinct lenticular bodies. The massive sulfide lenses are relatively small in overall size, but they contain large accumulations of sulfide minerals. The massive sulfide lenses range from less than 1 meter to approximately 5 meters thick. FRC (1987) reports the strike extent of the massive sulfide lenses to range from 20 to 90 meters, with a down-dip extent of approximately 100 meters. It should be noted that work by FRC (1987) was completed prior to initiation of mine development during the most recent period of mining at Silver Peak Mine, and that further extensions of massive sulfide mineralization may

have been discovered during the course of subsequent exploration and mine development.

Massive sulfide mineralization at Silver Peak Mine is predominantly pyrite with chalcopyrite, sphalerite and local bornite, tennantite, galena, and chalcocite. Barite and quartz occur within the massive sulfide lenses as gangue minerals. Four types of massive sulfide mineralization are present in the deposit (FRC 1987):

- Pyrite ore is principally pyrite with minor quartz and chalcopyrite;
- Yellow ore is pyrite and chalcopyrite;
- Semi-black ore is pyrite and chalcopyrite with sphalerite, barite and quartz; and
- Black ore is sphalerite, barite, pyrite, galena, chalcopyrite, tetrahedrite, and tennantite.

The primary payable metal at the Silver Peak Mine during the most recent period of mining was copper. Zinc concentrates were initially produced, but the zinc concentrate was not of sufficient quality to be an economic product from the mine. Therefore, the massive sulfide mineralization most profitable to mine would be the yellow ores because of the high chalcopyrite content. In addition, semi-black ore and black ore may have been economic to mine if the copper content was high enough to support mining and mineral processing costs.

The most important conclusion of this examination of ore mineralization data is that the entire foliated tuff unit contains pyrite and other potentially acid generating minerals. This includes the lenses of massive sulfide mineralization as well as the various subdivisions of the foliated tuff unit. Only the portions of this unit containing the highest copper concentrations were likely mined, but mine tunnels accessing the copper ore very likely exposed acid generating minerals where they penetrated the other massive sulfide units and the foliated tuff units. In addition, pillars of massive sulfide mineralization were not mined in order to provide ground support within the mine as described in Section 4.1. Therefore, exposed rock surfaces within the underground mine are an important source of acid generation in addition to backfilled tailings and other mine waste. Furthermore, cycling of dissolved ferric iron into submerged portions of the underground workings and subsequent discharge from groundwater to surface water is potentially occurring, which suggests that acid generation and associated metal dissolution may be occurring both within the vadose and saturated portions of the underground mine.

4.2.4 Structural Geology

FRC (1987) describe extensive shearing and faulting occurring within the ore bodies and along the hanging wall contact. In addition, several faults cross-cutting the mineralized zones are evident in various geological maps of the Site. As discussed previously in Section 4.2.2, secondary porosity in the form of shears and faults may be important in understanding the hydrogeological framework of crystalline rocks and well-indurated tuffs in the vicinity of the mine. Therefore, this section reviews the

available information regarding the presence of shearing and faulting at the Silver Peak Mine.

The massive sulfide mineralization occurs within an approximately 150 to 200 meter thick sequence of foliated tuff. The fabric of the foliated tuff includes a well defined foliation sub-parallel to bedding. This foliation is absent in adjacent dacite and basalt tuff units. FRC (1987) believe that this foliation is an expression of shearing deformation, which occurred in the general plane of the foliated tuff units (including zones of massive sulfide mineralization). The foliation is generally parallel to the strike of the rock units (strike 035 to 050 degrees, dip 60 to 75 degrees southeast), the orientation of the regional thrust faults, and the bedding of the massive sulfide units.

Structures cross-cutting the orientation of the major thrust faults are also present on various geological maps of the Site. A fault offsetting ore mineralization is present on a series of plan maps at various depths through the mine developed by FRC (1987). This structure is located approximately 30 meters south of the Formosa 1 adit. The structure is a right-lateral fault which displaces the ore zone by approximately 30 meters. The trend of this structure is generally west to northwest towards the Middle Creek drainage. Several other faults of similar orientation are provided on maps included in Derkey and Matsueda (1989) in the general area of the Silver Peak Mine.

4.3 Surface Water

This section describes available surface water data from the BLM/ODEQ RI phase through 2006. Historic surface water quality data collected prior to 1999 are not presented in this report, except for the USGS data collected in 1998. All macroinvertebrate and fish sampling data dating back to 1982 is discussed in Section 4.3.4 below. This set of data is crucial to understanding the observed affects to the aquatic biology of streams near the Site over the period of record from pre-modern mining to post-mining.

4.3.1 Surface Water Hydrology

The Site is located within the South Umpqua Basin, one of three sub-basins in the Umpqua Basin. Sub-watersheds near the Site include Russell Creek - Cow Creek, Middle Creek, and Canyon Creek. Russell Creek and West Fork Canyon Creek are the main drainages in the Russell Creek - Cow Creek and Canyon Creek sub-watersheds that have headwaters near the Site. Within the Middle Creek sub-watershed, both upper Middle Creek and South Fork Middle Creek have headwaters near the Site. These watersheds and drainages were shown previously on Figure 1-3.

Precipitation data from the Riddle Western Regional Climate Center was published in the HC RI report. Additional precipitation or climate data that may exist was not researched for this data summary report. The HC RI report presented an average yearly total rainfall of 31.59 inches (in). This data was averaged over the years 1948 through 2000. The highest average monthly precipitation totals are November 4.88 in, December 5.70 in, January 5.36 in, and February 3.39 in. By April, the average

monthly total drops to 2.04 in, and by June, the average monthly total drops below 1.0 in. Precipitation stays below 1.0 in until October (2.42 in). Climate data from the Silver Butte Fire Lookout Station was also compiled by HC; however, the RI report indicated that snowfall readings at this station were biased low because of instrument error.

Historic data from the Sexton Summit, Riddle, and Silver Butte Fire Lookout stations were presented in Norecols' baseline report (Norecol 1989a). This data set indicated average yearly total rainfall values of 55.0 in at Silver Butte, 38.14 in at Sexton Summit, and 31.61 in at Riddle. The period of record at the Sexton Summit and Riddle stations ranged from 1960 to 1980, while the Silver Butte station dataset only ranged from September 1988 to April 1989. All of these datasets from the 1989 report show the same yearly trends as described in the HC RI.

All surface water flow data collected over the historical range is presented in Appendix A. The historical range presented for flow is from the BLM/ODEQ RI phase (1999) through 2002. This historical range of data is not necessarily the complete historical set of data, but it is the most complete and available set of data. Surface water flow data that may have been collected after the HC supplemental RI (i.e., post June 2002) are not currently available. Surface water flow data for the Formosa adit, Silver Butte adit, Seep A, A4, A9, MXR, M3.0, SF1.0, SF3.0, SF4.7, M3.1, and M13.0 are shown in Figures 4-5 through 4-16. These locations were selected to be shown in figures for comparison to water quality data presented in Section 4.3.2 below.

Flow at the Formosa adit (Figure 4-5) ranges from 1 gpm to 190 gpm (17 measurements) and flow at the Silver Butte adit (Figure 4-6) ranges from 0 gpm to 20 gpm (8 measurements). The most detailed set of available flow data (or water quality data, see Section 4.3.2) ranges from May 1999 through May 2002. The lowest flows are observed in May through November and high flows are observed in December through February. Limited flow or water quality data are available for the Silver Butte adit because the adit is dry most of the year, except winter. Fluctuating flows for both adits appear to be closely related with changes in precipitation, which suggests rain/melt water is quickly infiltrating the upper workings and draining through the adits.

Flow measured at the remaining locations shown in Figures 4-7 through 4-16 indicate a positive correlation with the general precipitation trend, showing increases in flow in the winter months. For all figures that have a significant number of measurements, the 2000/2001 winter season flow peak appears lower than for the 1999/2000 and 2001/2002 winter seasons, although this may be due to the lack of flow measurements collected in December 2000 or January 2001 when much higher flow peaks may have been present.

4.3.2 Surface Water Quality

Surface water quality near the Site within Middle Creek and South Fork Middle Creek has been severely affected by metals loading and acidic water originating from the

Site. Surface water quality data collected from 1998 (USGS data only) through 2005 was compiled and analyzed with respect to each particular sampling location. For the purposes of this report, this dataset is considered the historical range of data and is the focus of this section.

Surface water quality data are compared to selected screening levels (SLs). SLs were developed using the ODEQ's *Assessment Methodology for Oregon's 2004/2006 Integrated Report on Water Quality Status* (ODEQ 2006). Water quality criteria are shown in Table 4-1, which include acute and chronic criteria for protection of aquatic life and three types of criteria for protection of human health: water and fish ingestion, consumption only, and the drinking water maximum contaminant level. Using the approach recommended by ODEQ (ODEQ 2006), the most stringent (i.e., lowest) water quality criteria were selected as the SLs for comparison to the Site water quality data. However, the selected SLs for arsenic and beryllium excluded the lowest criteria available (water and fish ingestion) because the lowest criteria are too low for a practical comparison to the water quality data set. The selected SLs are shown in Table 4-1 as bolded text.

All surface water quality data collected over the historical range are presented in Appendix A. To focus the discussion and data presentation, a statistical analysis has been completed for each location and each analyte, which includes evaluation of mean, median (for pH only), minimum, maximum, frequency of detection, and frequency of exceedance of the selected water quality SLs. These water quality statistics are presented in Tables 4-2 through 4-16 for the following : Formosa adit, Silver Butte adit, End of Pipe, Seep A, A4, A9, MXR, M3.0, SF1.0, SF3.0, SF4.7, M3.1, M13.0, C1, and C2. The average hardness for each location was used to compute the hardness-dependent SLs shown in the tables. Statistical summary tables for the remaining sample locations are provided in Appendix A. The locations presented in Tables 4-2 through 4-16 were selected for further discussion in order to provide an overall description of the affected areas.

Note that for some analytes, SLs are less than the method reporting limits. For these cases, the analyte is shown as an exceedance in Tables 4-2 through 4-16, although this may not be the case. These discrepancies between method reporting limits and SLs become more frequent for locations located further downstream that have more non-detect concentrations. Also, method reporting limits are variable depending on the laboratory and analysis methods employed. Non-detect results in the Appendix A tables are as indicated by a "U" qualifier.

Water quality figures (Figures 4-17 through 4-76) were also created for the selected locations shown in the tables for sulfate and pH, cadmium, copper, and zinc. Sulfate and pH are shown together on the first figure for each location as indicators of ARD, which can typically be represented by decreased pH and increased sulfate. Note that pH data are not available for samples collected in 2003, 2004, or 2005. Cadmium, copper, and zinc are shown on figures because: 1) they are representative of metal-laden ARD emanating from the Site; 2) they are some of the most frequently detected

analytes and have some of the greatest concentrations with respect to SLs; and 3) they are compounds of potential concern (COPCs) for human health risk and compounds of potential ecological concern (CPECs) in the HC risk assessment report (HC 2004a).

4.3.2.1 Adit Water

The Formosa adit summary statistics are shown in Table 4-2 and results for sulfate and pH, cadmium, copper, and zinc are shown in Figures 4-17 through 4-20. The Silver Butte adit summary statistics are shown in Table 4-3 and results for sulfate and pH, cadmium, copper, and zinc are shown in Figures 4-21 through 4-24. End of Pipe summary statistics are shown in Table 4-4 and results for sulfate and pH, cadmium, copper, and zinc are shown in Figures 4-25 through 4-28.

The Formosa adit water (28 samples total) has some of the highest concentrations of metals measured at the Site, with cadmium ranging from 0.265 mg/L to 1.21 mg/L, copper from 5.06 mg/L to 83.2 mg/L, and zinc from 47.6 mg/L to 258 mg/L. The median pH for the Formosa adit (21 samples for pH) is 3.05 su, minimum 2.15 su, and maximum 4.46 su. Silver Butte adit water (5 samples) is similar in concentration, with cadmium ranging from 0.14 mg/L to 0.47 mg/L, copper from 10.4 mg/L to 59.9 mg/L, and zinc from 17.9 mg/L to 76 mg/L. The median pH for the Silver Butte adit is 3.06 su, minimum 2.03 su, and maximum 3.22 su. For the Formosa adit, fluctuations in cadmium, copper, and zinc generally follow precipitation and flow trends. During higher adit flow in the rainy season, most metals concentrations are the greatest, followed by a decrease in concentration through the dryer season. Data collected at the End of Pipe location show similar concentrations to the Formosa adit, as expected because the Formosa adit comprises the majority of flow collected at the End of Pipe.

All sampled adit water (and End of Pipe) pH, cadmium, copper, and zinc concentrations exceed the water quality SLs shown in the figures (i.e., as dashed lines). Tables 4-2 through 4-4 also show exceedances for many other analytes. The most recent set of sampling data for the Formosa adit (April, June, July 2004 and July and September 2005) and End of Pipe (May, June, July 2004 and August 2005) shows concentrations similar to previous years, however, insufficient data are available to indicate any trends during these years.

4.3.2.2 Upper Middle Creek

Seep A, A4, A9, MXR, and M3.0 summary statistics are shown in Tables 4-5 through 4-9, and results for sulfate and pH, cadmium, copper, and zinc are shown in Figures 4-29 through 4-48.

Cadmium, copper, and zinc concentrations at Seep A (16 samples total) and A4 (13 samples total) are the greatest during low flow conditions, indicating influence by seeping ARD groundwater. The lowest pH levels at A4 are also observed during the drier season. During higher flow conditions, concentrations contributed by groundwater may be diluted. At Seep A, cadmium ranges from 0.0037 mg/L to 0.0554 mg/L, copper from 0.20 mg/L to 2.99 mg/L, zinc from 1.31 mg/L to 24.4

mg/L, and pH (13 samples) from 4.97 su to 7.27 su. At A4, cadmium ranges from 0.165 mg/L to 0.545 mg/L, copper from 1.58 mg/L to 11.7 mg/L, zinc from 4.22 mg/L to 42.2 mg/L, and pH (11 samples) from 3.23 su to 5.06 su. Metals concentrations are much greater for A4 than for Seep A, and pH is noticeably lower, suggesting that more acidic groundwater is potentially entering upper Middle Creek near A4. Oxidation of ferrous iron to ferric and subsequent precipitation of iron hydroxide precipitates may also be affecting pH in this area.

Seep B water quality was not presented in figures or tables due to the small set of available data, but data is presented in Appendix A. Seep B flow is intermittent, so only 3 samples were collected during the winter months (January and February 2000, and November 2001). Seep B is located upstream of location A4 (Seep A and Seep B stream confluence). At Seep B, cadmium ranges from 0.00408 mg/L to 0.437 mg/L, copper from 0.287 mg/L to 42.3 mg/L, zinc from 1.39 mg/L to 52.6 mg/L, and pH (13 samples) from 4.97 su to 7.27 su. Based on the available data, Seep B appears to represent a highly acidic groundwater entering the stream in this area. Intermittent ARD groundwater flow at Seep B may be some indication of fluctuations in groundwater level in this area and suggests connection with ARD groundwater seeps near A4 and further downstream. During most of the year, ARD groundwater may be entering the stream at a lower elevation, such as location A4 or lower. Then during the wet season, the water table may rise, and ARD seeps may also appear at higher elevations near the Seep B location.

Trends in concentrations in relation to flow at location A9 (16 samples) are not as clear as for Seep A or A4, however, in general metals concentrations are still quite high and pH is acidic (similar to A4).

At location MXR (28 samples total), the opposite trend from Seep A and A4 becomes apparent for copper and zinc. At higher flow, these metals concentrations are the highest. This increase in metals concentrations could be related to the flushing and dissolution of sediment and precipitate that may settle along the banks and in the stream bed. This conclusion is similar to that discussed by others (HC 2002). It may also be related to flushing of contaminants from the underground workings and surficial mine waste piles. Seasonal trends in cadmium are less apparent than for copper and zinc. At MXR, cadmium ranges from 0.00645 mg/L to 0.464 mg/L, copper from 0.0838 mg/L to 11.1 mg/L, zinc from 0.982 mg/L to 27.6 mg/L, and pH (22 samples) from 4.51 su to 7.8 su.

At location M3.0 (21 samples total), a similar flow-related trend is observed as for MXR, although metals concentrations range between one and two orders of magnitude lower than at MXR. At M3.0, cadmium ranges from non-detect (0.002 mg/L) to 0.0043 mg/L, copper from 0.0068 mg/L to 0.21 mg/L, zinc from 0.0957 mg/L to 1.01 mg/L, and pH (12 samples) from 6.34 su to 8.01 su.

At Seep A, A4, A9, and MXR, cadmium, copper, and zinc concentrations exceeded the water quality SLs for all samples, along with many other analytes shown in Tables 4-5

through 4-8. For M3.0, concentrations of cadmium, copper, and zinc are closer to the water quality SLs, but still exceeds SLs for most samples.

4.3.2.3 South Fork Middle Creek

SF1.0, SF3.0, and SF4.7 summary statistics are shown in Tables 4-10 through 4-12, and results for sulfate and pH, cadmium, copper, and zinc are shown in Figures 4-49 through 4-60.

At SF1.0 (20 samples total), cadmium ranges from non-detect (0.002 mg/L) to 0.0221 mg/L, copper from 0.0193 mg/L to 2.02 mg/L, zinc from 0.191 mg/L to 4.85 mg/L, and pH (18 samples) from 5.69 su to 8.9 su. At SF3.0 (12 samples total), cadmium ranges from non-detect (0.001 mg/L) to 0.0039 mg/L, copper from 0.0069 mg/L to 0.185 mg/L, zinc from 0.043 mg/L to 0.976 mg/L, and pH (10 samples) from 6.05 su to 8.09 su. At SF4.7 (21 samples total), cadmium ranges from non-detect (0.00021 mg/L) to 0.00101 mg/L, copper from non-detect (0.005 mg/L) to 0.179 mg/L, zinc from 0.0185 mg/L to 0.495 mg/L, and pH (18 samples) from 6.02 su to 8.02 su.

Metals concentrations measured at SF1.0 follow the same trend as for MXR and M3.0, where the highest concentrations are observed during the highest flow periods. Concentrations of cadmium, copper, and zinc at SF1.0 are approximately one-half to one order of magnitude lower than at MXR. At location SF3.0, metals concentrations decrease significantly as a result of dilution, and decrease even further at SF4.7. For SF3.0 and SF4.7, the same seasonal trends for copper and zinc were observed as for SF1.0. However, cadmium concentrations were too low or at non-detect concentrations, making trends harder to discern. At SF1.0, one cadmium measurement was non-detect (for total metals). At SF3.0, two cadmium measurements were non-detect (for dissolved metals), and at SF4.7, 13 cadmium measurements were non-detect (for dissolved metals).

At SF1.0, all copper, cadmium, and zinc results exceeded the surface water SLs. For SF3.0 and SF4.7, most copper and zinc results also exceeded the surface water SLs, except for a few samples collected in the drier season (i.e., summer - fall). Some low-level detections of cadmium in September and October 1999 showed that cadmium concentrations decreased below the surface water SLs during the dry season. Many of the method reporting limits for cadmium at SF4.7 were greater than the surface water SL for that location.

4.3.2.4 Lower Middle Creek

M3.1 and M13.0 summary statistics are shown in Tables 4-13 and 4-14, and results for sulfate and pH, cadmium, copper, and zinc are shown in Figures 4-61 through 4-68.

At both M3.1 and M13.0, similar seasonal copper and zinc trends were observed as for MXR, M3.0, and the South Fork Middle Creek locations. Metals concentrations at M3.1 are slightly lower than at M3.0, and concentrations at M13.0 are significantly lower. At M3.1 (18 samples total), cadmium ranges from non-detect (0.0001 mg/L) to

0.0022 mg/L, copper from 0.00142 mg/L to 0.135 mg/L, zinc from 0.0306 mg/L to 0.542 mg/L, and pH (18 samples) from 6.29 su to 8.02 su. For dissolved cadmium measurements at M3.1 there were 9 non-detects. At M13.0 (13 samples total), cadmium ranges from non-detect (0.0001 mg/L) to 0.00026 mg/L, copper from 0.00059 mg/L to 0.0345 mg/L, zinc from non-detect (0.0005 mg/L) to 0.104 mg/L, and pH (5 samples) from 7.49 su to 8.27 su. For dissolved cadmium measurements at M13.0 there were 9 non-detects.

At M3.1, some detectable cadmium concentrations exceed the surface water SLs, while most copper and zinc measurements have concentrations that exceed the SLs (i.e., 14 exceedances out of 16 samples [14/16] for dissolved copper and 15/16 for dissolved zinc). At M13.0, almost all cadmium measurements are non-detect and those samples that revealed detectable cadmium are below the SL. There were 4/10 exceedances of the SL for dissolved copper at M13.0 and 2/10 exceedances of the SL for dissolved zinc.

4.3.2.5 Cow Creek

C1 and C2 summary statistics are shown in Tables 4-15 and 4-16, and results for pH, cadmium, copper, and zinc are shown in Figures 4-69 through 4-76.

There were 10 total samples collected at C1 and 9 total samples collected at C2. Cadmium was non-detect for all samples at C1 (upstream of Middle Creek and Cow Creek confluence) and only one sample had a detection of cadmium at C2. At C1, dissolved copper was detected in 3 out of 9 samples and dissolved zinc was detected in 2 out of 9 samples. At C2, dissolved copper was detected in 3 out of 8 samples and dissolved zinc was detected in 5 out of 8 samples.

At C1, 2/9 dissolved copper results exceeded the surface water SL, although one of the exceedances was a non-detect reported result at a method reporting limit of 0.2 mg/L. For dissolved zinc, there were no exceedances of the SL at C1. At C2, 3/8 dissolved copper results exceeded the surface water SL, although one of the exceedances was a non-detect reported result at a method reporting limit of 0.2 mg/L. For dissolved zinc at C2, 1/8 results exceeded the surface water SL.

4.3.2.6 Stable Isotope Analyses

On July 6, 2005, an ODEQ/BLM/EPA team collected six samples from upper South Fork Middle Creek and upper Middle Creek for stable isotope analyses. The purpose of this program was to evaluate the source of the water and sulfate, and estimate the contribution of aerobic and anaerobic processes in generation of sulfate in the samples. The samples were evaluated for oxygen and hydrogen isotopes in water and sulfate.

Isotopes of an element such as oxygen are forms of the element that differ in terms of their atomic mass and number of neutrons. Stable isotopes are not radioactive and do not decay as is the case in radioactive isotopes, and the overall ratio of the various stable isotopes in nature is constant. For example, oxygen has three stable isotopes,

with atomic mass of 16, 17 and 18. Oxygen with atomic mass of 16 is the most common and represents 99.762 percent of the total. Oxygen with atomic mass of 16 is designated as ^{16}O. Stable isotopes fractionate in the environment through various mechanisms such as evaporation and chemical reactions, which causes local variations in the ratio of the various stable isotopes. This forms an isotopic signature that can be associated with various water types or geologic environments.

Stable isotopes are evaluated in relation to a standard. The standard for stable isotopes of oxygen and hydrogen is called Standard Mean Ocean Water (SMOW). The abundance of a stable isotope in a sample is compared to the abundance of the same isotope in the standard, and the difference is expressed as the permil difference. This value is referred to as delta (δ). For example:

$$\delta^{18}O = \left(\frac{^{18}O_{sample} - ^{18}O_{SMOW}}{^{18}O_{SMOW}} \right) \bullet 1000$$

Where: $^{18}O_{sample}$= Concentration ^{18}O in sample

$^{18}O_{SMOW}$= Concentration ^{18}O in SMOW

Exhibit 4-1 presents the results of the stable isotope analyses.

Exhibit 4-1. Stable Isotope Data From July 6, 2005 samples

Sample	$\delta^{18}O$ Water	$\delta^{2}H$ Water	$\delta^{18}O$ Sulfate	$\delta^{18}O$ Sulfate-repeat
SFA3	-11.45	-78.65	-5.53	-5.44
SFA2	-11.33	-78.68	-5.39	-5.59
SFA2 Duplicate	-11.31	-79.56	-5.81	-5.69
A9	-11.13	-78.15	-6.02	-5.77
A4	-11.21	-79.82	-5.24	-5.78
Formosa Adit	-11.20	-78.41	-5.29	-5.06

BLM (2006) evaluated the stable isotope data, and interpreted the data to show that all of the water comes from the same source based on the lack of variation in the oxygen and hydrogen isotopic signatures. BLM (2006) also concluded based on evaluation of oxygen isotopes in sulfate that approximately 15 to 25 percent of the sulfate was derived from oxidation of pyrite by oxygen and that 75 to 80 percent of the sulfate was derived from oxidation of pyrite by dissolved ferric iron. The importance of pyrite oxidation by dissolved ferric iron was discussed previously in Section 4.2.3. BLM (2006) concluded that some of the sulfate in the water was formed in an environment that contained atmospheric oxygen. As discussed previously in Section 4.2.2, oxidation of pyrite by dissolved ferric iron may occur in aerobic environments that contain atmospheric oxygen or in anaerobic environments that contain dissolved ferric iron.

4.3.3 Stream Sediment and Precipitate

Sediment samples were collected at the Site in 1998 (USGS sampling), 1999 (Dynamac sampling), and 2002 (HC sampling). Precipitate samples were only collected in 2002 by HC. Sediment and precipitate sampling during the HC RI phase only focused on upper Middle Creek, while sediment samples collected by Dynamac also included upper South Fork Middle Creek, near the 404 adit, and near the Formosa adit. USGS sediment samples were collected at the same locations as the USGS surface water samples.

Total metals results for sediment and precipitate samples are shown in Table 4-17 and elutriate results are shown in Table 4-18. Results from X-ray diffraction analysis and digestion analysis of precipitate samples are not discussed in this report, but the detailed report can be found in HCs Supplemental RI Report (HC 2002). Both sediment and precipitate total metals results are compared to EPA Region 3 sediment screening levels. Elutriate data are compared to the most stringent water quality SLs presented in Table 4-1, using a hardness of 100 mg/L for the applicable hardness-dependent SLs. Exceedances of these SLs are shown in Tables 4-17 and 4-18. For many of the total metals and some elutriate results, the method reporting limits for the analyses were greater than the sediment or water quality SLs. In these cases, the non-detect results are excluded from the exceedances count shown on the tables.

For Dynamac and HC data, all total metals sediment results for antimony, chromium, cyanide, selenium, and silver have method reporting limits greater than the SLs. Both sediment and precipitate cadmium total metals results have some method reporting limits above the sediment SL. For the elutriate samples, all cadmium and lead results had method reporting limits below the surface water SLs.

For Dynamac and HC total metals sediment samples, the following are exceedances of the sediment SLs:

- Arsenic – 4 exceedances out of 10 samples (4/10)
- Cadmium – 4/4
- Copper – 10/10
- Iron – 6/9
- Lead – 2/10
- Manganese – 5/10
- Mercury – 1/6
- Nickel – 4/10
- Zinc – 8/10

For USGS sediment samples, the following are exceedances of the sediment SLs:

- Antimony – 1/4
- Arsenic – 1/4
- Cadmium – 3/4
- Chromium – 4/4

- Copper – 4/4
- Iron – 4/4
- Manganese – 4/4
- Mercury – 1/4
- Nickel – 4/4
- Silver – 2/4
- Zinc – 3/4

For HC total metals precipitate samples, the following are exceedances of the sediment SLs (note that the analyte list for precipitate is much less extensive):

- Cadmium – 2/6
- Copper – 11/11
- Iron – 3/8
- Zinc – 4/11

High concentrations of analytes such as cadmium, copper, iron, and zinc detected in sediment and precipitate are reasonable given that these elements would be expected to a major part of the precipitates that have repeatedly deposited into upper Middle Creek. Sediment samples collected on upper South Fork Middle Creek (i.e., SFL and SFU) also have exceedances for copper, iron, manganese, and zinc. The sediment sample collected at the 404 adit drainage exceedances the SLs for arsenic, copper, and iron. USGS sediment results are important because they provide the only set of sediment data downstream of MXR and downstream on South Fork Middle Creek. However, compared to Dynamac and HC data, the USGS data indicate more detections of trace metals. This is due the lower method reporting limits and total acid digestion method used by USGS for total metals analyses, compared to only a partial digestion method (EPA 6010B) for Dynamac and HC samples.

For HC elutriate precipitate and sediment samples, the following are exceedances of the surface water SLs:

- Copper – 5/8
- Zinc – 4/8

The elutriate test conducted on the precipitate and sediment samples is a batch-type leachate test that used water samples collected at location M3.0 on the same dates as when the precipitate and sediment samples were collected. Copper and zinc dissolved metals results for the 4/22/2002 M3.0 sample were 0.0298 mg/L and 0.494 mg/L, respectively. Copper and zinc dissolved metals results for the 5/29/2002 M3.0 sample were 0.0191 mg/L and 0.256 mg/L, respectively. These surface water results are all greater than the SLs shown in Table 4-18, therefore, some exceedances of the elutriate results are due to the elevated copper and zinc concentrations already present in the M3.0 water. For three of the elutriate samples (precipitate sample collected at A19 on 4/22/2002 and precipitate and sediment samples collected at MXR on 5/29/2002), copper concentrations increased from that of the M3.0 water, indicating that copper

may have leached from solid phase to the water phase. For all of the zinc elutriate results that exceed the SLs, the reported concentrations are less than the concentrations present in the M3.0 water, indicating that zinc may be precipitating as a solid phase or adsorbing to the solid phase during the elutriate test.

4.3.4 Aquatic Biology

As described in Section 2, numerous studies have been conducted to evaluate the biotic conditions in the vicinity of the Site. Data are available from prior to modern mining, including the period from 1982 through 1988, and post-modern mining, including 1993 through 2007. Overall results of the data indicate that populations of fish and macroinvertebrates have severely declined since mine closure in 1993. This is due to multiple factors, including contamination of the watersheds of Middle Creek and South Fork Middle Creek, as well as habitat destruction. These watersheds historically were productive fisheries for salmonids; heavy metal pollution and poor flow characteristics now limit the use of these important spawning grounds. The following sections provide summaries of the data collected from the investigations completed through 2007.

It can be assumed that decreased populations and diversity of fish indicates a poorer habitat, either due to pollution or other environmental impacts (such as sedimentation or lack of suitable cover/protection). Additionally, several types of macroinvertebrates can be used as indicators of environmental stress. Macroinvertebrates are generally immobile in comparison to fish, and thus cannot avoid acute releases of toxic compounds. Ephemeropterans, plecopterans, and trichopterans (mayflies, stoneflies, and caddisflies, respectively)(EPT taxa), are pollution sensitive taxa, and a lack of nymph, or instar, stage populations of these insects indicates environmental stress. Often, areas where EPT and macroinvertebrate populations are low, fish populations also suffer due to a lack of food. Thus, locations with low densities of macroinvertebrates likely contain fewer fish, even if other habitat factors are suitable for survival.

4.3.4.1 1982 and 1984 Sampling

Macroinvertebrate sampling was completed in 1982 and 1984. However, data made available for 1982 sampling was illegible, and thus not included in this report. In 1984, three locations were sampled on Middle Creek, and one location was sampled on South Fork Middle Creek. The four locations had similar densities and total numbers of taxa, although the sampling method used likely resulted in underestimates of total populations. The total numbers of taxa, and numbers of EPT taxa, suggest that there is minimal difference in environmental conditions between the locations. The data are included in Table 4-19.

Results of the fish electroshock sampling are included in Table 4-20. 1982 fish electroshock sampling was completed at location M2.0 on Middle Creek, locations SF2.3 and SF4.7 on South Fork Middle Creek, and location Martin Creek 1982 on Martin Creek. 1984 fish electroshock sampling was completed at locations M2.0, M7.9, and M13.0 on Middle Creek, and at location SF2.3 on South Fork Middle Creek. The

sampling conducted at Middle Creek location M2.0 in 1982 encountered 2 fish: one cutthroat trout and one cottid. South Fork Middle Creek sampling indicated that more diverse, larger populations of fish were utilizing this creek, with a total abundance of 47 fish, including coho and steelhead, at location SF2.3. 1984 sampling again found large populations of fish at SF2.3, including coho and steelhead. 1984 sampling also indicated that large populations of coho and steelhead were utilizing Middle Creek as far upstream as sample location M2.0. The variability in populations at Middle Creek location M2.0 may be related to seasonal fluctuation in populations; the 1984 sample (7/31/84) contained large numbers of juvenile steelhead, and was collected at a later date than the 1982 (5/20/82) sample.

4.3.4.2 Baseline Fisheries Sampling 1988

Fish electroshock sampling data for the 1988 baseline environmental study is provided in Table 4-20. Location SF#1 was electroshocked, and seven rainbow/steelhead trout juveniles and 13 coho salmon juveniles were captured. The Middle Creek sample was collected at location M1, and three rainbow/steelhead trout, one cutthroat trout, and 25 coho salmon juveniles were captured. The South Fork Middle Creek and Middle Creek locations were determined to have excellent rearing habitat, but limited spawning habitat for salmonids due to substrate type and stream anatomy. Russell Creek (location R1) was sampled, and eight resident cutthroat trout were captured. Four locations in the Canyon Creek watershed were sampled, with numerous cutthroat trout, chub, and dace captured, but only one location included steelhead trout (location C4-Norecol). It is assumed that the lack of salmonids in this watershed is due to high water temperatures and beaver ponds that prevent upstream migration. Generally, results of the baseline sampling indicated that the Middle Creek and South Fork Middle Creek watersheds provided the best habitat for salmon of the investigated creeks. Comparison of 1984 to 1988 data does indicate that smaller populations of fish were utilizing the creeks in 1988, although differences in abundance may be due to different sampling approaches and/or different times of year for sampling. Additionally, the population in South Fork was less diverse in 1988 than 1984. However, sampling completed in 1993 (described below) and later indicated larger populations were utilizing certain parts of the creeks compared to 1988 populations, suggesting that factors in addition to mine impacts may have affected the populations in 1988.

4.3.4.3 Baseline Macroinvertebrate Sampling 1988

Macroinvertebrate data for the 1988 baseline environmental study, including the total abundance and number of taxa, as well as the abundance and taxa of EPT, are presented in Table 4-19. Overall, location SF#1 had the largest populations of macroinvertebrates, with overall abundance approximately twice that of locations M1 and X1 in both spring and fall events. Locations M1 and X1 had very similar numbers of individuals, but X1 had a larger number of taxa, indicating the location was more diverse. Interestingly, over half of the total population of X1 in the spring was comprised of EPT, while only 4 percent of the populations at both M1 and SF#1 were EPT. Similarly, there was a greater number of EPT taxa at X1 than at M1 and SF#1.

During the fall sampling, the percent EPT of total abundance and percent EPT of total taxa at location X1 had declined, while percent EPT of total abundance at M1 and SF#1 doubled and percent EPT of total taxa remained the same. The comparison between spring and fall sampling data suggests that spring runoff may have influenced the populations at locations M1 and SF#1 prior to reopening of the mine.

4.3.4.4 1993 Fish Surveys

Data from the fish surveys completed in 1993 are presented in Table 4-20. The fish surveys completed in summer 1993 indicated populations of juvenile coho salmon and steelhead trout were present in lower portions of Middle Creek (locations MID-6 and MID-7) and South Fork Middle Creek (locations MID-10 and MID-11), in populations larger than those seen during pre-modern mining investigations, although this may have been due to differences in sampling methods or time of year. Resident cutthroat and rainbow trout were also present in lower reaches of Middle Creek. Sampling locations increasingly closer to the mine area had fewer fish, with the final two locations on Middle Creek near the mine area (MID-8 and MID-9) having no fish. Compared to the July 1984 results at location M2.0 (between MID-8 and MID-9), the July 1993 results for MID-8 and MID-9 indicate a severe decline in fish population in this area.

Populations on South Fork Middle Creek (locations MID-10 and MID-11) had relatively large populations, with good diversity. Interestingly, populations on the South Fork Middle Creek reference stream (locations MID-12 and MID-13) were much lower than those seen on the main South Fork Middle Creek stem, although this may be due to the different habitat and smaller stream flow in the reference stream. Cedar Gulch, Peavine Creek, and Buck Creek had similar populations, while Martin Creek had substantially greater populations at MAR-1 compared to the other reference creeks. The greatest populations in each of the reference creeks (Peavine Creek, Martin Creek, Buck Creek, and Cedar Gulch) were observed closest to their confluence with Middle Creek (PEA-1, MAR-1, BUC-1, and CED-1, respectively).

1994 to 1997 Aquatic Biology Associates Macroinvertebrate Studies

ABA, Inc. completed macroinvertebrate sampling in the fall of 1994 through 1997. During this period, ABA Inc. noted a decline in overall bioassessment scores for both Middle Creek and South Fork Middle Creek. The decline in ratings was due to both a decrease in overall richness, as well as a decrease in EPT taxa richness. Data for abundance and taxa richness, both total and for EPT, are included in Table 4-19.

ABA, Inc. completed a full bioassessment on the 1994 macroinvertebrate data. Principal findings of this investigation included that the overall bioassessment score of 39.3 percent indicated severe degradation of the M1 location on Middle Creek. The score of 62.4 percent for the SF#1 location on South Fork Middle Creek also indicated some stress was present within the system. The low score for the M1 location was partly caused by very low species richness, and a lack of species that utilize streams with good water quality (i.e., EPT taxa). In comparison to the 1989 data (pre-modern mining), the 1994 conditions (post-modern mining) indicated there had been a

significant decline in species diversity, with populations dominated (85 percent) by weed taxa that are able to quickly populate degraded habitats (including 60 percent of total abundance accounted for by the mayfly species *Baetis tricaudatus*, a weed species). ABA, Inc. indicated that weed taxa were only 5 percent of the population present prior to modern mining activities (1988 data).

4.3.4.5 BLM/ODEQ RI Report Macroinvertebrate Studies

In 2000, BLM/ODEQ prepared an RI report comparing data gathered from pre-modern mining operations through 1999. Abundance and EPT taxa data are presented in Table 4-19. In the report, BLM/ODEQ concluded that the populations of macroinvertebrates in Middle Creek and South Fork Middle Creek were at their poorest condition in 1999. BLM/ODEQ reported that for Middle Creek location M3.0, macroinvertebrate densities and number of EPT taxa decreased 61 percent and 59 percent, respectively from pre-modern mining conditions to post-mining conditions, and 47 percent and 40 percent for South Fork Middle Creek location SF4.7. Comparing 1999 data alone to pre-modern mining conditions, total density and number of EPT taxa for M3.0 were reduced 96 percent and 73 percent, respectively, and 98 percent and 72 percent for SF4.7. The BLM/ODEQ RI found a correlation between increasing concentrations of zinc in the surface water and the decline of macroinvertebrate abundance and number of EPT taxa. Data from Cow Creek location C2 (downstream on Cow Creek and Middle Creek confluence) also indicates that macroinvertebrate communities have experienced stress due to the releases of heavy metals, likely zinc and copper.

For all locations, BLM/ODEQ data indicated a lower abundance and number of EPT taxa in spring 1999 when compared to fall 1999 results. The low numbers in spring correspond to higher concentrations of heavy metals, which suggests that the greatest stress to the population occurs in relation to increased mobilization of heavy metals during runoff. The increase in macroinvertebrates from spring to fall also is a promising result, suggesting that macroinvertebrate populations may recover quickly once remediation and habitat restoration begin. BLM/ODEQ suggested that, based on data acquired from reference stream locations, adequate recovery of macroinvertebrate communities could be defined as a total density of 300-400 organisms per square meter, and approximately 15-20 EPT taxa.

4.3.4.6 BLM Salmon Spawning Surveys

Several yearly salmon spawning surveys were completed between 1991 and 2002 on Middle Creek and South Fork Middle Creek. The creeks were divided into segments according to the distance from the Formosa Mine, including the following: upper Middle Creek (M0.9 - M5.2), central Middle Creek (M5.8 - M11.75), and lower Middle Creek (M11.75 - M13.0), and South Fork Middle Creek (SF4.0 – SF4.7). Exhibit 4-2 below provides a summary of the results provided by BLM (BLM 2009). The AUC or estimated salmon run size was calculated for each sampling event and stream reach using the methodology provided by ODFW (2007). For M11.75 - M13.0, from 1991 to 2001, run sizes decreased from an estimated 22 to 2. M5.8 - M11.75 saw a varying count from 1992 through 2001, with estimated sizes as high as 8, but as low as 1. M0.9

- M5.2 surveys only identified one fish during all years evaluated and South Fork Middle Creek locations had no fish during the years available. Data suggests that conditions in Upper Middle Creek and South Fork Middle Creek have not supported spawning runs since the mine reopened through the last year of available data (2002), and that deteriorating conditions in lower reaches of Middle Creek have led to reduced runs in those areas.

Exhibit 4-2. Formosa Mine Coho Spawning Survey Summary

M11.75 - M13.0							
Year	1991	1995	1996	2001			
Total Redds	70	3	2	1			
AUC	22	0	0	2			
M5.8 - M11.75							
Year	1992	1994	1995	1997	1999	2000	2001
Total Redds	4	3	4	3	38	8	1
AUC	1	6	8	1	4	2	1
M0.9 - M5.2							
Year	1998	1999	2000	2001	2002		
Total Redds	1	0	0	0	0		
AUC	2	0	0	0	1		
SF4.0 - SF4.7							
Year	1998	2001					
AUC	0	0					
Total Redds	0	0					

Note: AUC equals "Estimated Salmon Run Size"

4.3.4.7 BLM Fish Abundance Investigations

Results of the BLM fish electroshock sampling in 2000, 2003, and 2007 are provided in Table 4-20. This data generally indicates an increase in total fish with increased distance from the Site in both Middle and South Fork Middle Creeks. Comparison of populations at locations that were sampled during each of the three events does not indicate any substantial change over the seven year period. The BLM data also indicates that the fish that were present in the reaches closer to the Site were primarily larger salmonids that are more stress resistant and can easily move into and out of contaminated areas during periods of higher contaminant concentrations, such as during the winter flush of heavy metals from the mine.

4.4 Groundwater

This section describes analytical results for all available groundwater collected at the Site, and provides a general description of the hydrogeologic framework based on available data.

4.4.1 General Description of Hydrogeologic Framework

A generalized description of the hydrogeologic framework of the Silver Peak Mine area can be developed based on existing information regarding Site topography, precipitation, climate conditions, and geology, which was summarized in previous sections. The upper portions of Silver Butte Peak and the associated ridge system are likely areas of groundwater recharge by precipitation. The topography of the area is

very steep, and groundwater likely moves down a hydraulic gradient that is generally coincident with topography. Groundwater then discharges at springs that are located in steep tributary systems such as upper Middle Creek and the upper reaches of the South Fork of Middle Creek. These tributary drainages appear to be gaining streams as they flow from the Silver Butte Peak area towards lower portions of the Middle Creek and the South Fork of Middle Creek, suggesting continued discharge of groundwater to surface water.

The general geological framework of the area consists of a sequence of various types of flows and tuffs of basaltic to dacitic composition. The flows are crystalline igneous rocks and groundwater flow within these units flows is likely associated with secondary porosity in the form of fractures, faults and shears. Tuffs are granular rocks and the level of induration of the tuffs ranges from soft weakly indurated rocks to hard well indurated rocks. FRC (1987) notes that the level of induration of the rock units ranges laterally within individual rock units as well as vertically within the stratigraphic sequence. Therefore, groundwater flow within the tuff units may be associated with both primary intergranular porosity as well as secondary porosity.

It is likely that the underground mine markedly affects the local groundwater flow system. The underground mine workings may act as a conduit system conveying groundwater from upper portions of the system to discharge points located in Middle Creek or other areas. The underground workings may also connect otherwise isolated fracture systems, and thereby increase the rate of groundwater flow in close proximity of the mine.

4.4.2 Groundwater Quality

Available data for groundwater quality consists of baseline groundwater quality data collected in 1989 and data collected during the remedial investigations in 1999, 2000, and 2002. The location of monitoring wells sampled in these programs was shown previously on Figure 2-3.

Baseline 1989 sampling data (groundwater quality and water level elevations) from wells T1, T2, T3, and T4 are shown in Table 4-21. Note that the locations shown on Figure 2-3 are applicable to the surface topography that existed prior to modern mining. FEI leveled off the area around these wells during mine development to build the water and tailings storage pond and the mill building. However, elevations for these wells were surveyed by Norecol in 1989, and are provided in Table 4-22. This data set provides information regarding the hydrogeologic conditions prior to modern mining in the area of the current encapsulation mound and former mill site.

Groundwater quality at wells T1, T2, T3 was good when baseline samples were collected in 1989. Figure 4-77 provides a piper diagram showing the major ion concentration of the wells. The water in T2, T3 and T4 was calcium-bicarbonate type with low TDS and very low sulfate, which shows that this water was not affected by acid generation prior to mine facility development in the encapsulation mound area. The water in well T1 was calcium-chloride type water, also with very low TDS. The

pH of the samples ranged from 5.8 su to 6.7 su. Water levels in the wells were measured for a period of approximately 7 months. The data are plotted on Figure 4-78, and show that the water levels decreased over the period of March, 1999 to September, 1999 by a distance ranging from 26 to 84 ft.

When modern mining operations began at the Site, the 1989 wells T1, T2, T3, and T4 were abandoned. Groundwater was not further investigated until 1999, when Dynamac installed three wells at the Site (MW-1, MW-2, and MW-3). In 2002, HC installed two additional wells (MW-4 and MW-5). Monitor wells MW-1 and MW-and MW-5 are located in the encapsulation mound area and wells MW-2 and MW-4 are located near Formosa adit. MW-3 is located to the southwest of the mine area near the 404 adit along BLM Road 35.1. MW-1 was dry and was never sampled. MW-3 is located south of the mine.

Data from monitor well MW-5 shows effects on groundwater quality in the encapsulation mound area that occurred during or after development of the area. These data are shown in Table 4-23. Water quality data from MW-5 were collected three times in 2002. Groundwater levels ranged between 57.7 and 68.8 ft bgs during the sample events. The groundwater quality shows very marked effects of mine facility development and/or reclamation as compared to the 1989 pre-development sampling. Dissolved copper concentrations in wells T1, T2, T3 and T4 ranged from less than 0.0005 to 0.11 mg/L in 1989. Groundwater at MW-5, which is in the same general area contained copper concentrations ranging from 22.8 to 26.5 mg/L in 2002, an increase of approximately three orders of magnitude. Similarly, dissolved zinc concentrations in wells T1, T2, T3 and T4 ranged from less than 0.005 to 0.29 mg/L in 1989. Dissolved zinc concentrations measured in samples from MW-5 in 2002 range from 90.9 to 116 mg/L, again an increase of approximately three orders of magnitude. The sulfate concentration of MW-5 ranged from 2600 to 2950 mg/L as compared to pre-development concentrations of less than 1 to 11 mg/L in wells T1, T2, T3 and T4. This shows very marked effects of mineral development activities and associated sulfide oxidation in the encapsulation mound area.

Groundwater quality data for the Formosa adit area are restricted to sampling of MW-2 during 1999, 2000, and 2002, and sampling of MW-4 during 2002. These wells are both located close to the Formosa adit. MW-2 is located approximately 100 ft north of the Formosa adit on Russell Creek Road. MW-4 is located approximately 50 ft west of the Formosa adit, also along Russell Creek Road. The water quality of samples from the two wells is markedly different, suggesting the importance of discrete fracture-flow systems in transport of contaminants in groundwater towards the Middle Creek area. Groundwater levels in monitoring well MW-2 ranged between 92.7 and 97.4 ft bgs, and groundwater levels in MW-4 ranged between 96.4 and 176.2 ft bgs during the sampling events.

Available water quality data for MW-2 are included in Table 4-24. This well was sampled once in 1999 and three times in 2002. Figure 4-79 is a Piper diagram, which shows that groundwater at MW-2 is calcium-sulfate type water. The sulfate

concentration in this water 300 mg/L in October, 1999. Major ions were only analyzed in 1999, so the piper diagram analysis is limited to one point. Metals associated with ARD-influenced water were sampled during all sampling events. Dissolved zinc concentrations ranged from 0.09 to 3 mg/L, dissolved copper concentrations ranged from 0.007 to 3.08 mg/L, and dissolved cadmium concentrations ranged from less than detection to 0.0101 mg/L. The pH of the water is near-neutral with values ranging from 5.7 to 7.7 su. The presence of sulfate as the primary anion in this water suggests that the water may be influenced by ARD.

Water quality data for MW-4 are presented in Table 4-25. This well was sampled twice during 2002. Major ions were not analyzed in samples from MW-4, so piper diagram analysis cannot be completed. The sulfate concentration in the water ranged from 145 to 608 mg/L. The concentration of dissolved cadmium ranged from 0.006 to 0.0498 mg/L, dissolved copper ranged from 0.363 to 3.05 mg/L, and dissolved zinc ranged from 0.868 to 16.8 mg/L. The pH of the samples ranged from 6.9 to 7.1 su. The elevated sulfate, cadmium, copper and zinc concentrations in this water suggests that it is influenced by ARD and/or natural weathering of sulfide minerals. The near-neutral pH of this water as well as the general range of concentrations of sulfate, cadmium, copper and zinc are within the range of water quality data collected from groundwater seepage into Middle Creek measured at surface water location Seep A. Seep A is the uppermost seep in the Middle Creek drainage. This suggests that MW-4 is intersecting a zone of ARD-influenced groundwater moving from the general area of the Silver Peak Mine towards discharge points in Middle Creek.

MW-3 has been sampled once, and available water quality data are presented in Table 4-26. This well is located several thousand ft southwest of the Encapsulation Mound. The data show that the water at MW-3 did contain anomalous concentrations of iron and manganese. It is unknown if this reflects natural background conditions.

4.5 Soil and Waste Rock

Soil and waste rock sampling has been conducted at the Site in four investigations:

- The pre-modern mining investigations (Norecol 1989a)
- The SA (Dynamac 2000);
- The supplemental RI (HC 2002); and
- The post RI sampling (START-3 2006).

Individually, none of these previous investigations completely characterized geochemical conditions of soil and waste rock at the Site. However, a review of data from the four reports does provide general information that is useful to understand surface and near surface geochemical characteristics of soils and waste rock. It should be noted that the terms "waste rock" and "soil" were used somewhat loosely by the various investigators. Generally speaking, soil and waste rock samples were collected from surface and near-surface unconsolidated materials. The proportion of waste rock and/or natural soils included in the samples is unknown.

The location of these samples was presented previously in Figure 2-5. Based on the location of the samples, all samples appear to have been collected from disturbed areas of the Site, and therefore the samples may contain mine wastes such as waste rock, tailings, metal concentrates, or metal precipitates in addition to an unknown proportion of natural soils. Therefore, these samples are described together in this data summary. Sample analyses included total metals, acid base accounting, and various extraction tests.

4.5.1 Total Metals

Totals metals analyses conducted at mining sites are generally used to screen soils and mine waste for metals that could potentially be hazardous with respect to pathways of incidental ingestion or inhalation. Total metals analyses were completed on a portion of samples from each of the investigations described above and in detail in Section 2. Tables 4-27 and 4-28 provide the total metals data collected during the SA (Dynamac 2000) and the supplemental RI (HC 2002).

Tables 4-27 and 4-28 also provide general screening of the total metals data with respect to EPA soil SLs and ODEQ soil risk based concentration (RBC) values for residential and industrial soils. The EPA SLs and ODEQ RBC values are used as SLs to provide preliminary information regarding identification of COPCs at the Site. It should be noted that site-specific risk assessment will be required prior to determining the level of risk that soils and waste rock pose to humans or ecological receptors. COPCs that exceed one or more of the SLs in at least one sample include arsenic, iron, and lead.

The post-remedial action sampling (START-3 2006) included FPXRF analyses of approximately 25 soil and waste rock samples collected from bore holes drilled into the encapsulation mound and in an area of former waste rock and ore storage located northeast of the encapsulation mound. Six of these samples were submitted for standard laboratory analyses of total metals. START-3 (2006) includes information regarding the correlation coefficient between the FPXRF and laboratory analyses that shows an average correlation coefficient of 0.901. Correlation coefficients (r^2) between the FPXRF analyses and the six laboratory samples for individual analytes ranged from approximate 0.82 to 0.98. Therefore, START-3 (2006) presented the data as usable and describe overall total metals summary statistics for arsenic, copper, iron, lead, manganese, and zinc in Site samples. However, closer examination of this data shows that biases in the FPXRF data are present that are not displayed by simply examining the correlation coefficient.

Figures 4-80 through 4-85 show linear regressions that compare paired laboratory analyses to FPXRF analyses for samples collected by START-3 (2006) for arsenic, copper, iron, lead, manganese and zinc. All FPXRF analyses for cadmium were below the instrument detection limit, so cadmium data are not discussed further. Although the r^2 values are relatively high for the data sets, examination of the slope of the regression lines and the y-intercept values show that the FPXRF results are biased relative to the laboratory data for some analytes. For example, the r^2 value of the

regression line for arsenic is 0.96, which suggests a relatively good correlation between the data sets. However the slope of the regression line is only 0.34, which shows a strong bias with FPXRF values being much lower that the paired laboratory analyses. The slope of the copper regression line is relatively close to one (1.1006) and the r^2 value is relatively high (0.94). However, the y-intercept of the regression line is -862.26. Again the laboratory values are much higher than the paired FPXRF analyses. Based on this additional evaluation of the correlation between the laboratory and FPXRF data, it is recommended that further statistical analyses be completed regarding the accuracy of FPXRF at the Site prior to using FPXRF data developed by START-3 (2006). FPXRF may be a useful tool at the Site but additional work is required to understand the statistical relationships between laboratory and FPXRF data and to optimize FPXRF sample preparation procedures, analyses methods, and instrument count times.

Overall, total metals analyses of soils and waste rock are relatively limited for the Site, particularly if the START-3 (2006) FPXRF data are not considered because of the uncertain correlation with laboratory analyses. Preliminary analysis of the Site total metals dataset suggests that arsenic exceeds the soil SLs for a residential or industrial land use.

4.5.2 Acid Base Accounting Data

4.5.2.1 Introduction to Acid Base Accounting

ABA analyses are widely used to evaluate the potential for mine waste to generate ARD. ABA is a method to estimate the potential for a sample to generate acid at some time in the future. The propensity for a rock to generate acid drainage is dependent on both the acid generating and acid neutralizing potential of a rock. Acid generation results from oxidation of sulfide minerals, such as pyrite (FeS_2). Acid neutralization results from minerals that will neutralize acid, such as calcite ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$). Numerous other minerals have the potential to neutralize acid; however, they dissolve slowly and are less effective at preventing acid rock drainage. ABA is not a quantitative method, and correct data interpretation requires an understanding of the mineralogy of the rock as well as assumptions inherent in the specific ABA method used (Jambor et al. 2003).

In ABA analyses, acid potential is estimated based on a series of sulfur analyses. Sulfur is analyzed in fractions of the sample that are soluble in water, hydrochloric acid, and/or nitric acid. A total sulfur analysis is also performed. Sulfur measured in the various digestions is interpreted to represent different types of sulfur-containing minerals. It is important to understand that the ABA method does not measure the content of any specific minerals. The content of the different types of sulfur-containing minerals is estimated based on interpretations of the sulfur digestions in relation to the mineralogy of the rock.

The quantity of sulfur in the hydrochloric acid and water digestions are commonly assumed to be gypsum ($CaSO_4 \cdot 2H_2O$) or other non-acid generating sulfate minerals. However, other sulfate minerals may report to the hydrochloric/hot water digestions,

which can generate acidity and release metals. For example, many of the efflorescent iron sulfate minerals can generate acid upon dissolution. Acidity produced by these minerals is best evaluated using modified SPLP tests or paste pH because they are soluble in water.

The quantity of "sulfide sulfur" (e.g., sulfur present in the minerals such as pyrite or chalcopyrite) is estimated based on sulfur that reports to the nitric acid plus residual digestions. Generally, all sulfide is assumed to be pyrite which is a conservative assumption based on the amount of acid generated by pyrite in relation to other sulfide minerals. This assumption may overestimate the acid potential in samples from the Silver Peak Mine, because the massive sulfide ore bodies contain numerous other sulfide minerals as discussed previously in Section 4-2. In addition, barite ($BaSO_4$) may report to sulfur fraction assumed to be "sulfide sulfur". Barite is a sulfate mineral that does not generate acid, but it has very low solubility. Barite is reported as a gangue mineral at the Silver Peak Mine based on descriptions of FRC (1987) and Derkey and Matsueda (1989). In the absence of detailed mineralogical analyses of ABA samples, a conservative interpretation is that the nitric acid soluble plus residual sulfur is pyrite. Although the variety of sulfide and sulfate minerals present at the Silver Peak deposit makes this assumption somewhat tenuous, pyrite is reported to be the dominant sulfide mineral in the ore zones as well as the foliated tuff unit that envelopes the ore zones.

Estimating neutralization potential of ABA samples is completed using a titration method. Neutralization potential is estimated by adding a known quantity of hydrochloric acid to the sample followed by titration of the solution back to a pH of 8.3 using sodium hydroxide. The quantity of remaining acid is estimated based on the amount of sodium hydroxide necessary to raise the pH back to a value of 8.3 su. The quantity of acid consumed by the sample is the neutralization potential, which is estimated by difference and expressed in units of tons per kiloton calcium carbonate equivalent (t/kt CaCO3 eq).

The ABA method assumes that pyrite is the only sulfide mineral present and that the pyrite is oxidized by oxygen producing four moles of H^+ per mole of pyrite as shown below.

$$FeS_2 + 3.75O_2 + 3.5H_2O \rightarrow Fe(OH)_3 + 2SO_4^{2-} + 4H^+$$

The 4 protons generated in reaction 1 are then assumed to be neutralized by calcite as described below:

$$2CaCO_3 + 4H^+ \rightarrow 2Ca^2 + 2H_2CO_3$$

Pyrite oxidation by dissolved ferric iron (Fe^{+3}) is also common, and the quantity of acid generated per mole of pyrite varies based on the reaction path. In addition, the assumed neutralization path for neutralization of acidity by calcite is not unique, and up to four moles of calcite may be required to neutralize the acidity formed by oxidation of one mole of pyrite (i.e.; the required amount of calcite may be 2 times

that assumed in reaction 2 ;Rose and Cravotta 1998). The estimated acid potential is expressed in units of t/kt $CaCO_3$ eq.

As a result of the uncertainties described in proceeding paragraphs, interpretation of ABA data is based on a weight of evidence approach using empirically derived thresholds. Application of these thresholds is site-specific and based on an understanding of the mineralogy of the mine waste and other factors. Acid potential (AP) and neutralization potential (NP) are expressed in equal units of t/kt $CaCO_3$ eq. The difference between neutralization potential and acid potential is termed the net neutralization potential (NNP), which can be calculated based on total sulfur or sulfide sulfur. Evaluation of ABA data also considers the ratio of neutralization potential to acid potential (NP:AP ratio).

The weight of evidence applied in this document utilizes the following metrics in order to estimate potential for ARD generation:

- Total NNP values relative to the potential to generate acid in the future.
  - <0 t/kt $CaCO_3$ eq. indicates a high potential.
  - 0 to 20 t/kt $CaCO_3$ eq. indicates an uncertain potential.
  - >20 t/kt $CaCO_3$ eq. indicates an unlikely potential.

- NP:AP relative to the potential to generate acid in the future
  - <1 indicates a high potential.
  - 1 to 2 indicates a moderate potential.
  - 2 to 4 indicates a low potential.
  - >4 indicates the sample is unlikely to generate acid.

These metrics may be modified in the future at the Site based on increased understanding of sample mineralogy and geochemistry.

4.5.2.2 Evaluation of Available ABA Data

The existing ABA dataset includes 25 samples of various types of mine rock that were collected during pre-modern mining investigations (Norecol 1989a), 2 samples of tailings from mineral processing studies completed by Coastech Research Inc. (1990), and 9 samples of soils and waste rock collected by Dynamac (2000).

The 3 ABA analyses completed by Coastech Research Inc. (1990) represent the only ABA data available for tailings from the Silver Peak Mine. These samples were subjected to various mineral processing tests to evaluate recovery of copper and zinc from ore. As a part of these tests, Coastech Research Inc. (1990) completed two acid base accounting tests on tailings produced in their laboratory tests. These samples contained 34.23 and 32.75 percent sulfide sulfur, which corresponds to an estimated acid potential of 1067.7 and 1023.3 t/kt $CaCO_3$ eq. The neutralization potential of these samples was -2.0 and -1.2 t/kt $CaCO_3$ eq., which is essentially negligible. The NNP of these samples is -1071.7 and -1024.5 t/kt CaCO3 eq., which indicates that the tailings are extremely acid generating. If neutralization by pure limestone ($CaCO_3$)

was 100 percent efficient (which it never is), this value indicates that over a ton of pure limestone would be required to neutralize the acidity produced by one ton of tailings.

Norecol (1989) presents ABA data for 25 samples of various lithologies, which they defined as non-mineralized tuff, ore, oxidized tuff, and quartz sericite pyrite tuff. These data are presented in Table 4-29 and in Figures 4-86 and 4-87. The NNP data for the samples is included in Table 4-29. These data clearly show that the ore and the quartz-sericite-pyrite tuff have a high potential to generate acid. As discussed previously in Section 4-2, the quartz-sericite-pyrite tuff is a part of the foliated tuff unit that envelopes the ore zones. This unit is likely exposed in rock surfaces within underground mine tunnels. This unit is also a common component of surface waste dumps based on visual observations at the Site, which indicates that the unit was excavated during underground mine development in order to access the ore zones. Figures 4-86 and 4-87 present graphical representations of the ABA data in relation to the NP:AP ratio criteria described above. These figures again show that the ore and the quartz-sericite-pyrite tuff would be expected to generate acid. However, the non-mineralized tuff and the oxidized tuff units appear to be unlikely to generate acid.

Additional ABA data collected during the site assessment (Dynamac 2000) are presented in Table 4-30. These data show that much of the soil and rock sampled are classified as acid generating based on a NNP of less than 0. The data show an interesting anomaly with negative NP values ranging up to -93.5 t/kt $CaCO_3$ eq. Negative NP values are not common with ABA analyses, but if the samples contain a very high load of soluble acid salts that dissolved in the analysis, the amount of sodium hydroxide required to titrate the pH of the sample back to the end point of 8.3 su could exceed the amount of acid added in the analysis. This would result in a negative NP value. The ABA results for the samples collected by Dynamac seem to suggest that very high loads of soluble acidity are present in some samples. The lowest NP value of -93.5 su was collected from soils at the discharge pipe for ARD conveyed from the Formosa adit. This sample was collected in October, 1999, which is towards the end of the dry season at the Silver Peak Mine. It is therefore plausible that this soil contains high concentrations of efflorescent acid salts, which may have formed as a result of evaporation of ARD discharged from the pipeline. This stored acidity can dissolve very readily during precipitation events releasing a high load of stored products of previous acid generation into the environment. If this is the case, high concentrations of metals related to ARD would be expected in leachate from extraction tests conducted on these samples.

4.5.3 Extraction Tests

Extraction tests are a group of methods in which water or some other type of extraction fluid is mixed with rock or soil. Extraction tests are often done in agitated bottle roll tests such as the SPLP (EPA SW-846 Method 1312), TCLP (EPA SW-846 Method 1311), various column tests, or batch tests. Both SPLP and TCLP tests have been completed on samples of waste rock and soil from Site. In addition, HC (2002) completed three batch tests in which waste rock was placed into lined wood boxes

and rain water was collected and poured over the samples occasionally to evaluate the quantity of metals and other products of acid generation that rinsed from the rock.

SPLP tests were completed on samples of soils and waste rock by HC (2002) and Dynamac (1999). These data are presented in Tables 4-31 and 4-32. The SPLP test is designed to simulate leaching that would occur as a result of percolation of natural precipitation through the material. The extraction fluid is reagent grade water that is adjusted to the approximate pH of rain water. The procedure uses a solution to solid ratio of 20:1, which tends to dilute effects of metals rinsing from mine waste. This issue is exacerbated if laboratory detection levels for COPCs in the SPLP leachate are high, which is the case for SPLP analyses completed on samples collected at the Silver Peak Mine. For example, the detection levels for arsenic, cadmium, copper, and zinc in SPLP data presented in Tables 4-30 and 4-31 are 1 mg/L, 0.5 mg/L, 1 mg/L, and 10 mg/L respectively. The SPLP data for soils and waste rock shows that many analytes are reported as less than detection. However, this information should not be construed to mean that the samples are not releasing those metals. The only conclusion that can be drawn is that metals released from the samples did not exceed the threshold established by the laboratory detection levels multiplied by the 20:1 dilution of the SPLP analysis.

Although the SPLP method and associated laboratory detection levels cause a relatively high threshold for detection of metals leaching from soils and waste rock, several COPCs were detected at relatively high concentrations. For example, copper concentrations in the SPLP extract solution for soil and waste rock samples ranges from less than 1 mg/kg to 33 mg/kg. To put that data into perspective, a SPLP concentration of 17 mg/L indicates that the sample released 660 milligrams of copper per kilogram of sample, which is quite high. Similarly, zinc concentrations in SPLP extract solutions for soils and waste rock range from less than 10 mg/L to 67 mg/L. A value of 67 mg/L in SPLP extract corresponds to release of 1,340 milligrams zinc per kilogram of sample. Elevated SPLP leachate concentrations were detected in both soil and waste rock samples.

Several TCLP tests were also completed at the Site. The TCLP test is designed to evaluate the characteristics of leachate that could occur if a waste material was placed into a municipal landfill. The primary use of the TCLP test is in classifying waste material for toxicity characteristics under the Resource Conservation and Recovery Act (RCRA). It should be noted that the RCRA threshold criteria for toxicity characteristic is not relevant to evaluating the potential for exposed mine wastes and ARD affected soils to cause adverse effects to surface water quality and aquatic life in the Middle Creek and South Fork Middle Creek watersheds.

SPLP data from the waste rock used in the HC (2002) batch tests are included in Table 4-32. These data show high copper and zinc concentrations with copper concentrations ranging from 174 mg/L to 404 mg/L, and zinc concentrations ranging from 201 mg/L to 294 mg/L. These concentrations display the potential for mine wastes and ARD affected soils to affect water quality in the Middle Creek and South

Fork Middle Creek watersheds. Data from the actual leach cell tests are shown in Table 4-33. These data also show that the waste rock releases high concentrations of metals into the rinse water, which supports identification of surficial waste rock as a source of metals in the environment. However, the solid to solution ratio of the batch tests is unknown, which makes the data difficult to interpret in other than a qualitative manner.

Section 5
Recommendations

This section presents recommendations for future investigations at the Site based on a review of the existing data presented in this report and consideration of the role of the RI in the overall RI/FS process. The primary purpose of the RI is to provide sufficient information about the Site to support future FS and remedial action decisions.

This section is organized by selected sections of a RI report to focus the recommendations on specific issues that require further investigation. This section is organized as follows:

- Physical Characteristics
- Nature and Extent of Contamination
- Risk Assessment

5.1 Physical Characteristics

Evaluation of physical characteristics includes evaluation of the extent of mine facilities, previous reclamation completed at the Site, climate, geology, surface water, groundwater, and the Site water balance.

5.1.1 Extent and Location of Underground Mine Workings

Mining activities at the Silver Peak Mine were primarily conducted underground, and access into the underground mine workings is not currently possible. The underground workings are reported to contain large quantities of highly reactive acid generating rock and tailings. In addition, the FS for the Site conducted by HC for ODEQ selected the following for the preferred alternative:

> *…a phased approach utilizing, as necessary, elements of in-situ treatment of source materials, interception and treatment of contaminated groundwater, and removal of underground tailings. Lower cost elements would be implemented and monitored for effectiveness prior to more costly elements, providing multiple management decision points. The approach incrementally manages site uncertainty, and associated risk of investment, while optimizing reduction in environmental risk at the most reasonable cost.*

However, as discussed in Section 4.1, the specific location and extent of underground workings are not completely understood. This information will be required to fully develop and consider the partial excavation alternative in future FS and remedial action decisions. In addition, developing an improved understanding of the underground workings will facilitate more complete analyses of potential interactions between the acid generating rock and mine waste within the workings, groundwater, and groundwater discharges to surface water in the areas of upper Middle Creek and the South Fork of Middle Creek.

Two options are available to investigate the underground workings: reopen and enter the workings, or compile available data to the extent practicable. Reopening and entering the underground workings is likely to be very expensive. It would involve excavation of existing backfill in the adits, reestablishment of ventilation and roof support within the mine, installation of surface support infrastructure including generators and ventilation fans. It also would involve a level of hazard to personnel involved in underground investigations. Therefore, CDM recommends that data gaps related to the extent and location of underground workings be addressed by fully compiling available information.

CDM recommends the following:

- Continue with compilation work of historical maps and computer files that contain information regarding the location and extent of the underground workings;
- Geo-reference this information to convert information currently in the two site-specific mine coordinate systems into the overall coordinate system for the mine; and
- Consider developing a 3-D model of the underground mine that would assist with analysis of the interactions between the mine and other Site features such as contaminated groundwater seeps and adit discharges; Advantages offered by this approach include 3-D visualizing and quantitative volumetric modeling capabilities.

5.1.2 Delineation of Surface and Near-Surface Mine Waste

The existing information regarding geochemical characteristics of soils and waste rock exposed to the surface was discussed in Section 4.5. Existing data collected by previous mine workers indicate that ARD-affected soils and mine waste on the surface contain high concentrations of soluble metals and acidity that likely contribute to seasonal flushes of contaminants in the Middle Creek and South Fork watersheds. However, the specific location and volume of this material is unknown.

CDM recommends the following work to facilitate estimation of the volume and locations of this material:

- Surveying of surface waste piles using ground or aerial methods; and
- Evaluation of the thickness of the mine waste piles using trenching or other suitable methods.

5.1.3 Condition and Performance of Existing Reclamation

Numerous removal and reclamation activities have been conducted on the Site since mining ceased in the early 1990's. To assess final remedial actions at the Site, it is necessary to understand the performance of existing reclamation and remediation actions. For example, high concentrations of copper and zinc are reported in

groundwater at the encapsulation mound area, which suggests that the encapsulation mound cover is not functioning effectively at limiting ingress of water into buried mine wastes and/or that the lower liner of the encapsulation mound repository is breached. Evaluation of the condition and performance of existing reclamation and remediation will involve work related to both physical characteristics and nature and extent of contamination. This section focuses on recommended work related to physical characteristics only.

CDM recommends the following work to evaluation of performance of existing reclamation:

- Continued compilation of available data regarding construction of existing reclamation and remediation at the Site; and
- Visual inspection of existing reclamation and remediation infrastructure to evaluate performance and stability.

5.1.4 Climate

Currently, climate conditions are unclear at the Site because the various reports describe a wide range of estimates for climate conditions such as precipitation. This may be a result of natural orographic variations and differences in climate records for various reporting Sites.

CDM recommends the following work related to climate data:

- Retrieval of available climate data for the Site from National Oceanographic and Atmospheric Administration reporting stations and compilation and evaluation of this data;
- Further communications with BLM and other local agencies that may have climate data pertinent to the Site; and
- Evaluation of data from Silver Butte Peak weather station, and if station is not fully functional, evaluation of repairs/modifications would be necessary to make station fully functional.

5.1.5 Geology

As discussed in Section 4.2, an understanding of the local geology and mineralogy of the Site is important in understanding sources of ARD generation and considering potential remedial actions. For example, understanding the distribution of pyrite within exposed rock surfaces in the underground mine is critical to evaluating potential performance of a remedy that focuses on removal of backfilled mine wastes. In addition, understanding local structural geology features such as the location of fractures, faults and shear zones would be helpful in understand the Site hydrogeologic framework. Additional geological data are available including geological cross sections of the mine and geological plan maps at various

underground mine levels. These maps and sections contain information that would be useful in further understand the Site geology.

CDM recommends the following with regard to developing an improved understanding Site geology:

- Site fracture mapping to assess the orientation, openness and extent of exposed fractures in outcrops along mine roads; compilation of structural data from mine maps and sections and stereogram analysis of fracture orientation based on field data and data collected from maps and sections;
- Continued compilation of existing geological data to develop a 3-D understanding of geology in the mine area; and
- Potential incorporation of these data into a 3-D computer model to facilitate visualization and improve Site decision making.

5.1.6 Surface Water

Understanding the flow variation and magnitude in Middle Creek and South Fork is critical to understanding contaminant transport and mass loading. In addition, collection and treatment of contaminated water is likely to be considered as one alternative in the FS investigation for the Site. An adequate understanding of surface water flow is necessary to evaluate the cost of potential design and construction of ARD collection and treatment systems. This issue will be discussed further with respect to understanding the Site water balance in Section 5.8. In addition, access improvements are required to safely access surface monitoring Sites in the upper South Fork drainage.

CDM recommends the following work related to understanding surface water flow:

- Measurement of flow rate during all surface water sampling activities using portable flow meters, portable cutthroat flume, or other suitable methods;
- Installation of permanent flumes or weirs at sampling Site MXR and in upper South Fork Middle Creek, and installation of continuous flow monitoring instrumentation, and electronic data-loggers at those locations;
- Potential installation of automated water quality instrumentation at the flume sites; and
- Improvement of the existing road into the upper South Fork Drainage to facilitate safe access for water sampling and flow monitoring.

5.1.7 Groundwater

Based on existing Site data, the groundwater system is an important control on generation of ARD within the underground workings and in transportation of ARD

related contamination into surface water in Middle Creek and South Fork. Developing an adequate understanding of hydrogeological conditions at the Site will be necessary to develop and assess potential remedial actions at the Site.

CDM recommend the following work related to groundwater:

- Assess adequacy and condition of existing groundwater monitoring wells;
- Conduct seep and spring survey; and
- Develop groundwater investigation plan that considers the following:
  - Installation of groundwater wells in the upper South Fork drainage to assess the extent of groundwater contamination in the area downgradient of the encapsulation mound area and waste rock piles;
  - Installation of groundwater wells penetrating fracture zones identified in geological investigations to assess groundwater fracture-flow. Potential evaluation of fracture zones using down hole geophysics, videographic methods, or packer tests;
  - Installation of groundwater monitoring wells in upper Middle Creek drainage if access can be established;
  - Installation of groundwater monitoring well(s) that penetrate backfilled underground working to evaluate seasonal variation in water level with the backfilled mine waste;
  - Evaluate potential to install automated water level loggers in selected wells;
  - Completion of single well pumping tests or other well tests to estimate the hydrogeological characteristics of Site aquifers; and
  - Development of groundwater budget estimates and potentiometric surface maps of Site.

5.1.8 Site Water Balance

Understanding the Site water balance is an important component of ARD remediation at mine sites. This understanding should consider the volume of ARD generated at the Site in a water year, and it also should consider potential variations in ARD generation in particularly wet years. This information is critical to evaluating either passive or active water treatment systems during the FS phase of the project. Passive water treatment systems, in particular are very sensitive to large variations in the flow rate. Active water treatment plants also must be sized for the most economical treatment rate. ARD storage facilities are commonly necessary to store ARD produced during seasons of very high rates of ARD production, and prevent excess flows from passing through the water treatment system. The volume of ARD produced at the Site

is also critical to evaluating the future treatment costs and to conducting cost-benefit analyses of various treatment options.

CDM recommends the following work related to understanding the Site water balance:

- Rehabilitation of existing flume at Formosa adit and installation of continuous flow monitoring instrumentation;
- Evaluation of flow data collected at sampling Sites located in upper Middle Creek, MXR, and upper South Fork;
- Evaluation of climate data described previously;
- Evaluation of surface drainage basins within watershed that would be included within a Site ARD collection system;
- Evaluation of groundwater flux to upper Middle Creek and the South Fork of Middle Creek; and
- Development of stochastic water balance model to estimate volume of ARD generated at the Site.

5.2 Nature and Extent of Contamination

Evaluation of the nature and extent of contamination is focused on characterizing and identifying ARD sources at the Site, and delineating the extent of contaminant migration in soils, surface water and groundwater.

5.2.1 Primary Contaminant Sources

Primary contaminant sources are the ARD generating mine waste and exposed rock surfaces that contain sulfide minerals and lead to ARD generation.

5.2.1.1 Exposed and Near Surface Mine Waste and Exposed Rock Surfaces

Numerous surface disturbance areas exist at the Site, with most of these characterized as waste rock pile areas. Attempts at reclamation and surface revegetation were made for many of these areas from the period of 1993 through 1998; however, limited funding and focus on the adit water diversion system prevented surface reclamation from being successful. Previous investigation data from the various waste rock pile areas indicate elevated concentrations of metals and potential for acid generating material. Visual observations indicate the widespread presence of pyrite-containing materials in many surface disturbed areas. The lack of vegetation in waste rock pile areas and the presence of potentially acid-generating materials may provide a continuous source of contaminated surface runoff, and may lead to contaminated subsurface flow.

Existing data described in Section 4.5 indicate that exposed and near surface mine waste is ARD-generating and that this material contains high concentrations of soluble products of ARD generation that are readily flushed into the environment during periods of high precipitation or snow melt. It is necessary to understand both the geochemical characteristics of the material and the extent of this material prior to considering potential remedial actions such as excavation and placement in a capped impoundment. Although previous investigations show that this material is problematic in terms of ARD generation, sufficient information is not available to specifically delineate the extent and volume of this material. Recommendations for delineating the volume of material were discussed previously in Section 5.1.1. This section presents recommendations for delineating the extent of ARD generating mine waste and exposed rock surfaces.

CDM recommends the following work to delineate the extent of ARD generating mine waste and exposed rock surfaces that are exposed or present in the near surface environment.

- Completion of a detailed geochemical survey to include the following:
  - Collection of several hundred field paste pH measurements spread across the Site. These measurements will identify zones of ARD- generating mine waste or exposed rock surfaces. Tabulation of lithological descriptions of all samples. Potentially use FPXRF analyses.
  - Submittal of a subset of these samples (10-20 percent) for laboratory analyses including total metals, modified SPLP, ABA, and electron microprobe analyses.
  - Back-hoe or excavator trenching in areas containing accumulations of mine waste to evaluate subsurface geochemical characteristics and depth of fill.
  - Compilation and interpretation of data from the detailed Site geochemical survey.

5.2.1.2 Backfilled Mine Waste

Sampling of materials backfilled into the underground mine is not recommended because of the high cost and safety concerns associated with re-opening the underground workings. Data are available regarding the locations and types of mine backfill based on an AutoCAD file collected from the ODEQ Eugene office that was produced by Mr. Jay Wilson, as well as other maps that were obtained from ODEQ and DOGAMI. These files include information showing areas backfilled with tailings slurry, dry stack tailings, gob and other mine wastes.

CDM recommends the following work related to understanding geochemical characteristics of backfilled mine waste:

- Compilation of existing data collected from the DOGAMI, ODEQ , and Jay Wilson files.

- Interpretation of general characteristics of this backfill based on existing data including acid potential, grain size, volume, and location within mine.

- Potentially incorporation of this information on 3-D computer model of Site.

5.2.2 Secondary Contaminant Sources

Secondary contaminant sources refer to sources of ARD related contamination such as metal precipitates, areas of secondary acid salts and accumulations of soluble metals in areas of previous ARD discharge.

5.2.2.1 Soils in Areas of ARD Discharge

Surface and subsurface soils present near the pre-IRAM adit water diversion drain field and the IRAM adit water diversion drain field may represent a secondary source of stored acidity and metals in the soil. As the diverted adit water flows overland, metal-rich precipitates form on the soil surface and in the subsurface as the water flows through preferential pathways underground. During the high flow season, the surface ftprint of the drain field would be greater than during low flow. As such, high flow would contribute a precipitate loading that may temporarily become immobile through the dryer summer and fall. In the late fall (i.e., November), when heavy rain and rain on snow events return, these precipitates can become re-mobilized and present a secondary source of acidic and metal-laden water to the environment.

CDM recommends the following work in relation to soils in areas of ARD discharge:

- These areas would be included in the detailed paste pH survey of the Site described above. This investigation would include adit water drain field flow paths to define the extent of these secondary precipitates both spatially and seasonally.

- Additionally, the flow path of the diverted adit water as it moves in the subsurface is unknown, therefore, CDM recommends further investigation to determine if and where the discharged ARD may be flowing and if this water is reappearing within the upper Middle Creek drainage.

5.2.2.2 Stream Sediments/Precipitates

Discharge of ARD into the headwaters of Middle Creek and South Fork results in formation of extensive deposits of metal precipitates in the stream bed. The deposits vary in color, depth and extent at various time of the year, and transport and/or dissolution of these precipitates is an important factor in cycling of metals in the Middle Creek and South Fork watersheds. In addition, deposition and accumulation of these precipitates has increased the metal content of stream sediments in the watersheds.

CDM recommends the following work related to stream sediments:

- Development of an investigation to evaluate the concentration of metals in sediments and cycling of precipitates though the system. It is anticipated that this

investigation would be developed in conjunction with ecological risk assessment work.

- Evaluate potential to conduct a gradient survey to evaluate the rate of change in contaminant concentrations in Middle Creek and South Fork.

5.2.3 Groundwater

Development of an improved system of groundwater monitoring wells at the Site was discussed previously in Section 5.1.7. CDM recommends that a routine groundwater quality monitoring program be developed to sample these wells to evaluate the extent of contamination, the rate of contaminant migration, and seasonal fluctuations in groundwater quality. Use of chemical tracer tests in the upper Middle Creek area may also be useful to quantify inflows of ARD-affected groundwater to the stream.

5.2.4 Surface Water

5.2.4.1 Surface Water Sampling

Surface water sampling has not been completed at the Site in several years, and therefore water quality conditions within Middle Creek and South Fork are currently unknown. Acid rock drainage may mature over time and as the pH within ARD generating source materials decreases and the activity of bacteria responsible for catalyzation of sulfide mineral oxidation increases. This may result in increases in the load of metals and acidity released into the environment. It is currently unknown if water quality conditions are worsening at the Site.

Past surface water sampling has also focused on downstream portions of Middle Creek and South Fork, because a primary impetus of the work was to document the effects to water quality and aquatic life caused by the mine. As discussed previously, the goal of the RI is to provide sufficient information about the Site to support future FS and remedial action decisions. Therefore, CDM is recommending increased focus of the surface water quality sampling program on ARD discharge areas and locations in close proximity to the mine. The purpose of this focus is to provide sufficient detail with regard to ARD discharge rates and quality to facilitate evaluation of remedial actions such as potential passive or active water treatment, and to better understand the seasonal fluctuations in both ARD chemistry and discharge rate.

CDM recommends the following work with respect to surface water monitoring:

- Quarterly monitoring of surface water locations located on Lower Middle Creek and Lower South Fork Middle Creek.

- Monthly surface water quality monitoring in areas of ARD discharge and locations in close proximity to the mine.

5.2.4.2 Biotic Sampling

Very marked seasonal fluctuations in water quality are documented in Middle Creek and South Fork Creek, with the highest concentrations of metals occurring at periods

of highest flow. This indicates that periods of high precipitation or snow melt result in flushing of contaminants in area surface water. Water chemistry samples can miss periods of contaminant flushes, particularly when samples are collected on a quarterly basis only. In addition, water quality in South Fork and Middle Creek has not been sampled in several years, and therefore overall trends in water chemistry are unknown in recent years.

Biotic sampling can fill in these data gaps, because the overall health of the aquatic biological systems reflects water quality conditions that occur throughout the year. Biological monitoring is particularly useful in streams that have been sampled over a long period of record, so long-terms trends can be identified. Therefore, continued biological monitoring is a good tool to understand overall trends in water quality with respect to potential maturation of ARD generation at the Site as well as effectiveness of previous removal actions.

CDM recommends the following work with respect to biological monitoring:

- Consideration of continued biological monitoring on an annual basis at a time of year that best correlates with previous sampling events.
- Collaboration with BLM and ODEQ aquatic biologists and other stakeholders to determine the best approach to implementation of continued biological monitoring at the Site.

5.3 Risk Assessment Activities

Scoping for risk assessment activities should be considered in the near future to facilitate the most efficient data collection activities to support both evaluation of nature and extent of contamination and human health and ecological risk assessments. It is anticipated that specific protocols for risk assessment related investigations may be necessary in terms of collection of specific grain size fractions of surficial soils, collection of stream sediments and metal precipitates, and potentially additional biological sampling.

CDM recommends completion of a HHERA in accordance with the EPA guidance on completion of ERAs (EPA 1997), EPA guidance on completion of HHRAs (EPA 1989), and the Oregon DEQ guidance on ERAs (ODEQ 1998), as appropriate. Assuming EPA leads the risk assessment activities, this investigation will include the following steps, as documented in the EPA ERA guidance:

- Step 1: Screening-level problem formulation and toxicity evaluation;
- Step 2: Screening-level exposure estimate and risk calculation;
- Step 3: Problem formulation;
- Step 4: Study design and data quality objectives process;
- Step 5: Field sampling plan verification;
- Step 6: Site investigation and data analysis;
- Step 7: Risk characterization;and

- Step 8: Risk management.

CDM recommends review of the evaluations in the HHEBRA completed previously (HC 2002) to determine if any of the initial steps can be fulfilled using that report. Exposure estimates and risk calculations should be revised as necessary using data obtained during the initial field sampling activities, including surface water and surface soil sampling. Data quality objectives should be developed through a collaborative process with all stakeholders involved in the project. Based on CDM's current knowledge of the Site and available data, CDM provides the following recommendations for completion of a HHRA:

- Identify potential receptors at the Site. These include primarily campers, hikers, and recreational visitors. CDM will assess any additional activities that may result in exposure.

- **Identify potential exposure pathways, including contact** with surface soil and water.

- Complete necessary sampling to calculate potential risk to human health.

CDM provides the following recommendations for completion of the ERA:

- Identify potential receptors at the Site. These include terrestrial receptors, avian receptors, aquatic receptors, etc.

- Identify potential ecological exposure pathways, including contact with and consumption of surface soils, sediments, prey items, and surface waters.

- Complete necessary sampling to calculate potential risk to ecological receptors.

To evaluate risks to human health and ecological receptors, CDM preliminarily recommends completion of the following sampling activities:

- Surface soil: Collect samples of fine-grained surface soils (0-6 inch depth) and analyze for total metals to evaluate risk associated with surface soil contact and ingestion. Collect samples of subsurface soil (6-24 inch depth) and analyze for total metals to evaluate risk to burrowing animals and plants. Additional activities may be required depending on the outcome of receptor and exposure pathway investigations.

- Surface water: Utilize surface water sample activities (metals analysis, etc) to evaluate potential risk to terrestrial and aquatic receptors from direct contact and ingestion of surface water. Conduct biotic sampling, including macroinvertebrate and fish sampling.

- Tissue analysis: Collect specimens of small mammals and invertebrates from areas surrounding the Site and downstream along impacted waters, and conduct tissue

analysis for metal accumulation to identify risk to higher trophic level animals from consumption of animals in the vicinity of the Site.

- Sediment: Collect samples of fine-grained stream sediments and analyze for metals to identify risk to benthic macroinvertebrates and fish.

Additional data collection activities associated with completion of a HHERA may be required depending on results of initial investigations completed under steps 1 through 3 of the ecological investigation, and analysis of receptors and exposure pathways for human activity.

Section 6
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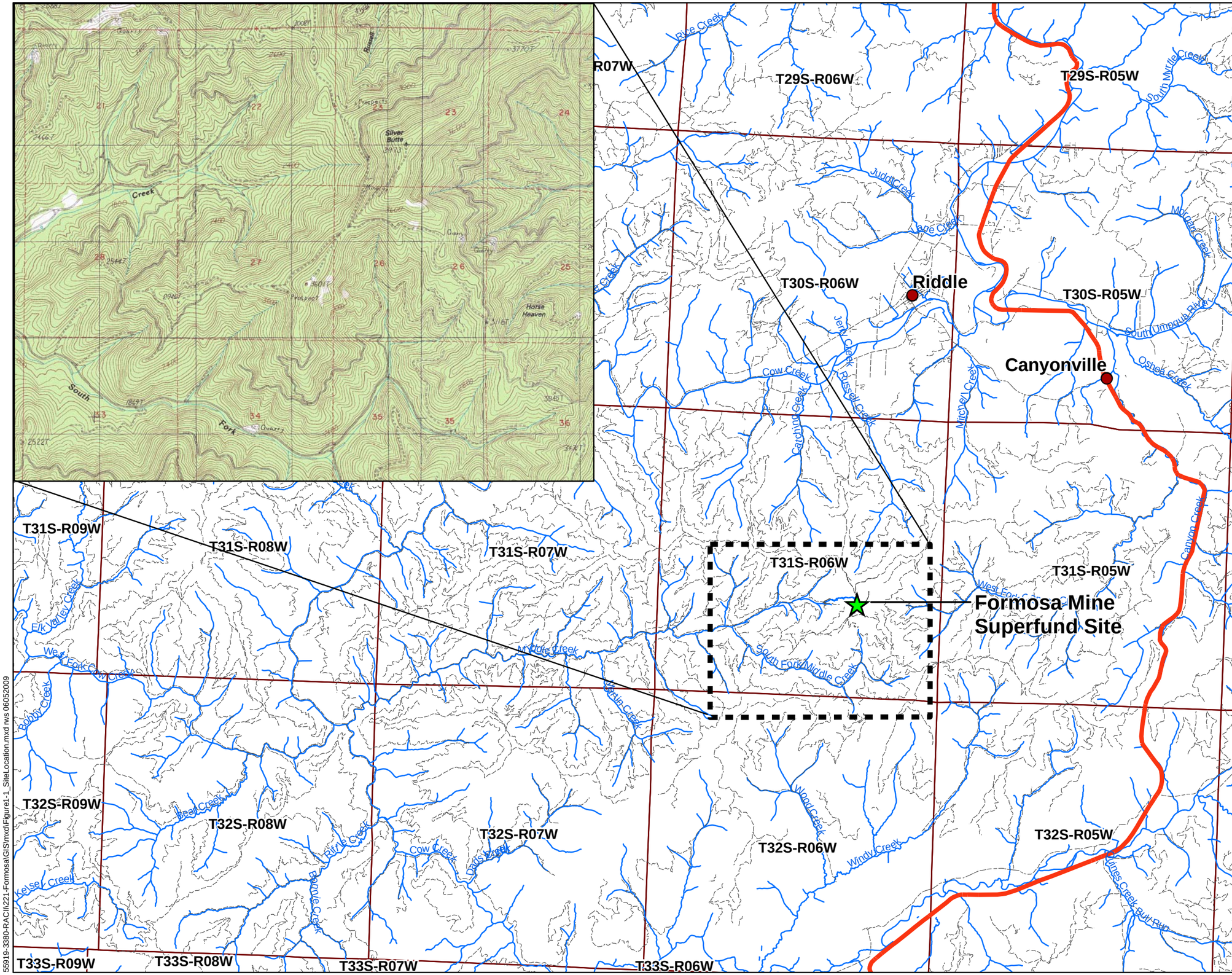

Legend

- Towns
- Highway
- Roads
- Hydrology
- Township/Range

0 1 2 4 Miles

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography
2009 Roads

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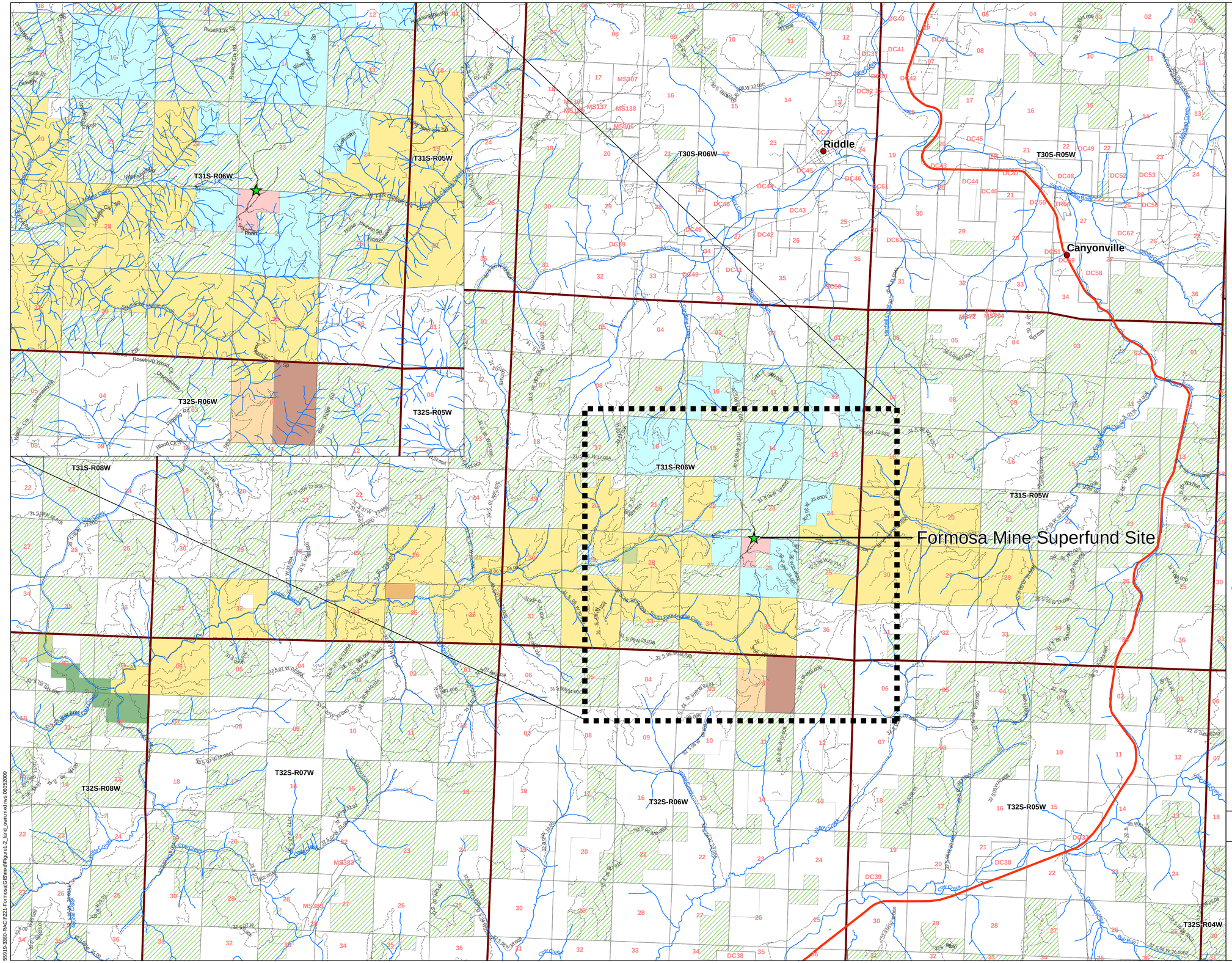
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 1-1

Site Location

Formosa Mine
Douglas County, Oregon

55919-3380-RACII\221-Formosa\GIS\mxd\Figure1-1_SiteLocation.mxd rws 06052009



Legend

- Towns
- Highway
- Roads
- Hydrology
- Sections
- Township/Range

Land Ownership

- Coast Range Resources
- Ford, Allyn
- Formosa Exploration Co.
- Lone Rock Timber Land Co.
- Plum Creek Timber Land
- Roseburg Resources Co.
- Silver Butte Timber Co.
- State of Oregon
- Bureau of Land Management
- Other

0 1 2 4 Miles

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

N

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Ownership, Section, Township and Range, and Topography
2009 Roads
Douglas County Assessor's Office Ownership 2009

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 1-2

Land Ownership

Formosa Mine
Douglas County, Oregon

55919-3380-RACI/021-Formosa/GIS/mxd/Figure1-2_land_own.mxd rws 06/05/2009

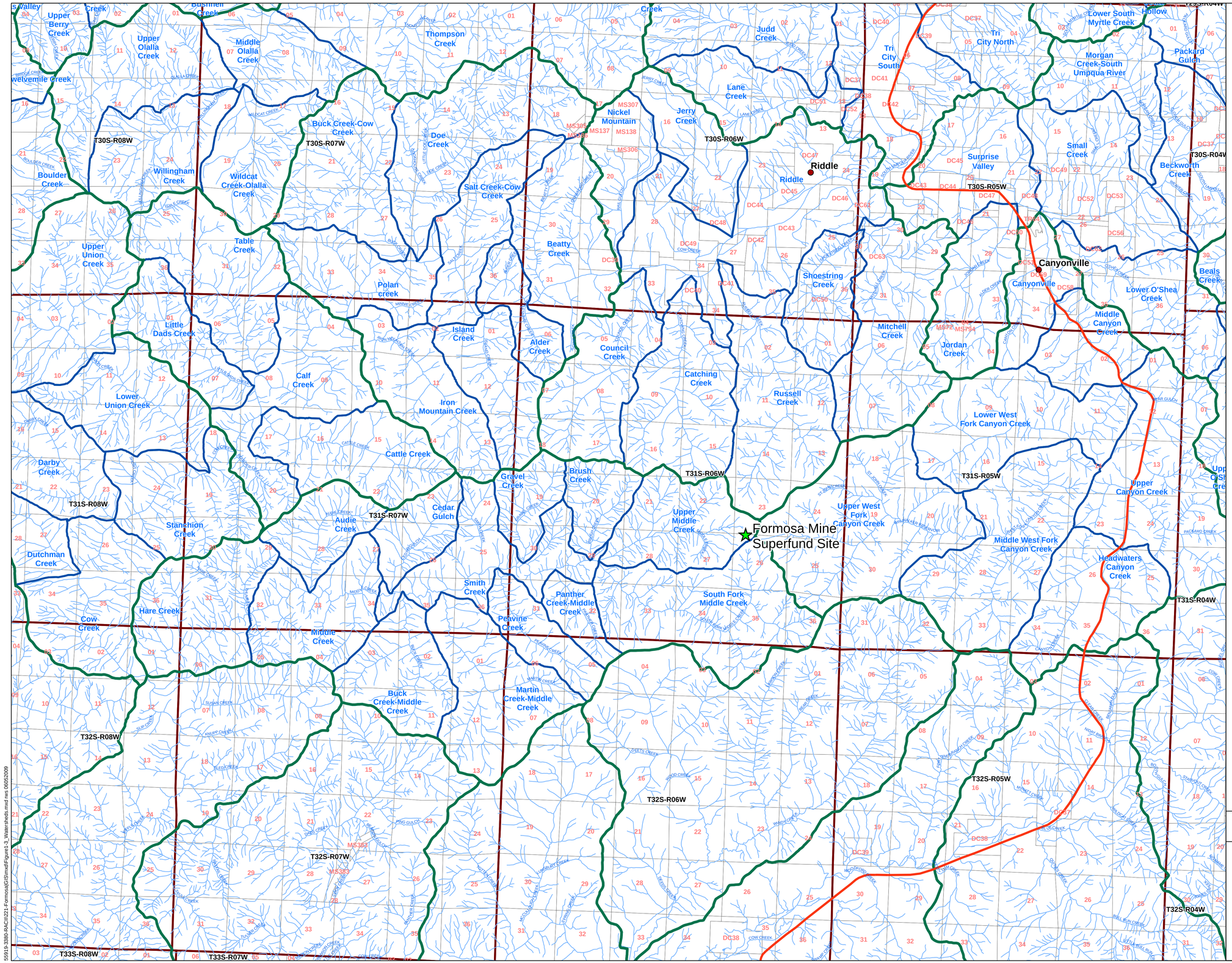
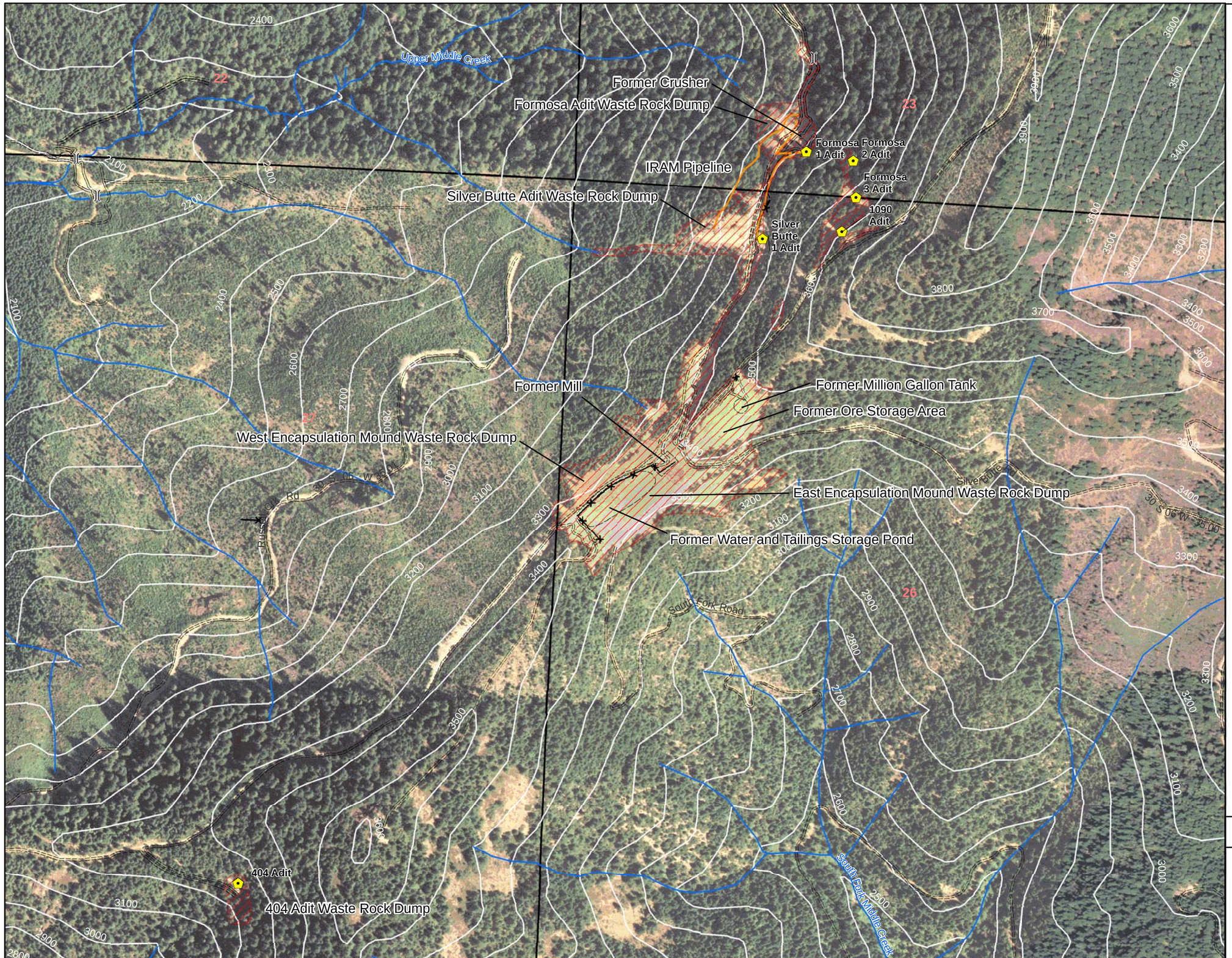


Figure 1-3

Watersheds

Formosa Mine
Douglas County, Oregon

55919-3880-RACH/221-Formosa\GIS\mxd\Figure1-3_Watersheds.mxd ws 06/05/2009



Legend

- Adit
- Culverts
- Fence
- IRAM Adit Water Diversion Pipeline
- Roads
- Hydrology
- Contours (100 ft)
- Surface Disturbance Areas
- Historic Site Features
- Sections

0 250 500 1,000 Feet

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

N

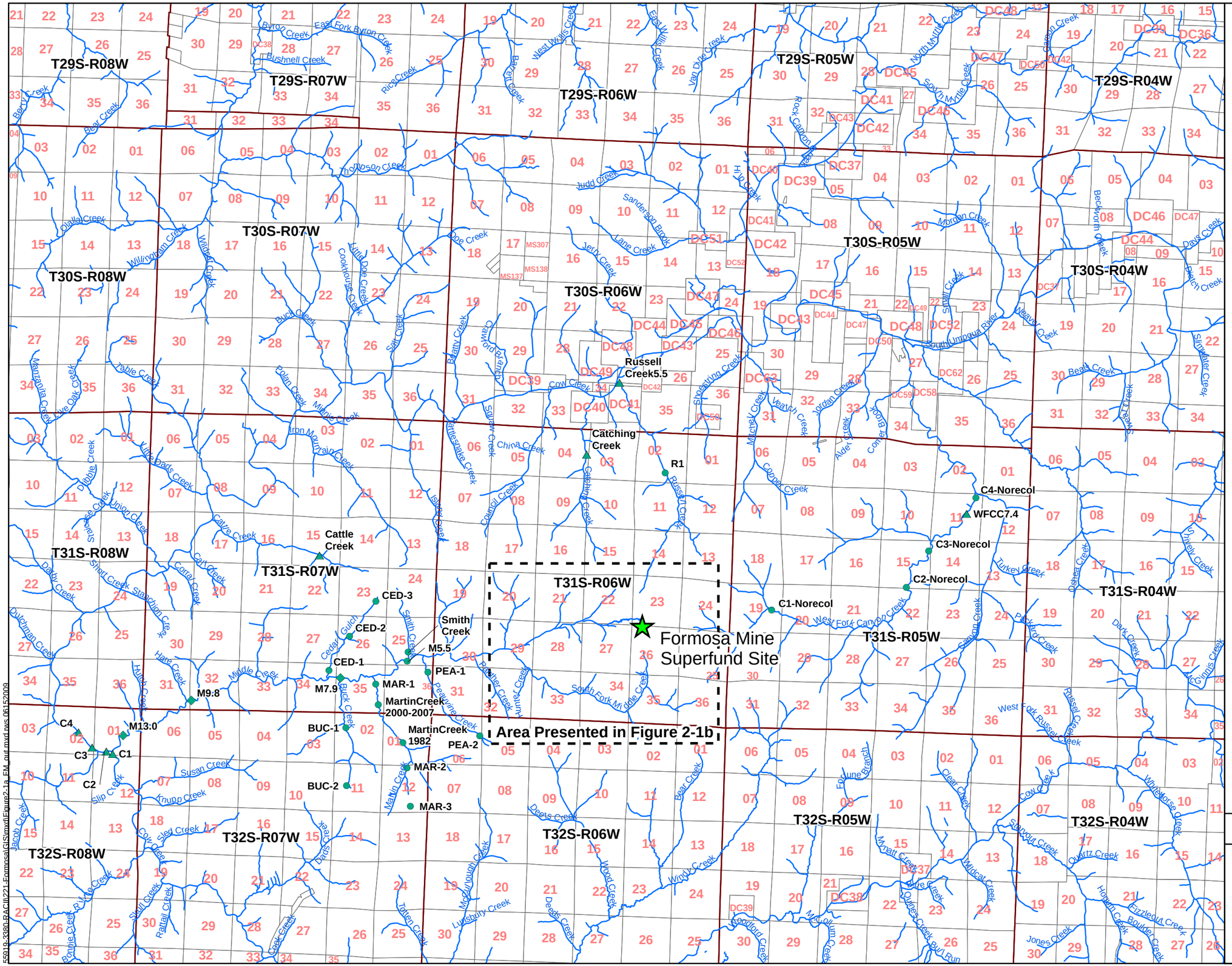
Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Township and Range, and Topography
2009 Roads
2006 National Agriculture Imagery Program

CDM

Figure 1-4

Site Features

Formosa Mine
Douglas County, Oregon



Legend

- Fish Sampling Locations
- Fish/Macroinvertebrate Sampling Locations
- Macroinvertebrate Sampling Locations
- Hydrology
- Sections
- Township/Range

0 1 2 4 Miles

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography
2009 Roads

CDM

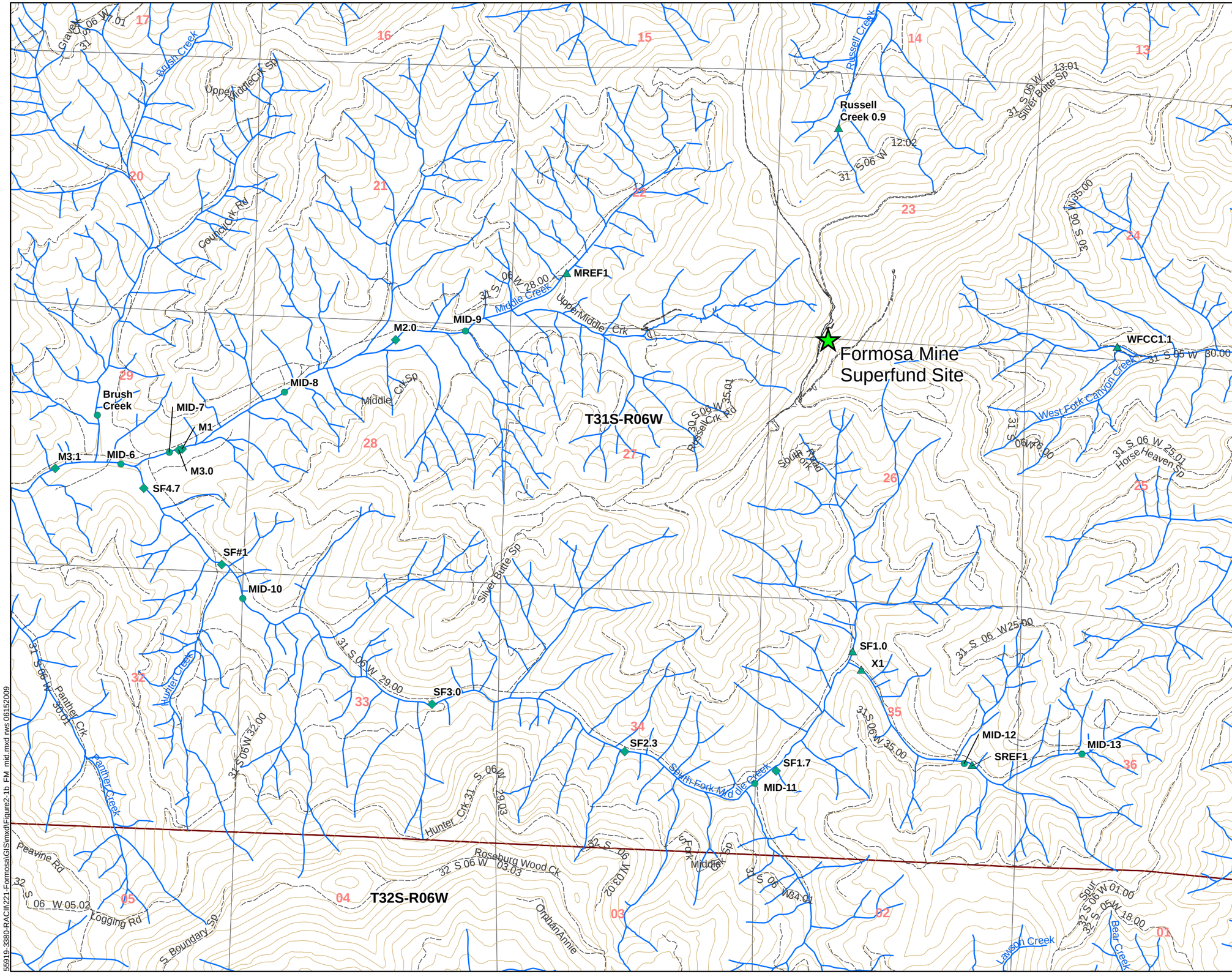
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 2-1a

Fish and Macroinvertebrate Sampling Locations Outer Zoom

Formosa Mine
Douglas County, Oregon

55919-3380-BACIII221-Formosa\GIS\mxd\Figure2-1a_FM_out.mxd rws 06152009



Legend

- Fish Sampling Locations
- Fish/Macroinvertebrate Sampling Locations
- Macroinvertebrate Sampling Locations
- Roads
- Hydrology
- Contours (100 ft)
- Sections
- Township/Range

0 0.2 0.4 0.8 Miles

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography
2009 Roads

CDM

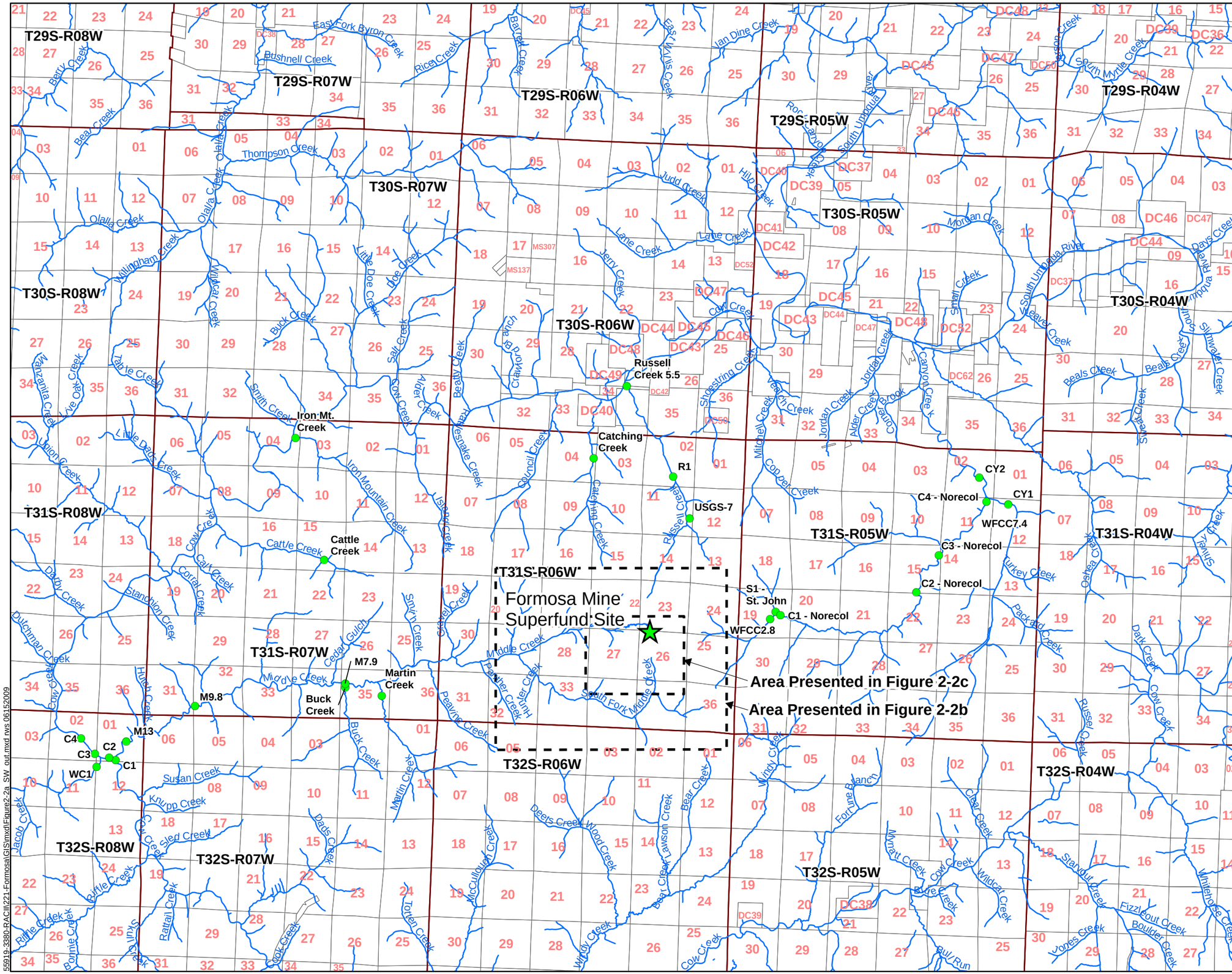
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 2-1b

Fish and Macroinvertebrate Sampling Locations Inner Zoom

Formosa Mine
Douglas County, Oregon

55919-3380-RACI\221-Formosa\GIS\mxd\Figure2-1b FM mid.mxd rws 06152009



Legend

- Surface Water Sampling Locations
- Hydrology
- Sections
- Township/Range

0 1 2 4 Miles

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography

N

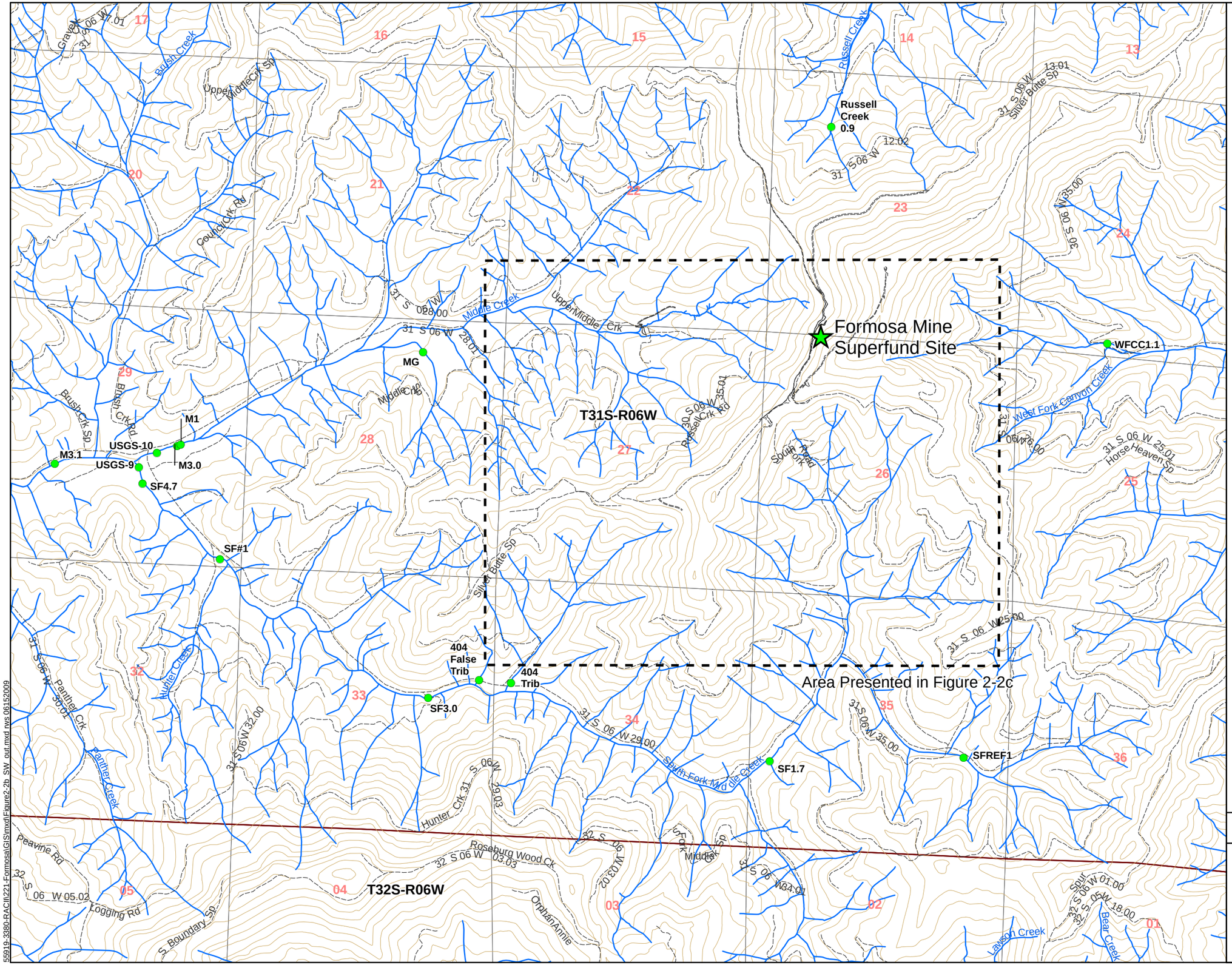
CDM

Figure 2-2a

Surface Water Sampling Locations Outer Zoom

Formosa Mine
Douglas County, Oregon

55919-3380-RACIII\221-Formosa\GIS\mxd\Figure2-2a_SW_out.mxd rws 06152009



Legend

- Surface Water Sampling Locations
- Roads
- Hydrology
- Contours (100 ft)
- Sections
- Township/Range

0 0.2 0.4 0.8 Miles

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography
2009 Roads

CDM

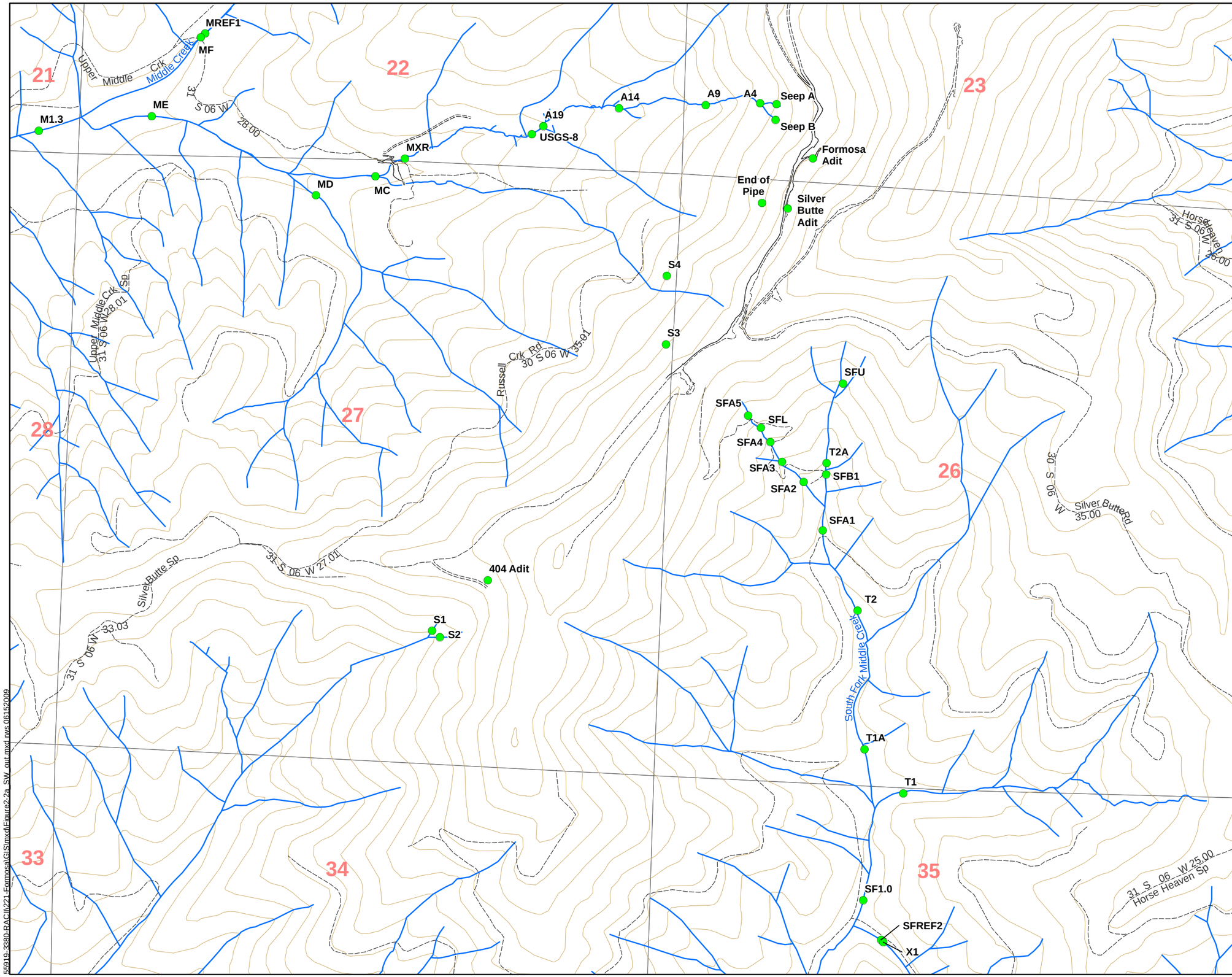
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 2-2b

Surface Water Sampling Locations Middle Zoom

Formosa Mine
Douglas County, Oregon

55919-3380-RACI\221-Formosa\GIS\mxd\Figure2-2b_SW_out.mxd rws 06152009



Legend

- Surface Water Sampling Locations
- Roads
- Hydrology
- Contours (100 ft)
- Sections

0 500 1,000 2,000 Feet

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography
2009 Roads

N

CDM

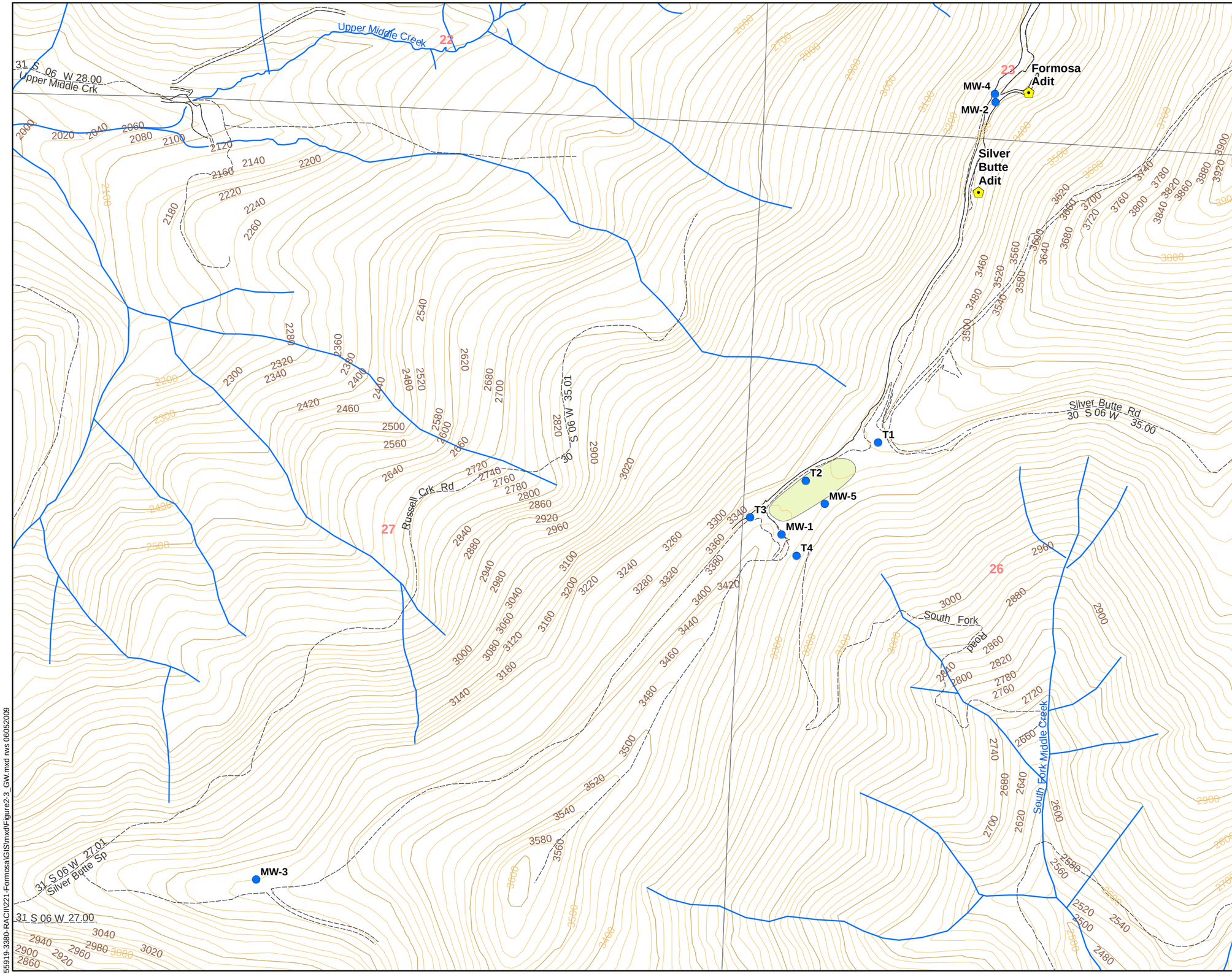
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 2-2c

Surface Water Sampling Locations Inner Zoom

Formosa Mine
Douglas County, Oregon

55919-3380-RACII\221-Formosa\GIS\mxd\Figure2-2a_SW_out.mxd rws 06152009



Legend

- Groundwater Sampling Locations
- Adit
- Roads
- Hydrology
- Sections
- Contours (100 ft)
- Contours (20 ft)
- Encapsulation Mound

0 250 500 1,000 Feet

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

N

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Township and Range, and Topography
2009 Roads

CDM

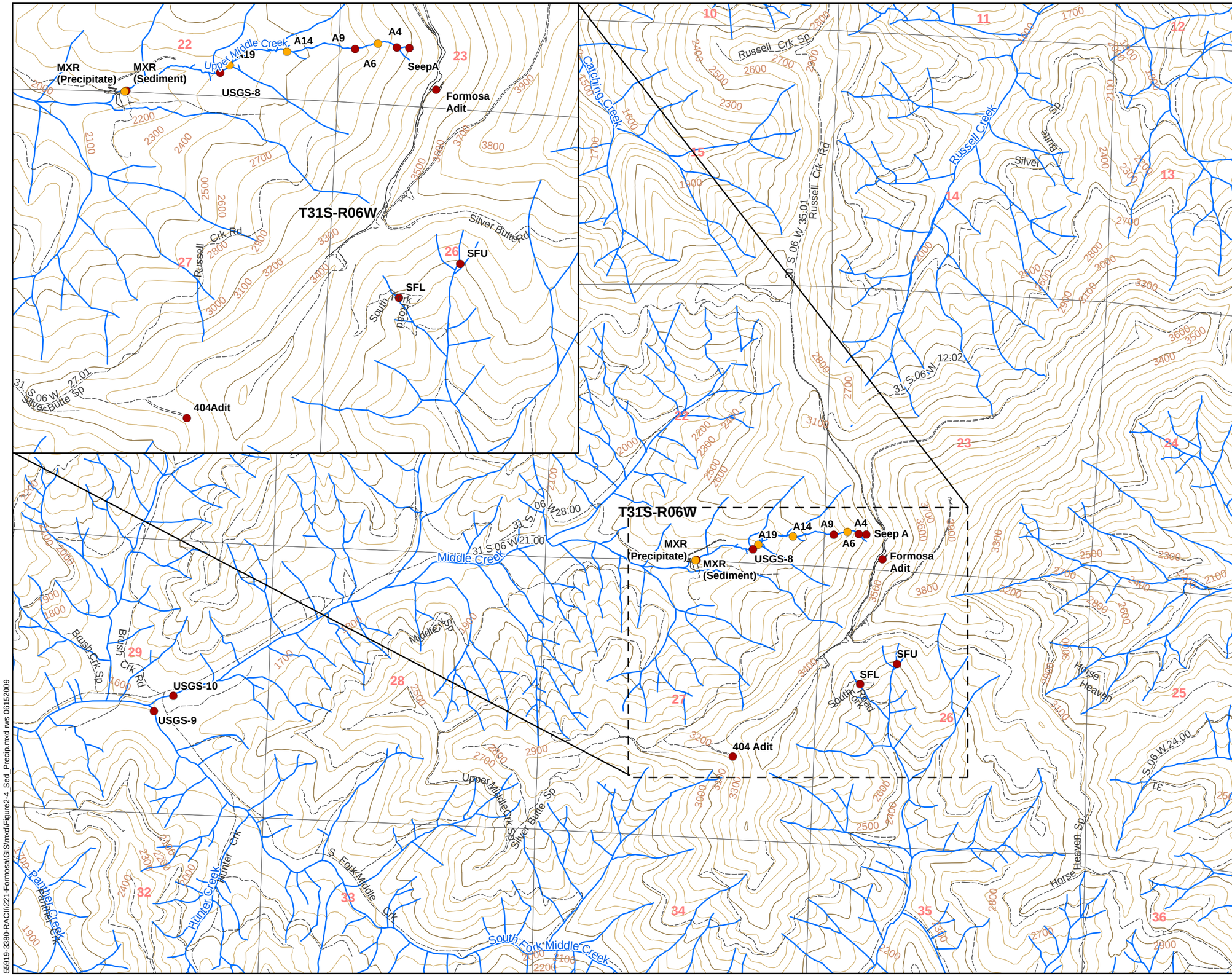
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 2-3

Groundwater Sampling Locations

Formosa Mine
Douglas County, Oregon

55919-3380-RACII\221-Formosa\GIS\mxd\Figure2-3_GW.mxd rws 06052009



Legend

- Precipitate Sampling Locations
- Sediment Sampling Locations
- Roads
- Hydrology
- Contours (500 ft)
- Contours (100 ft)
- Sections

0 0.25 0.5 Miles

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Section, Township and Range, and Topography
2009 Roads

CDM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 2-4

Sediment and Precipitate Sampling Locations

Formosa Mine
Douglas County, Oregon

55919-3380-RACI\221-Formosa\GIS\mxd\Figure2-4_Sed_Precip.mxd rws 06152009

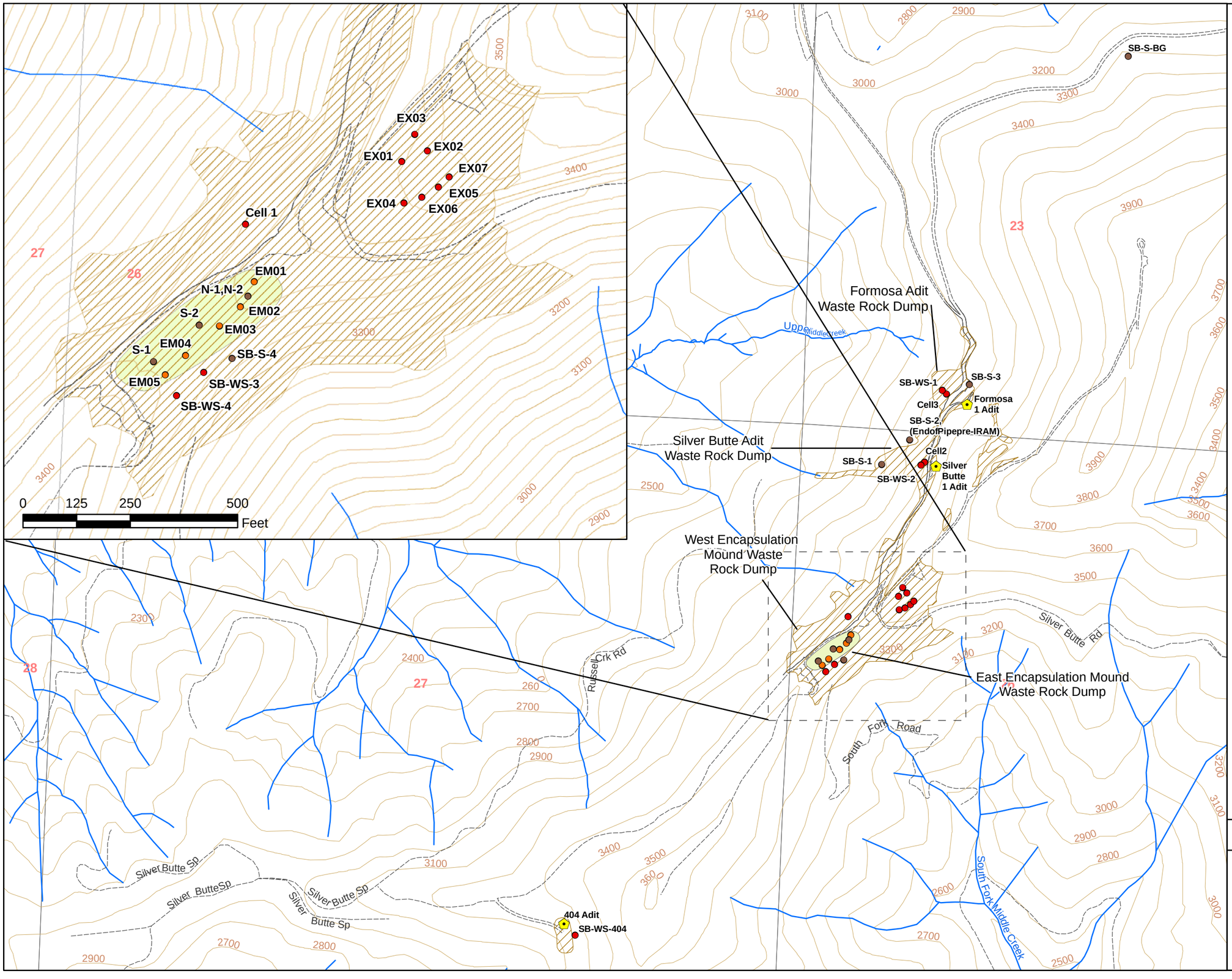
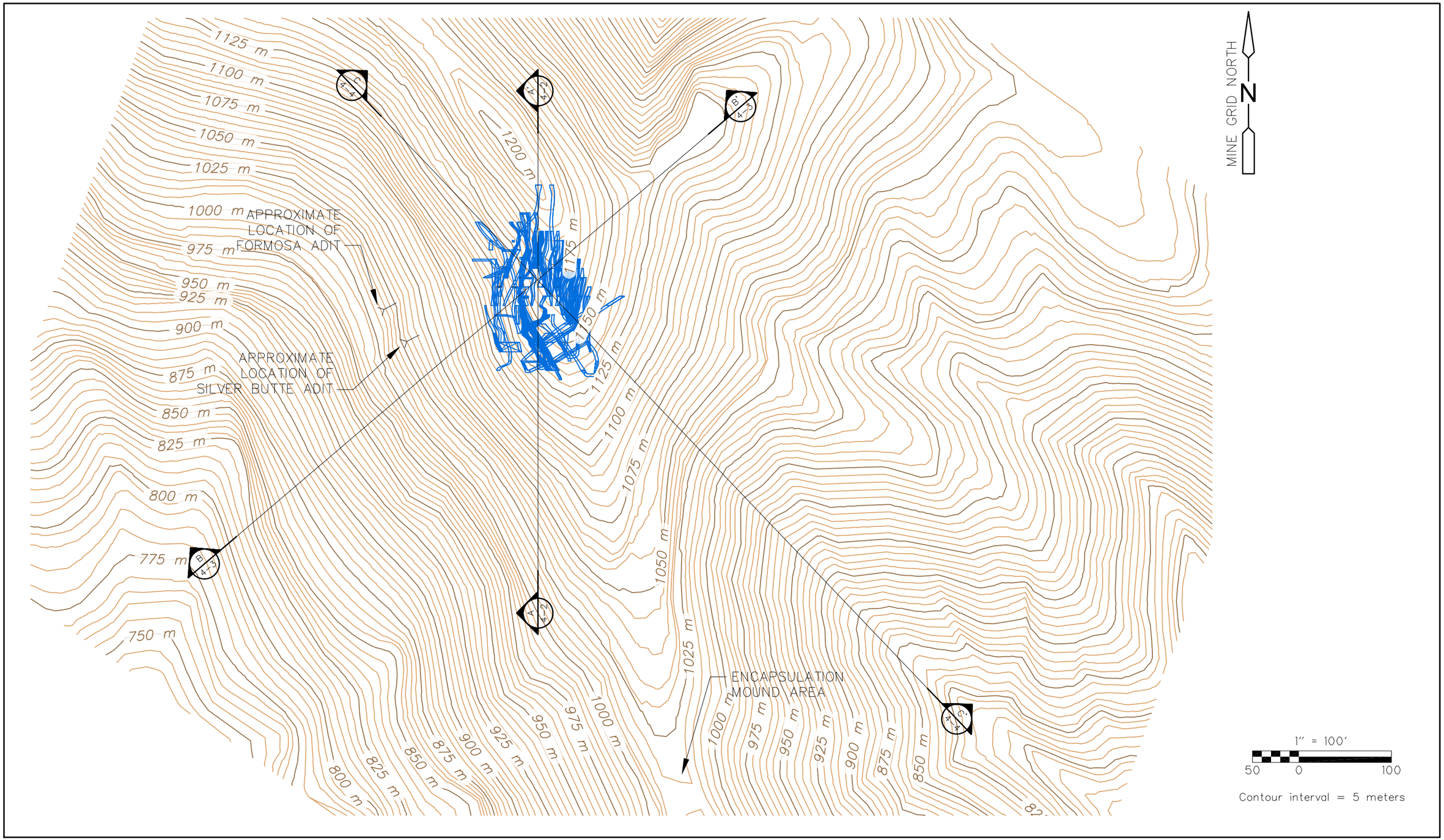


Figure 2-5

Waste Rock and Soil Sampling Locations

Formosa Mine
Douglas County, Oregon

55919-3380-RACI\221-Formosa\GIS\mxd\Figure2-5_Soil_WasteRock.mxd rws 06052009



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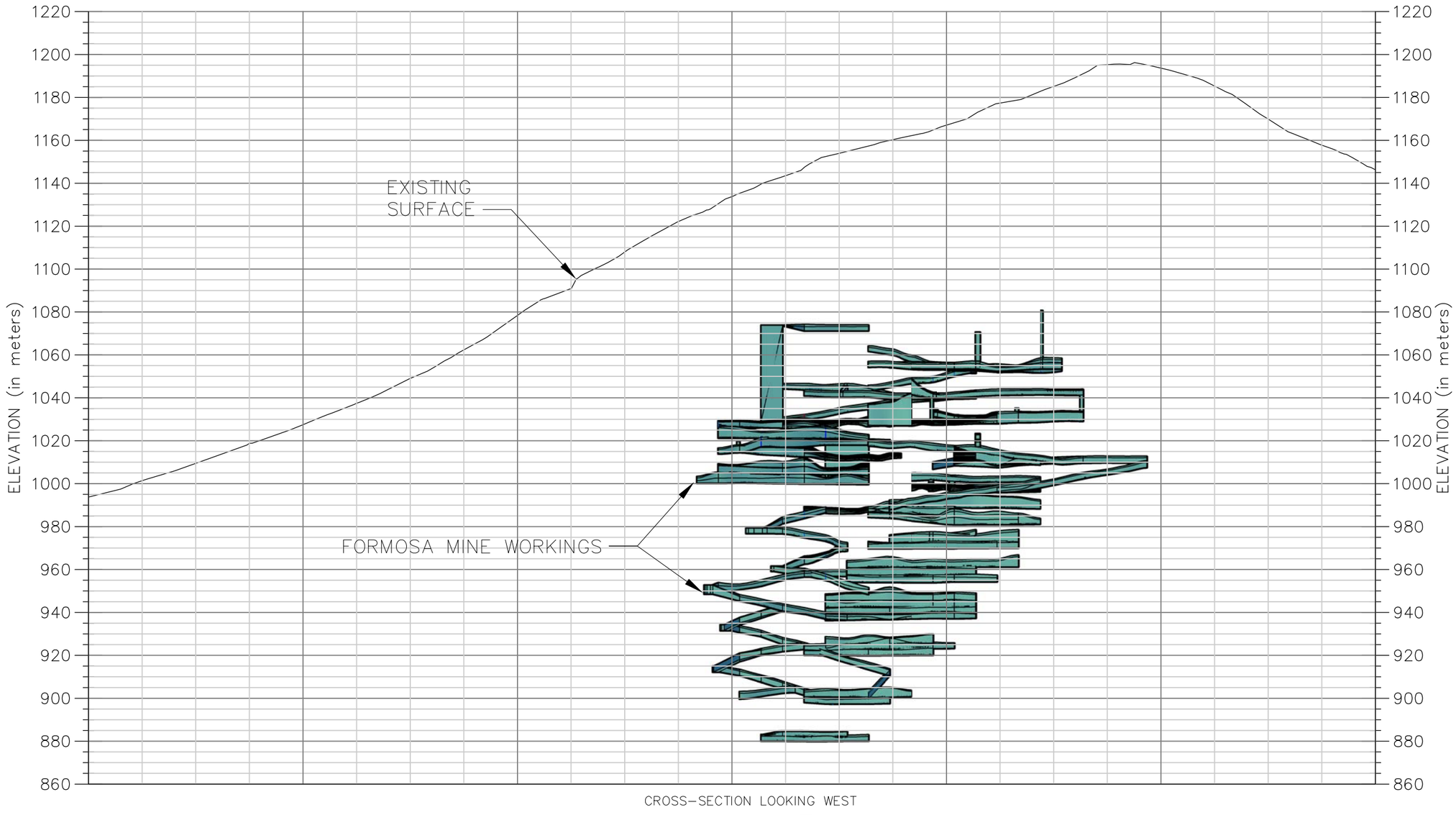
CDM

Figure 4-1a
Map Showing Partial Extent of Underground Workings



SECTION A 4-1

HORIZONTAL SCALE: 1:2000
VERTICAL SCALE: 1:2000

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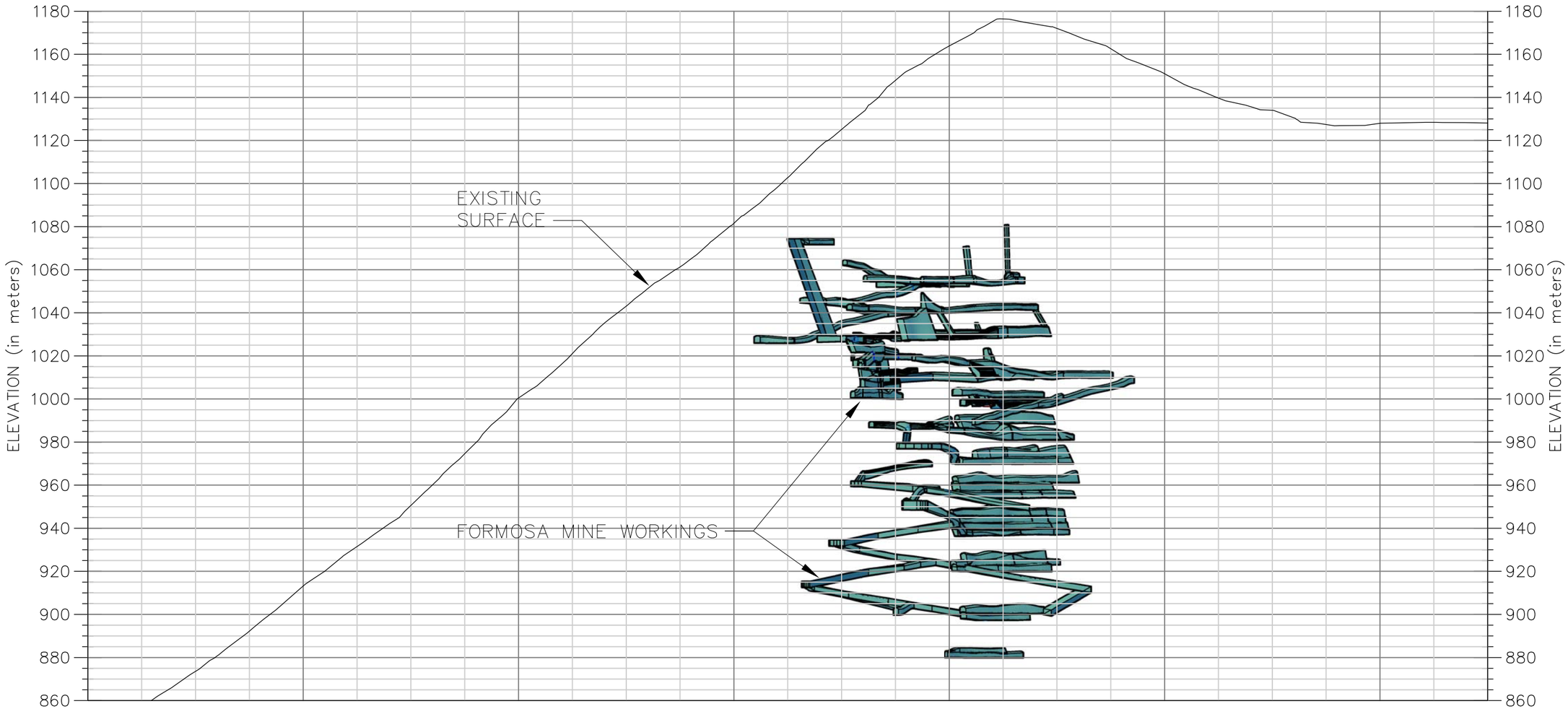
CDM

Figure 4-1b
Section A
Partial Extent of Underground Workings



CROSS-SECTION LOOKING NORTHWEST

SECTION B 4-1

HORIZONTAL SCALE: 1:2000
VERTICAL SCALE: 1:2000

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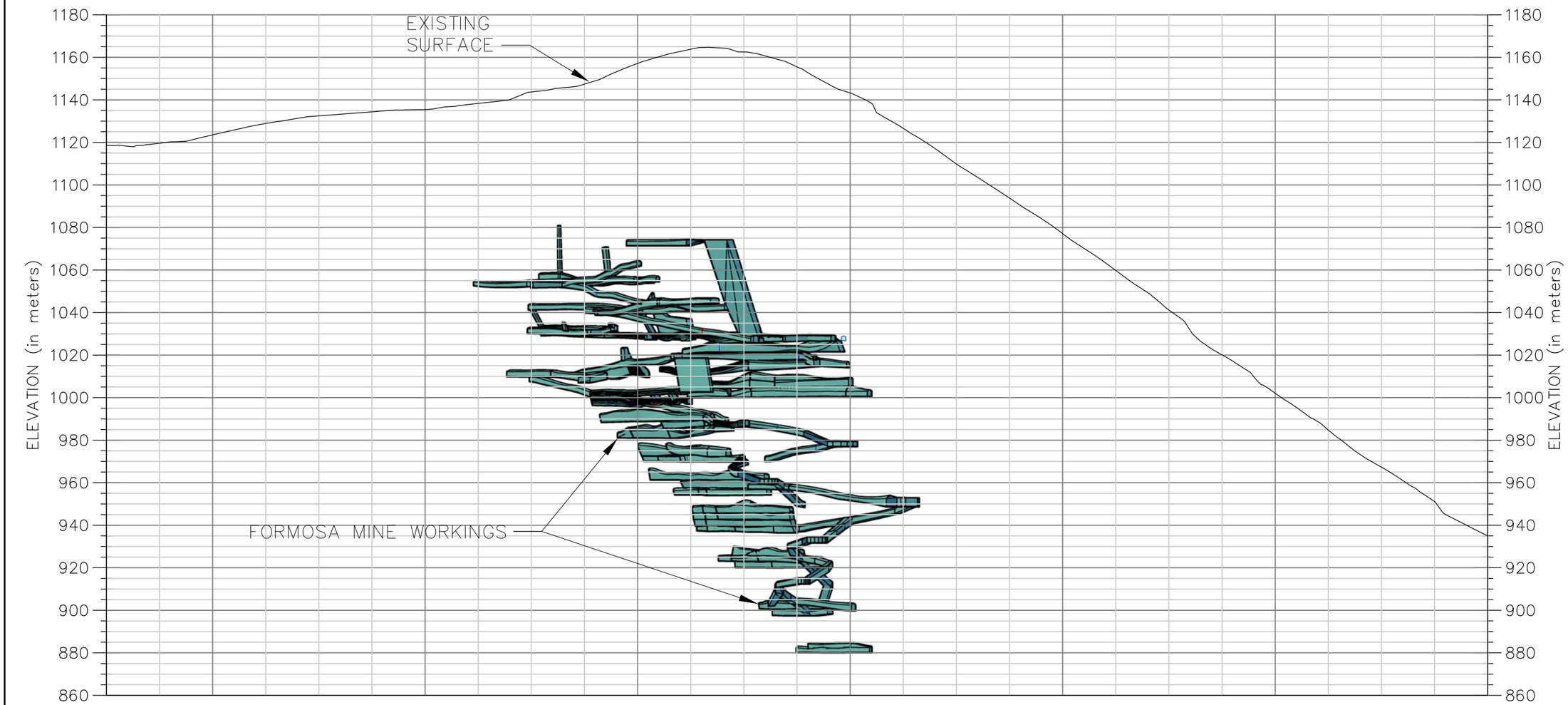
CDM

Figure 4-1c
Section B
Partial Extent of Underground Workings



CROSS-SECTION LOOKING NORTHEAST

SECTION C 4-1

HORIZONTAL SCALE: 1:2000
VERTICAL SCALE: 1:2000

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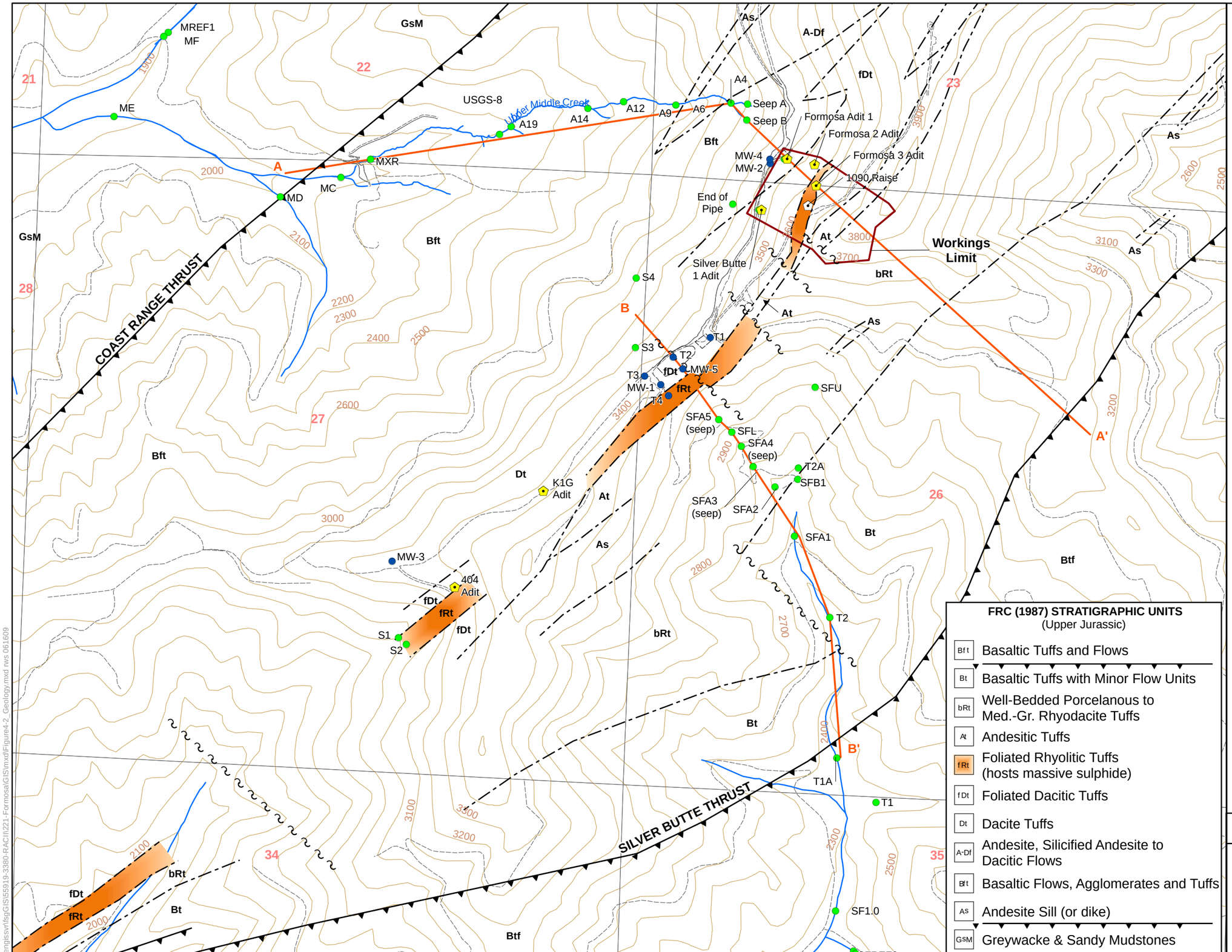
CDM

Figure 4-1d
Section C
Partial Extent of Underground Workings



Legend

- Adit
- Raise
- Ground Water Sampling Location
- Surface Water Sampling Location
- Fault
- Geological Contact
- Thrust Fault
- Approximate extent of underground workings
- Cross-Section Location
- Roads
- Hydrology
- Contours (100 ft)
- Historic Site Features
- Sections

0 500 1,000 2,000 Feet

FRC (1987) STRATIGRAPHIC UNITS
(Upper Jurassic)

- Bft — Basaltic Tuffs and Flows
- Bt — Basaltic Tuffs with Minor Flow Units
- bRt — Well-Bedded Porcelanous to Med.-Gr. Rhyodacite Tuffs
- At — Andesitic Tuffs
- fRt — Foliated Rhyolitic Tuffs (hosts massive sulphide)
- fDt — Foliated Dacitic Tuffs
- Dt — Dacite Tuffs
- A-Df — Andesite, Silicified Andesite to Dacitic Flows
- Btf — Basaltic Flows, Agglomerates and Tuffs
- As — Andesite Sill (or dike)
- GsM — Greywacke & Sandy Mudstones

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Data Sources:
Bureau of Land Management:
2001 Hydrography, 2005 Topography, 2009 Roads
Formosa Resources Corp., 1987, Regional Geology Map of the Formosa and Riddle Claims

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure 4-2

Local Geology

Formosa Mine
Douglas County, Oregon

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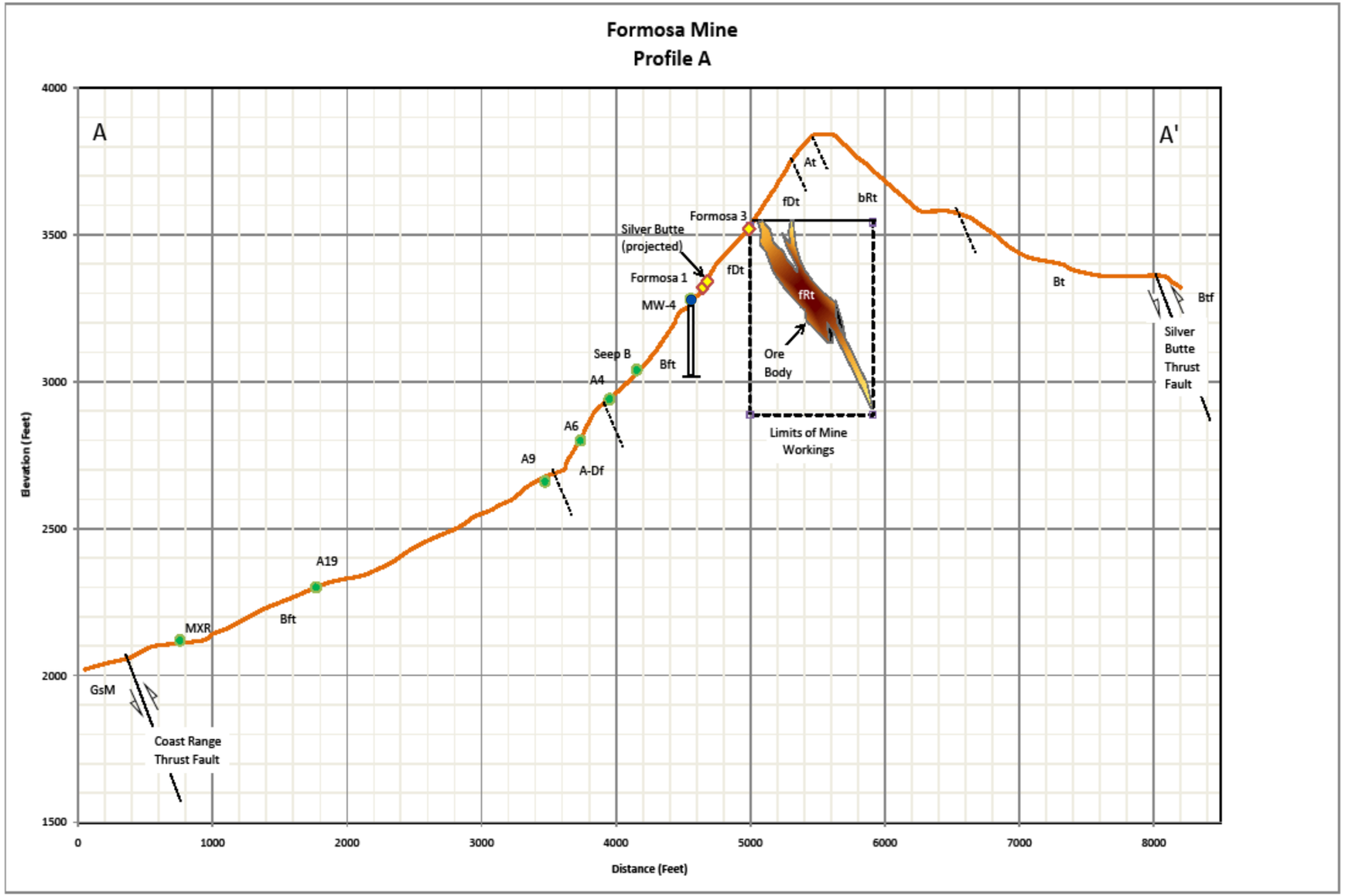
\\dengissvr\fsg\GIS\55919-3380-RACII\221-Formosa\GIS\mxd\Figure4-3_ProfileA.mxd MOD 05042009 scp



Legend

- Adit
- Groundwater Sampling Locations
- Surface Water Sampling Locations
- Geological Boundary
- Thrust Fault
- Ground Surface

STRATIGRAPHIC UNITS
(Upper Jurassic)

- Bft — Basaltic Tuffs and Flows
- Bt — Basaltic Tuffs with Minor Flow Units
- bRt — Well-Bedded Porcelanous to Med.-Gr. Rhyodacite Tuffs
- At — Andesitic Tuffs
- fRt — Foliated Rhyolitic Tuffs (hosts massive sulphide)
- fDt — Foliated Dacitic Tuffs
- Dt — Dacite Tuffs
- A-Df — Andesite, Silicified Andesite to Dacitic Flows
- Bft — Basaltic Flows, Agglomerates and Tuffs
- As — Andesite Sill (or dike)
- GsM — Greywacke & Sandy Mudstones

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Note: Geology - modified from FRC 1987

CDM

Figure 4-3

Profile A - A'

Formosa Mine
Douglas County, Oregon

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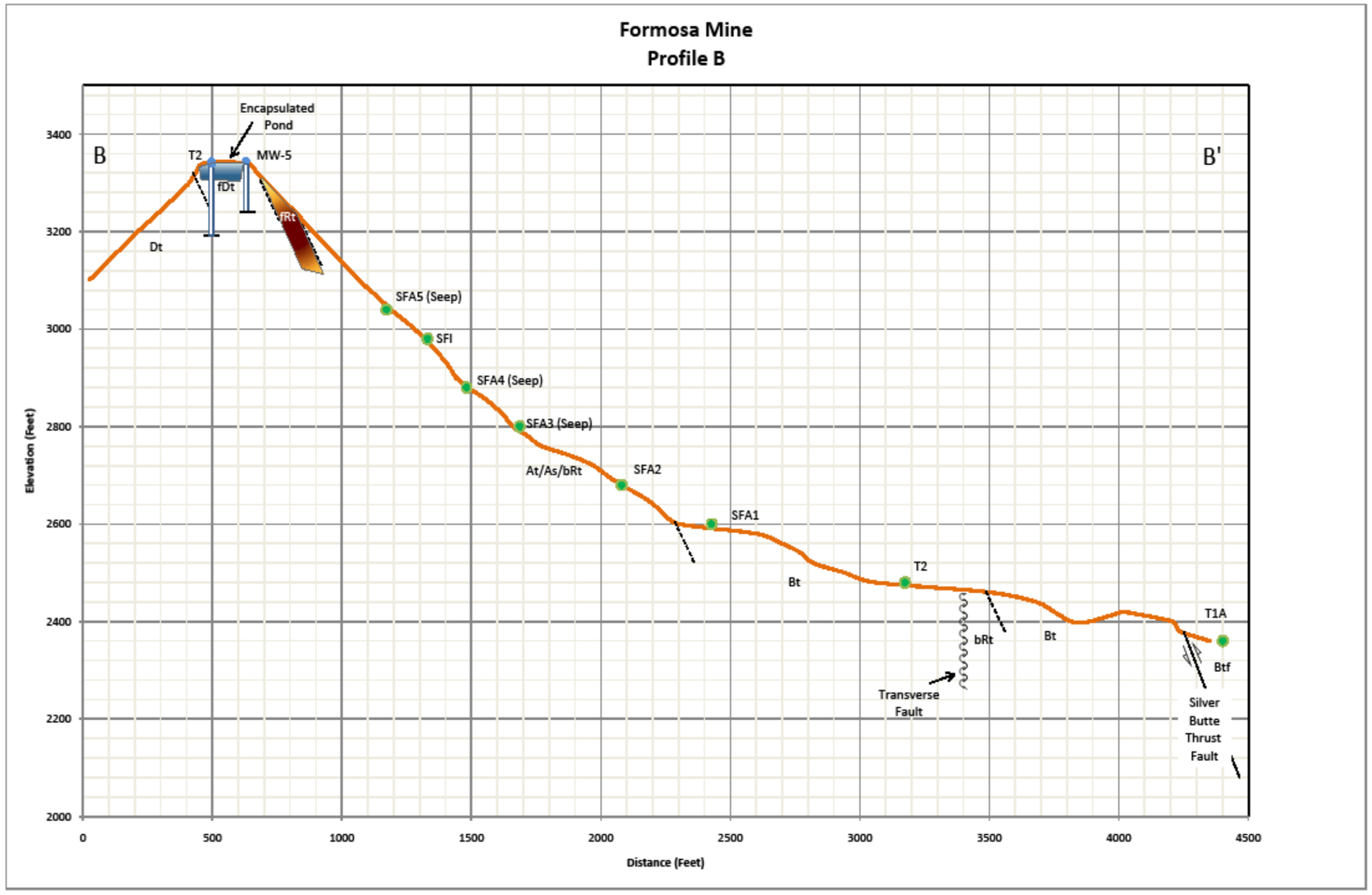

Legend

- Groundwater Sampling Locations
- Surface Water Sampling Locations
- Geological Boundary
- Thrust Fault
- Ground Surface

STRATIGRAPHIC UNITS
(Upper Jurassic)

- Bft — Basaltic Tuffs and Flows
- Bt — Basaltic Tuffs with Minor Flow Units
- bRt — Well-Bedded Porcelanous to Med.-Gr. Rhyodacite Tuffs
- At — Andesitic Tuffs
- fRt — Foliated Rhyolitic Tuffs (hosts massive sulphide)
- fDt — Foliated Dacitic Tuffs
- Dt — Dacite Tuffs
- A-Df — Andesite, Silicified Andesite to Dacitic Flows
- Bft — Basaltic Flows, Agglomerates and Tuffs
- As — Andesite Sill (or dike)
- GSM — Greywacke & Sandy Mudstones

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS

Note: Geology - modified from FRC 1987

N

CDM

Figure 4-4

Profile B - B'

Formosa Mine
Douglas County, Oregon

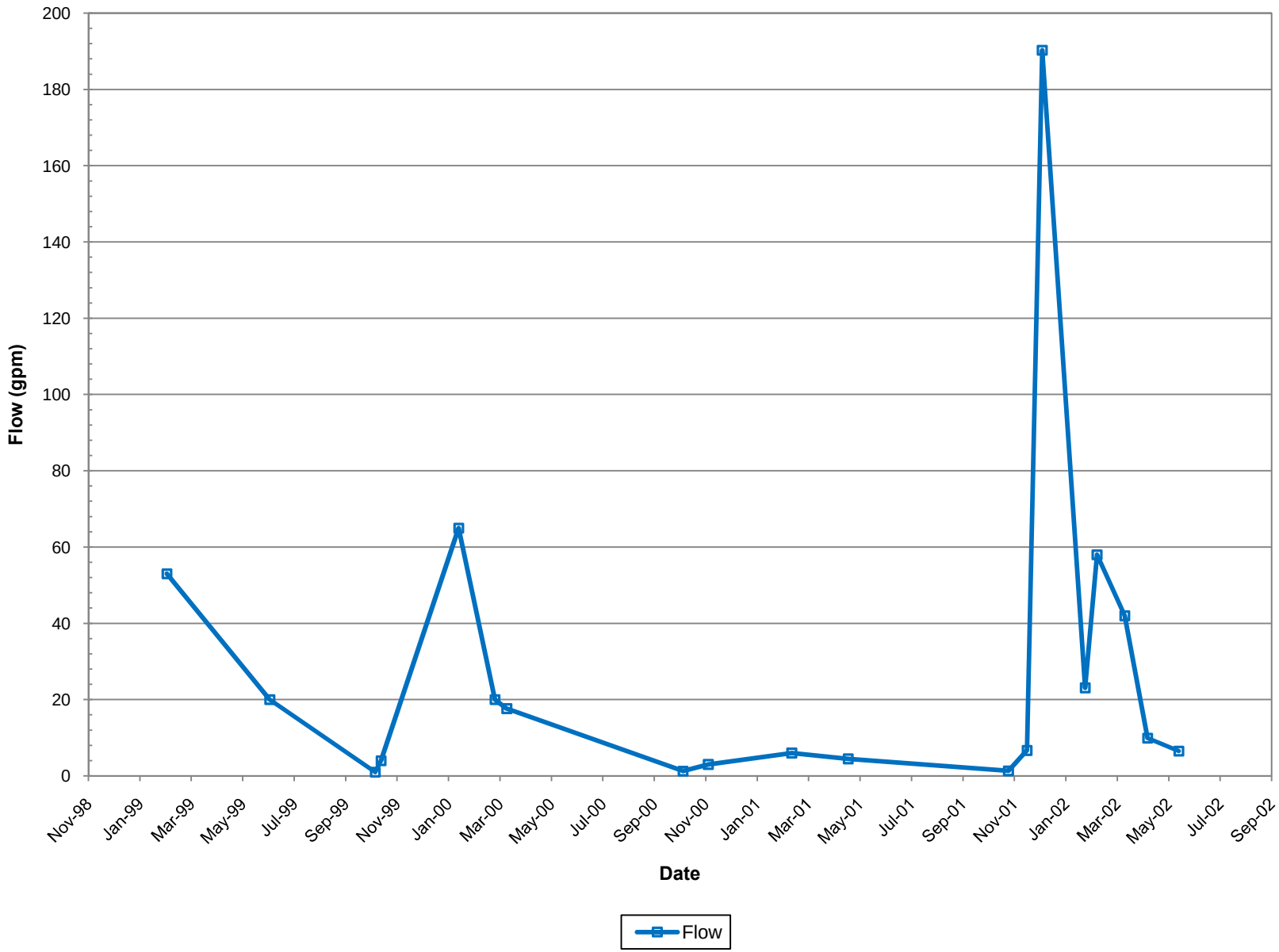

Figure 4-5
Formosa Adit
Historic Flow Measurements

CDM

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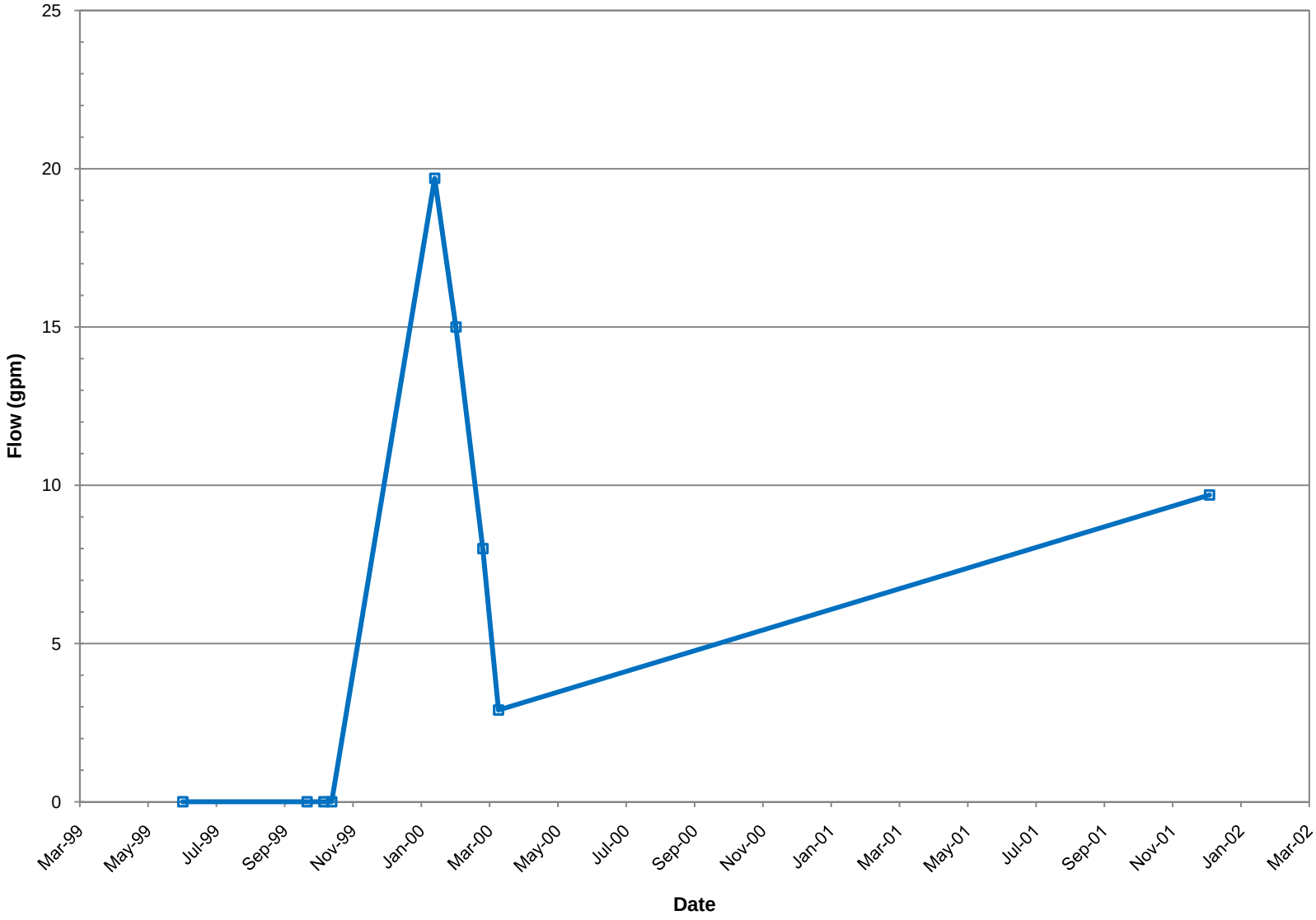

Figure 4-6
Silver Butte Adit
Historic Flow Measurements

CDM

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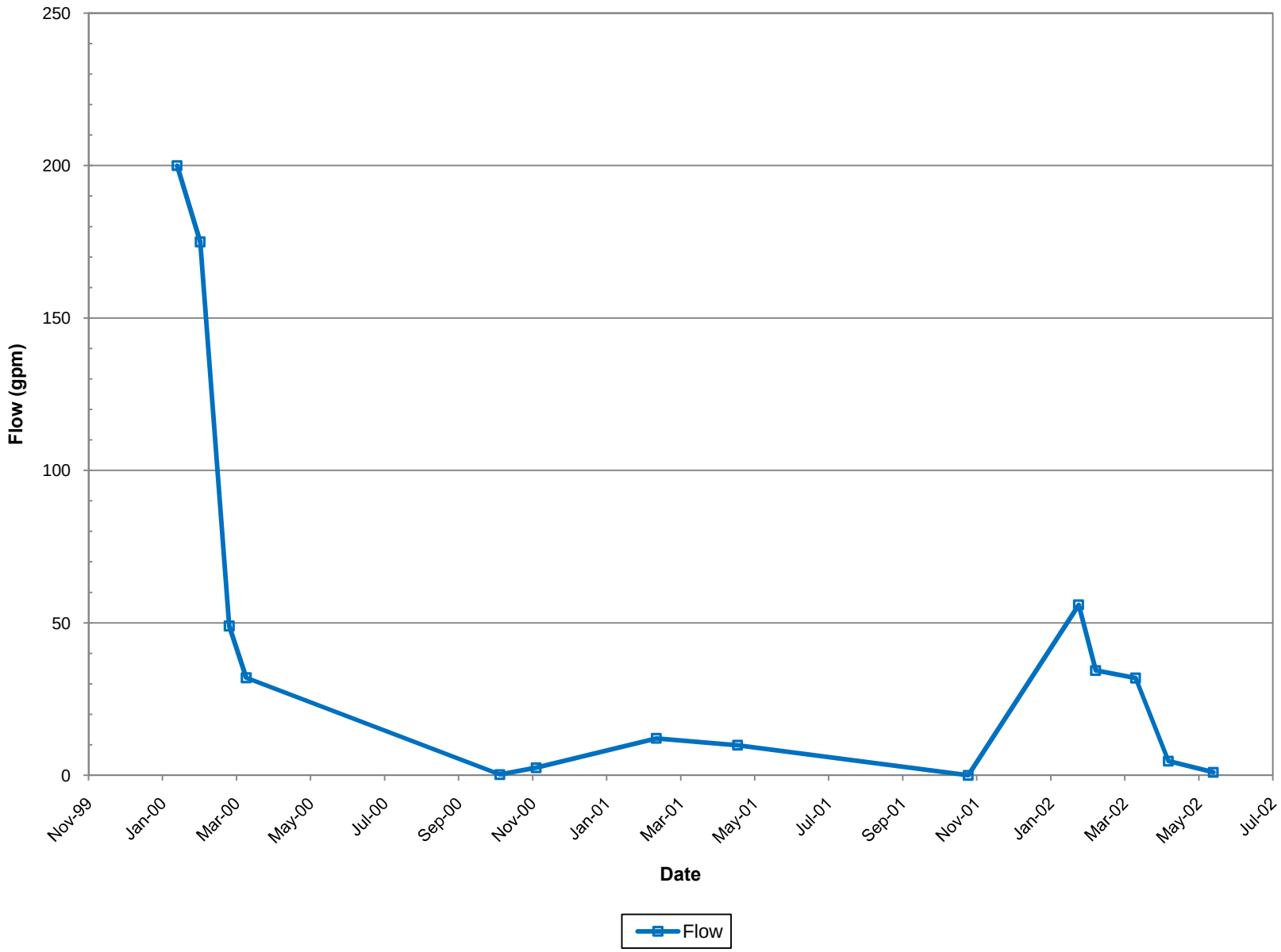

Figure 4-7
Seep A
Historic Flow Measurements

CDM

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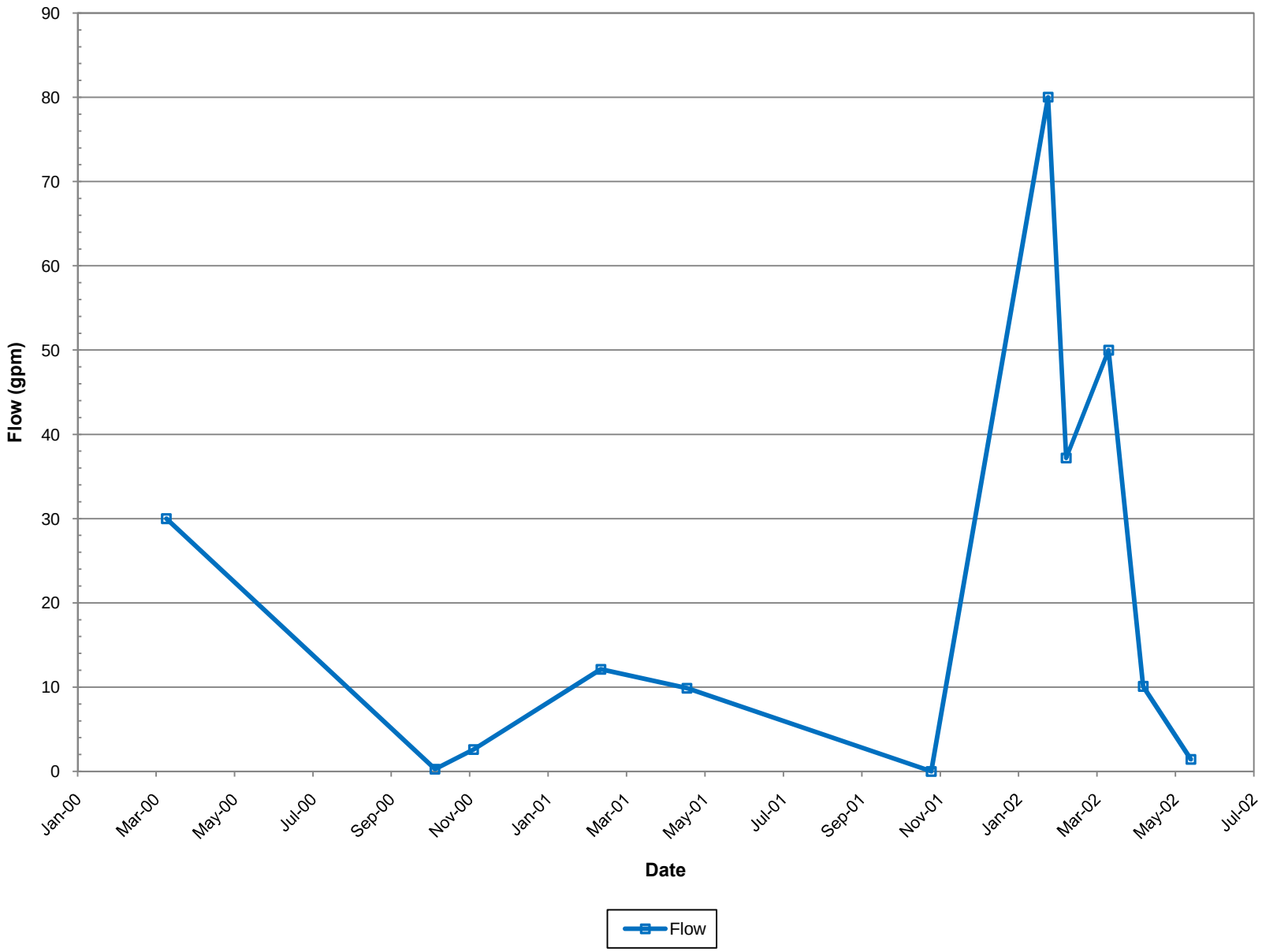

Figure 4-8
Location A4
Historic Flow Measurements

CDM

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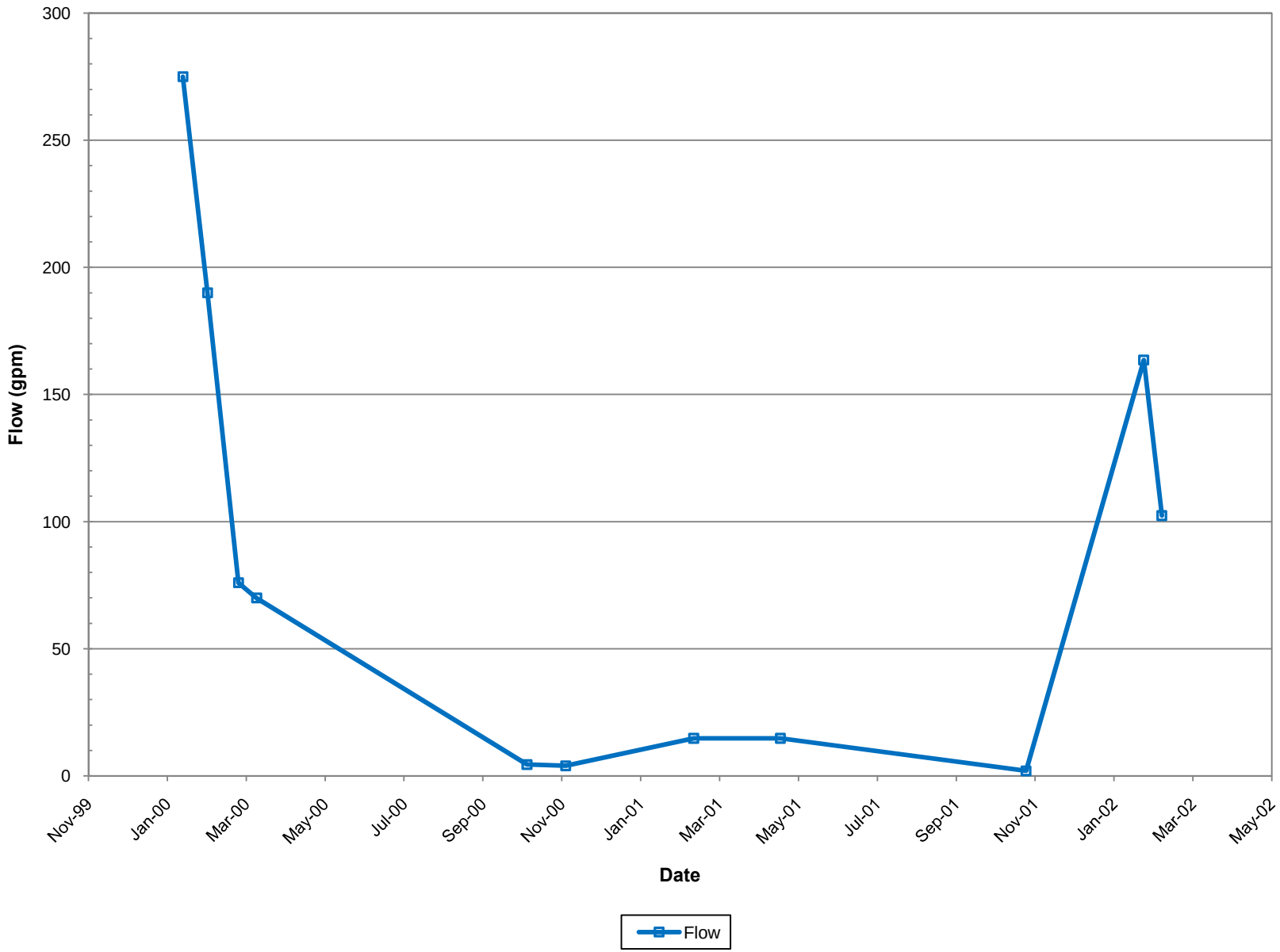

Figure 4-9
Location A9
Historic Flow Measurements

CDM

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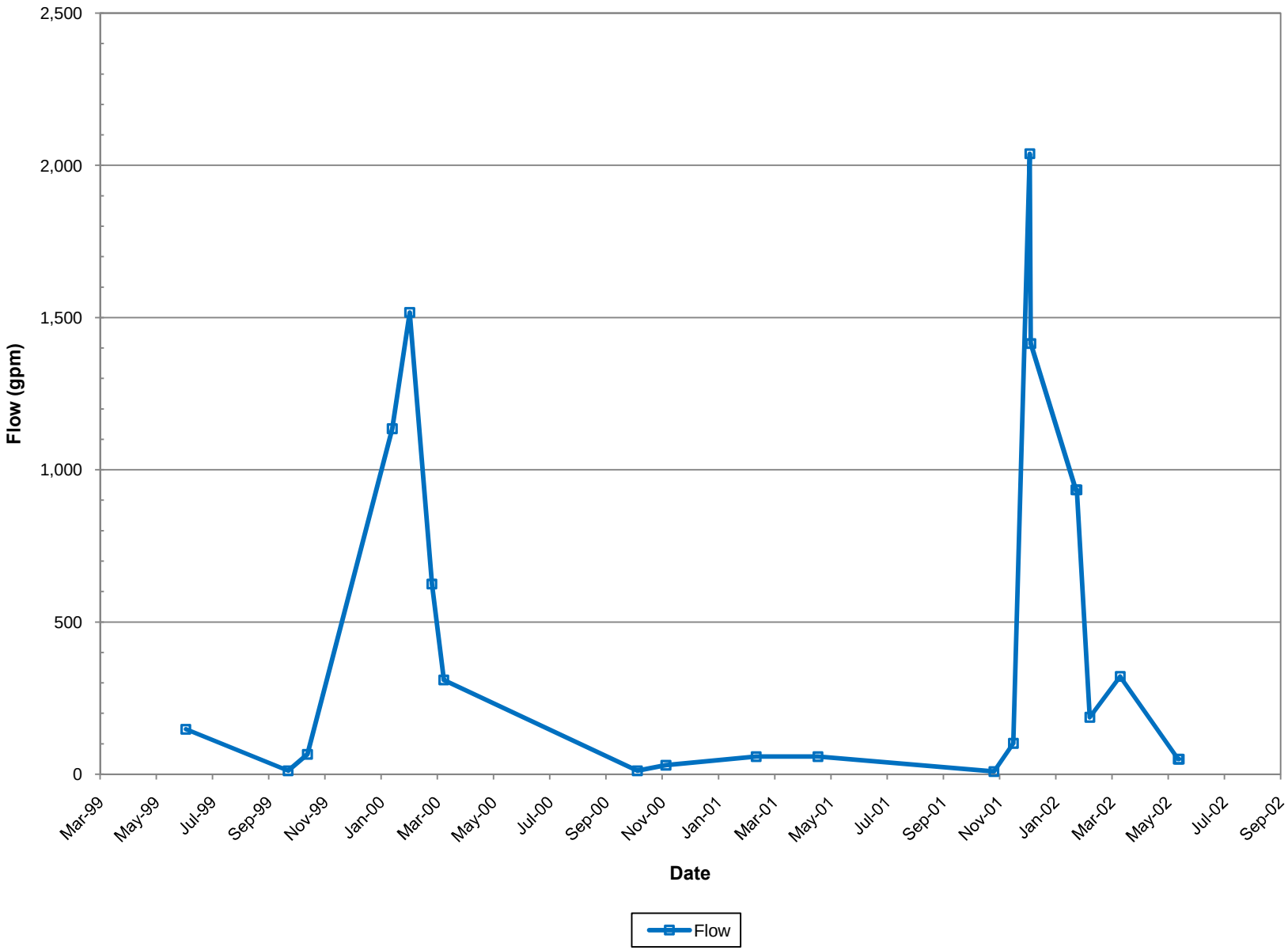

Figure 4-10
Location MXR
Historic Flow Measurements

CDM

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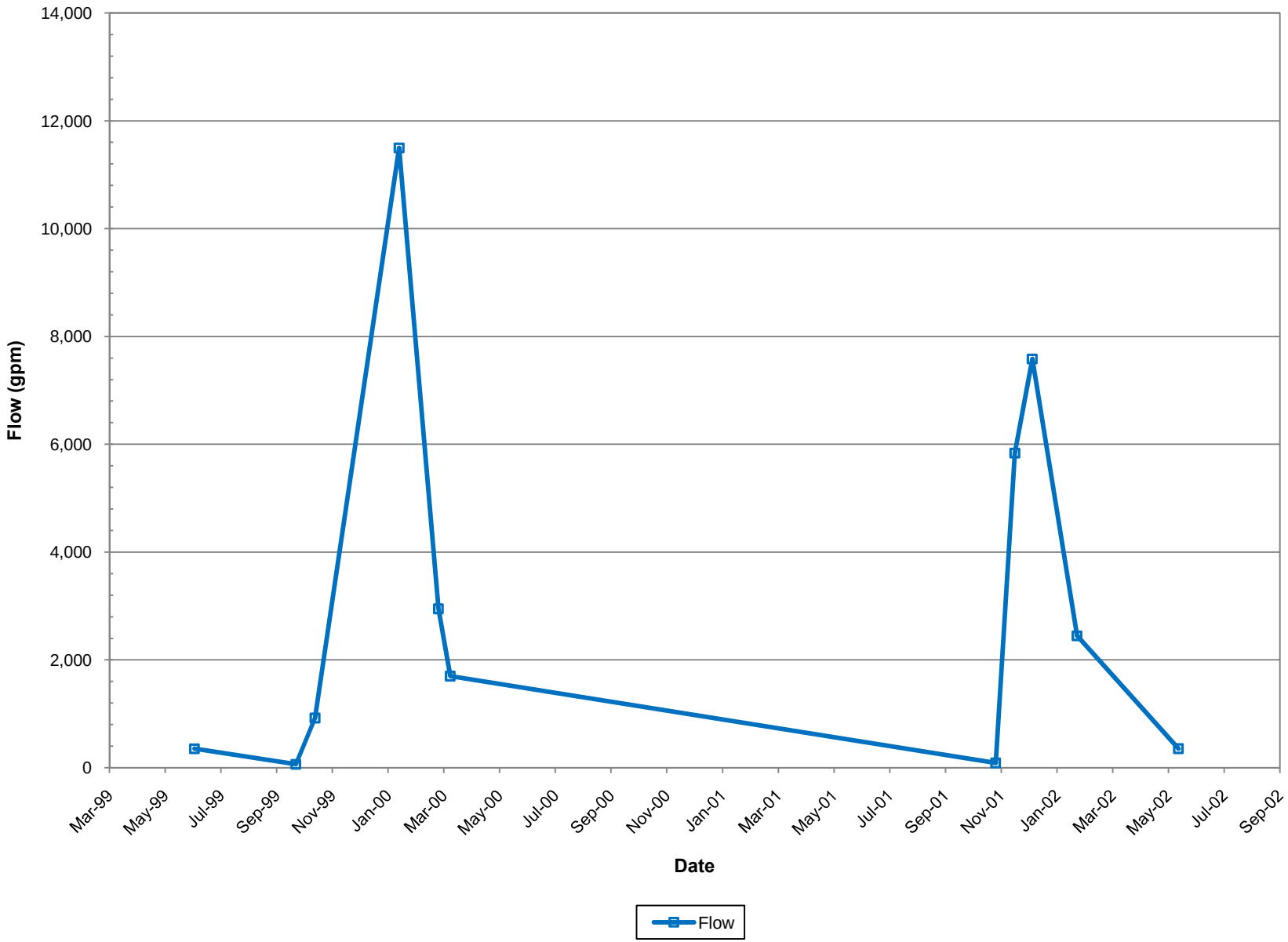

Figure 4-11
Location M3.0
Historic Flow Measurements

CDM

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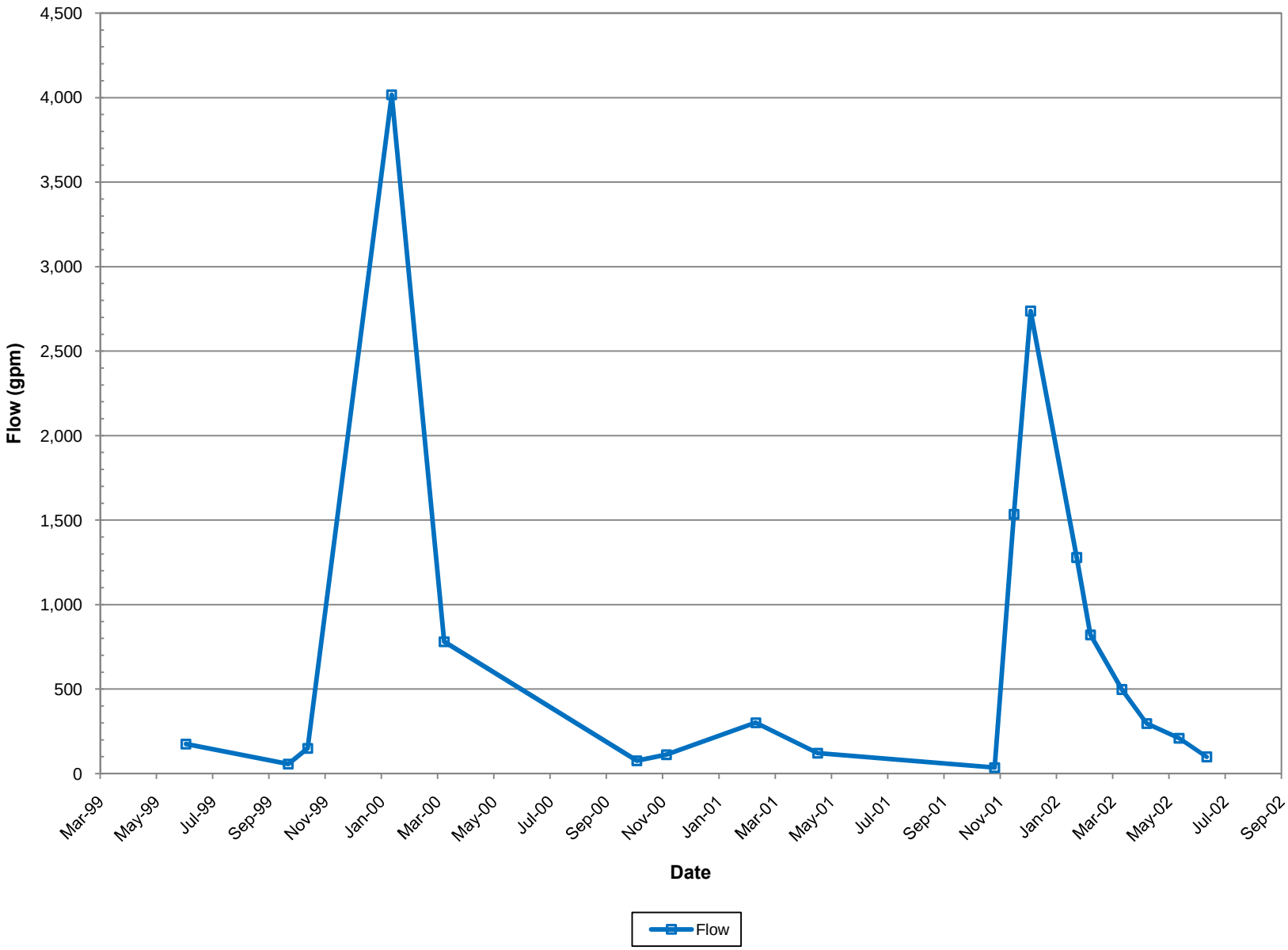

Figure 4-12
Location SF1.0
Historic Flow Measurements

CDM

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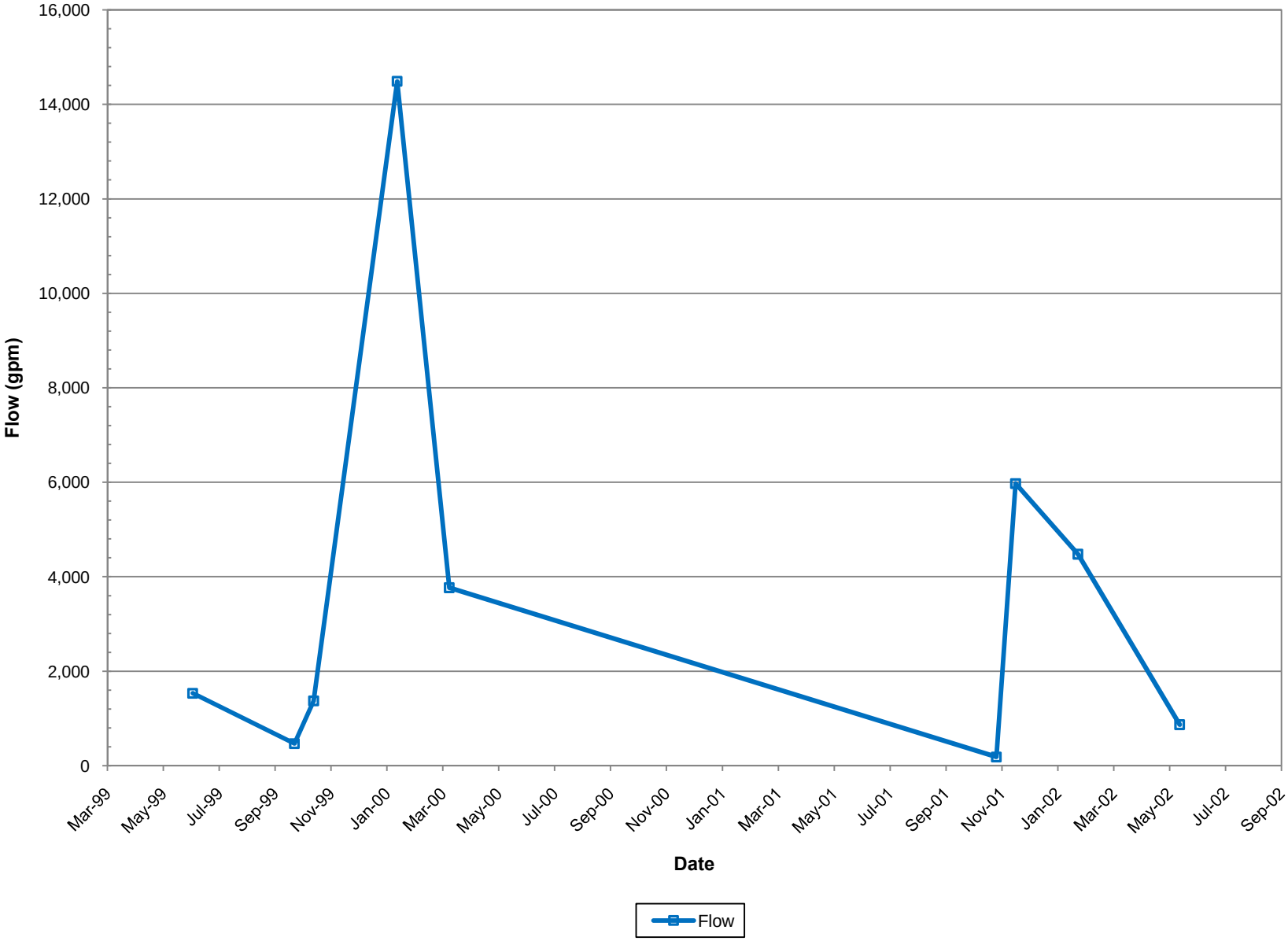

Figure 4-13
Location SF3.0
Historic Flow Measurements

CDM

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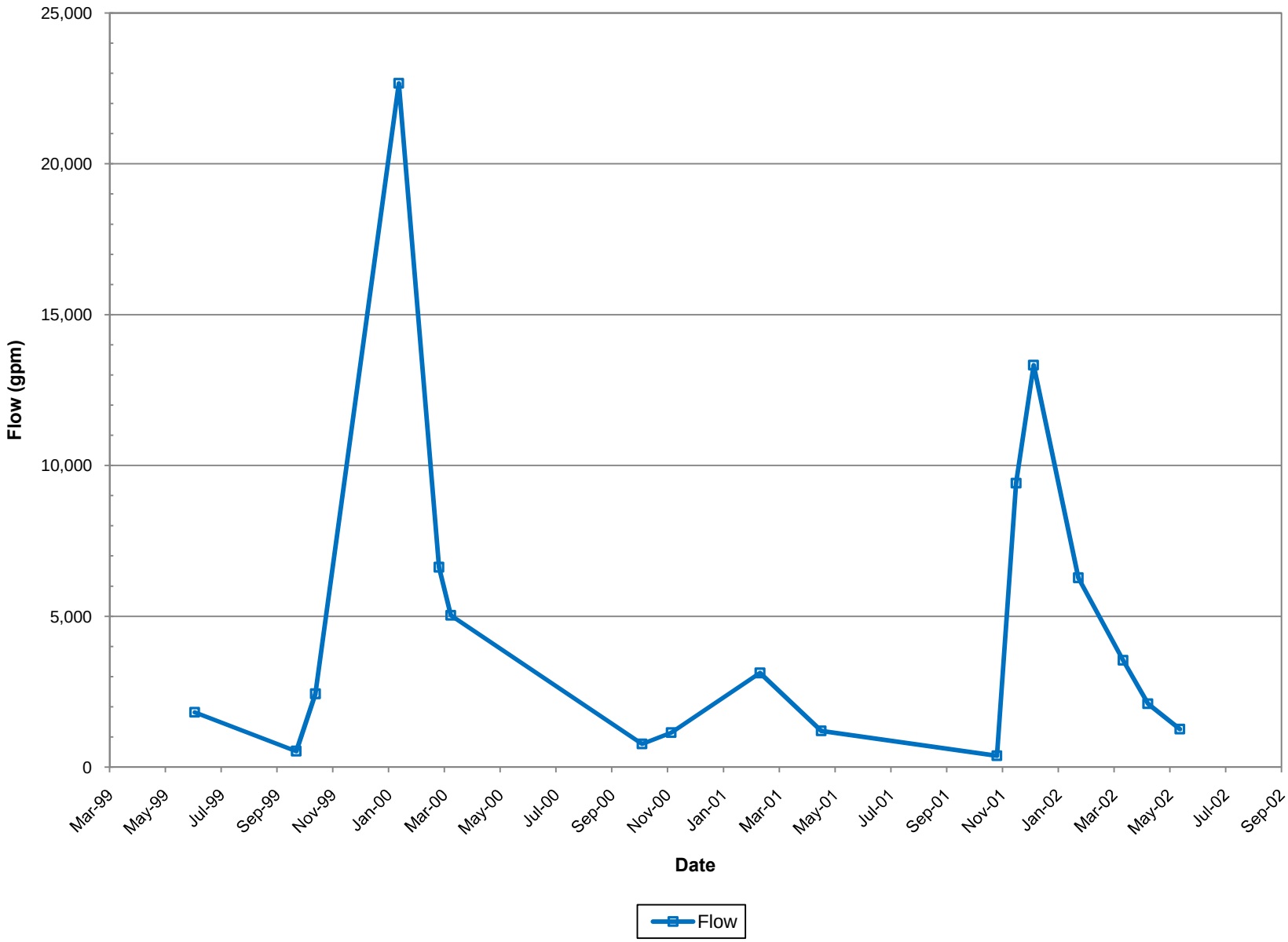

Figure 4-14
Location SF4.7
Historic Flow Measurements

CDM

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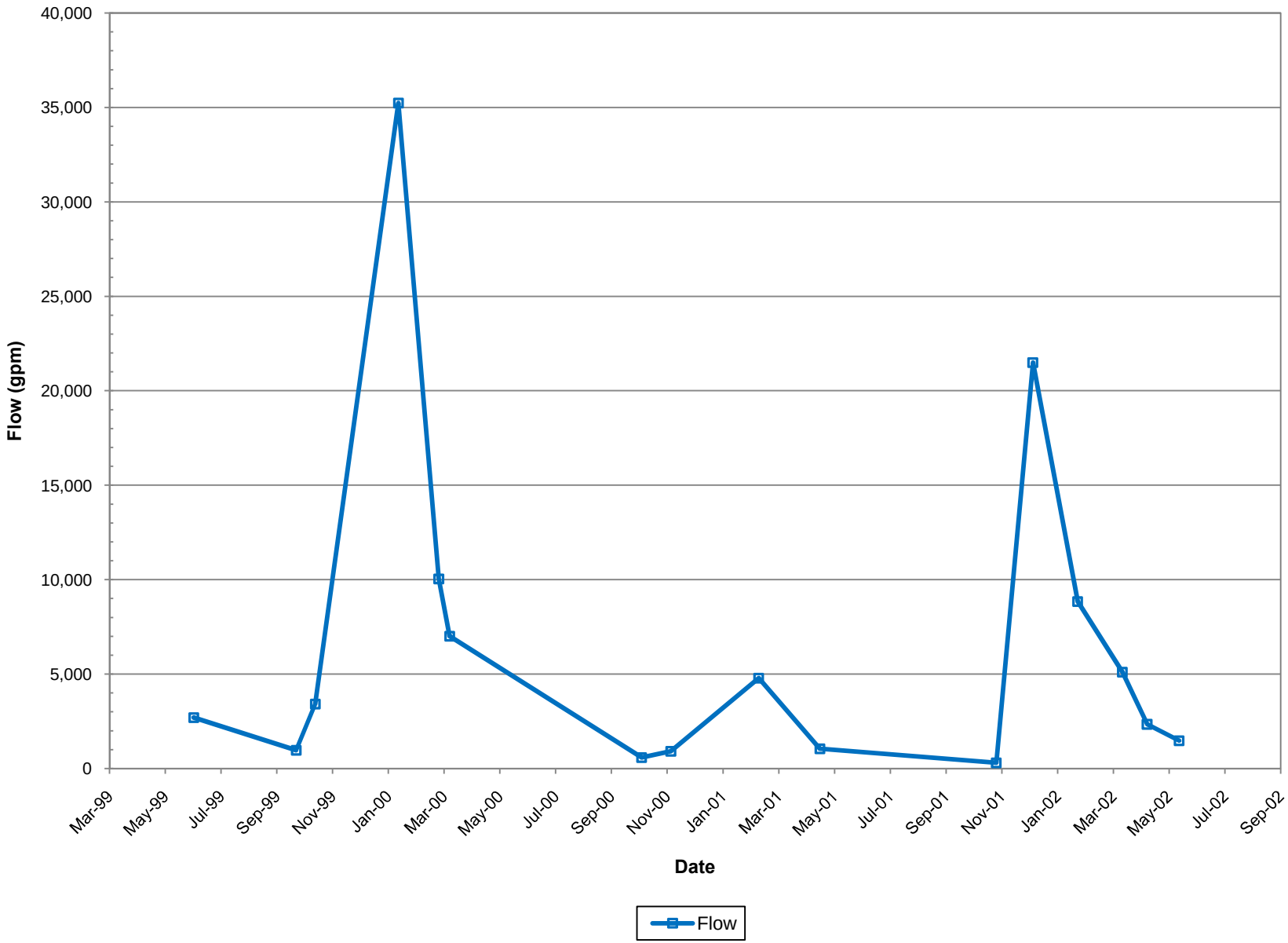

Figure 4-15
Location M3.1
Historic Flow Measurements

CDM

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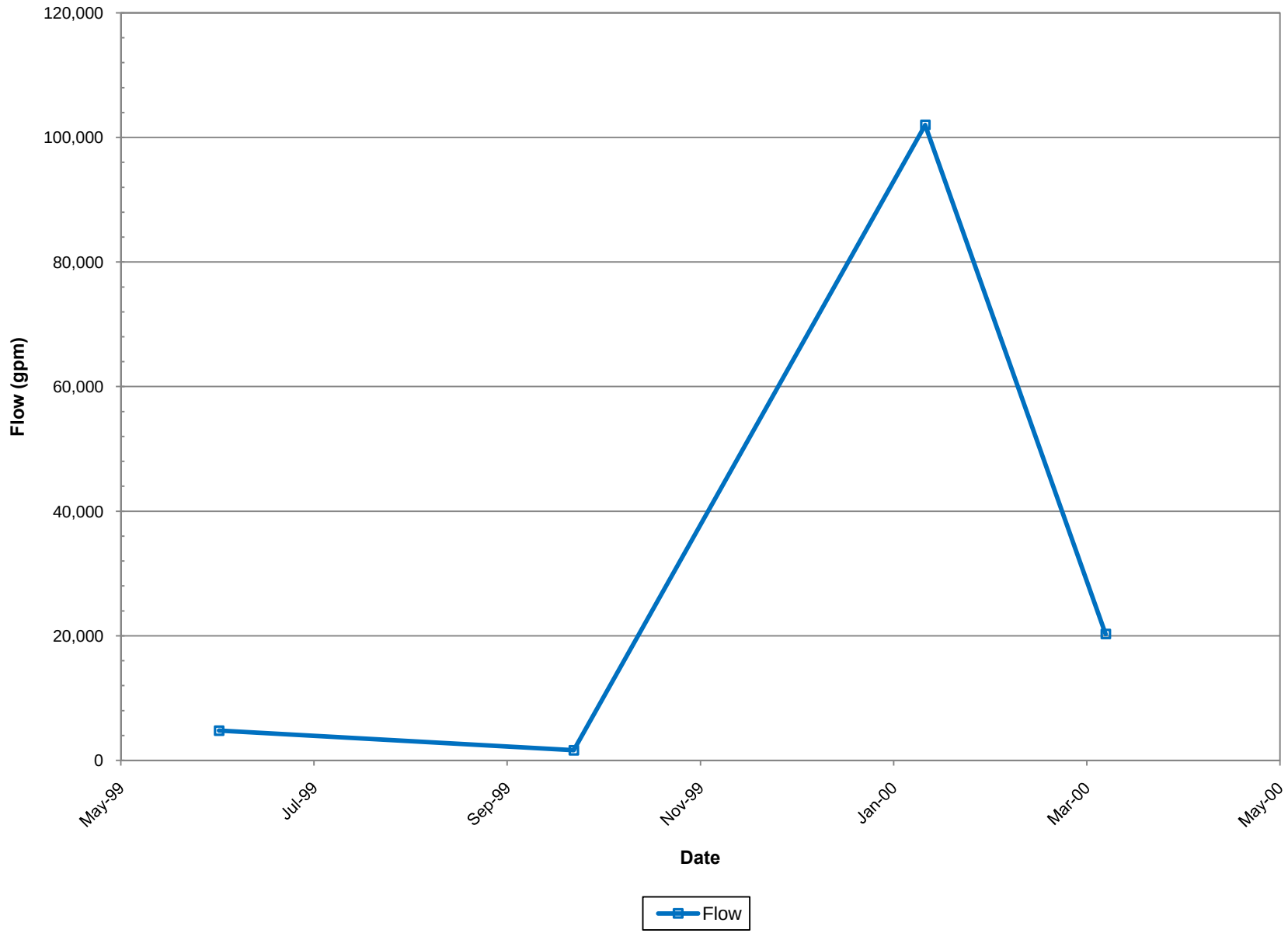

Figure 4-16
Location M13.0
Historic Flow Measurements

CDM

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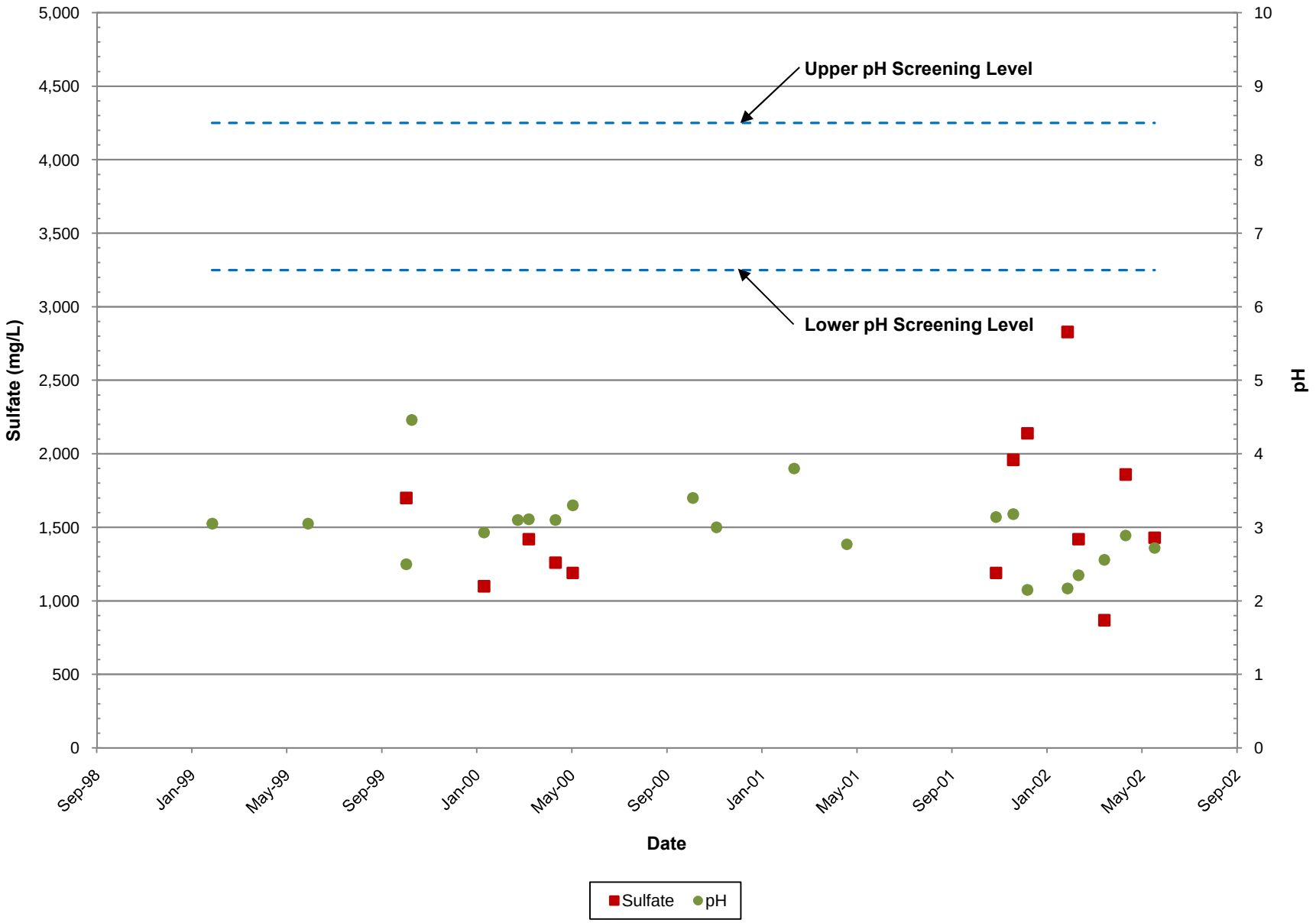

Figure 4-17
Formosa Adit
Historic pH and Sulfate Concentrations

CDM

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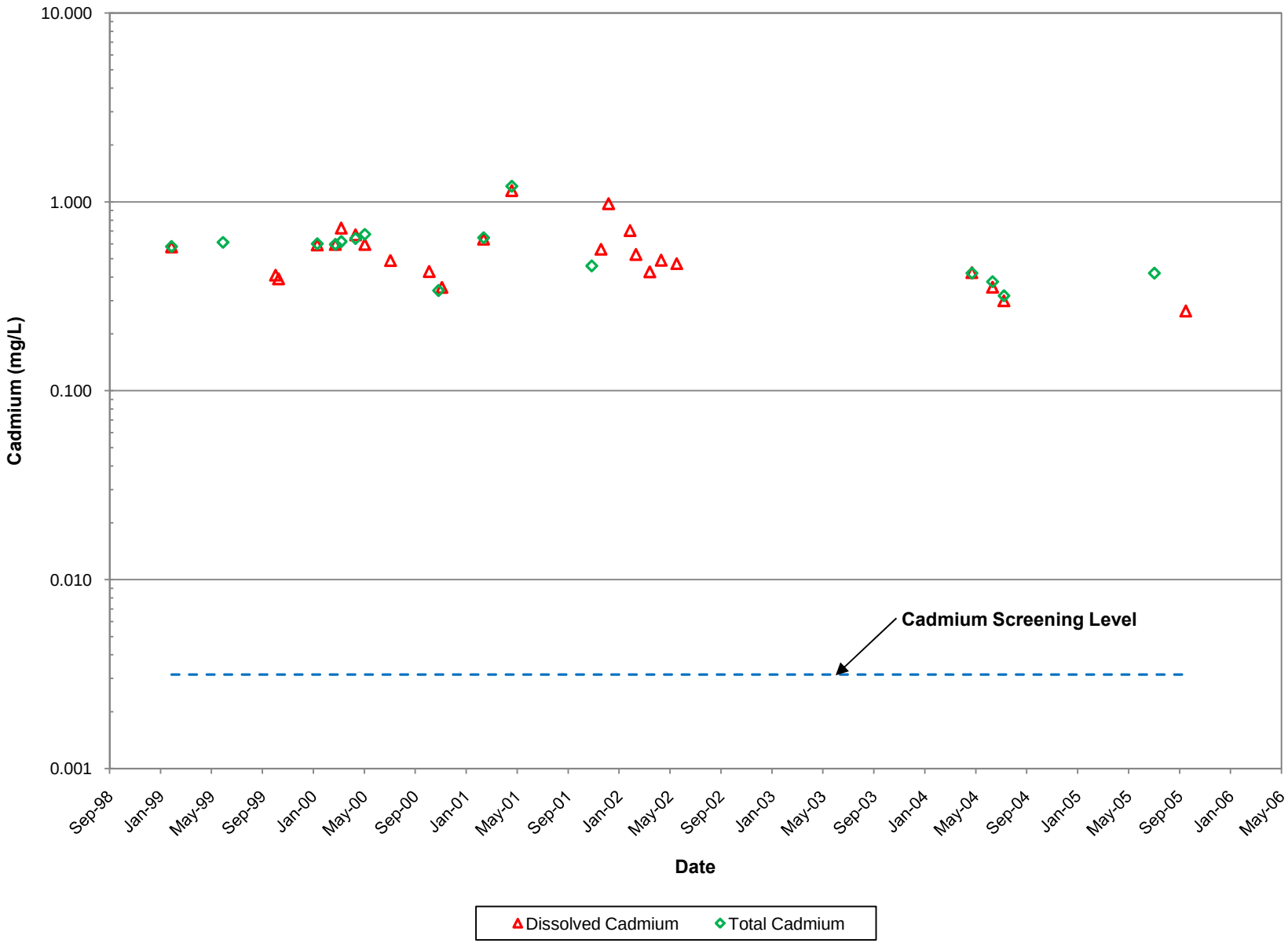

Figure 4-18
Formosa Adit
Historic Cadmium Concentrations

CDM

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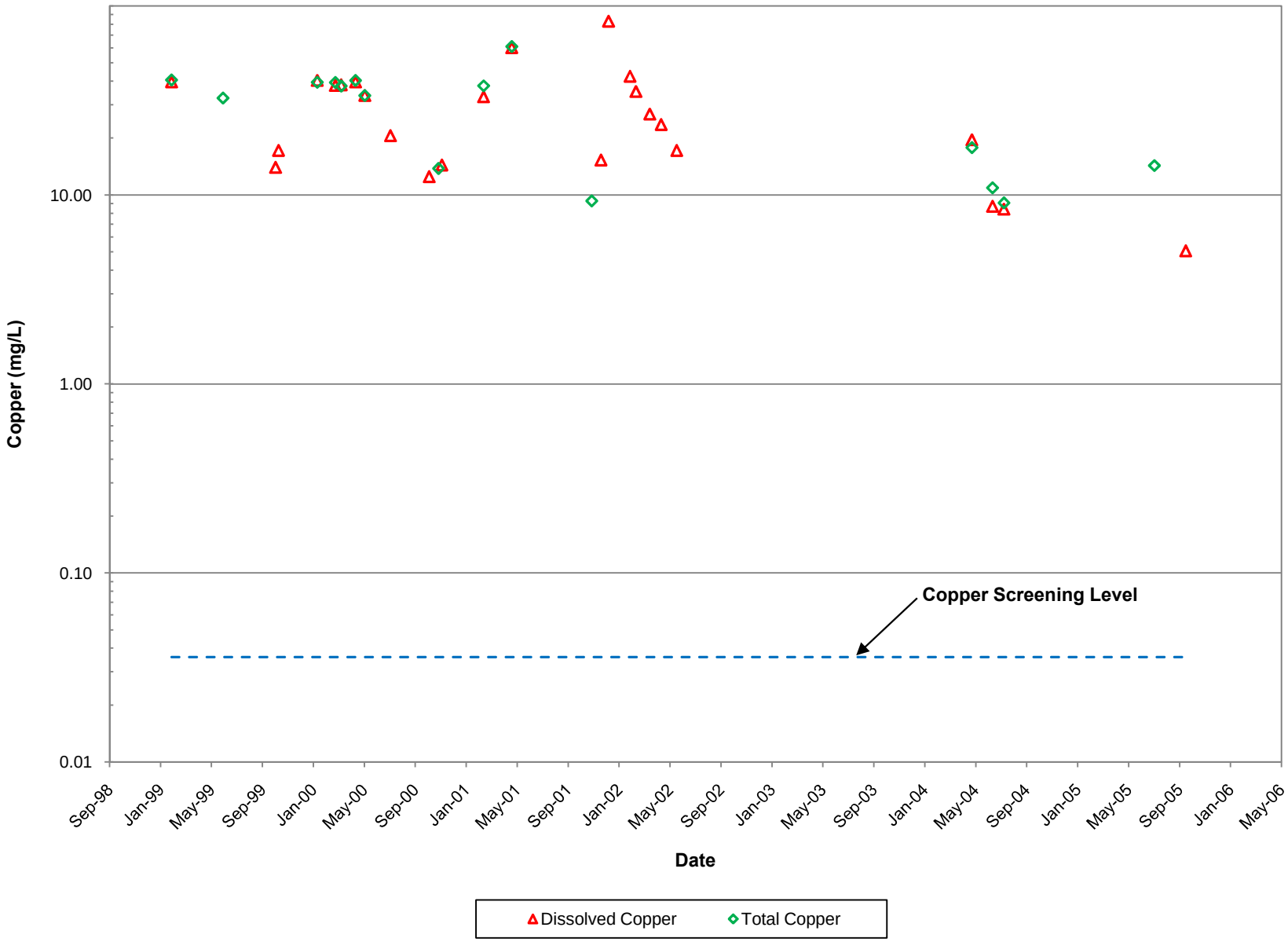

Figure 4-19
Formosa Adit
Historic Copper Concentrations

CDM

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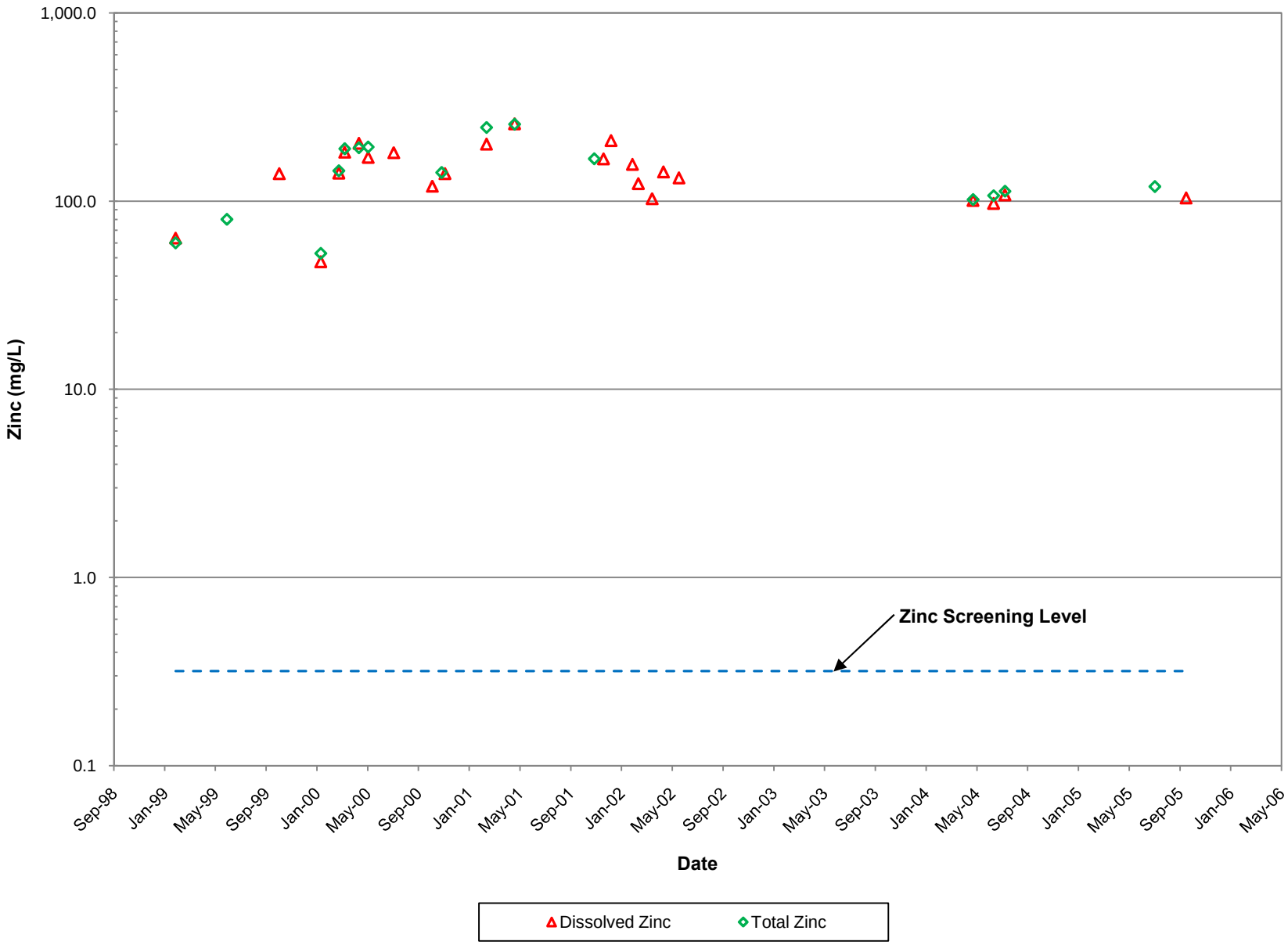

Figure 4-20
Formosa Adit
Historic Zinc Concentrations

CDM

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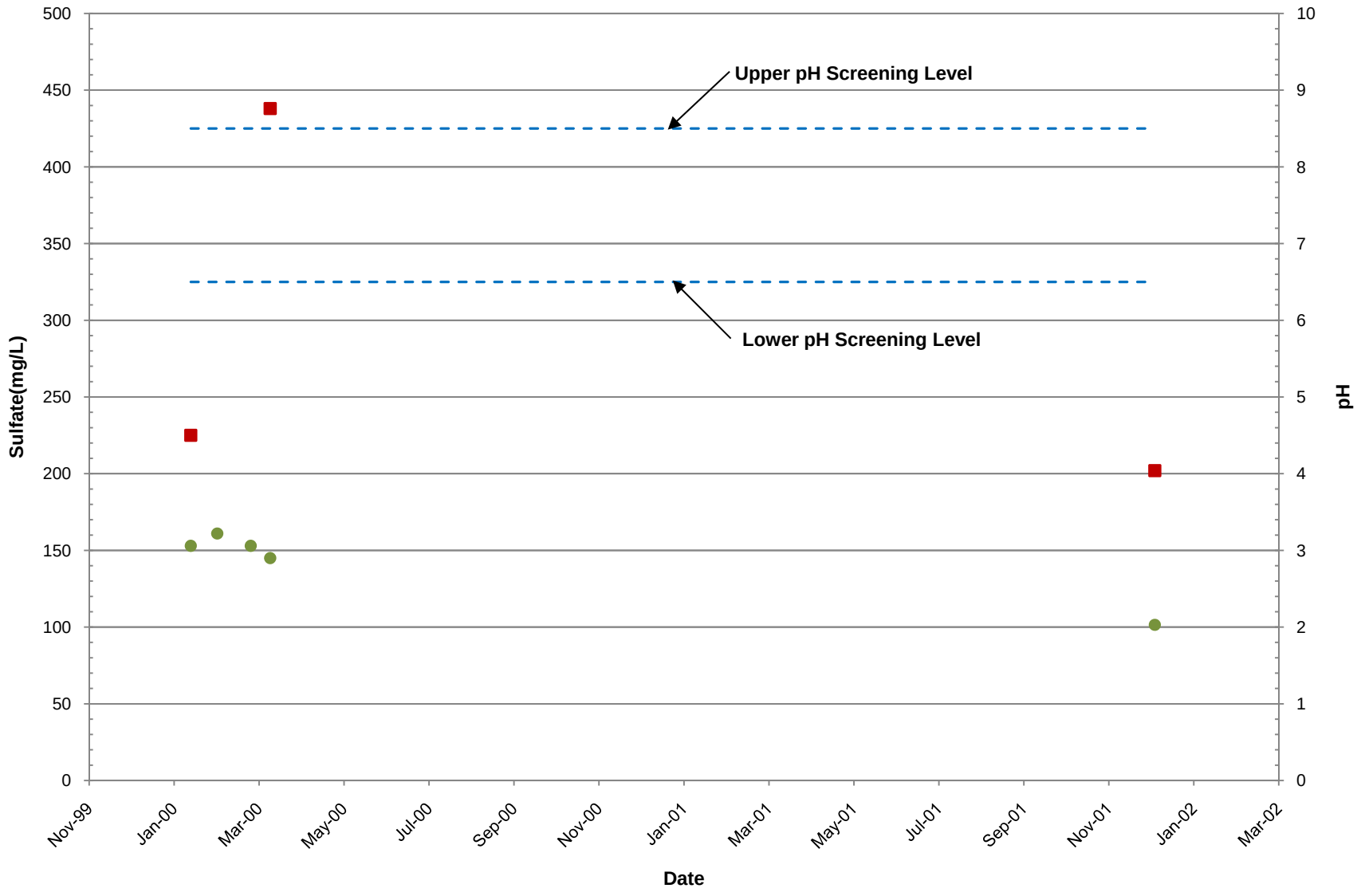

Figure 4-21
Silver Butte Adit
Historic pH and Sulfate Concentrations

CDM

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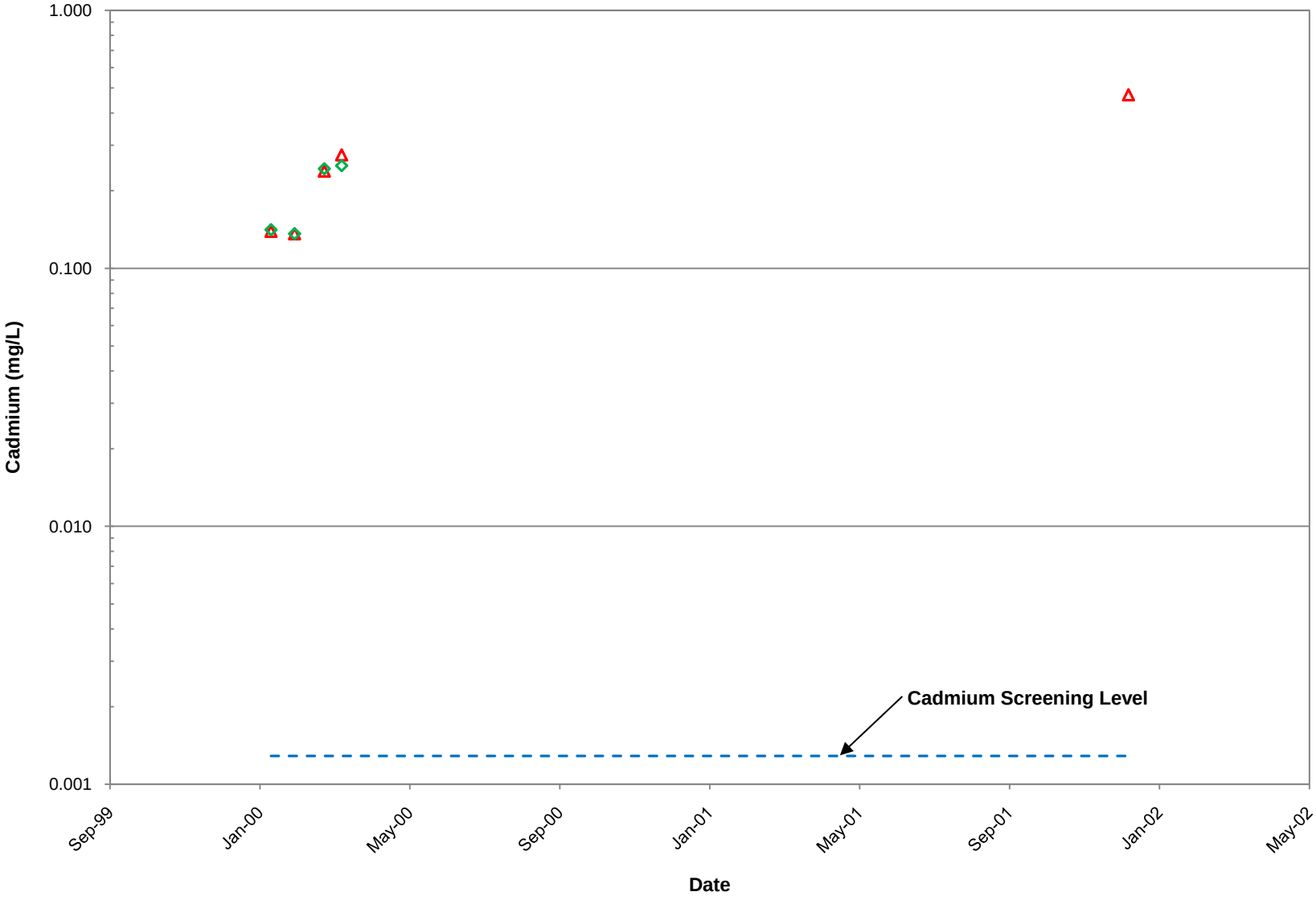

Figure 4-22
Silver Butte Adit
Historic Cadmium Concentrations

CDM

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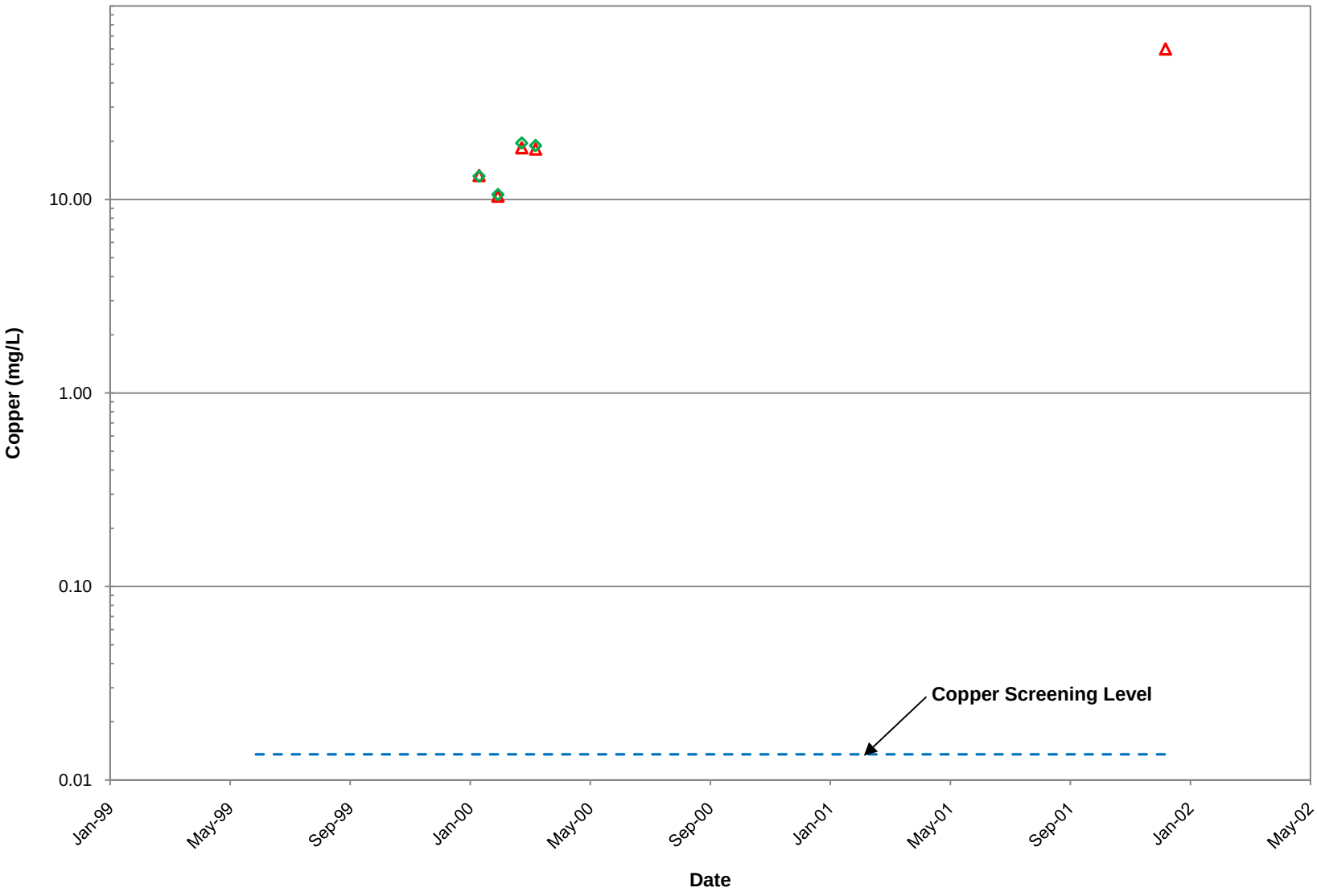

Figure 4-23
Silver Butte Adit
Historic Copper Concentrations

CDM

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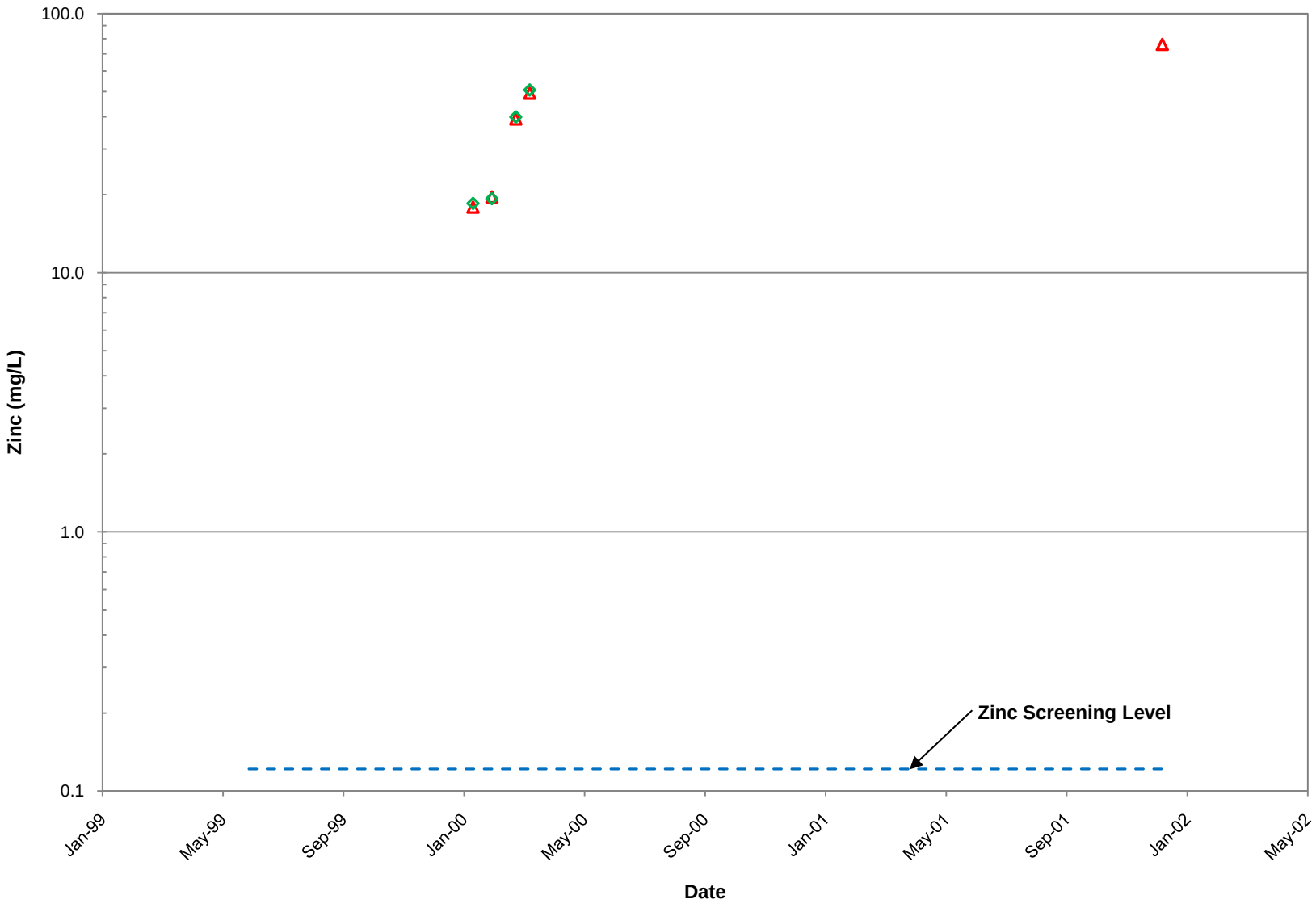

Figure 4-24
Silver Butte Adit
Historic Zinc Concentrations

CDM

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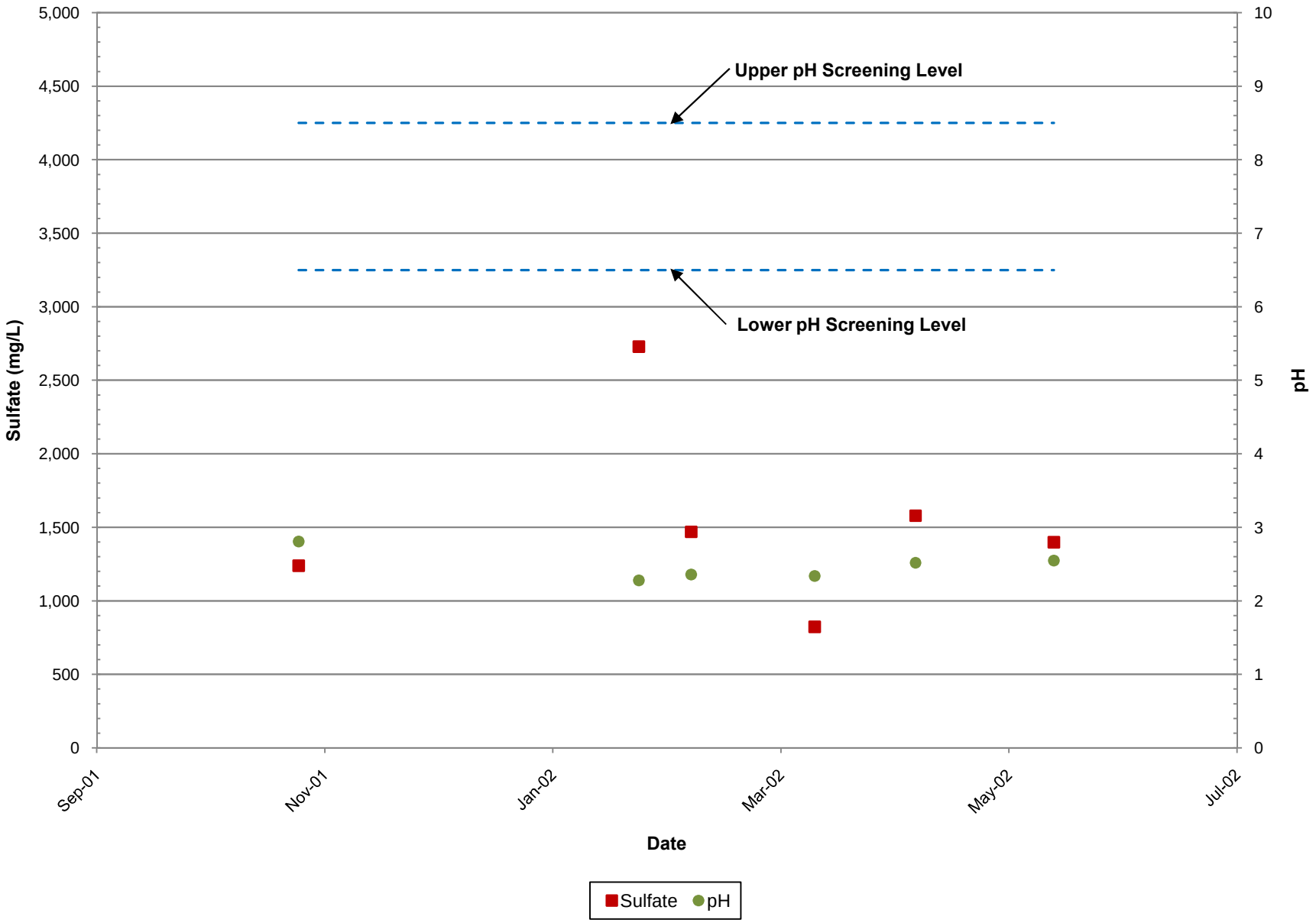

Figure 4-25
End of Pipe
Historic pH and Sulfate Concentrations

CDM

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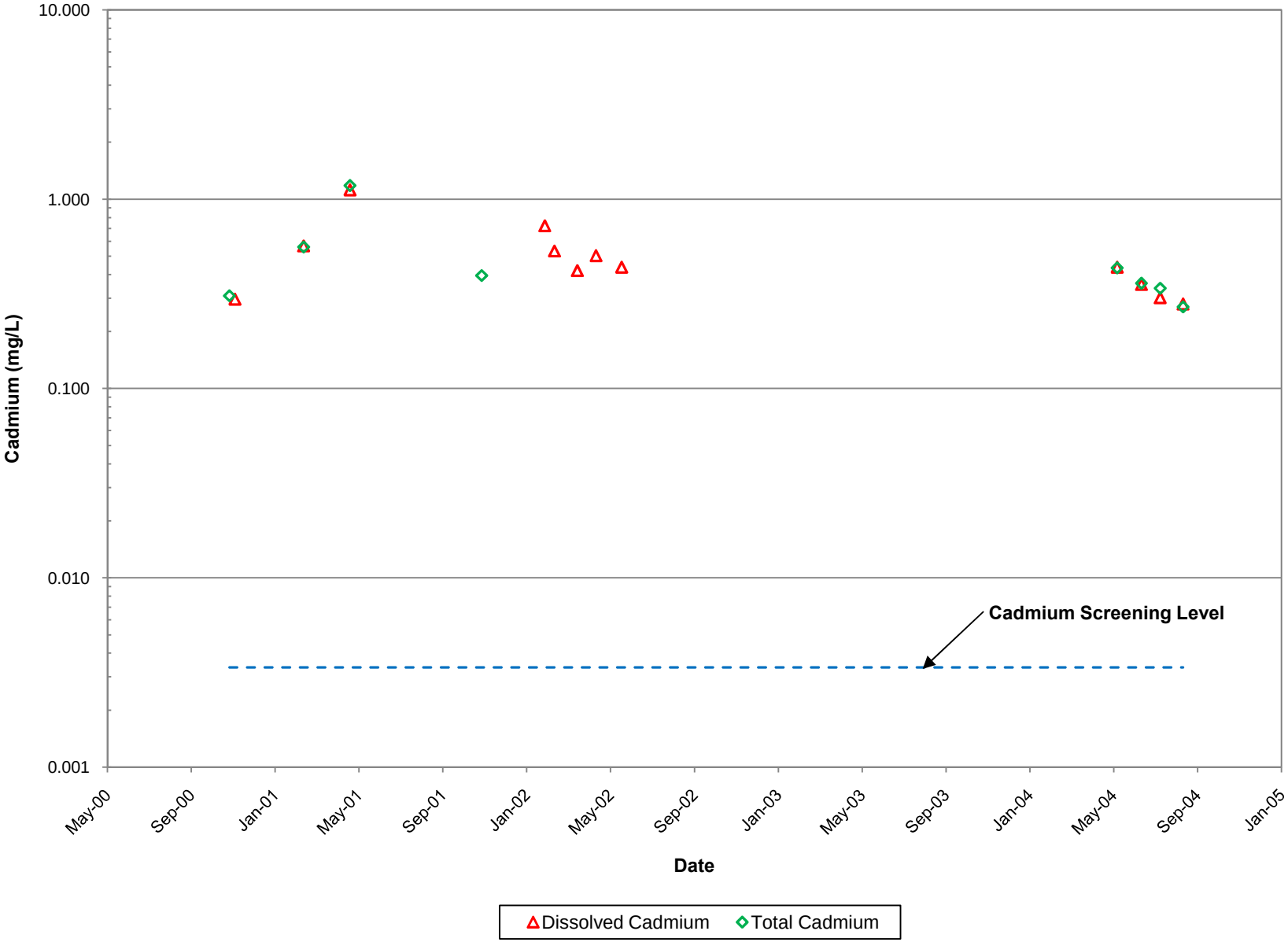

Figure 4-26
End of Pipe
Historic Cadmium Concentrations

CDM

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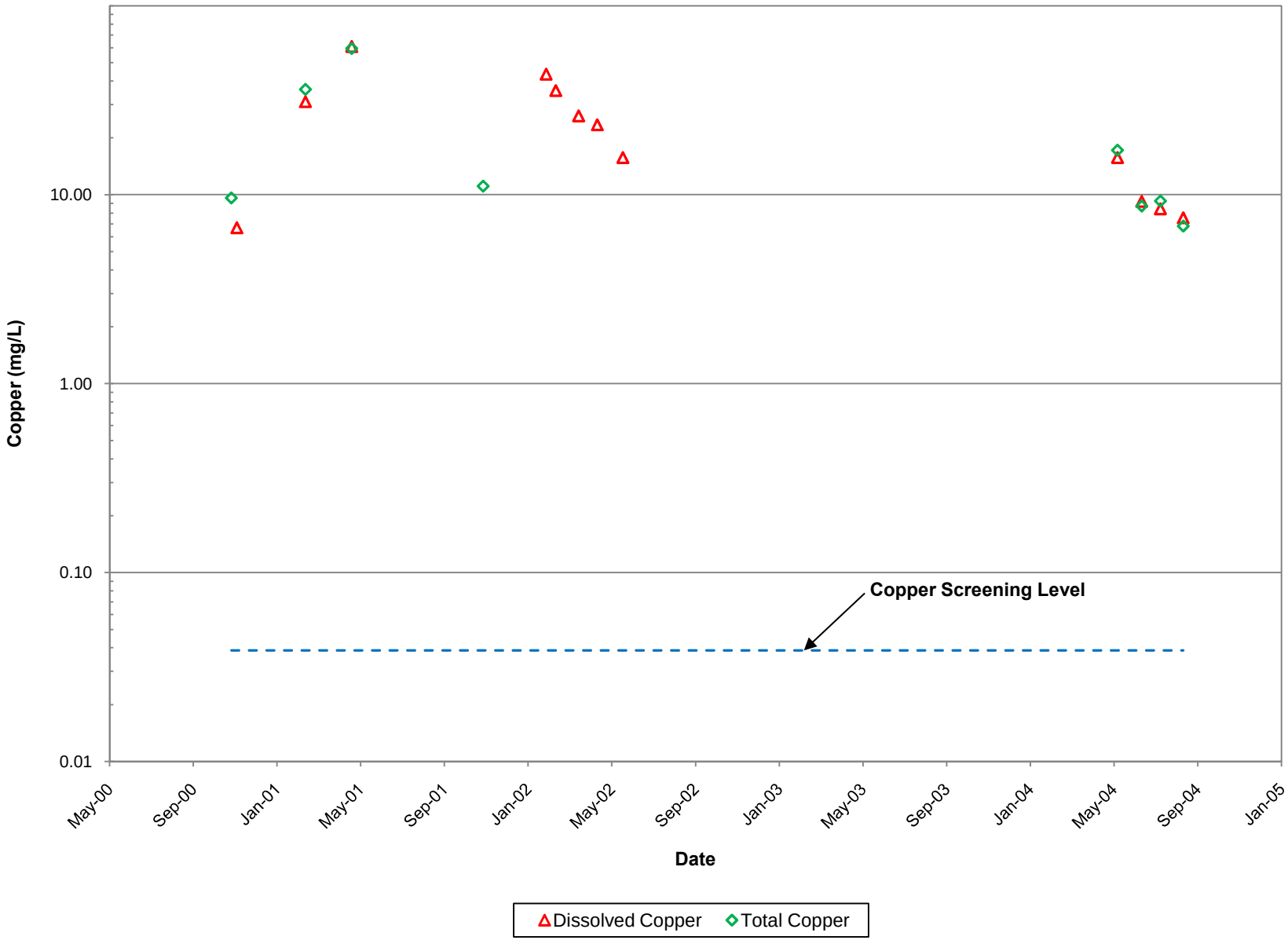

Figure 4-27
End of Pipe
Historic Copper Concentrations

CDM

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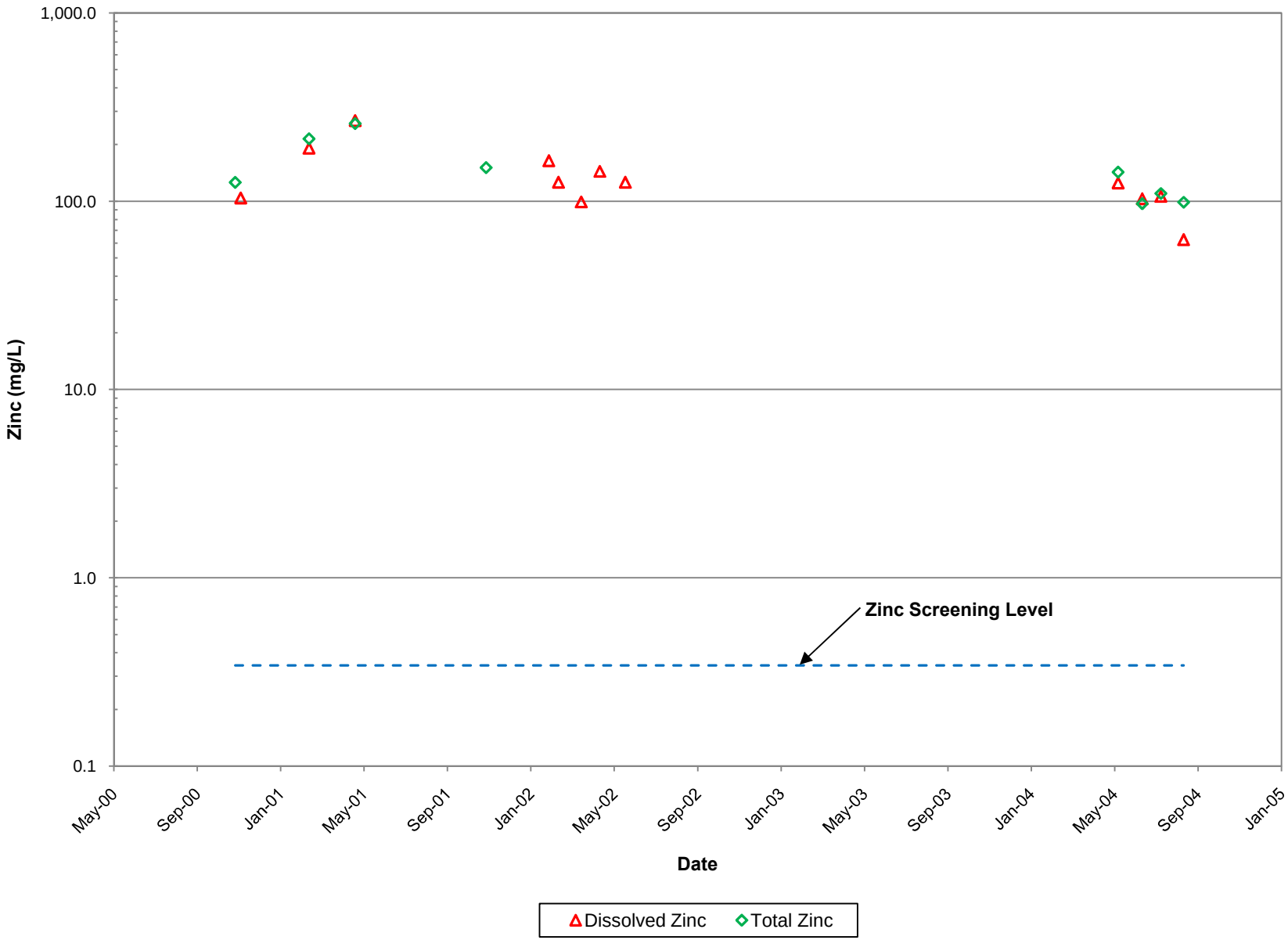

Figure 4-28
End of Pipe
Historic Zinc Concentrations

CDM

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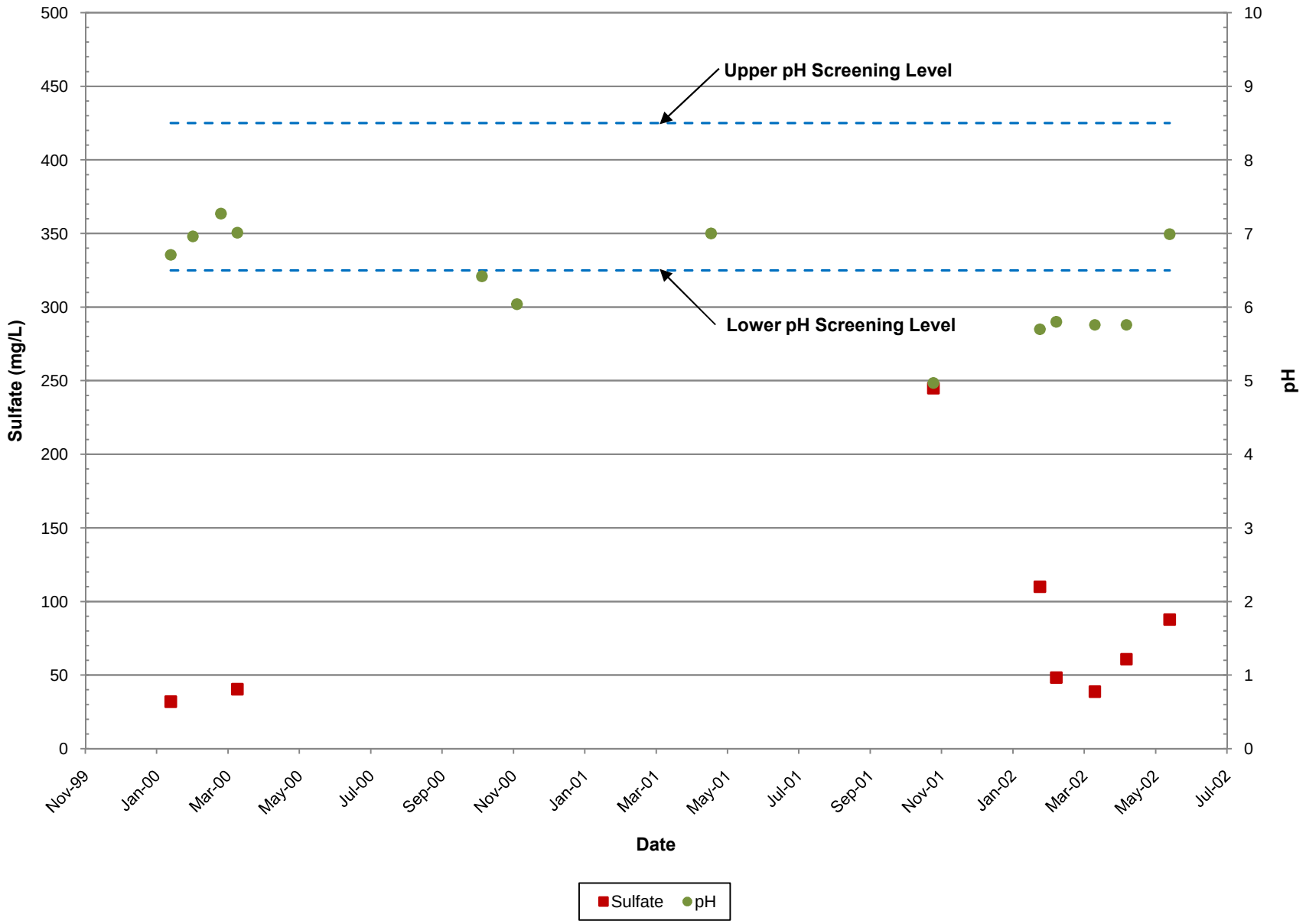

Figure 4-29
Seep A
Historic pH and Sulfate Concentrations

CDM

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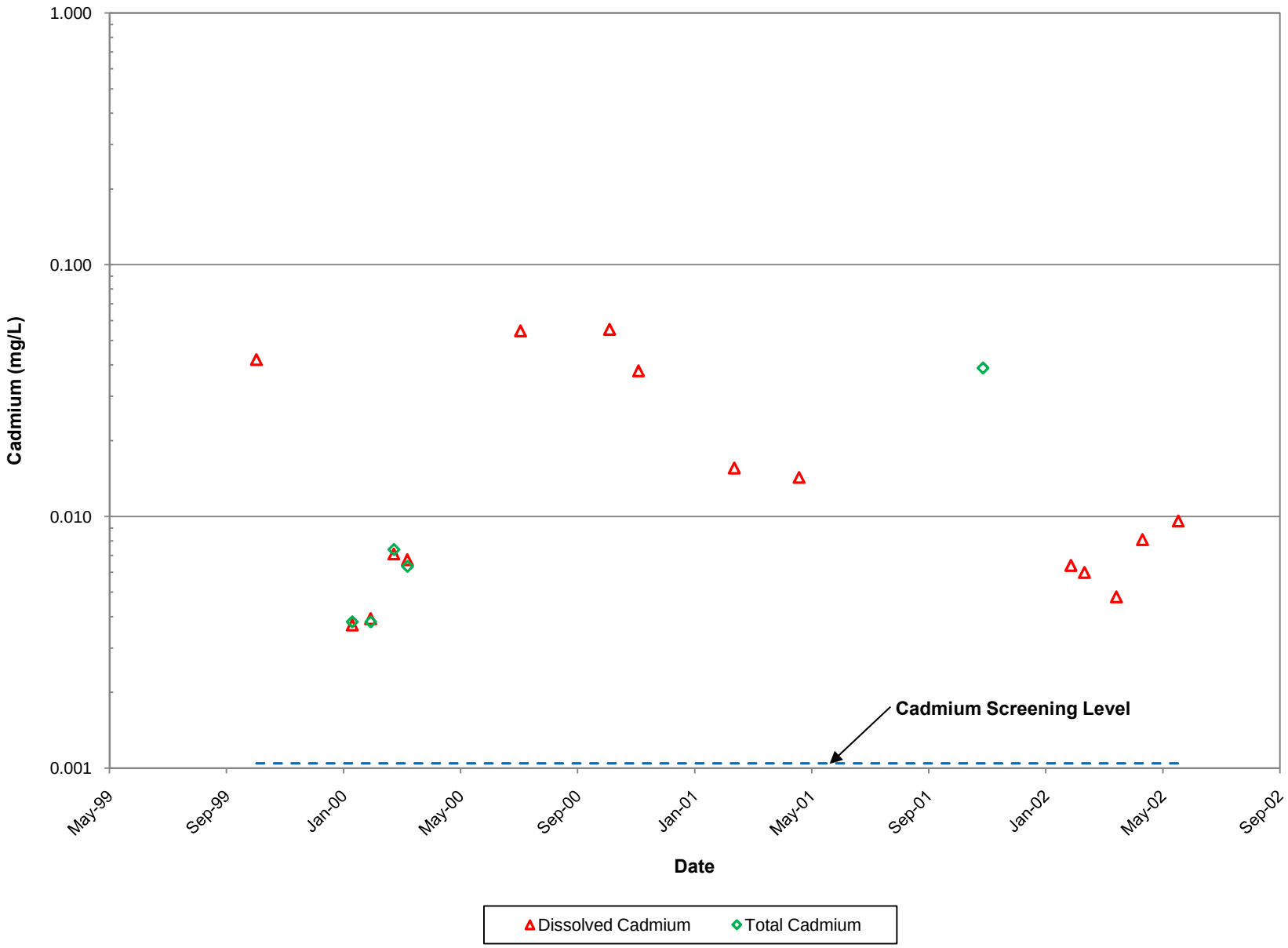

Figure 4-30
Seep A
Historic Cadmium Concentrations

CDM

P:\3380-New RAC8\221 - Formosa\Data Summary Report\Figures\Seep A-SW.xls

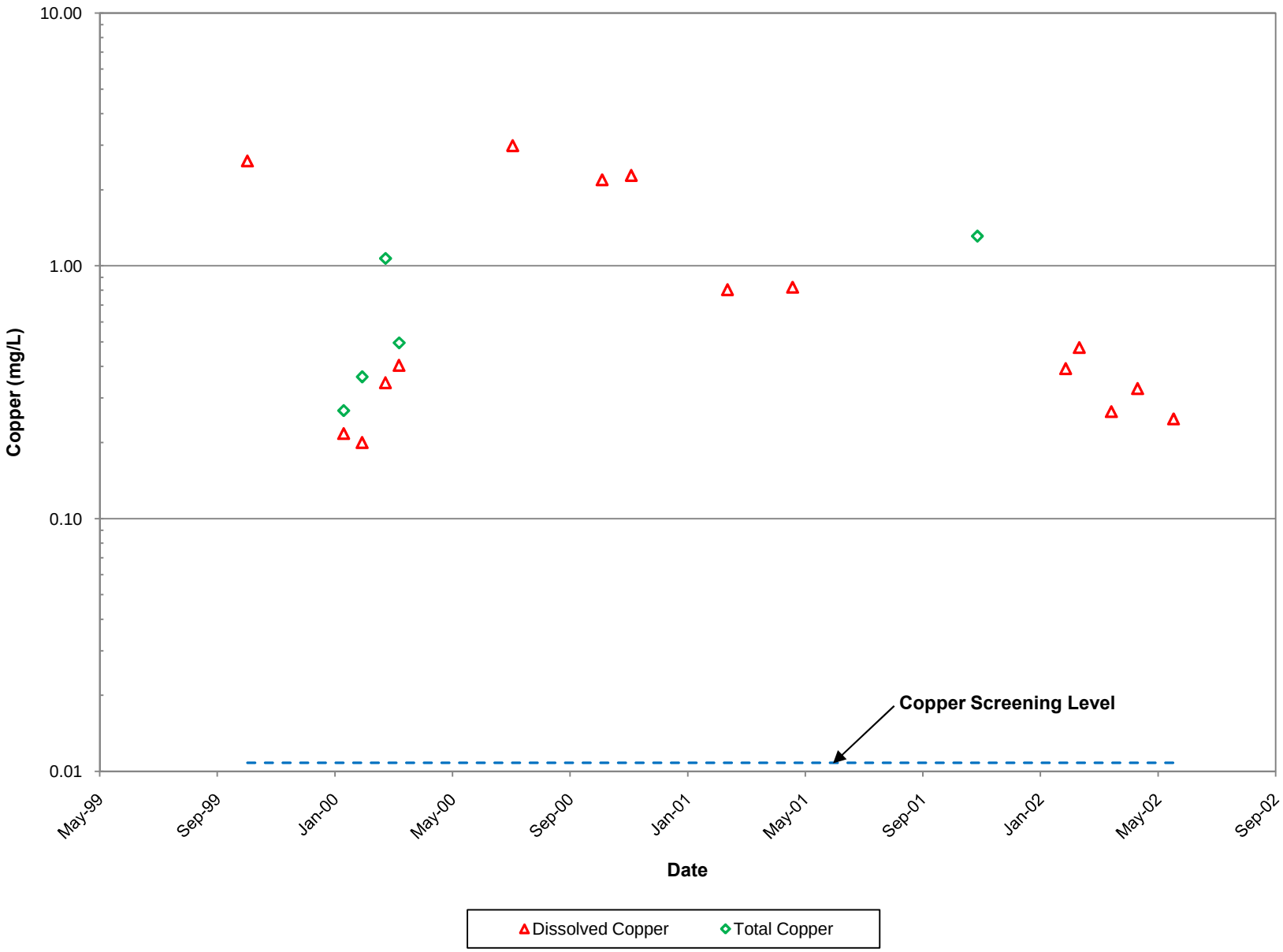

Figure 4-31
Seep A
Historic Copper Concentrations

CDM

P:\3380-New RAC8\221 - Formosa\Data Summary Report\Figures\Seep A-SW.xls

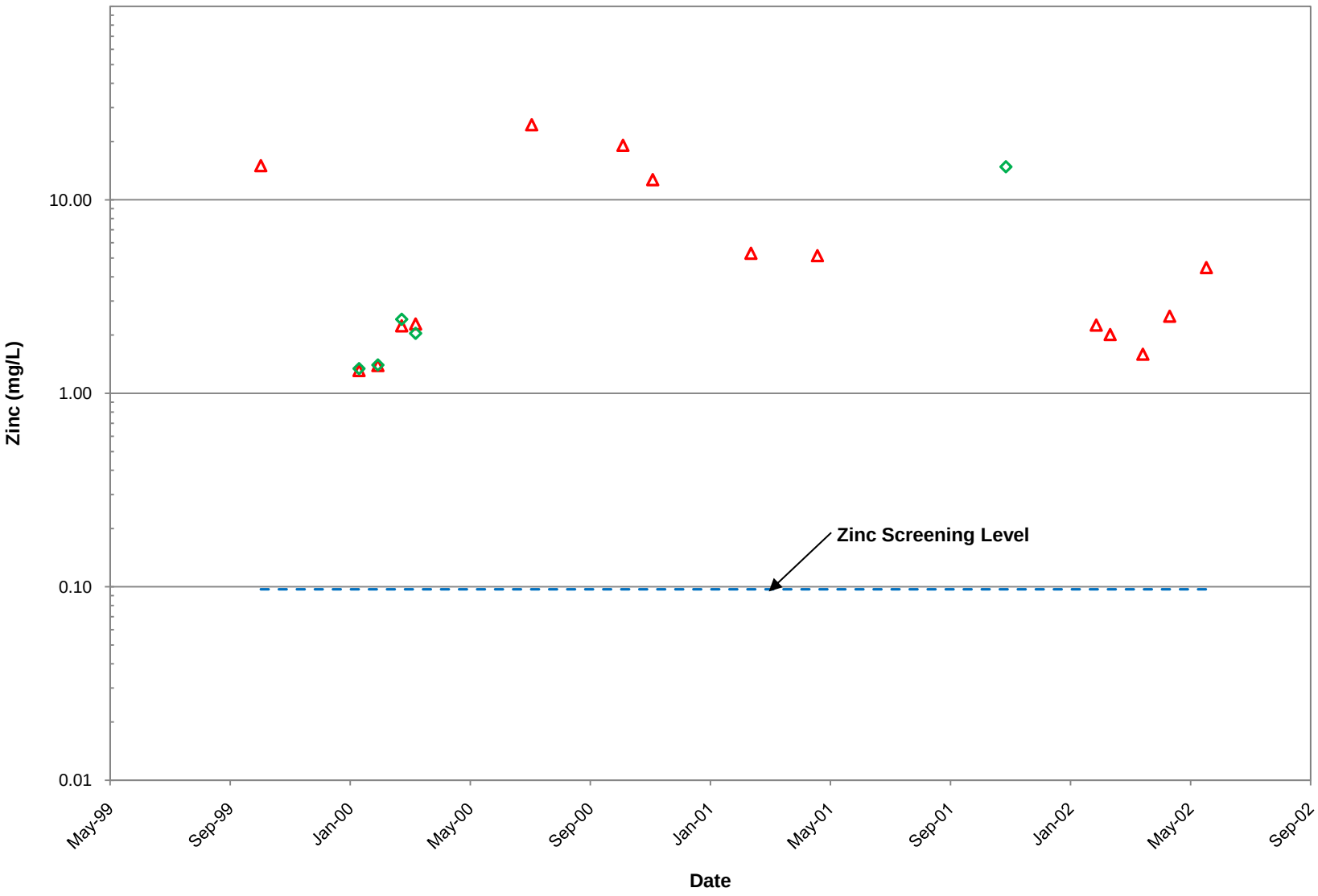

Figure 4-32
Seep A
Historic Zinc Concentrations

CDM

P:\3380-New RAC8\221 - Formosa\Data Summary Report\Figures\Seep A-SW

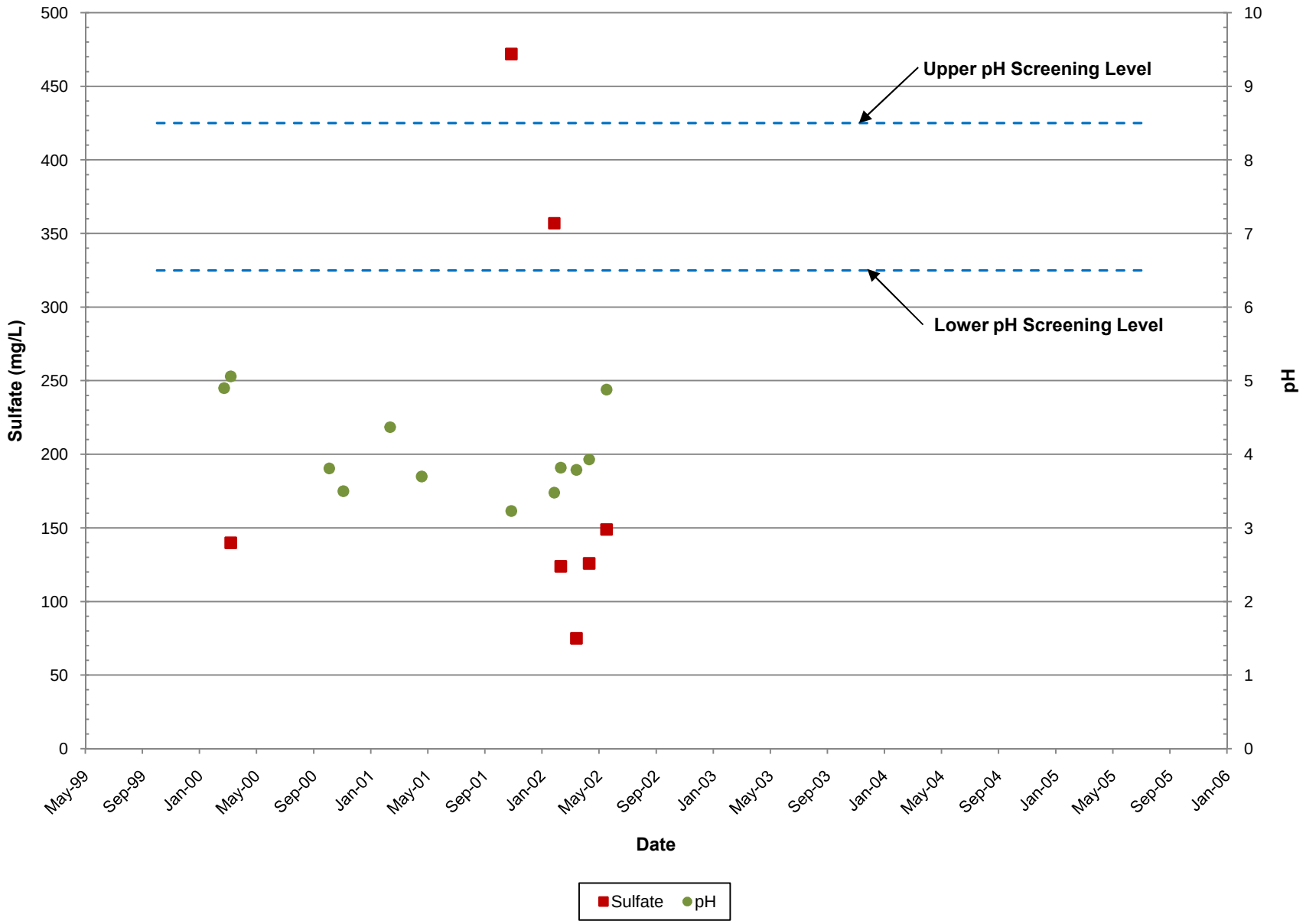

Figure 4-33
Location A4
Historic pH and Sulfate Concentrations

CDM

P:\3380-New RAC8\221 - Formosa\Data Summary Report\Figures\A4-SW.xls

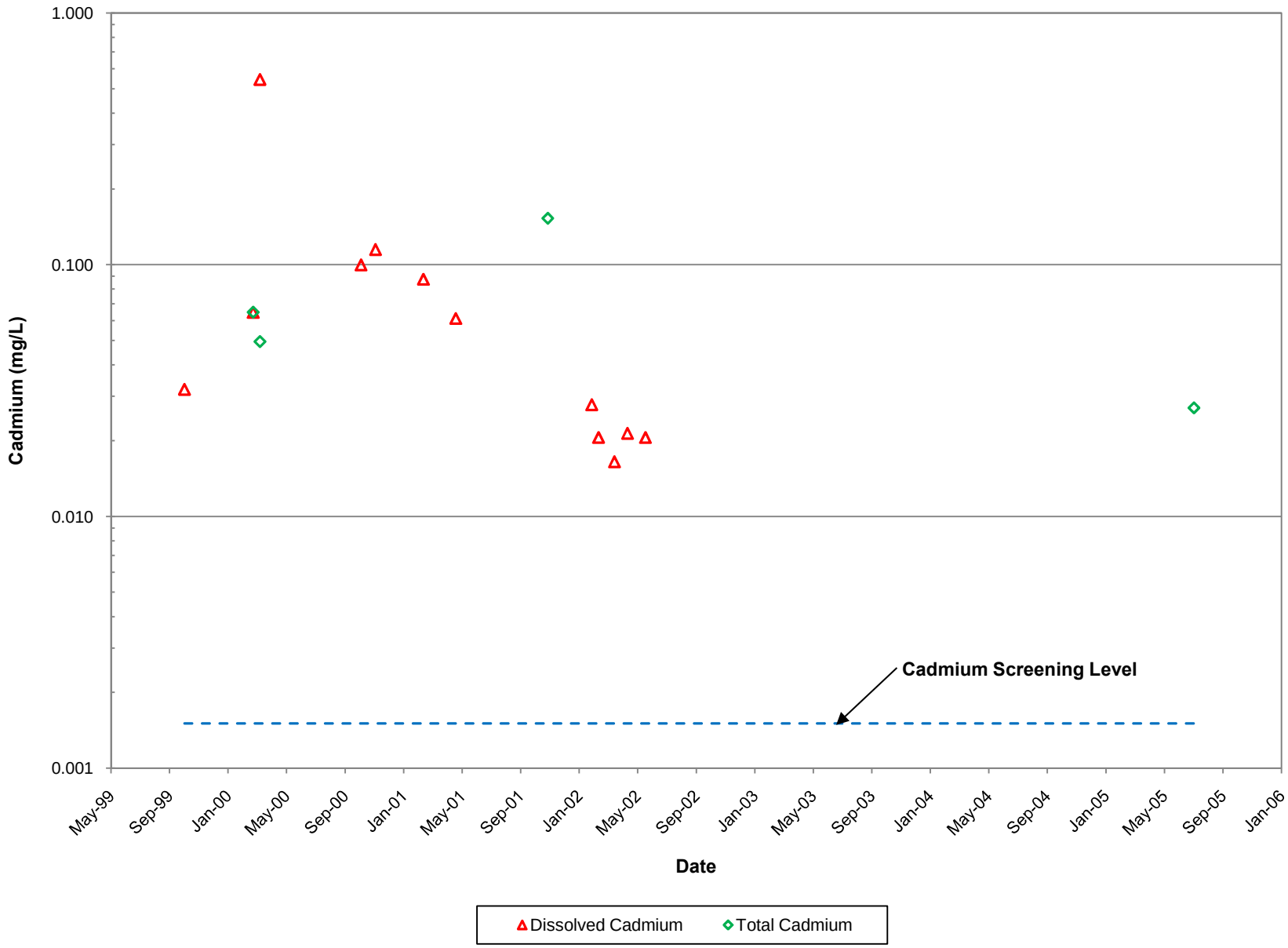

Figure 4-34
Location A4
Historic Cadmium Concentrations

CDM

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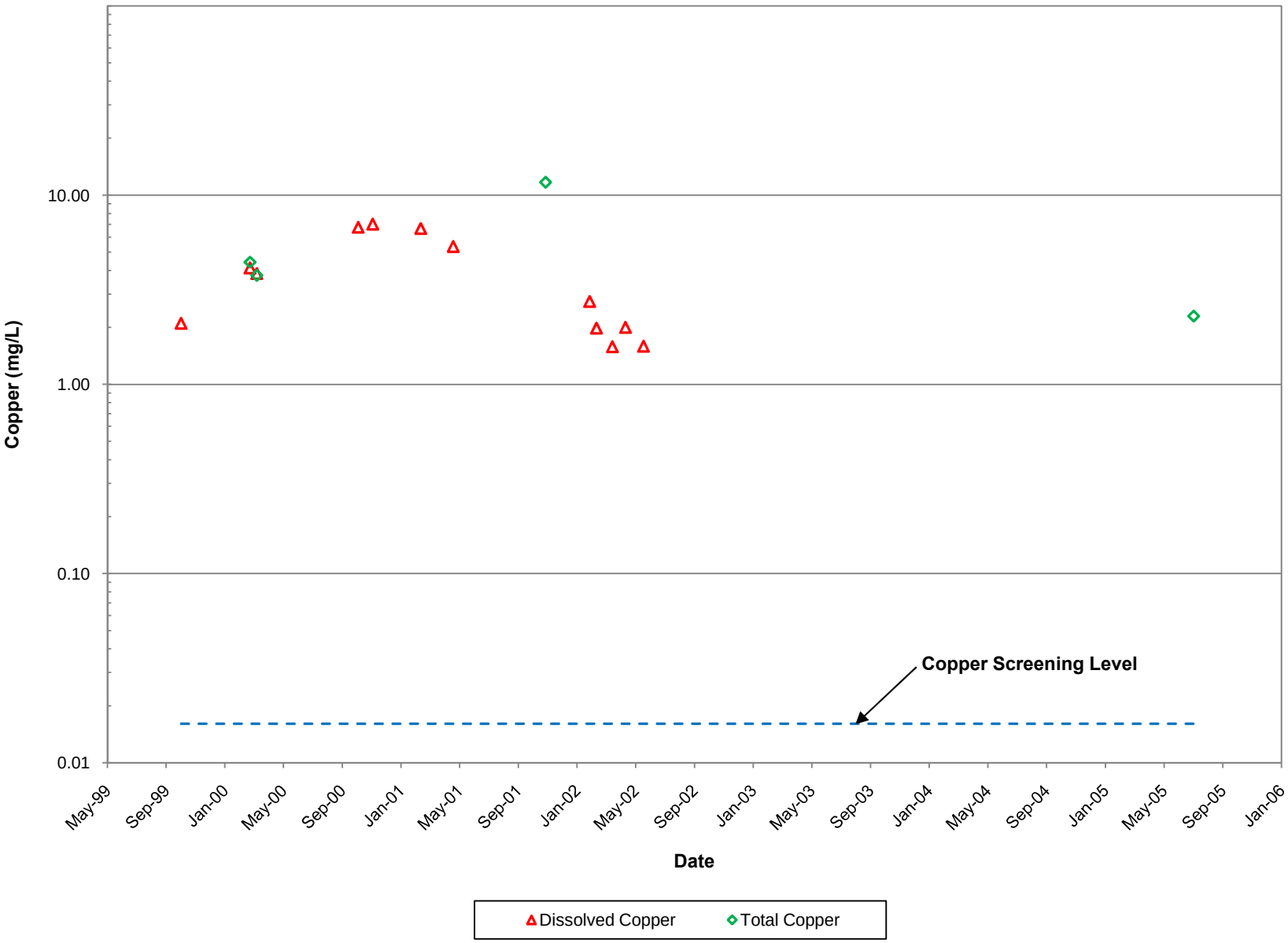

Figure 4-35
Location A4
Historic Copper Concentrations

CDM

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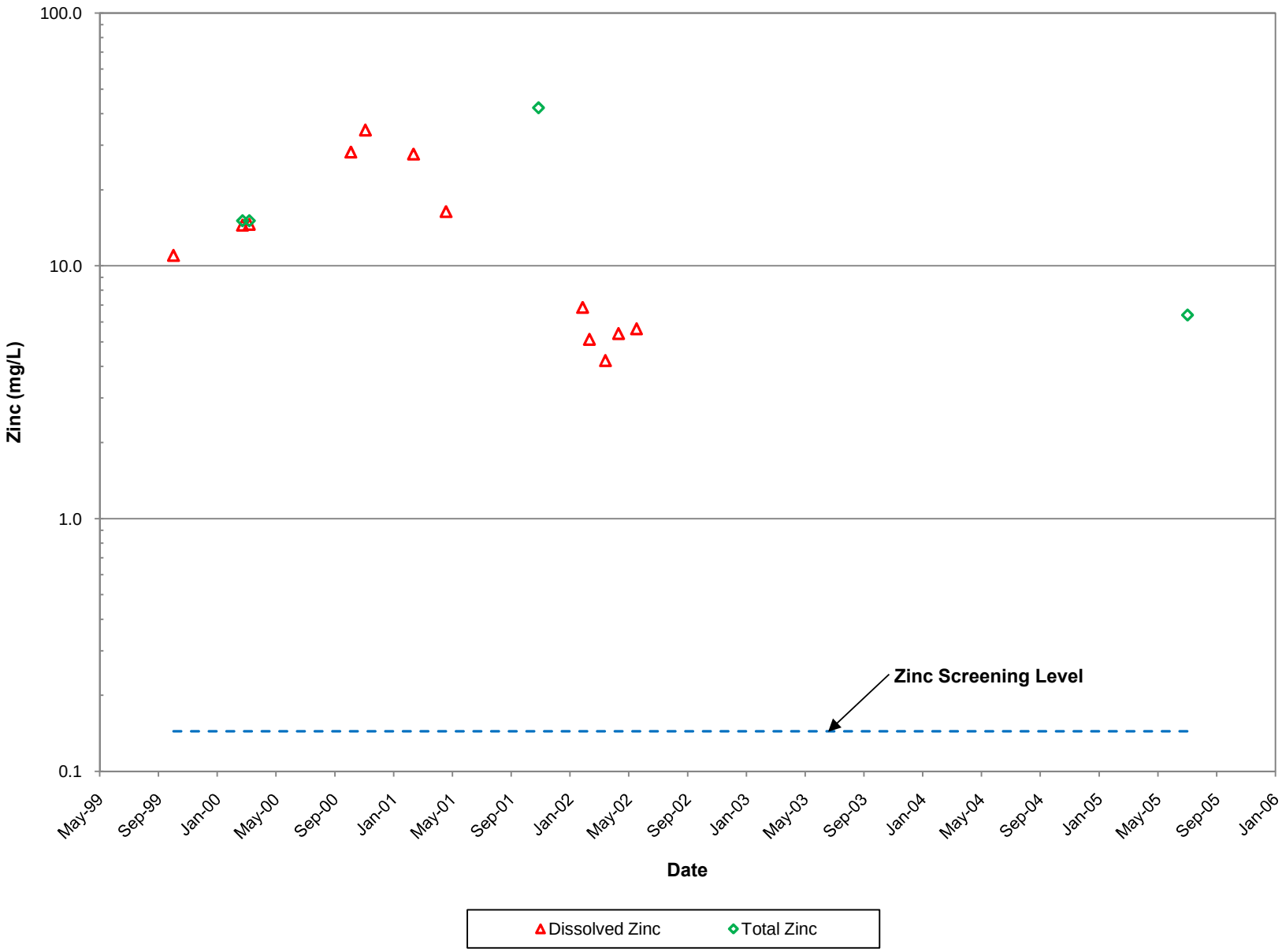

Figure 4-36
Location A4
Historic Zinc Concentrations

CDM

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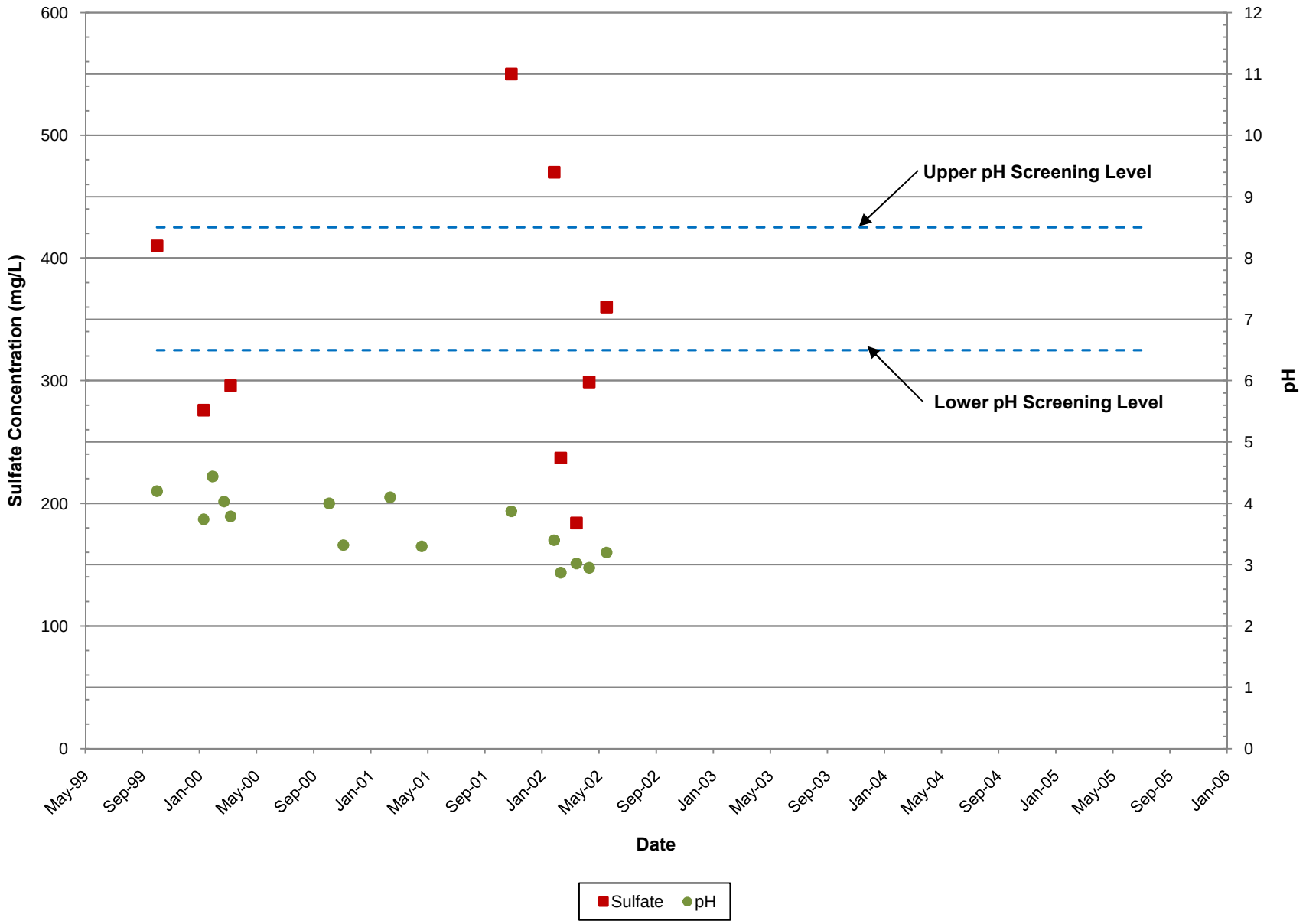

Figure 4-37
Location A9
Historic pH and Sulfate Concentrations

CDM

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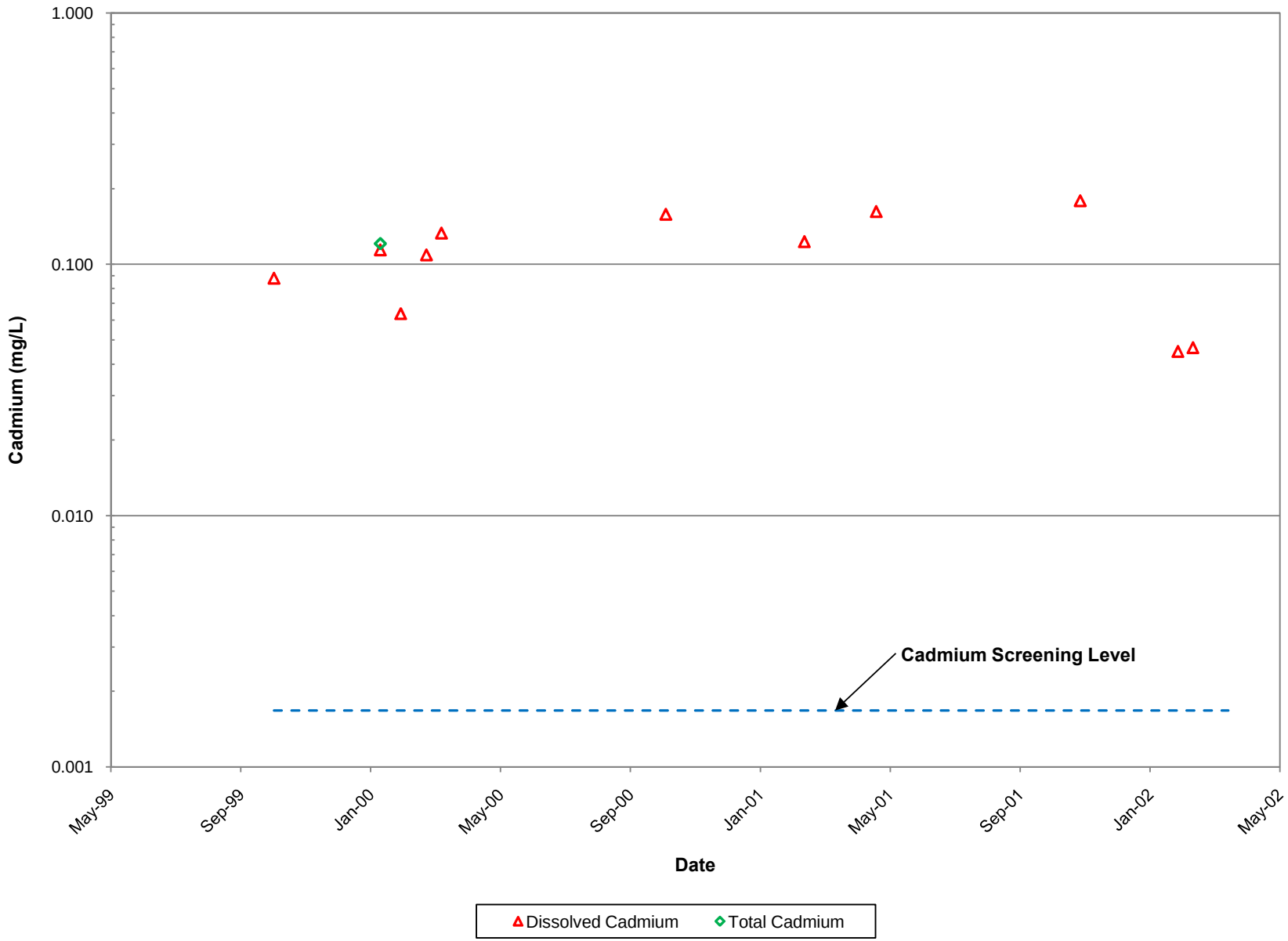

Figure 4-38
Location A9
Historic Cadmium Concentrations

CDM

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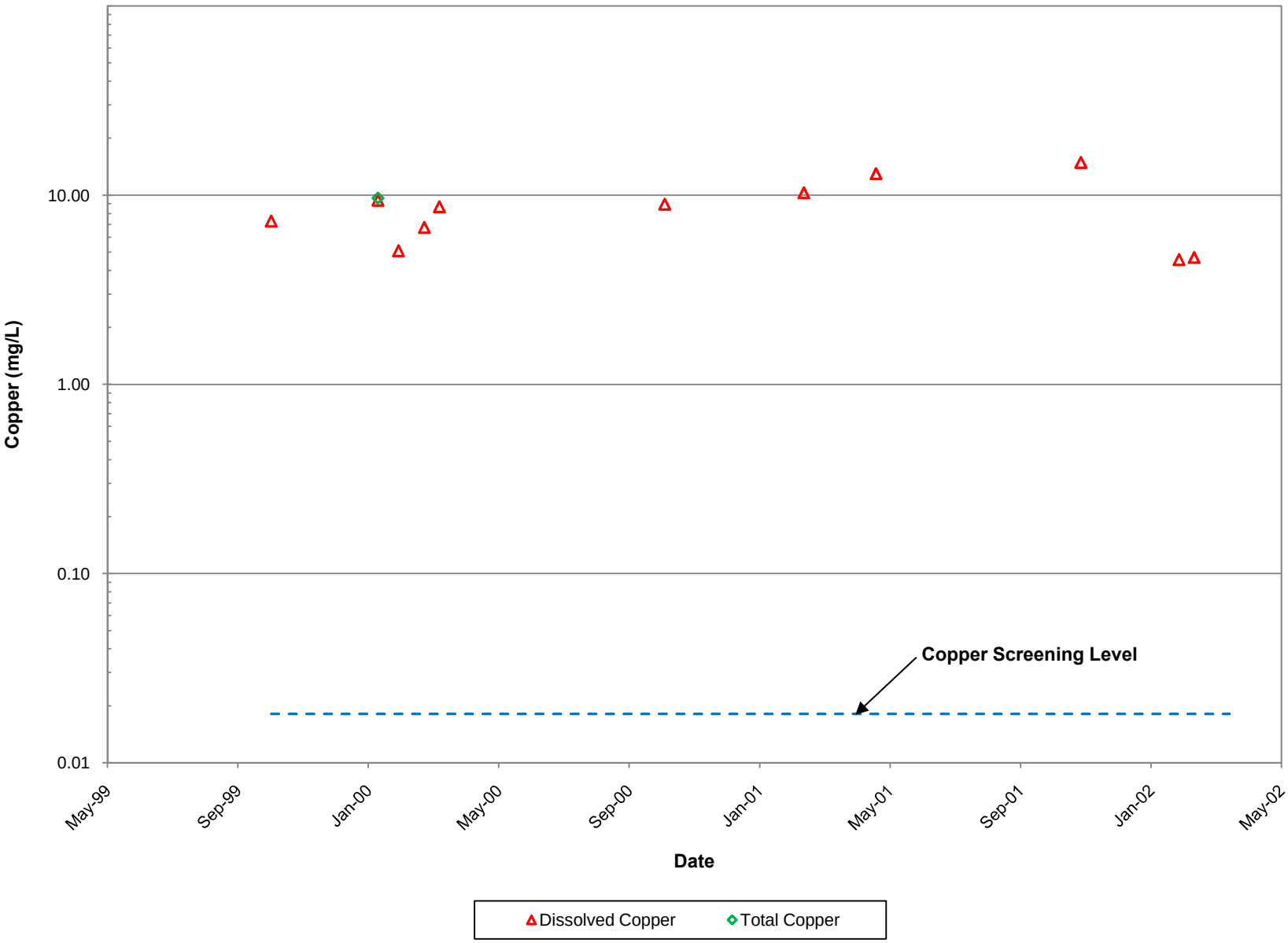

Figure 4-39
Location A9
Historic Copper Concentrations

CDM

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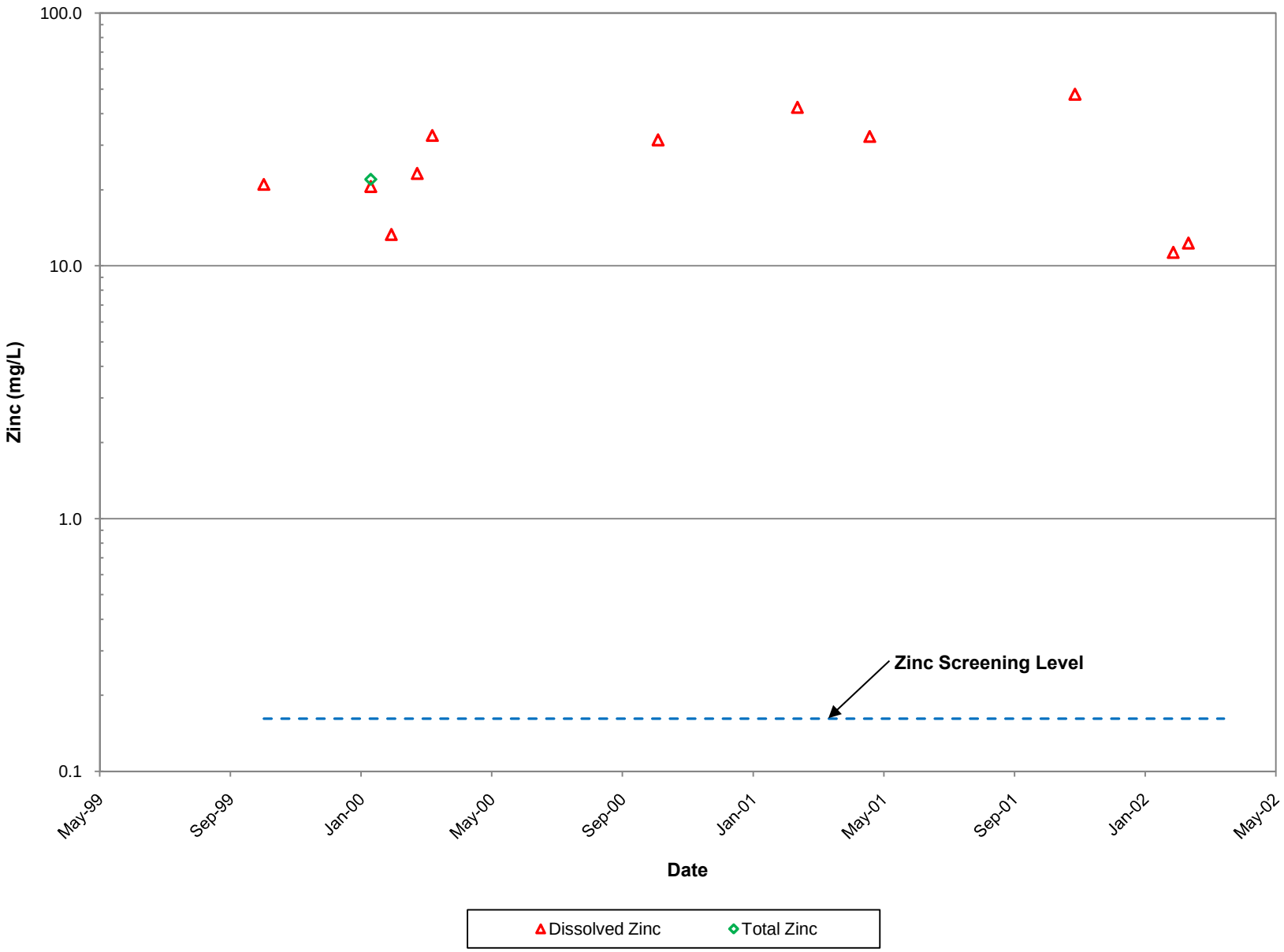

Figure 4-40
Location A9
Historic Zinc Concentrations

CDM

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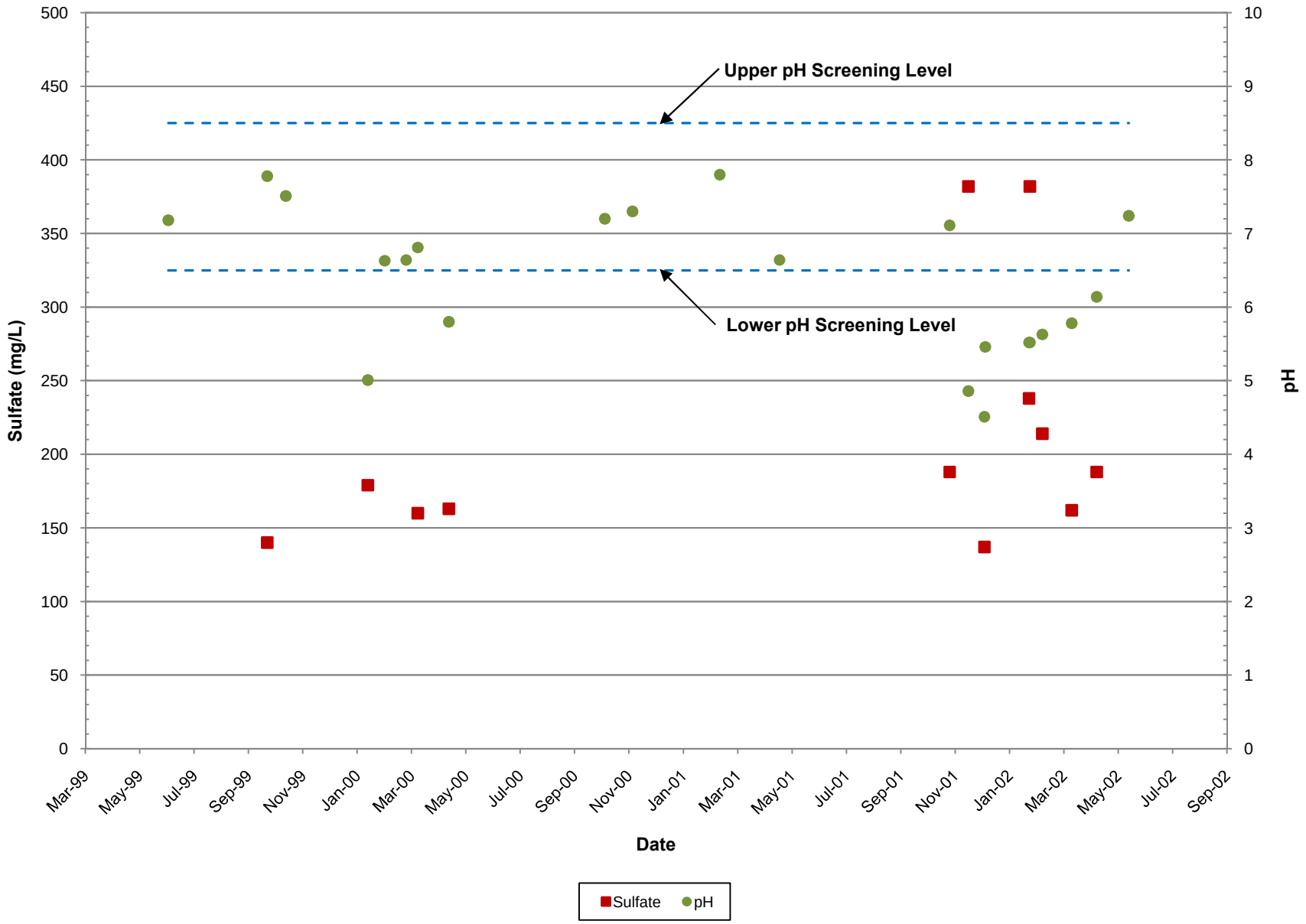

Figure 4-41
Location MXR
Historic pH and Sulfate Concentrations

CDM

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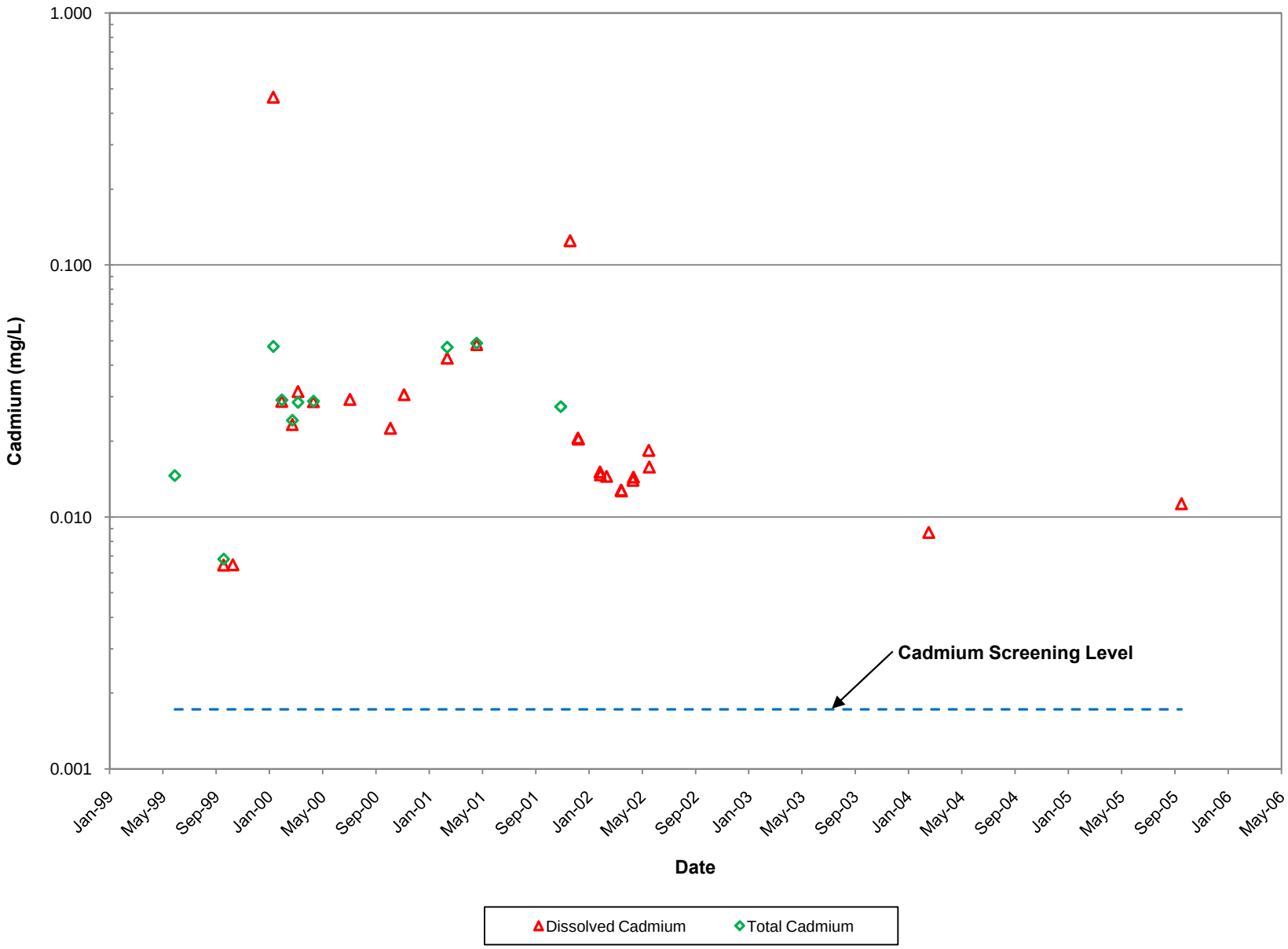

Figure 4-42
Location MXR
Historic Cadmium Concentrations

CDM

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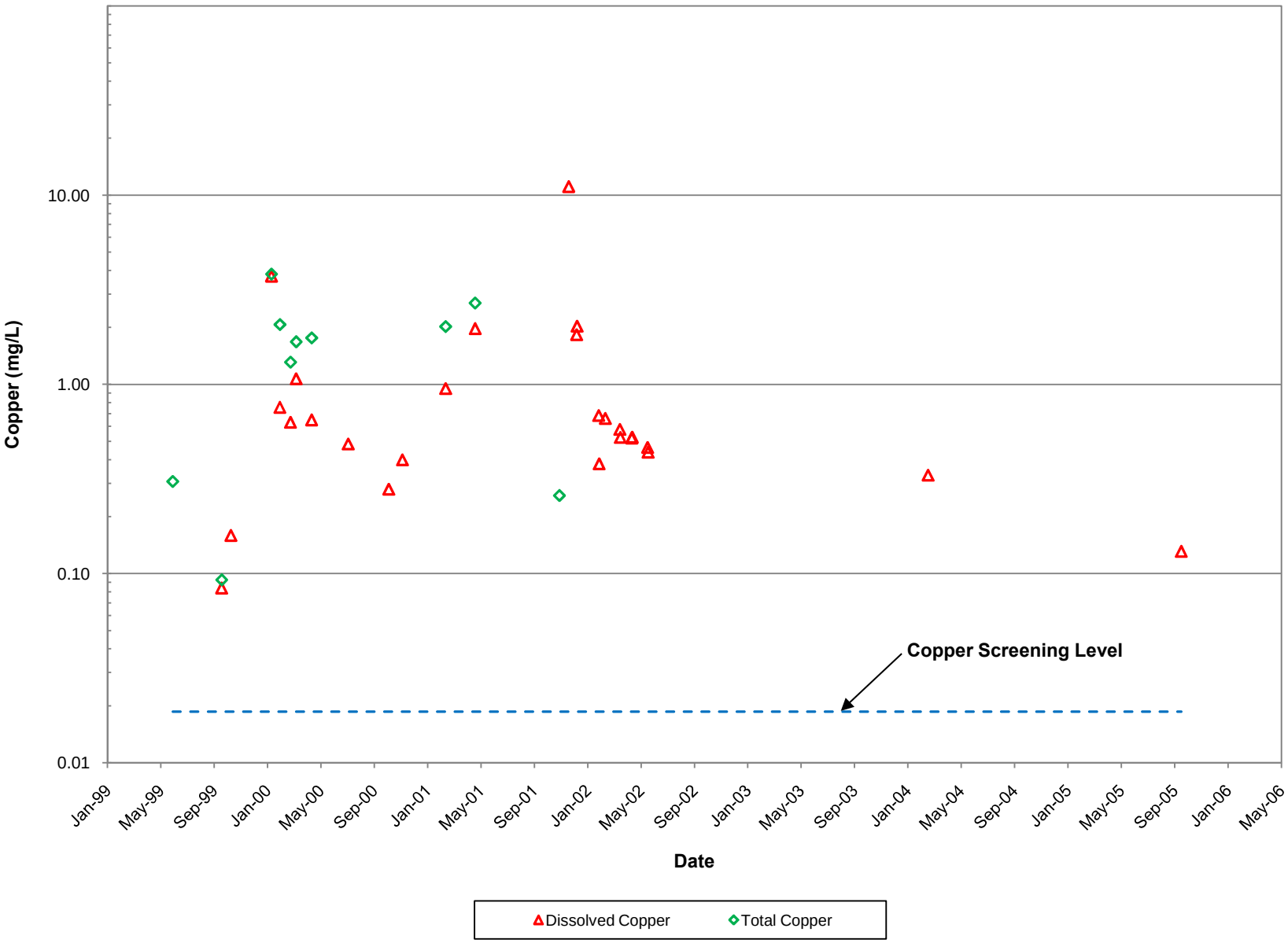

Figure 4-43
Location MXR
Historic Copper Concentrations

CDM

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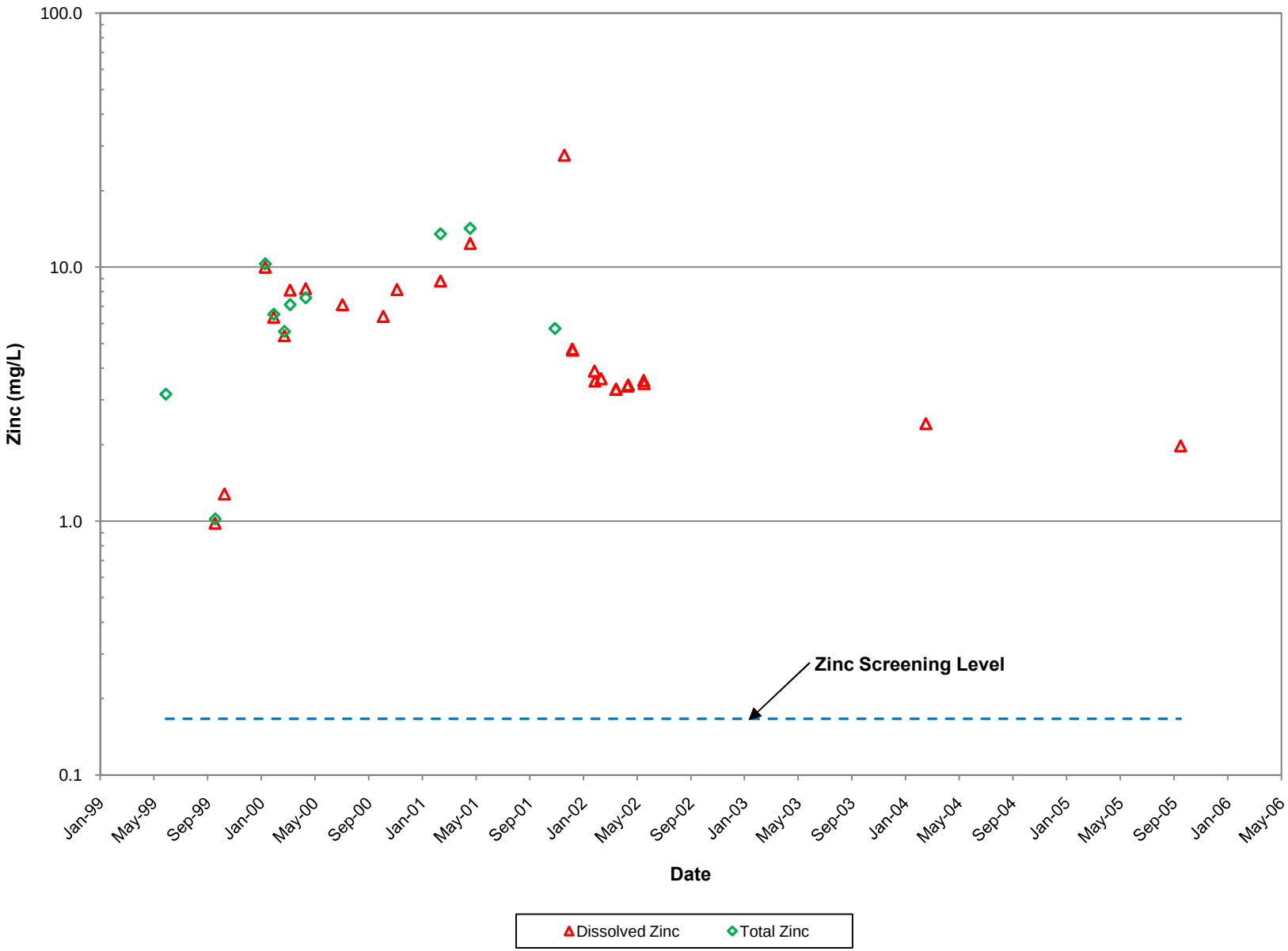

Figure 4-44
Location MXR
Historic Zinc Concentrations

CDM

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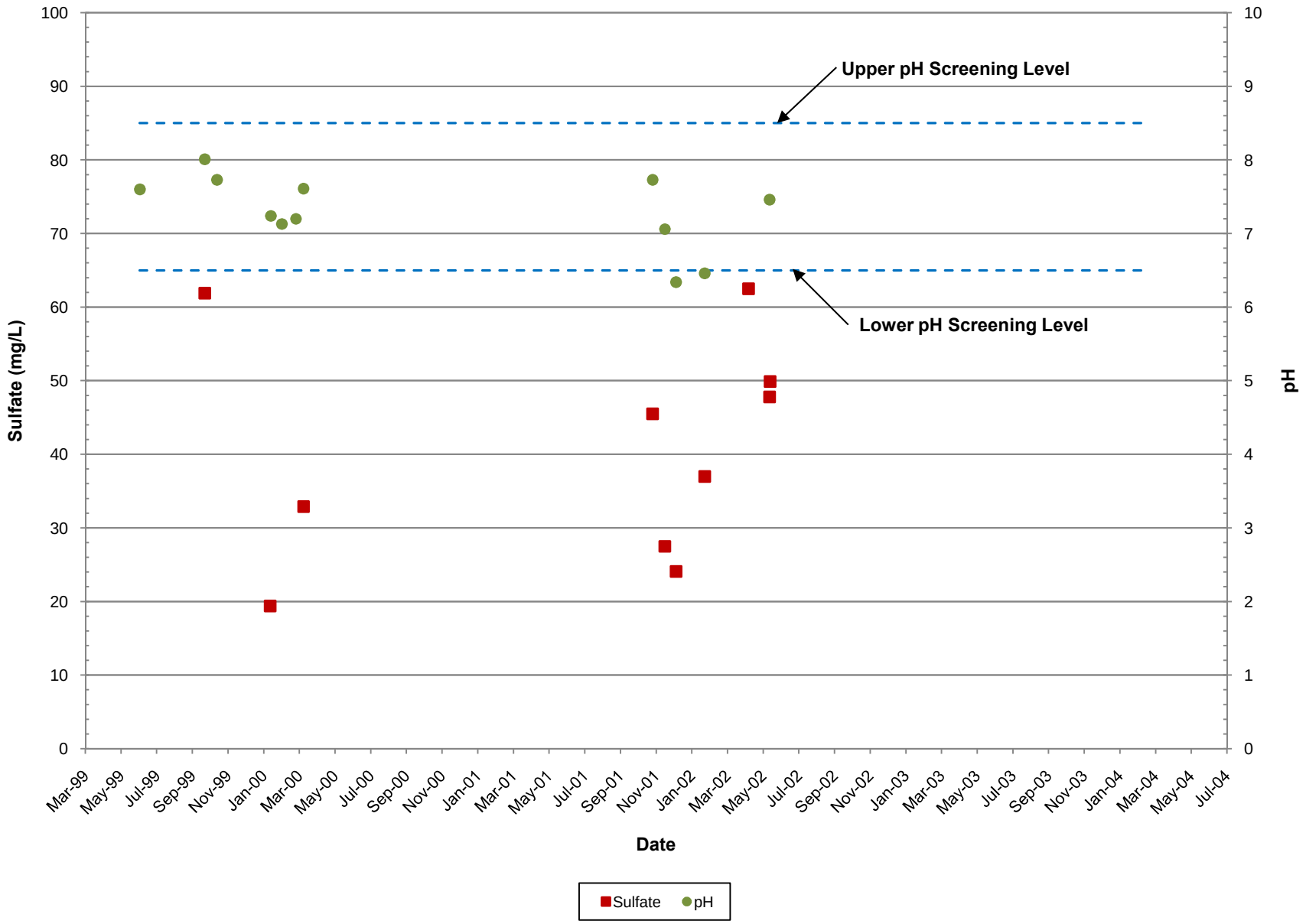

Figure 4-45
Location M3.0
Historic pH and Sulfate Concentrations

CDM

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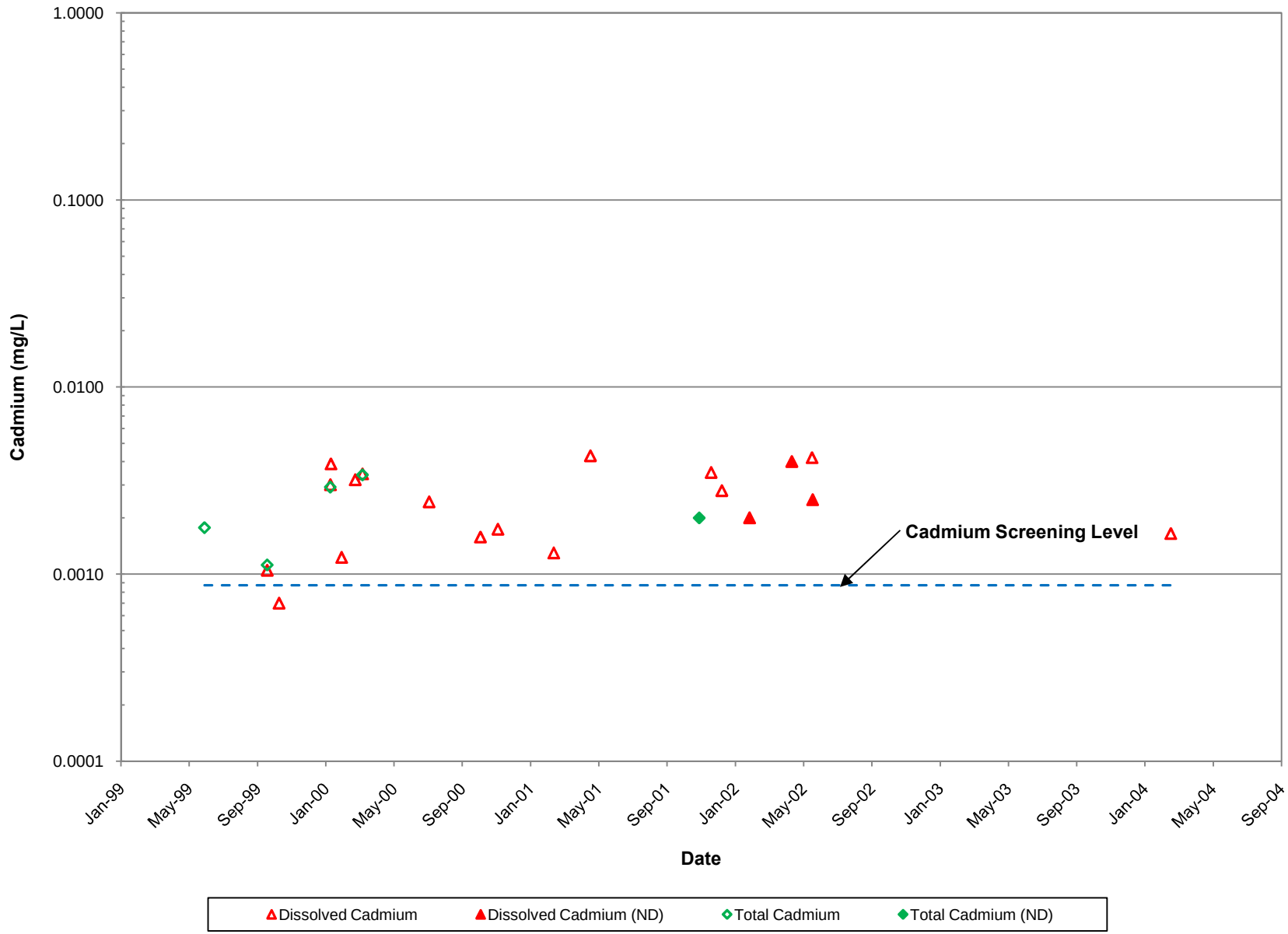

Figure 4-46
Location M3.0
Historic Cadmium Concentrations

CDM

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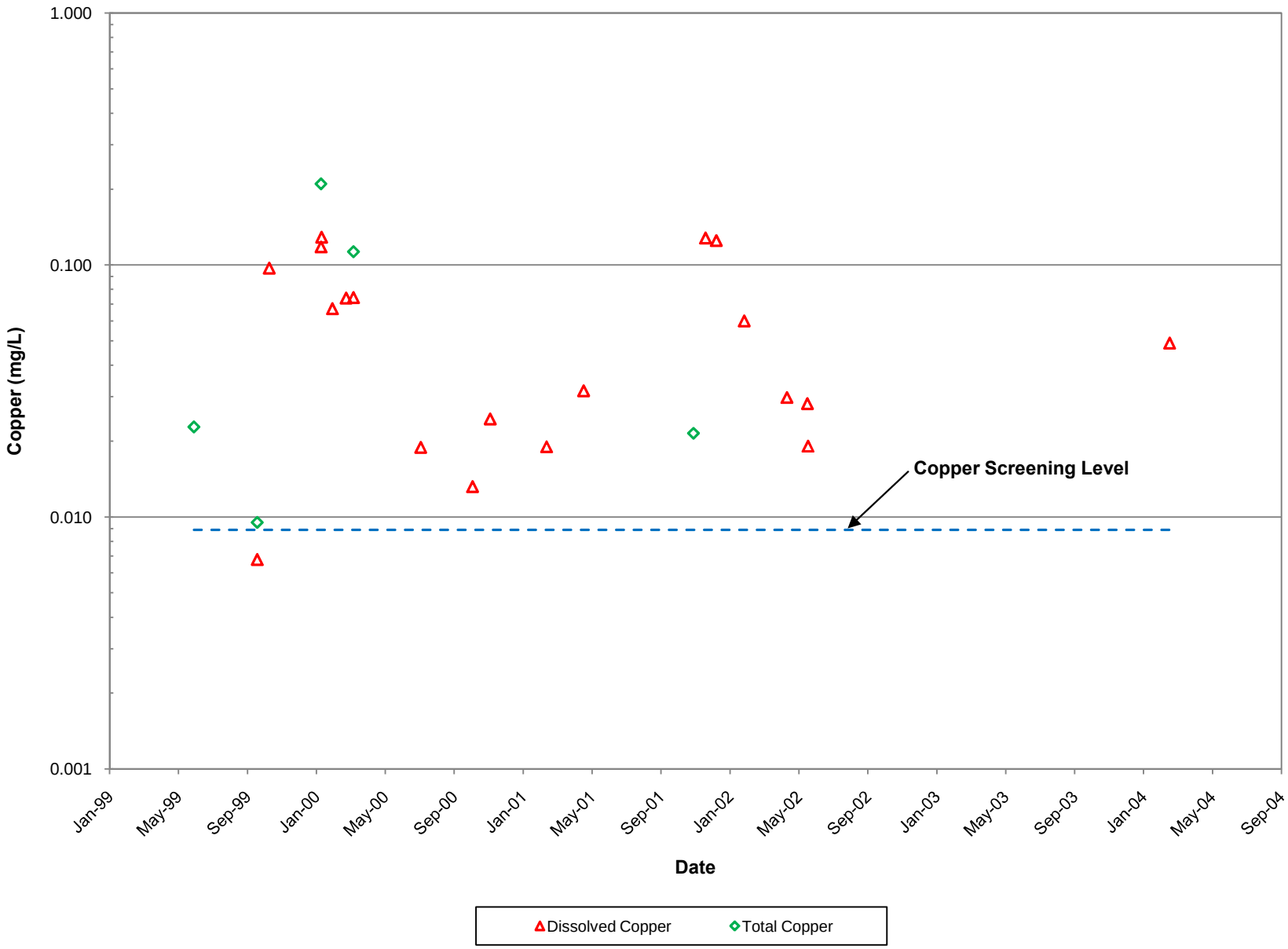

Figure 4-47
Location M3.0
Historic Copper Concentrations

CDM

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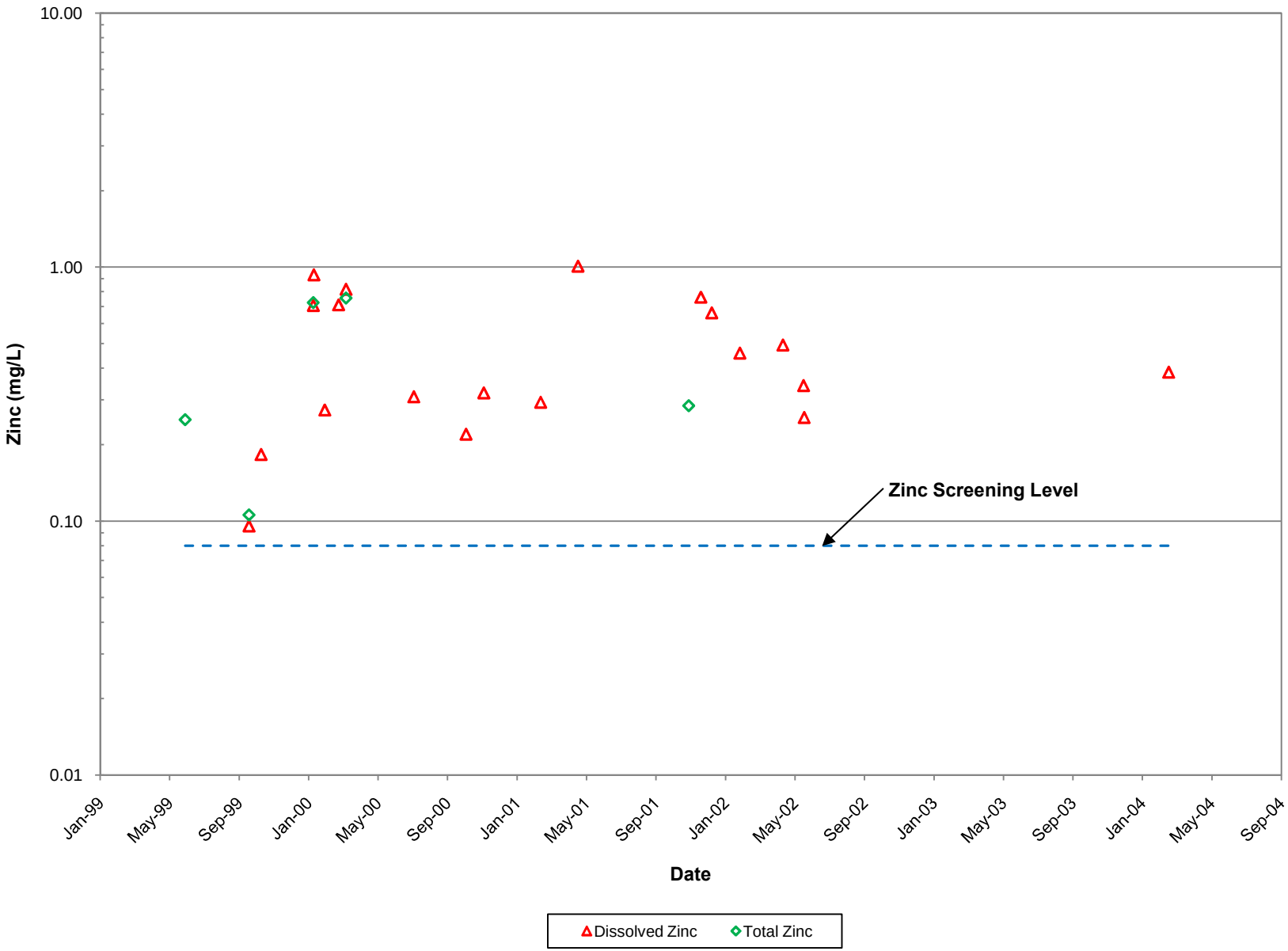

Figure 4-48
Location M3.0
Historic Zinc Concentrations

CDM

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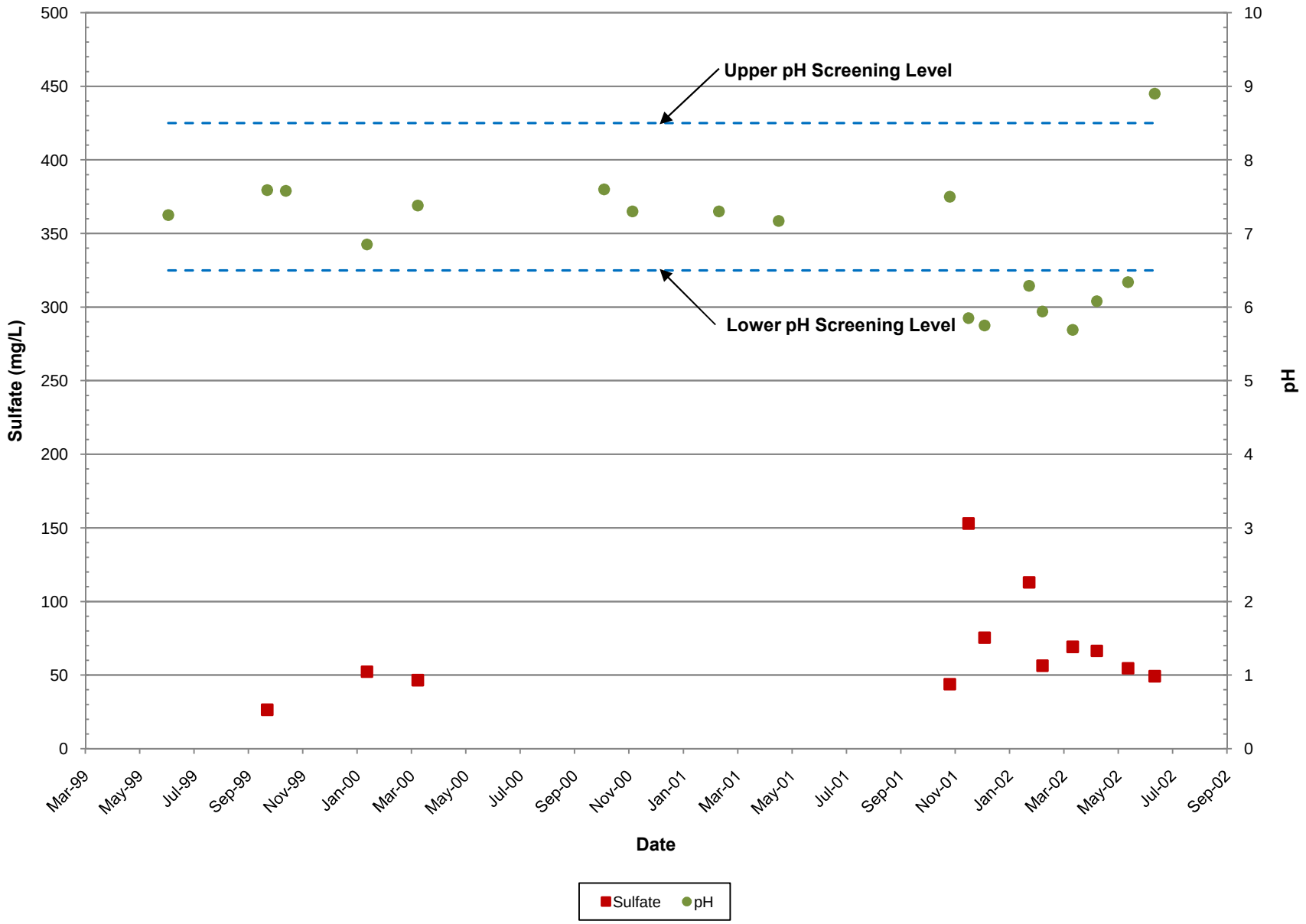

Figure 4-49
Location SF1.0
Historic pH and Sulfate Concentrations

CDM

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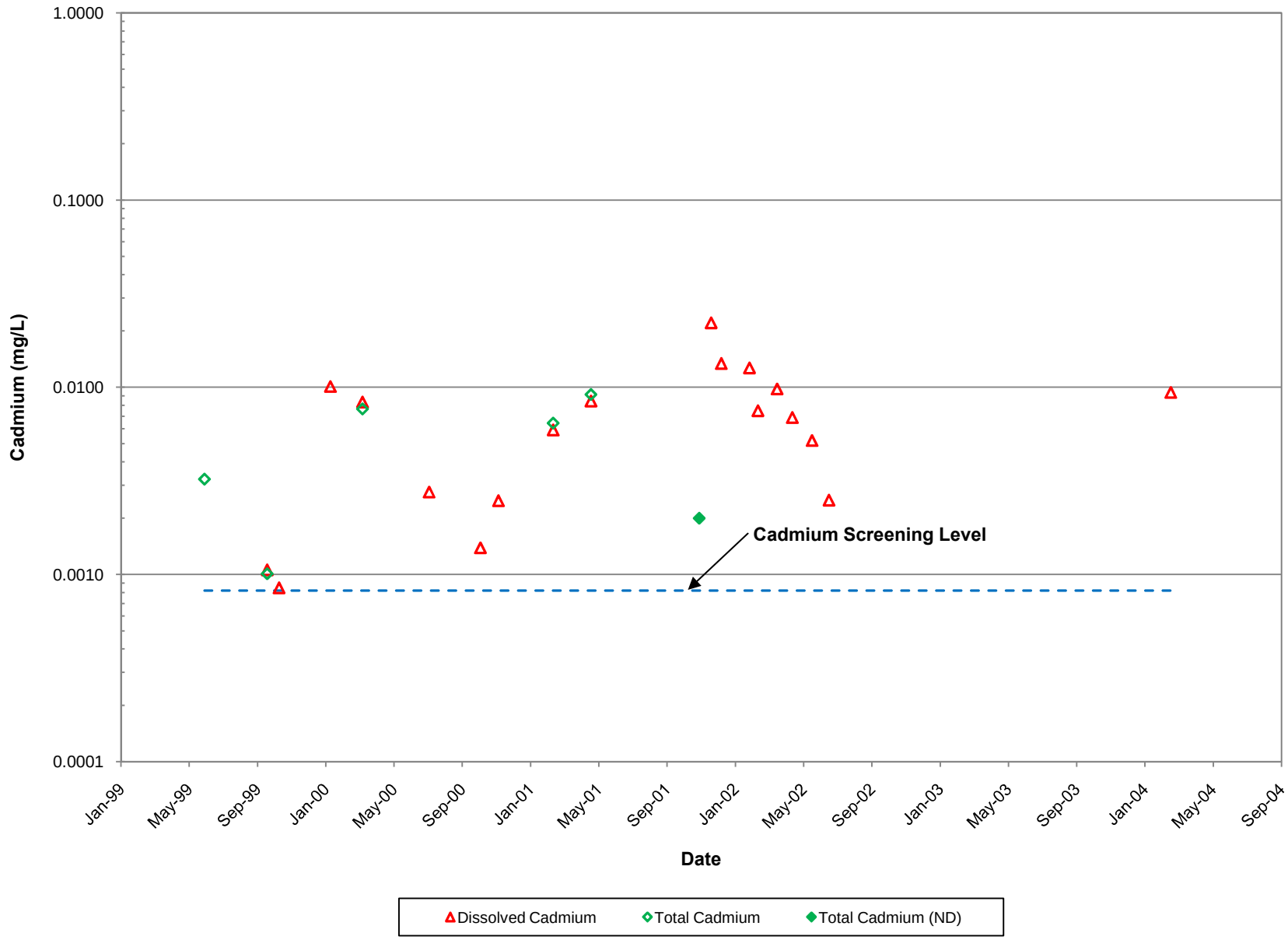

Figure 4-50
Location SF1.0
Historic Cadmium Concentrations

CDM

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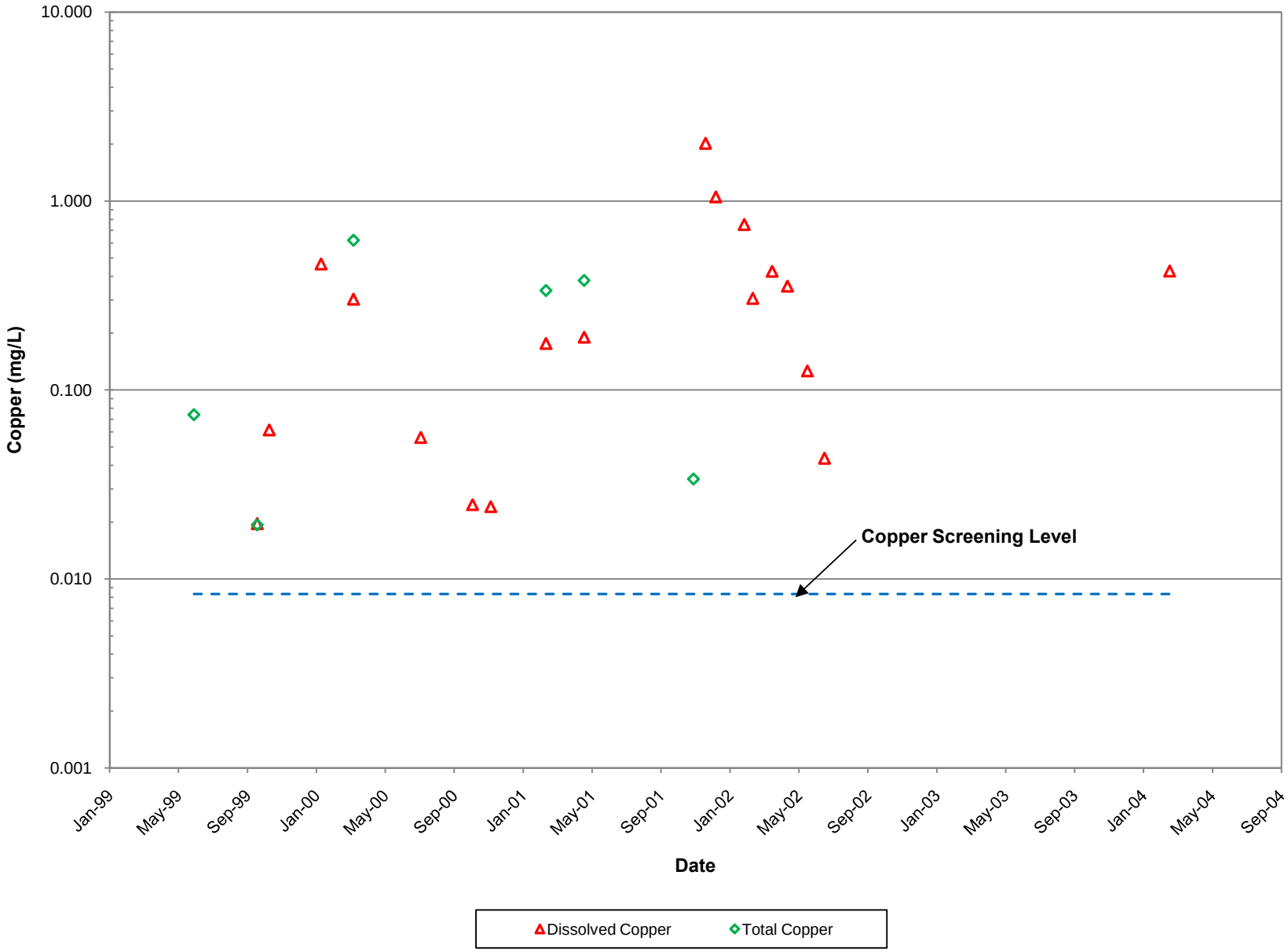

Figure 4-51
Location SF1.0
Historic Copper Concentrations

CDM

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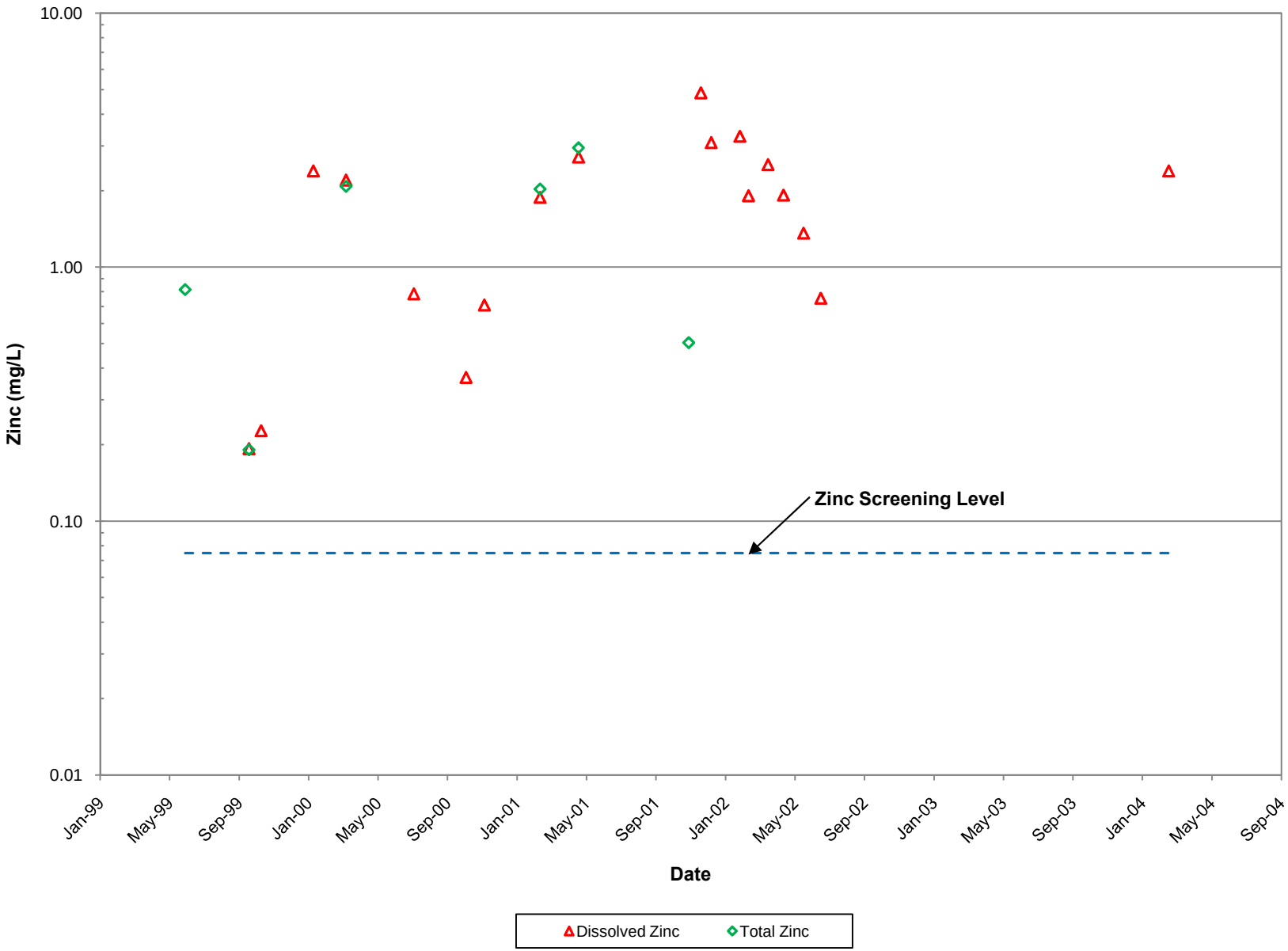

Figure 4-52
Location SF1.0
Historic Zinc Concentrations

CDM

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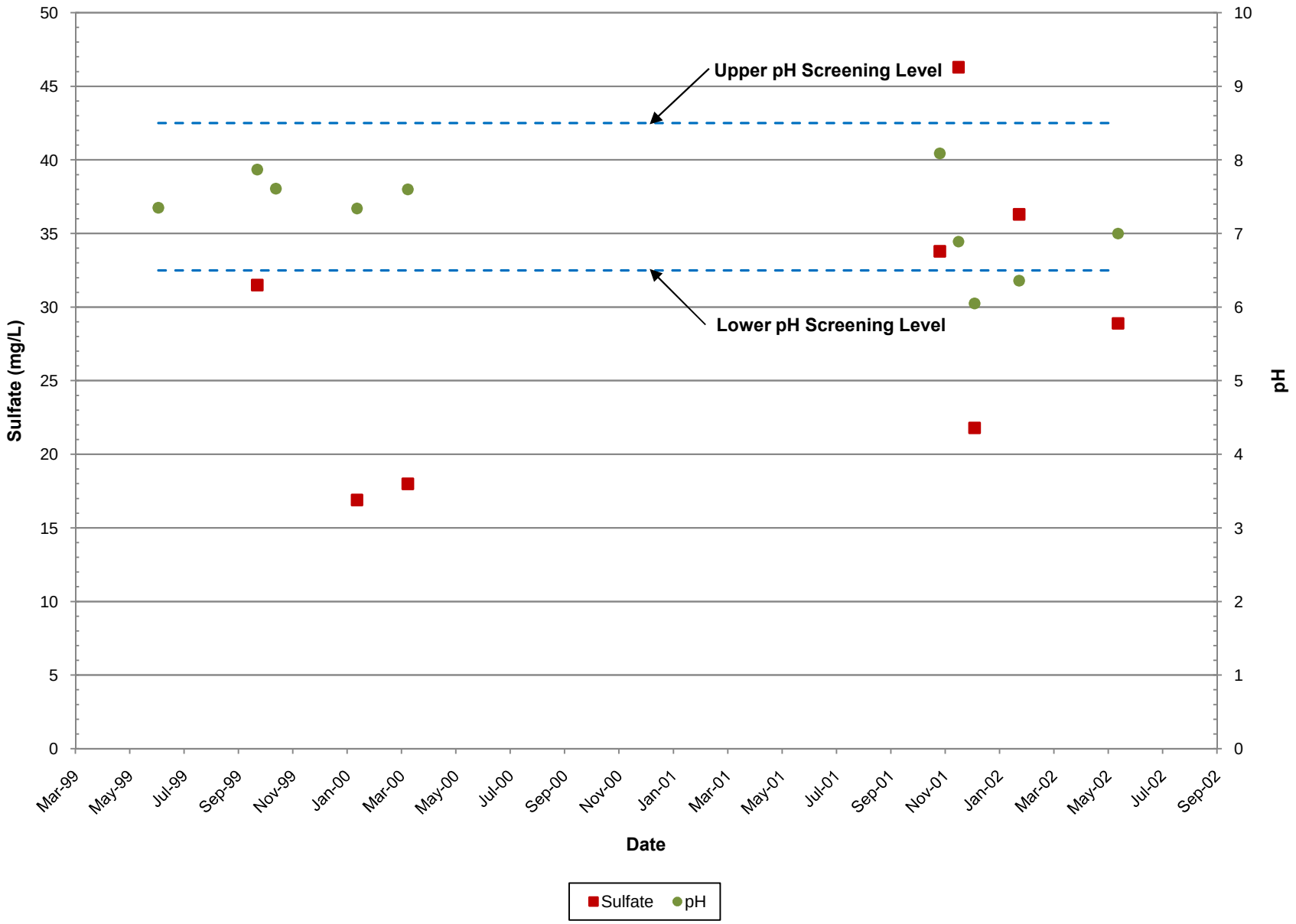

Figure 4-53
Location SF3.0
Historic pH and Sulfate Concentrations

CDM

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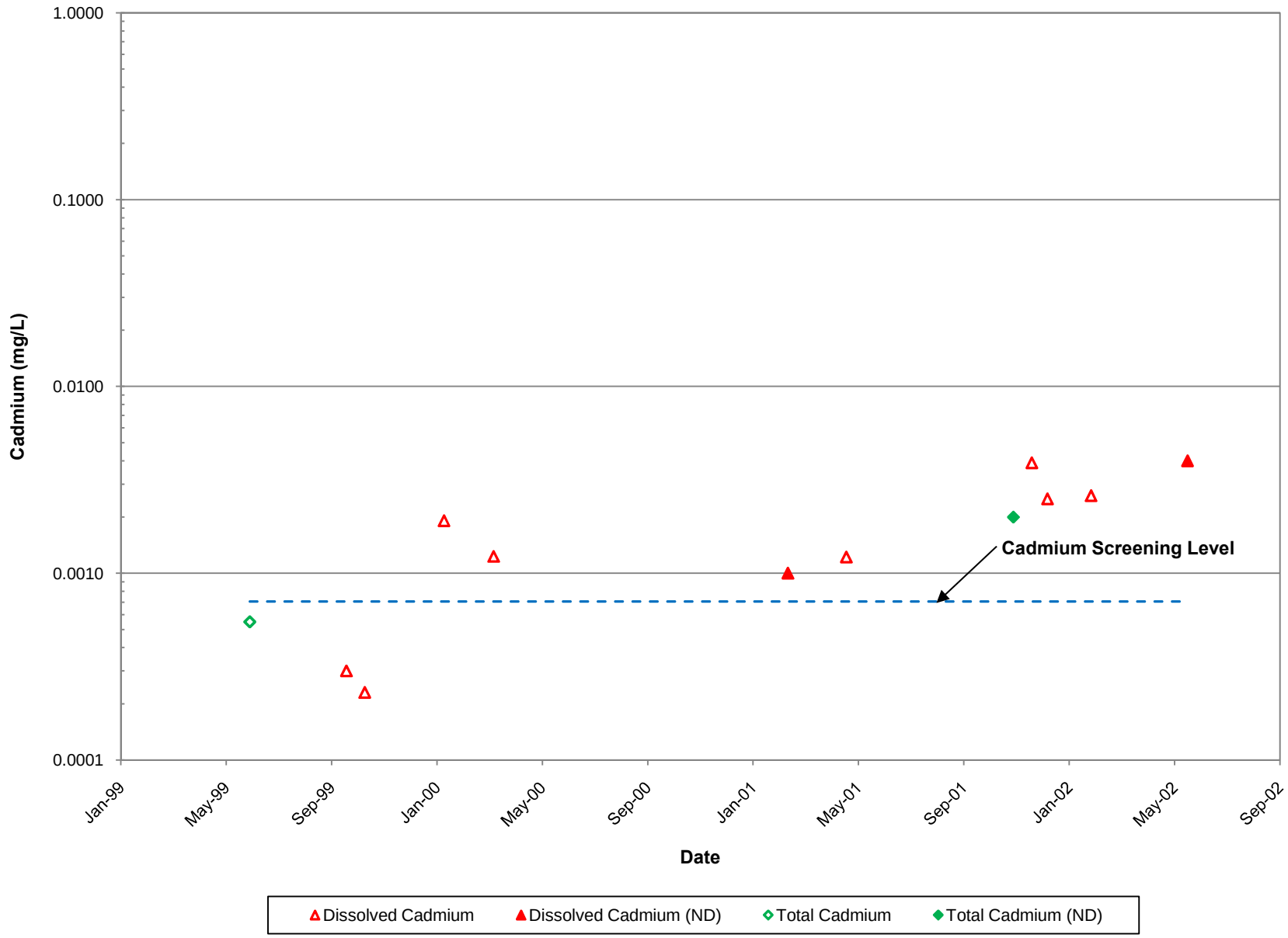

Figure 4-54
Location SF3.0
Historic Cadmium Concentrations

CDM

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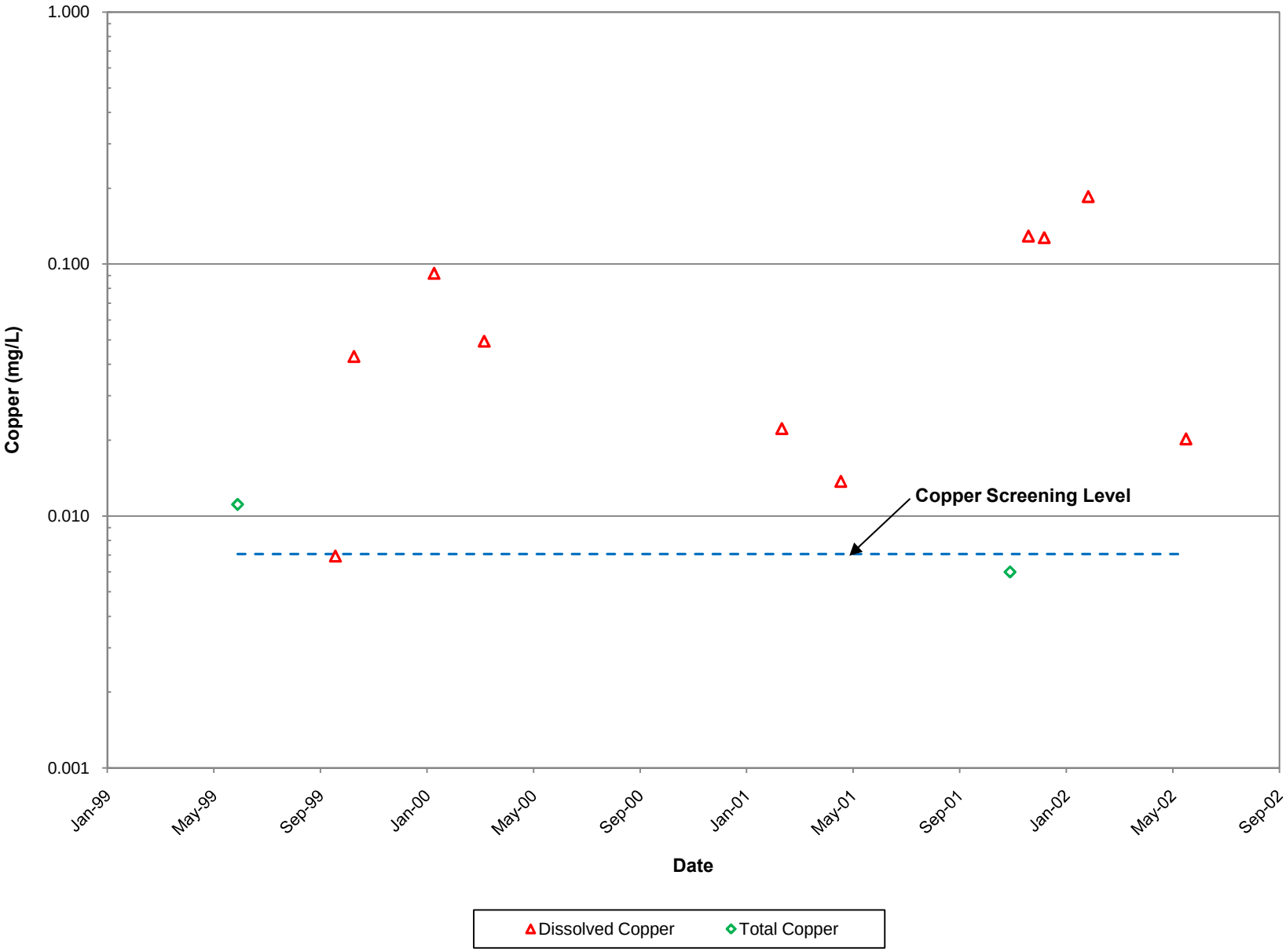

Figure 4-55
Location SF3.0
Historic Copper Concentrations

CDM

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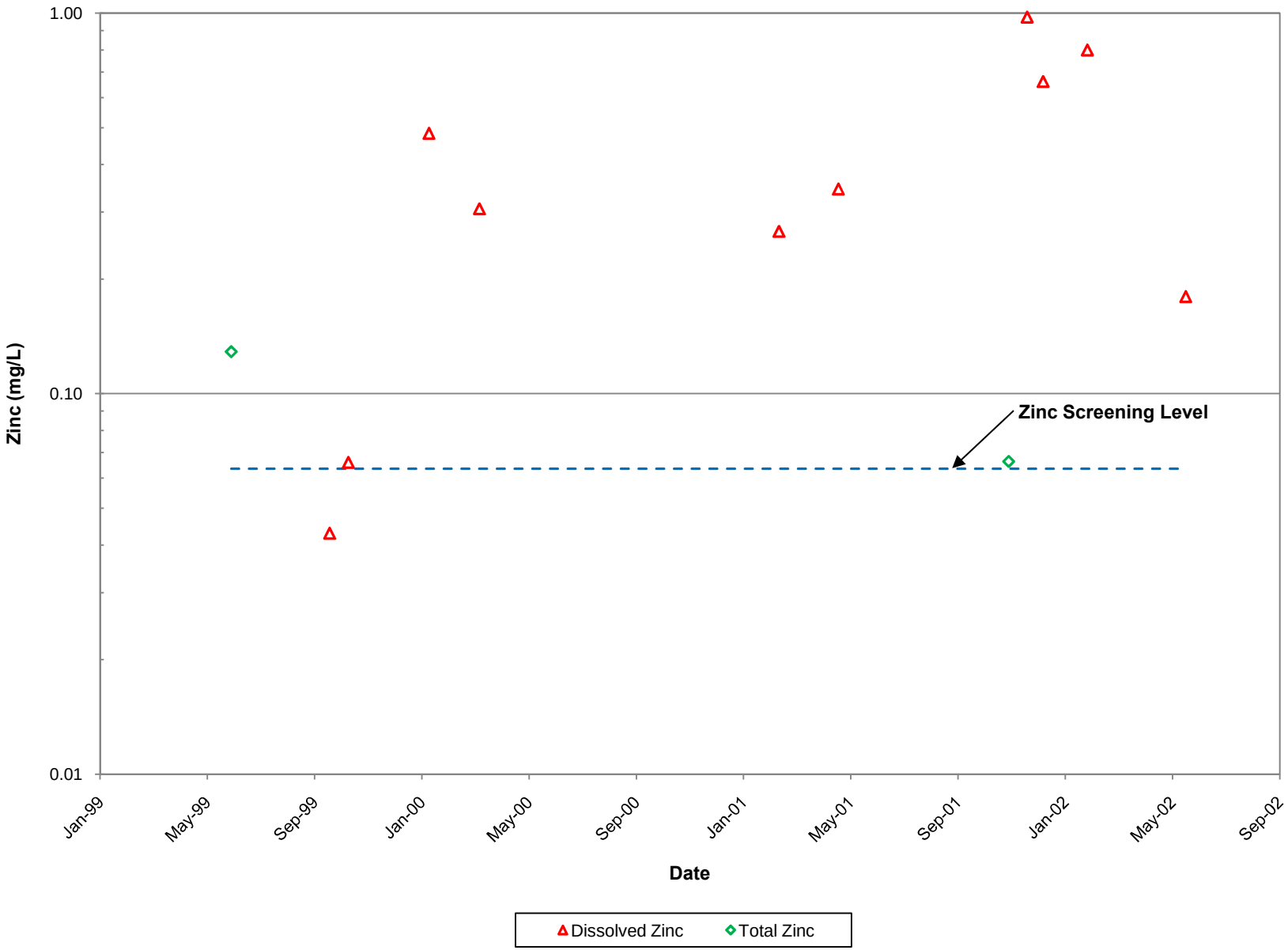

Figure 4-56
Location SF3.0
Historic Zinc Concentrations

CDM

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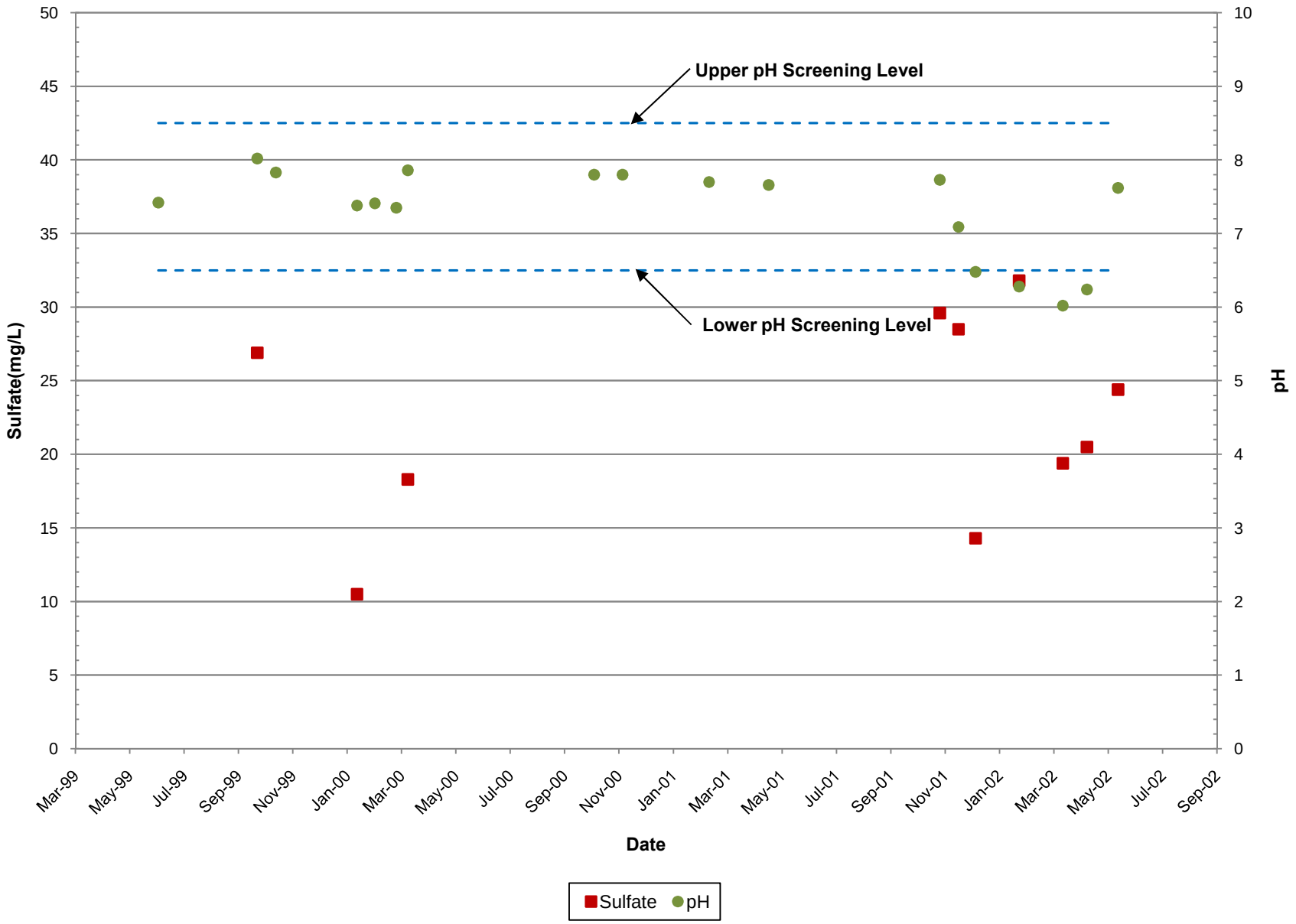

Figure 4-57
Location SF4.7
Historic pH and Sulfate Concentrations

CDM

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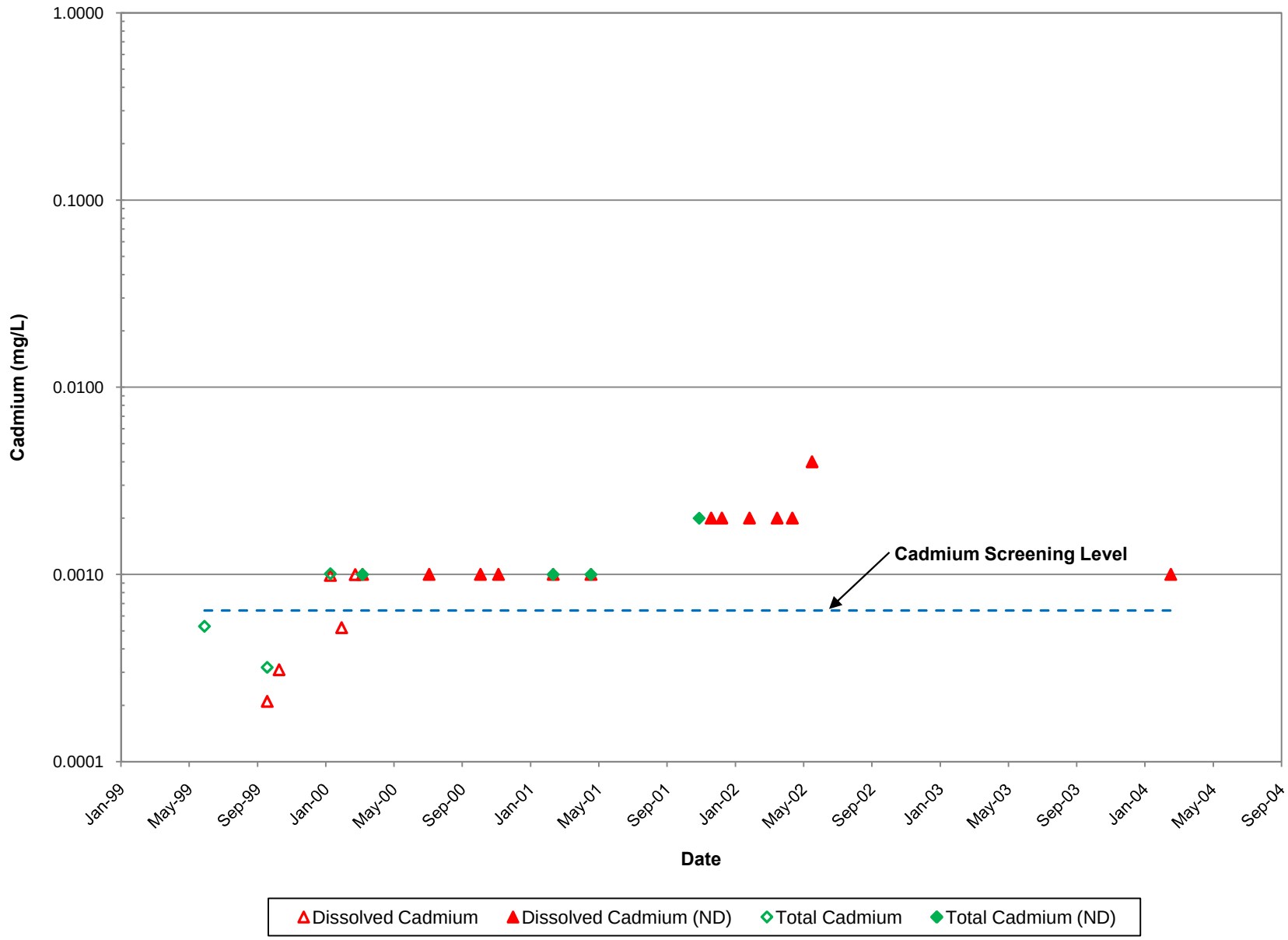

Figure 4-58
Location SF4.7
Historic Cadmium Concentrations

CDM

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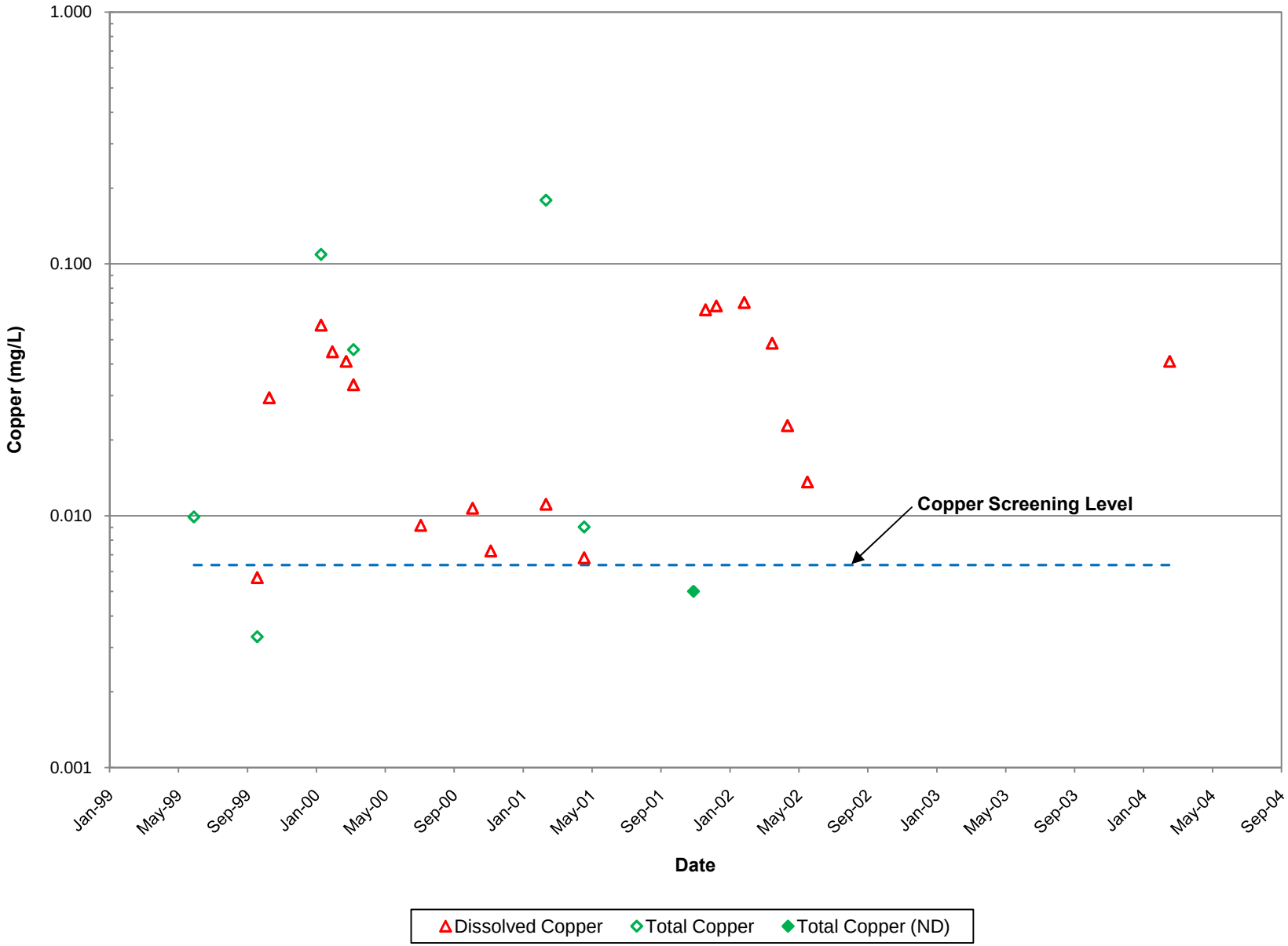

Figure 4-59
Location SF4.7
Historic Copper Concentrations

CDM

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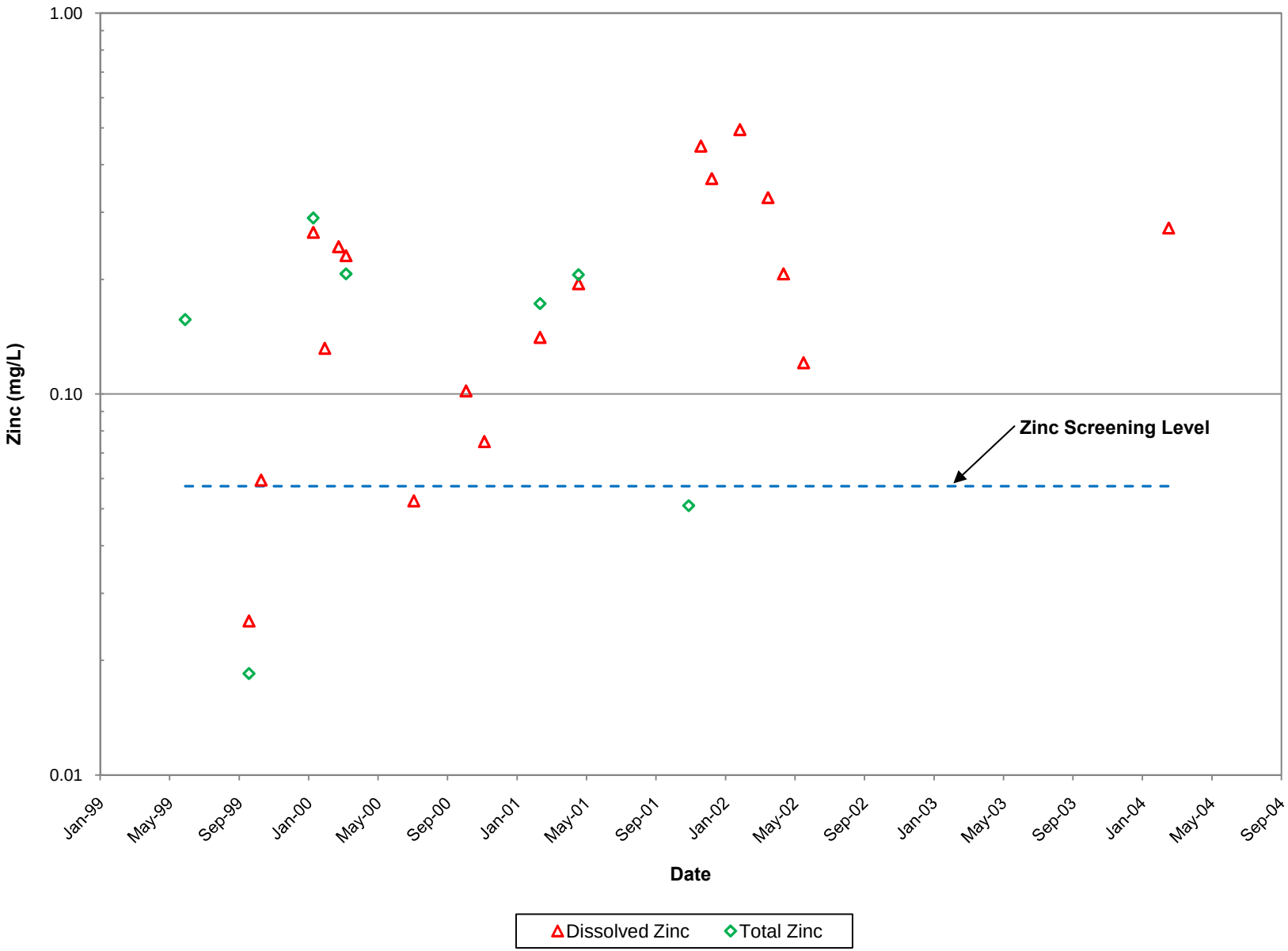

Figure 4-60
Location SF4.7
Historic Zinc Concentrations

CDM

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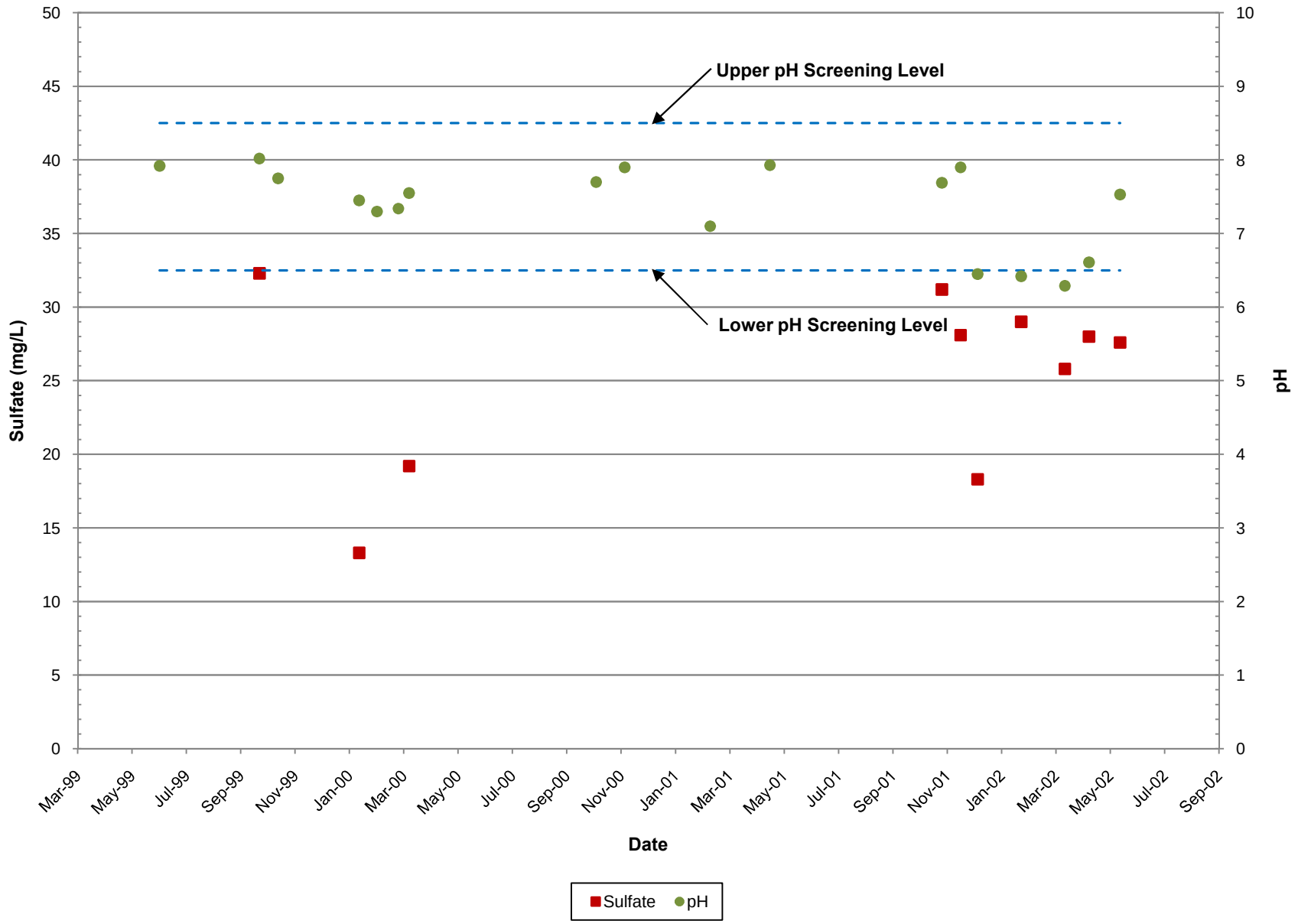

Figure 4-61
Location M3.1
Historic pH and Sulfate Concentrations

CDM

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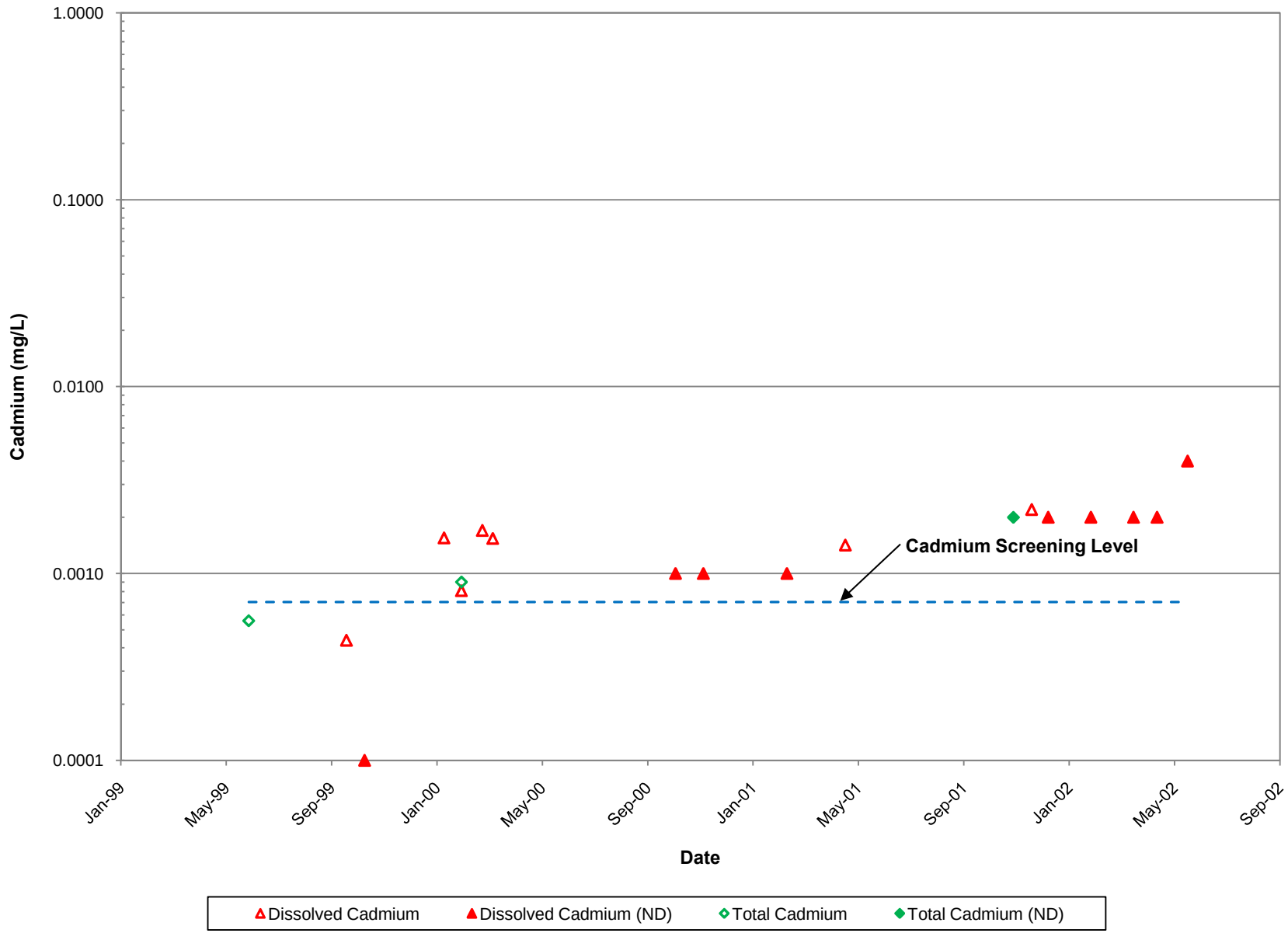

Figure 4-62
Location M3.1
Historic Cadmium Concentrations

CDM

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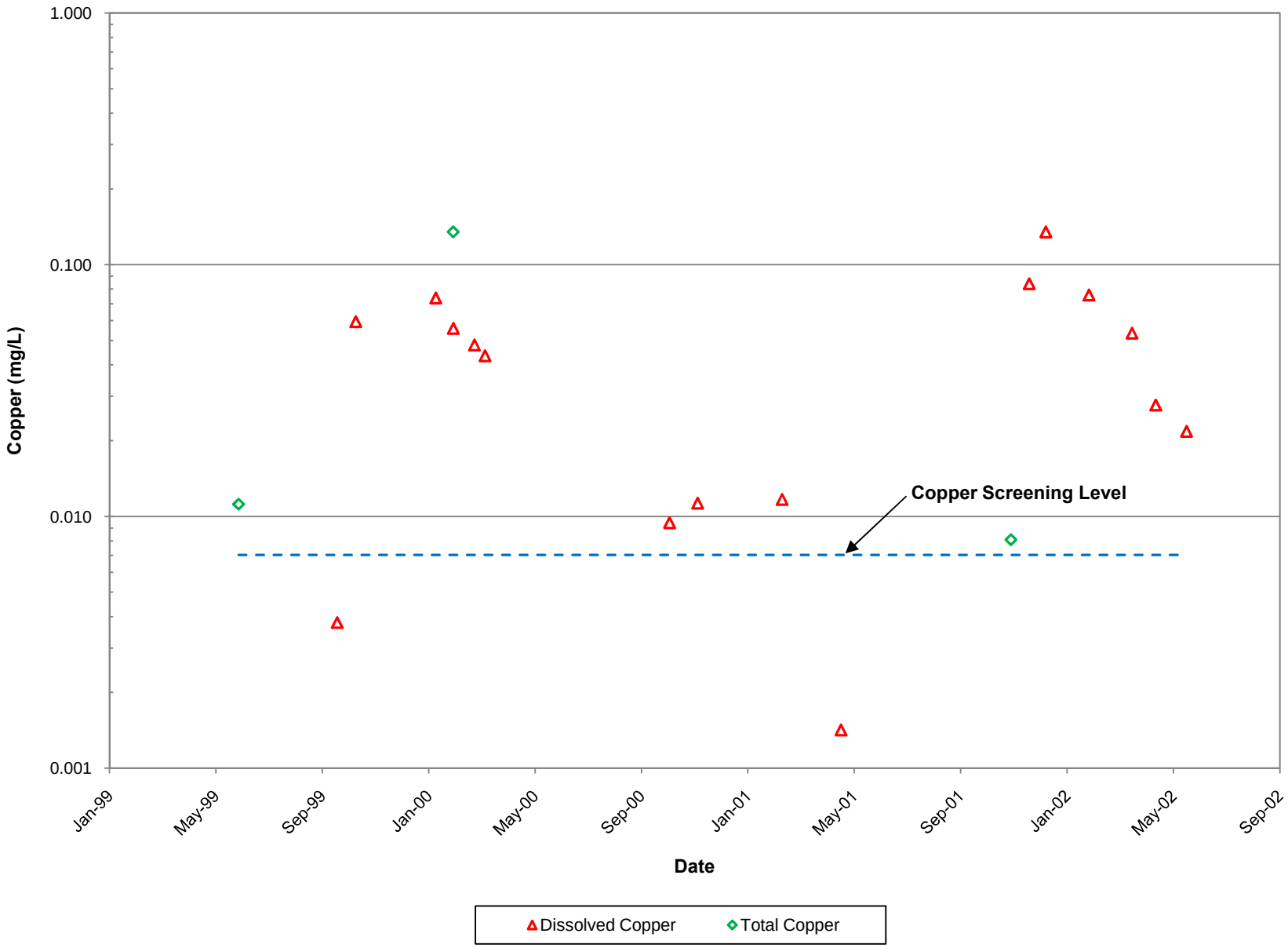

Figure 4-63
Location M3.1
Historic Copper Concentrations

CDM

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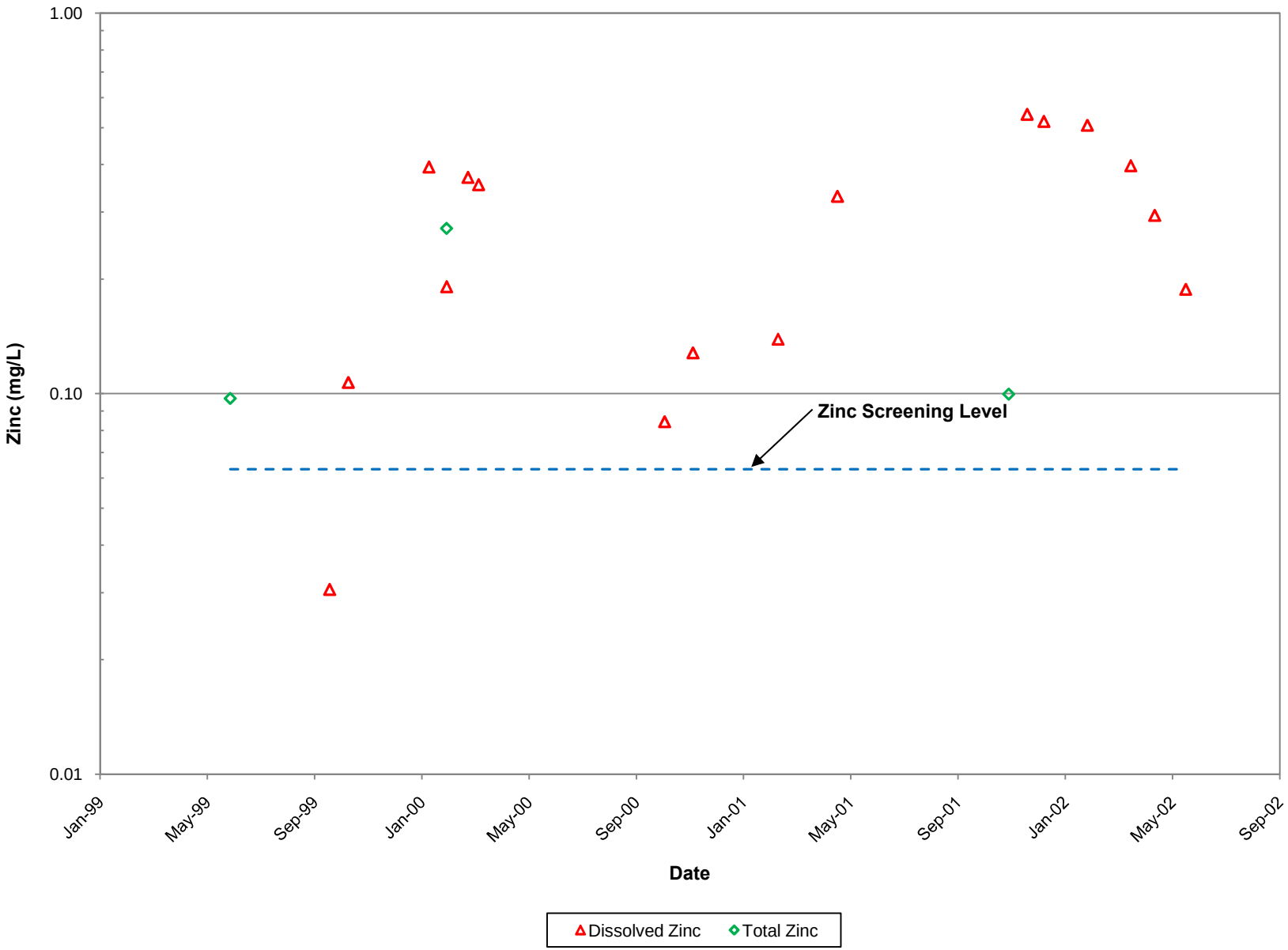

Figure 4-64
Location M3.1
Historic Zinc Concentrations

CDM

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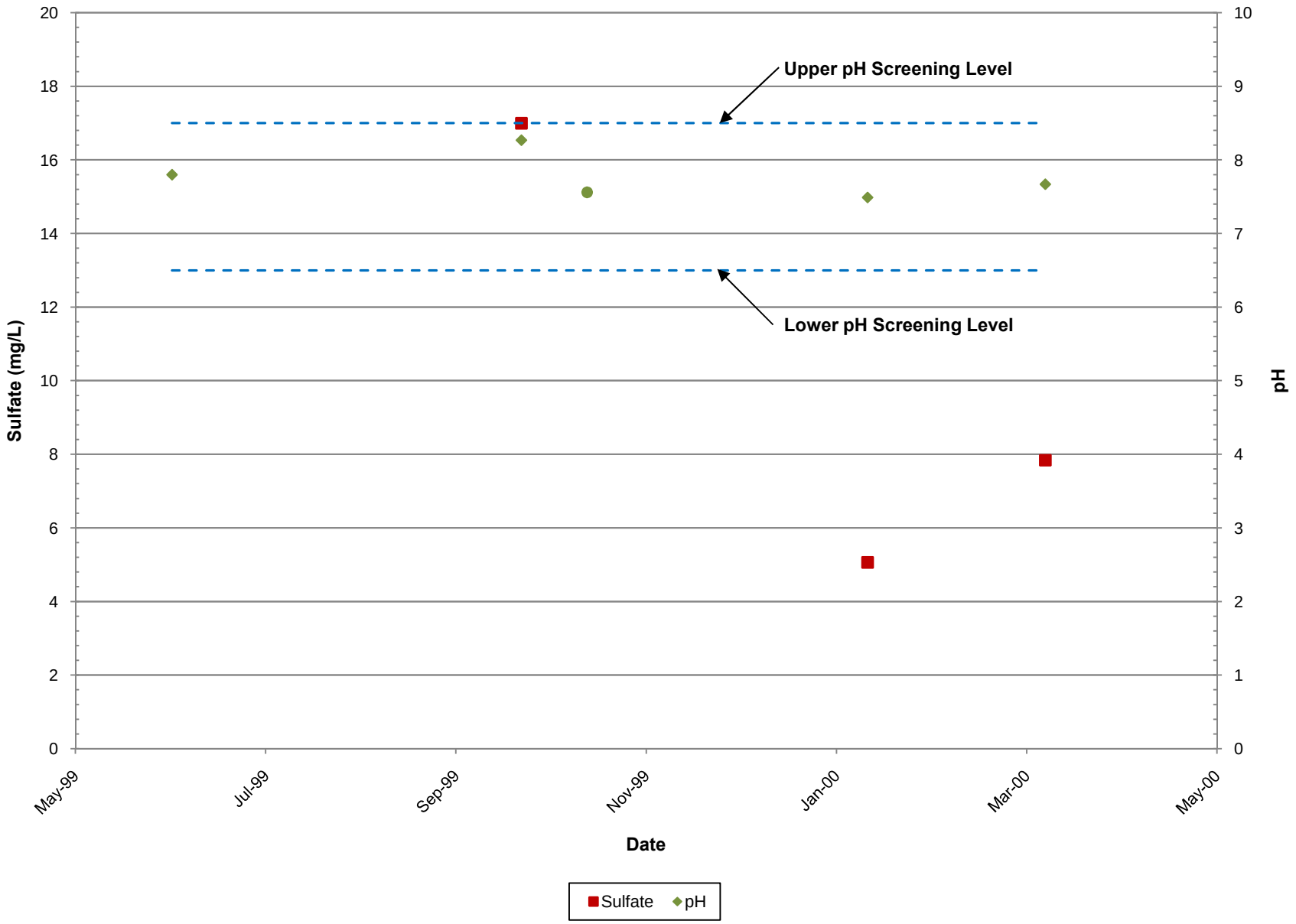

Figure 4-65
Location M13.0
Historic pH and Sulfate Concentrations

CDM

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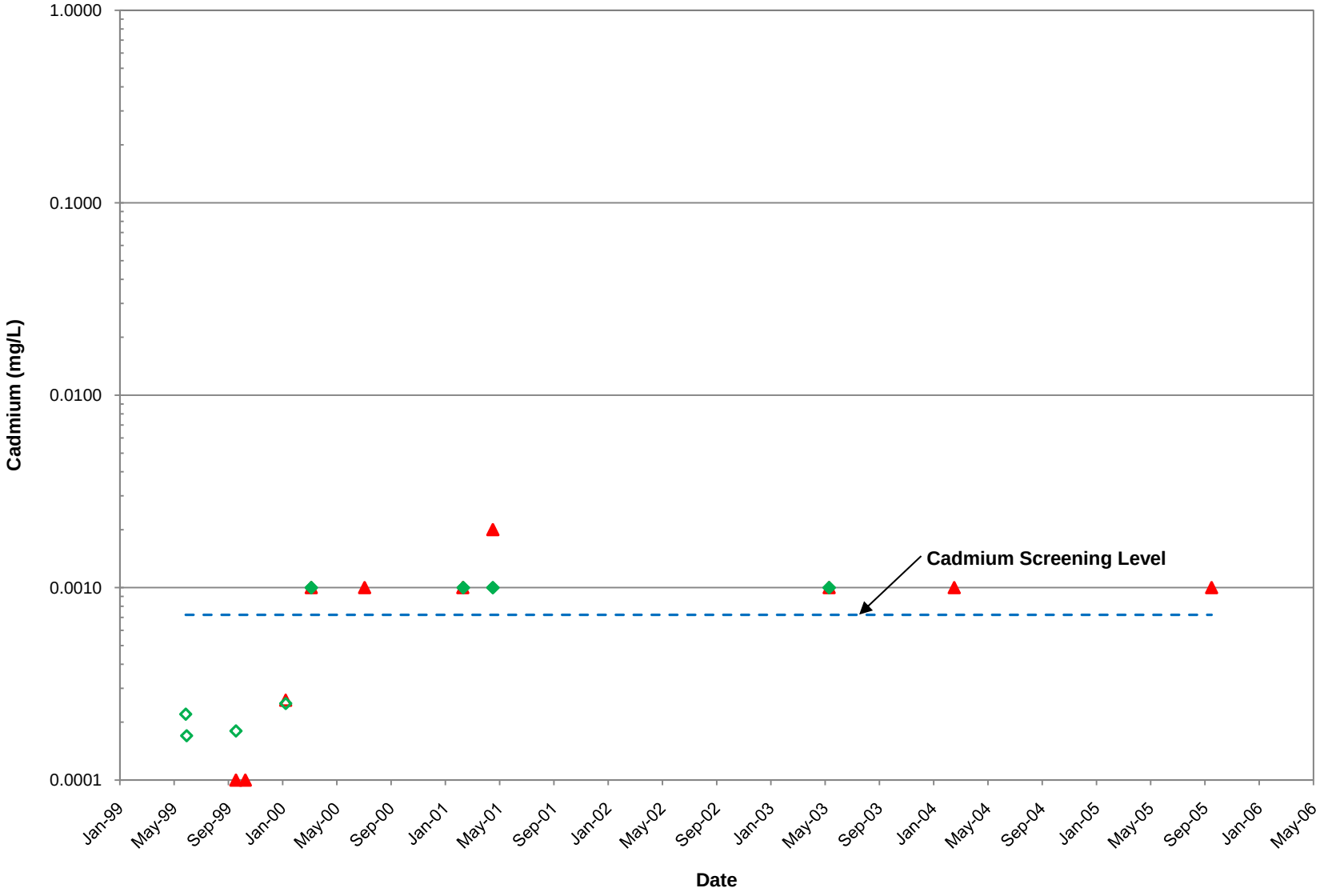

Figure 4-66
Location M13.0
Historic Cadmium Concentrations

CDM

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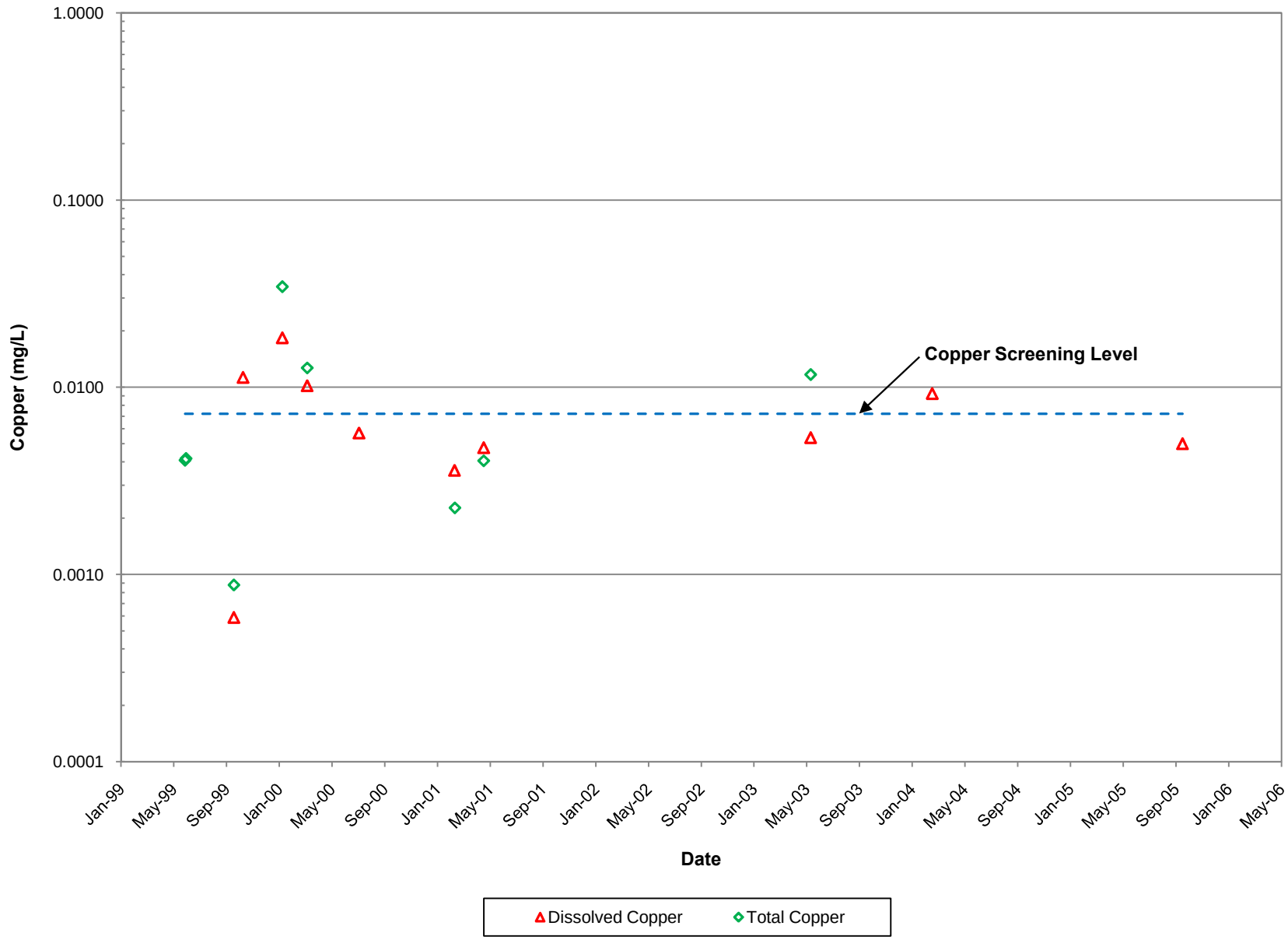

Figure 4-67
Location M13.0
Historic Copper Concentrations

CDM

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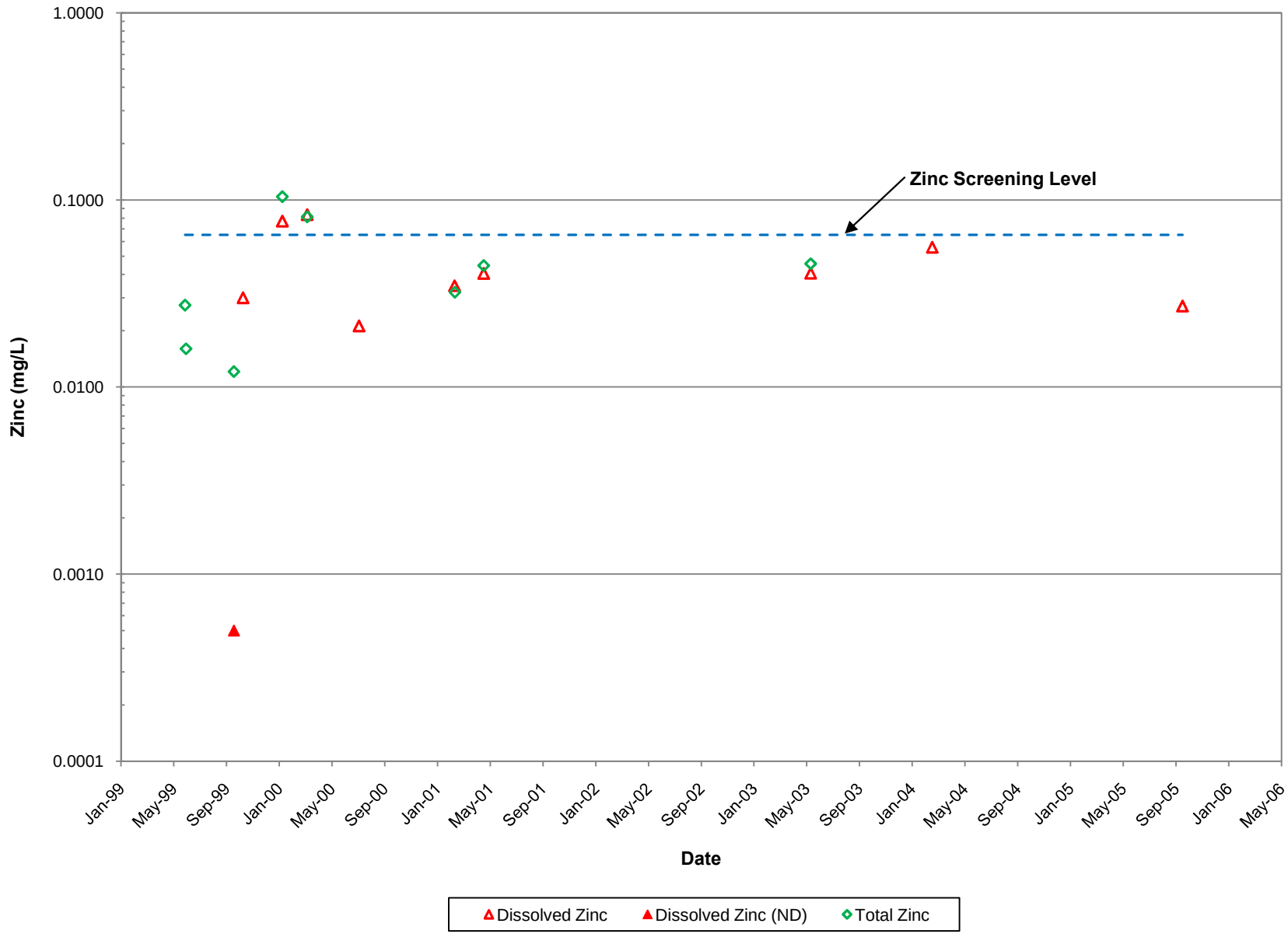

Figure 4-68
Location M13.0
Historic Zinc Concentrations

CDM

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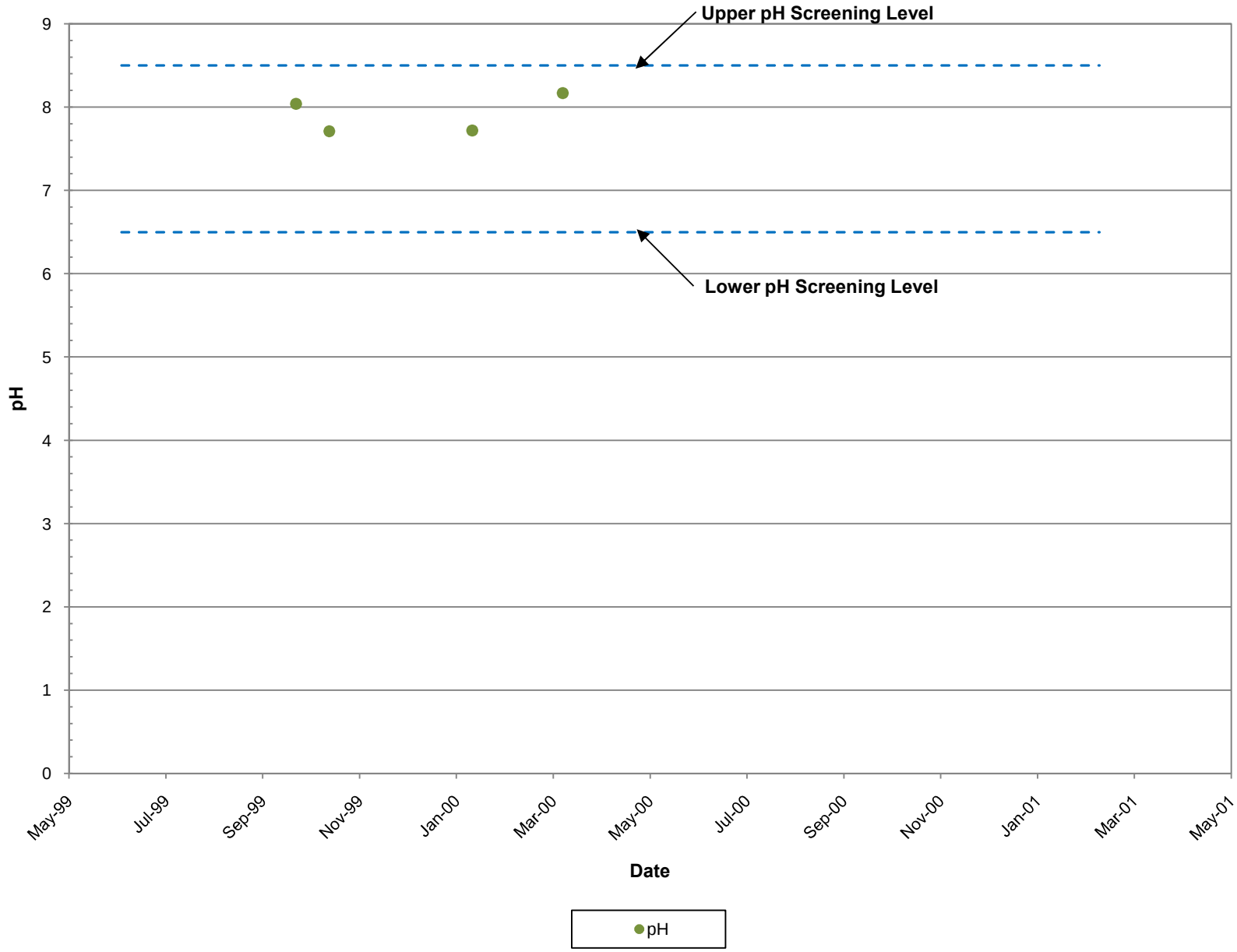

Figure 4-69
Location C1
Historic pH and Sulfate Concentrations

CDM

P:\3380-New RAC8\221 - Formosa\Data Summary Report\Figures\C1-SW.xls

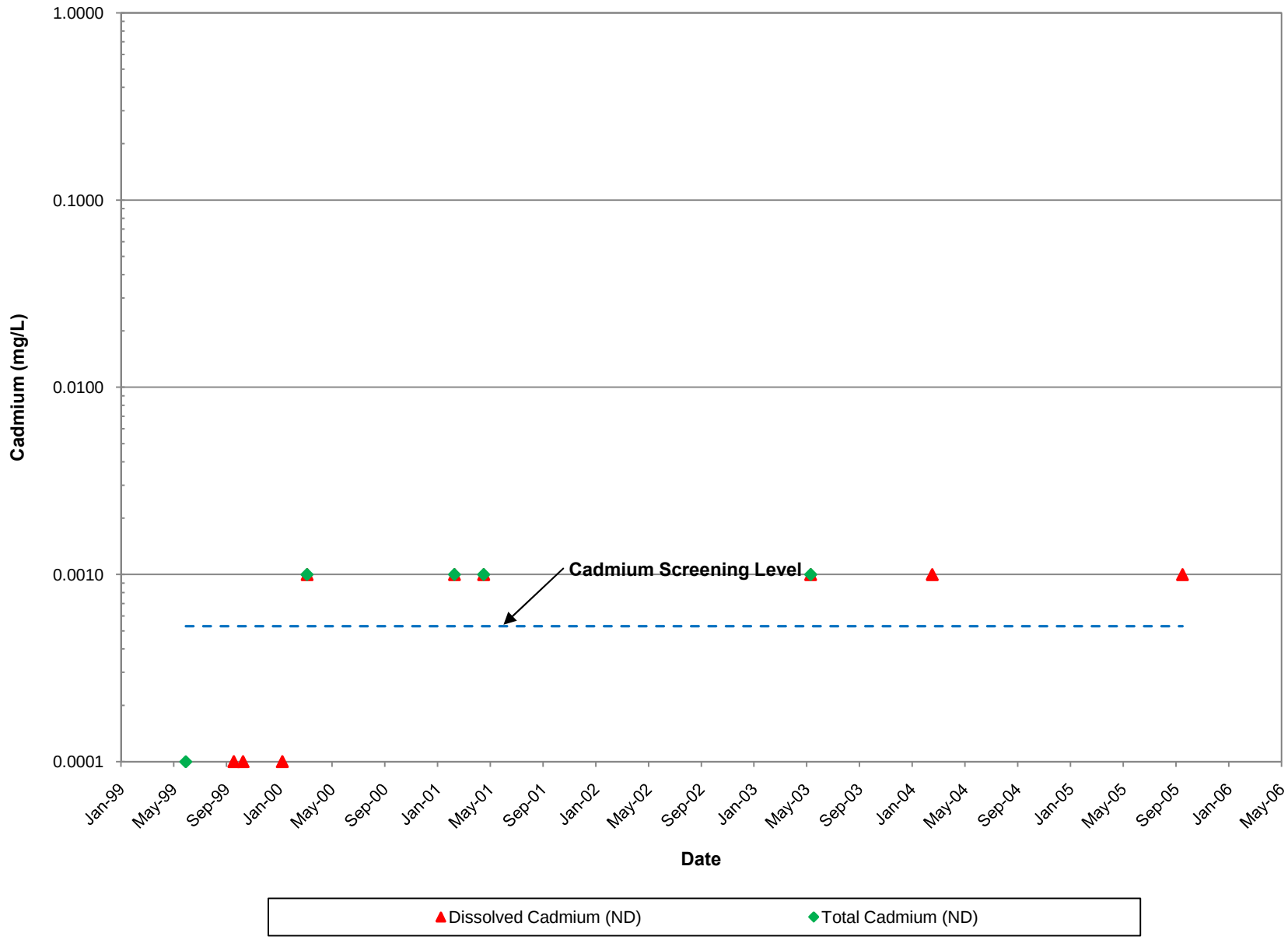

Figure 4-70
Location C1
Historic Cadmium Concentrations

CDM

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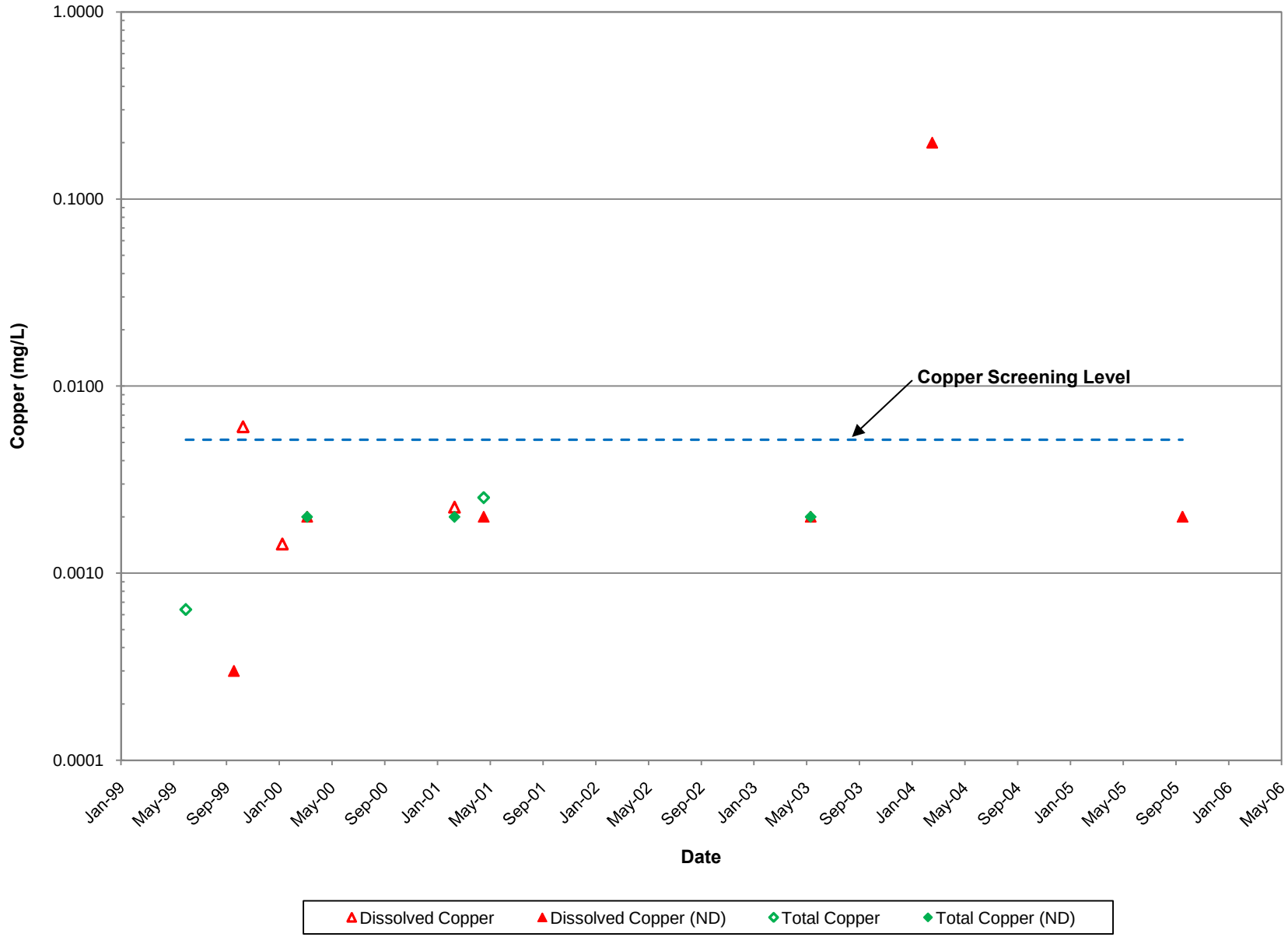

Figure 4-71
Location C1
Historic Copper Concentrations

CDM

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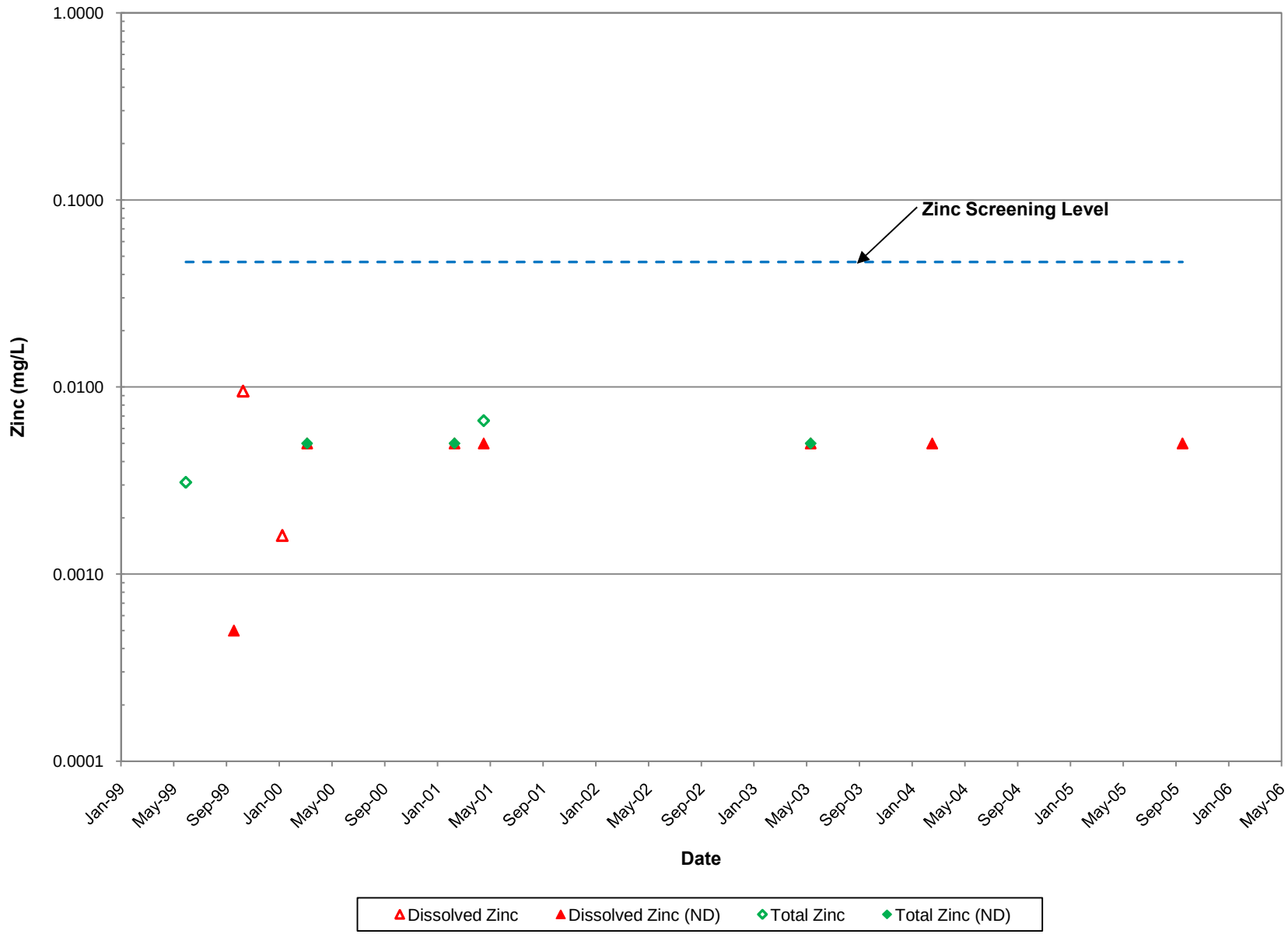

Figure 4-72
Location C1
Historic Zinc Concentrations

CDM

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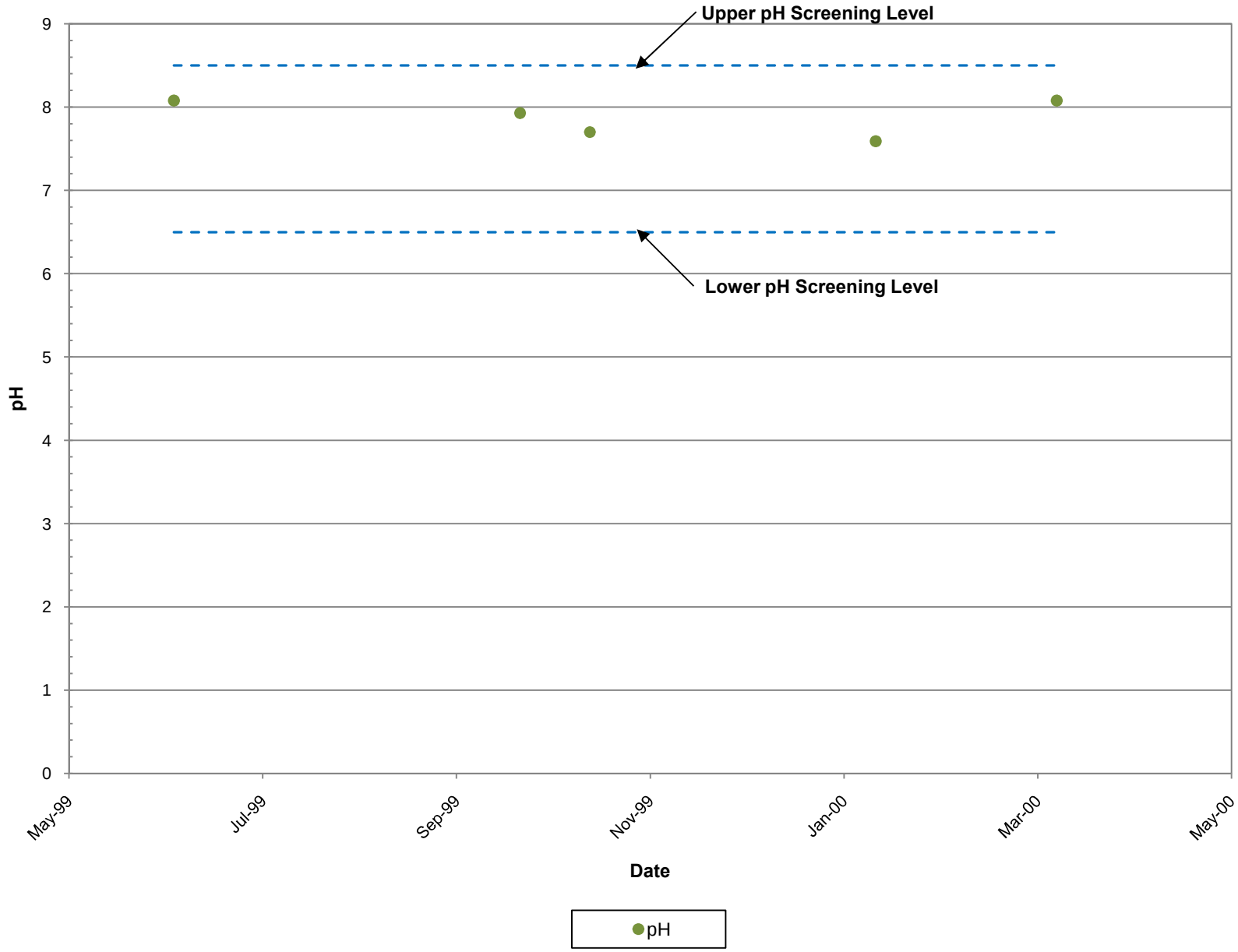

Figure 4-73
Location C2
Historic pH and Sulfate Concentrations

CDM

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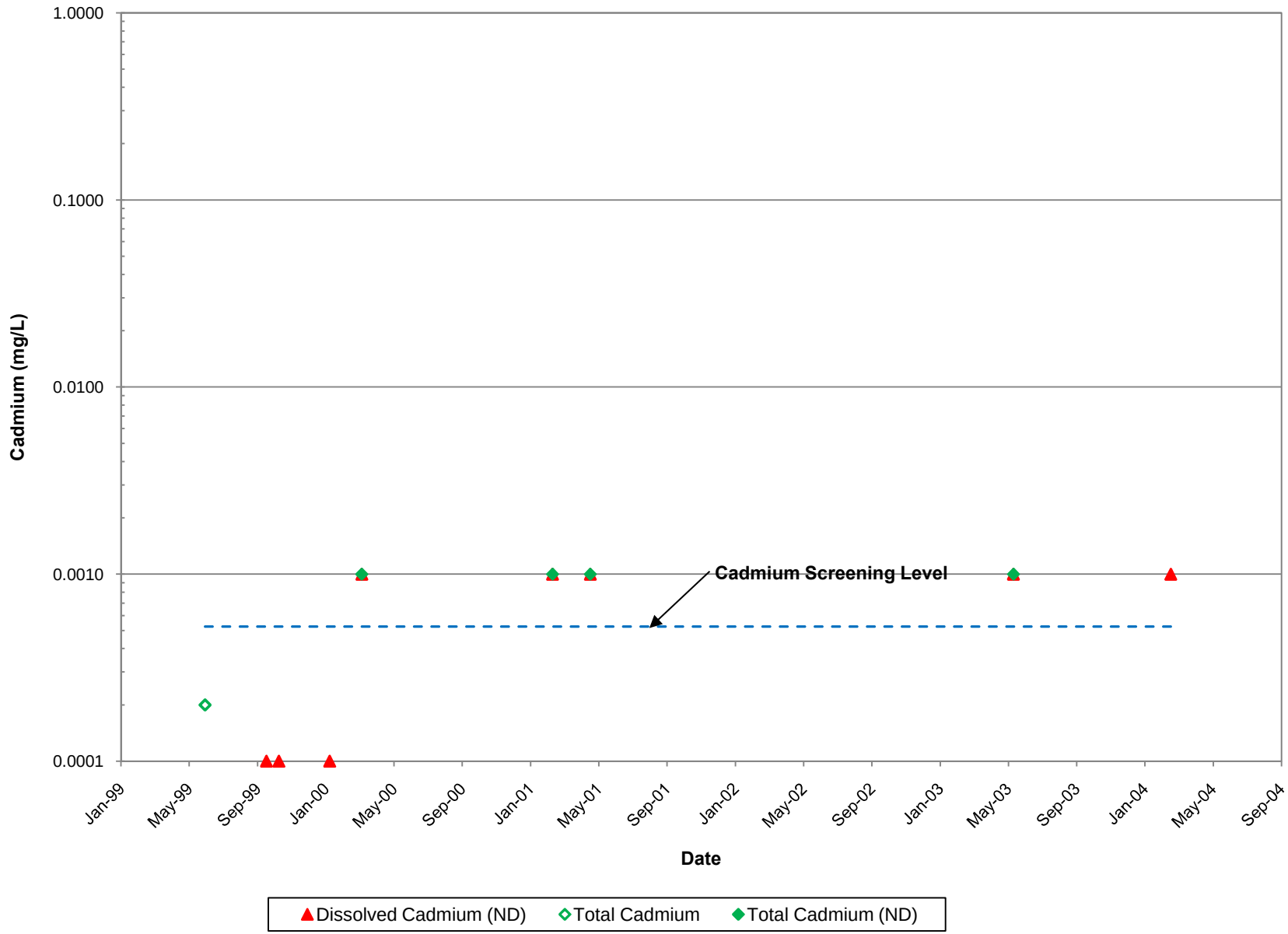

Figure 4-74
Location C2
Historic Cadmium Concentrations

CDM

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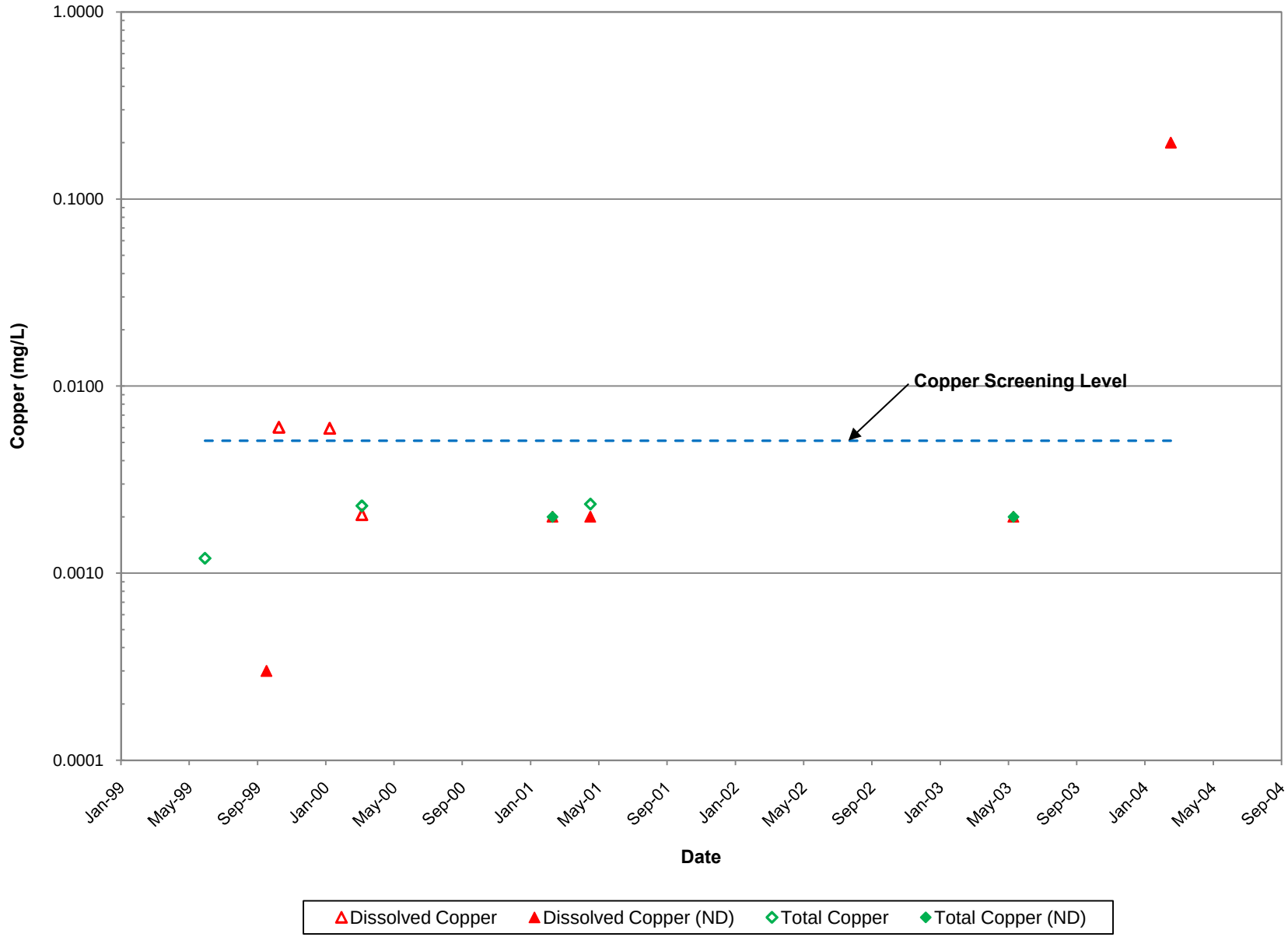

Figure 4-75
Location C2
Historic Copper Concentrations

CDM

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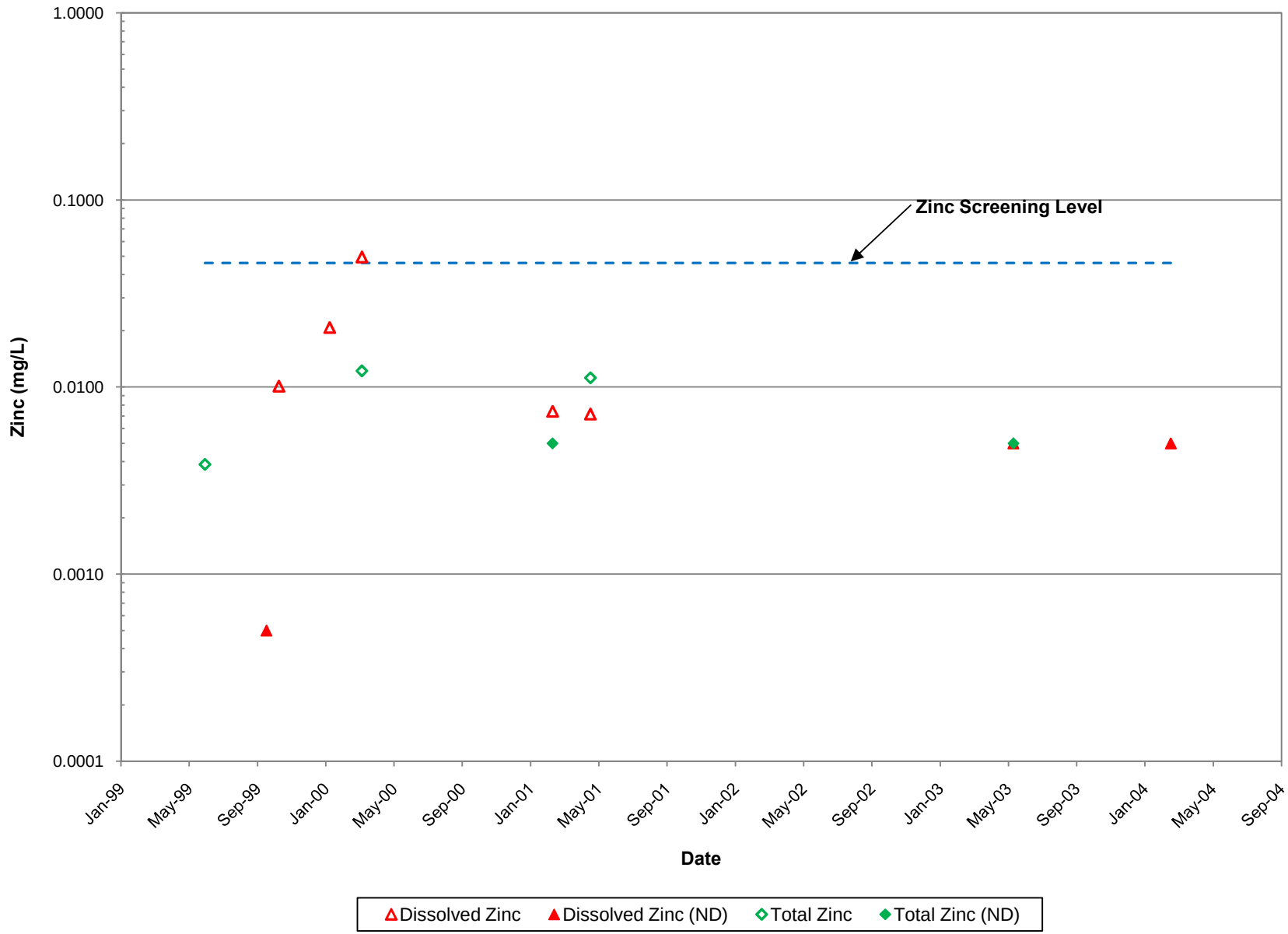

Figure 4-76
Location C2
Historic Zinc Concentrations

CDM

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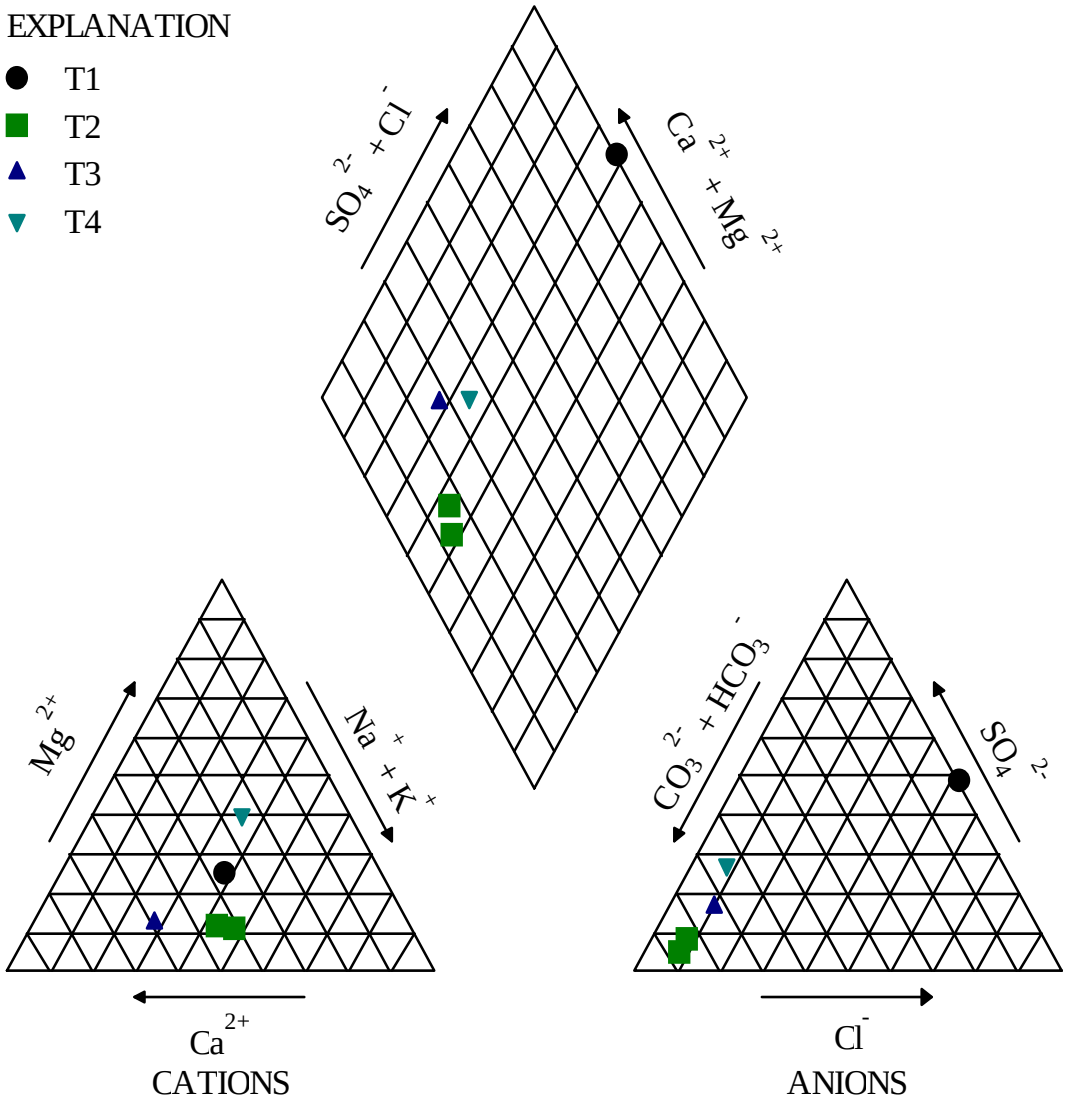
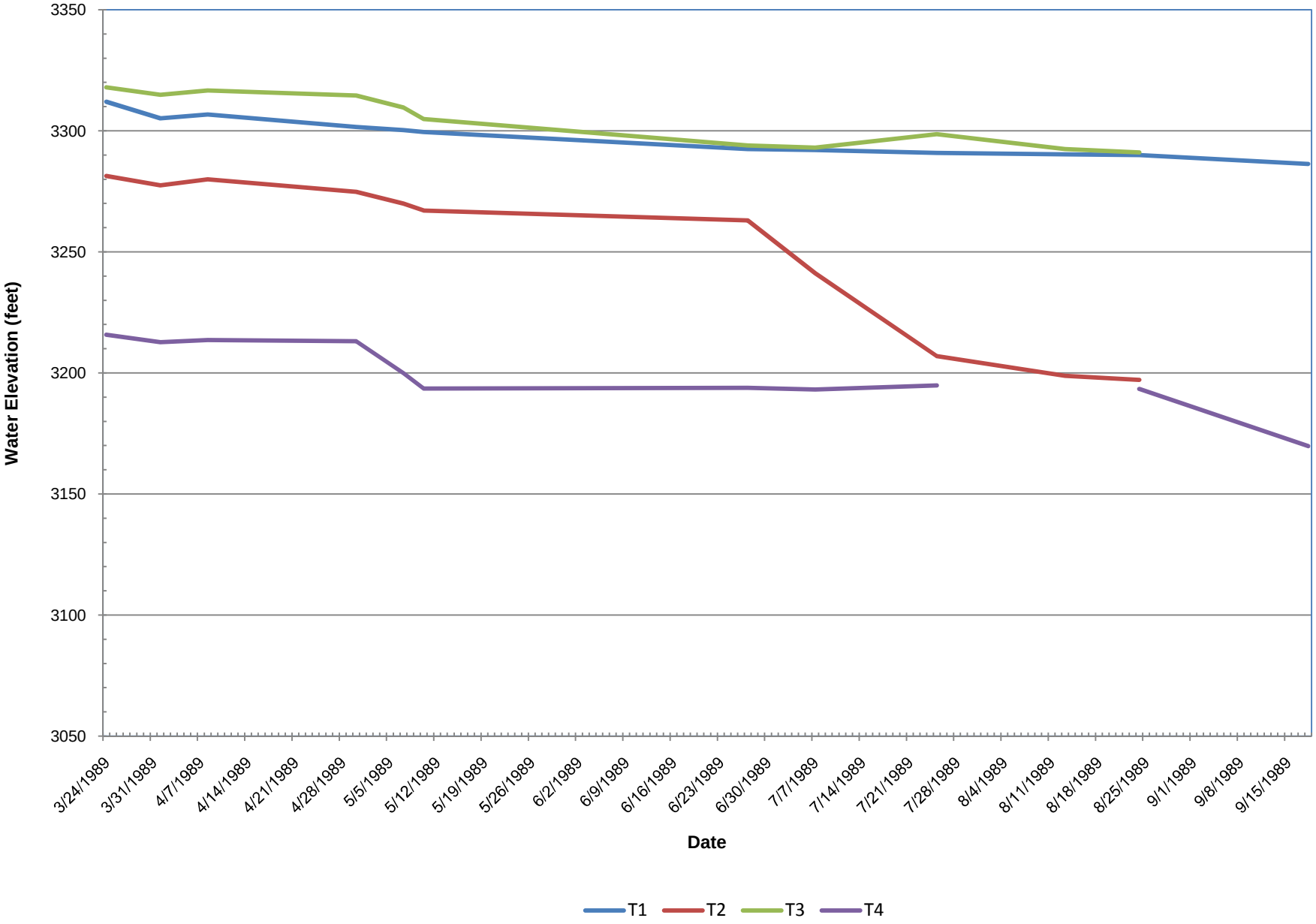


Figure 4-77. Piper Diagram Showing Pre-Mining Groundwater Quality at Encapsulation Mound Area.



CDM

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Figure 4-78

Pre-Mining Water level Data in Encapsulation Mound Area

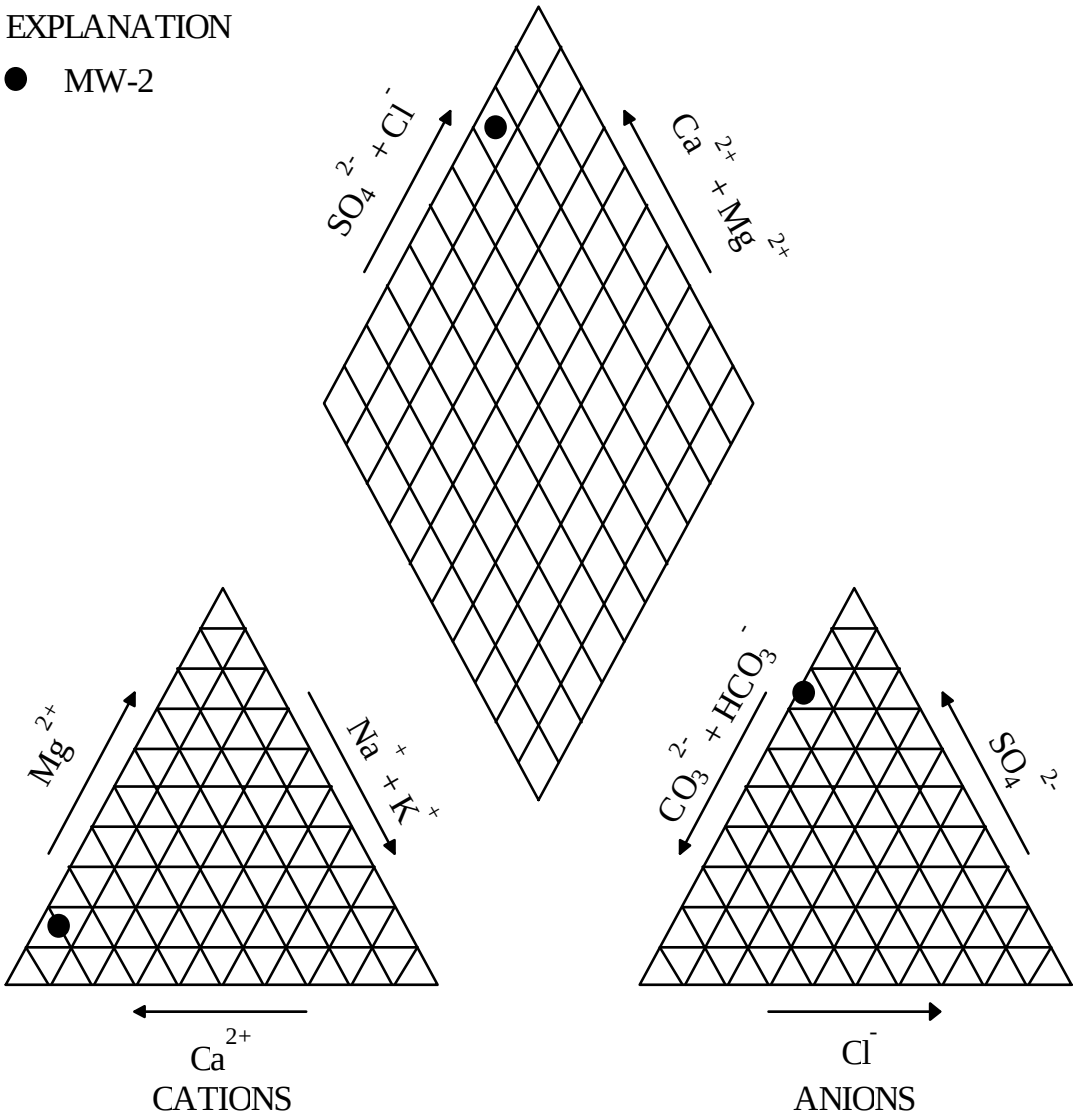

Figure 4-79. Piper Diagram Showing Post-Mining Groundwater Quality at MW-2, which is Located Near the Formosa #1 Adit.

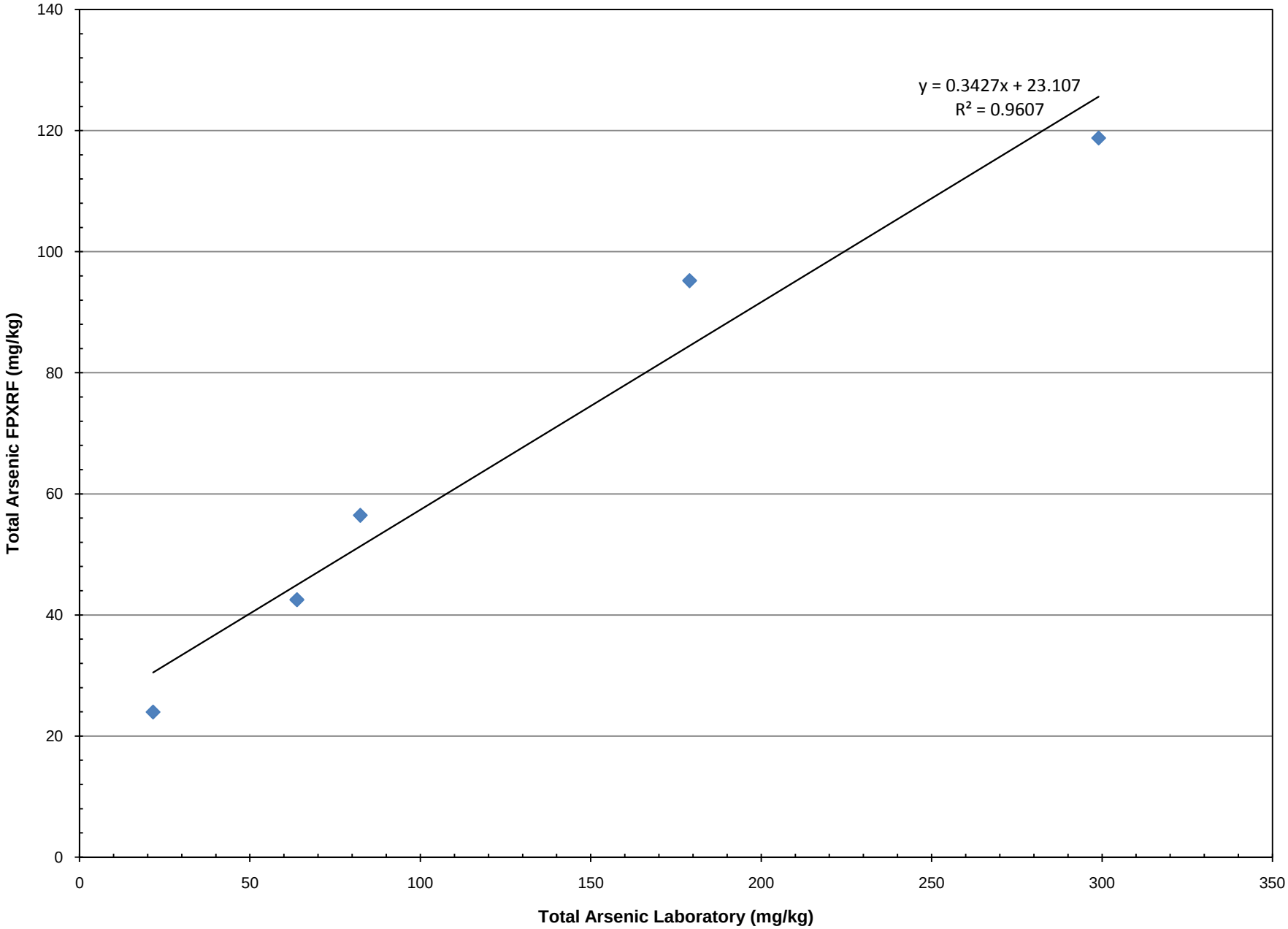

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Figure 4-80
Arsenic: Laboratory vs. FPXRF Analyses

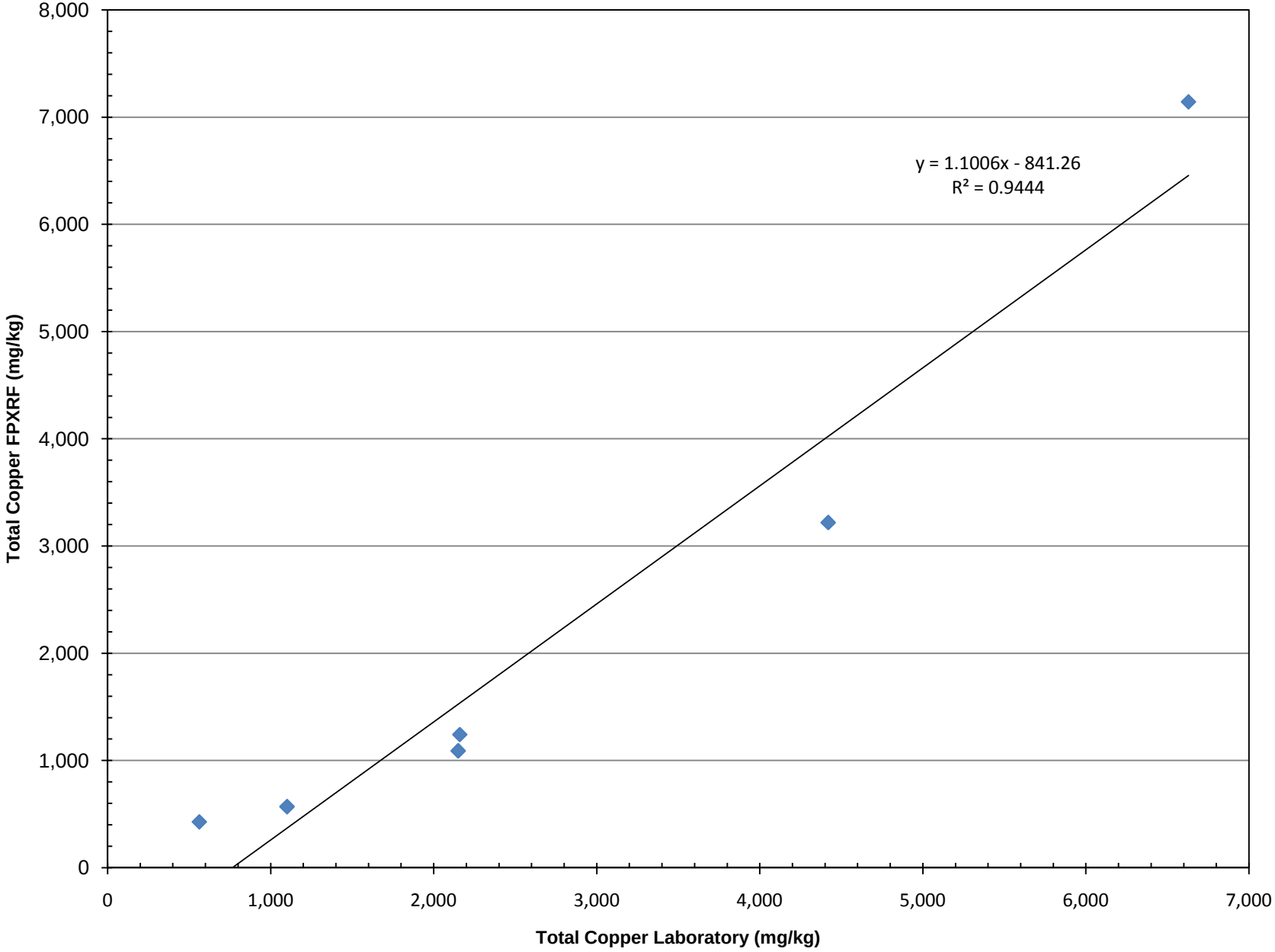

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Figure 4-81
Copper: Laboratory vs. FPXRF

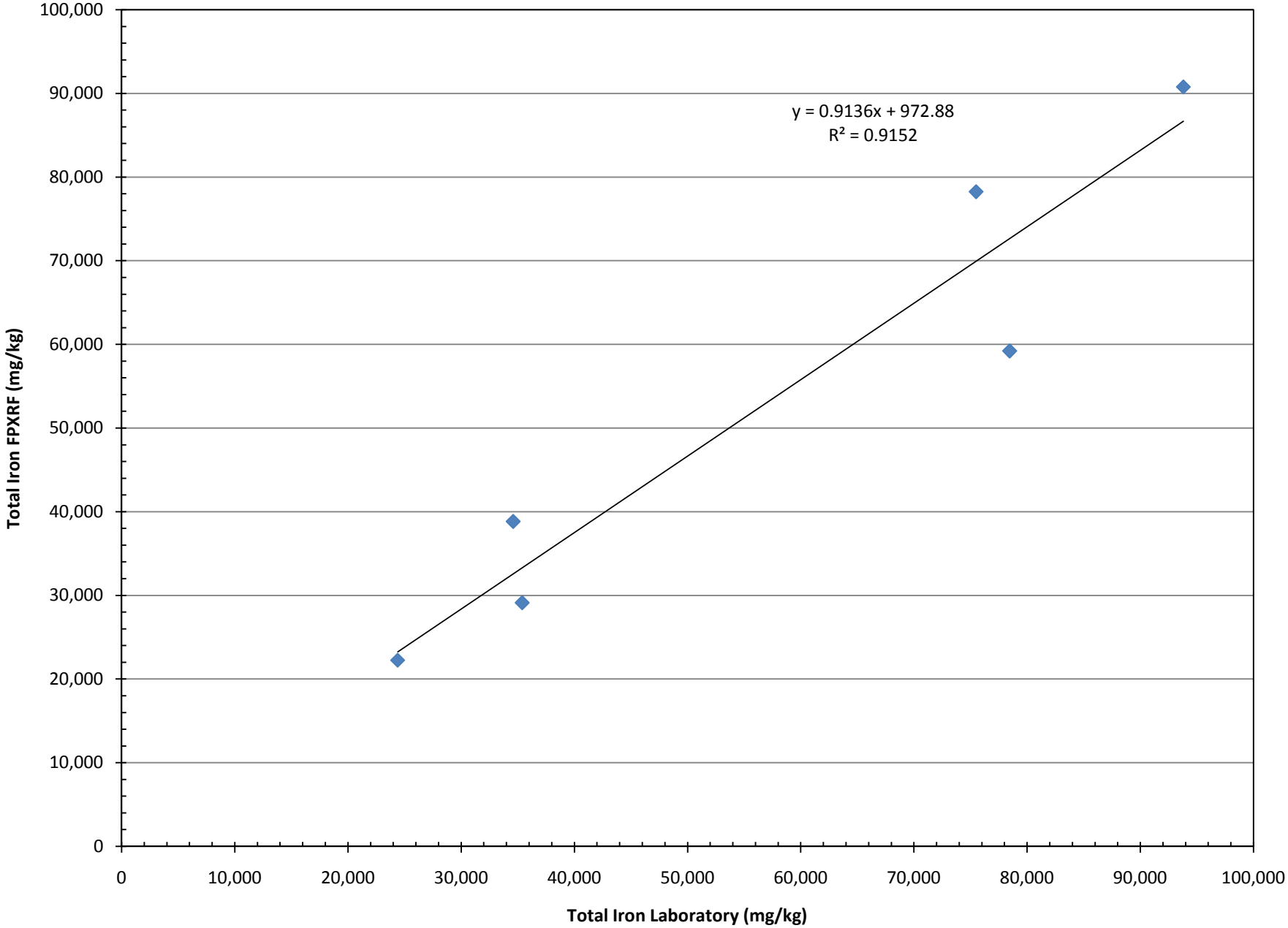

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Figure 4-82
Iron: Laboratory vs. FPXRF

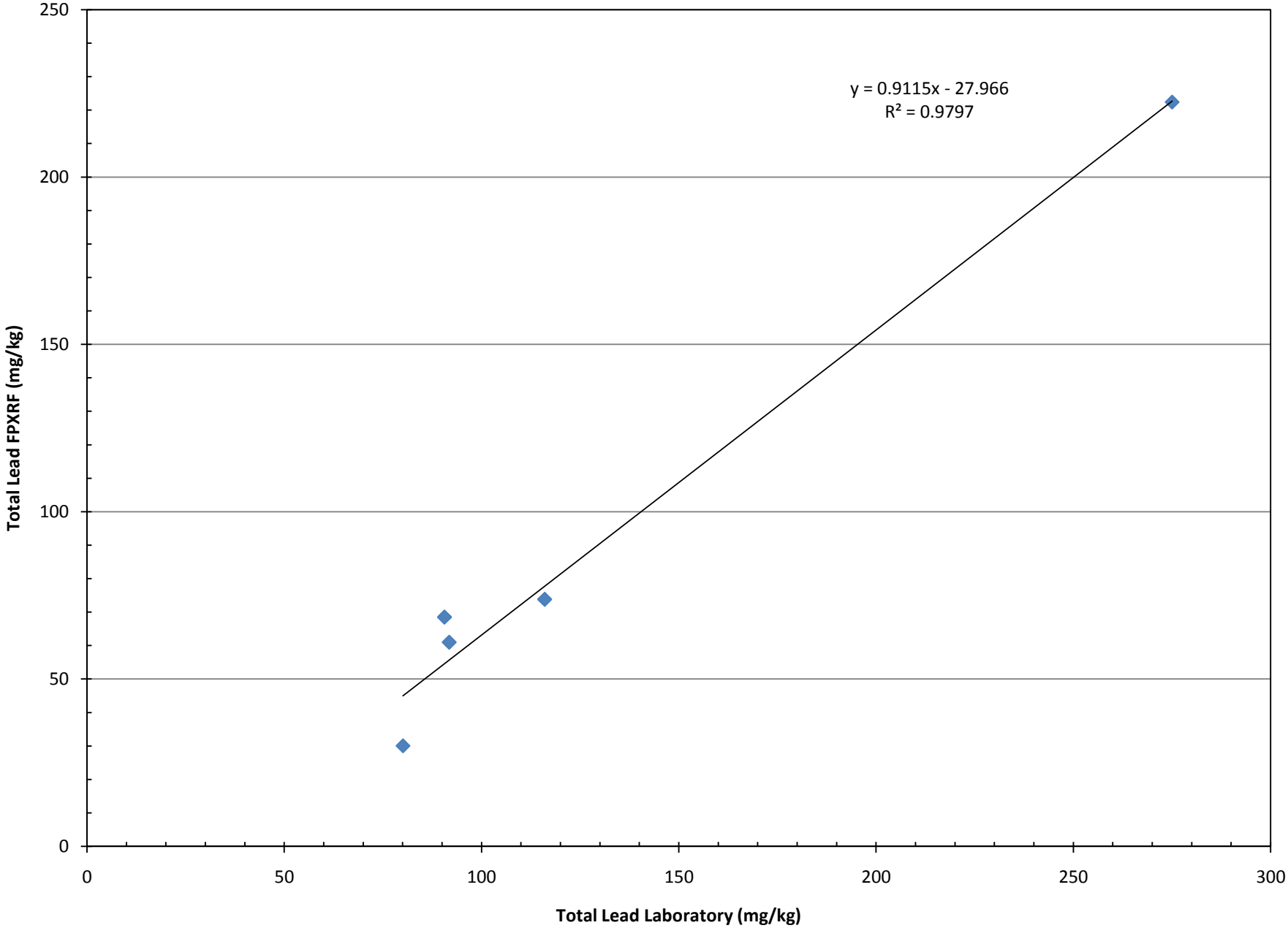

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Figure 4-83
Lead: Laboratory vs. FPXRF

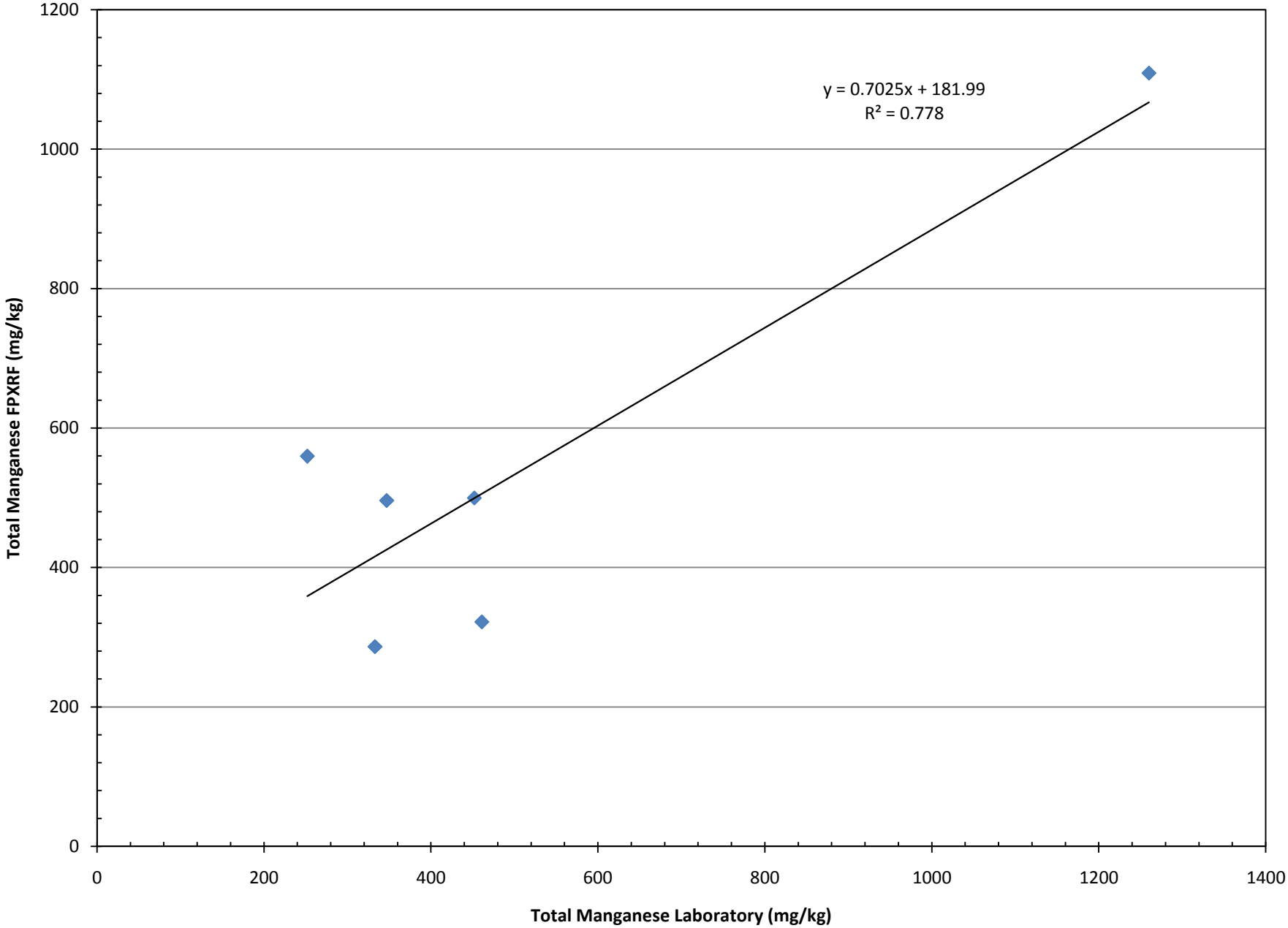

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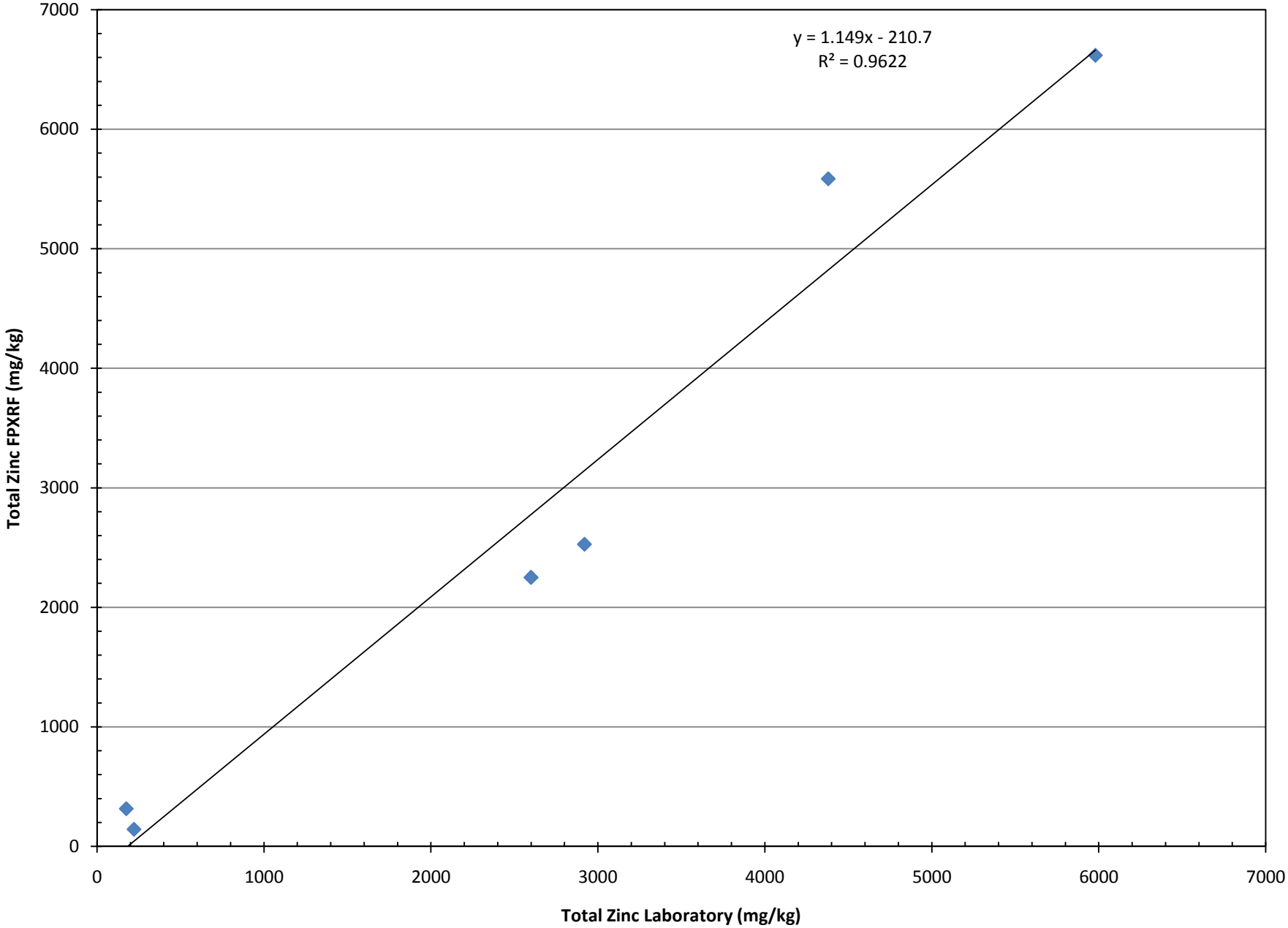
Figure 4-84
Manganese: Laboratory vs. FPXRF



CDM

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Figure 4-85
Zinc: Laboratory vs. FPXRF

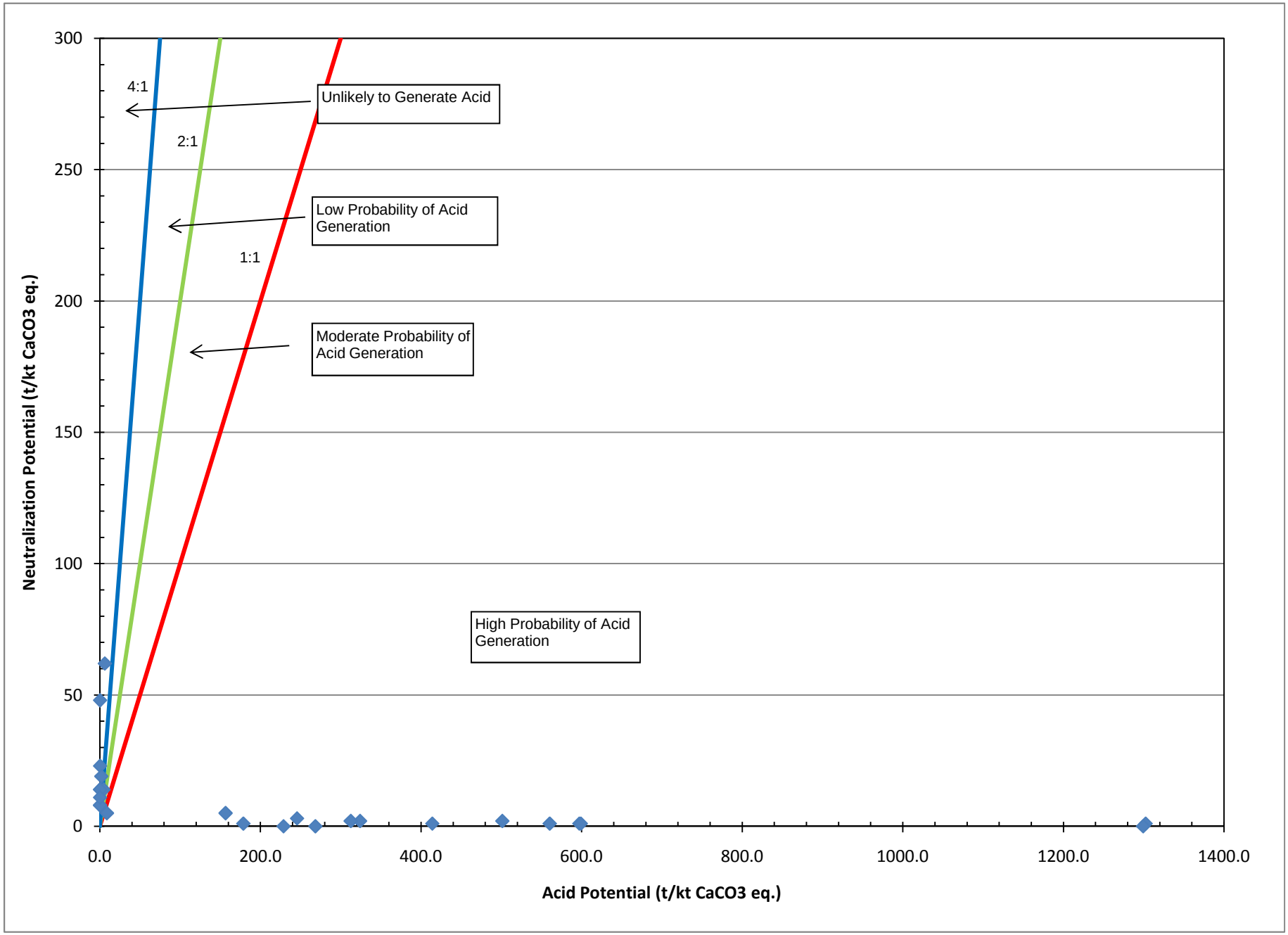

Figure 4-86
AP versus NP- All Samples

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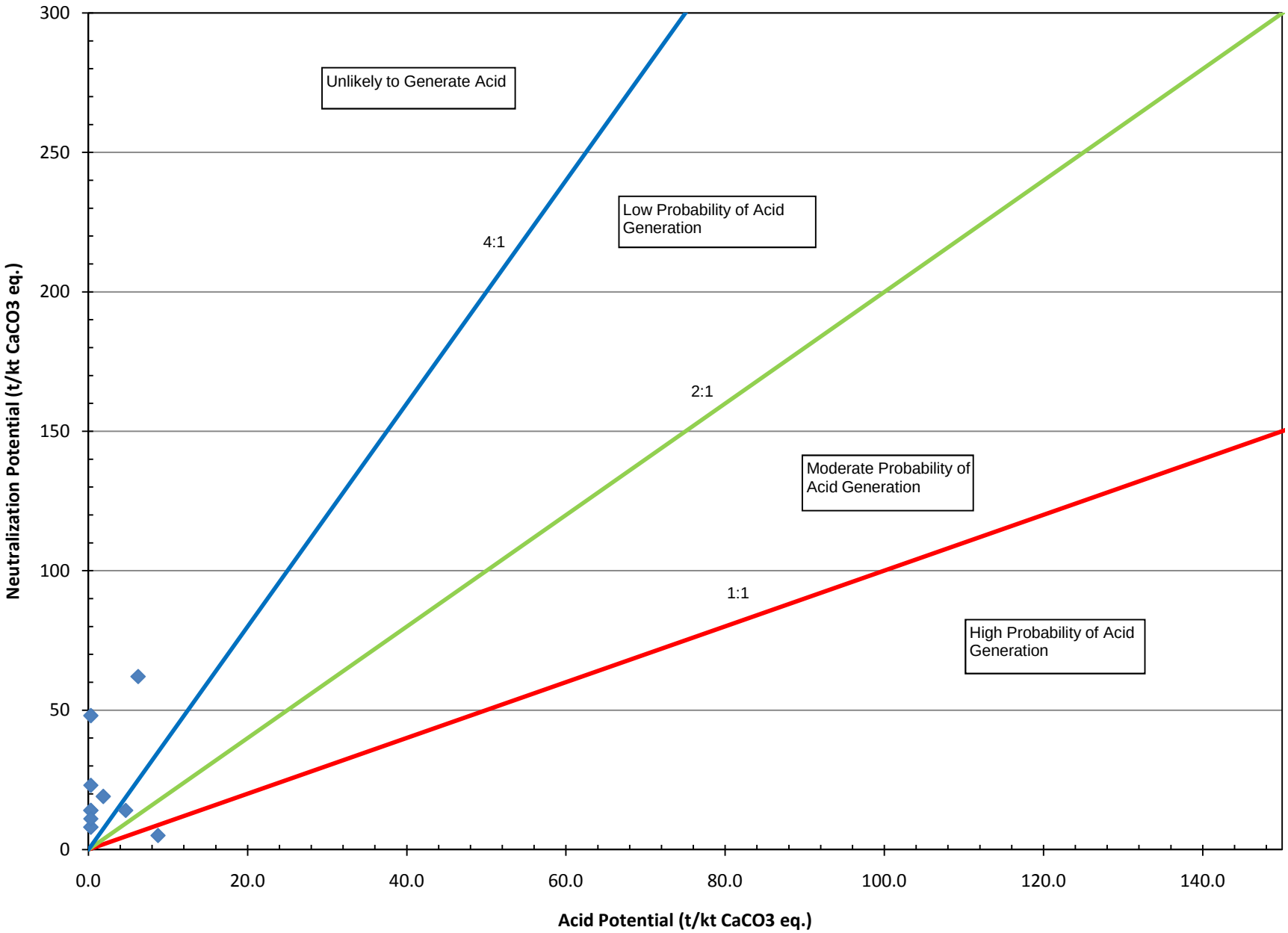

Figure 4-87
AP versus NP- Non mineralized samples

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Investigation/Source	Number of Samples	USGS	BLM/ODEQ RI			Dynamac Site Assessment		BLM/ODEQ RI						HC Removal Assessment	
Location True		August -September 1998	June 1999		October 1999 #1	October 1999 #2		October 1999 #3	January 2000		February 2000	March 2000 #1	March 2000 #2	April 2000	May 2000
404 Adit	4					10/19/1999	10/20/1999		1/25/2000				3/23/2000		
404 Trib	3								1/25/2000			3/9/2000	3/22/2000		
A14	5														
A19	1														
A4	14					10/19/1999						3/9/2000	3/23/2000		
A9	16					10/19/1999			1/26/2000		2/14/2000	3/9/2000	3/23/2000		
Buck Creek	2				10/7/1999										
C1	10		6/17/1999		10/5/1999			10/26/1999	1/24/2000				3/21/2000		
C2	10		6/17/1999		10/4/1999			10/26/1999	1/24/2000				3/21/2000		
C3	3		6/17/1999						1/24/2000				3/22/2000		
C4	4		6/17/1999		10/4/1999				1/24/2000				3/22/2000		
Catching Creek	2		6/21/1999		10/7/1999										
Cattle Creek	1		6/22/1999												
CY1	1		6/18/1999												
CY2	1		6/18/1999												
End of Pipe	14														
Formosa Adit	28		6/16/1999			10/19/1999		10/26/1999	1/26/2000		2/14/2000	3/9/2000	3/23/2000	4/26/2000	5/18/2000
Iron Mt. Creek	1		6/22/1999												
M1.3	1		6/15/1999												
M13.0	13		6/15/1999	6/17/1999	10/5/1999			10/26/1999	1/24/2000				3/21/2000		
M3.0	20		6/16/1999		10/5/1999			10/26/1999	1/25/2000	1/26/2000	2/14/2000	3/9/2000	3/22/2000		
M3.1	18		6/15/1999		10/5/1999			10/26/1999	1/25/2000		2/14/2000	3/9/2000	3/21/2000		
M7.9	9		6/15/1999		10/5/1999			10/26/1999	1/24/2000				3/21/2000		
M9.8	9		6/15/1999		10/5/1999			10/26/1999	1/24/2000				3/21/2000		
Martin Creek	1														
MREF1	5		6/16/1999		10/5/1999			10/26/1999	1/26/2000				3/22/2000		
MXR	28		6/16/1999		10/5/1999			10/26/1999	1/26/2000		2/14/2000	3/9/2000	3/22/2000	4/26/2000	
Russell Creek 0.9	2		6/21/1999												
Russell Creek 5.5	1		6/21/1999												
Seep A	16					10/19/1999			1/26/2000		2/14/2000	3/9/2000	3/23/2000		
Seep B	4								1/26/2000		2/14/2000	3/9/2000			
SF1.0	20		6/16/1999		10/5/1999			10/26/1999	1/25/2000				3/22/2000		
SF1.7	9		6/16/1999		10/5/1999			10/26/1999	1/25/2000				3/22/2000		
SF3.0	12		6/16/1999		10/5/1999			10/26/1999	1/25/2000				3/22/2000		
SF4.7	20		6/16/1999		10/5/1999			10/26/1999	1/25/2000		2/14/2000	3/9/2000	3/22/2000		
SFA1	1														
SFA2	2														
SFA3	2														
SFA4	1														
SFA5	1														
SFB1	1														
SFL	1					10/19/1999									
SFREF1	8		6/16/1999		10/7/1999			10/26/1999	1/25/2000				3/22/2000		
SFREF2	1														
SFU	1					10/19/1999									
Silver Butte Adit	9		6/15/1999		10/4/1999	10/19/1999		10/26/1999	1/26/2000		2/14/2000	3/9/2000	3/23/2000		
T1	1														
T1A	1														
T2	1														
T2A	1														
USGS-10	1	9/15/1998													
USGS-7	1	8/27/1998													
USGS-8	1	9/14/1998													
USGS-9	1	9/15/1998													
WC1	4		6/17/1999		10/4/1999				1/24/2000				3/21/2000		
WFCC1.1	2		6/18/1999												
WFCC2.8	1		6/18/1999												
WFCC7.4	1		6/18/1999												
Number of Locations Per Sample Event		**4**	**30**		**19**	**8**		**16**	**24**		**9**	**11**	**24**	**2**	**1**
Number of Days Per Event		**3**	**5**		**3**	**1**		**1**	**3**		**1**	**1**	**3**	**1**	**1**

Table 2-1
Surface Water
Sample Location and Event Matrix

Investigation/Source	Number of Samples	HC Data Evaluation and IRAM							HC Supplemental RI								
Location True		July 2000	October 2000	November 2000 #1	November 2000 #2	February 2001		April - May 2001	November 2001 #1	November 2001 #2	December 2001		February 2002 #1		February 2002 #2	March 2002	
404 Adit	4																
404 Trib	3																
A14	5												2/7/2002		2/21/2002	3/26/2002	
A19	1															3/26/2002	
A4	14		10/18/2000		11/17/2000	2/24/2001		5/2/2001	11/8/2001				2/7/2002		2/21/2002	3/26/2002	
A9	16		10/18/2000		11/17/2000	2/24/2001		5/2/2001	11/8/2001				2/7/2002		2/21/2002	3/26/2002	
Buck Creek	2	7/18/2000															
C1	10					2/22/2001		4/30/2001									
C2	10					2/22/2001		4/30/2001									
C3	3																
C4	4																
Catching Creek	2																
Cattle Creek	1																
CY1	1																
CY2	1																
End of Pipe	14			11/9/2000	11/17/2000	2/24/2001		5/2/2001	11/8/2001				2/7/2002		2/21/2002	3/26/2002	
Formosa Adit	28	7/18/2000	10/18/2000	11/9/2000	11/17/2000	2/24/2001		5/2/2001	11/8/2001	11/30/2001	12/18/2001		2/7/2002		2/21/2002	3/26/2002	
Iron Mt. Creek	1																
M1.3	1																
M13.0	13	7/18/2000				2/22/2001	2/23/2001	4/30/2001									
M3.0	20	7/18/2000	10/17/2000		11/17/2000	2/24/2001		4/30/2001	11/9/2001	11/30/2001	12/19/2001		2/6/2002				
M3.1	18		10/17/2000		11/18/2000	2/22/2001		4/30/2001	11/9/2001	11/30/2001	12/19/2001		2/6/2002			3/27/2002	
M7.9	9	7/18/2000				2/22/2001		4/30/2001									
M9.8	9	7/18/2000				2/22/2001		4/30/2001									
Martin Creek	1	7/18/2000															
MREF1	5																
MXR	28	7/18/2000	10/18/2000		11/18/2000	2/24/2001		5/2/2001	11/9/2001	11/30/2001	12/18/2001	12/19/2001	2/6/2002	2/7/2002	2/21/2002	3/26/2002	3/27/2002
Russell Creek 0.9	2																
Russell Creek 5.5	1																
Seep A	16	7/18/2000	10/18/2000		11/17/2000	2/24/2001		5/2/2001	11/8/2001				2/7/2002		2/21/2002	3/26/2002	
Seep B	4								11/8/2001								
SF1.0	20	7/18/2000	10/17/2000		11/18/2000	2/23/2001		5/1/2001	11/9/2001	11/30/2001	12/18/2001		2/6/2002		2/21/2002	3/27/2002	
SF1.7	9					2/23/2001		5/1/2001									
SF3.0	12					2/23/2001		5/1/2001	11/9/2001	11/30/2001	12/18/2001		2/6/2002				
SF4.7	20	7/18/2000	10/17/2000		11/18/2000	2/23/2001		5/1/2001	11/9/2001	11/30/2001	12/19/2001		2/6/2002			3/27/2002	
SFA1	1																
SFA2	2																
SFA3	2																
SFA4	1																
SFA5	1																
SFB1	1																
SFL	1																
SFREF1	8					2/23/2001		5/1/2001									
SFREF2	1																
SFU	1																
Silver Butte Adit	9										12/18/2001						
T1	1																
T1A	1																
T2	1																
T2A	1																
USGS-10	1																
USGS-7	1																
USGS-8	1																
USGS-9	1																
WC1	4																
WFCC1.1	2																
WFCC2.8	1																
WFCC7.4	1																
Number of Locations Per Sample Event		**11**	**9**	**2**	**10**	**18**		**18**	**12**	**7**	**8**		**12**		**8**	**11**	
Number of Days Per Event		**1**	**2**	**1**	**2**	**3**		**3**	**2**	**1**	**2**		**2**		**1**	**2**	

Table 2-1
Surface Water
Sample Location and Event Matrix

Investigation/Source	Number of Samples	HC Supplemental RI (Con't)					Post Supplemental RI - Data from Laborartory Reports									
Location True		April 2002		May 2002		June 2002	May 2003	February 2004	April 2004	May 2004	June 2004	July 2004	August 2004	June 2005	July 2005	September 2005
404 Adit	4															
404 Trib	3															
A14	5	4/22/2002		5/29/2002												
A19	1															
A4	14	4/22/2002		5/29/2002											7/6/2005	
A9	16	4/22/2002		5/29/2002											7/6/2005	
Buck Creek	2															
C1	10						5/20/2003	2/23/2004								9/19/2005
C2	10						5/20/2003	2/23/2004								9/19/2005
C3	3															
C4	4															
Catching Creek	2															
Cattle Creek	1															
CY1	1															
CY2	1															
End of Pipe	14	4/22/2002		5/29/2002						5/13/2004	6/17/2004	7/14/2004	8/16/2004			
Formosa Adit	28	4/22/2002		5/29/2002					4/29/2004		6/17/2004	7/14/2004			7/6/2005	9/19/2005
Iron Mt. Creek	1															
M1.3	1															
M13.0	13						5/20/2003	2/23/2004								9/19/2005
M3.0	20			5/28/2002	5/29/2002			2/23/2004								
M3.1	18	4/23/2002		5/28/2002												
M7.9	9							2/23/2004								
M9.8	9							2/23/2004								
Martin Creek	1															
MREF1	5															
MXR	28	4/22/2002	4/23/2002	5/28/2002	5/29/2002			2/23/2004								9/19/2005
Russell Creek 0.9	2						5/20/2003									
Russell Creek 5.5	1															
Seep A	16	4/22/2002		5/29/2002												
Seep B	4															
SF1.0	20	4/23/2002		5/28/2002		6/27/2002		2/23/2004								
SF1.7	9							2/23/2004								9/19/2005
SF3.0	12			5/28/2002												
SF4.7	20	4/23/2002		5/28/2002				2/23/2004								
SFA1	1													6/8/2005		
SFA2	2													6/8/2005	7/6/2005	
SFA3	2													6/8/2005	7/6/2005	
SFA4	1													6/8/2005		
SFA5	1													6/8/2005		
SFB1	1													6/8/2005		
SFL	1															
SFREF1	8							2/23/2004								
SFREF2	1					6/27/2002										
SFU	1															
Silver Butte Adit	9															
T1	1					6/27/2002										
T1A	1					6/27/2002										
T2	1					6/27/2002										
T2A	1					6/27/2002										
USGS-10	1															
USGS-7	1															
USGS-8	1															
USGS-9	1															
WC1	4															
WFCC1.1	2						5/20/2003									
WFCC2.8	1															
WFCC7.4	1															
Number of Locations Per Sample Event		**10**		**12**		**6**	**5**	**11**	**1**	**1**	**2**	**2**	**1**	**6**	**5**	**6**
Number of Days Per Event		**2**		**2**		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Table 2-1
Surface Water
Sample Location and Event Matrix

Compound Name	Priority Pollutant	Carcinogen	Concentration in Unit Per Liter for Protection of Aquatic Life		Concentration in Units Per Liter for Protection of Human Health		
			Fresh Acute Criteria	Fresh Chronic Criteria	Water and Fish Ingestion	Fish Consumption Only	Drinking Water M.C.L.
Alkalinity[2]	N	N		**20000 ug***			
Antimony	Y	N	9000 ug	1600 ug	**146 ug***	45000 ug	
Arsenic[1]	Y	Y			2.2 ng	17.5 ng	0.05 mg
Arsenic (Pent)	Y	Y	850 ug	**48 ug***			
Arsenic (Tri)	Y	Y	360 ug	190 ug			
Barium	N	N			**1 mg***		**1 mg***
Beryllium[1]	Y	Y	130 ug	**5.3 ug***	6.8 ng	117 ng	
Cadmium	Y	N	3.9+ ug	**1.1+ ug***	10 ug		0.010 mg
Chloride	N	N	860 mg	**230 mg***			
Chromium (Hex)	Y	N	16 ug	**11 ug***	50 ug		0.05 mg
Chromium (Tri)	N	N	1700+ ug	210+ ug	170 mg	3433 mg	0.05 mg
Copper	Y	N	18+ ug	**12+ ug***			
Iron	N	N		1000 ug	**0.3 mg***		
Lead	Y	N	82+ ug	**3.2+ ug***	50 ug		0.05 mg
Manganese	N	N			**50 ug***	100 ug	
Mercury	Y	N	2.4 ug	**0.012 ug***	144 ug	146 ug	0.002 mg
Nickel	Y	N	1400+ ug	160+ ug	**13.4 ug***	100 ug	
pH	---	---		6.5 to 8.5			
Selenium	Y	N	260 ug	35 ug	**10 ug***		**0.01 mg***
Silver	Y	N	4.1+ ug	**0.12 ug***	50 ug		0.05 mg
Sulfide Hydrogen Sulfide	N	N		**2 ug***			
Thallium	Y	N	1400 ug	40 ug	**13 ug***	48 ug	
Zinc	Y	N	120+ ug	**110+ ug***			

Notes:

Criteria in bold font are the screening levels (SLs) selected for comparison of surface water data at the Formosa Mine.

1 - Criteria for Water & Fish, and Fish Consumption Only was not selected because detection levels of dataset are not adequate to measure ng/L concentrations.

2 - Alkalinity should not be below this value in order to protect beneficial uses.

+ - Hardness Dependent Criteria. For evaluation of most stringent criteria, a hardness value was assumed to be 100 mg/L.

* - Most stringent value seletected for Screening Level.

ng - nanogram per liter, ug - microgram per liter, mg - milligram per liter

Table 4-1
Water Quality Screening Levels

Formosa Adit (Feb. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	1846	2420	2147.4	5/5		
Dissolved Oxygen		mg/L	0.6	1.2	0.9	2/2		
Flow		gpm	1.0	190.3	28.1	19/19		
ORP		mV	408	480	444	2/2		
pH		su	2.15	4.46	3.05	21/21	6.5 to 8.5	21/21
Temperature		deg C	9	18.3	11.6667	6/6		
Metals								
Aluminum	Dissolved	mg/L	14.5	49.6	25.6583	24/24		
Aluminum	Total	mg/L	16.1	48.7	27.1529	14/14		
Antimony	Dissolved	mg/L	0.001 U	0.0042	0.00456	6/17	0.146	0/17
Antimony	Total	mg/L	0.001 U	0.00332	0.00208	6/13	0.146	0/13
Arsenic	Dissolved	mg/L	0.002 U	0.338	0.09362	20/22	0.048	13/22
Arsenic	Total	mg/L	0.001	0.258	0.10586	14/14	0.048	9/14
Barium	Dissolved	mg/L	0.004 U	0.017	0.01233	16/17	1	0/17
Barium	Total	mg/L	0.02 U	0.0346	0.02815	11/14	1	0/14
Beryllium	Dissolved	mg/L	0.001 U	0.0013	0.0009	6/17	0.0053	1/17
Beryllium	Total	mg/L	0.001 U	0.00114	0.00125	6/14	0.0053	1/14
Boron		mg/L	0.369	0.369	0.369	1/1		
Cadmium	Dissolved	mg/L	0.265	1.15	0.54729	24/24	0.0031	24/24
Cadmium	Total	mg/L	0.319	1.21	0.56753	15/15	0.0031	15/15
Calcium	Dissolved	mg/L	58.1	335	149.247	17/17		
Calcium	Total	mg/L	61.7	1370	225.55	14/14		
Chromium	Dissolved	mg/L	0.01 U	0.035	0.01135	16/17	0.011	7/17
Chromium	Total	mg/L	0.02 U	0.0374	0.01266	13/14	0.011	8/14
Cobalt	Dissolved	mg/L	0.04 U	0.271	0.04464	16/17		
Cobalt	Total	mg/L	0.04 U	0.0469	0.02849	13/14		
Copper	Dissolved	mg/L	5.06	83.2	28.6408	24/24	0.036	24/24
Copper	Total	mg/L	9.08	61	29.1847	15/15	0.036	15/15
Iron	Dissolved	mg/L	11.3	588	257.404	24/24	0.3	24/24
Iron	Total	mg/L	10.6	602	287.663	15/15	0.3	15/15
Lanthanum	Dissolved	mg/L	0.0084	0.0172	0.01333	3/3		
Lanthanum	Total	mg/L	0.0078	0.099	0.03953	3/3		
Lead	Dissolved	mg/L	0.001 U	0.0545	0.03215	23/24	0.017	20/24
Lead	Total	mg/L	0.2 U	0.057	0.04263	13/14	0.017	13/14
Lithium	Dissolved	mg/L	0.0127	0.0367	0.0225	3/3		
Lithium	Total	mg/L	0.0135	0.0256	0.02	4/4		
Magnesium	Dissolved	mg/L	18.6	57.3	33	18/18		
Magnesium	Total	mg/L	19.2	45.6	32.0256	14/14		
Manganese	Dissolved	mg/L	1.76	5.51	3.1787	23/23	0.05	23/23
Manganese	Total	mg/L	1.87	4.46	3.21667	15/15	0.05	15/15

Table 4-2
Formosa Adit
Water Quality Summary Statistics for Historical Range

Formosa Adit (Feb. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/4	0.000012	4/4
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/4	0.000012	4/4
Molybdenum	Dissolved	mg/L	0.0004 U	0.0004 U	0.11513 U	0/3		
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/3		
Nickel	Dissolved	mg/L	0.0628	0.345	0.12498	22/22	0.0134	22/22
Nickel	Total	mg/L	0.0716	0.188	0.12449	14/14	0.0134	14/14
Potassium	Dissolved	mg/L	2 U	4.2	2.42953	14/15		
Potassium	Total	mg/L	2 U	3.65	2.15701	10/11		
Selenium	Dissolved	mg/L	0.001 U	0.0143	0.00525	9/17	0.01	4/17
Selenium	Total	mg/L	0.001 U	0.0159	0.01655	4/13	0.01	6/13
Silver	Dissolved	mg/L	0.0002 U	0.00016	0.00653	1/17	0.00012	17/17
Silver	Total	mg/L	0.0002 U	0.0001	0.00111	1/13	0.00012	12/13
Strontium	Total	mg/L	0.3	0.3	0.3	1/1		
Sulfur	Total	mg/L	437	437	437	1/1		
Sodium	Dissolved	mg/L	2 U	18.3	9.12294	16/17		
Sodium	Total	mg/L	4.83	15.6	9.27554	14/14		
Thallium	Dissolved	mg/L	0.001 U	0.0089	0.00249	2/17	0.013	1/17
Thallium	Total	mg/L	0.001 U	0.00049	0.00935	1/13	0.013	2/13
Tin	Total	mg/L	0.041	0.041	0.041	1/1		
Vanadium	Dissolved	mg/L	0.0001 U	0.0282	0.02297	5/17		
Vanadium	Total	mg/L	0.0001 U	0.0303	0.05103	7/14		
Zinc	Dissolved	mg/L	47.6	258	143.063	24/24	0.32	24/24
Zinc	Total	mg/L	52.9	256	144.527	15/15	0.32	15/15
Major Ions								0/0
Ammonia as N		mg/L	0.69	1.01	0.85	2/2		
Bicarbonate Alkalinity		mg/L	10 U	10 U	10 U	0/1		
Carbonate Alkalinity		mg/L	10 U	10 U	10 U	0/1		
Chloride		mg/L	2.1	21.2	8.27	5/5	230	0/5
Fluoride		mg/L	1.3	1070	215.478	5/5		
Hydroxide Alkalinity		mg/L	10 U	10 U	10 U	0/1		
Nitrate & Nitrite as N		mg/L as N	0.116	0.116	0.116	1/1		
Nitrate as N		mg/L as N	0.2 U	0.128	0.116	3/4		
Nitrite as N		mg/L as N	0.05 U	1 U	0.3125 U	0/4		
Orthophosphate as P		mg/L as P	0.296	0.43	0.358	4/4		
Phosphorus		mg/L	0.3044	0.342	0.3232	2/2		
Silica (SiO2)		mg/L	22.1577	704	253.653	3/3		
Sulfate		mg/L	868	2830	1566.77	13/13		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/8	0.002	0/8
Total Alkalinity		mg/L	10 U	10 U	10 U	0/3	20	3/3
Total Phosphate as P		mg/L as P	0.56	0.56	0.56	1/1		

Table 4-2
Formosa Adit
Water Quality Summary Statistics for Historical Range

Formosa Adit (Feb. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Other								
Acidity		mg/L	64.8	1320	692.4	2/2		
Total Cyanide		mg/L	0.02 U	0.02 U	0.02 U	0/1		
Dissolved Organic Carbon		mg/L	3 U	3 U	3 U	0/1		
Hardness[4]		mg/L	222	536	367.077	13/13		
Total Dissolved Solids		mg/L	2400	2400	2400	1/1		
Total Organic Carbon		mg/L	3 U	1	1.25	1/2		
Total Suspended Solids		mg/L	6	64	22.6	10/10		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-2
Formosa Adit
Water Quality Summary Statistics for Historical Range

Silver Butte Adit (Jun. 1999 to Dec. 2001)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	819	819	819	1/1		
Flow		gpm	0.0	19.7	6.1	9/9		
pH		su	2.03	3.22	3.06	5/5	6.5 to 8.5	5/5
Temperature		deg C	9	9	9	1/1		
Metals								
Aluminum	Dissolved	mg/L	5.37	17.9	9.852	5/5		
Aluminum	Total	mg/L	5.28	12.8	8.5925	4/4		
Antimony	Dissolved	mg/L	0.001 U	0.0002	0.00093	1/4	0.146	0/4
Antimony	Total	mg/L	0.001 U	0.0002	0.00093	1/4	0.146	0/4
Arsenic	Dissolved	mg/L	0.002 U	0.0464	0.01066	2/5	0.048	0/5
Arsenic	Total	mg/L	0.002 U	0.0039	0.00264	2/4	0.048	0/4
Barium	Dissolved	mg/L	0.0167	0.0252	0.02048	4/4	1	0/4
Barium	Total	mg/L	0.0175	0.122	0.04523	4/4	1	0/4
Beryllium	Dissolved	mg/L	0.001 U	0.00039	0.00034	3/4	0.0053	0/4
Beryllium	Total	mg/L	0.001 U	0.00041	0.00034	3/4	0.0053	0/4
Boron		mg/L	0.051	0.051	0.051	1/1		
Cadmium	Dissolved	mg/L	0.136	0.47	0.2516	5/5	0.0013	5/5
Cadmium	Total	mg/L	0.136	0.25	0.1925	4/4	0.0013	4/4
Calcium	Dissolved	mg/L	23.8	43	33.1	4/4		
Calcium	Total	mg/L	23.6	46.6	34.075	4/4		
Chromium	Dissolved	mg/L	0.00182	0.00362	0.00257	4/4	0.011	0/4
Chromium	Total	mg/L	0.0019	0.0031	0.0025	4/4	0.011	0/4
Cobalt	Dissolved	mg/L	0.00799	0.0161	0.0115	4/4		
Cobalt	Total	mg/L	0.00811	0.0142	0.01126	4/4		
Copper	Dissolved	mg/L	10.4	59.9	24.06	5/5	0.014	5/5
Copper	Total	mg/L	10.6	19.6	15.6	4/4	0.014	4/4
Iron	Dissolved	mg/L	20.6	141	51.62	5/5	0.3	5/5
Iron	Total	mg/L	23.6	42.2	33.125	4/4	0.3	4/4
Lanthanum	Dissolved	mg/L	0.001 U	0.0011	0.0008	1/2		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/2		
Lead	Dissolved	mg/L	0.0313	0.0774	0.0506	5/5	0.0039	5/5
Lead	Total	mg/L	0.0377	0.0733	0.0566	4/4	0.0039	4/4
Lithium	Dissolved	mg/L	0.00328	0.00418	0.00373	2/2		
Lithium	Total	mg/L	0.00337	0.00367	0.00352	2/2		
Magnesium	Dissolved	mg/L	7.03	16.4	11.582	5/5		
Magnesium	Total	mg/L	7.17	14.8	10.9275	4/4		
Manganese	Dissolved	mg/L	0.934	1.65	1.255	4/4	0.05	4/4
Manganese	Total	mg/L	0.916	1.86	1.31975	4/4	0.05	4/4
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Molybdenum	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2		
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2		
Nickel	Dissolved	mg/L	0.0238	0.07	0.04246	5/5	0.0134	5/5

Table 4-3
Silver Butte Adit
Water Quality Summary Statistics for Historical Range

Silver Butte Adit (Jun. 1999 to Dec. 2001)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Nickel	Total	mg/L	0.0242	0.046	0.03498	4/4	0.0134	4/4
Potassium	Dissolved	mg/L	1 U	0.37	0.543	2/4		
Potassium	Total	mg/L	1 U	0.444	0.555	2/4		
Selenium	Dissolved	mg/L	0.003 U	0.00532	0.00271	1/4	0.01	0/4
Selenium	Total	mg/L	0.003 U	0.1 U	0.02775 U	0/4	0.01	1/4
Silver	Dissolved	mg/L	0.0002 U	0.00009	0.0002	1/4	0.00012	3/4
Silver	Total	mg/L	0.00004 U	0.001 U	0.00036 U	0/4	0.00012	3/4
Sodium	Dissolved	mg/L	2.27	3.99	3.4575	4/4		
Sodium	Total	mg/L	2.2	4.64	3.6725	4/4		
Thallium	Dissolved	mg/L	0.001 U	0.0042	0.00153	2/4	0.013	0/4
Thallium	Total	mg/L	0.001 U	0.00042	0.00073	1/4	0.013	0/4
Vanadium	Dissolved	mg/L	0.0001 U	0.0388 U	0.01225 U	0/4		
Vanadium	Total	mg/L	0.0001 U	0.00012	0.00574	1/4		
Zinc	Dissolved	mg/L	17.9	76	40.4	5/5	0.12	5/5
Zinc	Total	mg/L	18.5	50.7	32.1	4/4	0.12	4/4
Major Ions								
Alkalinity		mg/L	0	0	0	1/1		
Ammonia as N		mg/L as N	0.05	0.11	0.08	2/2		
Chloride		mg/L	1.5	3.24	2.37	2/2	230	0/2
Fluoride		mg/L	0.3	1.18	0.74	2/2		
Nitrate & Nitrite as N		mg/L as N	0.233	0.233	0.233	1/1		
Nitrate as N		mg/L as N	0.158	0.158	0.158	1/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.006	0.0267	0.01635	2/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	25.4	382	203.7	2/2		
Sulfate		mg/L	202	438	288.333	3/3		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/1	0.002	1/1
Total Phosphate as P		mg/L as P	0.04	0.04	0.04	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	3 U	3 U	0/1		
Hardness[4]		mg/L	88.4	161	117.467	3/3		
Total Organic Carbon		mg/L	1 U	3 U	2 U	0/2		
Total Suspended Solids		mg/L	10 U	19	12	2/3		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-3
Silver Butte Adit
Water Quality Summary Statistics for Historical Range

End of Pipe (Nov. 2000 to Aug. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Flow		gpm	1.3	58.0	24.0	6/6		
pH		su	2.28	2.81	2.44	6/6	6.5 to 8.5	6/6
Metals								
Aluminum	Dissolved	mg/L	12.5	47.4	24.6	12/12		
Aluminum	Total	mg/L	16.8	47.1	26.5571	7/7		
Antimony	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/7	0.146	0/7
Antimony	Total	mg/L	0.001 U	0.002	0.00067	2/7	0.146	0/7
Arsenic	Dissolved	mg/L	0.01 U	0.135	0.04362	11/12	0.048	5/12
Arsenic	Total	mg/L	0.005 U	0.198	0.04867	7/8	0.048	3/8
Barium	Dissolved	mg/L	0.00884	0.0131	0.01085	7/7	1	0/7
Barium	Total	mg/L	0.02 U	0.0128	0.03819	5/7	1	0/7
Beryllium	Dissolved	mg/L	0.001 U	0.00111	0.00059	1/7	0.0053	0/7
Beryllium	Total	mg/L	0.001 U	0.00111	0.00119	1/7	0.0053	1/7
Cadmium	Dissolved	mg/L	0.28	1.12	0.49817	12/12	0.0034	12/12
Cadmium	Total	mg/L	0.27	1.18	0.48063	8/8	0.0034	8/8
Calcium	Dissolved	mg/L	155	295	191.571	7/7		
Calcium	Total	mg/L	142	301	193.143	7/7		
Chromium	Dissolved	mg/L	0.00161	0.033	0.01152	7/7	0.011	3/7
Chromium	Total	mg/L	0.00401	0.0364	0.01254	7/7	0.011	3/7
Cobalt	Dissolved	mg/L	0.0219	0.0454	0.03076	7/7		
Cobalt	Total	mg/L	0.0221	0.0481	0.03102	7/7		
Copper	Dissolved	mg/L	6.67	60.8	23.6175	12/12	0.039	12/12
Copper	Total	mg/L	6.83	59.4	19.7788	8/8	0.039	8/8
Iron	Dissolved	mg/L	96.2	526	225.183	12/12	0.3	12/12
Iron	Total	mg/L	99.5	538	233.563	8/8	0.3	8/8
Lead	Dissolved	mg/L	0.00511	0.0566	0.03284	12/12	0.019	11/12
Lead	Total	mg/L	0.0095	0.384	0.07496	8/8	0.019	7/8
Magnesium	Dissolved	mg/L	26.3	42.2	35.4143	7/7		
Magnesium	Total	mg/L	27.7	45.7	35.8143	7/7		
Manganese	Dissolved	mg/L	1.74	4.69	3.11917	12/12	0.05	12/12
Manganese	Total	mg/L	2.82	4.65	3.6725	8/8	0.05	8/8
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Nickel	Dissolved	mg/L	0.0621	0.194	0.10649	10/10	0.0134	10/10
Nickel	Total	mg/L	0.0956	0.202	0.13951	7/7	0.0134	7/7
Potassium	Dissolved	mg/L	2.13	3.75	2.82143	7/7		
Potassium	Total	mg/L	2.24	3.07	2.55333	6/6		

Table 4-4
End of Pipe
Water Quality Summary Statistics for Historical Range

End of Pipe (Nov. 2000 to Aug. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Selenium	Dissolved	mg/L	0.001 U	0.00886	0.01078	4/7	0.01	1/7
Selenium	Total	mg/L	0.001 U	0.0148	0.01865	3/7	0.01	3/7
Silver	Dissolved	mg/L	0.001 U	0.1 U	0.01514 U	0/7	0.00012	7/7
Silver	Total	mg/L	0.001 U	0.001 U	0.001 U	0/7	0.00012	7/7
Sodium	Dissolved	mg/L	8.34	14.4	10.5314	7/7		
Sodium	Total	mg/L	8.57	14.1	10.5471	7/7		
Thallium	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/7	0.013	0/7
Thallium	Total	mg/L	0.001 U	0.2 U	0.03071 U	0/7	0.013	1/7
Vanadium	Dissolved	mg/L	0.005 U	0.00579	0.00297	1/7		
Vanadium	Total	mg/L	0.005 U	0.0204	0.00627	3/7		
Zinc	Dissolved	mg/L	62.5	268	134.883	12/12	0.34	12/12
Zinc	Total	mg/L	97.2	259	150	8/8	0.34	8/8
Major Ions								
Sulfate	Dissolved	mg/L	824	2730	1540.67	6/6		
Sulfide	Dissolved	mg/L	0.05 U	0.05 U	0.05 U	0/6	0.002	6/6
Other								
Hardness[4]	Dissolved	mg/L	224	836	425.333	6/6		
Total Suspended Solids	Dissolved	mg/L	5 U	60	20.3333	4/6		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-4
End of Pipe
Water Quality Summary Statistics for Historical Range

Seep A (Oct. 1999 to May 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Flow		gpm	0.0	200.0	43.5	14/14		
pH		su	4.97	7.27	6.42	13/13	6.5 to 8.5	7/13
Temperature		deg C	6.9	9.1	8	2/2		
Metals								
Aluminum	Dissolved	mg/L	0.05 U	0.315	0.13207	12/15		
Aluminum	Total	mg/L	0.181	1.6	0.5814	5/5		
Antimony	Dissolved	mg/L	0.001 U	0.0001	0.00131	1/10	0.146	0/10
Antimony	Total	mg/L	0.001 U	0.0002	0.00093	1/4	0.146	0/4
Arsenic	Dissolved	mg/L	0.001 U	0.0024	0.00227	3/13	0.048	0/13
Arsenic	Total	mg/L	0.002 U	0.00111	0.00162	1/5	0.048	0/5
Barium	Dissolved	mg/L	0.2 U	0.0496	0.04335	9/10	1	0/10
Barium	Total	mg/L	0.0447	0.08	0.06158	4/4	1	0/4
Beryllium	Dissolved	mg/L	0.00001 U	3.8E-05	0.00081	1/10	0.0053	1/10
Beryllium	Total	mg/L	0.001 U	0.00015	0.00018	3/4	0.0053	0/4
Boron	Total	mg/L	0.0044	0.0044	0.0044	1/1		
Cadmium	Dissolved	mg/L	0.00371	0.0554	0.01841	15/15	0.001	15/15
Cadmium	Total	mg/L	0.00382	0.0389	0.01206	5/5	0.001	5/5
Calcium	Dissolved	mg/L	10.5	168	54.98	10/10		
Calcium	Total	mg/L	10.6	16.2	13.7	4/4		
Chromium	Dissolved	mg/L	0.0002 U	0.00117	0.00095	2/10	0.011	0/10
Chromium	Total	mg/L	0.0002 U	0.0008	0.0004	2/4	0.011	0/4
Cobalt	Dissolved	mg/L	0.0002 U	0.0046	0.00211	5/10		
Cobalt	Total	mg/L	0.002 U	0.00107	0.00095	3/4		
Copper	Dissolved	mg/L	0.2	2.99	0.97073	15/15	0.011	15/15
Copper	Total	mg/L	0.268	1.31	0.7016	5/5	0.011	5/5
Iron	Dissolved	mg/L	0.1 U	1.14	0.24726	10/15	0.3	5/15
Iron	Total	mg/L	0.1 U	0.314	0.1606	4/5	0.3	1/5
Lanthanum	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/2		
Lanthanum	Total	mg/L	0.001 U	0.0018	0.00115	1/2		
Lead	Dissolved	mg/L	0.00004 U	0.01 U	0.00294 U	0/15	0.0028	7/15
Lead	Total	mg/L	0.001 U	0.0032	0.00161	2/5	0.0028	3/5
Lithium	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2		
Lithium	Total	mg/L	0.00052	0.00054	0.00053	2/2		
Magnesium	Dissolved	mg/L	2.9	32.2	11.744	10/10		
Magnesium	Total	mg/L	2.89	3.96	3.4875	4/4		
Manganese	Dissolved	mg/L	0.0583	0.733	0.25671	15/15	0.05	15/15
Manganese	Total	mg/L	0.0596	0.693	0.21576	5/5	0.05	5/5
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.000012	2/2
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Molybdenum	Dissolved	mg/L	0.0004 U	0.00114	0.00067	1/2		
Molybdenum	Total	mg/L	0.00054	0.00061	0.00058	2/2		
Nickel	Dissolved	mg/L	0.0053	0.053	0.01579	13/13	0.0134	4/13
Nickel	Total	mg/L	0.00578	0.0311	0.01201	5/5	0.0134	1/5

Table 4-5
Seep A
Water Quality Summary Statistics for Historical Range

Seep A (Oct. 1999 to May 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Potassium	Dissolved	mg/L	1 U	1.17	0.7536	5/10		
Potassium	Total	mg/L	1 U	0.335	0.519	2/4		
Selenium	Dissolved	mg/L	0.001 U	0.00913	0.00316	5/10	0.01	1/10
Selenium	Total	mg/L	0.001 U	0.005 U	0.003 U	0/4	0.01	0/4
Silver	Dissolved	mg/L	0.00004 U	0.01 U	0.00164 U	0/10	0.00012	9/10
Silver	Total	mg/L	0.0002 U	0.00008	0.0002	1/4	0.00012	3/4
Sodium	Dissolved	mg/L	2.77	8.29	4.303	10/10		
Sodium	Total	mg/L	2.83	3.1	2.94	4/4		
Thallium	Dissolved	mg/L	0.00004 U	0.003	0.0032	1/10	0.013	1/10
Thallium	Total	mg/L	0.00004 U	0.002 U	0.00126 U	0/4	0.013	0/4
Vanadium	Dissolved	mg/L	0.0001 U	0.00022	0.00478	1/10		
Vanadium	Total	mg/L	0.005 U	0.00017	0.00196	2/4		
Zinc	Dissolved	mg/L	1.31	24.4	6.77667	15/15	0.097	15/15
Zinc	Total	mg/L	1.34	14.8	4.398	5/5	0.097	5/5
Major Ions								
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.035 U	0/2		
Chloride		mg/L	1.8	18.5	10.15	2/2	230	0/2
Fluoride		mg/L	0.01 U	0.5 U	0.255 U	0/2		
Nitrate & Nitrite as N		mg/L as N	0.0504	0.0504	0.0504	1/1		
Nitrate as N		mg/L as N	0.14	0.14	0.14	1/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.005 U	0.0033	0.0029	1/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	15.2	160	87.6	2/2		
Sulfate		mg/L	31.9	245	82.8625	8/8		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/6	0.002	6/6
Total Phosphate as P		mg/L as P	0.01 U	0.01 U	0.01 U	0/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	3 U	3 U	0/1		
Hardness[4]		mg/L	38	298	90.1125	8/8		
Total Organic Carbon		mg/L	3 U	2	1.75	1/2		
Total Suspended Solids		mg/L	5 U	10 U	5.71429 U	0/7		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-5
Seep A
Water Quality Summary Statistics for Historical Range

A4 (Oct. 1999 to July 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurement								
Flow		gpm	0.0	80.0	22.8	12/12		
pH		su	3.23	5.06	3.815	12/12	6.5 to 8.5	12/12
Metals								
Aluminum	Dissolved	mg/L	0.21	13.3	5.444	12/12		
Aluminum	Total	mg/L	4.11	19.6	10.085	4/4		
Antimony	Dissolved	mg/L	0.0001 U	0.01 U	0.00216 U	0/7	0.146	0/7
Antimony	Total	mg/L	0.0001 U	0.001 U	0.00055 U	0/2	0.146	0/2
Arsenic	Dissolved	mg/L	0.001 U	0.01 U	0.00445 U	0/11	0.048	0/11
Arsenic	Total	mg/L	0.005 U	1	0.25154	2/4	0.048	1/4
Barium	Dissolved	mg/L	0.00908	0.0372	0.02137	7/7	1	0/7
Barium	Total	mg/L	0.0414	0.169	0.0848	3/3	1	0/3
Beryllium	Dissolved	mg/L	0.001 U	0.00044	0.00049	1/7	0.0053	0/7
Beryllium	Total	mg/L	0.0002 U	0.00042	0.00034	1/3	0.0053	0/3
Cadmium	Dissolved	mg/L	0.0165	0.545	0.09269	12/12	0.0015	12/12
Cadmium	Total	mg/L	0.027	0.153	0.07358	4/4	0.0015	4/4
Calcium	Dissolved	mg/L	26.1	159	75.7857	7/7		
Calcium	Total	mg/L	28.3	35	30.9333	3/3		
Chromium	Dissolved	mg/L	0.001 U	0.00232	0.00182	4/7	0.011	0/7
Chromium	Total	mg/L	0.001 U	0.0009	0.00095	1/3	0.011	0/3
Cobalt	Dissolved	mg/L	0.01 U	0.0154	0.00999	6/7		
Cobalt	Total	mg/L	0.0056	0.00756	0.00643	3/3		
Copper	Dissolved	mg/L	1.58	7.03	3.81333	12/12	0.016	12/12
Copper	Total	mg/L	2.3	11.7	5.55	4/4	0.016	4/4
Iron	Dissolved	mg/L	0.1 U	2.25	0.58504	10/12	0.3	6/12
Iron	Total	mg/L	0.786	1.17	0.9965	4/4	0.3	4/4
Lead	Dissolved	mg/L	0.001 U	0.00101	0.00162	2/12	0.005	1/12
Lead	Total	mg/L	0.005 U	0.00122	0.00135	2/3	0.005	0/3
Lithium	Total	mg/L	0.0056 U	0.0056 U	0.0056 U	0/1		
Magnesium	Dissolved	mg/L	6.45	32	17.0457	7/7		
Magnesium	Total	mg/L	4.53	8.5916	6.9372	3/3		
Manganese	Dissolved	mg/L	0.309	1.93	0.83817	12/12	0.05	12/12
Manganese	Total	mg/L	0.5	2.91	1.1915	4/4	0.05	4/4
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.000012	2/2
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Nickel	Dissolved	mg/L	0.0112	0.0599	0.02323	10/10	0.0134	7/10
Nickel	Total	mg/L	0.01	0.0742	0.0319	4/4	0.0134	3/4
Potassium	Dissolved	mg/L	1 U	1.37	0.85571	2/7		
Potassium	Total	mg/L	1 U	0.5895	0.6965	1/3		
Selenium	Dissolved	mg/L	0.005 U	0.00383	0.00383	5/7	0.01	1/7
Selenium	Total	mg/L	0.005 U	0.00164	0.00207	1/2	0.01	0/2
Silver	Dissolved	mg/L	0.001 U	0.00004	0.00108	1/7	0.00012	6/7
Silver	Total	mg/L	0.00004 U	0.001 U	0.00052 U	0/2	0.00012	1/2
Sodium	Dissolved	mg/L	3.37	8.32	5.15	7/7		
Sodium	Total	mg/L	3.69	4.4546	3.9582	3/3		
Strontium	Total	mg/L	0.0489	0.0489	0.0489	1/1		

Table 4-6
Location A4
Water Quality Summary Statistics for Historical Range

A4 (Oct. 1999 to July 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Sulfur	Total	mg/L	53	53	53	1/1		
Thallium	Dissolved	mg/L	0.001 U	0.00005	0.00394	1/7	0.013	1/7
Thallium	Total	mg/L	0.001 U	0.00004	0.00027	1/2	0.013	0/2
Tin	Total	mg/L	0.0137 U	0.0137 U	0.0137 U	0/1		
Vanadium	Dissolved	mg/L	0.005 U	0.01 U	0.00643 U	0/7		
Vanadium	Total	mg/L	0.0016 U	0.01 U	0.00553 U	0/3		
Zinc	Dissolved	mg/L	4.22	34.5	14.5108	12/12	0.14	12/12
Zinc	Total	mg/L	6.4	42.2	19.7	4/4	0.14	4/4
Major Ions								
Ammonia as N		mg/L as N	0.05 U	0.05 U	0.05 U	0/1		
Chloride		mg/L	21.4	21.4	21.4	1/1	230	0/1
Fluoride		mg/L	0.918	0.918	0.918	1/1		
Nitrate as N		mg/L as N	0.174	0.174	0.174	1/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.0048	0.0048	0.0048	1/1		
Phosphorus		mg/L	0.035 U	0.0935 U	0.06425 U	0/2		
Silica (SiO2)		mg/L	10.7072	257	133.854	2/2		
Sulfate		mg/L	75.1	472	206.157	7/7		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/6	0.002	6/6
Other			0	0				
Dissolved Organic Carbon		mg/L	3 U	3 U	3 U	0/1		
Hardness[4]		mg/L	69	418	143.733	6/6		
Total Organic Carbon		mg/L	3 U	3 U	3 U	0/1		
Total Suspended Solids		mg/L	5 U	55	20.2143	6/7		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-6
Location A4
Water Quality Summary Statistics for Historical Range

A9 (Oct. 1999 to Jul. 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Flow		gpm	2.0	275	76.2965	14/14		
pH		su	2.87	4.44	3.74	15/15	6.5 to 8.5	15/15
Temperature		deg C	9.2	9.2	9.2	1/1		
Metals								
Aluminum	Dissolved	mg/L	6.41	29.6	15.3847	15/15		
Aluminum	Total	mg/L	7.42	42.62	18.868	5/5		
Antimony	Dissolved	mg/L	0.0001 U	0.01 U	0.00234 U	0/9	0.146	0/9
Antimony	Total	mg/L	0.0001 U	0.003 U	0.00178 U	0/4	0.146	0/4
Arsenic	Dissolved	mg/L	0.001 U	0.01 U	0.00414 U	0/14	0.048	0/14
Arsenic	Total	mg/L	0.001 U	0.005 U	0.0025 U	0/4	0.048	0/4
Barium	Dissolved	mg/L	0.00712	0.0325	0.01765	9/9	1	0/9
Barium	Total	mg/L	0.0167	0.0419	0.02756	5/5	1	0/5
Beryllium	Dissolved	mg/L	0.001 U	0.0011	0.0007	6/9	0.0053	0/9
Beryllium	Total	mg/L	0.001 U	0.0058	0.00158	4/5	0.0053	1/5
Boron		mg/L	0.0069	0.0069	0.0069	1/1		
Cadmium	Dissolved	mg/L	0.0405	0.198	0.10606	15/15	0.0017	15/15
Cadmium	Total	mg/L	0.0608	0.25	0.13336	5/5	0.0017	5/5
Calcium	Dissolved	mg/L	25.1	140	73.3111	9/9		
Calcium	Total	mg/L	24.3	210	71.4	5/5		
Chromium	Dissolved	mg/L	0.001 U	0.00431	0.00187	7/9	0.011	0/9
Chromium	Total	mg/L	0.0029 U	0.00189	0.00132	4/5	0.011	0/5
Cobalt	Dissolved	mg/L	0.008	0.0306	0.01893	9/9		
Cobalt	Total	mg/L	0.00822	0.059	0.0224	5/5		
Copper	Dissolved	mg/L	4.07	14.9	8.308	15/15	0.018	15/15
Copper	Total	mg/L	5.09	27	11.576	5/5	0.018	5/5
Iron	Dissolved	mg/L	0.133	1.76	0.68043	14/14	0.3	11/14
Iron	Total	mg/L	0.07	2.22	1.066	5/5	0.3	4/5
Lanthanum	Dissolved	mg/L	0.0059	0.0065	0.0062	2/2		
Lanthanum	Total	mg/L	0.0062	0.0066	0.0064	2/2		
Lead	Dissolved	mg/L	0.00112	0.00138	0.00513	5/15	0.006	2/15
Lead	Total	mg/L	0.001 U	0.0042	0.00172	2/4	0.006	0/4
Lithium	Dissolved	mg/L	0.00313	0.00318	0.00316	2/2		
Lithium	Total	mg/L	0.00303	0.013	0.00644	3/3		
Magnesium	Dissolved	mg/L	6.73	33.7	18.2022	9/9		
Magnesium	Total	mg/L	6.56	13.3	10.015	4/4		
Manganese	Dissolved	mg/L	0.712	3.86	1.81213	15/15	0.05	15/15
Manganese	Total	mg/L	0.697	9.5	2.7974	5/5	0.05	5/5
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.000012	2/2
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Molybdenum	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2		
Molybdenum	Total	mg/L	0.0004 U	0.00042	0.00031	1/2		
Nickel	Dissolved	mg/L	0.0205	0.0793	0.03768	13/13	0.0134	13/13
Nickel	Total	mg/L	0.0207	0.2	0.06594	5/5	0.0134	5/5
Potassium	Dissolved	mg/L	1 U	1.95	0.90811	4/9		
Potassium	Total	mg/L	2 U	2.217	1.0652	4/5		

Table 4-7
Location A9
Water Quality Summary Statistics for Historical Range

A9 (Oct. 1999 to Jul. 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Selenium	Dissolved	mg/L	0.003 U	0.00421	0.00356	5/9	0.01	1/9
Selenium	Total	mg/L	0.003 U	0.00366	0.00229	1/4	0.01	0/4
Silver	Dissolved	mg/L	0.0002 U	0.00004	0.00636	1/9	0.00012	8/9
Silver	Total	mg/L	0.0002 U	0.00007	0.00019	1/4	0.00012	3/4
Sodium	Dissolved	mg/L	3.37	8.42	5.37556	9/9		
Sodium	Total	mg/L	3.26	13.5185	5.9897	5/5		
Strontium	Total	mg/L	0.439	0.439	0.439	1/1		
Sulfur	Total	mg/L	422	422	422	1/1		
Thallium	Dissolved	mg/L	0.001 U	0.0029	0.0035	2/9	0.013	1/9
Thallium	Total	mg/L	0.001 U	0.00005	0.00064	1/4	0.013	0/4
Tin	Total	mg/L	0.0418	0.0418	0.0418	1/1		
Vanadium	Dissolved	mg/L	0.0001 U	0.01 U	0.00502 U	0/9		
Vanadium	Total	mg/L	0.0001 U	0.00021	0.00171	1/5		
Zinc	Dissolved	mg/L	10.1	54.2	27.06	15/15	0.16	15/15
Zinc	Total	mg/L	12.8	65.8	31.8	5/5	0.16	5/5
Major Ions								
Ammonia as N		mg/L as N	0.05 U	0.05	0.0375	1/2		
Bicarbonate Alkalinity		mg/L	10 U	10 U	10 U	0/1		
Carbonate Alkalinity		mg/L	10 U	10 U	10 U	0/1		
Chloride		mg/L	2	20.4	8.56667	3/3	230	0/3
Fluoride		mg/L	0.4	1.1	0.75	2/2		
Hydroxide Alkalinity		mg/L	10 U	10 U	10 U	0/1		
Nitrate & Nitrite as N		mg/L as N	0.133	0.133	0.133	1/1		
Nitrate as N		mg/L as N	0.343	0.73	0.5365	2/2		
Nitrite as N		mg/L as N	0.05 U	0.1 U	0.075 U	0/2		
Orthophosphate as P		mg/L as P	0.005 U	0.0096	0.00605	1/2		
Phosphorus		mg/L	0.035 U	0.3687	0.1931	1/2		
Silica (SiO2)		mg/L	21.4555	317	121.785	3/3		
Sulfate		mg/L	184	550	342.444	9/9		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/6	0.002	6/6
Total Alkalinity		mg/L	10 U	10 U	10 U	0/1	20	1/1
Total Phosphate as P		mg/L as P	0.01	0.01	0.01	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	3 U	3 U	0/1		
Hardness[4]		mg/L	90.3	422	164.788	8/8		
Total Cyanide		mg/L	0.02 U	0.02 U	0.02 U	0/1		
Total Organic Carbon		mg/L	3 U	2	1.75	1/2		
Total Suspended Solids		mg/L	5 U	570	76.1875	4/8		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-7
Location A9
Water Quality Summary Statistics for Historical Range

MXR (Jun. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	384	384	384	1/1		
Conductivity		µS/cm	370	400	385.25	4/4		
Flow		gpm	9.5	2038.0	476.9	21/21		
ORP		mV	267	267	267	1/1		
pH		su	4.51	7.8	6.635	22/22	6.5 to 8.5	10/22
Temperature		deg C	9	13.8	11.36	5/5		
Metals								
Aluminum	Dissolved	mg/L	0.01 U	14.5	0.75596	12/26		
Aluminum	Total	mg/L	0.05 U	4.85	2.0092	9/10		
Antimony	Dissolved	mg/L	0.0001 U	0.01 U	0.00244 U	0/14	0.146	0/14
Antimony	Total	mg/L	0.0001 U	0.003 U	0.00179 U	0/9	0.146	0/9
Arsenic	Dissolved	mg/L	0.001 U	0.01	0.00215	2/24	0.048	0/24
Arsenic	Total	mg/L	0.001 U	0.00227	0.00128	1/10	0.048	0/10
Barium	Dissolved	mg/L	0.0199	0.0295	0.02566	14/14	1	0/14
Barium	Total	mg/L	0.0225	0.12	0.03581	9/9	1	0/9
Beryllium	Dissolved	mg/L	0.00001 U	0.0002	0.00067	3/14	0.0053	1/14
Beryllium	Total	mg/L	0.00001 U	0.00023	0.00028	4/9	0.0053	0/9
Boron		mg/L	0.006	0.0072	0.0066	2/2		
Cadmium	Dissolved	mg/L	0.00645	0.464	0.04158	26/26	0.0017	26/26
Cadmium	Total	mg/L	0.00681	0.0489	0.0303	10/10	0.0017	10/10
Calcium	Dissolved	mg/L	23.7	72.1	50.4571	14/14		
Calcium	Total	mg/L	23.5	73.9	46.7111	9/9		
Chromium	Dissolved	mg/L	0.0002 U	0.00482	0.00078	4/14	0.011	0/14
Chromium	Total	mg/L	0.0002 U	0.00313	0.00109	6/9	0.011	0/9
Cobalt	Dissolved	mg/L	0.0002 U	0.0068	0.00238	9/14		
Cobalt	Total	mg/L	0.00037	0.00689	0.00312	9/9		
Copper	Dissolved	mg/L	0.0838	11.1	1.20599	26/26	0.019	26/26
Copper	Total	mg/L	0.0929	3.82	1.60089	10/10	0.019	10/10
Iron	Dissolved	mg/L	0.002 U	0.201	0.23927	11/26	0.3	1/26
Iron	Total	mg/L	0.01 U	1.32	0.20928	6/10	0.3	2/10
Lanthanum	Dissolved	mg/L	0.001 U	0.0016	0.00098	2/4		
Lanthanum	Total	mg/L	0.001 U	0.0016	0.00078	1/4		
Lead	Dissolved	mg/L	0.00004 U	0.0072	0.00204	2/26	0.0063	3/26
Lead	Total	mg/L	0.001 U	0.00011	0.00106	1/10	0.0063	0/10
Lithium	Dissolved	mg/L	0.0004 U	0.00634	0.00305	3/4		
Lithium	Total	mg/L	0.0004 U	0.00653	0.00225	3/4		
Magnesium	Dissolved	mg/L	9.64	23.7	16.5888	16/16		
Magnesium	Total	mg/L	9.9	34	18.2444	9/9		
Manganese	Dissolved	mg/L	0.00103	1.59	0.26595	24/24	0.05	20/24
Manganese	Total	mg/L	0.00123	0.508	0.26382	10/10	0.05	8/10
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.000012	2/2
Mercury	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.000012	2/2
Molybdenum	Dissolved	mg/L	0.0004 U	0.00206	0.00076	2/4		

Table 4-8
Location MXR
Water Quality Summary Statistics for Historical Range

MXR (Jun. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/4		
Nickel	Dissolved	mg/L	0.00284	0.0546	0.01321	24/24	0.0134	6/24
Nickel	Total	mg/L	0.00356	0.0252	0.01476	9/9	0.0134	5/9
Potassium	Dissolved	mg/L	0.1 U	1.2	0.63662	5/13		
Potassium	Total	mg/L	1 U	0.777	0.6495	4/8		
Selenium	Dissolved	mg/L	0.001 U	0.0048	0.00131	2/14	0.01	0/14
Selenium	Total	mg/L	0.001 U	0.00135	0.00176	1/9	0.01	0/9
Silver	Dissolved	mg/L	0.00004 U	0.00025	0.00031	1/14	0.00012	13/14
Silver	Total	mg/L	0.00004 U	0.001 U	0.00054 U	0/9	0.00012	8/9
Sodium	Dissolved	mg/L	3.67	7.26	5.76643	14/14		
Sodium	Total	mg/L	3.53	6.41	5.42	9/9		
Thallium	Dissolved	mg/L	0.00004 U	0.01	0.00125	1/14	0.013	0/14
Thallium	Total	mg/L	0.00004 U	0.0025	0.00084	1/9	0.013	0/9
Vanadium	Dissolved	mg/L	0.0001 U	0.00164	0.00531	2/14		
Vanadium	Total	mg/L	0.0001 U	0.00238	0.00198	3/9		
Zinc	Dissolved	mg/L	0.982	27.6	6.01238	26/26	0.17	26/26
Zinc	Total	mg/L	1.02	14.2	7.47	10/10	0.17	10/10
Major Ions								
Alkalinity		mg/L	0	90.2	46.4	3/3		
Ammonia as N		mg/L as N	0.02 U	0.05	0.01833	1/3		
Chloride		mg/L	2.2	20.3	6.93	4/4	230	0/4
Fluoride		mg/L	0.5 U	0.654	0.301	3/4		
Nitrate & Nitrite as N		mg/L	0.0146	0.168	0.0913	2/2		
Nitrate as N		mg/L as N	0.187	0.197	0.192	2/2		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/2		
Orthophosphate as P		mg/L as P	0.005 U	0.375	0.1271	2/3		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	14.7	197	78.0667	3/3		
Sulfate		mg/L	137	382	211.083	12/12		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/8	0.002	8/8
Total Phosphate as P		mg/L as P	0.01 U	0.01 U	0.01 U	0/1		
Other								
Acidity		mg/L	10 U	10 U	10 U	0/1		
Dissolved Organic Carbon		mg/L	1 U	3 U	2 U	0/2		
Hardness[4]		mg/L	99.4	286	170.689	18/18		
Total Organic Carbon		mg/L	3 U	1	1.16667	2/3		
Total Suspended Solids		mg/L	1 U	38	9.63636	7/11		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-8
Location MXR
Water Quality Summary Statistics for Historical Range

M3.0 (Jun. 1999 to Feb. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	101	263	170.5	4/4		
Flow		gpm	66.0	11499.0	3074.1	11/11		
pH		su	6.34	8.01	7.35	12/12	6.5 to 8.5	2/12
Temperature		deg C	9	16.1	12	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.062 U	0.382	0.13156	11/18		
Aluminum	Total	mg/L	0.05 U	0.849	0.2606	4/5		
Antimony	Dissolved	mg/L	0.0001 U	0.005 U	0.00201 U	0/13	0.146	0/13
Antimony	Total	mg/L	0.001 U	0.003 U	0.0025 U	0/4	0.146	0/4
Arsenic	Dissolved	mg/L	0.001 U	0.0077	0.00202	1/16	0.048	0/16
Arsenic	Total	mg/L	0.001 U	0.005 U	0.0024 U	0/5	0.048	0/5
Barium	Dissolved	mg/L	0.0117	0.0374	0.02057	13/13	1	0/13
Barium	Total	mg/L	0.0158	0.369	0.1067	4/4	1	0/4
Beryllium	Dissolved	mg/L	0.00001 U	0.00019	0.00037	3/13	0.0053	0/13
Beryllium	Total	mg/L	0.00001 U	6.3E-05	0.00015	2/4	0.0053	0/4
Boron		mg/L	0.011	0.031	0.021	2/2		
Cadmium	Dissolved	mg/L	0.002 U	0.0043	0.00207	16/18	0.00087	17/18
Cadmium	Total	mg/L	0.002 U	0.00339	0.00204	4/5	0.00087	5/5
Calcium	Dissolved	mg/L	6.43	31.1	17.8692	13/13		
Calcium	Total	mg/L	8.72	28.6	17.68	4/4		
Chromium	Dissolved	mg/L	0.0002 U	0.00498	0.00109	6/13	0.011	0/13
Chromium	Total	mg/L	0.0002 U	0.00235	0.00087	2/4	0.011	0/4
Cobalt	Dissolved	mg/L	0.0002 U	0.00251	0.00096	5/13		
Cobalt	Total	mg/L	0.002 U	0.00119	0.00072	3/4		
Copper	Dissolved	mg/L	0.00678	0.129	0.0586	18/18	0.0088	17/18
Copper	Total	mg/L	0.00953	0.21	0.07537	5/5	0.0088	5/5
Iron	Dissolved	mg/L	0.002 U	0.54	0.41607	11/18	0.3	5/18
Iron	Total	mg/L	0.1 U	0.678	0.18046	4/5	0.3	1/5
Lanthanum	Dissolved	mg/L	0.001 U	0.0015	0.0007	1/5		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/3		
Lead	Dissolved	mg/L	0.001 U	0.0069	0.00179	2/18	0.0021	10/18
Lead	Total	mg/L	0.001 U	0.005 U	0.003 U	0/5	0.0021	4/5
Lithium	Dissolved	mg/L	0.0004 U	0.00637	0.00224	3/5		
Lithium	Total	mg/L	0.0004 U	0.00546	0.00195	1/3		
Magnesium	Dissolved	mg/L	3.34	13.3	6.99893	14/14		
Magnesium	Total	mg/L	4.12	12.8	8.0625	4/4		
Manganese	Dissolved	mg/L	0.0062 U	0.0417	0.01409	10/17	0.05	0/17
Manganese	Total	mg/L	0.00161	0.0357	0.01402	5/5	0.05	0/5
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Molybdenum	Dissolved	mg/L	0.0004 U	0.002	0.00067	2/5		
Molybdenum	Total	mg/L	0.0004 U	0.00086	0.00042	1/3		
Nickel	Dissolved	mg/L	0.002 U	0.00433	0.003	8/16	0.0134	0/16
Nickel	Total	mg/L	0.005 U	0.00502	0.003	4/5	0.0134	0/5

Table 4-9
Location M3.0
Water Quality Summary Statistics for Historical Range

M3.0 (Jun. 1999 to Feb. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Potassium	Dissolved	mg/L	1 U	1.39	0.61031	5/13		
Potassium	Total	mg/L	1 U	1.05	0.6575	3/4		
Selenium	Dissolved	mg/L	0.001 U	0.0048	0.00129	1/13	0.01	0/13
Selenium	Total	mg/L	0.001 U	0.003 U	0.0025 U	0/4	0.01	0/4
Silver	Dissolved	mg/L	0.00004 U	0.00023	0.00032	1/13	0.00012	12/13
Silver	Total	mg/L	0.0002 U	0.001 U	0.0004 U	0/4	0.00012	4/4
Sodium	Dissolved	mg/L	2.57	5.82	4.27077	13/13		
Sodium	Total	mg/L	1 U	5.95	3.58	3/4		
Thallium	Dissolved	mg/L	0.00004 U	0.0099	0.00134	1/13	0.013	0/13
Thallium	Total	mg/L	0.001 U	0.0039	0.0016	1/4	0.013	0/4
Vanadium	Dissolved	mg/L	0.005 U	0.00191	0.00213	5/13		
Vanadium	Total	mg/L	0.005 U	0.00212	0.00132	3/4		
Zinc	Dissolved	mg/L	0.0957	1.01	0.48571	18/18	0.08	18/18
Zinc	Total	mg/L	0.106	0.755	0.4244	5/5	0.08	5/5
Major Ions								
Alkalinity		mg/L	22	58	40	2/2		
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3		
Chloride		mg/L	1.4	20.1	8.13333	3/3	230	0/3
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3		
Nitrate & Nitrite as N		mg/L	0.021	0.157	0.089	2/2		
Nitrate as N		mg/L as N	0.111	0.111	0.111	1/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.005 U	0.0059	0.0042	1/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	15.8	129	54.7667	3/3		
Sulfate		mg/L	19.4	61.9	38.4444	9/9		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/6	0.002	6/6
Total Phosphate as P		mg/L as P	0.03	0.03	0.03	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	3	2.25	1/2		
Hardness[4]		mg/L	29.8	120	70.8917	12/12		
Total Organic Carbon		mg/L	3 U	3	1.83333	2/3		
Total Suspended Solids		mg/L	1 U	7	3.1875	2/8		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-9
Location M3.0
Water Quality Summary Statistics for Historical Range

SF1.0 (Jun. 1999 to Feb. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	154	154	154	1/1		
Conductivity		µS/cm	148	161	152.667	3/3		
Flow		gpm	35.9	4017.0	739.0	18/18		
pH		su	5.69	8.9	7.21	18/18	6.5 to 8.5	8/18
Temperature		deg C	8.9	11.2	9.9	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.05 U	0.282	0.0711	7/18		
Aluminum	Total	mg/L	0.05 U	1.03	0.36233	5/6		
Antimony	Dissolved	mg/L	0.001 U	0.005 U	0.002 U	0/10	0.146	0/10
Antimony	Total	mg/L	0.001 U	0.003 U	0.0018 U	0/5	0.146	0/5
Arsenic	Dissolved	mg/L	0.001 U	0.01 U	0.0035 U	0/16	0.048	0/16
Arsenic	Total	mg/L	0.001 U	0.005 U	0.002 U	0/6	0.048	0/6
Barium	Dissolved	mg/L	0.00401	0.00745	0.00567	10/10	1	0/10
Barium	Total	mg/L	0.00395	0.00811	0.00556	5/5	1	0/5
Beryllium	Dissolved	mg/L	0.00001 U	3.8E-05	0.00036	2/10	0.0053	0/10
Beryllium	Total	mg/L	0.00001 U	7.7E-05	0.00032	1/5	0.0053	0/5
Boron		mg/L	0.363	0.363	0.363	1/1		
Cadmium	Dissolved	mg/L	0.00085	0.0221	0.00727	18/18	0.00082	18/18
Cadmium	Total	mg/L	0.002 U	0.00915	0.00475	5/6	0.00082	6/6
Calcium	Dissolved	mg/L	14.3	28	19.33	10/10		
Calcium	Total	mg/L	14.9	29.4	20.22	5/5		
Chromium	Dissolved	mg/L	0.0002 U	0.00033	0.00042	2/10	0.011	0/10
Chromium	Total	mg/L	0.0002 U	0.00134	0.00051	1/5	0.011	0/5
Cobalt	Dissolved	mg/L	0.0002 U	0.00237	0.00106	2/10		
Cobalt	Total	mg/L	0.002 U	0.00064	0.00077	2/5		
Copper	Dissolved	mg/L	0.0196	2.02	0.37874	18/18	0.0083	18/18
Copper	Total	mg/L	0.0193	0.62	0.24385	6/6	0.0083	6/6
Iron	Dissolved	mg/L	0.01 U	0.137	0.31411	9/18	0.3	1/18
Iron	Total	mg/L	0.1 U	0.332	0.10513	4/6	0.3	1/6
Lanthanum	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/3		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/2		
Lead	Dissolved	mg/L	0.001 U	0.01 U	0.00346 U	0/18	0.0019	11/18
Lead	Total	mg/L	0.001 U	0.005 U	0.00233 U	0/6	0.0019	3/6
Lithium	Dissolved	mg/L	0.0004 U	0.00516	0.00185	1/3		
Lithium	Total	mg/L	0.0004 U	0.00443	0.00232	1/2		
Magnesium	Dissolved	mg/L	4.93	9.01	6.37818	11/11		
Magnesium	Total	mg/L	5.27	9.72	7.326	5/5		
Manganese	Dissolved	mg/L	0.01 U	0.724	0.20188	16/17	0.05	11/17
Manganese	Total	mg/L	0.00847	0.277	0.13415	6/6	0.05	4/6
Molybdenum	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/3		
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2		
Nickel	Dissolved	mg/L	0.0002 U	0.017	0.00648	12/16	0.0134	1/16
Nickel	Total	mg/L	0.005 U	0.00626	0.00372	4/5	0.0134	0/5

Table 4-10
Location SF1.0
Water Quality Summary Statistics for Historical Range

SF1.0 (Jun. 1999 to Feb. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Potassium	Dissolved	mg/L	1 U	0.626	0.4865	3/10		
Potassium	Total	mg/L	1 U	0.719	0.522	2/5		
Selenium	Dissolved	mg/L	0.001 U	0.00198	0.00103	2/10	0.01	0/10
Selenium	Total	mg/L	0.001 U	0.003 U	0.0018 U	0/5	0.01	0/5
Silver	Dissolved	mg/L	0.0002 U	0.001 U	0.00076 U	0/10	0.00012	10/10
Silver	Total	mg/L	0.0002 U	0.001 U	0.00068 U	0/5	0.00012	5/5
Sodium	Dissolved	mg/L	2.66	5.25	3.979	10/10		
Sodium	Total	mg/L	3.88	4.42	4.138	5/5		
Thallium	Dissolved	mg/L	0.001 U	0.002 U	0.0013 U	0/10	0.013	0/10
Thallium	Total	mg/L	0.001 U	0.0029	0.0013	2/5	0.013	0/5
Vanadium	Dissolved	mg/L	0.005 U	0.00081	0.00192	3/10		
Vanadium	Total	mg/L	0.005 U	0.00055	0.00168	2/5		
Zinc	Dissolved	mg/L	0.193	4.85	1.86317	18/18	0.075	18/18
Zinc	Total	mg/L	0.191	2.95	1.4285	6/6	0.075	6/6
Major Ions								
Alkalinity		mg/L	12	41	26.5	2/2		
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3		
Chloride		mg/L	1.2	16.7	6.53333	3/3	230	0/3
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3		
Nitrate & Nitrite as N		mg/L as N	0.0126	0.0517	0.03215	2/2		
Nitrate as N		mg/L as N	0.102	0.102	0.102	1/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.005 U	0.0096	0.00605	1/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	22.8	137	79.9	2/2		
Sulfate		mg/L	26.4	153	67.1833	12/12		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/9	0.002	9/9
Total Phosphate as P		mg/L as P	0.01	0.01	0.01	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	1	1.25	1/2		
Hardness[4]		mg/L	0.33 U	97	66.3177	12/13		
Total Organic Carbon		mg/L	1 U	2	1.33333	1/3		
Total Suspended Solids		mg/L	1 U	23	5.5	4/12		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-10
Location SF1.0
Water Quality Summary Statistics for Historical Range

SF3.0 (Jun. 1999 to May 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	85	85	85	1/1		
Conductivity		µS/cm	90	162	126.333	3/3		
Flow		gpm	187.6	14488.2	3683.1	9/9		
pH		su	6.05	8.09	7.216	10/10	6.5 to 8.5	2/10
Temperature		deg C	9.4	11.5	10.725	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.1 U	0.35	0.1318	7/10		
Aluminum	Total	mg/L	0.0706	0.097	0.0838	2/2		
Antimony	Dissolved	mg/L	0.001 U	0.003 U	0.002 U	0/6	0.146	0/6
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.146	0/1
Arsenic	Dissolved	mg/L	0.001 U	0.01 U	0.0034 U	0/10	0.048	0/10
Arsenic	Total	mg/L	0.002 U	0.005 U	0.0035 U	0/2	0.048	0/2
Barium	Dissolved	mg/L	0.00419	0.00657	0.00526	6/6	1	0/6
Barium	Total	mg/L	0.00508	0.00508	0.00508	1/1	1	0/1
Beryllium	Dissolved	mg/L	0.00001 U	2.2E-05	0.00026	2/6	0.0053	0/6
Beryllium	Total	mg/L	7.9E-05	7.9E-05	7.9E-05	1/1	0.0053	0/1
Boron		mg/L	0.0374	0.0374	0.0374	1/1		
Cadmium	Dissolved	mg/L	0.001 U	0.0039	0.00164	8/10	0.00071	8/10
Cadmium	Total	mg/L	0.002 U	0.00055	0.00078	1/2	0.00071	1/2
Calcium	Dissolved	mg/L	7.91	20.9	15.6517	6/6		
Calcium	Total	mg/L	12.5	12.5	12.5	1/1		
Chromium	Dissolved	mg/L	0.0002 U	0.00103	0.00041	2/6	0.011	0/6
Chromium	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.011	0/1
Cobalt	Dissolved	mg/L	0.0002 U	0.00066	0.00067	2/6		
Cobalt	Total	mg/L	0.00029	0.00029	0.00029	1/1		
Copper	Dissolved	mg/L	0.00692	0.185	0.06879	10/10	0.0071	9/10
Copper	Total	mg/L	0.006	0.0111	0.00855	2/2	0.0071	1/2
Iron	Dissolved	mg/L	0.1 U	0.181	0.09727	8/10	0.3	0/10
Iron	Total	mg/L	0.0557	0.0602	0.05795	2/2	0.3	0/2
Lanthanum	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/3		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/1		
Lead	Dissolved	mg/L	0.001 U	0.01 U	0.0037 U	0/10	0.0015	7/10
Lead	Total	mg/L	0.003 U	0.005 U	0.004 U	0/2	0.0015	2/2
Lithium	Dissolved	mg/L	0.0004 U	0.00281	0.00107	1/3		
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1		
Magnesium	Dissolved	mg/L	2.85	5.04	3.95143	7/7		
Magnesium	Total	mg/L	3.69	3.69	3.69	1/1		
Manganese	Dissolved	mg/L	0.01 U	0.139	0.0441	8/9	0.05	3/9
Manganese	Total	mg/L	0.0077	0.0165	0.0121	2/2	0.05	0/2
Molybdenum	Dissolved	mg/L	0.0004 U	0.00041	0.00027	1/3		
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1		
Nickel	Dissolved	mg/L	0.0002 U	0.00232	0.00197	2/9	0.0134	0/9
Nickel	Total	mg/L	0.005 U	0.00229	0.0024	1/2	0.0134	0/2

Table 4-11
Location SF3.0
Water Quality Summary Statistics for Historical Range

SF3.0 (Jun. 1999 to May 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Potassium	Dissolved	mg/L	1 U	0.909	0.49967	3/6		
Potassium	Total	mg/L	0.733	0.733	0.733	1/1		
Selenium	Dissolved	mg/L	0.001 U	0.003 U	0.002 U	0/6	0.01	0/6
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.01	0/1
Silver	Dissolved	mg/L	0.0002 U	0.001 U	0.0006 U	0/6	0.00012	6/6
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.00012	1/1
Sodium	Dissolved	mg/L	2.82	4.74	3.79833	6/6		
Sodium	Total	mg/L	4.02	4.02	4.02	1/1		
Thallium	Dissolved	mg/L	0.001 U	0.002 U	0.0015 U	0/6	0.013	0/6
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/1	0.013	0/1
Vanadium	Dissolved	mg/L	0.005 U	0.00103	0.00165	3/6		
Vanadium	Total	mg/L	0.00054	0.00054	0.00054	1/1		
Zinc	Dissolved	mg/L	0.043	0.976	0.4127	10/10	0.064	9/10
Zinc	Total	mg/L	0.0664	0.129	0.0977	2/2	0.064	2/2
Major Ions								
Alkalinity		mg/L	19	44	31.5	2/2		
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3		
Chloride		mg/L	1.2	19	7.33333	3/3	230	0/3
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3		
Nitrate & Nitrite as N		mg/L as N	0.0272	0.0364	0.0318	2/2		
Nitrate as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.005 U	0.0067	0.0046	1/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	22.5	142	82.25	2/2		
Sulfate		mg/L	16.9	46.3	29.1875	8/8		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/5	0.002	5/5
Total Phosphate as P		mg/L as P	0.02	0.02	0.02	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	2	1.75	1/2		
Hardness[4]		mg/L	31.5	86	54.6333	9/9		
Total Organic Carbon		mg/L	1 U	2	1.33333	1/3		
Total Suspended Solids		mg/L	1 U	5	2.875	1/8		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-11
Location SF3.0
Water Quality Summary Statistics for Historical Range

SF4.7 (Jun. 1999 to Feb. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	73	73	73	1/1		
Conductivity		µS/cm	78	163	122.667	3/3		
Flow		gpm	380.1	22670.4	4804.6	17/17		
pH		su	6.02	8.02	7.31611	18/18	6.5 to 8.5	4/18
Temperature		deg C	9.7	11.6	10.825	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.05 U	0.362	0.12076	11/18		
Aluminum	Total	mg/L	0.1 U	0.775	0.21296	6/7		
Antimony	Dissolved	mg/L	0.0001 U	0.005 U	0.00193 U	0/12	0.146	0/12
Antimony	Total	mg/L	0.001 U	0.003 U	0.002 U	0/6	0.146	0/6
Arsenic	Dissolved	mg/L	0.001 U	0.002	0.00165	1/17	0.048	0/17
Arsenic	Total	mg/L	0.001 U	0.005 U	0.002 U	0/7	0.048	0/7
Barium	Dissolved	mg/L	0.005 U	0.00785	0.00566	11/12	1	0/12
Barium	Total	mg/L	0.00447	0.00741	0.00605	6/6	1	0/6
Beryllium	Dissolved	mg/L	0.00001 U	2.8E-05	0.0003	2/12	0.0053	0/12
Beryllium	Total	mg/L	0.00001 U	3.6E-05	0.00026	2/6	0.0053	0/6
Boron		mg/L	0.002	0.0076	0.0048	2/2		
Cadmium	Dissolved	mg/L	0.00021 U	0.001	0.00075	5/18	0.00064	15/18
Cadmium	Total	mg/L	0.001 U	0.00101	0.00062	3/7	0.00064	5/7
Calcium	Dissolved	mg/L	6.22	21.2	13.1175	12/12		
Calcium	Total	mg/L	7.07	19.4	14.045	6/6		
Chromium	Dissolved	mg/L	0.0002 U	0.0009	0.00047	4/12	0.011	0/12
Chromium	Total	mg/L	0.0002 U	0.001	0.00042	2/6	0.011	0/6
Cobalt	Dissolved	mg/L	0.0002 U	0.00049	0.00065	3/12		
Cobalt	Total	mg/L	0.0002 U	0.00103	0.00071	1/6		
Copper	Dissolved	mg/L	0.00567	0.0703	0.03255	18/18	0.0064	17/18
Copper	Total	mg/L	0.005 U	0.179	0.04481	6/7	0.0064	5/7
Iron	Dissolved	mg/L	0.1 U	0.293	0.38574	12/18	0.3	1/18
Iron	Total	mg/L	0.1 U	0.607	0.19313	6/7	0.3	2/7
Lanthanum	Dissolved	mg/L	0.001 U	0.002	0.00088	1/4		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/3		
Lead	Dissolved	mg/L	0.00004 U	0.01 U	0.003 U	0/18	0.0013	10/18
Lead	Total	mg/L	0.001 U	0.1 U	0.01657 U	0/7	0.0013	5/7
Lithium	Dissolved	mg/L	0.0004 U	0.00232	0.00081	2/4		
Lithium	Total	mg/L	0.0004 U	0.00471	0.0017	1/3		
Magnesium	Dissolved	mg/L	2.4	5.85	4.05538	13/13		
Magnesium	Total	mg/L	2.7	5.64	4.35333	6/6		
Manganese	Dissolved	mg/L	0.01 U	0.0535	0.01741	11/17	0.05	1/17
Manganese	Total	mg/L	0.01 U	0.0395	0.01441	6/7	0.05	0/7
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Molybdenum	Dissolved	mg/L	0.0004 U	0.00053	0.00028	1/4		
Molybdenum	Total	mg/L	0.0004 U	0.00073	0.00038	1/3		
Nickel	Dissolved	mg/L	0.0002 U	0.00228	0.00184	4/16	0.0134	0/16

Table 4-12
Location SF4.7
Water Quality Summary Statistics for Historical Range

SF4.7 (Jun. 1999 to Feb. 2004)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Nickel	Total	mg/L	0.002 U	0.00313	0.00154	3/6	0.0134	0/6
Potassium	Dissolved	mg/L	1 U	0.823	0.51675	4/12		
Potassium	Total	mg/L	1 U	0.473	0.441	3/6		
Selenium	Dissolved	mg/L	0.001 U	0.005 U	0.002 U	0/12	0.01	0/12
Selenium	Total	mg/L	0.001 U	0.003 U	0.002 U	0/6	0.01	0/6
Silver	Dissolved	mg/L	0.00004 U	0.001 U	0.00065 U	0/12	0.00012	11/12
Silver	Total	mg/L	0.0002 U	0.001 U	0.0006 U	0/6	0.00012	6/6
Sodium	Dissolved	mg/L	2.13	5.73	3.85	12/12		
Sodium	Total	mg/L	2.37	4.83	3.75	6/6		
Thallium	Dissolved	mg/L	0.00004 U	0.002 U	0.00125 U	0/12	0.013	0/12
Thallium	Total	mg/L	0.001 U	0.0034	0.00133	2/6	0.013	0/6
Vanadium	Dissolved	mg/L	0.005 U	0.00154	0.00223	4/12		
Vanadium	Total	mg/L	0.005 U	0.00233	0.00147	3/6		
Zinc	Dissolved	mg/L	0.0254	0.495	0.20908	18/18	0.057	16/18
Zinc	Total	mg/L	0.0185	0.29	0.1575	7/7	0.057	5/7
Major Ions								
Alkalinity		mg/L	20	45	32.5	2/2		
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3		
Chloride		mg/L	1.1	16.9	6.83333	3/3	230	0/3
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3		
Nitrate & Nitrite as N		mg/L as N	0.0117	0.0831	0.0474	2/2		
Nitrate as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.005 U	0.0037	0.0031	1/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	16.8	142	60.1333	3/3		
Sulfate		mg/L	10.5	31.8	22.42	10/10		
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/7	0.002	7/7
Total Phosphate as P		mg/L as P	0.02	0.02	0.02	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	2	1.75	1/2		
Hardness[4]		mg/L	25.4	82	48.4417	12/12		
Total Organic Carbon		mg/L	3 U	2	1.5	2/3		
Total Suspended Solids		mg/L	1 U	3	2.6	1/10		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-12
Location SF4.7
Water Quality Summary Statistics for Historical Range

M3.1 (Jun. 1999 to May 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	83	83	83	1/1		
Conductivity		µS/cm	82	176	131.667	3/3		
Flow		gpm	311.5	35237.6	6648.1	16/16		
pH		su	6.29	8.02	7.54	18/18	6.5 to 8.5	3/18
Temperature		deg C	9	15.8	11.3	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.1 U	0.781	0.15313	10/16		
Aluminum	Total	mg/L	0.05 U	1.31	0.45433	2/3		
Antimony	Dissolved	mg/L	0.0001 U	0.003 U	0.00171 U	0/10	0.146	0/10
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.146	0/2
Arsenic	Dissolved	mg/L	0.001 U	0.0068	0.00237	1/15	0.048	0/15
Arsenic	Total	mg/L	0.002 U	0.005 U	0.003 U	0/3	0.048	0/3
Barium	Dissolved	mg/L	0.00771	0.0187	0.00922	10/10	1	0/10
Barium	Total	mg/L	0.00973	0.0131	0.01142	2/2	1	0/2
Beryllium	Dissolved	mg/L	0.00001 U	0.00019	0.00037	2/10	0.0053	0/10
Beryllium	Total	mg/L	1.2E-05	2.5E-05	1.9E-05	2/2	0.0053	0/2
Boron		mg/L	0.0195	0.0195	0.0195	1/1		
Cadmium	Dissolved	mg/L	0.0001 U	0.0022	0.00103	7/16	0.0007	14/16
Cadmium	Total	mg/L	0.002 U	0.0009	0.00082	2/3	0.0007	2/3
Calcium	Dissolved	mg/L	6.74	22.7	13.906	10/10		
Calcium	Total	mg/L	6.68	14.6	10.64	2/2		
Chromium	Dissolved	mg/L	0.0002 U	0.00461	0.00107	4/10	0.011	0/10
Chromium	Total	mg/L	0.00041	0.00235	0.00138	2/2	0.011	0/2
Cobalt	Dissolved	mg/L	0.0002 U	0.00259	0.00079	3/10		
Cobalt	Total	mg/L	0.0002 U	0.00082	0.00046	1/2		
Copper	Dissolved	mg/L	0.00142	0.135	0.04436	16/16	0.007	14/16
Copper	Total	mg/L	0.0081	0.135	0.05143	3/3	0.007	3/3
Iron	Dissolved	mg/L	0.1 U	0.526	0.14863	12/16	0.3	2/16
Iron	Total	mg/L	0.0399	1.21	0.43027	3/3	0.3	1/3
Lanthanum	Dissolved	mg/L	0.001 U	0.0011	0.00065	1/4		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/2		
Lead	Dissolved	mg/L	0.001 U	0.143	0.01072	3/16	0.0015	10/16
Lead	Total	mg/L	0.003 U	0.005 U	0.00367 U	0/3	0.0015	3/3
Lithium	Dissolved	mg/L	0.0004 U	0.00526	0.0024	2/4		
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2		
Magnesium	Dissolved	mg/L	2.83	7.69	5.03909	11/11		
Magnesium	Total	mg/L	3.14	4.87	4.005	2/2		
Manganese	Dissolved	mg/L	0.01 U	0.0465	0.02259	10/15	0.05	1/15
Manganese	Total	mg/L	0.0057	0.0396	0.01803	3/3	0.05	0/3
Mercury	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.000012	1/1
Molybdenum	Dissolved	mg/L	0.0004 U	0.00192	0.00071	2/4		
Molybdenum	Total	mg/L	0.0004 U	0.0004	0.0003	1/2		
Nickel	Dissolved	mg/L	0.0002 U	0.00361	0.00225	4/14	0.0134	0/14

Table 4-13
Location M3.1
Water Quality Summary Statistics for Historical Range

M3.1 (Jun. 1999 to May 2002)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Nickel	Total	mg/L	0.005 U	0.00405	0.00187	2/3	0.0134	0/3
Potassium	Dissolved	mg/L	1 U	1.17	0.5316	5/10		
Potassium	Total	mg/L	0.395	0.463	0.429	2/2		
Selenium	Dissolved	mg/L	0.001 U	0.0051	0.00146	1/10	0.01	0/10
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.01	0/2
Silver	Dissolved	mg/L	0.00004 U	0.00033	0.00032	1/10	0.00012	9/10
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.00012	2/2
Sodium	Dissolved	mg/L	2.42	5.55	3.888	10/10		
Sodium	Total	mg/L	2.33	4.23	3.28	2/2		
Thallium	Dissolved	mg/L	0.00004 U	0.0112	0.00167	1/10	0.013	0/10
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.013	0/2
Vanadium	Dissolved	mg/L	0.005 U	0.00205	0.00229	4/10		
Vanadium	Total	mg/L	0.00073	0.00391	0.00232	2/2		
Zinc	Dissolved	mg/L	0.0306	0.542	0.28594	16/16	0.063	15/16
Zinc	Total	mg/L	0.0972	0.272	0.1563	3/3	0.063	3/3
Major Ions								
Alkalinity		mg/L	21	48	34.5	2/2		
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3		
Chloride		mg/L	1.2	20.4	8.06667	3/3	230	0/3
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3		
Nitrate & Nitrite as N		mg/L as N	0.0125	0.109	0.06075	2/2		
Nitrate as N		mg/L as N	0.143	0.143	0.143	1/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.005 U	0.0061	0.0043	1/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	0.05 U	139	19.9688	2/8		
Sulfate		mg/L	13.3	32.3	25.28	10/10		
Total Phosphate as P		mg/L as P	0.02	0.02	0.02	1/1		
Other								
Dissolved Organic Carbon		mg/L	3 U	2	1.75	1/2		
Hardness[4]		mg/L	28.5	89	54.5167	12/12		
Total Organic Carbon		mg/L	1 U	2	1.33333	1/3		
Total Suspended Solids		mg/L	1 U	4	2.75	1/8		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-13
Location M3.1
Water Quality Summary Statistics for Historical Range

M13.0 (Jun. 1999 to Sep. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	66	250	160.333	3/3		
Flow		gpm	1638.2	102032.5	32185.6	4/4		
pH		su	7.49	8.27	7.67	5/5	6.5 to 8.5	0/5
Temperature		deg C	7.8	12	10.025	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.1 U	0.228	0.0963	5/10		
Aluminum	Total	mg/L	0.1 U	0.453	0.111	5/8		
Antimony	Dissolved	mg/L	0.001 U	0.005 U	0.0021 U	0/10	0.146	0/10
Antimony	Total	mg/L	0.001 U	0.003 U	0.002 U	0/8	0.146	0/8
Arsenic	Dissolved	mg/L	0.001 U	0.0077	0.00169	3/9	0.048	0/9
Arsenic	Total	mg/L	0.001 U	0.002 U	0.00163 U	0/8	0.048	0/8
Barium	Dissolved	mg/L	0.0198	0.146	0.07301	10/10	1	0/10
Barium	Total	mg/L	0.0233	0.121	0.06069	8/8	1	0/8
Beryllium	Dissolved	mg/L	0.00001 U	0.00019	0.00042	2/10	0.0053	0/10
Beryllium	Total	mg/L	0.00001 U	5.4E-05	0.00026	3/8	0.0053	0/8
Boron		mg/L	0.0134	0.0834	0.0484	2/2		
Cadmium	Dissolved	mg/L	0.0001 U	0.00026	0.00044	1/10	0.00072	7/10
Cadmium	Total	mg/L	0.001 U	0.00025	0.00035	4/8	0.00072	4/8
Calcium	Dissolved	mg/L	4.9	25.1	14.638	10/10		
Calcium	Total	mg/L	5.6	23.5	12.75	8/8		
Chromium	Dissolved	mg/L	0.0002 U	0.00453	0.001	3/10	0.011	0/10
Chromium	Total	mg/L	0.0002 U	0.00101	0.00049	3/8	0.011	0/8
Cobalt	Dissolved	mg/L	0.001 U	0.00239	0.00097	3/10		
Cobalt	Total	mg/L	0.0002 U	0.0008	0.00063	3/8		
Copper	Dissolved	mg/L	0.00059	0.0184	0.00742	10/10	0.0072	4/10
Copper	Total	mg/L	0.00088	0.0345	0.00929	8/8	0.0072	3/8
Iron	Dissolved	mg/L	0.1 U	0.324	0.58065	4/10	0.3	2/10
Iron	Total	mg/L	0.1 U	0.5	0.11068	5/8	0.3	1/8
Lanthanum	Dissolved	mg/L	0.001 U	0.0022	0.00107	1/3		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/4		
Lead	Dissolved	mg/L	0.001 U	0.0062	0.00132	1/10	0.0015	4/10
Lead	Total	mg/L	0.001 U	0.003 U	0.002 U	0/8	0.0015	4/8
Lithium	Dissolved	mg/L	0.0004 U	0.0125	0.00696	2/3		
Lithium	Total	mg/L	0.0004 U	0.0121	0.00393	3/4		
Magnesium	Dissolved	mg/L	2.28	6.83	4.637	10/10		
Magnesium	Total	mg/L	2.36	6.65	4.17625	8/8		
Manganese	Dissolved	mg/L	0.01 U	0.00973	0.00479	4/10	0.05	0/10
Manganese	Total	mg/L	0.001 U	0.0104	0.00354	5/8	0.05	0/8
Molybdenum	Dissolved	mg/L	0.0004 U	0.00314	0.00118	1/3		
Molybdenum	Total	mg/L	0.0004 U	0.00067	0.00032	1/4		
Nickel	Dissolved	mg/L	0.0002 U	0.00307	0.00124	2/8	0.0134	0/8
Nickel	Total	mg/L	0.002 U	0.00257	0.00142	4/6	0.0134	0/6
Potassium	Dissolved	mg/L	0.1 U	1.1	0.486	3/10		

Table 4-14
Location M13.0
Water Quality Summary Statistics for Historical Range

M13.0 (Jun. 1999 to Sep. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Potassium	Total	mg/L	0.1 U	1.15	0.5895	4/8		
Selenium	Dissolved	mg/L	0.001 U	0.0047	0.00122	1/10	0.01	0/10
Selenium	Total	mg/L	0.001 U	0.00161	0.00123	2/8	0.01	0/8
Silver	Dissolved	mg/L	0.0002 U	0.002 U	0.00104 U	0/10	0.00012	10/10
Silver	Total	mg/L	0.0002 U	0.001 U	0.0006 U	0/8	0.00012	8/8
Sodium	Dissolved	mg/L	3.64	20.3	11.137	10/10		
Sodium	Total	mg/L	3.37	19.2	9.37625	8/8		
Thallium	Dissolved	mg/L	0.001 U	0.0128	0.00201	2/10	0.013	0/10
Thallium	Total	mg/L	0.001 U	0.002 U	0.0015 U	0/8	0.013	0/8
Vanadium	Dissolved	mg/L	0.0001 U	0.00168	0.00228	2/10		
Vanadium	Total	mg/L	0.0001 U	0.00132	0.00156	3/8		
Zinc	Dissolved	mg/L	0.0005 U	0.0836	0.04112	9/10	0.065	2/10
Zinc	Total	mg/L	0.0121	0.104	0.04538	8/8	0.065	2/8
Major Ions								
Alkalinity		mg/L	20	44	32	2/2		
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3		
Chloride		mg/L	3.1	41	22.2333	3/3	230	0/3
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3		
Nitrate & Nitrite as N		mg/L as N	0.005 U	0.0365	0.0195	1/2		
Nitrate as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1		
Orthophosphate as P		mg/L as P	0.0047	0.007	0.00585	2/2		
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1		
Silica (SiO2)		mg/L	15.1	142	58.2667	3/3		
Sulfate		mg/L	5.06	17	9.96667	3/3		
Total Phosphate as P		mg/L as P	0.03	0.03	0.03	1/1		
Other								
Dissolved Organic Carbon		mg/L	2	3.89	2.945	2/2		
Hardness[4]		mg/L	21.6	81.6	56.28	5/5		
Total Organic Carbon		mg/L	3 U	2	1.5	2/3		
Total Suspended Solids		mg/L	1 U	2	2.5	1/3		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-14
Location M13.0
Water Quality Summary Statistics for Historical Range

C1 (Oct. 1999 to Sep. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	69	100	84.5	2/2		
Flow		gpm	41256.5	41256.5	41256.5	1/1		
pH		su	7.71	8.17	7.88	4/4	6.5 to 8.5	0/4
Temperature		deg C	11	13	12	3/3		
Metals								
Aluminum	Dissolved	mg/L	0.1 U	0.162	0.093778	4/9		
Aluminum	Total	mg/L	0.1 U	0.101	0.0656	2/5		
Antimony	Dissolved	mg/L	0.001 U	0.003 U	0.001667 U	0/9	0.146	0/9
Antimony	Total	mg/L	0.001 U	0.003 U	0.0014 U	0/5	0.146	0/5
Arsenic	Dissolved	mg/L	0.001 U	0.0074	0.001439	2/9	0.048	0/9
Arsenic	Total	mg/L	0.001 U	0.002 U	0.0014 U	0/5	0.048	0/5
Barium	Dissolved	mg/L	0.00632	0.00937	0.007653	9/9	1	0/9
Barium	Total	mg/L	0.00619	0.0103	0.007998	5/5	1	0/5
Beryllium	Dissolved	mg/L	0.00001 U	0.0002	0.000358	2/9	0.0053	0/9
Beryllium	Total	mg/L	0.001 U	5.6E-05	0.000411	1/5	0.0053	0/5
Cadmium	Dissolved	mg/L	0.0001 U	0.001 U	0.0007 U	0/9	0.00053	6/9
Cadmium	Total	mg/L	0.0001 U	0.001 U	0.00082 U	0/5	0.00053	4/5
Calcium	Dissolved	mg/L	5.36	10.8	8.093333	9/9		
Calcium	Total	mg/L	7.12	11	8.69	5/5		
Chromium	Dissolved	mg/L	0.0002 U	0.00453	0.001372	6/9	0.011	0/9
Chromium	Total	mg/L	0.001 U	0.00134	0.000744	3/5	0.011	0/5
Cobalt	Dissolved	mg/L	0.0002 U	0.00277	0.000811	2/9		
Cobalt	Total	mg/L	0.001 U	0.00037	0.000774	1/5		
Copper	Dissolved	mg/L	0.0003 U	0.00606	0.012654	3/9	0.0052	2/9
Copper	Total	mg/L	0.002 U	0.00253	0.001234	2/5	0.0052	0/5
Iron	Dissolved	mg/L	0.1 U	0.253	0.097167	5/9	0.3	0/9
Iron	Total	mg/L	0.0338	0.254	0.14236	5/5	0.3	0/5
Lanthanum	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/3		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/1		
Lead	Dissolved	mg/L	0.001 U	0.0062	0.001356	1/9	0.00093	9/9
Lead	Total	mg/L	0.001 U	0.003 U	0.0014 U	0/5	0.00093	5/5
Lithium	Dissolved	mg/L	0.0004 U	0.00553	0.00292	2/3		
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1		
Magnesium	Dissolved	mg/L	4.15	7.46	5.645556	9/9		
Magnesium	Total	mg/L	5.08	7.82	5.998	5/5		
Manganese	Dissolved	mg/L	0.0002 U	0.00617	0.003577	3/9	0.05	0/9
Manganese	Total	mg/L	0.01 U	0.00656	0.00469	2/5	0.05	0/5
Molybdenum	Dissolved	mg/L	0.0004 U	0.0022	0.000953	2/3		
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1		
Nickel	Dissolved	mg/L	0.002 U	0.00463	0.002534	6/7	0.0134	0/7
Nickel	Total	mg/L	0.002 U	0.00311	0.00222	2/3	0.0134	0/3
Potassium	Dissolved	mg/L	0.1 U	0.76	0.436333	3/9		
Potassium	Total	mg/L	0.1 U	1	0.51	1/5		

Table 4-15
Location C1
Water Quality Summary Statistics for Historical Range

C1 (Oct. 1999 to Sep. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Selenium	Dissolved	mg/L	0.001 U	0.0067	0.001901	1/9	0.01	0/9
Selenium	Total	mg/L	0.001 U	0.003 U	0.0014 U	0/5	0.01	0/5
Silver	Dissolved	mg/L	0.0002 U	0.001 U	0.000733 U	0/9	0.00012	9/9
Silver	Total	mg/L	0.0002 U	0.001 U	0.00084 U	0/5	0.00012	5/5
Sodium	Dissolved	mg/L	2.61	4.75	3.764444	9/9		
Sodium	Total	mg/L	3.28	4.22	3.846	5/5		
Thallium	Dissolved	mg/L	0.001 U	0.0131	0.002222	2/9	0.013	1/9
Thallium	Total	mg/L	0.001 U	0.002 U	0.0012 U	0/5	0.013	0/5
Vanadium	Dissolved	mg/L	0.005 U	0.00197	0.002079	3/9		
Vanadium	Total	mg/L	0.005 U	0.00082	0.002164	1/5		
Zinc	Dissolved	mg/L	0.0005 U	0.00951	0.00293	2/9	0.047	0/9
Zinc	Total	mg/L	0.005 U	0.00661	0.003442	2/5	0.047	0/5
Other								
Hardness[4]		mg/L	30.5	44.4	37.9	4/4		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-15
Location C1
Water Quality Summary Statistics for Historical Range

C2 (Jun. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Field Measurements								
Conductivity		µS/cm	10	105	69.75	4/4		
Flow		gpm	45439.5	45439.5	45439.5	1/1		
pH		su	7.59	8.08	7.93	5/5	6.5 to 8.5	0/5
Temperature		deg C	10	19.8	12.95	4/4		
Metals								
Aluminum	Dissolved	mg/L	0.1 U	0.189	0.09389	4/9		
Aluminum	Total	mg/L	0.1 U	0.119	0.0676	2/5		
Antimony	Dissolved	mg/L	0.001 U	0.003 U	0.00167 U	0/9	0.146	0/9
Antimony	Total	mg/L	0.001 U	0.003 U	0.0014 U	0/5	0.146	0/5
Arsenic	Dissolved	mg/L	0.001 U	0.0075	0.00188	2/9	0.048	0/9
Arsenic	Total	mg/L	0.001 U	0.00164	0.00093	1/5	0.048	0/5
Barium	Dissolved	mg/L	0.00862	0.02	0.01226	9/9	1	0/9
Barium	Total	mg/L	0.00989	0.0219	0.01474	5/5	1	0/5
Beryllium	Dissolved	mg/L	0.00001 U	0.00022	0.00036	2/9	0.0053	0/9
Beryllium	Total	mg/L	0.001 U	6.3E-05	0.00041	1/5	0.0053	0/5
Cadmium	Dissolved	mg/L	0.0001 U	0.001 U	0.0007 U	0/9	0.00052	6/9
Cadmium	Total	mg/L	0.001 U	0.0002	0.00044	1/5	0.00052	4/5
Calcium	Dissolved	mg/L	5.31	11.8	8.35556	9/9		
Calcium	Total	mg/L	7.26	11.9	9.08	5/5		
Chromium	Dissolved	mg/L	0.0002 U	0.00422	0.00126	6/9	0.011	0/9
Chromium	Total	mg/L	0.001 U	0.0011	0.00057	2/5	0.011	0/5
Cobalt	Dissolved	mg/L	0.0002 U	0.00299	0.00089	2/9		
Cobalt	Total	mg/L	0.001 U	0.00036	0.00077	1/5		
Copper	Dissolved	mg/L	0.0003 U	0.00603	0.01313	3/9	0.0051	3/9
Copper	Total	mg/L	0.002 U	0.00234	0.00157	3/5	0.0051	0/5
Iron	Dissolved	mg/L	0.1 U	0.259	0.09705	5/9	0.3	0/9
Iron	Total	mg/L	0.0272	0.19	0.11844	5/5	0.3	0/5
Lanthanum	Dissolved	mg/L	0.001 U	0.0014	0.0008	1/3		
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/1		
Lead	Dissolved	mg/L	0.001 U	0.0067	0.00141	1/9	0.00091	9/9
Lead	Total	mg/L	0.001 U	0.003 U	0.0014 U	0/5	0.00091	5/5
Lithium	Dissolved	mg/L	0.0004 U	0.00518	0.00327	2/3		
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1		
Magnesium	Dissolved	mg/L	3.62	7.04	5.39556	9/9		
Magnesium	Total	mg/L	4.99	7.35	5.754	5/5		
Manganese	Dissolved	mg/L	0.0002 U	0.00556	0.00403	3/9	0.05	0/9
Manganese	Total	mg/L	0.01 U	0.00677	0.00571	2/5	0.05	0/5
Molybdenum	Dissolved	mg/L	0.0004 U	0.00208	0.00093	2/3		
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1		
Nickel	Dissolved	mg/L	0.002 U	0.0051	0.00254	6/7	0.0134	0/7
Nickel	Total	mg/L	0.002 U	0.00324	0.00218	2/3	0.0134	0/3
Potassium	Dissolved	mg/L	0.1 U	0.816	0.43267	3/9		
Potassium	Total	mg/L	0.1 U	1	0.51	1/5		

Table 4-16
Location C2
Water Quality Summary Statistics for Historical Range

C2 (Jun. 1999 to Sept. 2005)

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]
Metals (Con't)								
Selenium	Dissolved	mg/L	0.001 U	0.003 U	0.00178 U	0/9	0.01	0/9
Selenium	Total	mg/L	0.001 U	0.00275	0.00154	3/5	0.01	0/5
Silver	Dissolved	mg/L	0.0002 U	0.001 U	0.00073 U	0/9	0.00012	9/9
Silver	Total	mg/L	0.0002 U	0.001 U	0.00084 U	0/5	0.00012	5/5
Sodium	Dissolved	mg/L	3.04	5.58	4.15333	9/9		
Sodium	Total	mg/L	3.54	5.39	4.458	5/5		
Thallium	Dissolved	mg/L	0.001 U	0.0146	0.00229	2/9	0.013	1/9
Thallium	Total	mg/L	0.001 U	0.002 U	0.0012 U	0/5	0.013	0/5
Vanadium	Dissolved	mg/L	0.005 U	0.00182	0.00204	3/9		
Vanadium	Total	mg/L	0.005 U	0.00087	0.00217	1/5		
Zinc	Dissolved	mg/L	0.0005 U	0.0496	0.01143	5/9	0.046	1/9
Zinc	Total	mg/L	0.005 U	0.0122	0.00645	3/5	0.046	0/5
Other								
Hardness[4]		mg/L	28.1	42.6	37.425	4/4		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table 4-16
Location C2
Water Quality Summary Statistics for Historical Range

USGS Sediment Results

Sample Location			USGS-7		USGS-8		USGS-9		USGS-10		EPA Sediment Screening Level[1]	EPA Sediment Screening Level Exceedances
Sample Date			8/27/1998		9/14/1998		9/15/1998		9/15/1998			
Sample Media			Sediment		Sediment		Sediment		Sediment			
Analyte	Analysis Method	Unit	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual		
Aluminum	Total	percent	8.4		9.4		8.5		7.7			
Antimony	Total	mg/kg	0.5		4.8		0.2		0.9		2	1/4
Arsenic	Total	mg/kg	6.2		28		3.7		7.1		9.8	1/4
Barium	Total	mg/kg	410		8400		310		970			
Beryllium	Total	mg/kg	1.1		2		0.9		1.1			
Bismuth	Total	mg/kg	1	U	1	U	1	U	1	U		
Cadmium	Total	mg/kg	0.3		30		17		17		0.99	3/4
Calcium	Total	percent	2		1.3		1.9		1.5			
Carbon (inorganic)	Total	percent	0.05		0.07		0.17		0.03			
Carbon (organic)	Total	percent	6.7		4		6.5		5.3			
Carbon (inorganic plus organic)	Total	percent	6.7		4.1		6.7		5.4			
Cerium	Total	mg/kg	36		55		38		33			
Chromium	Total	mg/kg	280		150		84		230		43.4	4/4
Cobalt	Total	mg/kg	33		23		29		29		50	0/4
Copper	Total	mg/kg	86		16000		1400		1500		31.6	4/4
Europium	Total	mg/kg	1		4		2		2			
Gallium	Total	mg/kg	18		14		16		15			
Gold	Total	mg/kg	1	U	1	U	1	U	1	U		
Holmium	Total	mg/kg	1		5		4		1			
Iron	Total	mg/kg	58000		57000		57000		49000		20000	4/4
Lanthanum	Total	mg/kg	18		31		31		20			
Lead	Total	mg/kg	9		29		8		11		35.8	0/4
Lithium	Total	mg/kg	49		12		18		40			
Magnesium	Total	percent	2.3		1.8		1.3		2.2			
Manganese	Total	mg/kg	1000		920		3600		1000		460	4/4
Mercury	Total	mg/kg	0.14		0.61		0.12		0.17		0.18	1/4
Molybdenum	Total	mg/kg	0.7		3		0.5	U	0.8			
Neodymium	Total	mg/kg	21		48		39		24			
Nickel	Total	mg/kg	190		100		62		170		22.7	4/4
Niobium	Total	mg/kg	4	U	4	U	4	U	5			
Phosphorus	Total	percent	0.085		0.063		0.1		0.086			
Potassium	Total	percent	0.82		0.42		0.54		0.78			
Scandium	Total	mg/kg	29		26		26		23			
Selenium	Total	mg/kg	1.2		0.3		1.7		0.9		2	0/4
Silver	Total	mg/kg	0.4		2		0.3		1.2		1.0	2/4
Sodium	Total	percent	0.97		0.91		0.68		1			
Strontium	Total	mg/kg	120		130		130		110			
Sulfur	Total	percent	0.06		0.6		0.14		0.2			
Tantalum	Total	mg/kg	1	U	1	U	1	U	1	U		
Thallium	Total	mg/kg	1	U	1	U	1	U	1	U		
Thorium	Total	mg/kg	3		1		2		3			
Tin	Total	mg/kg	1		1		1		1			
Titanium	Total	percent	0.51		0.32		0.38		0.39			
Uranium	Total	mg/kg	1.2		0.8		0.6		1			
Vanadium	Total	mg/kg	200		140		170		140			
Ytterbium	Total	mg/kg	3		8		5		3			
Yttrium	Total	mg/kg	28		110		73		28			
Zinc	Total	mg/kg	120		11000		4600		3800		121	3/4

Table 4-17
Sediment and Precipitate Total Metals Data

Hart Crowser and Dynamac Sediment Results

Sample Location			A4		A9		Formosa Adit		404 Adit		SFL		SFU		MXR			MXR			MXR			MXR			EPA Sediment Screening Level[1]	EPA Sediment Screening Level Exceedances
Sample Date			10/19/1999		10/19/1999		10/19/1999		10/20/1999		10/20/1999		10/20/1999		2/7/2002			4/4/2002			4/22/2002			5/29/2002				
Sample Media			Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment			Sediment			Sediment			Sediment				
Analyte	Analysis Method	Unit	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual		
Aluminum	Total	mg/kg	1100		3900		27		940		11000		19000		15800		J	16100		J	17700		J	16600				
Antimony	Total	mg/kg	5	U	5	U	5	U	5	U	5	U	5	U													2	0/0
Arsenic	Total	mg/kg	20		62		57		29		5	U	5	U	3.69			2.53			1.65			1.67			9.8	4/10
Barium	Total	mg/kg	1200		850		50	U	50	U	170		5.2															
Beryllium	Total	mg/kg	2	U	2	U	2	U	2	U	2	U	2	U														
Cadmium	Total	mg/kg	2	U	2	U	2	U	2	U	2	U	2	U	3.22		J	5.34			3.36			4.85			0.99	4/4
Calcium	Total	mg/kg	240		630		240		140		5100		6300															
Chromium	Total	mg/kg	50	U	50	U	50	U	50	U	50	U	50	U													43.4	0/0
Cobalt	Total	mg/kg	5	U	5	U	5	U	5	U	5	U	18														50	0/6
Copper	Total	mg/kg	420		620		45		84		230		44		6540			3190			1880			3240			31.6	10/10
Cyanide	Total	mg/kg	1	U	1	U	1	U	1	U	1	U	1	U													0.1	0/0
Iron	Total	mg/kg	55000		58000		150000		73000		18000		28000		16700		J	19200		J				22000			20000	6/9
Lead	Total	mg/kg	12		40		11		9.1		17		5	U	3.55			2.64			47			1.78			35.8	2/10
Magnesium	Total	mg/kg	240		1400		130		120		2800		9000															
Manganese	Total	mg/kg	21		170		5.6		9.4		270		600		4540			890			820			1140			460	5/10
Mercury	Total	mg/kg	0.31		0.1	U	0.1	U	0.1	U	0.1	U	0.1	U													0.18	1/6
Nickel	Total	mg/kg	5	U	5	U	5	U	5	U	5	U	8.4		24.1			39.2			33.2			65.5			22.7	4/10
Potassium	Total	mg/kg	150		170		100	U	70		330		150															
Selenium	Total	mg/kg	25	U	25	U	25	U	25	U	25	U	25	U													2	0/0
Silver	Total	mg/kg	25	U	25	U	25	U	25	U	25	U	25	U													1.0	0/0
Sodium	Total	mg/kg	1000	U	1000	U	1000	U	1000	U	1000	U	1000	U														
Thallium	Total	mg/kg	50	U	50	U	50	U	50	U	50	U	50	U														
Vanadium	Total	mg/kg	6.1		16		9.4		5	U	35		76															
Zinc	Total	mg/kg	190		440		160		10	U	300		37		2400			2080			1340			2020			121	8/10

Hart Crowser Precipitate Results

Sample Location			A19			A6			A14			A19			A6			A14			A19			A6			A14		
Sample Date			2/7/2002			2/7/2002			4/4/2002			4/4/2002			4/4/2002			4/22/2002			4/22/2002			4/22/2002			5/29/2002		
Sample Media			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate		
Analyte	Analysis Method	Unit	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual
Aluminum	Total	mg/kg	43100		J	1100		J	21800		J	13100		J	1250		J	11600		J	6840		J	3580		J	15800		
Arsenic	Total	mg/kg	1	U		2.22			1	U		1	U		3.11			0.436			0.238			7.6			0.5	U	
Cadmium	Total	mg/kg	1	U	J	1	U	J	1	U		1	U		1	U		0.2	U		0.486			1.04			0.5	U	
Copper	Total	mg/kg	407			298			161			2810			366			167			1960			252			316		
Iron	Total	mg/kg	6850		J	132000		J	1320		J	363		J	69200		J										1090		
Lead	Total	mg/kg	1	U		1	U		1	U		1	U		1	U		0.596			0.58			8.84			0.565		
Manganese	Total	mg/kg	56.5			25.5			3.93			22.4			5.53			6.9			49.6			43.2			4.93		
Nickel	Total	mg/kg	1	U		1	U		1	U		1.19			1	U		0.334			2.34			1.73			0.5	U	
Zinc	Total	mg/kg	40.8			29.8			24.6			304			36.6			28.8			358			139			44.4		

Hart Crowser Precipitate Results (Cont.)

Sample Location			A6			MXR			EPA Sediment Screening Level[1]	EPA Sediment Screening Level Exceedances
Sample Date			5/29/2002			5/29/2002				
Sample Media			Precipitate			Precipitate				
Analyte	Analysis Method	Unit	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual		
Aluminum	Total	mg/kg	1120			12000				
Arsenic	Total	mg/kg	2.31			0.565			9.8	0/11
Cadmium	Total	mg/kg	0.96			2.04			0.99	2/6
Copper	Total	mg/kg	231			4370			31.6	11/11
Iron	Total	mg/kg	29800			2000			20000	3/8
Lead	Total	mg/kg	1.65			0.72			35.8	0/11
Manganese	Total	mg/kg	26.2			60			460	0/11
Nickel	Total	mg/kg	0.695			2.89			22.7	0/11
Zinc	Total	mg/kg	73			1500			121	4/11

1 - EPA Sediment Screening Levels were obtained the EPA Mid-Atlantic Risk Assessment webpage, Freshwater Sediment Screening Benchmarks for ecological risk. http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm

Table 4-17
Sediment and Precipitate Total Metals Data

Sample Location			MXR			A6			A6			A14			A14			A19			MXR			MXR			Water Quality Screening Level[2]	Water Quality Screening Level Exceedances
Sample Date			5/29/2002			4/22/2002			5/29/2002			4/22/2002			5/29/2002			4/22/2002			4/22/2002			5/29/2002				
Sample Media			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate			Precipitate			Sediment			Sediment				
Analyte[1]	Analysis Method	Unit	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual		
Aluminum	Elutriate	mg/L	0.185			0.1	U		0.062	U		0.1	U		0.594			0.238			0.1	U		0.062	U			
Arsenic	Elutriate	mg/L	0.0062	U		0.01	U		0.0062	U		0.01	U		0.0062	U		0.01	U		0.01	U		0.0062	U		0.048	0/8
Cadmium	Elutriate	mg/L	0.0025	U		0.004	U		0.0025	U		0.004	U		0.0025	U		0.004	U		0.004	U		0.0025	U		0.0011	0/0
Copper	Elutriate	mg/L	0.0781			0.01	U		0.0062	U		0.01	U		0.0135			0.0666			0.0186			0.0342			0.012	5/8
Iron	Elutriate	mg/L	0.0179			0.0558			0.162			0.02	U		0.0356			0.0206			0.02	U		0.0217			0.3	0/8
Lead	Elutriate	mg/L	0.0062	U		0.01	U		0.0062	U		0.01	U		0.0062	U		0.01	U		0.01	U		0.0062	U		0.0032	0/0
Manganese	Elutriate	mg/L	0.0085			0.01	U		0.0062	U		0.01	U		0.0062	U		0.01	U		0.01	U		0.0062	U		0.05	0/8
Nickel	Elutriate	mg/L	0.0062	U		0.01	U		0.0062	U		0.01	U		0.0062	U		0.01	U		0.01	U		0.0062	U		0.0134	0/8
Zinc	Elutriate	mg/L	0.139			0.078			0.015			0.0568			0.0216			0.122			0.39			0.221			0.11	4/8
Total Suspended Solids	Elutriate	mg/L	30			16			25			70		J	71			79		J	12		J	5	U			
Hardness	Elutriate	mg/L	87.4			80.6		J	86.8			81.2			87			81.2			81.4			87.4				
Sulfate	Elutriate	mg/L	51.2			61.6			53.5			65.9			63.7			56.6			53.7			51.1				
Sulfide	Elutriate	mg/L	0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U			

1 - Metals results are dissolved.

2 - Water Quality Screening Levels were selected as the most stringent standards from Table 4-1, and using a hardenss of 100 mg/L for hardness dependent standards.

Table 4-18
Sediment and Precipitate Elutriate Data

	USFS				Baseline Monitoring					
	Summer 1984				May 1989			September 1989		
	SF2.0	M2.0	M7.9	M13.0	X1	M1	SF#1	X1	M1	SF#1
Abundance (average per m^2)	520	373	699	441	3948	4010	11138	13788	13035	25430
Total # of Taxa	23	23	22	21	33	24	39	50	30	48
Abundance EPT (avg. per m^2)	118	154	240	183	2171	160	481	1984	1099	2727
# of EPT Taxa	11	14	10	11	8	4	7	10	5	9
% EPT Abundance	23	41	34	41	55	4	4	14	8	11
% EPT Taxa	48	61	45	52	24	17	18	20	17	19

	Aquatic Biology Associates						
	November 1994		November 1995		November 1996		November 1997
	M1	SF#1	M1	SF#1	M1	SF#1	M1
Abundance (average per m^2)	1095	3165	7140	15932	693	10758	1249
Total # of Taxa	32	53	24	52	11	28	20
Abundance EPT (avg. per m^2)	743	1685	2288	7941	11	5664	355
# of EPT Taxa	10	30	8	22	2	14	9
% EPT Abundance	68	53	32	50	2	53	28
% EPT Taxa	31	57	33	42	18	50	45

	BLM Data											
	June 1999						October 1999					
Middle Creek	M1	M3.1	M7.9	M9.8	M13.0	MREF1	M1	M3.1	M7.9	M9.8	M13.0	MREF1
Abundance (average per m^2)	20	19	87	50	122	272	324	316	359	328	665	590
# of EPT Taxa	1	7	12	10	11	28	7	10	12	12	12	19

	June 1999					October 1999				
South Fork Middle Creek	SF1.0	SF1.7	SF3.0	SF4.7	SFREF1	SF1.0	SF1.7	SF3.0	SF4.7	SFREF1
Abundance (average per m^2)	0	1	27	62	594	47	27	355	363	595
# of EPT Taxa	0	0	2	4	19	2	4	6	8	22

	June 1999									
Reference Streams	C1	C2	C3	C4	Cattle Creek	Catching Creek	WFCC1.1	WFCC7.4	Russell Creek 0.9	Russell Creek 5.5
Abundance (average per m^2)	406	277	312	524	379	1257	314	713	482	374
# of EPT Taxa	15	11	13	16	28	24	29	18	22	19

Notes:
Summer 1984 data source: USFS 1982 - 1984
Baseline monitoring data source: Norecol 1989a (average values used as applicable)
Aquatic Biology Associates data source: ABA, Inc. 1994a - c, 1995, 1996, and 1997
BLM data source: BLM/ODEQ 2000a and 2000b

Figure 4-19
Macroinvertebrate Data Summary

Investigation Source	USFS		USFS		Norecol		ODFW		BLM		BLM		BLM		
Year	1982		1984		1988		1993		2000		2003		2007		
Parameter	Abundance	Richness	Abundance	Richness	Abundance	Richness	Abundance	Richness	Abundance	Richness	Abundance	Richness	Abundance	Richness	Density (fish/sq.ft.)
Middle Creek															
MID-9							0	0							
M2.0	2	2	97	3							0	0			
MID-8							0	0							
M1/M3.0					29	3			1	1	1	1	3	2	0.003
MID-7							20	5							
MID-6							129	6							
M3.1													9	5	0.003
M5.5													59	4	0.015
M7.9			28	4					29	4	29	3	67	6	0.012
M9.8									52	5	51	4	78	5	0.012
M13.0			105	4					79	7					
South Fork Middle Creek															
MID-13							0	0							
MID-12							27	2							
SF1.7											0	0			
MID-11							67	5							
SF2.3	47	6	97	3											
SF3.0											0	0	1	1	0.001
MID-10							76	5							
SF#1					20	2									
SF4.7	39	6							6	2	0	0	5	2	0.003
Russell Creek															
R1					8	1									
West Fork Canyon Creek															
C1 - Norecol					27	1									
C2 - Norecol					0	0									
C3 - Norecol					0	0									
C4 - Norecol					6	2									
Brush Creek															
Brush Creek													52	3	0.082
Peavine Creek															
PEA-1							54	4							
PEA-2							8	2							
Smith Creek															
Smith Creek													35	3	0.088
Martin Creek															
MAR-1							111	5							
MAR-2							45	5							
MAR-3							0	0							
Martin Creek 1982	48	4													
Martin Creek 2000 - 2007									93	4			99	5	0.028
Buck Creek															
BUC-1							17	4							
BUC-2							0	0							
Cedar Gulch															
CED-1							38	5							
CED-2							17	1							
CED-3							0	0							

Notes:

= not sampled

* = mean value provided, as applicable

Middle Creek and South Fork Middle Creek listed in order of increasing distance from the Mine Site.

1982 and 1984 data source: USFS 1982 - 1984

1988 data source: Norecol 1989a (average values used as applicable)

1993 data source: ODFW 1993

2000 to 2007 data source: BLM 2009

Table 4-20

Fish Abundance for Formosa Mine Site Sampling Locations

Site ID		T1	T1	T1	T2	T2	T3	T4	T4	T4
Sample Info		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Date		5/10/1989	7/24/1989	9/18/1989	2/21/1989	5/10/1989	5/21/1989	5/11/1989	7/24/1989	9/18/1989
Parameter ID	Unit									
Field Measured										
pH		6	6.3	6.3	5.9	5.8	6.1	6	6.4	6.7
Eh	mV	508	430	470	461	485	468	479	410	440
Alkalinity	mg/L $CaCO_3$	31	33	35	26	25	23	34	59	69
Carbonate Alkalinity	mg/L $CaCO_3$	0	0	0	0	0	0	0	0	0
Bicarbonate Alkalinity	mg/L $CaCO_3$	31	33	35	26	25	23	34	59	69
Turbidity	NTU	33	31	77	415	30	110	105	35	375
Conductance	µmhos/cm	58	69	64	50	49	56	80	101	109
Total Solids	mg/L	79	112	162	1197	120	393	176	315	507
Dissolved Solids	mg/L	62	88	55	71	52	84	96	151	194
Suspended Solids	mg/L	17	24	107	1126	68	309	80	164	313
Settleable Solids	mg/L	2	16	69	---	58	---	70	142	234
Calculated Hardness	mg/L $CaCO_3$	25	23	19	19	15	27	31	45	45
Sulfate	mg/L	3	1 U	1	2	1	4	11	6	6
Ammonia	mg/L N	0.017	0.005	0.005 U	0.018	0.005 U	0.005 U	0.083	0.005 U	0.01
Nitrate	mg/L N	0.22	0.161	0.09	0.135	0.365	1.06	0.011	0.005 U	0.005 U
Nitrite	mg/L N	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloride	mg/L	2.35	1.88	1.93	1.43	1.44	1.96	2.43	1.05	1.52
Fluoride	mg/L	0.16	1.14	0.15	0.21	0.12	0.12	0.16	0.14	0.17
Total Phosphorus	mg/L P	0.064	0.06	0.132	0.58	0.069	0.168	0.065	0.097	0.234
Total Cynaide	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
WAD Cyanide	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Gross Alpha	Bq/L	0.2 U	---	---	0.05 U	0.2 U	0.05 U	0.2 +/- 0.2	---	---
Gross Beta	Bq/L	0.3 +/- 0.3	---	---	0.39 +/- 0.26	0.5 U	0.32 +/- 0.16	0.5 U	---	---
Total Metals										
Silver	mg/L	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001	0.0001
Aluminum	mg/L	2.8	1	1.3	1.1	0.28	0.84	2.6	2.8	1.3
Arsenic	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.003	0.001 U	0.001 U	0.002
Barium	mg/L	0.005 U	0.005 U	0.01	0.005 U	0.005 U	0.047	0.006	0.018	0.06
Calcium	mg/L	5.9	5.9	4.1	5.9	4.9	8.7	5.3	7.6	5.5
Cadmium	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0009	0.0014	0.0068	0.0056
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.002	0.002
Chromium	mg/L	0.001 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001	0.001	0.001
Copper	mg/L	0.0028	0.0025	0.0032	0.13	0.022	0.11	0.19	0.22	0.27
Iron	mg/L	0.37	0.69	1.24	2.7	0.68	1.97	1.41	2.2	4.1
Mercury	µg/L	0.05 U	0.05 U	0.05 U	0.12	0.05 U	0.12	0.08	0.36	0.48

Table 4-21
Historic Technical Hole Analytical Results

Site ID		T1	T1	T1	T2	T2	T3	T4	T4	T4
Sample Info		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Date		5/10/1989	7/24/1989	9/18/1989	2/21/1989	5/10/1989	5/21/1989	5/11/1989	7/24/1989	9/18/1989
Parameter ID	Unit									
Total Metals (con't)										
Potassium	mg/L	0.36	0.35	0.46	1.03	0.3	1.08	0.47	0.48	0.57
Magnesium	mg/L	2.5	1.99	2.1	1.1	0.7	1.31	4.4	6.3	7.5
Manganese	mg/L	0.17	0.23	0.37	0.11	0.06	0.12	0.3	1.53	2.39
Molybdenum	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Sodium	mg/L	5.6	5.8	6.1	6.4	5.7	4.8	6.7	6.8	10.3
Nickel	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Lead	mg/L	0.001	0.001	0.001 U	0.002	0.001	0.002	0.001	0.001	0.002
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Selenium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Zinc	mg/L	0.0067	0.012	0.023	0.05	0.01	0.18	0.36	0.33	0.36
Dissolved Metals										
Silver	mg/L	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001
Aluminum	mg/L	0.028	0.01 U	0.54	0.09	0.28	0.01	0.08	0.9	0.54
Arsenic	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.002
Barium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.009	0.005 U	0.005 U	0.019
Calcium	mg/L	4.9	---	---	5.3	4.3	8.7	4	---	---
Cadmium	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0008	0.0009	0.0039	0.0053
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Copper	mg/L	0.0005	0.0005 U	0.0005 U	0.06	0.002	0.11	0.05	0.09	0.1
Iron	mg/L	0.006	0.005 U	0.39	0.09	0.012	0.005 U	0.11	0.45	1.69
Potassium	mg/L	0.33	---	---	0.36	0.3	0.48	0.43	---	---
Magnesium	mg/L	2	---	---	0.82	0.7	1.1	3.9	---	---
Manganese	mg/L	0.14	0.22	0.28	0.06	0.05	0.06	0.22	1.39	2.19
Molybdenum	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Sodium	mg/L	5.6	---	---	5.7	5.6	4.5	6.2	---	---
Nickel	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Lead	mg/L	0.001	0.001 U	0.001 U	0.001 U	0.001	0.001 U	0.001 U	0.001	0.001 U
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Selenium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Zinc	mg/L	0.003	0.0005 U	0.011	0.016	0.0068	0.16	0.29	0.24	0.25

Table 4-21
Historic Technical Hole Analytical Results

Location	T1		T2		T3		T4	
Top of Pipe		3362		3342.4		3321.7		3356.1
Ground Elevation		3359.8		3340.1		3354		3319.8
Date	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation
3/24/1989	47.8	3312	58.8	3281.3	36.1	3317.9	104	3215.8
4/1/1989	54.6	3305.2	62.7	3277.4	39.2	3314.8	107.1	3212.7
4/8/1989	53.1	3306.7	60.2	3279.9	37.4	3316.6	106.2	3213.6
4/30/1989	58.2	3301.6	65.3	3274.8	39.5	3314.5	106.7	3213.1
5/7/1989	59.5	3300.3	70.2	3269.9	44.4	3309.6	119.9	3199.9
5/10/1989	60.3	3299.5	73.1	3267	49.2	3304.8	126.3	3193.5
6/27/1989	67.3	3292.5	77.1	3263	60.1	3293.9	126	3193.8
7/7/1989	67.7	3292.1	99	3241.1	61	3293	126.7	3193.1
7/25/1989	68.9	3290.9	133.2	3206.9	55.5	3298.5	125	3194.8
8/13/1989	69.5	3290.3	141.3	3198.8	61.6	3292.4	---	---
8/24/1989	69.8	3290	143	3197.1	63	3291	126.5	3193.3
9/18/1989	73.5	3286.3	NA	DRY	DRY	NA	150.1	3169.7

Notes:

1. Elevations are given in feet above mean sea level.

Key:

--- = Water levels were not measured.

Table 4-22

Historic Technical Hole Water Level Measurements

Analyte	Analyte 2	Unit	2/26/2002	4/23/2002	5/21/2002
Depth to Groundwater		feet	57.65	65.46	68.78
Field Measurements					
Approximate Groundwater Elevation		feet	3282	3275	3271
Conductivity		uS/cm	2950	2880	2889
Dissolved Oxygen		mg/L	2.87		
ORP		mV	76	81	461
pH		SU	6.4	5.5	7.1
Temperature		C	12.2	5.5	11.3
Metals					
Aluminum	Total	mg/L	17.9	20.6	25.4
Arsenic	Dissolved	mg/L	0.005U	0.005U	0.005U
Arsenic	Total	mg/L	0.005U	0.005U	0.005U
Cadmium	Dissolved	mg/L	0.176	0.166	0.165
Cadmium	Total	mg/L	0.186	0.179	0.185
Copper	Dissolved	mg/L	25.4	25.1	22.4
Copper	Total	mg/L	25.7	26.5	22.8
Iron	Dissolved	mg/L	0.947	0.0796	0.103
Iron	Total	mg/L	1.16	1.79	8.76
Lead	Dissolved	mg/L	0.005U	0.005U	0.005U
Lead	Total	mg/L	0.005U	0.005U	0.0097
Manganese	Dissolved	mg/L	17.1	8.56	18.7
Manganese	Total	mg/L	17.2	9.83	18.8
Nickel	Dissolved	mg/L	0.379	0.302	0.443
Nickel	Total	mg/L	0.402	0.334	0.448
Zinc	Dissolved	mg/L	102	90.9	111
Zinc	Total	mg/L	104	96.5	116
Other					
Hardness		mg/L	1320	1270	1240
Sulfate		mg/L	2600	2950	2680
Sulfide		mg/L	0.05U	0.05U	0.05U
Total Suspended Solids		mg/L	20	1310	722J

Notes:

U- Data less than detecton level

J- Estimated Value

Analyte	Analyte 2	Unit	10/25/1999	3/23/2000	2/26/2002	4/23/2002	5/20/2002
Field Measurements							
Depth to Groundwater		feet	94.6	89.05	92.66	95.02	97.37
Approximate Groundwater Elevation		feet	3192.4	3198.0	3194.3	3192.0	3189.6
Conductivity		uS/cm			572	339	515
Dissolved Oxygen		mg/L			4.11		
ORP		mV			90	86	420
pH		SU	7.7	7.4	6.9	5.7	7.5
Temperature		C			8	7.7	9.7
Metals							
Aluminum	Dissolved	mg/L	0.087U	0.10U	0.05U	0.0802	0.0686
Aluminum	Total	mg/L		4.04	3.49	1.2	1.25
Antimony	Dissolved	mg/L	0.010U				
Arsenic	Dissolved	mg/L		0.0016	0.005U	0.005U	0.005U
Arsenic	Total	mg/L	0.010U		0.005U	0.005U	0.005U
Barium	Dissolved	mg/L	0.013	0.00244			
Barium	Total			0.0247			
Beryllium	Dissolved	mg/L	0.0010U				
Cadmium	Dissolved	mg/L	0.0088	0.001U	0.002U	0.0202	0.0101
Cadmium	Total	mg/L		0.001U	0.002U	0.0051	0.0121
Calcium	Dissolved	mg/L	140				
Chromium	Dissolved	mg/L	0.010U				
Cobalt	Dissolved	mg/L	0.010U				
Copper	Dissolved	mg/L	0.46	0.007	0.0162	3.08	0.537
Copper	Total	mg/L		0.131	0.0652	0.786	1.08
Iron	Dissolved	mg/L	0.050U	0.10U	0.0287	0.01U	0.0244
Iron	Total	mg/L		9.75	7.9	2.55	3.11
Lead	Dissolved	mg/L	0.0020U	0.001U	0.005U	0.005U	0.005U
Lead	Total	mg/L		0.001U	0.005U	0.005U	0.005U
Magnesium	Dissolved	mg/L	16				
Manganese	Dissolved	mg/L	0.010U	0.010U	0.0159	0.22	0.103
Manganese	Total	mg/L		0.241	0.166	0.097	0.167
Mercury	Dissolved	mg/L	0.00089				
Nickel	Dissolved	mg/L	0.010U		0.005U	0.0105	0.006
Nickel	Total	mg/L			0.005U	0.005U	0.0092
Potassium	Dissolved	mg/L	3.7				
Selenium	Dissolved	mg/L	0.020U				
Silver	Dissolved	mg/L	0.010U				
Sodium	Dissolved	mg/L	8.2				
Thallium	Dissolved	mg/L	0.010U				
Vanadium	Dissolved	mg/L	0.010U				
Zinc	Dissolved	mg/L	2.8	0.0229	0.0931	3	1.42
Zinc	Total	mg/L		0.176	0.136	0.815	1.69
Major Ions							
Nitrate		mg/L	0.61				
Nitrite		mg/L	0.10U				
Chloride		mg/L	3.0				
Sulfate		mg/L	300		251	142	168
Sulfide		mg/L			0.05U	0.05U	0.05U
Total Alkalinity		mg/L	130				
Hydroxide Alkalinity		mg/L	10U				
Carbonate Alkalinity		mg/L	10U				
Bicarbonate Alkalinity		mg/L	130				
Other							
Total Cyanide		mg/L	0.020U				
Hardness		mg/L			343	285	232
Total Dissolved Solids		mg/L	590				
Total Suspended Solids		mg/L			79	50	41J

Notes:

U- Data less than detecton level

J- Estimated Value

Analyte	Analyte 2	Unit	2/26/2002	4/23/2002	5/20/2002
Field Measurements					
Depth to Groundwater		feet	96.35	176.2	174.5
Approximate Groundwater Elevation		feet	3174	3094	3096
Conductivity		uS/cm	867		669
Dissolved Oxygen		mg/L	3.96		
ORP		mV	44		301
pH		SU	6.9		7.1
Temperature		C	7.7		6.1
Metals					
Aluminum	Dissolved	mg/L	0.0647		0.056
Aluminum	Total	mg/L	1.5		1.19
Arsenic	Dissolved	mg/L	0.005U		0.005U
Arsenic	Total	mg/L	0.005U		0.005U
Cadmium	Dissolved	mg/L	0.0498		0.006
Cadmium	Total	mg/L	0.0542		0.0131
Copper	Dissolved	mg/L	3.05		0.363
Copper	Total	mg/L	3.78		1.17
Iron	Dissolved	mg/L	0.0494		0.0104
Iron	Total	mg/L	0.744		3.41
Lead	Dissolved	mg/L	0.005U		0.005U
Lead	Total	mg/L	0.005U		0.005U
Manganese	Dissolved		1.73		0.0585
Manganese	Total	mg/L	1.87		0.148
Nickel	Dissolved	mg/L	0.0265		0.005U
Nickel	Total	mg/L	0.0293		0.0163
Zinc	Dissolved	mg/L	16.8		0.868
Zinc	Total	mg/L	16.7		1.77
Other					
Sulfate		mg/L	608		145
Sulfide		mg/L	0.05U		0.05U
Total Suspended Solids		mg/L	19		73J
Hardness		mg/L	562		273

Notes:

U- Data less than detecton level

J- Estimated Value

Analyte	Analyte 2	Unit	3/23/2000
Aluminum	Total	mg/L	11.8
Barium	Total	mg/L	0.254
Cadmium	Total	mg/L	0.001U
Copper	Total	mg/L	0.284
Iron	Total	mg/L	19.3
Lead	Total	mg/L	0.0159
Manganese	Total	mg/L	1.85
Zinc	Total	mg/L	0.0854

Notes:
U- Data less than detecton level

Table 4-26
MW-3 Groundwater Quality

Sample ID			SB-S-1		SB-S-2		SB-S-3		SB-S-4		SB-S-BG		N-1			N-2			S-1			S-2			Soil Screening Levels				
Sample Location			Below Silver Butte Waste Rock Dump		End of Pipe Pre-IRAM		Ditch along BLM Road 31-6-13.1 Next to Formosa Adit		Below East Side of Encapsualtion Mound		Along BLM Road 31-6-13.1 to North of Site		North Side of Encapsulation Mound			North Side of Encapsulation Mound			South Side of Encapsulation Mound			South Side of Encapsulation Mound			EPA Screening Level - Residential Soil[1]	EPA Screening Level - Industrial Soil[1]	ODEQ Risk Based Concentrations - Residential Soil[2]	ODEQ Risk Based Concentrations - Industrial Soil[2]	EPA Screening Level (SSL) - Residential Soil[1]
Sample Depth (ft)			0		0		0		0		0		3			6			2			3							
Sample Date			10/20/1999		10/20/1999		10/20/1999		10/20/1999		10/21/1999		11/19/2001			11/19/2001			11/19/2001			11/19/2001							
Analysis Method	Analyte	Unit	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual					
ABA	Acid Base Potential	t/kt CaCO3 eq.	-171		-247				-12.7		-10																		
ABA	Acid Potential	t/kt CaCO3 eq.	126		154				7.14		1.87																		
ABA	Calcium Carbonate	%	-4.447		-9.35				-0.556		-0.809																		
ABA	Neutralization Potential	t/kt CaCO3 eq.	-44.5		-93.5				-5.6		-8.1																		
ABA	Sulfur	%	4.039		4.927				0.229		0.06																		
Total Metals	Aluminum	mg/kg	1600		190		7300		15000		28000		17500		J	12600		J	10400		J	7970		J	77000	990000			0/9
Total Metals	Antimony	mg/kg	14		5	U	5	U	5	U	50	U													31	450			1/5
Total Metals	Arsenic	mg/kg	180		160		210		12		50	U	18.7		J	72.3		J	34.8		J	28.1		J	0.39	1.60	0.39	1.7	9/9
Total Metals	Barium	mg/kg	66		50	U	1100		1300		150														15000	190000			0/5
Total Metals	Beryllium	mg/kg	2	U	2	U	2	U	2	U	20	U													160	2000			0/5
Total Metals	Cadmium	mg/kg	2	U	20	U	4.3		2	U	20	U	2.23			6.79			1	U		1	U		70	810	1500	8600	0/9
Total Metals	Calcium	mg/kg	170		560		1400		1500		8700																		
Total Metals	Chromium	mg/kg	5	U	50	U	50	U	5	U	50	U													39.00	200.00			3/5
Total Metals	Cobalt	mg/kg	5	U	5	U	8.9		7.3		50	U													23	300			1/5
Total Metals	Copper	mg/kg	290		100		1100		200		67		716			1420			195			132			3100	41000	3100	41000	0/9
Total Metals	Cyanide	mg/kg	1	U	1	U	1	U	1	U	1	U																	
Total Metals	Iron	mg/kg	260000		160000		290000		29000		40000		34800		J	45300		J	28500		J	23200		J	55000	720000			3/9
Total Metals	Lead	mg/kg	320		10		110		38		50	U	45.8			62.9			51.6			41.6			400	800	400	800	0/9
Total Metals	Magnesium	mg/kg	810		160		2900		3500		9800																		
Total Metals	Manganese	mg/kg	64		10		180		530		1600		450			428			313			206			1800	23000	1800	22000	0/9
Total Metals	Mercury	mg/kg	2.5		0.1	U	0.52		0.48		0.1	U													23	310	23	310	0/5
Total Metals	Nickel	mg/kg	5	U	5	U	11		5	U	50	U	6.57			6.44			3.47			2.46			1600	20000	1600	20000	0/9
Total Metals	Potassium	mg/kg	2300		100	U	830		690		1000	U																	
Total Metals	Selenium	mg/kg	2.5	U	25	U	25	U	2.5	U	25	U													390	5100			0/5
Total Metals	Silver	mg/kg	2.5	U	25	U	25	U	2.5	U	25	U													390	5100	390	5100	0/5
Total Metals	Sodium	mg/kg	100	U	1000	U	1000	U	100	U	1000	U																	
Total Metals	Thallium	mg/kg	50	U	50	U	50	U	5	U	50	U													5.10	66.00			4/5
Total Metals	Vanadium	mg/kg	21		12		42		40		120														550	7200			0/5
Total Metals	Zinc	mg/kg	750		240		2500		590		140		498			1580			114			83.4			23000	310000			0/9

Notes:
ABA - Acid Base Accounting
SPLP - Synthetic Precipiation Leaching Procedure
1 - EPA Soil Screening Levels compiled from:
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

2 - Risk Based Screening Levels from Hart Crowser Risk Assessment

Table 4-27
Total Metals and ABA Data for Soils

Sample ID			Soil Screening Level Exceedances		
Sample Location			EPA Screening Level (SSL) - Industrial Soil[1]	ODEQ Risk Based Concentrations - Residential Soil[2]	ODEQ Risk Based Concentrations - Industrial Soil[2]
Sample Depth (ft)					
Sample Date					
Analysis Method	Analyte	Unit			
ABA	Acid Base Potential	t/kt CaCO3 eq.			
ABA	Acid Potential	t/kt CaCO3 eq.			
ABA	Calcium Carbonate	%			
ABA	Neutralization Potential	t/kt CaCO3 eq.			
ABA	Sulfur	%			
Total Metals	Aluminum	mg/kg	0/9		
Total Metals	Antimony	mg/kg	0/5		
Total Metals	Arsenic	mg/kg	9/9	9/9	9/9
Total Metals	Barium	mg/kg	0/5		
Total Metals	Beryllium	mg/kg	0/5		
Total Metals	Cadmium	mg/kg	0/9	0/9	0/9
Total Metals	Calcium	mg/kg			
Total Metals	Chromium	mg/kg	0/5		
Total Metals	Cobalt	mg/kg	0/5		
Total Metals	Copper	mg/kg	0/9	0/9	0/9
Total Metals	Cyanide	mg/kg			
Total Metals	Iron	mg/kg	0/9		
Total Metals	Lead	mg/kg	0/9	0/9	0/9
Total Metals	Magnesium	mg/kg			
Total Metals	Manganese	mg/kg	0/9	0/9	0/9
Total Metals	Mercury	mg/kg	0/5	0/5	0/5
Total Metals	Nickel	mg/kg	0/9	0/9	0/9
Total Metals	Potassium	mg/kg			
Total Metals	Selenium	mg/kg	0/5		
Total Metals	Silver	mg/kg	0/5	0/5	0/5
Total Metals	Sodium	mg/kg			
Total Metals	Thallium	mg/kg	0/5		
Total Metals	Vanadium	mg/kg	0/5		
Total Metals	Zinc	mg/kg	0/9		

Notes:

ABA - Acid Base Accounting

SPLP - Synthetic Precipiation Leaching Procedure

1 - EPA Soil Screening Levels compiled from: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

2 - Risk Based Screening Levels from Hart Crowser Risk Assessment

Table 4-27
Total Metals and ABA Data for Soils

Sample ID			SB-WS-1		SB-WS-2		SB-WS-3		SB-WS-4		SB-WS-404		Cell 1			Cell 2			Cell 3			Soil Screening Levels				Soil Screening Level Exceedances			
Sample Location			Formosa Adit Waste Rock Dump		Silver Butte Adit Waste Rock Dump		Encapsualation Mound		Below Southeast Side of Encapsualtion Mound		404 Adit Waste Rock Dump		Formosa Adit Waste Rock Dump			Silver Butte Adit Waste Rock Dump			Waste Rock Dump to East of Encapsulation Mound			EPA Screening Level - Residential Soil[1]	EPA Screening Level - Industrial Soil[1]	ODEQ Risk Based Concentrations - Residential Soil[2]	ODEQ Risk Based Concentrations - Industrial Soil[2]	EPA Screening Level (SSL) - Residential Soil[1]	EPA Screening Level (SSL) - Industrial Soil[1]	ODEQ Risk Based Concentrations - Residential Soil[2]	ODEQ Risk Based Concentrations - Industrial Soil[2]
Sample Depth (ft)			0		0		0		0		0		0			0			0										
Sample Date			10/20/1999		10/20/1999		10/20/1999		10/20/1999		10/21/1999		11/19/2001			11/19/2001			11/19/2001										
Analyte2	Analyte	Unit	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual								
ABA	Acid Base Potential	t/kt CaCO3 eq.	-33.2		-98		-161		-57.8		-35.1																		
ABA	Acid Potential	t/kt CaCO3 eq.	25.6		79.8		122		50.2		29.5																		
ABA	Calcium Carbonate	%	-0.758		-1.82		-3.942		-0.758		-0.556																		
ABA	Neutralization Potential	t/kt CaCO3 eq.	-7.6		-18.2		-39.4		-7.6		-5.6																		
ABA	Sulfur	%	0.82		2.554		3.897		1.607		0.945																		
Total Metals	Aluminum	mg/kg	10000		4500		3400		5000		6000		12700			5870		J	10400			77000	990000			0/8	0/8		
Total Metals	Antimony	mg/kg	5	U	7.1		5	U	5	U	5	U										31	450			0/5	0/5		
Total Metals	Arsenic	mg/kg	18		170		66		36		39		32.1		J	264		J	68.8		J	0.39	1.60	0.39	1.7	8/8	8/8	8/8	8/8
Total Metals	Barium	mg/kg	1700		700		280		680		340											15000	190000			0/5	0/5		
Total Metals	Beryllium	mg/kg	2	U	2	U	2	U	2	U	2	U										160	2000			0/5	0/5		
Total Metals	Cadmium	mg/kg	3.3		2	U	8		2	U	2	U	1	U		1	U		1.24			70	810	1500	8600	0/8	0/8	0/8	0/8
Total Metals	Calcium	mg/kg	780		900		1900		630		860																		
Total Metals	Chromium	mg/kg	5.1		5	U	5	U	5	U	5	U										39.00	200.00			0/5	0/5		
Total Metals	Cobalt	mg/kg	9.6		5.1		5	U	5	U	5	U										23	300			0/5	0/5		
Total Metals	Copper	mg/kg	440		530		1000		240		94		174			404			326			3100	41000	3100	41000	0/8	0/8	0/8	0/8
Total Metals	Cyanide	mg/kg	1	U	1	U	1	U	1	U	1	U																	
Total Metals	Iron	mg/kg	33000		73000		64000		42000		34000		34200		J	68000		J	30800		J	55000	720000			3/8	0/8		
Total Metals	Lead	mg/kg	43		330		47		33		160		31.8			657			184			400	800	400	800	1/8	0/8	1/8	0/8
Total Metals	Magnesium	mg/kg	4100		2000		1800		1900		2700																		
Total Metals	Manganese	mg/kg	280		190		170		250		360		557			182			402			1800	23000	1800	22000	0/8	0/8	0/8	0/8
Total Metals	Mercury	mg/kg	0.68		3.4		0.37		0.18		0.89											23	310	23	310	0/5	0/5	0/5	0/5
Total Metals	Nickel	mg/kg	10		5	U	7		5	U	5	U	5.08			2.72			6.39			1600	20000	1600	20000	0/8	0/8	0/8	0/8
Total Metals	Potassium	mg/kg	290		1900		1500		1700		1800																		
Total Metals	Selenium	mg/kg	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U										390	5100			0/5	0/5		
Total Metals	Silver	mg/kg	2.5	U	4.9		2.5	U	2.5	U	2.5	U										390	5100	390	5100	0/5	0/5	0/5	0/5
Total Metals	Sodium	mg/kg	100	U	100	U	100	U	100	U	100	U																	
Total Metals	Thallium	mg/kg	5	U	25	U	25	U	5	U	5	U										5.10	66.00			2/5	0/5		
Total Metals	Vanadium	mg/kg	56		38		14		8.7		22											550	7200			0/5	0/5		
Total Metals	Zinc	mg/kg	700		160		2000		270		66		206			201			294			23000	310000			0/8	0/8		

Notes:
ABA - Acid Base Accounting
SPLP - Synthetic Precipiation Leaching Procedure
1 - EPA Soil Screening Levels compiled from:
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

2 - Risk Based Screening Levels from Hart Crowser Risk Assessment

Table 4-28 Total Metals and ABA Data for Waste Rock

Sample	Lithology	Total Sulfur	HCl_Sulfur	HNO3_Sulfur	Residual_Sulfur	NP	AP	NNP	NP:AP Ratio
		(%)	(%)	(%)	(%)	(t/kt CaCO3 eq.)	(t/kt CaCO3 eq.)	(t/kt CaCO3 eq.)	
4-FS18	Non-mineralized Tuff	0.013	0.01	0.01	-0.007	23	0.3	22.7	73.600
15-FS22	Non-mineralized Tuff	0.03	0.01	0.01	0.01	14	0.3	13.7	44.800
14-FS18	Non-mineralized Tuff	0.031	0.01	0.01	0.011	48	0.3	47.7	153.600
11-FS10	Non-mineralized Tuff	0.101	0.03	0.06	0.011	19	1.9	17.1	10.133
7-FS20	Non-mineralized Tuff	0.201	0.08	0.2	-0.079	62	6.3	55.8	9.920
5-FS10	Non-mineralized Tuff	0.225	0.04	0.15	0.035	14	4.7	9.3	2.987
13-FS22	Non-mineralized Tuff	0.311	0.02	0.28	0.011	5	8.8	-3.8	0.571
8PA-FU8	Ore	17.6	0.48	17.93	-0.81	1	560.3	-559.3	0.002
8DY-FS28	Ore	43.6	0.18	41.68	1.74	1	1302.5	-1301.5	0.001
8CP-FU14	Ore	46.9	0.42	41.58	4.9	0	1299.4	-1299.4	0.000
2-FS10	Oxidized Tuff	0.001	0.01	0.01	-0.019	14	0.3	13.7	44.800
6-FS13	Oxidized Tuff	0.001	0.01	0.01	-0.019	8	0.3	7.7	25.600
1-FS10	Oxidized Tuff	0.003	0.01	0.01	-0.017	8	0.3	7.7	25.600
3-FS10	Oxidized Tuff	0.005	0.01	0.01	-0.015	11	0.3	10.7	35.200
34-137	Quartz Sericite Pyrite Tuff	4.98	0.09	5.01	-0.12	5	156.6	-151.6	0.032
34-135	Quartz Sericite Pyrite Tuff	8.12	0.2	7.86	0.06	3	245.6	-242.6	0.012
36-041	Quartz Sericite Pyrite Tuff	8.15	0.04	7.32	0.79	0	228.8	-228.8	0.000
37-039	Quartz Sericite Pyrite Tuff	8.56	0.06	8.59	-0.09	0	268.4	-268.4	0.000
10-FS23	Quartz Sericite Pyrite Tuff	8.86	0.16	5.72	2.98	1	178.8	-177.8	0.006
41-079	Quartz Sericite Pyrite Tuff	10.6	0.11	10.37	0.12	2	324.1	-322.1	0.006
41-096	Quartz Sericite Pyrite Tuff	10.7	0.1	10	0.6	2	312.5	-310.5	0.006
37-029	Quartz Sericite Pyrite Tuff	13.3	0.12	13.25	-0.07	1	414.1	-413.1	0.002
41-075	Quartz Sericite Pyrite Tuff	16.9	0.18	16.04	0.68	2	501.3	-499.3	0.004
34-144	Quartz Sericite Pyrite Tuff	18.9	0.27	19.11	-0.48	1	597.2	-596.2	0.002
37-028	Quartz Sericite Pyrite Tuff	19.2	0.6	19.17	-0.57	1	599.1	-598.1	0.002

Table 4-29
Pre-Mining ABA Data

Sample	Description	Total Sulfur	NP	AP	NNP	NP:AP Ratio
		(%)	(t/kt CaCO3 eq.)	(t/kt CaCO3 eq.)	(t/kt CaCO3 eq.)	
Formosa Adit Waste Dump	Waste Rock	0.82	-7.6	25.6	-33.2	-0.297
Silver Butte Adit Waste Dump	Waste Rock	2.5554	-18.2	79.9	-98.1	-0.228
Encapsulation Mound	Waste Rock	3.897	-39.4	121.8	-161.2	-0.324
Below SE Side Encapsulation Mound	Waste Rock	1.607	-7.6	50.2	-57.8	-0.151
404 Adit Waste Rock Dump	Waste Rock	0.945	-5.6	29.5	-35.1	-0.190
Below Silver Butte	Soil	4.039	-44.5	126.2	-170.7	-0.353
End of Pipe Pre IRAM	Soil	4.927	-93.5	154.0	-247.5	-0.607
Below East Side of Encapsulation Mound	Soil	0.229	-5.6	7.2	-12.8	-0.783
Along BLM Road North of Site	Soil	0.06	-8.1	1.9	-10.0	-4.320

Table 4-30
Dynamac ABA Data

Sample ID			SB-S-1		SB-S-2		SB-S-3		SB-S-4		SB-S-BG		N-1			N-2			S-1			S-2			Water Quality Screening Level[2]
Sample Location			Below Silver Butte Waste Rock Dump		End of Pipe Pre-IRAM		Ditch along BLM Road 31-6-13.1 Next to Formosa Adit		Below East Side of Encapsualtion Mound		Along BLM Road 31-6-13.1 to North of Site		North Side of Encapsulation Mound			North Side of Encapsulation Mound			South Side of Encapsulation Mound			South Side of Encapsulation Mound			
Sample Depth (ft)			0		0		0		0		0		3			6			2			3			
Sample Date			10/20/1999		10/20/1999		10/20/1999		10/20/1999		10/21/1999		11/19/2001			11/19/2001			11/19/2001			11/19/2001			
Analysis Method	Analyte	Unit	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	
SPLP	Aluminum	mg/L	5	U	5	U	29		5	U	29		0.72		J	10.7		J	0.303		J	0.215		J	
SPLP	Antimony	mg/L	1	U	1	U	1	U	1	U	1	U													0.146
SPLP	Arsenic	mg/L	1	U	1	U	1	U	1	U	1	U	0.05	U	J	0.05	U	J	0.05	U	J	0.05	U	J	0.048
SPLP	Barium	mg/L	5	U	5	U	5	U	5	U	5	U													1
SPLP	Beryllium	mg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U													0.0053
SPLP	Cadmium	mg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.05	U		0.134			0.05	U		0.05	U		0.0011
SPLP	Calcium	mg/L	20	U	32		20	U	20	U	20	U													
SPLP	Chromium	mg/L	1	U	1	U	1	U	1	U	1	U													0.011
SPLP	Copper	mg/L	1	U	1.2		13		1.4		1	U	6.83			17.1			0.605			0.554			0.012
SPLP	Iron	mg/L	10		10	U	26		10	U	73		0.308		J	0.921		J	0.0903		J	0.05	U	J	0.3
SPLP	Lead	mg/L	1	U	1	U	1	U	1	U	1	U	0.05	U		0.05	U		0.05	U		0.05	U		0.0032
SPLP	Magnesium	mg/L	20	U	20	U	20	U	20	U	20	U													
SPLP	Manganese	mg/L	1	U	1	U	1.1		2.7		2.4		0.48			1.72			0.0585			0.209			0.05
SPLP	Mercury	mg/L	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U													0.000012
SPLP	Nickel	mg/L	1	U	1	U	1	U	1	U	1	U	0.05	U		0.105			0.05	U		0.05	U		0.0134
SPLP	Potassium	mg/L	20	U	20	U	20	U	20	U	20	U													
SPLP	Selenium	mg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U													0.01
SPLP	Silver	mg/L	1	U	1	U	1	U	1	U	1	U													0.00012
SPLP	Sodium	mg/L	20	U	20	U	20	U	20	U	20	U													
SPLP	Thallium	mg/L	1	U	1	U	1	U	1	U	1	U													0.013
SPLP	Vanadium	mg/L	1	U	1	U	1	U	1	U	1	U													
SPLP	Zinc	mg/L	10	U	14		49		15		10	U	2.8			27.6			0.538			0.486			0.11

Notes:

ABA - Acid Base Accounting

SPLP - Synthetic Precipiation Leaching Procedure

1 - EPA Soil Screening Levels compiled from: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

2 - Risk Based Screening Levels from Hart Crowser Risk Assessment

Table 4-31
SPLP Data for Soils

Sample ID			SB-WS-1		SB-WS-2		SB-WS-3		SB-WS-4		SB-WS-404		Cell 1			Cell 2			Cell 3		
Sample Location			Formosa Adit Waste Rock Dump		Silver Butte Adit Waste Rock Dump		Encapsualation Mound		Below Southeast Side of Encapsualtion Mound		404 Adit Waste Rock Dump		Formosa Adit Waste Rock Dump			Silver Butte Adit Waste Rock Dump			Waste Rock Dump to East of Encapsulation Mound		
Sample Depth (ft)			0		0		0		0		0		0			0			0		
Sample Date			10/20/1999		10/20/1999		10/20/1999		10/20/1999		10/21/1999		11/19/2001			11/19/2001			11/19/2001		
Analyte2	Analyte	Unit	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual	Value	Lab Qual	HC Qual
SPLP	Aluminum	mg/L	5	U	24		48		5	U	5	U	0.223		J	0.598		J	0.494		J
SPLP	Antimony	mg/L	1	U	1	U	1	U	1	U	1	U									
SPLP	Arsenic	mg/L	1	U	1	U	1	U	1	U	1	U	0.05	U	J	0.05	U	J	0.05	U	J
SPLP	Barium	mg/L	5	U	5	U	5	U	5	U	5	U									
SPLP	Beryllium	mg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U									
SPLP	Cadmium	mg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.05	U		0.05	U		0.05	U	
SPLP	Calcium	mg/L	20	U	20	U	45		20	U	20	U									
SPLP	Chromium	mg/L	1	U	1	U	1	U	1	U	1	U									
SPLP	Cobalt	mg/L	1	U	1	U	1	U	1	U	1	U									
SPLP	Copper	mg/L	1	U	7.4		33		2.2		1	U	0.591			0.583			0.902		
SPLP	Iron	mg/L	10	U	10	U	120		10	U	10	U	0.123		J	0.226		J	0.943		J
SPLP	Lead	mg/L	1	U	1	U	1	U	1	U	1	U	0.05	U		0.05	U		0.05	U	
SPLP	Magnesium	mg/L	20	U	20	U	38		20	U	20	U									
SPLP	Manganese	mg/L	1	U	1.1		2.8		1	U	1	U	0.2			0.0673			0.0612		
SPLP	Mercury	mg/L	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U									
SPLP	Nickel	mg/L	1	U	1	U	1	U	1	U	1	U	0.05	U		0.05	U		0.05	U	
SPLP	Potassium	mg/L	20	U	20	U	20	U	20	U	20	U									
SPLP	Selenium	mg/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U									
SPLP	Silver	mg/L	1	U	1	U	1	U	1	U	1	U									
SPLP	Sodium	mg/L	20	U	20	U	20	U	20	U	20	U									
SPLP	Thallium	mg/L	1	U	1	U	1	U	1	U	1	U									
SPLP	Vanadium	mg/L	1	U	1	U	1	U	1	U	1	U									
SPLP	Zinc	mg/L	10	U	10	U	67		10	U	10	U	0.881			0.309			0.61		

Table 4-32
SPLP Data for Waste Rock

Location	Analyte	Analyte2	Unit	2/21/2002	2/22/2002	4/22/2002
Cell 1	Aluminum	Dissolved	mg/L	13		7.07
	Aluminum	Total	mg/L	59.5		8.25
	Arsenic	Dissolved	mg/L	0.005 U		0.005 U
	Arsenic	Total	mg/L	0.005 U		0.005 U
	Cadmium	Dissolved	mg/L	0.0614		0.0445
	Cadmium	Total	mg/L	0.168		0.0499
	Copper	Dissolved	mg/L	7.99		6.36
	Copper	Total	mg/L	22.9		7.2
	Hardness	Total	mg/L	344		145
	Iron	Dissolved	mg/L	0.111		0.0457
	Iron	Total	mg/L	0.265		0.162
	Lead	Dissolved	mg/L	0.005 U		0.005 U
	Lead	Total	mg/L	0.005 U		0.005 U
	Manganese	Dissolved	mg/L	1.73		1.43
	Manganese	Total	mg/L	4.33		1.6
	Nickel	Dissolved	mg/L	0.0247		0.0234
	Nickel	Total	mg/L	0.0545		0.0242
	pH		su	6.5		6.4
	Sulfate	Total	mg/L	475		272
	Sulfide	Total	mg/L	0.05 UJ		0.05 U
	Total Suspended Solids	Total	mg/L	78		5
	Zinc	Dissolved	mg/L	13.9		5.29
	Zinc	Total	mg/L	39.5		10.1
Cell 2	Aluminum	Dissolved	mg/L		33.8	7.55
	Aluminum	Total	mg/L		37.4	15.1
	Arsenic	Dissolved	mg/L		0.005 U	0.005 U
	Arsenic	Total	mg/L		0.005 U	0.005 U
	Cadmium	Dissolved	mg/L		0.0567	0.0441
	Cadmium	Total	mg/L		0.0604	0.014
	Copper	Dissolved	mg/L		18.2	6.33
	Copper	Total	mg/L		17.6	9.09
	Hardness	Total	mg/L		430	140
	Iron	Dissolved	mg/L		1.11	0.149
	Iron	Total	mg/L		16.6	9.76
	Lead	Dissolved	mg/L		0.005 U	0.005 U
	Lead	Total	mg/L		0.0088	0.005 U
	Manganese	Dissolved	mg/L		2.94	1.36
	Manganese	Total	mg/L		3.14	0.889
	Nickel	Dissolved	mg/L		0.0423	0.0203
	Nickel	Total	mg/L		0.0465	0.0227
	pH		su		5.6	5.8
	Sulfate	Total	mg/L		892	294
	Sulfide	Total	mg/L		0.05 UJ	0.05 U
	Total Suspended Solids	Total	mg/L		44	5 U
	Zinc	Dissolved	mg/L		14.6	9.25
	Zinc	Total	mg/L		14.4	2.24

Table 4-33
Waste Rock Cell Data

Location	Analyte	Analyte2	Unit	2/21/2002	2/22/2002	4/22/2002
Cell 3	Aluminum	Dissolved	mg/L		2.57	7.53
	Aluminum	Total	mg/L		4.51	8.7
	Arsenic	Dissolved	mg/L		0.005 U	0.005 U
	Arsenic	Total	mg/L		0.005 U	0.005 U
	Cadmium	Dissolved	mg/L		0.0158	4.35
	Cadmium	Total	mg/L		0.0168	0.0263
	Copper	Dissolved	mg/L		4.2	6.23
	Copper	Total	mg/L		4.67	9.81
	Hardness	Total	mg/L		172	203
	Iron	Dissolved	mg/L		0.294	0.118
	Iron	Total	mg/L		7.46	1.82
	Lead	Dissolved	mg/L		0.101	0.005 U
	Lead	Total	mg/L		0.0052	0.005 U
	Manganese	Dissolved	mg/L		0.56	1.34
	Manganese	Total	mg/L		0.623	1.1
	Nickel	Dissolved	mg/L		0.0178	0.0194
	Nickel	Total	mg/L		0.0198	0.0455
	pH		su		6	5.9
	Sulfate	Total	mg/L		221	290
	Sulfide	Total	mg/L		0.05 UJ	0.05 U
	Total Suspended Solids	Total	mg/L		66	5 U
	Zinc	Dissolved	mg/L		3.11	9.07
	Zinc	Total	mg/L		3.3	3.9

Notes:
U- Value less than detection
J- Estimated Value

Table 4-33
Waste Rock Cell Data

Appendix A
Historical Results – Surface Water

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/19/1999		10/26/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		4/26/2000		5/18/2000		7/18/2000		10/18/2000		11/9/2000	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																										
Conductivity		µS/cm	2280		1846				1911								2280		2420							
Dissolved Oxygen		mg/L															0.6		1.2							
Flow		gpm	20.0		1.0		4.0		65.0		53.0		20.0		17.7								1.3			
ORP		mV															408		480							
pH		su	3.05		2.5		4.46		2.93		3.05		3.1		3.11		3.1		3.3				3.4			
Temperature		deg C	18.3		10.9		9		9								10		12.8							
Metals																										
Aluminum	Dissolved	mg/L			19		30.5		20.4		26		24.6		23.9		29.5		28.1		26.6		20.7			
Aluminum	Total	mg/L	25.6						20.1		26.3		25.5		29.7		29.2		28.8							
Antimony	Dissolved	mg/L			0.01	U	0.0042		0.003	U	0.003	U	0.0015		0.00163		0.1	U	0.00244		0.005	U	0.001	U		
Antimony	Total	mg/L	0.003	U					0.003	U	0.003	U	0.0012		0.0016		0.00252		0.02	U					0.00105	
Arsenic	Dissolved	mg/L			0.01	U	0.002	U	0.121		0.0681		0.148		0.156		0.119		0.25							
Arsenic	Total	mg/L	0.0643						0.188		0.124		0.13		0.133		0.258		0.121						0.132	
Barium	Dissolved	mg/L			0.004	U	0.0128		0.0151		0.0167		0.017		0.0135		0.014		0.0145		0.0159		0.0107			
Barium	Total	mg/L	0.0116						0.0346		0.0166		0.018		0.0121		0.0141		0.04	U					0.4	U
Beryllium	Dissolved	mg/L			0.0013		0.00115		0.00042		0.0006		0.00064		0.001	U	0.001	U	0.001	U	0.01	U	0.001	U		
Beryllium	Total	mg/L	0.000696						0.000414		0.0006		0.00062		0.001	U	0.001	U	0.02	U					0.001	U
Boron		mg/L							0.369																	
Cadmium	Dissolved	mg/L			0.41		0.392		0.593		0.579		0.596		0.728		0.671		0.596		0.49		0.429			
Cadmium	Total	mg/L	0.611						0.601		0.581		0.596		0.618		0.64		0.674						0.34	
Calcium	Dissolved	mg/L			140		335		58.1		99.1		108		131		111		117		128		163			
Calcium	Total	mg/L	125						61.7		100		110		147		182		122						158	
Chromium	Dissolved	mg/L			0.01	U	0.00663		0.00834		0.0117		0.0137		0.0171		0.0104		0.0161		0.00818		0.00663			
Chromium	Total	mg/L	0.0045						0.00854		0.0121		0.0131		0.015		0.0163		0.02	U					0.00705	
Cobalt	Dissolved	mg/L			0.042		0.0723		0.0222		0.0274		0.0258		0.0325		0.0219		0.04	U	0.0258		0.271			
Cobalt	Total	mg/L	0.0317						0.0218		0.0278		0.0255		0.0292		0.0269		0.04	U					0.0276	
Copper	Dissolved	mg/L			14		17.2		40.4		39.7		38		38.3		39.7		33.6		20.6		12.5			
Copper	Total	mg/L	32.6						39.5		40.6		39.4		37.7		40.4		33.6						13.8	
Iron	Dissolved	mg/L			290		132		190		202		233		283		340		379		340		291			
Iron	Total	mg/L	258						199		215		242		319		375		357						351	
Lanthanum	Dissolved	mg/L					0.0172		0.0084		0.0144															
Lanthanum	Total	mg/L	0.099						0.0078		0.0118															
Lead	Dissolved	mg/L			0.0096		0.0149		0.0496		0.0423		0.0361		0.0351		0.0534		0.0439		0.0315		0.0188			
Lead	Total	mg/L	0.0218						0.057		0.0437		0.0348		0.0315		0.0503		0.0462						0.2	U
Lithium	Dissolved	mg/L					0.0367		0.0127		0.0181															
Lithium	Total	mg/L	0.0241						0.0135		0.0168															
Magnesium	Dissolved	mg/L			36		57.3		18.6		23.4		24.3		26.1		30.7		32.8		36.5		38			
Magnesium	Total	mg/L	31.7						19.2		24.1		24.9		33.1		32.3		33.5						42.9	
Manganese	Dissolved	mg/L			3.5		5.51		1.88		2.65		2.49		2.57		3		3.09		3.37		3.5			
Manganese	Total	mg/L	3.26						1.87		2.64		2.55		3.44		3.13		3.38						3.82	
Mercury	Dissolved	mg/L			0.0002	U							0.0002	U			0.0002	U	0.0002	U						
Mercury	Total	mg/L											0.0002	U			0.0002	U	0.0002	U					0.0002	U
Molybdenum	Dissolved	mg/L					0.0004	U	0.0004	U	0.0004	U														
Molybdenum	Total	mg/L	0.0004	U					0.0004	U	0.0004	U														
Nickel	Dissolved	mg/L			0.14		0.345		0.0713		0.106		0.111		0.13		0.0982		0.159		0.136		0.153			
Nickel	Total	mg/L	0.127						0.0716		0.106		0.109		0.118		0.162		0.148						0.164	
Potassium	Dissolved	mg/L			4.2		2.98		0.703		1.37		2	U	2.13						2.84		3.27			
Potassium	Total	mg/L	3.01						0.713		1.42		2	U	2.27											
Selenium	Dissolved	mg/L			0.02	U	0.003	U	0.003	U	0.003	U	0.005	U	0.0143		0.00614		0.02	U	0.00343		0.00389			
Selenium	Total	mg/L	0.003	U					0.003	U	0.003	U	0.005	U	0.1	U	0.02	U	0.02	U					0.2	U
Silver	Dissolved	mg/L			0.01	U	0.0002	U	0.0002	U	0.0002	U	0.00016		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Silver	Total	mg/L	0.0002	U					0.0002	U	0.0002	U	0.0001		0.001	U	0.001	U	0.02	U					0.001	U
Strontium	Total	mg/L																								
Sulfur	Total	mg/L																								
Sodium	Dissolved	mg/L			2	U	18.3		4.62		6.27		7.06		7.4		7.88		9.01		11.8		14.9			
Sodium	Total	mg/L	12.1						4.83		6.21		7.21		8.95		8.22		9.08						15.6	
Thallium	Dissolved	mg/L			0.05	U	0.0089		0.002	U	0.002	U	0.00049		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Thallium	Total	mg/L	0.002	U					0.002	U	0.002	U	0.00049		0.001	U	0.001	U	0.02	U					0.2	U
Tin	Total	mg/L																								
Vanadium	Dissolved	mg/L			0.01	U	0.0001	U	0.0001	U	0.0001	U	0.014		0.0382	U	0.5	U	0.012		0.05	U	0.0102			
Vanadium	Total	mg/L	0.0001	U					0.00042		0.0001	U	0.015		0.5	U	0.005	U	0.1	U					0.0149	

Table A-1
Formosa Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/19/1999		10/26/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		4/26/2000		5/18/2000		7/18/2000		10/18/2000		11/9/2000	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Metals (Con't)																										
Zinc	Dissolved	mg/L			140		137		47.6		63.6		141		182		203		171		181		120			
Zinc	Total	mg/L	80.2						52.9		60.1		145		190		192		194						142	
Major Ions																										
Ammonia as N		mg/L							0.69						1.01											
Bicarbonate Alkalinity		mg/L			10	U																				
Carbonate Alkalinity		mg/L			10	U																				
Chloride		mg/L			6.1				2.1						21.2		5.94		6.01							
Fluoride		mg/L					1070		1.3						2.43		1.85		1.81							
Hydroxide Alkalinity		mg/L			10	U																				
Nitrate & Nitrite as N		mg/L as N							0.116																	
Nitrate as N		mg/L as N			0.2	U									0.128		0.126		0.11							
Nitrite as N		mg/L as N			0.05	U									1	U	0.1	U	0.1	U						
Orthophosphate as P		mg/L as P							0.376						0.33		0.43		0.296							
Phosphorus		mg/L													0.342											
Silica (SiO2)		mg/L							34.8						704											
Sulfate		mg/L			1700				1100						1420		1260		1190							
Sulfide		mg/L																								
Alkalinity		mg/L			10	U											10	U	10	U						
Total Phosphate as P		mg/L as P							0.56																	
Other																										
Acidity		mg/L															64.8		1320							
Total Cyanide		mg/L			0.02	U																				
Dissolved Organic Carbon		mg/L													3	U										
Hardness		mg/L	444						222		344						404		427							
Total Dissolved Solids		mg/L			2400																					
Total Organic Carbon		mg/L							1						3	U										
Total Suspended Solids		mg/L							64						30											

Key:

U = Nondetect

Table A-1
Formosa Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/17/2000		2/24/2001		5/2/2001		11/8/2001		11/30/2001		12/18/2001		2/7/2002		2/21/2002		3/26/2002		4/22/2002		5/29/2002		4/29/2004		6/17/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Conductivity		µS/cm																										
Dissolved Oxygen		mg/L																										
Flow		gpm	3.0		6.0		4.5		1.3		6.7		190.3		23.1		58.0		42.0		9.9		6.5					
ORP		mV																										
pH		su	3		3.8		2.77		3.14		3.18		2.15		2.17		2.35		2.56		2.89		2.72					
Temperature		deg C																										
Metals																												
Aluminum	Dissolved	mg/L	21.4		37.2		49.6				27.3		33.2		31.8		22.2		18.2		24.8		24.4		25.8		18.3	
Aluminum	Total	mg/L			40.8		48.7		24.3																25.1		18.7	
Antimony	Dissolved	mg/L	0.001	U	0.00105		0.00313																		0.001	U	0.001	U
Antimony	Total	mg/L			0.00133		0.00332																		0.001	U	0.001	U
Arsenic	Dissolved	mg/L	0.0207		0.14		0.212				0.0412		0.338		0.124		0.108		0.0662		0.0681		0.03		0.00545		0.0174	
Arsenic	Total	mg/L			0.001		0.25		0.0182																0.00757		0.044	
Barium	Dissolved	mg/L	0.011		0.011		0.012																		0.0121		0.0112	
Barium	Total	mg/L			0.02	U	0.0128																		0.0121		0.0115	
Beryllium	Dissolved	mg/L	0.001	U	0.001	U	0.00124																		0.001	U	0.001	U
Beryllium	Total	mg/L			0.001	U	0.00114																		0.001	U	0.001	U
Boron		mg/L																										
Cadmium	Dissolved	mg/L	0.353		0.637		1.15				0.562		0.981		0.707		0.528		0.427		0.492		0.472		0.423		0.354	
Cadmium	Total	mg/L			0.646		1.21		0.459																0.42		0.378	
Calcium	Dissolved	mg/L	156		165		141																		127		157	
Calcium	Total	mg/L			167		150																		1370		152	
Chromium	Dissolved	mg/L	0.00688		0.0156		0.035																		0.0116		0.00855	
Chromium	Total	mg/L			0.0146		0.0374																		0.0136		0.00936	
Cobalt	Dissolved	mg/L	0.0292		0.0348		0.0433																		0.0237		0.0219	
Cobalt	Total	mg/L			0.0354		0.0469																		0.0247		0.0233	
Copper	Dissolved	mg/L	14.4		33.1		60.2				15.3		83.2		42.5		35.3		26.8		23.6		17.2		19.6		8.71	
Copper	Total	mg/L			37.8		61		9.29																17.8		10.9	
Iron	Dissolved	mg/L	31.4		428		588				309		356		295		192		160		292		270		11.3		205	
Iron	Total	mg/L			415		602		321																10.6		230	
Lanthanum	Dissolved	mg/L																										
Lanthanum	Total	mg/L																										
Lead	Dissolved	mg/L	0.001	U	0.0256		0.0487				0.0072		0.0293		0.0446		0.0509		0.0484		0.0261		0.0216		0.0545		0.0348	
Lead	Total	mg/L			0.0292		0.0493		0.0115																0.05414		0.0372	
Lithium	Dissolved	mg/L																										
Lithium	Total	mg/L																										
Magnesium	Dissolved	mg/L	40.3		40.1		43.4						23.7												28.8		27.9	
Magnesium	Total	mg/L			43.4		45.6																		28.2		28.7	
Manganese	Dissolved	mg/L	3.8		4.63		4.23				4.36				2.9		1.94		1.76		2.6		3		2.7		2.93	
Manganese	Total	mg/L			4.46		4.09		3.86																2.65		3.01	
Mercury	Dissolved	mg/L																										
Mercury	Total	mg/L																										
Molybdenum	Dissolved	mg/L																										
Molybdenum	Total	mg/L																										
Nickel	Dissolved	mg/L			0.177						0.174		0.107		0.112		0.0734		0.0628		0.0972		0.114		0.0832		0.0958	
Nickel	Total	mg/L			0.188				0.154																0.0943		0.101	
Potassium	Dissolved	mg/L	3.8		3.82		2.41																		2.08		2.24	
Potassium	Total	mg/L			3.65		2.46																		2.04		2.32	
Selenium	Dissolved	mg/L	0.00424		0.0116		0.01																		0.001	U	0.0018	
Selenium	Total	mg/L			0.0159		0.0128																		0.00757		0.00136	
Silver	Dissolved	mg/L	0.2	U	0.001	U	0.001	U																	0.001	U	0.001	U
Silver	Total	mg/L			0.001	U	0.001	U																	0.001	U	0.001	U
Strontium	Total	mg/L																										
Sulfur	Total	mg/L																										
Sodium	Dissolved	mg/L	14.7		12.3		9.22																		7.69		8.79	
Sodium	Total	mg/L			12.7		9.56																		7.48		8.98	
Thallium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U																	0.001	U	0.001	U
Thallium	Total	mg/L			0.01	U	0.001	U																	0.001	U	0.001	U
Tin	Total	mg/L																										
Vanadium	Dissolved	mg/L	0.005	U	0.0144		0.0282																		0.005	U	0.005	U
Vanadium	Total	mg/L			0.014		0.0303																		0.005	U	0.00515	

Table A-1
Formosa Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/17/2000		2/24/2001		5/2/2001		11/8/2001		11/30/2001		12/18/2001		2/7/2002		2/21/2002		3/26/2002		4/22/2002		5/29/2002		4/29/2004		6/17/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Metals (Con't)																												
Zinc	Dissolved	mg/L	140		201		258				168		210		157		124		103		143		133		101		97.3	
Zinc	Total	mg/L			246		256		168																102		107	
Major Ions																												
Ammonia as N		mg/L																										
Bicarbonate Alkalinity		mg/L																										
Carbonate Alkalinity		mg/L																										
Chloride		mg/L																										
Fluoride		mg/L																										
Hydroxide Alkalinity		mg/L																										
Nitrate & Nitrite as N		mg/L as N																										
Nitrate as N		mg/L as N																										
Nitrite as N		mg/L as N																										
Orthophosphate as P		mg/L as P																										
Phosphorus		mg/L																										
Silica (SiO2)		mg/L																										
Sulfate		mg/L							1190		1960		2140		2830		1420		868		1860		1430					
Sulfide		mg/L							0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U					
Alkalinity		mg/L																										
Total Phosphate as P		mg/L as P																										
Other																												
Acidity		mg/L																										
Total Cyanide		mg/L																										
Dissolved Organic Carbon		mg/L																										
Hardness		mg/L							536		523		233		380		233		226		388		412					
Total Dissolved Solids		mg/L																										
Total Organic Carbon		mg/L																										
Total Suspended Solids		mg/L							61		6		12		11		12		10		10		10					

Key:

U = Nondetect

Table A-1
Formosa Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water	
Sample Date			7/14/2004		7/6/2005		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements								
Conductivity		µS/cm						
Dissolved Oxygen		mg/L						
Flow		gpm						
ORP		mV						
pH		su						
Temperature		deg C						
Metals								
Aluminum	Dissolved	mg/L	17.8				14.5	
Aluminum	Total	mg/L	16.1		21.24			
Antimony	Dissolved	mg/L	0.001	U			0.001	U
Antimony	Total	mg/L	0.001	U				
Arsenic	Dissolved	mg/L	0.0118				0.0086	
Arsenic	Total	mg/L	0.0109					
Barium	Dissolved	mg/L	0.0103				0.0094	
Barium	Total	mg/L	0.0112		0.0095			
Beryllium	Dissolved	mg/L	0.001	U			0.001	U
Beryllium	Total	mg/L	0.001	U	0.0005			
Boron		mg/L						
Cadmium	Dissolved	mg/L	0.3				0.265	
Cadmium	Total	mg/L	0.319		0.42			
Calcium	Dissolved	mg/L	167				234	
Calcium	Total	mg/L	156		157			
Chromium	Dissolved	mg/L	0.00715				0.00442	
Chromium	Total	mg/L	0.00763		0.008			
Cobalt	Dissolved	mg/L	0.0223				0.0228	
Cobalt	Total	mg/L	0.0231		0.035			
Copper	Dissolved	mg/L	8.41				5.06	
Copper	Total	mg/L	9.08		14.3			
Iron	Dissolved	mg/L	182				178	
Iron	Total	mg/L	194		226.35			
Lanthanum	Dissolved	mg/L						
Lanthanum	Total	mg/L						
Lead	Dissolved	mg/L	0.0274				0.0168	
Lead	Total	mg/L	0.0302					
Lithium	Dissolved	mg/L						
Lithium	Total	mg/L			0.0256			
Magnesium	Dissolved	mg/L	30.3				35.8	
Magnesium	Total	mg/L	27.9		32.858			
Manganese	Dissolved	mg/L	3.2				3.5	
Manganese	Total	mg/L	3.09		3			
Mercury	Dissolved	mg/L						
Mercury	Total	mg/L						
Molybdenum	Dissolved	mg/L						
Molybdenum	Total	mg/L						
Nickel	Dissolved	mg/L	0.0997				0.104	
Nickel	Total	mg/L	0.1		0.1			
Potassium	Dissolved	mg/L	2.3				2.79	
Potassium	Total	mg/L	2.36		2.4841			
Selenium	Dissolved	mg/L	0.00539				0.002	U
Selenium	Total	mg/L	0.001	U				
Silver	Dissolved	mg/L	0.001	U			0.001	U
Silver	Total	mg/L	0.001	U				
Strontium	Total	mg/L			0.3			
Sulfur	Total	mg/L			437			
Sodium	Dissolved	mg/L	10.3				13	
Sodium	Total	mg/L	9.31		9.6276			
Thallium	Dissolved	mg/L	0.001	U			0.001	U
Thallium	Total	mg/L	0.001	U				
Tin	Total	mg/L			0.041			
Vanadium	Dissolved	mg/L	0.005	U			0.005	U
Vanadium	Total	mg/L	0.005	U	0.0194			

Table A-1
Formosa Adit
Historical Results

Sample Media Sample Date Analyte	Analyte 2	Unit	Surface Water 7/14/2004 Value	Qualifier	Surface Water 7/6/2005 Value	Qualifier	Surface Water 9/19/2005 Value	Qualifier
Metals (Con't)								
Zinc	Dissolved	mg/L	108				104	
Zinc	Total	mg/L	113		119.7			
Major Ions								
Ammonia as N		mg/L						
Bicarbonate Alkalinity		mg/L						
Carbonate Alkalinity		mg/L						
Chloride		mg/L						
Fluoride		mg/L						
Hydroxide Alkalinity		mg/L						
Nitrate & Nitrite as N		mg/L as N						
Nitrate as N		mg/L as N						
Nitrite as N		mg/L as N						
Orthophosphate as P		mg/L as P						
Phosphorus		mg/L			0.3044			
Silica (SiO2)		mg/L			22.1577			
Sulfate		mg/L						
Sulfide		mg/L						
Alkalinity		mg/L						
Total Phosphate as P		mg/L as P						
Other								
Acidity		mg/L						
Total Cyanide		mg/L						
Dissolved Organic Carbon		mg/L						
Hardness		mg/L						
Total Dissolved Solids		mg/L						
Total Organic Carbon		mg/L						
Total Suspended Solids		mg/L						

Key:

U = Nondetect

Table A-1
Formosa Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/15/1999		10/4/1999		10/19/1999		10/26/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		12/18/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																				
Conductivity		µS/cm									819									
Flow		gpm	0		0		0		0		19.7		15.0		8.0		2.9		9.7	
pH		su									3.06		3.22		3.06		2.9		2.03	
Temperature		deg C									9									
Metals																				
Aluminum	Dissolved	mg/L									5.37		5.81		9.68		10.5		17.9	
Aluminum	Total	mg/L									5.28		6.09		10.2		12.8			
Antimony	Dissolved	mg/L									0.003	U	0.003	U	0.0002		0.001	U		
Antimony	Total	mg/L									0.003	U	0.003	U	0.0002		0.001	U		
Arsenic	Dissolved	mg/L									0.002	U	0.002	U	0.005	U	0.00242		0.0464	
Arsenic	Total	mg/L									0.0039		0.002	U	0.005	U	0.00317			
Barium	Dissolved	mg/L									0.0167		0.0252		0.02		0.02			
Barium	Total	mg/L									0.0175		0.122		0.02		0.0214			
Beryllium	Dissolved	mg/L									0.000225		0.000237		0.00039		0.001	U		
Beryllium	Total	mg/L									0.000217		0.000213		0.00041		0.001	U		
Boron		mg/L									0.051									
Cadmium	Dissolved	mg/L									0.139		0.136		0.238		0.275		0.47	
Cadmium	Total	mg/L									0.141		0.136		0.243		0.25			
Calcium	Dissolved	mg/L									26.8		23.8		38.8		43			
Calcium	Total	mg/L									26.7		23.6		39.4		46.6			
Chromium	Dissolved	mg/L									0.00182		0.00184		0.003		0.00362			
Chromium	Total	mg/L									0.0019		0.00198		0.0031		0.00301			
Cobalt	Dissolved	mg/L									0.00902		0.00799		0.0129		0.0161			
Cobalt	Total	mg/L									0.00894		0.00811		0.0138		0.0142			
Copper	Dissolved	mg/L									13.3		10.4		18.5		18.2		59.9	
Copper	Total	mg/L									13.2		10.6		19.6		19			
Iron	Dissolved	mg/L									22.3		20.6		39		35.2		141	
Iron	Total	mg/L									27.2		23.6		42.2		39.5			
Lanthanum	Dissolved	mg/L									0.0011		0.001	U						
Lanthanum	Total	mg/L									0.001	U	0.001	U						
Lead	Dissolved	mg/L									0.0351		0.0373		0.0719		0.0774		0.0313	
Lead	Total	mg/L									0.0377		0.0429		0.0733		0.0725			
Lithium	Dissolved	mg/L									0.00328		0.00418							
Lithium	Total	mg/L									0.00337		0.00367							
Magnesium	Dissolved	mg/L									8.68		7.03		12.4		13.4		16.4	
Magnesium	Total	mg/L									8.94		7.17		12.8		14.8			
Manganese	Dissolved	mg/L									0.934		0.946		1.49		1.65			
Manganese	Total	mg/L									0.916		0.963		1.54		1.86			
Mercury	Dissolved	mg/L													0.0002	U				
Mercury	Total	mg/L													0.0002	U				
Molybdenum	Dissolved	mg/L									0.0004	U	0.0004	U						
Molybdenum	Total	mg/L									0.0004	U	0.0004	U						
Nickel	Dissolved	mg/L									0.0248		0.0238		0.0437		0.05		0.07	
Nickel	Total	mg/L									0.0242		0.0242		0.046		0.0455			
Potassium	Dissolved	mg/L									0.302		0.37		2	U	1	U		
Potassium	Total	mg/L									0.276		0.444		2	U	1	U		
Selenium	Dissolved	mg/L									0.003	U	0.003	U	0.005	U	0.00532			
Selenium	Total	mg/L									0.003	U	0.003	U	0.005	U	0.1	U		
Silver	Dissolved	mg/L									0.0002	U	0.0002	U	0.00009		0.001	U		
Silver	Total	mg/L									0.0002	U	0.0002	U	0.00004	U	0.001	U		
Sodium	Dissolved	mg/L									3.62		2.27		3.95		3.99			
Sodium	Total	mg/L									3.72		2.2		4.13		4.64			
Thallium	Dissolved	mg/L									0.0042		0.002	U	0.00042		0.001	U		
Thallium	Total	mg/L									0.002	U	0.002	U	0.00042		0.001	U		
Vanadium	Dissolved	mg/L									0.0001	U	0.0001	U	0.01	U	0.0388	U		
Vanadium	Total	mg/L									0.0001	U	0.00012		0.01	U	0.0356	U		
Zinc	Dissolved	mg/L									17.9		19.6		39.2		49.3		76	
Zinc	Total	mg/L									18.5		19.3		39.9		50.7			

Table A-2
Silver Butte Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/15/1999		10/4/1999		10/19/1999		10/26/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		12/18/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																				
Alkalinity		mg/L									0									
Ammonia as N		mg/L as N									0.05						0.11			
Chloride		mg/L									1.5						3.24			
Fluoride		mg/L									0.3						1.18			
Nitrate & Nitrite as N		mg/L as N									0.233									
Nitrate as N		mg/L as N															0.158			
Nitrite as N		mg/L as N															0.1	U		
Orthophosphate as P		mg/L as P									0.006						0.0267			
Phosphorus		mg/L															0.035	U		
Silica (SiO2)		mg/L									25.4						382			
Sulfate		mg/L									225						438		202	
Sulfide		mg/L																	0.05	U
Total Phosphate as P		mg/L as P									0.04									
Other																				
Dissolved Organic Carbon		mg/L															3	U		
Hardness		mg/L									103		88.4						161	
Total Organic Carbon		mg/L									1	U					3	U		
Total Suspended Solids		mg/L									19						10	U	13	

Key:

U = Nondetect

Table A-2
Silver Butte Adit
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/9/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002		3/26/2002		4/22/2002		5/29/2002		5/13/2004		6/17/2004		7/14/2004		8/16/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																														
Flow		gpm									1.3		23.1		58.0		45.3		9.9		6.5									
pH		su									2.81		2.28		2.36		2.34		2.52		2.55									
Metals																														
Aluminum	Dissolved	mg/L			12.5		35.1		47.4				32.5		22.4		17.9		25.4		22.2		28.4		17.2		17.3		16.9	
Aluminum	Total	mg/L					38		47.1		22.1												26.8		17.9		16.8		17.2	
Antimony	Dissolved	mg/L			0.001	U	0.001	U	0.001	U													0.001	U	0.001	U	0.001	U	0.001	U
Antimony	Total	mg/L	0.001	U			0.001	U	0.002														0.0012		0.001	U	0.001	U	0.001	U
Arsenic	Dissolved	mg/L			0.00159		0.0259		0.135				0.111		0.0881		0.0592		0.0521		0.01	U	0.0276		0.0103		0.00606		0.00153	
Arsenic	Total	mg/L	0.0139				0.0905		0.198		0.005	U											0.0512		0.0241		0.00529		0.00387	
Barium	Dissolved	mg/L			0.00884		0.0101		0.0118														0.0131		0.011		0.0102		0.0109	
Barium	Total	mg/L	0.4	U			0.02	U	0.0128														0.0121		0.011		0.0105		0.0109	
Beryllium	Dissolved	mg/L			0.001	U	0.001	U	0.00111														0.001	U	0.001	U	0.001	U	0.001	U
Beryllium	Total	mg/L	0.001	U			0.00937	U	0.00111														0.001	U	0.001	U	0.001	U	0.001	U
Cadmium	Dissolved	mg/L			0.297		0.567		1.12				0.724		0.533		0.42		0.504		0.438		0.438		0.355		0.302		0.28	
Cadmium	Total	mg/L	0.309				0.559		1.18		0.395												0.434		0.36		0.338		0.27	
Calcium	Dissolved	mg/L			295		208		172														155		159		159		193	
Calcium	Total	mg/L	301				227		175														142		147		162		198	
Chromium	Dissolved	mg/L			0.00161		0.0124		0.033														0.0125		0.00825		0.00679		0.00607	
Chromium	Total	mg/L	0.00401				0.0118		0.0364														0.0128		0.0101		0.00772		0.00493	
Cobalt	Dissolved	mg/L			0.0349		0.0396		0.0454														0.0258		0.0219		0.0224		0.0253	
Cobalt	Total	mg/L	0.0378				0.0395		0.0481														0.0231		0.0224		0.02411		0.0221	
Copper	Dissolved	mg/L			6.67		31		60.8				43.4		35.5		26.1		23.4		15.7		15.7		9.21		8.4		7.53	
Copper	Total	mg/L	9.62				36.1		59.4		11.1												17.2		8.72		9.26		6.83	
Iron	Dissolved	mg/L			143		299		526				292		188		154		266		192		251		165		130		96.2	
Iron	Total	mg/L	193				334		538		130												254		176		144		99.5	
Lead	Dissolved	mg/L			0.00511		0.0201		0.0455				0.042		0.0479		0.0418		0.0265		0.0206		0.0566		0.0344		0.0275		0.0261	
Lead	Total	mg/L	0.384				0.0222		0.0461		0.0095												0.049		0.0352		0.0312		0.0225	
Magnesium	Dissolved	mg/L			40		40.4		42.2														36.2		26.3		29.2		33.6	
Magnesium	Total	mg/L	39				45.7		44.2														33.9		27.7		28.2		32	
Manganese	Dissolved	mg/L			4.09		4.69		4.27				2.93		1.95		1.74		2.66		3.06		2.97		2.7		3.01		3.36	
Manganese	Total	mg/L	4.04				4.65		4.24		4.35												2.89		2.82		3.06		3.33	
Mercury	Total	mg/L	0.0002	U																										
Nickel	Dissolved	mg/L					0.194						0.114		0.0736		0.0621		0.101		0.112		0.107		0.0943		0.0989		0.108	
Nickel	Total	mg/L	0.177				0.202				0.189												0.108		0.0956		0.105		0.1	
Potassium	Dissolved	mg/L			3.64		3.75		2.21														2.5		2.13		2.62		2.9	
Potassium	Total	mg/L					3.07		2.38														2.38		2.24		2.46		2.79	
Selenium	Dissolved	mg/L			0.1	U	0.0088		0.00886														0.001	U	0.0026		0.00417		0.001	U
Selenium	Total	mg/L	0.2	U			0.0148		0.012														0.001	U	0.00228		0.001	U	0.001	U
Silver	Dissolved	mg/L			0.1	U	0.001	U	0.001	U													0.001	U	0.001	U	0.001	U	0.001	U
Silver	Total	mg/L	0.001	U			0.001	U	0.001	U													0.001	U	0.001	U	0.001	U	0.001	U
Sodium	Dissolved	mg/L			14.4		12.1		8.85														8.93		8.34		10		11.1	
Sodium	Total	mg/L	14.1				13		9.25														8.57		8.66		9.55		10.7	
Thallium	Dissolved	mg/L			0.001	U	0.001	U	0.001	U													0.001	U	0.001	U	0.001	U	0.001	U
Thallium	Total	mg/L	0.2	U			0.01	U	0.001	U													0.001	U	0.001	U	0.001	U	0.001	U
Vanadium	Dissolved	mg/L			0.005	U	0.005	U	0.00579														0.005	U	0.005	U	0.005	U	0.005	U
Vanadium	Total	mg/L	0.005	U			0.00642		0.0204														0.00708		0.005	U	0.005	U	0.005	U
Zinc	Dissolved	mg/L			104		191		268				164		126		99.1		144		126		125		103		106		62.5	
Zinc	Total	mg/L	126				215		259		151												143		97.2		110		98.8	
Major Ions																														
Sulfate		mg/L									1240		2730		1470		824		1580		1400									
Sulfide		mg/L									0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U								
Other																														
Hardness		mg/L									836		382		235		224		399		476									
Total Suspended Solids		mg/L									5	U	5	U	10		27		60		20									

Key:

U = Nondetect

Table A-3
End of Pipe
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			10/19/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		7/18/2000		10/18/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Flow		gpm			200.0		175.0		49.0		32.0				0.3		2.5		12.1		9.9		0.0		55.9		34.4	
pH		su			6.71		6.96		7.27		7.01				6.42		6.04				7		4.97		5.7		5.8	
Temperature		deg C			9.1														6.9									
Metals																												
Aluminum	Dissolved	mg/L	0.21		0.086		0.076		0.05	U	0.1		0.223		0.143		0.175		0.1	U	0.1	U			0.157		0.315	
Aluminum	Total	mg/L			0.181		0.372		1.6		0.319												0.435					
Antimony	Dissolved	mg/L	0.01	U	0.003	U	0.003	U	0.0001		0.001	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U						
Antimony	Total	mg/L			0.003	U	0.003	U	0.0002		0.001	U																
Arsenic	Dissolved	mg/L	0.01	U	0.002	U	0.002	U	0.005	U	0.00109						0.00103		0.0024		0.001	U			0.005	U	0.005	U
Arsenic	Total	mg/L			0.002	U	0.002	U	0.005	U	0.00111												0.005	U				
Barium	Dissolved	mg/L	0.02		0.0431		0.0496		0.046		0.0462		0.0476		0.0233		0.2	U	0.0255		0.0322							
Barium	Total	mg/L			0.0503		0.0713		0.08		0.0447																	
Beryllium	Dissolved	mg/L	0.001	U	0.000038		0.00001	U	0.00004	U	0.001	U	0.01	U	0.001	U	0.001	U	0.001	U	0.001	U						
Beryllium	Total	mg/L			0.000033		0.000023		0.00015		0.001	U																
Boron	Total	mg/L			0.0044																							
Cadmium	Dissolved	mg/L	0.042		0.00371		0.00393		0.0071		0.00674		0.0546		0.0554		0.0379		0.0156		0.0143				0.0064		0.006	
Cadmium	Total	mg/L			0.00382		0.00382		0.0074		0.00634												0.0389					
Calcium	Dissolved	mg/L	61		10.5		12.3		15.4		14.2		94.5		168		92		47.9		34							
Calcium	Total	mg/L			10.6		12.2		15.8		16.2																	
Chromium	Dissolved	mg/L	0.01	U	0.0002	U	0.0002	U	0.0006		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.00117							
Chromium	Total	mg/L			0.0002		0.0002	U	0.0008		0.001	U																
Cobalt	Dissolved	mg/L	0.01	U	0.00154		0.0002	U	0.001		0.002	U	0.0046		0.00254		0.00327		0.002	U	0.002	U						
Cobalt	Total	mg/L			0.00094		0.00077		0.00107		0.002	U																
Copper	Dissolved	mg/L	2.6		0.217		0.2		0.345		0.404		2.99		2.19		2.28		0.805		0.823				0.392		0.475	
Copper	Total	mg/L			0.268		0.364		1.07		0.496												1.31					
Iron	Dissolved	mg/L	1	U	0.0173		0.0316		0.04		0.1	U	0.113		0.1	U	0.1	U	0.172		0.1	U			0.376		0.354	
Iron	Total	mg/L			0.091		0.211		0.314		0.1	U											0.137					
Lanthanum	Dissolved	mg/L			0.001	U	0.001	U																				
Lanthanum	Total	mg/L			0.001	U	0.0018																					
Lead	Dissolved	mg/L	0.002	U	0.003	U	0.003	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U			0.005	U	0.005	U
Lead	Total	mg/L			0.0032		0.003	U	0.00034		0.001	U											0.005	U				
Lithium	Dissolved	mg/L			0.0004	U	0.0004	U																				
Lithium	Total	mg/L			0.00052		0.00054																					
Magnesium	Dissolved	mg/L	13		2.9		3.3		3.84		3.39		21.3		32.2		20		10		7.51							
Magnesium	Total	mg/L			2.89		3.15		3.96		3.95																	
Manganese	Dissolved	mg/L	0.45		0.0722		0.0583		0.13		0.111		0.733		0.575		0.674		0.301		0.269				0.11		0.106	
Manganese	Total	mg/L			0.0722		0.0596		0.136		0.118												0.693					
Mercury	Dissolved	mg/L	0.0002	U					0.0002	U																		
Mercury	Total	mg/L							0.0002	U																		
Molybdenum	Dissolved	mg/L			0.00114		0.0004	U																				
Molybdenum	Total	mg/L			0.00054		0.00061																					
Nickel	Dissolved	mg/L	0.025		0.00647		0.00574		0.0094		0.0079		0.0459		0.053				0.0146						0.0077		0.0071	
Nickel	Total	mg/L			0.00578		0.00661		0.0097		0.00685												0.0311					
Potassium	Dissolved	mg/L	2	U	0.232		0.424		2	U	1	U	1.17		1.06		1.15		1	U	1	U						
Potassium	Total	mg/L			0.241		0.335		2	U	1	U																
Selenium	Dissolved	mg/L	0.02	U	0.003	U	0.003	U	0.005	U	0.00108		0.001	U	0.00161		0.00273		0.00913		0.00109							
Selenium	Total	mg/L			0.003	U	0.003	U	0.005	U	0.001	U																
Silver	Dissolved	mg/L	0.01	U	0.0002	U	0.0002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U						
Silver	Total	mg/L			0.0002	U	0.0002	U	0.00008		0.001	U																
Sodium	Dissolved	mg/L	3.3		2.77		2.85		2.94		2.85		6.02		8.29		5.83		4.43		3.75							
Sodium	Total	mg/L			2.83		2.84		2.99		3.1																	
Thallium	Dissolved	mg/L	0.05	U	0.003		0.002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U						
Thallium	Total	mg/L			0.002	U	0.002	U	0.00004	U	0.001	U																
Vanadium	Dissolved	mg/L	0.01	U	0.0001	U	0.00022		0.01	U	0.005	U	0.05	U	0.005	U	0.005	U	0.005	U	0.005	U						
Vanadium	Total	mg/L			0.00016		0.00017		0.01	U	0.005	U																
Zinc	Dissolved	mg/L	15		1.31		1.39		2.23		2.28		24.4		19.1		12.7		5.29		5.14				2.25		2.01	
Zinc	Total	mg/L			1.34		1.4		2.41		2.04												14.8					

Table A-4
Seep A
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			10/19/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		7/18/2000		10/18/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Ammonia as N		mg/L as N			0.02	U					0.05	U																
Chloride		mg/L			1.8						18.5																	
Fluoride		mg/L			0.01	U					0.5	U																
Nitrate & Nitrite as N		mg/L as N			0.0504																							
Nitrate as N		mg/L as N									0.14																	
Nitrite as N		mg/L as N									0.1	U																
Orthophosphate as P		mg/L as P			0.005	U					0.0033																	
Phosphorus		mg/L									0.035	U																
Silica (SiO2)		mg/L			15.2						160																	
Sulfate		mg/L			31.9						40.4												245		110		48.3	
Sulfide		mg/L																					0.05	U	0.05	U	0.05	U
Total Phosphate as P		mg/L as P			0.01	U																						
Other																												
Dissolved Organic Carbon		mg/L									3	U																
Hardness		mg/L			38		44.3																298		62.9		55.7	
Total Organic Carbon		mg/L			2						3	U																
Total Suspended Solids		mg/L									10	U											5	U	5	U	5	U

Key:

U = Nondetect

Table A-4
Seep A
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water	
Sample Date			3/26/2002		4/22/2002		5/29/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements								
Flow		gpm	31.9		4.7		1.0	
pH		su	5.76		5.76		6.99	
Temperature		deg C						
Metals								
Aluminum	Dissolved	mg/L	0.107		0.162		0.102	
Aluminum	Total	mg/L						
Antimony	Dissolved	mg/L						
Antimony	Total	mg/L						
Arsenic	Dissolved	mg/L	0.005	U	0.005	U	0.01	U
Arsenic	Total	mg/L						
Barium	Dissolved	mg/L						
Barium	Total	mg/L						
Beryllium	Dissolved	mg/L						
Beryllium	Total	mg/L						
Boron	Total	mg/L						
Cadmium	Dissolved	mg/L	0.0048		0.0081		0.0096	
Cadmium	Total	mg/L						
Calcium	Dissolved	mg/L						
Calcium	Total	mg/L						
Chromium	Dissolved	mg/L						
Chromium	Total	mg/L						
Cobalt	Dissolved	mg/L						
Cobalt	Total	mg/L						
Copper	Dissolved	mg/L	0.265		0.327		0.248	
Copper	Total	mg/L						
Iron	Dissolved	mg/L	0.269		1.14		0.496	
Iron	Total	mg/L						
Lanthanum	Dissolved	mg/L						
Lanthanum	Total	mg/L						
Lead	Dissolved	mg/L	0.005	U	0.005	U	0.01	U
Lead	Total	mg/L						
Lithium	Dissolved	mg/L						
Lithium	Total	mg/L						
Magnesium	Dissolved	mg/L						
Magnesium	Total	mg/L						
Manganese	Dissolved	mg/L	0.0765		0.106		0.0786	
Manganese	Total	mg/L						
Mercury	Dissolved	mg/L						
Mercury	Total	mg/L						
Molybdenum	Dissolved	mg/L						
Molybdenum	Total	mg/L						
Nickel	Dissolved	mg/L	0.0053		0.0065		0.0106	
Nickel	Total	mg/L						
Potassium	Dissolved	mg/L						
Potassium	Total	mg/L						
Selenium	Dissolved	mg/L						
Selenium	Total	mg/L						
Silver	Dissolved	mg/L						
Silver	Total	mg/L						
Sodium	Dissolved	mg/L						
Sodium	Total	mg/L						
Thallium	Dissolved	mg/L						
Thallium	Total	mg/L						
Vanadium	Dissolved	mg/L						
Vanadium	Total	mg/L						
Zinc	Dissolved	mg/L	1.59		2.5		4.46	
Zinc	Total	mg/L						

Table A-4
Seep A
Historical Results

Sample Media Sample Date Analyte	Analyte 2	Unit	Surface Water 3/26/2002 Value	Qualifier	Surface Water 4/22/2002 Value	Qualifier	Surface Water 5/29/2002 Value	Qualifier
Major Ions								
Ammonia as N		mg/L as N						
Chloride		mg/L						
Fluoride		mg/L						
Nitrate & Nitrite as N		mg/L as N						
Nitrate as N		mg/L as N						
Nitrite as N		mg/L as N						
Orthophosphate as P		mg/L as P						
Phosphorus		mg/L						
Silica (SiO2)		mg/L						
Sulfate		mg/L	38.8		60.8		87.7	
Sulfide		mg/L	0.05	U	0.05	U	0.05	U
Total Phosphate as P		mg/L as P						
Other								
Dissolved Organic Carbon		mg/L						
Hardness		mg/L	51.7		69.3		101	
Total Organic Carbon		mg/L						
Total Suspended Solids		mg/L	5	U	5	U	5	U

Key:

U = Nondetect

Table A-4
Seep A
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			10/19/1999		3/9/2000		3/23/2000		10/18/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002		3/26/2002		4/22/2002		5/29/2002		7/6/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurement																														
Flow		gpm			40.0		30.0		0.3		2.6		12.1		9.9		0.0		80.0		37.2		50.0		10.1		1.4			
pH		su			4.9		5.06		3.81		3.5		4.37		3.7		3.23		3.48		3.82		3.79		3.93		4.88			
Metals																														
Aluminum	Dissolved	mg/L	0.21		6.76		5.39		8.58		12.1		13.3		8.7				3.3		2.9		0.636		2.47		0.982			
Aluminum	Total	mg/L			7.9		8.8										19.6												4.1	
Antimony	Dissolved	mg/L	0.01	U	0.0001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U														
Antimony	Total	mg/L			0.0	U	0.0	U																						
Arsenic	Dissolved	mg/L	0.01	U	0.005	U	0.001	U			0.001	U	0.001	U	0.001	U			0.005	U	0.005	U	0.005	U	0.005	U	0.01	U		
Arsenic	Total	mg/L			0.0	U	0.0										0.0	U							1.0					
Barium	Dissolved	mg/L	0.024		0.036		0.0372		0.0101		0.00908		0.0132		0.02															
Barium	Total	mg/L			0.0		0.2																						0.0	
Beryllium	Dissolved	mg/L	0.001	U	0.00044		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U														
Beryllium	Total	mg/L			0.0		0.0	U																					0.0	U
Cadmium	Dissolved	mg/L	0.032		0.0647		0.545		0.0999		0.115		0.0876		0.0612				0.0278		0.0206		0.0165		0.0214		0.0206			
Cadmium	Total	mg/L			0.1		0.0										0.2												0.0	
Calcium	Dissolved	mg/L	54		28.5		26.1		159		128		79.5		55.4															
Calcium	Total	mg/L			29.5		28.3																						35.0	
Chromium	Dissolved	mg/L	0.01	U	0.0009		0.001	U	0.001	U	0.0014		0.00212		0.00232															
Chromium	Total	mg/L			0.0		0.0	U																					0.0	U
Cobalt	Dissolved	mg/L	0.01	U	0.00758		0.00676		0.0126		0.0154		0.0125		0.0101															
Cobalt	Total	mg/L			0.0		0.0																						0.0	
Copper	Dissolved	mg/L	2.1		4.12		3.85		6.76		7.03		6.66		5.35				2.74		1.98		1.58		2		1.59			
Copper	Total	mg/L			4.4		3.8										11.7												2.3	
Iron	Dissolved	mg/L	1	U	0.102		0.1	U	0.244		0.552		2.02		2.25				0.339		0.802		0.0384		0.0835		0.0396			
Iron	Total	mg/L			0.8		1.2										1.2												0.9	
Lead	Dissolved	mg/L	0.002	U	0.00038		0.001	U	0.00101		0.001	U	0.001	U	0.001	U			0.005	U	0.005	U	0.005	U	0.005	U	0.01	U		
Lead	Total	mg/L			0.0		0.0										0.0	U												
Lithium	Total	mg/L																											0.0056	U
Magnesium	Dissolved	mg/L	13		7.4		6.5		32.0		29.1		18.3		13.1															
Magnesium	Total	mg/L			7.69		4.53																						8.5916	
Manganese	Dissolved	mg/L	0.7		0.7		0.5		1.7		1.9		1.5		1.1				0.5		0.4		0.3		0.4		0.3			
Manganese	Total	mg/L			0.682		0.674										2.91												0.5	
Mercury	Dissolved	mg/L	0.0002	U	0.0	U																								
Mercury	Total	mg/L			0.0002	U																								
Nickel	Dissolved	mg/L	0.017		0.0		0.0		0.1				0.0						0.0		0.0		0.0		0.0		0.0			
Nickel	Total	mg/L			0.0241		0.0193										0.0742												0.01	
Potassium	Dissolved	mg/L	2	U	2.0	U	1.0	U	1.0	U	1.4		1.1		1.0	U														
Potassium	Total	mg/L			2	U	1	U																					0.5895	
Selenium	Dissolved	mg/L	0.02	U	0.0	U	0.0		0.0		0.0		0.0		0.0															
Selenium	Total	mg/L			0.005	U	0.00164																							
Silver	Dissolved	mg/L	0.01	U	0.0		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U														
Silver	Total	mg/L			0.00004	U	0.001	U																						
Sodium	Dissolved	mg/L	3.9		3.5		3.4		8.3		6.8		5.6		4.5															
Sodium	Total	mg/L			3.73		3.69																						4.4546	
Strontium	Total	mg/L																											0.0	
Sulfur	Total	mg/L																											53	
Thallium	Dissolved	mg/L	0.05	U	0.0		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U														
Thallium	Total	mg/L			0.00004		0.001	U																						
Tin	Total	mg/L																											0.0	U
Vanadium	Dissolved	mg/L	0.01	U	0.01	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U														

Table A-5
Location A4
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			10/19/1999		3/9/2000		3/23/2000		10/18/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002		3/26/2002		4/22/2002		5/29/2002		7/6/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Metals (Con't)																														
Vanadium	Total	mg/L			0.01	U	0.005	U																					0.0016	U
Zinc	Dissolved	mg/L	11		14.5		14.6		28.2		34.5		27.7		16.4				6.9		5.1		4.2		5.4		5.6			
Zinc	Total	mg/L			15.1		15.1										42.2												6.4	
Major Ions																														
Ammonia as N		mg/L as N					0.05	U																						
Chloride		mg/L					21.4																							
Fluoride		mg/L					0.918																							
Nitrate as N		mg/L as N					0.2																							
Nitrite as N		mg/L as N					0.1	U																						
Orthophosphate as P		mg/L as P					0.0																							
Phosphorus		mg/L					0.035	U																					0.0935	U
Silica (SiO2)		mg/L					257.0																						10.7	
Sulfate		mg/L					140										472		357		124		75.1		126		149			
Sulfide		mg/L															0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U		
Other																														
Dissolved Organic Carbon		mg/L					3.0	U																						
Hardness		mg/L															418		89.6		77.2		69		91.6		117			
Total Organic Carbon		mg/L					3.0	U																						
Total Suspended Solids		mg/L					22										5	U	43		9		55		5		5			

Key:

U = Nondetect

Table A-5
Location A4
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			10/19/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		10/18/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002		3/26/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Flow		gpm			275.0		190.0		76.0		70.0		4.5		4.0		14.8		14.8		2.0		163.6		102.4		117.5	
pH		su	4.2		3.74		4.44		4.03		3.79		4		3.32		4.1		3.3		3.87		3.4		2.87		3.02	
Temperature		deg C			9.2																							
Metals																												
Aluminum	Dissolved	mg/L	11		13.8		7.52		12.1		15.5		18.8		28		22.6		27.8		29.6		7.8		8.14		6.41	
Aluminum	Total	mg/L			14.4		7.42		12.4		17.5																	
Antimony	Dissolved	mg/L	0.01	U	0.003	U	0.003	U	0.0001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U								
Antimony	Total	mg/L			0.003	U	0.003	U	0.0001	U	0.001	U																
Arsenic	Dissolved	mg/L	0.01	U	0.002	U	0.002	U	0.005	U	0.001	U			0.001	U	0.001	U	0.001	U	0.005	U	0.005	U	0.005	U	0.005	U
Arsenic	Total	mg/L			0.002	U	0.002	U	0.005	U	0.001	U																
Barium	Dissolved	mg/L	0.016		0.0283		0.0325		0.025		0.0211		0.0119		0.00843		0.00712		0.00854									
Barium	Total	mg/L			0.0319		0.0419		0.027		0.0203																	
Beryllium	Dissolved	mg/L	0.0011		0.000572		0.000326		0.00067		0.001	U	0.001	U	0.00108		0.001	U	0.00103									
Beryllium	Total	mg/L			0.000635		0.000303		0.00067		0.001	U																
Boron		mg/L			0.0069																							
Cadmium	Dissolved	mg/L	0.088		0.114		0.0636		0.109		0.133		0.158		0.198		0.123		0.162		0.179		0.045		0.0466		0.0405	
Cadmium	Total	mg/L			0.121		0.0608		0.111		0.124																	
Calcium	Dissolved	mg/L	65		32.8		25.1		38.4		46.1		120		140		101		91.4									
Calcium	Total	mg/L			33.9		24.3		38.2		50.6																	
Chromium	Dissolved	mg/L	0.01	U	0.00167		0.00094		0.001		0.0013		0.001	U	0.00213		0.00186		0.00431									
Chromium	Total	mg/L			0.00189		0.00087		0.0012		0.00117																	
Cobalt	Dissolved	mg/L	0.017		0.0163		0.008		0.0124		0.0169		0.0188		0.0306		0.0222		0.0282									
Cobalt	Total	mg/L			0.0166		0.00822		0.0125		0.0157																	
Copper	Dissolved	mg/L	7.3		9.41		5.09		6.76		8.69		8.97		14.1		10.3		13		14.9		4.57		4.69		4.07	
Copper	Total	mg/L			9.66		5.09		6.85		9.28																	
Iron	Dissolved	mg/L	0.4		1.76		0.182		0.644		0.765		0.133		0.733		0.692		1.49		0.2		1.13		0.493		0.368	
Iron	Total	mg/L			2.22		1.01		1.01		1.02																	
Lanthanum	Dissolved	mg/L			0.0059		0.0065																					
Lanthanum	Total	mg/L			0.0062		0.0066																					
Lead	Dissolved	mg/L	0.002	U	0.003	U	0.003	U	0.00069		0.001		0.00132		0.1	U	0.00112		0.00138		0.005	U	0.005	U	0.005	U	0.005	U
Lead	Total	mg/L			0.0042		0.003	U	0.00066		0.001	U																
Lithium	Dissolved	mg/L			0.00318		0.00313																					
Lithium	Total	mg/L			0.00328		0.00303																					
Magnesium	Dissolved	mg/L	16		9.69		6.73		10.3		11.4		28.2		33.7		25.4		22.4									
Magnesium	Total	mg/L			9.9		6.56		10.3		13.3																	
Manganese	Dissolved	mg/L	1.9		1.26		0.712		1.08		1.33		2.39		3.7		2.7		2.84		3.86		0.88		0.897		0.793	
Manganese	Total	mg/L			1.26		0.697		1.09		1.44																	
Mercury	Dissolved	mg/L	0.0002	U					0.0002	U																		
Mercury	Total	mg/L							0.0002	U																		
Molybdenum	Dissolved	mg/L			0.0004	U	0.0004	U																				
Molybdenum	Total	mg/L			0.0004	U	0.00042																					
Nickel	Dissolved	mg/L	0.024		0.0338		0.0205		0.035		0.0424		0.0553				0.0652				0.0793		0.024		0.0254		0.0208	
Nickel	Total	mg/L			0.0344		0.0207		0.0351		0.0395																	
Potassium	Dissolved	mg/L	2	U	0.538		0.575		2	U	1	U	1.95		1.61		1	U	1	U								
Potassium	Total	mg/L			0.582		0.497		2	U	1.03																	
Selenium	Dissolved	mg/L	0.02	U	0.003	U	0.003	U	0.005	U	0.00421		0.00269		0.00279		0.00367		0.0032									
Selenium	Total	mg/L			0.003	U	0.003	U	0.005	U	0.00366																	
Silver	Dissolved	mg/L	0.01	U	0.0002	U	0.0002	U	0.00004		0.001	U	0.001	U	0.1	U	0.001	U	0.001	U								
Silver	Total	mg/L			0.0002	U	0.0002	U	0.00007		0.001	U																
Sodium	Dissolved	mg/L	4		3.94		3.37		4.34		4.25		8.42		8.13		6.52		5.41									
Sodium	Total	mg/L			4.08		3.26		4.32		4.77																	
Strontium	Total	mg/L																										
Sulfur	Total	mg/L																										
Thallium	Dissolved	mg/L	0.05	U	0.0029		0.002	U	0.00006		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U								
Thallium	Total	mg/L			0.002	U	0.002	U	0.00005		0.001	U																
Tin	Total	mg/L																										
Vanadium	Dissolved	mg/L	0.01	U	0.0001	U	0.0001	U	0.01	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U								
Vanadium	Total	mg/L			0.0001	U	0.00021		0.01	U	0.005	U																
Zinc	Dissolved	mg/L	21		20.6		13.3		23.2		32.8		31.5		54.2		42.4		32.5		47.8		11.3		12.3		10.1	
Zinc	Total	mg/L			22		12.8		23.1		35.3																	

Table A-6
Location A9
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			10/19/1999		1/26/2000		2/14/2000		3/9/2000		3/23/2000		10/18/2000		11/17/2000		2/24/2001		5/2/2001		11/8/2001		2/7/2002		2/21/2002		3/26/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Ammonia as N		mg/L as N			0.05						0.05	U																
Bicarbonate Alkalinity		mg/L	10	U																								
Carbonate Alkalinity		mg/L	10	U																								
Chloride		mg/L	3.3		2						20.4																	
Fluoride		mg/L			0.4						1.1																	
Hydroxide Alkalinity		mg/L	10	U																								
Nitrate & Nitrite as N		mg/L as N			0.133																							
Nitrate as N		mg/L as N	0.73								0.343																	
Nitrite as N		mg/L as N	0.05	U							0.1	U																
Orthophosphate as P		mg/L as P			0.005	U					0.0096																	
Phosphorus		mg/L									0.035	U																
Silica (SiO2)		mg/L			26.9						317																	
Sulfate		mg/L	410		276						296										550		470		237		184	
Sulfide		mg/L																			0.05	U	0.05	U	0.05	U	0.05	U
Total Alkalinity		mg/L	10	U																								
Total Phosphate as P		mg/L as P			0.01																							
Other																												
Dissolved Organic Carbon		mg/L									3	U																
Hardness		mg/L			122		90.3														422		113		115		105	
Total Cyanide		mg/L	0.02	U																								
Total Organic Carbon		mg/L			2						3	U																
Total Suspended Solids		mg/L	570								10	U									5	U	8		11		8	

Key:

U = Nondetect

Table A-6
Location A9
Historical Results

Sample Media Sample Date Analyte	Analyte 2	Unit	Surface Water 4/22/2002 Value	Qualifier	Surface Water 5/29/2002 Value	Qualifier	Surface Water 7/6/2005 Value	Qualifier
Field Measurements								
Flow		gpm	24.7		8.8			
pH		su	2.95		3.2			
Temperature		deg C						
Metals								
Aluminum	Dissolved	mg/L	10		11.7			
Aluminum	Total	mg/L					42.62	
Antimony	Dissolved	mg/L						
Antimony	Total	mg/L						
Arsenic	Dissolved	mg/L	0.005	U	0.01	U		
Arsenic	Total	mg/L						
Barium	Dissolved	mg/L						
Barium	Total	mg/L					0.0167	
Beryllium	Dissolved	mg/L						
Beryllium	Total	mg/L					0.0058	
Boron		mg/L						
Cadmium	Dissolved	mg/L	0.0576		0.0736			
Cadmium	Total	mg/L					0.25	
Calcium	Dissolved	mg/L						
Calcium	Total	mg/L					210	
Chromium	Dissolved	mg/L						
Chromium	Total	mg/L					0.0029	U
Cobalt	Dissolved	mg/L						
Cobalt	Total	mg/L					0.059	
Copper	Dissolved	mg/L	5.83		6.94			
Copper	Total	mg/L					27	
Iron	Dissolved	mg/L	0.536					
Iron	Total	mg/L					0.07	
Lanthanum	Dissolved	mg/L						
Lanthanum	Total	mg/L						
Lead	Dissolved	mg/L	0.005	U	0.01	U		
Lead	Total	mg/L						
Lithium	Dissolved	mg/L						
Lithium	Total	mg/L					0.013	
Magnesium	Dissolved	mg/L						
Magnesium	Total	mg/L						
Manganese	Dissolved	mg/L	1.19		1.65			
Manganese	Total	mg/L					9.5	
Mercury	Dissolved	mg/L						
Mercury	Total	mg/L						
Molybdenum	Dissolved	mg/L						
Molybdenum	Total	mg/L						
Nickel	Dissolved	mg/L	0.0286		0.0356			
Nickel	Total	mg/L					0.2	
Potassium	Dissolved	mg/L						
Potassium	Total	mg/L					2.217	
Selenium	Dissolved	mg/L						
Selenium	Total	mg/L						
Silver	Dissolved	mg/L						
Silver	Total	mg/L						
Sodium	Dissolved	mg/L						
Sodium	Total	mg/L					13.5185	
Strontium	Total	mg/L					0.439	
Sulfur	Total	mg/L					422	
Thallium	Dissolved	mg/L						
Thallium	Total	mg/L						
Tin	Total	mg/L					0.0418	
Vanadium	Dissolved	mg/L						
Vanadium	Total	mg/L					0.0016	U
Zinc	Dissolved	mg/L	15.5		37.4			
Zinc	Total	mg/L					65.8	

Table A-6
Location A9
Historical Results

Sample Media Sample Date Analyte	Analyte 2	Unit	Surface Water 4/22/2002 Value	Qualifier	Surface Water 5/29/2002 Value	Qualifier	Surface Water 7/6/2005 Value	Qualifier
Major Ions								
Ammonia as N		mg/L as N						
Bicarbonate Alkalinity		mg/L						
Carbonate Alkalinity		mg/L						
Chloride		mg/L						
Fluoride		mg/L						
Hydroxide Alkalinity		mg/L						
Nitrate & Nitrite as N		mg/L as N						
Nitrate as N		mg/L as N						
Nitrite as N		mg/L as N						
Orthophosphate as P		mg/L as P						
Phosphorus		mg/L					0.3687	
Silica (SiO2)		mg/L					21.4555	
Sulfate		mg/L	299		360			
Sulfide		mg/L	0.05	U	0.05	U		
Total Alkalinity		mg/L						
Total Phosphate as P		mg/L as P						
Other								
Dissolved Organic Carbon		mg/L						
Hardness		mg/L	149		202			
Total Cyanide		mg/L						
Total Organic Carbon		mg/L						
Total Suspended Solids		mg/L	5	U	5	U		

Key:

U = Nondetect

Table A-6
Location A9
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/26/2000		2/14/2000		3/9/2000		3/22/2000		4/26/2000		7/18/2000		10/18/2000		11/18/2000		2/24/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																										
Conductivity		µS/cm							384																	
Conductivity		µS/cm	397		400				374								370									
Flow		gpm	148.0		12.0		66.0		1135.0		1517.0		625.0		310.0						11.7		30.1		58.3	
ORP		mV															267									
pH		su	7.18		7.78		7.51		5.01		6.63		6.64		6.81		5.8				7.2		7.3		7.8	
Temperature		deg C	13.8		11		9		11								12									
Metals																										
Aluminum	Dissolved	mg/L			0.039		0.036		3.2		0.01	U	0.05	U	0.1	U	0.1	U	0.127		0.1	U	0.109		0.111	
Aluminum	Total	mg/L	0.028		0.039				4.85		4.46		1.86		3.09		2.41								1.44	
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.003	U	0.0001	U	0.001	U	0.01	U	0.005	U	0.001	U	0.001	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U			0.003	U	0.003	U	0.0001	U	0.001	U	0.001	U							0.001	U
Arsenic	Dissolved	mg/L			0.002	U	0.0066		0.002		0.002	U	0.005	U	0.001	U	0.001	U					0.001	U	0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U			0.002	U	0.002	U	0.005	U	0.001	U	0.00227								0.001	U
Barium	Dissolved	mg/L			0.0237		0.0275		0.028		0.0235		0.023		0.0256		0.0236		0.0295		0.0274		0.0256		0.0199	
Barium	Total	mg/L	0.0261		0.0239				0.0295		0.12		0.024		0.0238		0.0251								0.0225	
Beryllium	Dissolved	mg/L			0.00001	U	0.000198		0.000191		0.000011		0.00004	U	0.001	U	0.001	U	0.01	U	0.001	U	0.001	U	0.001	U
Beryllium	Total	mg/L	0.000014		0.00001	U			0.000227		0.000133		0.0001		0.001	U	0.001	U							0.001	U
Boron		mg/L			0.0072				0.006																	
Cadmium	Dissolved	mg/L			0.00645		0.00647		0.464		0.0288		0.0233		0.0315		0.0287		0.0293		0.0225		0.0306		0.0427	
Cadmium	Total	mg/L	0.0146		0.00681				0.0475		0.0291		0.0242		0.0285		0.0288								0.0472	
Calcium	Dissolved	mg/L			46.9		44.3		34.7		23.7		35.7		40.9		43.4		48.5		65.7		69.5		72.1	
Calcium	Total	mg/L	42.5		46.9				35.5		23.5		36		43.6		45.3								73.2	
Chromium	Dissolved	mg/L			0.0002	U	0.00482		0.0005		0.00044		0.0005		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Chromium	Total	mg/L	0.00095		0.0002	U			0.0013		0.00313		0.0009		0.001	U	0.00122								0.001	U
Cobalt	Dissolved	mg/L			0.0002	U	0.0025		0.0068		0.00313		0.00254		0.00332		0.00265		0.002	U	0.002	U	0.002	U	0.00335	
Cobalt	Total	mg/L	0.00072		0.00037				0.00689		0.0037		0.00266		0.00295		0.00318								0.00323	
Copper	Dissolved	mg/L			0.0838		0.159		3.73		0.756		0.63		1.07		0.649		0.484		0.279		0.399		0.95	
Copper	Total	mg/L	0.307		0.0929				3.82		2.07		1.31		1.68		1.76								2.02	
Iron	Dissolved	mg/L			0.002	U	0.0446		0.0353		0.0052		0.02	U	0.1	U	0.185		0.1	U	0.1	U	0.1	U	0.1	U
Iron	Total	mg/L	0.004		0.0188				0.39		1.32		0.09		0.1	U	0.115								0.1	U
Lanthanum	Dissolved	mg/L			0.001	U	0.0016		0.0013		0.001	U														
Lanthanum	Total	mg/L	0.001	U	0.001	U			0.0016		0.001	U														
Lead	Dissolved	mg/L			0.003	U	0.0072		0.003	U	0.0032		0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U			0.003	U	0.003	U	0.00011		0.001	U	0.001	U							0.001	U
Lithium	Dissolved	mg/L			0.00634		0.00499		0.00066		0.0004	U														
Lithium	Total	mg/L	0.00089		0.00653				0.00137		0.0004	U														
Magnesium	Dissolved	mg/L			17.6		18		11.7		9.78		12.7		13.8		15.6		20		21.2		23.7		21.7	
Magnesium	Total	mg/L	16.1		17.9				12.1		9.9		12.9		34		15.9								22.2	
Manganese	Dissolved	mg/L			0.00103		0.0255		0.486		0.297		0.206		0.263		0.255		0.161		0.048		0.171		0.488	
Manganese	Total	mg/L	0.0723		0.00123				0.508		0.306		0.21		0.317		0.301								0.454	
Mercury	Dissolved	mg/L											0.0002	U			0.0002	U								
Mercury	Total	mg/L											0.0002	U			0.0002	U								
Molybdenum	Dissolved	mg/L			0.0004	U	0.00206		0.00057		0.0004	U														
Molybdenum	Total	mg/L	0.0004	U	0.0004	U			0.0004	U	0.0004	U														
Nickel	Dissolved	mg/L			0.00284		0.00666		0.0181		0.0111		0.0141		0.0141		0.011		0.0139		0.0121				0.0214	
Nickel	Total	mg/L	0.0086		0.00356				0.018		0.0132		0.0147		0.0127		0.0216								0.0252	
Potassium	Dissolved	mg/L			0.77		1.2		0.573		0.603		2	U	1	U			1	U	1	U	1	U	1.08	
Potassium	Total	mg/L	0.764		0.777				0.554		0.601		2	U	1	U									1	U
Selenium	Dissolved	mg/L			0.003	U	0.0048		0.003	U	0.003	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.00204	
Selenium	Total	mg/L	0.003	U	0.003	U			0.003	U	0.003	U	0.005	U	0.001	U	0.01	U							0.001	U
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.00025		0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U			0.0002	U	0.0002	U	0.00004	U	0.001	U	0.001	U							0.001	U
Sodium	Dissolved	mg/L			6.01		6.84		4.61		3.67		5.05		5.13		4.88		6.27		6.62		5.81		5.83	
Sodium	Total	mg/L	5.89		6.37				4.83		3.53		5.07		5.39		5.09								6.2	
Thallium	Dissolved	mg/L			0.002	U	0.01		0.002	U	0.002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Thallium	Total	mg/L	0.002	U	0.0025				0.002	U	0.002	U	0.00004	U	0.001	U	0.001	U							0.001	U
Vanadium	Dissolved	mg/L			0.0001	U	0.00164		0.0001	U	0.00011		0.01	U	0.005	U	0.05	U	0.05	U	0.005	U	0.005	U	0.005	U
Vanadium	Total	mg/L	0.00023		0.0001	U			0.0002		0.00238		0.01	U	0.005	U	0.005	U							0.005	U
Zinc	Dissolved	mg/L			0.982		1.28		10		6.36		5.37		8.12		8.23		7.12		6.4		8.16		8.82	
Zinc	Total	mg/L	3.16		1.02				10.3		6.52		5.58		7.12		7.57								13.5	

Table A-7
Location MXR
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/26/2000		2/14/2000		3/9/2000		3/22/2000		4/26/2000		7/18/2000		10/18/2000		11/18/2000		2/24/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																										
Alkalinity		mg/L			49				0								90.2									
Ammonia as N		mg/L as N			0.02	U			0.02						0.05	U										
Chloride		mg/L			2.9				2.2						20.3		2.32									
Fluoride		mg/L			0.1				0.2						0.654		0.5	U								
Nitrate & Nitrite as N		mg/L			0.0146				0.168																	
Nitrate as N		mg/L as N													0.197		0.187									
Nitrite as N		mg/L as N													0.1	U	0.1	U								
Orthophosphate as P		mg/L as P							0.005	U					0.0038		0.375									
Phosphorus		mg/L													0.035	U										
Silica (SiO2)		mg/L			14.7				22.5						197											
Sulfate		mg/L			140				179						160		163									
Sulfide		mg/L																								
Total Phosphate as P		mg/L as P							0.01	U																
Other																										
Acidity		mg/L															10	U								
Dissolved Organic Carbon		mg/L							1	U					3	U										
Hardness		mg/L	172		189		185		135		99.4						173									
Total Organic Carbon		mg/L			1				1						3	U										
Total Suspended Solids		mg/L			1	U			8						13											

Key:

U = Nondetect

Table A-7
Location MXR
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			5/2/2001		11/9/2001		11/30/2001		12/18/2001		12/19/2001		2/6/2002		2/7/2002		2/21/2002		3/26/2002		3/27/2002		4/22/2002		4/23/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																										
Conductivity		µS/cm																								
Conductivity		µS/cm																								
Flow		gpm	58.3		9.5		102.0		2038.0		1415.1		934.4		934.4		187.5		321.6							
ORP		mV																								
pH		su	6.64		7.11		4.86		4.51		5.46		5.52		5.52		5.63		5.78						6.14	
Temperature		deg C																								
Metals																										
Aluminum	Dissolved	mg/L	0.109				14.5		0.107		0.574		0.05	U	0.05	U	0.05	U	0.163		0.05	U	0.05	U	0.0749	
Aluminum	Total	mg/L	1.89		0.05	U																				
Antimony	Dissolved	mg/L	0.001	U																						
Antimony	Total	mg/L	0.001	U																						
Arsenic	Dissolved	mg/L	0.001	U			0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Arsenic	Total	mg/L	0.001	U	0.005	U																				
Barium	Dissolved	mg/L	0.0268																							
Barium	Total	mg/L	0.0274																							
Beryllium	Dissolved	mg/L	0.001	U																						
Beryllium	Total	mg/L	0.001	U																						
Boron		mg/L																								
Cadmium	Dissolved	mg/L	0.0484				0.125		0.0206		0.0204		0.0151		0.0147		0.0145		0.0128		0.0127		0.014		0.0144	
Cadmium	Total	mg/L	0.0489		0.0274																					
Calcium	Dissolved	mg/L	71.5																							
Calcium	Total	mg/L	73.9																							
Chromium	Dissolved	mg/L	0.001	U																						
Chromium	Total	mg/L	0.00123																							
Cobalt	Dissolved	mg/L	0.00419																							
Cobalt	Total	mg/L	0.00441																							
Copper	Dissolved	mg/L	1.97				11.1		1.83		2.03		0.684		0.38		0.66		0.578		0.524		0.52		0.526	
Copper	Total	mg/L	2.69		0.259																					
Iron	Dissolved	mg/L	0.1	U			0.181		0.201		0.0397		0.01	U	0.0214		0.01	U	0.0116		0.01	U	0.01	U	0.0807	
Iron	Total	mg/L	0.1	U	0.01	U																				
Lanthanum	Dissolved	mg/L																								
Lanthanum	Total	mg/L																								
Lead	Dissolved	mg/L	0.001	U			0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Lead	Total	mg/L	0.001	U	0.005	U																				
Lithium	Dissolved	mg/L																								
Lithium	Total	mg/L																								
Magnesium	Dissolved	mg/L	21.4						10.7		9.64															
Magnesium	Total	mg/L	23.2																							
Manganese	Dissolved	mg/L	0.451				1.59						0.235		0.249		0.222		0.208		0.204		0.19		0.197	
Manganese	Total	mg/L	0.441		0.0277																					
Mercury	Dissolved	mg/L																								
Mercury	Total	mg/L																								
Molybdenum	Dissolved	mg/L																								
Molybdenum	Total	mg/L																								
Nickel	Dissolved	mg/L					0.0546		0.0125		0.0126		0.0108		0.0097		0.011		0.0103		0.0103		0.0097		0.0105	
Nickel	Total	mg/L			0.0153																					
Potassium	Dissolved	mg/L	1	U																						
Potassium	Total	mg/L	1	U																						
Selenium	Dissolved	mg/L	0.001	U																						
Selenium	Total	mg/L	0.00135																							
Silver	Dissolved	mg/L	0.001	U																						
Silver	Total	mg/L	0.001	U																						
Sodium	Dissolved	mg/L	6.25																							
Sodium	Total	mg/L	6.41																							
Thallium	Dissolved	mg/L	0.001	U																						
Thallium	Total	mg/L	0.001	U																						
Vanadium	Dissolved	mg/L	0.005	U																						
Vanadium	Total	mg/L	0.005	U																						
Zinc	Dissolved	mg/L	12.4				27.6		4.76		4.71		3.9		3.56		3.64		3.3		3.31		3.4		3.44	
Zinc	Total	mg/L	14.2		5.73																					

Table A-7
Location MXR
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			5/2/2001		11/9/2001		11/30/2001		12/18/2001		12/19/2001		2/6/2002		2/7/2002		2/21/2002		3/26/2002		3/27/2002		4/22/2002		4/23/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																										
Alkalinity		mg/L																								
Ammonia as N		mg/L as N																								
Chloride		mg/L																								
Fluoride		mg/L																								
Nitrate & Nitrite as N		mg/L																								
Nitrate as N		mg/L as N																								
Nitrite as N		mg/L as N																								
Orthophosphate as P		mg/L as P																								
Phosphorus		mg/L																								
Silica (SiO2)		mg/L																								
Sulfate		mg/L			188		382		137				238		382		214		162						188	
Sulfide		mg/L			0.05	U	0.05	U	0.05	U			0.05	U	0.05	U	0.05	U	0.05	U					0.05	U
Total Phosphate as P		mg/L as P																								
Other																										
Acidity		mg/L																								
Dissolved Organic Carbon		mg/L																								
Hardness		mg/L			286		276		122		111		169		127		164		156		160		180		178	
Total Organic Carbon		mg/L																								
Total Suspended Solids		mg/L			5	U	9		12				5	U	38		6		12						5	U

Key:

U = Nondetect

Table A-7
Location MXR
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			5/28/2002		5/29/2002		2/23/2004		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements										
Conductivity		µS/cm								
Conductivity		µS/cm								
Flow		gpm	50.0		50.0					
ORP		mV								
pH		su			7.24					
Temperature		deg C								
Metals										
Aluminum	Dissolved	mg/L	0.1	U	0.1	U	0.1	U	0.1	U
Aluminum	Total	mg/L								
Antimony	Dissolved	mg/L					0.001	U	0.001	U
Antimony	Total	mg/L								
Arsenic	Dissolved	mg/L	0.01	U	0.01	U	0.001	U	0.001	U
Arsenic	Total	mg/L								
Barium	Dissolved	mg/L					0.0295		0.0256	
Barium	Total	mg/L								
Beryllium	Dissolved	mg/L					0.001	U	0.001	U
Beryllium	Total	mg/L								
Boron		mg/L								
Cadmium	Dissolved	mg/L	0.0184		0.0158		0.00869		0.0113	
Cadmium	Total	mg/L								
Calcium	Dissolved	mg/L					45.1		64.4	
Calcium	Total	mg/L								
Chromium	Dissolved	mg/L					0.001	U	0.001	U
Chromium	Total	mg/L								
Cobalt	Dissolved	mg/L					0.00125		0.001	U
Cobalt	Total	mg/L								
Copper	Dissolved	mg/L	0.464		0.438		0.331		0.131	
Copper	Total	mg/L								
Iron	Dissolved	mg/L	0.0246		0.02	U	10	U	0.1	U
Iron	Total	mg/L								
Lanthanum	Dissolved	mg/L								
Lanthanum	Total	mg/L								
Lead	Dissolved	mg/L	0.01	U	0.01	U	0.001	U	0.001	U
Lead	Total	mg/L								
Lithium	Dissolved	mg/L								
Lithium	Total	mg/L								
Magnesium	Dissolved	mg/L					15.9		22	
Magnesium	Total	mg/L								
Manganese	Dissolved	mg/L	0.151		0.145		0.117		0.0223	
Manganese	Total	mg/L								
Mercury	Dissolved	mg/L								
Mercury	Total	mg/L								
Molybdenum	Dissolved	mg/L								
Molybdenum	Total	mg/L								
Nickel	Dissolved	mg/L	0.013		0.0102		0.00927		0.00736	
Nickel	Total	mg/L								
Potassium	Dissolved	mg/L					1	U	0.1	U
Potassium	Total	mg/L								
Selenium	Dissolved	mg/L					0.001	U	0.002	U
Selenium	Total	mg/L								
Silver	Dissolved	mg/L					0.001	U	0.001	U
Silver	Total	mg/L								
Sodium	Dissolved	mg/L					6.5		7.26	
Sodium	Total	mg/L								
Thallium	Dissolved	mg/L					0.001	U	0.001	U
Thallium	Total	mg/L								
Vanadium	Dissolved	mg/L					0.005	U	0.005	U
Vanadium	Total	mg/L								
Zinc	Dissolved	mg/L	3.58		3.48		2.42		1.98	
Zinc	Total	mg/L								

Table A-7
Location MXR
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			5/28/2002		5/29/2002		2/23/2004		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions										
Alkalinity		mg/L								
Ammonia as N		mg/L as N								
Chloride		mg/L								
Fluoride		mg/L								
Nitrate & Nitrite as N		mg/L								
Nitrate as N		mg/L as N								
Nitrite as N		mg/L as N								
Orthophosphate as P		mg/L as P								
Phosphorus		mg/L								
Silica (SiO2)		mg/L								
Sulfate		mg/L								
Sulfide		mg/L								
Total Phosphate as P		mg/L as P								
Other										
Acidity		mg/L								
Dissolved Organic Carbon		mg/L								
Hardness		mg/L			190					
Total Organic Carbon		mg/L								
Total Suspended Solids		mg/L								

Key:

U = Nondetect

Table A-7
Location MXR
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		1/26/2000		2/14/2000		3/9/2000		3/22/2000		7/18/2000		10/17/2000		11/17/2000		2/24/2001		4/30/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Conductivity		µS/cm	212		263				101		106																	
Flow		gpm	354.6		66.0		924.1				11499.0				2948.8		1701.1											
pH		su	7.6		8.01		7.73				7.24		7.13		7.2		7.61											
Temperature		deg C	16.1		10.5		9				12.4																	
Metals																												
Aluminum	Dissolved	mg/L			0.034		0.043		0.244		0.141		0.296		0.123		0.1	U	0.1	U	0.1	U	0.1	U	0.186		0.1	U
Aluminum	Total	mg/L	0.084		0.057				0.849								0.288											
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.003	U	0.003	U	0.0001	U	0.001	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U			0.003	U							0.001	U										
Arsenic	Dissolved	mg/L			0.002	U	0.0077		0.002	U	0.002	U	0.002	U	0.005	U	0.001	U					0.001	U	0.001	U	0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U			0.002	U							0.001	U										
Barium	Dissolved	mg/L			0.0374		0.0324		0.0135		0.0131		0.0117		0.015		0.0166		0.0356		0.0345		0.026		0.0143		0.0239	
Barium	Total	mg/L	0.0258		0.369				0.0158								0.0162											
Beryllium	Dissolved	mg/L			0.00001	U	0.000192		0.000027		0.000019		0.00001	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Beryllium	Total	mg/L	0.000063		0.00001	U			0.000019								0.001	U										
Boron		mg/L			0.031				0.011																			
Cadmium	Dissolved	mg/L			0.00105		0.0007		0.00301		0.00389		0.00123		0.0032		0.00344		0.00244		0.00158		0.00174		0.0013		0.0043	
Cadmium	Total	mg/L	0.00177		0.00112				0.00292								0.00339											
Calcium	Dissolved	mg/L			27.5		23.1		8.45		9.12		6.43		12.8		13.8		29.3		31.1		22.6		12		21.7	
Calcium	Total	mg/L	18.6		28.6				8.72								14.8											
Chromium	Dissolved	mg/L			0.0002	U	0.00498		0.00119		0.00072		0.00144		0.0012		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	
Chromium	Total	mg/L	0.00051		0.0002	U			0.00235								0.001	U										
Cobalt	Dissolved	mg/L			0.0002	U	0.00251		0.00069		0.00101		0.00036		0.00028		0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Cobalt	Total	mg/L	0.0003		0.00038				0.00119								0.002	U										
Copper	Dissolved	mg/L			0.00678		0.0972		0.118		0.129		0.0671		0.074		0.0743		0.0189		0.0132		0.0245		0.019		0.0317	
Copper	Total	mg/L	0.0228		0.00953				0.21								0.113											
Iron	Dissolved	mg/L			0.002	U	0.0846		0.312		0.149		0.363		0.103		0.54		0.1	U	0.1	U	0.1	U	0.224		0.1	U
Iron	Total	mg/L	0.0071		0.0202				0.678								0.1	U										
Lanthanum	Dissolved	mg/L			0.001	U	0.0015		0.001	U	0.001	U	0.001	U														
Lanthanum	Total	mg/L	0.001	U	0.001	U			0.001	U																		
Lead	Dissolved	mg/L			0.003	U	0.0069		0.003	U	0.003	U	0.003	U	0.0002		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U			0.003	U							0.001	U										
Lithium	Dissolved	mg/L			0.00637		0.004		0.00044		0.0004	U	0.0004	U														
Lithium	Total	mg/L	0.0004	U	0.00546				0.0004	U																		
Magnesium	Dissolved	mg/L			12.6		11.2		4.36		4.13		3.34		5.57		6		12.2		13.3		10.1		5.49		8.71	
Magnesium	Total	mg/L	8.73		12.8				4.12								6.6											
Manganese	Dissolved	mg/L			0.00141		0.0143		0.027		0.0378		0.0153		0.017		0.016		0.01	U	0.01	U	0.01	U	0.01	U	0.017	
Manganese	Total	mg/L	0.00481		0.00161				0.0357								0.02											
Mercury	Dissolved	mg/L													0.0002	U												
Molybdenum	Dissolved	mg/L			0.0004	U	0.002		0.0004	U	0.00073		0.0004	U														
Molybdenum	Total	mg/L	0.0004	U	0.0004	U			0.00086																			
Nickel	Dissolved	mg/L			0.00077		0.00433		0.0033		0.00367		0.00235		0.0041		0.00313		0.002	U	0.002	U			0.002	U		
Nickel	Total	mg/L	0.00328		0.00139				0.00502								0.00283											
Potassium	Dissolved	mg/L			0.634		1.39		0.392		0.445		0.573		2	U	1	U	1	U	1	U	1	U	1	U	1	U
Potassium	Total	mg/L	1.05		0.651				0.429								1	U										
Selenium	Dissolved	mg/L			0.003	U	0.0048		0.003	U	0.003	U	0.003	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Selenium	Total	mg/L	0.003	U	0.003	U			0.003	U							0.001	U										
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.00023		0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U			0.0002	U							0.001	U										
Sodium	Dissolved	mg/L			5.82		5.71		3.22		2.87		2.57		3.55		3.48		5.57		5.78		4.84		3.81		4.59	
Sodium	Total	mg/L	5		5.95				2.87								1	U										
Thallium	Dissolved	mg/L			0.002	U	0.0099		0.002	U	0.002	U	0.002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Thallium	Total	mg/L	0.002	U	0.0039				0.002	U							0.001	U										
Vanadium	Dissolved	mg/L			0.00025		0.00191		0.00122		0.00057		0.00125		0.01	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Vanadium	Total	mg/L	0.00046		0.0002				0.00212								0.005	U										
Zinc	Dissolved	mg/L			0.0957		0.183		0.707		0.934		0.274		0.711		0.819		0.309		0.22		0.32		0.294		1.01	
Zinc	Total	mg/L	0.251		0.106				0.725								0.755											

Table A-8
Location M3.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		1/26/2000		2/14/2000		3/9/2000		3/22/2000		7/18/2000		10/17/2000		11/17/2000		2/24/2001		4/30/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Alkalinity		mg/L			58				22																			
Ammonia as N		mg/L as N			0.02	U			0.02	U							0.05	U										
Chloride		mg/L			2.9				1.4								20.1											
Fluoride		mg/L			0.1	U			0.1	U							0.5	U										
Nitrate & Nitrite as N		mg/L			0.021				0.157																			
Nitrate as N		mg/L as N															0.111											
Nitrite as N		mg/L as N															0.1	U										
Orthophosphate as P		mg/L as P							0.005	U							0.0059											
Phosphorus		mg/L															0.035	U										
Silica (SiO2)		mg/L			15.8				19.5								129											
Sulfate		mg/L			61.9				19.4								32.9											
Sulfide		mg/L																										
Total Phosphate as P		mg/L as P							0.03																			
Other																												
Dissolved Organic Carbon		mg/L							3								3	U										
Hardness		mg/L	82.4		120		104		39		39.8		29.8															
Total Organic Carbon		mg/L			1				3								3	U										
Total Suspended Solids		mg/L			1	U			3								10	U										

Key:

U = Nondetect

Table A-8
Location M3.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/9/2001		11/30/2001		12/19/2001		2/6/2002		5/28/2002		5/29/2002		2/23/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																
Conductivity		µS/cm														
Flow		gpm	90.7		5838.9		7584.7		2450.4		356.3					
pH		su	7.73		7.06		6.34		6.46		7.46					
Temperature		deg C														
Metals																
Aluminum	Dissolved	mg/L			0.382		0.299		0.156		0.1	U	0.062	U	0.133	
Aluminum	Total	mg/L	0.05	U												
Antimony	Dissolved	mg/L													0.001	U
Antimony	Total	mg/L														
Arsenic	Dissolved	mg/L			0.005	U	0.005	U	0.005	U	0.01	U	0.0062	U	0.001	U
Arsenic	Total	mg/L	0.005	U												
Barium	Dissolved	mg/L													0.0184	
Barium	Total	mg/L														
Beryllium	Dissolved	mg/L													0.001	U
Beryllium	Total	mg/L														
Boron		mg/L														
Cadmium	Dissolved	mg/L			0.0035		0.0028		0.002	U	0.0042		0.0025	U	0.00165	
Cadmium	Total	mg/L	0.002	U												
Calcium	Dissolved	mg/L													14.4	
Calcium	Total	mg/L														
Chromium	Dissolved	mg/L													0.001	U
Chromium	Total	mg/L														
Cobalt	Dissolved	mg/L													0.001	U
Cobalt	Total	mg/L														
Copper	Dissolved	mg/L			0.128		0.125		0.06		0.0282		0.0191		0.049	
Copper	Total	mg/L	0.0215													
Iron	Dissolved	mg/L			0.352		0.294		0.148		0.0288		0.012	U	10	U
Iron	Total	mg/L	0.147													
Lanthanum	Dissolved	mg/L														
Lanthanum	Total	mg/L														
Lead	Dissolved	mg/L			0.005	U	0.005	U	0.005	U	0.01	U	0.0062	U	0.001	U
Lead	Total	mg/L	0.005	U												
Lithium	Dissolved	mg/L														
Lithium	Total	mg/L														
Magnesium	Dissolved	mg/L					4.22								6.17	
Magnesium	Total	mg/L														
Manganese	Dissolved	mg/L			0.0417				0.014		0.01	U	0.0062	U	0.01	U
Manganese	Total	mg/L	0.008													
Mercury	Dissolved	mg/L														
Molybdenum	Dissolved	mg/L														
Molybdenum	Total	mg/L														
Nickel	Dissolved	mg/L			0.005	U	0.005	U	0.005	U	0.01	U	0.0062	U	0.00271	
Nickel	Total	mg/L	0.005	U												
Potassium	Dissolved	mg/L													1	U
Potassium	Total	mg/L														
Selenium	Dissolved	mg/L													0.001	U
Selenium	Total	mg/L														
Silver	Dissolved	mg/L													0.001	U
Silver	Total	mg/L														
Sodium	Dissolved	mg/L													3.71	
Sodium	Total	mg/L														
Thallium	Dissolved	mg/L													0.001	U
Thallium	Total	mg/L														
Vanadium	Dissolved	mg/L													0.005	U
Vanadium	Total	mg/L														
Zinc	Dissolved	mg/L			0.762		0.661		0.459		0.342		0.256		0.386	
Zinc	Total	mg/L	0.285													

Table A-8
Location M3.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/9/2001		11/30/2001		12/19/2001		2/6/2002		5/28/2002		5/29/2002		2/23/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																
Alkalinity		mg/L														
Ammonia as N		mg/L as N														
Chloride		mg/L														
Fluoride		mg/L														
Nitrate & Nitrite as N		mg/L														
Nitrate as N		mg/L as N														
Nitrite as N		mg/L as N														
Orthophosphate as P		mg/L as P														
Phosphorus		mg/L														
Silica (SiO2)		mg/L														
Sulfate		mg/L	45.5		27.5		24.1		37		47.8		49.9			
Sulfide		mg/L	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U		
Total Phosphate as P		mg/L as P														
Other																
Dissolved Organic Carbon		mg/L														
Hardness		mg/L	119		46		42		52.8		88		87.9			
Total Organic Carbon		mg/L														
Total Suspended Solids		mg/L	5	U	7		5	U	5	U	5	U				

Key:

U = Nondetect

Table A-8
Location M3.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		3/22/2000		7/18/2000		10/17/2000		11/18/2000		2/23/2001		5/1/2001		11/9/2001		11/30/2001		12/18/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Conductivity		µS/cm							154																			
Conductivity		µS/cm	161		148				149																			
Flow		gpm	175.0		57.0		149.9		4017.0		781.0				76.3		112.2		300.7		121.2		35.9		1534.9		2737.7	
pH		su	7.25		7.59		7.58		6.85		7.38				7.6		7.3		7.3		7.17		7.5		5.85		5.75	
Temperature		deg C	11.2		10.5		9		8.9																			
Metals																												
Aluminum	Dissolved	mg/L			0.037		0.035		0.034		0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U			0.239		0.0814	
Aluminum	Total	mg/L	0.081		0.05						1.03								0.573		0.415		0.05	U				
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U						
Antimony	Total	mg/L	0.003	U	0.003	U					0.001	U							0.001	U	0.001	U						
Arsenic	Dissolved	mg/L			0.002	U	0.002	U	0.002	U	0.001	U					0.001	U	0.001	U	0.001	U			0.005	U	0.005	U
Arsenic	Total	mg/L	0.002	U	0.002	U					0.001	U							0.001	U	0.001	U	0.005	U				
Barium	Dissolved	mg/L			0.00401		0.0066		0.00506		0.00495		0.00639		0.00498		0.0063		0.00529		0.00745							
Barium	Total	mg/L	0.00539		0.00395						0.00463								0.00571		0.00811							
Beryllium	Dissolved	mg/L			0.00001	U	0.000038		0.000038		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U						
Beryllium	Total	mg/L	0.000077		0.00001	U					0.001	U							0.001	U	0.001	U						
Boron		mg/L			0.363																							
Cadmium	Dissolved	mg/L			0.00106		0.00085		0.0101		0.00835		0.00276		0.00139		0.00248		0.00592		0.00845				0.0221		0.0134	
Cadmium	Total	mg/L	0.00323		0.00101						0.00766								0.00644		0.00915		0.002	U				
Calcium	Dissolved	mg/L			16.8		15.2		14.3		15.1		20.5		20.2		22.8		22.1		28							
Calcium	Total	mg/L	14.9		16.1						17.4								23.3		29.4							
Chromium	Dissolved	mg/L			0.0002	U	0.00033		0.00029		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U						
Chromium	Total	mg/L	0.0002	U	0.0002	U					0.001	U							0.001	U	0.00134							
Cobalt	Dissolved	mg/L			0.0002	U	0.0002	U	0.00237		0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U						
Cobalt	Total	mg/L	0.00064		0.00021						0.002	U							0.002	U	0.002	U						
Copper	Dissolved	mg/L			0.0196		0.0614		0.464		0.302		0.056		0.0247		0.0241		0.176		0.19				2.02		1.05	
Copper	Total	mg/L	0.074		0.0193						0.62								0.336		0.38		0.0338					
Iron	Dissolved	mg/L			0.0195		0.0788		0.0113		0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U			0.01	U	0.137	
Iron	Total	mg/L	0.0222		0.332						0.1	U							0.138		0.1	U	0.0386					
Lanthanum	Dissolved	mg/L			0.001	U	0.001	U	0.001	U																		
Lanthanum	Total	mg/L	0.001	U	0.001	U																						
Lead	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U			0.005	U	0.005	U
Lead	Total	mg/L	0.003	U	0.003	U					0.001	U							0.001	U	0.001	U	0.005	U				
Lithium	Dissolved	mg/L			0.00516		0.0004	U	0.0004	U																		
Lithium	Total	mg/L	0.0004	U	0.00443																							
Magnesium	Dissolved	mg/L			5.58		5.4		4.93		5.2		6.82		6.82		7.37		7.13		9.01						5.86	
Magnesium	Total	mg/L	5.44		5.27						8.89								7.31		9.72							
Manganese	Dissolved	mg/L			0.00962		0.0312		0.313		0.228		0.025		0.01	U	0.021		0.213		0.243				0.724			
Manganese	Total	mg/L	0.0573		0.00847						0.277								0.199		0.245		0.0181					
Molybdenum	Dissolved	mg/L			0.0004	U	0.0004	U	0.0004	U																		
Molybdenum	Total	mg/L	0.0004	U	0.0004	U																						
Nickel	Dissolved	mg/L			0.0002	U	0.00124		0.00851		0.00688		0.00253		0.002	U			0.00523						0.017		0.0106	
Nickel	Total	mg/L	0.00479		0.00131						0.00626								0.00533				0.005	U				
Potassium	Dissolved	mg/L			0.427		0.626		0.312		1	U	1	U	1	U	1	U	1	U	1	U						
Potassium	Total	mg/L	0.719		0.391						1	U							1	U	1	U						
Selenium	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.00198		0.001	U	0.00133		0.001	U	0.001	U	0.001	U						
Selenium	Total	mg/L	0.003	U	0.003	U					0.001	U							0.001	U	0.001	U						
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U						
Silver	Total	mg/L	0.0002	U	0.0002	U					0.001	U							0.001	U	0.001	U						
Sodium	Dissolved	mg/L			4.71		4.52		2.66		2.98		4.49		5.25		4.04		3.61		3.98							
Sodium	Total	mg/L	4.27		4.42						3.98								3.88		4.14							
Thallium	Dissolved	mg/L			0.002	U	0.002	U	0.002	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U						
Thallium	Total	mg/L	0.0029		0.0021						0.001	U							0.001	U	0.001	U						
Vanadium	Dissolved	mg/L			0.0006		0.00081		0.00027		0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U						
Vanadium	Total	mg/L	0.00055		0.00033						0.005	U							0.005	U	0.005	U						
Zinc	Dissolved	mg/L			0.193		0.227		2.39		2.2		0.785		0.368		0.71		1.88		2.71				4.85		3.09	
Zinc	Total	mg/L	0.816		0.191						2.08								2.03		2.95		0.504					

Table A-9
Location SF1.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		3/22/2000		7/18/2000		10/17/2000		11/18/2000		2/23/2001		5/1/2001		11/9/2001		11/30/2001		12/18/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Alkalinity		mg/L			41				12																			
Ammonia as N		mg/L as N			0.02	U			0.02	U	0.05	U																
Chloride		mg/L			1.7				1.2		16.7																	
Fluoride		mg/L			0.1	U			0.1	U	0.5	U																
Nitrate & Nitrite as N		mg/L as N			0.0126				0.0517																			
Nitrate as N		mg/L as N									0.102																	
Nitrite as N		mg/L as N									0.1	U																
Orthophosphate as P		mg/L as P							0.005	U	0.0096																	
Phosphorus		mg/L									0.035	U																
Silica (SiO2)		mg/L			22.8						137																	
Sulfate		mg/L			26.4				52.3		46.5												43.8		153		75.4	
Sulfide		mg/L																					0.05	U	0.05	U	0.05	U
Total Phosphate as P		mg/L as P							0.01																			
Other																												
Dissolved Organic Carbon		mg/L							1		3	U																
Hardness		mg/L	59.6		64.8		60.1		55.9														95		97		67.1	
Total Organic Carbon		mg/L			1	U			2		3	U																
Total Suspended Solids		mg/L			1	U			11		10	U											5	U	23		11	

Key:

U = Nondetect

Table A-9
Location SF1.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			2/6/2002		2/21/2002		3/27/2002		4/23/2002		5/28/2002		6/27/2002		2/23/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																
Conductivity		µS/cm														
Conductivity		µS/cm														
Flow		gpm	1279.1		821.3		498.2		296.2		209.8		99.3			
pH		su	6.29		5.94		5.69		6.08		6.34		8.9			
Temperature		deg C														
Metals																
Aluminum	Dissolved	mg/L	0.05	U	0.0904		0.05	U	0.282		0.1	U	0.062	U	0.1	U
Aluminum	Total	mg/L														
Antimony	Dissolved	mg/L													0.001	U
Antimony	Total	mg/L														
Arsenic	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U	0.005	U	0.001	U
Arsenic	Total	mg/L														
Barium	Dissolved	mg/L													0.00567	
Barium	Total	mg/L														
Beryllium	Dissolved	mg/L													0.001	U
Beryllium	Total	mg/L														
Boron		mg/L														
Cadmium	Dissolved	mg/L	0.0127		0.0075		0.0098		0.0069		0.0052		0.0025		0.00939	
Cadmium	Total	mg/L														
Calcium	Dissolved	mg/L													18.3	
Calcium	Total	mg/L														
Chromium	Dissolved	mg/L													0.001	U
Chromium	Total	mg/L														
Cobalt	Dissolved	mg/L													0.00204	
Cobalt	Total	mg/L														
Copper	Dissolved	mg/L	0.751		0.305		0.424		0.354		0.126		0.0435		0.426	
Copper	Total	mg/L														
Iron	Dissolved	mg/L	0.0129		0.0177		0.01	U	0.0226		0.0312		0.013		10	U
Iron	Total	mg/L														
Lanthanum	Dissolved	mg/L														
Lanthanum	Total	mg/L														
Lead	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U	0.0062	U	0.001	U
Lead	Total	mg/L														
Lithium	Dissolved	mg/L														
Lithium	Total	mg/L														
Magnesium	Dissolved	mg/L													6.04	
Magnesium	Total	mg/L														
Manganese	Dissolved	mg/L	0.444		0.239		0.334		0.204		0.0678		0.0124		0.318	
Manganese	Total	mg/L														
Molybdenum	Dissolved	mg/L														
Molybdenum	Total	mg/L														
Nickel	Dissolved	mg/L	0.0115		0.007		0.0092		0.0062		0.01	U	0.0062	U	0.00866	
Nickel	Total	mg/L														
Potassium	Dissolved	mg/L													1	U
Potassium	Total	mg/L														
Selenium	Dissolved	mg/L													0.001	U
Selenium	Total	mg/L														
Silver	Dissolved	mg/L													0.001	U
Silver	Total	mg/L														
Sodium	Dissolved	mg/L													3.55	
Sodium	Total	mg/L														
Thallium	Dissolved	mg/L													0.001	U
Thallium	Total	mg/L														
Vanadium	Dissolved	mg/L													0.005	U
Vanadium	Total	mg/L														
Zinc	Dissolved	mg/L	3.27		1.91		2.53		1.92		1.36		0.754		2.39	
Zinc	Total	mg/L														

Table A-9
Location SF1.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			2/6/2002		2/21/2002		3/27/2002		4/23/2002		5/28/2002		6/27/2002		2/23/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																
Alkalinity		mg/L														
Ammonia as N		mg/L as N														
Chloride		mg/L														
Fluoride		mg/L														
Nitrate & Nitrite as N		mg/L as N														
Nitrate as N		mg/L as N														
Nitrite as N		mg/L as N														
Orthophosphate as P		mg/L as P														
Phosphorus		mg/L														
Silica (SiO2)		mg/L														
Sulfate		mg/L	113		56.4		69.2		66.4		54.6		49.2			
Sulfide		mg/L	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U		
Total Phosphate as P		mg/L as P														
Other																
Dissolved Organic Carbon		mg/L														
Hardness		mg/L	76.5		61		71.3		0.33	U	78		75.5			
Total Organic Carbon		mg/L														
Total Suspended Solids		mg/L	11		5	U	5	U	5	U	5	U	5	U		

Key:

U = Nondetect

Table A-9
Location SF1.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		3/22/2000		2/23/2001		5/1/2001		11/9/2001		11/30/2001		12/18/2001		2/6/2002		5/28/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																										
Conductivity		µS/cm							85																	
Conductivity		µS/cm	127		162				90																	
Flow		gpm	1535.0		469.9		1373.4		14488.2		3770.2						187.6		5973.5				4479.0		870.6	
pH		su	7.35		7.87		7.61		7.34		7.6						8.09		6.89		6.05		6.36		7	
Temperature		deg C	11.5		11		11		9.4																	
Metals																										
Aluminum	Dissolved	mg/L			0.065		0.038		0.156		0.1	U	0.114		0.1	U			0.229		0.216		0.35		0.1	U
Aluminum	Total	mg/L	0.097														0.0706									
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U										
Antimony	Total	mg/L	0.003	U																						
Arsenic	Dissolved	mg/L			0.002	U	0.002	U	0.002	U	0.001	U	0.001	U	0.001	U			0.005	U	0.005	U	0.005	U	0.01	U
Arsenic	Total	mg/L	0.002	U													0.005	U								
Barium	Dissolved	mg/L			0.00583		0.00657		0.00419		0.00434		0.00454		0.0061											
Barium	Total	mg/L	0.00508																							
Beryllium	Dissolved	mg/L			0.00001	U	0.00002		0.000022		0.001	U	0.001	U	0.001	U										
Beryllium	Total	mg/L	0.000079																							
Boron		mg/L			0.0374																					
Cadmium	Dissolved	mg/L			0.0003		0.00023		0.00191		0.00123		0.001	U	0.00122				0.0039		0.0025		0.0026		0.004	U
Cadmium	Total	mg/L	0.00055														0.002	U								
Calcium	Dissolved	mg/L			20.1		17.7		7.91		10.5		16.8		20.9											
Calcium	Total	mg/L	12.5																							
Chromium	Dissolved	mg/L			0.0002	U	0.0002	U	0.00025		0.001	U	0.001	U	0.00103											
Chromium	Total	mg/L	0.0002	U																						
Cobalt	Dissolved	mg/L			0.0002	U	0.00028		0.00066		0.002	U	0.002	U	0.002	U										
Cobalt	Total	mg/L	0.00029																							
Copper	Dissolved	mg/L			0.00692		0.0429		0.0917		0.0493		0.0222		0.0137				0.129		0.127		0.185		0.0202	
Copper	Total	mg/L	0.0111														0.006									
Iron	Dissolved	mg/L			0.0778		0.103		0.169		0.1	U	0.0135		0.1	U			0.149		0.181		0.115		0.0644	
Iron	Total	mg/L	0.0557														0.0602									
Lanthanum	Dissolved	mg/L			0.001	U	0.001	U	0.001	U																
Lanthanum	Total	mg/L	0.001	U																						
Lead	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U			0.005	U	0.005	U	0.005	U	0.01	U
Lead	Total	mg/L	0.003	U													0.005	U								
Lithium	Dissolved	mg/L			0.00281		0.0004	U	0.0004	U																
Lithium	Total	mg/L	0.0004	U																						
Magnesium	Dissolved	mg/L			5		4.36		2.85		3.12		4.38		5.04						2.91					
Magnesium	Total	mg/L	3.69																							
Manganese	Dissolved	mg/L			0.00917		0.0214		0.0548		0.035		0.024		0.021				0.139				0.0875		0.01	U
Manganese	Total	mg/L	0.0165														0.0077									
Molybdenum	Dissolved	mg/L			0.0004	U	0.00041		0.0004	U																
Molybdenum	Total	mg/L	0.0004	U																						
Nickel	Dissolved	mg/L			0.0002	U	0.00085		0.00232		0.002	U	0.002	U					0.005	U	0.005	U	0.005	U	0.01	U
Nickel	Total	mg/L	0.00229														0.005	U								
Potassium	Dissolved	mg/L			0.432		0.909		0.157		1	U	1	U	1	U										
Potassium	Total	mg/L	0.733																							
Selenium	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U										
Selenium	Total	mg/L	0.003	U																						
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.001	U	0.001	U	0.001	U										
Silver	Total	mg/L	0.0002	U																						
Sodium	Dissolved	mg/L			4.74		4.5		2.82		3.03		3.71		3.99											
Sodium	Total	mg/L	4.02																							
Thallium	Dissolved	mg/L			0.002	U	0.002	U	0.002	U	0.001	U	0.001	U	0.001	U										
Thallium	Total	mg/L	0.002	U																						
Vanadium	Dissolved	mg/L			0.00085		0.00051		0.00103		0.005	U	0.005	U	0.005	U										
Vanadium	Total	mg/L	0.00054																							
Zinc	Dissolved	mg/L			0.043		0.066		0.483		0.306		0.267		0.345				0.976		0.661		0.8		0.18	
Zinc	Total	mg/L	0.129														0.0664									

Table A-10
Location SF3.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		3/22/2000		2/23/2001		5/1/2001		11/9/2001		11/30/2001		12/18/2001		2/6/2002		5/28/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																										
Alkalinity		mg/L			44				19																	
Ammonia as N		mg/L as N			0.02	U			0.02	U	0.05	U														
Chloride		mg/L			1.8				1.2		19															
Fluoride		mg/L			0.1	U			0.1	U	0.5	U														
Nitrate & Nitrite as N		mg/L as N			0.0272				0.0364																	
Nitrate as N		mg/L as N									0.1	U														
Nitrite as N		mg/L as N									0.1	U														
Orthophosphate as P		mg/L as P							0.005	U	0.0067															
Phosphorus		mg/L									0.035	U														
Silica (SiO2)		mg/L			22.5						142															
Sulfate		mg/L			31.5				16.9		18						33.8		46.3		21.8		36.3		28.9	
Sulfide		mg/L															0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Total Phosphate as P		mg/L as P							0.02																	
Other																										
Dissolved Organic Carbon		mg/L							2		3	U														
Hardness		mg/L	46.4		70.8		62.2		31.5								86		54		36		45.6		59.2	
Total Organic Carbon		mg/L			1	U			2		3	U														
Total Suspended Solids		mg/L			1	U			5		10	U					5	U	5	U	5	U	5	U	5	U

Key:

U = Nondetect

Table A-10
Location SF3.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		2/14/2000		3/9/2000		3/22/2000		7/18/2000		10/17/2000		11/18/2000		2/23/2001		5/1/2001		11/9/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Conductivity		µS/cm							73																			
Conductivity		µS/cm	127		163				78																			
Flow		gpm	1817.8		534.1		2432.7		22670.4				6629.2		5035.9				772.0		1144.5		3123.9		1202.9		380.1	
pH		su	7.42		8.02		7.83		7.38		7.41		7.35		7.86				7.8		7.8		7.7		7.66		7.73	
Temperature		deg C	11.6		11		11		9.7																			
Metals																												
Aluminum	Dissolved	mg/L			0.035		0.026		0.245		0.287		0.083		0.1	U	0.1	U	0.1	U	0.1	U	0.139		0.1	U		
Aluminum	Total	mg/L	0.03		0.042				0.775						0.164								0.376		0.1	U	0.0537	
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.003	U	0.0001	U	0.001	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U		
Antimony	Total	mg/L	0.003	U	0.003	U			0.003	U					0.001	U							0.001	U	0.001	U		
Arsenic	Dissolved	mg/L			0.002	U	0.002		0.002	U	0.002	U	0.005	U	0.001	U	0.001	U			0.001	U	0.001	U	0.001	U		
Arsenic	Total	mg/L	0.002	U	0.002	U			0.002	U					0.001	U							0.001	U	0.001	U	0.005	U
Barium	Dissolved	mg/L			0.00631		0.00785		0.00474		0.00427		0.005	U	0.00472		0.00639		0.00667		0.00661		0.00583		0.00715			
Barium	Total	mg/L	0.00629		0.00591				0.00566						0.00447								0.00658		0.00741			
Beryllium	Dissolved	mg/L			0.00001	U	0.000022		0.000028		0.00001	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Beryllium	Total	mg/L	0.000034		0.00001	U			0.000036						0.001	U							0.001	U	0.001	U		
Boron		mg/L			0.002				0.0076																			
Cadmium	Dissolved	mg/L			0.00021		0.00031		0.00099		0.00052		0.001		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Cadmium	Total	mg/L	0.00053		0.00032				0.00101						0.001	U							0.001	U	0.001	U	0.002	U
Calcium	Dissolved	mg/L			18.5		16.5		6.36		6.22		9.36		9.53		17.6		21.2		8.04		13.9		18.3			
Calcium	Total	mg/L	14.1		19				7.07						10.5								14.2		19.4			
Chromium	Dissolved	mg/L			0.0002	U	0.00027		0.0004		0.00052		0.0009		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Chromium	Total	mg/L	0.0002	U	0.0002	U			0.00083						0.001	U							0.001	U	0.001			
Cobalt	Dissolved	mg/L			0.0002	U	0.00044		0.00049		0.0002	U	0.00017		0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U		
Cobalt	Total	mg/L	0.0002	U	0.0002	U			0.00103						0.002	U							0.002	U	0.002	U		
Copper	Dissolved	mg/L			0.00567		0.0294		0.0571		0.0448		0.041		0.0331		0.00915		0.0107		0.00724		0.0111		0.0068			
Copper	Total	mg/L	0.0099		0.00331				0.109						0.0457								0.179		0.00903		0.005	U
Iron	Dissolved	mg/L			0.0514		0.116		0.256		0.293		0.071		0.1	U	0.1	U	0.1	U	0.1	U	0.172		0.1	U		
Iron	Total	mg/L	0.0629		0.059				0.607						0.104								0.421		0.1	U	0.048	
Lanthanum	Dissolved	mg/L			0.002		0.001	U	0.001	U	0.001	U																
Lanthanum	Total	mg/L	0.001	U	0.001	U			0.001	U																		
Lead	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.003	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Lead	Total	mg/L	0.003	U	0.003	U			0.003	U					0.001	U							0.1	U	0.001	U	0.005	U
Lithium	Dissolved	mg/L			0.00232		0.0005		0.0004	U	0.0004	U																
Lithium	Total	mg/L	0.0004	U	0.00471				0.0004	U																		
Magnesium	Dissolved	mg/L			5.14		5.22		2.74		2.4		3.23		3.18		5.11		5.85		3.08		4.5		5.17			
Magnesium	Total	mg/L	4.35		5.2				2.7						3.83								4.4		5.64			
Manganese	Dissolved	mg/L			0.00328		0.0169		0.0256		0.0162		0.024		0.019		0.01	U	0.01	U	0.01	U	0.01	U	0.01	U		
Manganese	Total	mg/L	0.013		0.00267				0.0395						0.025								0.01	U	0.01		0.0057	
Mercury	Dissolved	mg/L											0.0002	U														
Molybdenum	Dissolved	mg/L			0.0004	U	0.00053		0.0004	U	0.0004	U																
Molybdenum	Total	mg/L	0.0004	U	0.0004	U			0.00073																			
Nickel	Dissolved	mg/L			0.0002	U	0.00092		0.00228		0.00137		0.0022		0.002	U	0.002	U	0.002	U			0.002	U				
Nickel	Total	mg/L	0.00125		0.00034				0.00313						0.002	U							0.002	U			0.005	U
Potassium	Dissolved	mg/L			0.386		0.823		0.149		0.343		2	U	1	U	1	U	1	U	1	U	1	U	1	U		
Potassium	Total	mg/L	0.441		0.473				0.232						1	U							1	U	1	U		
Selenium	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.003	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Selenium	Total	mg/L	0.003	U	0.003	U			0.003	U					0.001	U							0.001	U	0.001	U		
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.0002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Silver	Total	mg/L	0.0002	U	0.0002	U			0.0002	U					0.001	U							0.001	U	0.001	U		
Sodium	Dissolved	mg/L			4.84		4.87		2.53		2.13		3.05		2.85		4.58		5.73		4.31		3.53		4.06			
Sodium	Total	mg/L	4.31		4.83				2.37						3.16								3.58		4.25			
Thallium	Dissolved	mg/L			0.002	U	0.002	U	0.002	U	0.002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U		
Thallium	Total	mg/L	0.002	U	0.0021				0.0034						0.001	U							0.001	U	0.001	U		
Vanadium	Dissolved	mg/L			0.00063		0.00069		0.00136		0.00154		0.01	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U		
Vanadium	Total	mg/L	0.00066		0.00039				0.00233						0.005	U							0.005	U	0.005	U		
Zinc	Dissolved	mg/L			0.0254		0.0595		0.266		0.132		0.244		0.231		0.0525		0.102		0.0751		0.141		0.195			
Zinc	Total	mg/L	0.157		0.0185				0.29						0.207								0.173		0.206		0.051	

Table A-11
Location SF4.7
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/16/1999		10/5/1999		10/26/1999		1/25/2000		2/14/2000		3/9/2000		3/22/2000		7/18/2000		10/17/2000		11/18/2000		2/23/2001		5/1/2001		11/9/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Alkalinity		mg/L			45				20																			
Ammonia as N		mg/L as N			0.02	U			0.02	U					0.05	U												
Chloride		mg/L			2.5				1.1						16.9													
Fluoride		mg/L			0.1	U			0.1	U					0.5	U												
Nitrate & Nitrite as N		mg/L as N			0.0117				0.0831																			
Nitrate as N		mg/L as N													0.1	U												
Nitrite as N		mg/L as N													0.1	U												
Orthophosphate as P		mg/L as P							0.005	U					0.0037													
Phosphorus		mg/L													0.035	U												
Silica (SiO2)		mg/L			21.6				16.8						142													
Sulfate		mg/L			26.9				10.5						18.3												29.6	
Sulfide		mg/L																									0.05	U
Total Phosphate as P		mg/L as P							0.02																			
Other																												
Dissolved Organic Carbon		mg/L							2						3	U												
Hardness		mg/L	53.2		67.4		62.7		27.1		25.4																82	
Total Organic Carbon		mg/L			1				2						3	U												
Total Suspended Solids		mg/L			1	U			3						10	U											5	U

Key:

U = Nondetect

Table A-11
Location SF4.7
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/30/2001		12/19/2001		2/6/2002		3/27/2002		4/23/2002		5/28/2002		2/23/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																
Conductivity		µS/cm														
Conductivity		µS/cm														
Flow		gpm	9415.8		13329.4		6278.7		3545.5		2104.9		1261.1			
pH		su	7.09		6.48		6.28		6.02		6.24		7.62			
Temperature		deg C														
Metals																
Aluminum	Dissolved	mg/L	0.362		0.259		0.121		0.0997		0.05	U	0.1	U	0.192	
Aluminum	Total	mg/L														
Antimony	Dissolved	mg/L													0.001	U
Antimony	Total	mg/L														
Arsenic	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U	0.001	U
Arsenic	Total	mg/L														
Barium	Dissolved	mg/L													0.00485	
Barium	Total	mg/L														
Beryllium	Dissolved	mg/L													0.001	U
Beryllium	Total	mg/L														
Boron		mg/L														
Cadmium	Dissolved	mg/L	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.004	U	0.001	U
Cadmium	Total	mg/L														
Calcium	Dissolved	mg/L													11.9	
Calcium	Total	mg/L														
Chromium	Dissolved	mg/L													0.001	U
Chromium	Total	mg/L														
Cobalt	Dissolved	mg/L													0.001	U
Cobalt	Total	mg/L														
Copper	Dissolved	mg/L	0.0657		0.0681		0.0703		0.0484		0.0228		0.0136		0.041	
Copper	Total	mg/L														
Iron	Dissolved	mg/L	0.253		0.219		0.0949		0.0762		0.043		0.0478		10	U
Iron	Total	mg/L														
Lanthanum	Dissolved	mg/L														
Lanthanum	Total	mg/L														
Lead	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U	0.001	U
Lead	Total	mg/L														
Lithium	Dissolved	mg/L														
Lithium	Total	mg/L														
Magnesium	Dissolved	mg/L			2.96										4.14	
Magnesium	Total	mg/L														
Manganese	Dissolved	mg/L	0.0535				0.044		0.0283		0.0138		0.01	U	0.0214	
Manganese	Total	mg/L														
Mercury	Dissolved	mg/L														
Molybdenum	Dissolved	mg/L														
Molybdenum	Total	mg/L														
Nickel	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U	0.002	U
Nickel	Total	mg/L														
Potassium	Dissolved	mg/L													1	U
Potassium	Total	mg/L														
Selenium	Dissolved	mg/L													0.001	U
Selenium	Total	mg/L														
Silver	Dissolved	mg/L													0.001	U
Silver	Total	mg/L														
Sodium	Dissolved	mg/L													3.72	
Sodium	Total	mg/L														
Thallium	Dissolved	mg/L													0.001	U
Thallium	Total	mg/L														
Vanadium	Dissolved	mg/L													0.005	U
Vanadium	Total	mg/L														
Zinc	Dissolved	mg/L	0.448		0.368		0.495		0.328		0.207		0.121		0.273	
Zinc	Total	mg/L														

Table A-11
Location SF4.7
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			11/30/2001		12/19/2001		2/6/2002		3/27/2002		4/23/2002		5/28/2002		2/23/2004	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																
Alkalinity		mg/L														
Ammonia as N		mg/L as N														
Chloride		mg/L														
Fluoride		mg/L														
Nitrate & Nitrite as N		mg/L as N														
Nitrate as N		mg/L as N														
Nitrite as N		mg/L as N														
Orthophosphate as P		mg/L as P														
Phosphorus		mg/L														
Silica (SiO2)		mg/L														
Sulfate		mg/L	28.5		14.3		31.8		19.4		20.5		24.4			
Sulfide		mg/L	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U		
Total Phosphate as P		mg/L as P														
Other																
Dissolved Organic Carbon		mg/L														
Hardness		mg/L	45		33.3		42		40.7		45.3		57.2			
Total Organic Carbon		mg/L														
Total Suspended Solids		mg/L	5	U	5	U	5	U	5	U	5	U	5	U		

Key:

U = Nondetect

Table A-11
Location SF4.7
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/15/1999		10/5/1999		10/26/1999		1/25/2000		2/14/2000		3/9/2000		3/21/2000		10/17/2000		11/18/2000		2/22/2001		4/30/2001		11/9/2001		11/30/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Conductivity		µS/cm							83																			
Conductivity		µS/cm	137		176				82																			
Flow		gpm	2702.0		978.4		3424.6		35237.6				10049.3		7015.2		592.5		924.6		4789.0		1054.8		311.5			
pH		su	7.92		8.02		7.75		7.45		7.3		7.34		7.55		7.7		7.9		7.1		7.93		7.69		7.9	
Temperature		deg C	15.8		10		9		10.4																			
Metals																												
Aluminum	Dissolved	mg/L			0.035		0.044		0.254		0.325		0.113		0.1	U	0.1	U	0.1	U	0.1	U	0.1	U			0.296	
Aluminum	Total	mg/L	0.028								1.31														0.05	U		
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.003	U	0.0001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U				
Antimony	Total	mg/L	0.003	U							0.003	U																
Arsenic	Dissolved	mg/L			0.002	U	0.0068		0.002	U	0.002	U	0.005	U	0.001	U			0.001	U	0.001	U	0.001	U			0.005	U
Arsenic	Total	mg/L	0.002	U							0.002	U													0.005	U		
Barium	Dissolved	mg/L			0.0108		0.0187		0.00775		0.00771		0.008		0.00805		0.0111		0.0109		0.00825		0.0127					
Barium	Total	mg/L	0.00973								0.0131																	
Beryllium	Dissolved	mg/L			0.00001	U	0.000189		0.000023		0.00001	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U				
Beryllium	Total	mg/L	0.000012								0.000025																	
Boron		mg/L			0.0195																							
Cadmium	Dissolved	mg/L			0.00044		0.0001	U	0.00155		0.00081		0.0017		0.00154		0.001	U	0.001	U	0.001	U	0.00142				0.0022	
Cadmium	Total	mg/L	0.00056								0.0009														0.002	U		
Calcium	Dissolved	mg/L			19.6		20.2		7.08		6.74		10.1		9.94		22.7		20.6		13.5		18.9					
Calcium	Total	mg/L	14.6								6.68																	
Chromium	Dissolved	mg/L			0.0002	U	0.00461		0.00086		0.00075		0.0009		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U				
Chromium	Total	mg/L	0.00041								0.00235																	
Cobalt	Dissolved	mg/L			0.0002	U	0.00259		0.00067		0.0002	U	0.0002		0.002	U	0.002	U	0.002	U	0.002	U	0.002	U				
Cobalt	Total	mg/L	0.0002	U							0.00082																	
Copper	Dissolved	mg/L			0.00379		0.0594		0.0738		0.0559		0.048		0.0435		0.00945		0.0113		0.0117		0.00142				0.084	
Copper	Total	mg/L	0.0112								0.135														0.0081			
Iron	Dissolved	mg/L			0.0379		0.118		0.295		0.326		0.093		0.1	U	0.1	U	0.1	U	0.112		0.1	U			0.282	
Iron	Total	mg/L	0.0409								1.21														0.0399			
Lanthanum	Dissolved	mg/L			0.001	U	0.0011		0.001	U	0.001	U																
Lanthanum	Total	mg/L	0.001	U							0.001	U																
Lead	Dissolved	mg/L			0.003	U	0.0064		0.003	U	0.003	U	0.00005		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U			0.005	U
Lead	Total	mg/L	0.003	U							0.003	U													0.005	U		
Lithium	Dissolved	mg/L			0.00526		0.00393		0.0004	U	0.0004	U																
Lithium	Total	mg/L	0.0004	U							0.0004	U																
Magnesium	Dissolved	mg/L			6.06		7.69		3.27		2.83		3.83		3.63		7		6.61		4.85		6.2					
Magnesium	Total	mg/L	4.87								3.14																	
Manganese	Dissolved	mg/L			0.0022		0.0151		0.0257		0.0166		0.021		0.017		0.01	U	0.01	U	0.01	U	0.1	U			0.0465	
Manganese	Total	mg/L	0.00878								0.0396														0.0057			
Mercury	Dissolved	mg/L											0.0002	U														
Molybdenum	Dissolved	mg/L			0.0004	U	0.00192		0.0005		0.0004	U																
Molybdenum	Total	mg/L	0.0004								0.0004	U																
Nickel	Dissolved	mg/L			0.0002	U	0.00361		0.00261		0.00179		0.0029		0.002	U	0.002	U			0.002	U					0.005	U
Nickel	Total	mg/L	0.00092								0.00405														0.005	U		
Potassium	Dissolved	mg/L			0.496		1.17		0.225		0.415		2	U	1	U	1	U	1	U	1	U	0.01					
Potassium	Total	mg/L	0.395								0.463																	
Selenium	Dissolved	mg/L			0.003	U	0.0051		0.003	U	0.003	U	0.005	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U				
Selenium	Total	mg/L	0.003	U							0.003	U																
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.00033		0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U				
Silver	Total	mg/L	0.0002	U							0.0002	U																
Sodium	Dissolved	mg/L			4.85		5.55		2.72		2.42		3.1		2.79		5.16		4.38		3.66		4.25					
Sodium	Total	mg/L	4.23								2.33																	
Thallium	Dissolved	mg/L			0.002	U	0.0112		0.002	U	0.002	U	0.00004	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U				
Thallium	Total	mg/L	0.002	U							0.002	U																
Vanadium	Dissolved	mg/L			0.00031		0.00205		0.00139		0.0016		0.01	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U				
Vanadium	Total	mg/L	0.00073								0.00391																	
Zinc	Dissolved	mg/L			0.0306		0.107		0.394		0.191		0.37		0.354		0.0844		0.128		0.139		0.33				0.542	
Zinc	Total	mg/L	0.0972								0.272														0.0997			

Table A-12
Location M3.1
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/15/1999		10/5/1999		10/26/1999		1/25/2000		2/14/2000		3/9/2000		3/21/2000		10/17/2000		11/18/2000		2/22/2001		4/30/2001		11/9/2001		11/30/2001	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Alkalinity		mg/L			48				21																			
Ammonia as N		mg/L as N			0.02	U			0.02	U					0.05	U												
Chloride		mg/L			2.6				1.2						20.4													
Fluoride		mg/L			0.1	U			0.1	U					0.5	U												
Nitrate & Nitrite as N		mg/L as N			0.0125				0.109																			
Nitrate as N		mg/L as N													0.143													
Nitrite as N		mg/L as N													0.1	U												
Orthophosphate as P		mg/L as P							0.005	U					0.0061													
Phosphorus		mg/L													0.035	U												
Silica (SiO2)		mg/L			20.6										139										0.05	U	0.05	U
Sulfate		mg/L			32.3				13.3						19.2										31.2		28.1	
Total Phosphate as P		mg/L as P							0.02																			
Other																												
Dissolved Organic Carbon		mg/L							2						3	U												
Hardness		mg/L	56.4		74		82.1		31.1		28.5														89		45	
Total Organic Carbon		mg/L			1	U			2						3	U												
Total Suspended Solids		mg/L			1	U			4						10	U									5	U	5	U

Key:

U = Nondetect

Table A-12
Location M3.1
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			12/19/2001		2/6/2002		3/27/2002		4/23/2002		5/28/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements												
Conductivity		µS/cm										
Conductivity		µS/cm										
Flow		gpm	21497.5		8845.8		5111.8		2351.7		1483.3	
pH		su	6.45		6.42		6.29		6.61		7.53	
Temperature		deg C										
Metals												
Aluminum	Dissolved	mg/L	0.781		0.147		0.0987		0.0563		0.1	U
Aluminum	Total	mg/L										
Antimony	Dissolved	mg/L										
Antimony	Total	mg/L										
Arsenic	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U
Arsenic	Total	mg/L										
Barium	Dissolved	mg/L										
Barium	Total	mg/L										
Beryllium	Dissolved	mg/L										
Beryllium	Total	mg/L										
Boron		mg/L										
Cadmium	Dissolved	mg/L	0.002	U	0.002	U	0.002	U	0.002	U	0.004	U
Cadmium	Total	mg/L										
Calcium	Dissolved	mg/L										
Calcium	Total	mg/L										
Chromium	Dissolved	mg/L										
Chromium	Total	mg/L										
Cobalt	Dissolved	mg/L										
Cobalt	Total	mg/L										
Copper	Dissolved	mg/L	0.135		0.0758		0.0535		0.0277		0.0218	
Copper	Total	mg/L										
Iron	Dissolved	mg/L	0.526		0.129		0.0745		0.0409		0.0438	
Iron	Total	mg/L										
Lanthanum	Dissolved	mg/L										
Lanthanum	Total	mg/L										
Lead	Dissolved	mg/L	0.005	U	0.143		0.005	U	0.005	U	0.01	U
Lead	Total	mg/L										
Lithium	Dissolved	mg/L										
Lithium	Total	mg/L										
Magnesium	Dissolved	mg/L	3.46									
Magnesium	Total	mg/L										
Manganese	Dissolved	mg/L			0.0366		0.0246		0.0136		0.01	U
Manganese	Total	mg/L										
Mercury	Dissolved	mg/L										
Molybdenum	Dissolved	mg/L										
Molybdenum	Total	mg/L										
Nickel	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.01	U
Nickel	Total	mg/L										
Potassium	Dissolved	mg/L										
Potassium	Total	mg/L										
Selenium	Dissolved	mg/L										
Selenium	Total	mg/L										
Silver	Dissolved	mg/L										
Silver	Total	mg/L										
Sodium	Dissolved	mg/L										
Sodium	Total	mg/L										
Thallium	Dissolved	mg/L										
Thallium	Total	mg/L										
Vanadium	Dissolved	mg/L										
Vanadium	Total	mg/L										
Zinc	Dissolved	mg/L	0.519		0.507		0.397		0.294		0.188	
Zinc	Total	mg/L										

Table A-12
Location M3.1
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			12/19/2001		2/6/2002		3/27/2002		4/23/2002		5/28/2002	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions												
Alkalinity		mg/L										
Ammonia as N		mg/L as N										
Chloride		mg/L										
Fluoride		mg/L										
Nitrate & Nitrite as N		mg/L as N										
Nitrate as N		mg/L as N										
Nitrite as N		mg/L as N										
Orthophosphate as P		mg/L as P										
Phosphorus		mg/L										
Silica (SiO2)		mg/L	0.05	U	0.05	U	0.05	U			0.05	U
Sulfate		mg/L	18.3		29		25.8		28		27.6	
Total Phosphate as P		mg/L as P										
Other												
Dissolved Organic Carbon		mg/L										
Hardness		mg/L	36.5		45.2		47.5		53.9		65	
Total Organic Carbon		mg/L										
Total Suspended Solids		mg/L	5	U	5	U					5	U

Key:

U = Nondetect

Table A-12
Location M3.1
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/15/1999		6/17/1999		10/5/1999		10/26/1999		1/24/2000		3/21/2000		7/18/2000		2/22/2001		2/23/2001		4/30/2001		5/20/2003		2/23/2004		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																												
Conductivity		µS/cm	165				250				66																	
Flow		gpm	4775.6				1638.2				102032.5		20296.1															
pH		su	7.8				8.27		7.56		7.49		7.67															
Temperature		deg C	7.8				12		11		9.3																	
Metals																												
Aluminum	Dissolved	mg/L					0.028		0.025		0.228		0.1 U		0.1 U		0.1				0.1 U		0.5 U		0.132		0.1 U	
Aluminum	Total	mg/L	0.026		0.079		0.036				0.453		0.1 U						0.144		0.1 U		0.1 U					
Antimony	Dissolved	mg/L					0.003 U		0.003 U		0.003 U		0.001 U		0.005 U		0.001 U				0.002 U		0.001 U		0.001 U		0.001 U	
Antimony	Total	mg/L	0.003 U		0.003 U		0.003 U				0.003 U		0.001 U						0.001 U		0.001 U		0.001 U					
Arsenic	Dissolved	mg/L					0.002 U		0.0077		0.0021		0.001 U				0.001 U				0.002 U		0.00138		0.001 U		0.001 U	
Arsenic	Total	mg/L	0.002 U		0.002 U		0.002 U				0.002 U		0.001 U						0.001 U		0.001 U		0.002 U					
Barium	Dissolved	mg/L					0.115		0.124		0.0198		0.0295		0.0917		0.0507				0.0796		0.0454		0.0284		0.146	
Barium	Total	mg/L	0.0597		0.0566		0.121				0.0233		0.03						0.0585		0.0888		0.0476					
Beryllium	Dissolved	mg/L					0.00001 U		0.000193		0.000029		0.001 U		0.001 U		0.001 U				0.002 U		0.001 U		0.001 U		0.001 U	
Beryllium	Total	mg/L	0.000025		0.000054		0.00001 U				0.000021		0.001 U						0.001 U		0.001 U		0.001 U					
Boron		mg/L					0.0834				0.0134																	
Cadmium	Dissolved	mg/L					0.0001 U		0.0001 U		0.00026		0.001 U		0.001 U		0.001 U				0.002 U		0.001 U		0.001 U		0.001 U	
Cadmium	Total	mg/L	0.00022		0.00017		0.00018				0.00025		0.001 U						0.001 U		0.001 U		0.001 U					
Calcium	Dissolved	mg/L					22		22		4.9		7.54		19.6		10.9				15.6		11.6		7.14		25.1	
Calcium	Total	mg/L	13		12		23.5				5.6		8.2						12		16.7		11					
Chromium	Dissolved	mg/L					0.0002 U		0.00453		0.00081		0.001 U		0.001 U		0.001 U				0.002 U		0.00104		0.001 U		0.001 U	
Chromium	Total	mg/L	0.00024		0.0002 U		0.0002 U				0.00094		0.001 U						0.001 U		0.00101		0.001 U					
Cobalt	Dissolved	mg/L					0.00023		0.00239		0.0006		0.002 U		0.002 U		0.002 U				0.004 U		0.001 U		0.001 U		0.001 U	
Cobalt	Total	mg/L	0.0002 U		0.0003		0.0003				0.0008		0.002 U						0.002 U		0.002 U		0.001 U					
Copper	Dissolved	mg/L					0.00059		0.0113		0.0184		0.0102		0.0057		0.0036				0.00476		0.00539		0.00927		0.005	
Copper	Total	mg/L	0.00408		0.00417		0.00088				0.0345		0.0127						0.00227		0.00405		0.0117					
Iron	Dissolved	mg/L					0.006		0.0695		0.324		0.1 U		0.1 U		0.157				0.1 U		0.1 U		10 U		0.1 U	
Iron	Total	mg/L	0.0107		0.0118		0.0139				0.5		0.1 U						0.199		0.1 U		0.1 U					
Lanthanum	Dissolved	mg/L					0.001 U		0.0022		0.001 U																	
Lanthanum	Total	mg/L	0.001 U		0.001 U		0.001 U				0.001 U																	
Lead	Dissolved	mg/L					0.003 U		0.0062		0.003 U		0.001 U		0.001 U		0.001 U				0.002 U		0.001 U		0.001 U		0.001 U	
Lead	Total	mg/L	0.003 U		0.003 U		0.003 U				0.003 U		0.001 U						0.001 U		0.001 U		0.001 U					
Lithium	Dissolved	mg/L					0.0125		0.00817		0.0004 U																	
Lithium	Total	mg/L	0.00257		0.0004 U		0.0121				0.00083																	
Magnesium	Dissolved	mg/L					6.37		6.47		2.28		2.86		5.84		3.96				4.81		4.04		2.91		6.83	
Magnesium	Total	mg/L	4.24		4.16		6.65				2.36		3.33						3.73		5.15		3.79					
Manganese	Dissolved	mg/L					0.00024		0.00973		0.00455		0.01 U		0.01 U		0.01 U				0.01 U		0.0034		0.01 U		0.01 U	
Manganese	Total	mg/L	0.00146		0.00174		0.00085				0.0104		0.01 U						0.001 U		0.01 U		0.00339					
Molybdenum	Dissolved	mg/L					0.0004 U		0.00314		0.0004 U																	
Molybdenum	Total	mg/L	0.0004 U		0.0004 U		0.0004 U				0.00067																	
Nickel	Dissolved	mg/L					0.0002 U		0.00307		0.00178		0.002 U		0.002 U		0.002 U								0.002 U		0.002 U	
Nickel	Total	mg/L	0.00093		0.00245		0.00056				0.00257		0.002 U						0.002 U									
Potassium	Dissolved	mg/L					0.836		1.1		0.324		1 U		1 U		1 U				1 U		0.1 U		1 U		0.1 U	
Potassium	Total	mg/L	0.721		1.15		0.857				0.438		1 U						1 U		1 U		0.1 U					
Selenium	Dissolved	mg/L					0.003 U		0.0047		0.003 U		0.001 U		0.001 U		0.001 U				0.002 U		0.001 U		0.001 U		0.002 U	
Selenium	Total	mg/L	0.003 U		0.003 U		0.003 U				0.003 U		0.001 U						0.001 U		0.00161		0.00119					
Silver	Dissolved	mg/L					0.0002 U		0.002 U		0.0002 U		0.001 U		0.001 U		0.001 U				0.002 U		0.001 U		0.001 U		0.001 U	
Silver	Total	mg/L	0.0002 U		0.0002 U		0.0002 U				0.0002 U		0.001 U						0.001 U		0.001 U		0.001 U					
Sodium	Dissolved	mg/L					18.1		19.8		3.64		4.55		15		7.74				10.7		7.19		4.35		20.3	
Sodium	Total	mg/L	9.97		10.2		19.2				3.37		5.88						8.29		11.3		6.8					
Thallium	Dissolved	mg/L					0.0023		0.0128		0.002 U		0.001 U		0.001 U		0.001 U				0.002 U		0.001 U		0.001 U		0.001 U	
Thallium	Total	mg/L	0.002 U		0.002 U		0.002 U				0.002 U		0.001 U						0.001 U		0.001 U		0.001 U					
Vanadium	Dissolved	mg/L					0.0001 U		0.00168		0.00108		0.005 U		0.005 U		0.005 U				0.01 U		0.005 U		0.005 U		0.005 U	
Vanadium	Total	mg/L	0.00063		0.0005		0.0001 U				0.00132		0.005 U						0.005 U		0.005 U		0.005 U					
Zinc	Dissolved	mg/L					0.0005 U		0.03		0.0772		0.0836		0.0212		0.0348				0.0405		0.0406		0.0559		0.0271	
Zinc	Total	mg/L	0.0274		0.016		0.0121				0.104		0.0812						0.0321		0.0446		0.0456					

Table A-13
Location M13.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/15/1999		6/17/1999		10/5/1999		10/26/1999		1/24/2000		3/21/2000		7/18/2000		2/22/2001		2/23/2001		4/30/2001		5/20/2003		2/23/2004		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																												
Alkalinity		mg/L					44				20																	
Ammonia as N		mg/L as N					0.02	U			0.02	U	0.05	U														
Chloride		mg/L					41				3.1		22.6															
Fluoride		mg/L					0.1	U			0.1	U	0.5	U														
Nitrate & Nitrite as N		mg/L as N					0.005	U			0.0365																	
Nitrate as N		mg/L as N											0.1	U														
Nitrite as N		mg/L as N											0.1	U														
Orthophosphate as P		mg/L as P									0.007		0.0047															
Phosphorus		mg/L											0.035	U														
Silica (SiO2)		mg/L					15.1				17.7		142															
Sulfate		mg/L					17				5.06		7.84															
Total Phosphate as P		mg/L as P									0.03																	
Other																												
Dissolved Organic Carbon		mg/L									2		3.89															
Hardness		mg/L	49.8		47.2		81.2		81.6		21.6																	
Total Organic Carbon		mg/L					1				2		3	U														
Total Suspended Solids		mg/L					1	U			2		10	U														

Key:

U = Nondetect

Table A-13
Location M13.0
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/17/1999		10/5/1999		10/26/1999		1/24/2000		3/21/2000		2/22/2001		4/30/2001		5/20/2003		2/23/2004		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																						
Conductivity		µS/cm			100				69													
Flow		gpm			41256.5																	
pH		su			8.04		7.71		7.72		8.17											
Temperature		deg C			13		11		12													
Metals																						
Aluminum	Dissolved	mg/L			0.052		0.031		0.162		0.1	U	0.1	U	0.1	U	0.5	U	0.149		0.1	U
Aluminum	Total	mg/L	0.077								0.1	U	0.1	U	0.1	U	0.101					
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Antimony	Total	mg/L	0.003	U							0.001	U	0.001	U	0.001	U	0.001	U				
Arsenic	Dissolved	mg/L			0.002	U	0.0074		0.002	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.00105	
Arsenic	Total	mg/L	0.002	U							0.001	U	0.001	U	0.001	U	0.002	U				
Barium	Dissolved	mg/L			0.00632		0.00922		0.00709		0.00638		0.00782		0.00836		0.00716		0.00716		0.00937	
Barium	Total	mg/L	0.00665								0.00619		0.0103		0.00939		0.00746					
Beryllium	Dissolved	mg/L			0.00001	U	0.000195		0.000024		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Beryllium	Total	mg/L	0.000056								0.001	U	0.001	U	0.001	U	0.001	U				
Cadmium	Dissolved	mg/L			0.0001	U	0.0001	U	0.0001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Cadmium	Total	mg/L	0.0001	U							0.001	U	0.001	U	0.001	U	0.001	U				
Calcium	Dissolved	mg/L			7.31		8.62		5.36		6.33		9.06		10.8		8.15		7.01		10.2	
Calcium	Total	mg/L	7.12								7.16		10.1		11		8.07					
Chromium	Dissolved	mg/L			0.0002	U	0.00453		0.00124		0.00106		0.001	U	0.00188		0.00152		0.001	U	0.00102	
Chromium	Total	mg/L	0.00028								0.001	U	0.0011		0.00134		0.001	U				
Cobalt	Dissolved	mg/L			0.0002	U	0.00277		0.00043		0.002	U	0.001	U	0.002	U	0.001	U	0.001	U	0.001	U
Cobalt	Total	mg/L	0.00037								0.002	U	0.002	U	0.002	U	0.001	U				
Copper	Dissolved	mg/L			0.0003	U	0.00606		0.00143		0.002	U	0.00225		0.002	U	0.002	U	0.2	U	0.002	U
Copper	Total	mg/L	0.00064								0.002	U	0.002	U	0.00253		0.002	U				
Iron	Dissolved	mg/L			0.0765		0.102		0.253		0.1	U	0.1	U	0.1	U	0.123		0.12		0.1	U
Iron	Total	mg/L	0.0338								0.254		0.166		0.147		0.111					
Lanthanum	Dissolved	mg/L			0.001	U	0.001	U	0.001	U												
Lanthanum	Total	mg/L	0.001	U																		
Lead	Dissolved	mg/L			0.003	U	0.0062		0.003	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Lead	Total	mg/L	0.003	U							0.001	U	0.001	U	0.001	U	0.001	U				
Lithium	Dissolved	mg/L			0.00553		0.00303		0.0004	U												
Lithium	Total	mg/L	0.0004	U																		
Magnesium	Dissolved	mg/L			4.8		5.57		4.15		4.75		6.24		7.46		5.81		5.23		6.8	
Magnesium	Total	mg/L	5.08								5.25		5.93		7.82		5.91					
Manganese	Dissolved	mg/L			0.0002	U	0.0003		0.00617		0.01	U	0.001	U	0.01	U	0.00512		0.01	U	0.01	U
Manganese	Total	mg/L	0.00189								0.01	U	0.01	U	0.01	U	0.00656					
Molybdenum	Dissolved	mg/L			0.0004	U	0.0022		0.00046													
Molybdenum	Total	mg/L	0.0004	U																		
Nickel	Dissolved	mg/L			0.00134		0.00463		0.00346		0.00264		0.002	U					0.00262		0.00205	
Nickel	Total	mg/L	0.00311								0.00255		0.002	U								
Potassium	Dissolved	mg/L			0.76		0.742		0.325		1	U	1	U	1	U	0.1	U	1	U	0.1	U
Potassium	Total	mg/L	1								1	U	1	U	1	U	0.1	U				
Selenium	Dissolved	mg/L			0.003	U	0.0067		0.003	U	0.001	U	0.001	U	0.00882	U	0.001	U	0.001	U	0.002	U
Selenium	Total	mg/L	0.003	U							0.001	U	0.001	U	0.001	U	0.001	U				
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Silver	Total	mg/L	0.0002	U							0.001	U	0.001	U	0.001	U	0.001	U				
Sodium	Dissolved	mg/L			3.48		4.75		3.03		2.61		3.83		4.41		3.68		3.51		4.58	
Sodium	Total	mg/L	3.93								3.28		4.22		4.22		3.58					
Thallium	Dissolved	mg/L			0.0029		0.0131		0.002	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Thallium	Total	mg/L	0.002	U							0.001	U	0.001	U	0.001	U	0.001	U				
Vanadium	Dissolved	mg/L			0.00055		0.00197		0.00119		0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Vanadium	Total	mg/L	0.00082								0.005	U	0.005	U	0.005	U	0.005	U				
Zinc	Dissolved	mg/L			0.0005	U	0.00951		0.00161		0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Zinc	Total	mg/L	0.0031								0.005	U	0.005	U	0.00661		0.005	U				
Other																						
Hardness		mg/L	38.7		38		44.4		30.5													

Key:

U = Nondetect

Table A-14
Location C1
Historical Results

Sample Media			Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Sample Date			6/17/1999		10/4/1999		10/26/1999		1/24/2000		3/21/2000		2/22/2001		4/30/2001		5/20/2003		2/23/2004		9/19/2005	
Analyte	Analyte 2	Unit	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurements																						
Conductivity		µS/cm	105		94		10		70													
Flow		gpm			45439.55												`					
pH		su	8.08		7.93		7.7		7.59		8.08											
Temperature		deg C	19.8		12		10		10													
Metals																						
Aluminum	Dissolved	mg/L			0.055		0.024		0.189		0.1	U	0.1	U	0.1	U	0.5	U	0.127		0.1	U
Aluminum	Total	mg/L	0.069								0.1	U	0.119		0.1	U	0.1	U				
Antimony	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Antimony	Total	mg/L	0.003	U							0.001	U	0.001	U	0.001	U	0.001	U				
Arsenic	Dissolved	mg/L			0.002	U	0.0075		0.002	U	0.001	U	0.001	U	0.0088	U	0.001	U	0.001	U	0.00105	
Arsenic	Total	mg/L	0.002	U							0.00164		0.001	U	0.001	U	0.002	U				
Barium	Dissolved	mg/L			0.00956		0.0165		0.0101		0.0101		0.0161		0.02		0.00995		0.00862		0.00937	
Barium	Total	mg/L	0.0113								0.00989		0.0192		0.0219		0.0114					
Beryllium	Dissolved	mg/L			0.00001	U	0.000216		0.000023		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Beryllium	Total	mg/L	0.000063								0.001	U	0.001	U	0.001	U	0.001	U				
Cadmium	Dissolved	mg/L			0.0001	U	0.0001	U	0.0001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Cadmium	Total	mg/L	0.0002								0.001	U	0.001	U	0.001	U	0.001	U				
Calcium	Dissolved	mg/L			7.86		8.66		5.31		6.87		9.36		11.8		7.97		7.17		10.2	
Calcium	Total	mg/L	7.57								7.26		10.3		11.9		8.37					
Chromium	Dissolved	mg/L			0.0002	U	0.00422		0.00108		0.00106		0.001	U	0.00148		0.00137		0.001	U	0.00102	
Chromium	Total	mg/L	0.00026								0.001	U	0.001	U	0.0011		0.001	U				
Cobalt	Dissolved	mg/L			0.0002	U	0.00299		0.00044		0.002	U	0.002	U	0.002	U	0.001	U	0.001	U	0.001	U
Cobalt	Total	mg/L	0.00036								0.002	U	0.002	U	0.002	U	0.001	U				
Copper	Dissolved	mg/L			0.0003	U	0.00603		0.00595		0.00205		0.002	U	0.002	U	0.002	U	0.2	U	0.002	U
Copper	Total	mg/L	0.0012								0.00229		0.002	U	0.00234		0.002	U				
Iron	Dissolved	mg/L			0.0686		0.0888		0.259		0.1	U	0.108		0.1	U	0.1	U	0.102		0.1	U
Iron	Total	mg/L	0.0272								0.127		0.19		0.137		0.111					
Lanthanum	Dissolved	mg/L			0.001	U	0.0014		0.001	U												
Lanthanum	Total	mg/L	0.001	U																		
Lead	Dissolved	mg/L			0.003	U	0.0067		0.003	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Lead	Total	mg/L	0.003	U							0.001	U	0.001	U	0.001	U	0.001	U				
Lithium	Dissolved	mg/L			0.00518		0.00443		0.0004	U												
Lithium	Total	mg/L	0.0004	U																		
Magnesium	Dissolved	mg/L			4.86		5.11		3.62		4.81		5.77		7.04		5.38		5.17		6.8	
Magnesium	Total	mg/L	4.99								5.32		5.4		7.35		5.71					
Manganese	Dissolved	mg/L			0.0002	U	0.00084		0.00556		0.01	U	0.01	U	0.01	U	0.00481		0.01	U	0.01	U
Manganese	Total	mg/L	0.00176								0.01	U	0.01	U	0.01	U	0.00677					
Molybdenum	Dissolved	mg/L			0.0004	U	0.00208		0.00052													
Molybdenum	Total	mg/L	0.0004	U																		
Nickel	Dissolved	mg/L			0.00175		0.0051		0.00305		0.00233		0.002	U					0.00251		0.00205	
Nickel	Total	mg/L	0.00324								0.00231		0.002	U								
Potassium	Dissolved	mg/L			0.816		0.622		0.356		1	U	1	U	1	U	0.1	U	1	U	0.1	U
Potassium	Total	mg/L	1								1	U	1	U	1	U	0.1	U				
Selenium	Dissolved	mg/L			0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.002	U
Selenium	Total	mg/L	0.003	U							0.00177		0.00275		0.001	U	0.00116					
Silver	Dissolved	mg/L			0.0002	U	0.0002	U	0.0002	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Silver	Total	mg/L	0.0002	U							0.001	U	0.001	U	0.001	U	0.001	U				
Sodium	Dissolved	mg/L			3.87		5.3		3.09		3.04		4.57		5.58		3.71		3.64		4.58	
Sodium	Total	mg/L	4.44								3.54		5.1		5.39		3.82					
Thallium	Dissolved	mg/L			0.002	U	0.0146		0.002		0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Thallium	Total	mg/L	0.002	U							0.001	U	0.001	U	0.001	U	0.001	U				
Vanadium	Dissolved	mg/L			0.00046		0.00182		0.00108		0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Vanadium	Total	mg/L	0.00087								0.005	U	0.005	U	0.005	U	0.005	U				
Zinc	Dissolved	mg/L			0.0005	U	0.0101		0.0208		0.0496		0.00741		0.00717		0.005	U	0.005	U	0.005	U
Zinc	Total	mg/L	0.00387								0.0122		0.005	U	0.0112		0.005	U				
Other																						
Hardness		mg/L	39.4		39.6		42.6		28.1													

Key:

U = Nondetect

Table A-15
Location C2
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 10/19/1999 Value	Surface Water 10/19/1999 Qualifier	Surface Water 10/20/1999 Value	Surface Water 10/20/1999 Qualifier	Surface Water 1/25/2000 Value	Surface Water 1/25/2000 Qualifier	Surface Water 3/23/2000 Value	Surface Water 3/23/2000 Qualifier
Field Measurement																
Conductivity		µS/cm	130	130	130	1/1			130							
Flow		gpm	0.1	3.5	1.3	3/3			0.1				3.5		0.4	
pH		su	3.27	5.94	4.29	4/4	6.5 to 8.5	4/4	5.3		5.94		3.27		3.28	
Temperature		deg C	9	10.9	9.95	2/2			10.9				9			
Metals																
Aluminum	Dissolved	mg/L	0.087	U	3.18	1.78783	2/3				0.087	U	3.18		2.14	
Antimony	Dissolved	mg/L	0.001	U	0.01	U	0.00467	U	0/3	0.146	0/3		0.01	U	0.003	U	0.001	U
Arsenic	Dissolved	mg/L	0.001	U	0.01	U	0.00433	U	0/3	0.048	0/3		0.01	U	0.002	U	0.001	U
Barium	Dissolved	mg/L	0.0349		0.0471		0.04267		3/3	1	0/3		0.046		0.0471		0.0349	
Beryllium	Dissolved	mg/L	0.001	U	0.00007		0.00036		1/3	0.0053	0/3		0.001	U	0.00007		0.001	U
Cadmium	Dissolved	mg/L	0.001	U	0.00232		0.00171		2/3	0.00069	3/3		0.001	U	0.00232		0.0018	
Calcium	Dissolved	mg/L	14		34		22.3667		3/3				34		14		19.1	
Chromium	Dissolved	mg/L	0.001	U	0.0003		0.00193		1/3	0.011	0/3		0.01	U	0.0003		0.001	U
Cobalt	Dissolved	mg/L	0.01	U	0.00299		0.00362		2/3				0.01	U	0.00299		0.00287	
Copper	Dissolved	mg/L	0.01	U	0.334		0.20233		2/3	0.0068	3/3		0.01	U	0.334		0.268	
Iron	Dissolved	mg/L	3.64		28		12.1567		3/3	0.3	3/3		28		4.83		3.64	
Lanthanum	Dissolved	mg/L	0.0011		0.0011		0.0011		1/1						0.0011			
Lead	Dissolved	mg/L	0.002	U	0.0107		0.00511		2/3	0.0014	3/3		0.002	U	0.0107		0.00362	
Lithium	Dissolved	mg/L	0.00224		0.00224		0.00224		1/1						0.00224			
Magnesium	Dissolved	mg/L	4.31		5.8		4.95667		3/3				5.8		4.31		4.76	
Manganese	Dissolved	mg/L	0.16		0.182		0.17033		3/3	0.05	3/3		0.16		0.169		0.182	
Mercury	Dissolved	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.000012	1/1		0.0002	U				
Molybdenum	Dissolved	mg/L	0.00058		0.00058		0.00058		1/1						0.00058			
Nickel	Dissolved	mg/L	0.002	U	0.00214		0.00271		1/3	0.0134	0/3		0.01	U	0.00214		0.002	U
Potassium	Dissolved	mg/L	1	U	0.596		0.69867		1/3				2	U	0.596		1	U
Selenium	Dissolved	mg/L	0.02	U	0.00238		0.00463		1/3	0.01	1/3		0.02	U	0.003	U	0.00238	
Silver	Dissolved	mg/L	0.0002	U	0.01	U	0.00373	U	0/3	0.00012	3/3		0.01	U	0.0002	U	0.001	U
Sodium	Dissolved	mg/L	2.5		2.73		2.64333		3/3				2.7		2.5		2.73	
Thallium	Dissolved	mg/L	0.001	U	0.01	U	0.00433	U	0/3	0.013	0/3		0.01	U	0.002	U	0.001	U
Vanadium	Dissolved	mg/L	0.0001	U	0.01	U	0.00503	U	0/3				0.01	U	0.0001	U	0.005	U
Zinc	Dissolved	mg/L	0.05	U	0.477		0.30567		2/3	0.062	2/3		0.05	U	0.477		0.415	
Major Ions																
Bicarbonate Alkalinity		mg/L	28		28		28		1/1				28					
Carbonate Alkalinity		mg/L	10	U	10	U	10	U	0/1				10	U				
Chloride		mg/L	2.2		2.2		2.2		1/1	230	0/1		2.2					
Hydroxide Alkalinity		mg/L	10	U	10	U	10	U	0/1				10	U				
Nitrate as N		mg/L as N	0.2	U	0.2	U	0.2	U	0/1				0.2	U				
Nitrite as N		mg/L as N	0.05	U	0.05	U	0.05	U	0/1				0.05	U				
Sulfate		mg/L	120		120		120		1/1				120					
Total Alkalinity		mg/L	28		28		28		1/1	20	0/1		28					
Other																
Total Cyanide		mg/L	0.02	U	0.02	U	0.02	U	0/1				0.02	U				
Hardness[4]		mg/L	52.7		52.7		52.7		1/1						52.7			
Total Dissolved Solids		mg/L	210		210		210		1/1				210					

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-16
404 Adit
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 1/25/2000 Value	Surface Water 1/25/2000 Qualifier	Surface Water 3/9/2000 Value	Surface Water 3/9/2000 Qualifier	Surface Water 3/22/2000 Value	Surface Water 3/22/2000 Qualifier
Field Measurement														
Conductivity		µS/cm	82	82	82	1/1			82					
Flow		gpm	150.0	600.0	336.7	3/3			600.0		260.0		150.0	
pH		su	7.63	7.64	7.64	3/3	6.5 to 8.5	0/3	7.64		7.64		7.63	
Temperature		deg C	9.2	9.2	9.2	1/1			9.2					
Metals														
Aluminum	Dissolved	mg/L	0.05	U	0.205	0.09333	1/3			0.205		0.05	U	0.1	U
Antimony	Dissolved	mg/L	0.0001	U	0.003	U	0.00137	U	0/3	0.146	0/3	0.003	U	0.0001	U	0.001	U
Arsenic	Dissolved	mg/L	0.001	U	0.005	U	0.00267	U	0/3	0.048	0/3	0.002	U	0.005	U	0.001	U
Barium	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0/1					0.005	U		
Barium	Dissolved	mg/L	0.00454		0.00462		0.00458		2/2	1	0/2	0.00454				0.00462	
Beryllium	Dissolved	mg/L	0.00004	U	0.001	U	0.00038	U	0/3	0.0053	0/3	0.0001	U	0.00004	U	0.001	U
Cadmium	Dissolved	mg/L	0.0001	U	0.001	U	0.0004	U	0/3	0.0005	1/3	0.0001	U	0.0001	U	0.001	U
Calcium	Dissolved	mg/L	9.14		10.5		9.8		3/3			9.14		9.76		10.5	
Chromium	Dissolved	mg/L	0.001	U	0.0011		0.00062		2/3	0.011	0/3	0.00025		0.0011		0.001	U
Cobalt	Dissolved	mg/L	0.002	U	0.00007		0.00054		1/2					0.00007		0.002	U
Cobalt	Dissolved	mg/L	0.00031		0.00031		0.00031		1/1			0.00031					
Copper	Dissolved	mg/L	0.01	U	0.00438		0.00381		2/3	0.0049	1/3	0.00438		0.01	U	0.00205	
Iron	Dissolved	mg/L	0.1	U	0.193		0.09033		2/3	0.3	0/3	0.193		0.028		0.1	U
Lanthanum	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U				
Lead	Dissolved	mg/L	0.001	U	0.00003		0.00068		1/3	0.00085	2/3	0.003	U	0.00003		0.001	U
Lithium	Dissolved	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U				
Magnesium	Dissolved	mg/L	3.07		3.71		3.38333		3/3			3.07		3.37		3.71	
Manganese	Dissolved	mg/L	0.005	U	0.00155		0.00302		1/3	0.05	0/3	0.00155		0.005	U	0.01	U
Mercury	Dissolved	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.000012	1/1			0.0002	U		
Molybdenum	Dissolved	mg/L	0.00061		0.00061		0.00061		1/1			0.00061					
Nickel	Dissolved	mg/L	0.002	U	0.0015		0.00115		2/3	0.0134	0/3	0.00095		0.0015		0.002	U
Potassium	Dissolved	mg/L	1	U	0.2		0.56667		1/3			0.2		2	U	1	U
Selenium	Dissolved	mg/L	0.001	U	0.005	U	0.003	U	0/3	0.01	0/3	0.003	U	0.005	U	0.001	U
Silver	Dissolved	mg/L	0.00004	U	0.001	U	0.00041	U	0/3	0.00012	2/3	0.0002	U	0.00004	U	0.001	U
Sodium	Dissolved	mg/L	2.63		3.08		2.88667		3/3			2.63		3.08		2.95	
Thallium	Dissolved	mg/L	0.00004	U	0.002	U	0.00101	U	0/3	0.013	0/3	0.002	U	0.00004	U	0.001	U
Vanadium	Dissolved	mg/L	0.005	U	0.00155		0.00302		1/3			0.00155		0.01	U	0.005	U
Zinc	Dissolved	mg/L	0.01	U	0.0135		0.01027		2/3	0.044	0/3	0.0135		0.01	U	0.0123	
Other																	
Hardness[4]		mg/L	35.4		35.4		35.4		1/1			35.4					

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-17
404 Trib
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 2/7/2002		Surface Water 2/21/2002		Surface Water 3/26/2002		Surface Water 4/22/2002		Surface Water 5/29/2002	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Field Measurement																		
Flow		gpm	26.7	200.0	111.6	5/5			200.0		115.3		152.1		64.0		26.7	
pH		su	3.62	5.38	4.48	5/5	6.5 to 8.5	5/5	3.62		4.04		4.48		4.59		5.38	
Metals																		
Aluminum	Dissolved	mg/L	0.244	5.59	2.7248	5/5			5.59		4.97		1.14		1.68		0.244	
Arsenic	Dissolved	mg/L	0.005 U	0.01 U	0.006 U	0/5	0.048	0/5	0.005 U		0.005 U		0.005 U		0.005 U		0.01 U	
Cadmium	Dissolved	mg/L	0.0231	0.0343	0.02994	5/5	0.0016	5/5	0.0343		0.0321		0.0231		0.0282		0.032	
Copper	Dissolved	mg/L	2.22	3.45	2.826	5/5	0.017	5/5	3.45		3.15		2.22		2.71		2.6	
Iron	Dissolved	mg/L	0.02 U	0.327	0.0931	4/5	0.3	1/5	0.327		0.0904		0.0197		0.0184		0.02 U	
Lead	Dissolved	mg/L	0.005 U	0.01 U	0.006 U	0/5	0.0054	1/5	0.005 U		0.005 U		0.005 U		0.005 U		0.01 U	
Manganese	Dissolved	mg/L	0.441	0.657	0.5784	5/5	0.05	5/5	0.657		0.602		0.441		0.564		0.628	
Nickel	Dissolved	mg/L	0.0131	0.0183	0.01634	5/5	0.0134	4/5	0.0183		0.0174		0.0131		0.0157		0.0172	
Zinc	Dissolved	mg/L	5.27	8.54	7.288	5/5	0.15	5/5	8.48		8.54		5.27		6.39		7.76	
Major Ions																		
Sulfate		mg/L	154	460	257.8	5/5			460		233		154		205		237	
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/5	0.002	5/5	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
Other																		
Hardness[4]		mg/L	119	196	151	5/5			130		148		119		162		196	
Total Suspended Solids		mg/L	12	35	19.8	5/5			35		15		12		21		16	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.

2. The median was calculated for pH instead of mean.

3. Some method reporting limits exceed the SL.

4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-18
Location A14
Historical Results

A19 (Mar. 2002)

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 3/26/2002	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Dissolved	mg/L			0.05	U
Arsenic	Dissolved	mg/L	0.048	1/1	0.005	U
Cadmium	Dissolved	mg/L	No Hardness		0.002	U
Copper	Dissolved	mg/L	No Hardness		0.005	U
Hardness	Dissolved	mg/L			307	
Iron	Dissolved	mg/L	0.3	0/1	0.0235	
Lead	Dissolved	mg/L	No Hardness		0.005	U
Manganese	Dissolved	mg/L	0.05	0/1	0.005	U
Nickel	Dissolved	mg/L	0.0134	0/1	0.0132	
Zinc	Dissolved	mg/L	No Hardness		2.91	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 10/7/1999		Surface Water 7/18/2000	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier
Field Measurement								
Conductivity		µS/cm			101			
Flow		gpm			130.2			
pH		su	6.5 to 8.5	0/1	7.65			
Temperature		deg C			13			
Metals								
Aluminum	Dissolved	mg/L					0.1	U
Aluminum	Total	mg/L			0.01	U		
Antimony	Dissolved	mg/L	0.146	0/1			0.005	U
Antimony	Total	mg/L	0.146	0/1	0.003	U		
Arsenic	Dissolved	mg/L	0.048	0/1			0.001	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U		
Barium	Dissolved	mg/L	1	0/1			0.0184	
Barium	Total	mg/L	1	0/1	0.0185			
Beryllium	Dissolved	mg/L	0.0053	0/1			0.001	U
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U		
Boron		mg/L			0.0173			
Cadmium	Dissolved	mg/L	0.00049	1/1			0.001	U
Cadmium	Total	mg/L	0.00049	0/1	0.00015			
Calcium	Dissolved	mg/L					8.04	
Calcium	Total	mg/L			7.87			
Chromium	Dissolved	mg/L	0.011	0/1			0.00125	
Chromium	Total	mg/L	0.011	0/1	0.0002	U		
Cobalt	Dissolved	mg/L					0.002	U
Cobalt	Total	mg/L			0.0002	U		
Copper	Dissolved	mg/L	0.0048	1/1			0.00527	
Copper	Total	mg/L	0.0048	0/1	0.0003	U		
Iron	Dissolved	mg/L	0.3	0/1			0.1	U
Iron	Total	mg/L	0.3	0/1	0.0233			
Lanthanum	Total	mg/L			0.001	U		
Lead	Dissolved	mg/L	0.00082	1/1			0.001	U
Lead	Total	mg/L	0.00082	1/1	0.003	U		
Lithium	Total	mg/L			0.00086			
Magnesium	Dissolved	mg/L					3.68	
Magnesium	Total	mg/L			3.6			
Manganese	Dissolved	mg/L	0.05	0/1			0.01	U
Manganese	Total	mg/L	0.05	0/1	0.00086			
Molybdenum	Total	mg/L			0.00046			
Nickel	Dissolved	mg/L	0.0134	0/1			0.002	U
Nickel	Total	mg/L	0.0134	0/1	0.0013			
Potassium	Dissolved	mg/L					1	U
Potassium	Total	mg/L			0.683			
Selenium	Dissolved	mg/L	0.01	0/1			0.001	U
Selenium	Total	mg/L	0.01	0/1	0.003	U		
Silver	Dissolved	mg/L	0.00012	1/1			0.001	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U		
Sodium	Dissolved	mg/L					5.57	
Sodium	Total	mg/L			5.95			
Thallium	Dissolved	mg/L	0.013	0/1			0.001	U
Thallium	Total	mg/L	0.013	0/1	0.002	U		
Vanadium	Dissolved	mg/L					0.005	U
Vanadium	Total	mg/L			0.0001	U		
Zinc	Dissolved	mg/L	0.043	0/1			0.00995	
Zinc	Total	mg/L	0.043	0/1	0.00053			
Major Ions								
Silica (SiO2)		mg/L			13.7			
Other								
Hardness[4]		mg/L			34.5			

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-20
Buck Creek
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/17/1999 Value	Surface Water 6/17/1999 Qualifier	Surface Water 1/24/2000 Value	Surface Water 1/24/2000 Qualifier	Surface Water 3/22/2000 Value	Surface Water 3/22/2000 Qualifier
Field Measurements														
Conductivity		µS/cm	72	97	84.5	2/2			97		72			
pH		su	7.62	8.16	7.87	3/3	6.5 to 8.5	0/3	8.16		7.62		7.87	
Temperature		deg C	10.5	19.7	15.1	2/2			19.7		10.5			
Metals														
Aluminum	Dissolved	mg/L	0.1	U	0.184	0.117	1/2				0.184		0.1	U
Aluminum	Total	mg/L	0.071		0.071	0.071	1/1		0.071					
Antimony	Dissolved	mg/L	0.001	U	0.003	U	0.002	U	0/2	0.146	0/2		0.003	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.146	0/1	0.003	U			
Arsenic	Dissolved	mg/L	0.001	U	0.002	U	0.0015	U	0/2	0.048	0/2		0.002	U	0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.048	0/1	0.002	U			
Barium	Dissolved	mg/L	0.00912		0.0104	0.00976	2/2		1	0/2		0.00912		0.0104	
Barium	Total	mg/L	0.0126		0.0126	0.0126	1/1		1	0/1	0.0126				
Beryllium	Dissolved	mg/L	0.001	U	0.00003		0.00027	1/2	0.0053	0/2		0.00003		0.001	U
Beryllium	Total	mg/L	4.9E-05		4.9E-05	4.9E-05	1/1		0.0053	0/1	0.000049				
Cadmium	Dissolved	mg/L	0.0001	U	0.001	U	0.00055	U	0/2	0.00046	1/2		0.0001	U	0.001	U
Cadmium	Total	mg/L	0.0001	U	0.0001	U	0.0001	U	0/1	0.00046	0/1	0.0001	U			
Calcium	Dissolved	mg/L	5.05		5.21	5.13	2/2					5.05		5.21	
Calcium	Total	mg/L	7.27		7.27	7.27	1/1				7.27				
Chromium	Dissolved	mg/L	0.001	U	0.00112		0.00081	1/2	0.011	0/2		0.00112		0.001	U
Chromium	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.011	0/1	0.0002	U			
Cobalt	Dissolved	mg/L	0.002	U	0.00038		0.00069	1/2				0.00038		0.002	U
Cobalt	Total	mg/L	0.00034		0.00034	0.00034	1/1				0.00034				
Copper	Dissolved	mg/L	0.002	U	0.00444		0.00272	1/2	0.0044	1/2		0.00444		0.002	U
Copper	Total	mg/L	0.00204		0.00204	0.00204	1/1		0.0044	0/1	0.00204				
Iron	Dissolved	mg/L	0.1	U	0.273		0.1615	1/2	0.3	0/2		0.273		0.1	U
Iron	Total	mg/L	0.0216		0.0216	0.0216	1/1		0.3	0/1	0.0216				
Lanthanum	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U		
Lanthanum	Total	mg/L	0.001	U	0.001	U	0.001	U	0/1		0.001	U			
Lead	Dissolved	mg/L	0.001	U	0.003	U	0.002	U	0/2	0.00073	2/2		0.003	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.00073	1/1	0.003	U			
Lithium	Dissolved	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1				0.0004	U		
Lithium	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U			
Magnesium	Dissolved	mg/L	2.46		3.62	3.04	2/2					3.62		2.46	
Magnesium	Total	mg/L	4.26		4.26	4.26	1/1				4.26				
Manganese	Dissolved	mg/L	0.01	U	0.00614		0.00557	1/2	0.05	0/2		0.00614		0.01	U
Manganese	Total	mg/L	0.00359		0.00359	0.00359	1/1		0.05	0/1	0.00359				
Molybdenum	Dissolved	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U		
Molybdenum	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1		0.0004	U			
Nickel	Dissolved	mg/L	0.002	U	0.00297		0.00199	1/2	0.0134	0/2		0.00297		0.002	U
Nickel	Total	mg/L	0.00305		0.00305	0.00305	1/1		0.0134	0/1	0.00305				
Potassium	Dissolved	mg/L	1	U	0.32		0.41	1/2				0.32		1	U
Potassium	Total	mg/L	0.993		0.993	0.993	1/1				0.993				
Selenium	Dissolved	mg/L	0.001	U	0.003	U	0.002	U	0/2	0.01	0/2		0.003	U	0.001	U
Selenium	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.01	0/1	0.003	U			
Silver	Dissolved	mg/L	0.0002	U	0.001	U	0.0006	U	0/2	0.00012	2/2		0.0002	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.00012	1/1	0.0002	U			
Sodium	Dissolved	mg/L	2.82		3.05	2.935	2/2					3.05		2.82	
Sodium	Total	mg/L	4.22		4.22	4.22	1/1				4.22				
Thallium	Dissolved	mg/L	0.001	U	0.002	U	0.0015	U	0/2	0.013	0/2		0.002	U	0.001	U
Thallium	Total	mg/L	0.0024		0.0024	0.0024	1/1		0.013	0/1	0.0024				
Vanadium	Dissolved	mg/L	0.005	U	0.00115		0.00183	1/2				0.00115		0.005	U
Vanadium	Total	mg/L	0.00068		0.00068	0.00068	1/1				0.00068				
Zinc	Dissolved	mg/L	0.005	U	0.0136		0.00805	1/2	0.040	0/2		0.0136		0.005	U
Zinc	Total	mg/L	0.00321		0.00321	0.00321	1/1		0.040	0/1	0.00321				
Other														
Hardness[4]		mg/L	27.5		35.7	31.6	2/2				35.7		27.5	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-21
Location C3
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/17/1999 Value	Surface Water 6/17/1999 Qualifier	Surface Water 10/4/1999 Value	Surface Water 10/4/1999 Qualifier	Surface Water 1/24/2000 Value	Surface Water 1/24/2000 Qualifier	Surface Water 3/22/2000 Value	Surface Water 3/22/2000 Qualifier
Field Measurements																
Conductivity		µS/cm	41	100	79	3/3			100		96		41			
Flow		gpm	951.5	61741.1	31346.3	2/2			61741.1		951.5					
pH		su	7.68	8.05	7.88	4/4	6.5 to 8.5	0/4	8.05		7.77		7.68		7.99	
Temperature		deg C	11.2	18.3	14.1333	3/3			18.3		12.9		11.2			
Metals																
Aluminum	Dissolved	mg/L	0.1	U	0.129	0.07933	2/3				0.059		0.129		0.1	U
Aluminum	Total	mg/L	0.053		0.053	0.053	1/1		0.053							
Antimony	Dissolved	mg/L	0.001	U	0.003	U	0.00233	U	0/3	0.146	0/3		0.003	U	0.003	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.146	0/1	0.003	U					
Arsenic	Dissolved	mg/L	0.001	U	0.002		0.00117		1/3	0.048	0/3		0.002	U	0.002		0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.048	0/1	0.002	U					
Barium	Dissolved	mg/L	0.00851		0.0107		0.00974		3/3	1	0/3		0.0107		0.00851		0.01	
Barium	Total	mg/L	0.0139		0.0139		0.0139		1/1	1	0/1	0.0139						
Beryllium	Dissolved	mg/L	0.00001	U	2.7E-05		0.00018		1/3	0.0053	0/3		0.00001	U	0.000027		0.001	U
Beryllium	Total	mg/L	0.00001	U	0.00001	U	0.00001	U	0/1	0.0053	0/1	0.00001	U					
Cadmium	Dissolved	mg/L	0.0001	U	0.001	U	0.0004	U	0/3	0.00048	1/3		0.0001	U	0.0001	U	0.001	U
Cadmium	Total	mg/L	0.00037		0.00037		0.00037		1/1	0.00048	0/1	0.00037						
Calcium	Dissolved	mg/L	4.1		8.25		6.07333		3/3				8.25		4.1		5.87	
Calcium	Total	mg/L	8.18		8.18		8.18		1/1			8.18						
Chromium	Dissolved	mg/L	0.0002	U	0.00082		0.00047		1/3	0.011	0/3		0.0002	U	0.00082		0.001	U
Chromium	Total	mg/L	0.00051		0.00051		0.00051		1/1	0.011	0/1	0.00051						
Cobalt	Dissolved	mg/L	0.0002	U	0.00051		0.00054		1/3				0.0002	U	0.00051		0.002	U
Cobalt	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1			0.0002	U					
Copper	Dissolved	mg/L	0.0003	U	0.00297		0.00198		2/3	0.0047	0/3		0.0003	U	0.00297		0.00282	
Copper	Total	mg/L	0.0009		0.0009		0.0009		1/1	0.0047	0/1	0.0009						
Iron	Dissolved	mg/L	0.1	U	0.2		0.1089		2/3	0.3	0/3		0.0767		0.2		0.1	U
Iron	Total	mg/L	0.0275		0.0275		0.0275		1/1	0.3	0/1	0.0275						
Lanthanum	Dissolved	mg/L	0.001	U	0.0013		0.0009		1/2				0.0013		0.001	U		
Lanthanum	Total	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U					
Lead	Dissolved	mg/L	0.001	U	0.003	U	0.00233	U	0/3	0.00079	3/3		0.003	U	0.003	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.00079	1/1	0.003	U					
Lithium	Dissolved	mg/L	0.0001	U	0.00458		0.00232		1/2				0.00458		0.0001	U		
Lithium	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U					
Magnesium	Dissolved	mg/L	2.57		4.81		3.61333		3/3				4.81		2.57		3.46	
Magnesium	Total	mg/L	4.64		4.64		4.64		1/1			4.64						
Manganese	Dissolved	mg/L	0.01	U	0.00456		0.00346		2/3	0.05	0/3		0.00083		0.00456		0.01	U
Manganese	Total	mg/L	0.00172		0.00172		0.00172		1/1	0.05	0/1	0.00172						
Molybdenum	Dissolved	mg/L	0.0004	U	0.00068		0.00044		1/2				0.0004	U	0.00068			
Molybdenum	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U					
Nickel	Dissolved	mg/L	0.002	U	0.00225		0.00156		2/3	0.0134	0/3		0.00142		0.00225		0.002	U
Nickel	Total	mg/L	0.00179		0.00179		0.00179		1/1	0.0134	0/1	0.00179						
Potassium	Dissolved	mg/L	1	U	0.731		0.49933		2/3				0.731		0.267		1	U
Potassium	Total	mg/L	0.716		0.716		0.716		1/1			0.716						
Selenium	Dissolved	mg/L	0.001	U	0.003	U	0.00233	U	0/3	0.01	0/3		0.003	U	0.003	U	0.001	U
Selenium	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.01	0/1	0.003	U					
Silver	Dissolved	mg/L	0.0002	U	0.001	U	0.00047	U	0/3	0.00012	3/3		0.0002	U	0.0002	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.00012	1/1	0.0002	U					
Sodium	Dissolved	mg/L	2.63		3.96		3.17		3/3				3.96		2.63		2.92	
Sodium	Total	mg/L	4.58		4.58		4.58		1/1			4.58						
Thallium	Dissolved	mg/L	0.001	U	0.002	U	0.00167	U	0/3	0.013	0/3		0.002	U	0.002	U	0.001	U
Thallium	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.013	0/1	0.002	U					
Vanadium	Dissolved	mg/L	0.005	U	0.00075		0.00123		2/3				0.00043		0.00075		0.005	U
Vanadium	Total	mg/L	0.00068		0.00068		0.00068		1/1			0.00068						
Zinc	Dissolved	mg/L	0.0005	U	0.00816		0.00538		2/3	0.042	0/3		0.0005	U	0.00774		0.00816	
Zinc	Total	mg/L	0.00267		0.00267		0.00267		1/1	0.042	0/1	0.00267						
Other																
Hardness[4]		mg/L	20.8		40.4		33.5667		3/3			39.5		40.4		20.8		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-22
Location C4
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/21/1999		Surface Water 10/7/1999	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier
Field Measurements												
Flow		gpm	390.5	395.0	392.7	2/2			390.5		395.0	
pH		su	7.53	7.71	7.62	2/2	6.5 to 8.5	0/2	7.53		7.71	
Metals												
Aluminum	Total	mg/L	0.012	0.069	0.0405	2/2			0.069		0.012	
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.146	0/2	0.003 U		0.003 U	
Arsenic	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.048	0/2	0.002 U		0.002 U	
Barium	Total	mg/L	0.0254	0.0317	0.02855	2/2	1	0/2	0.0254		0.0317	
Beryllium	Total	mg/L	0.00001 U	0.00001 U	0.00001 U	0/2	0.0053	0/2	0.00001 U		0.00001 U	
Boron		mg/L	0.0474	0.0474	0.0474	1/1					0.0474	
Cadmium	Total	mg/L	0.0001 U	0.0001 U	0.0001 U	0/2	0.00085	0/2	0.0001 U		0.0001 U	
Calcium	Total	mg/L	15.9	17.9	16.9	2/2			15.9		17.9	
Chromium	Total	mg/L	0.00022	0.00075	0.00049	2/2	0.011	0/2	0.00075		0.00022	
Cobalt	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2			0.0002 U		0.0002 U	
Copper	Total	mg/L	0.0003 U	0.0003 U	0.0003 U	0/2	0.0087	0/2	0.0003 U		0.0003 U	
Iron	Total	mg/L	0.008	0.0163	0.01215	2/2	0.3	0/2	0.0163		0.008	
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/2			0.001 U		0.001 U	
Lead	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.002	2/2	0.003 U		0.003 U	
Lithium	Total	mg/L	0.0004 U	0.00364	0.00192	1/2			0.0004 U		0.00364	
Magnesium	Total	mg/L	6.32	7.08	6.7	2/2			6.32		7.08	
Manganese	Total	mg/L	0.00126	0.0016	0.00143	2/2	0.05	0/2	0.0016		0.00126	
Molybdenum	Total	mg/L	0.0004 U	0.00066	0.00043	1/2			0.00066		0.0004 U	
Nickel	Total	mg/L	0.0002 U	0.00096	0.00053	1/2	0.0134	0/2	0.0002 U		0.00096	
Potassium	Total	mg/L	0.813	1.63	1.2215	2/2			1.63		0.813	
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.01	0/2	0.003 U		0.003 U	
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.00012	2/2	0.0002 U		0.0002 U	
Sodium	Total	mg/L	10.6	13.5	12.05	2/2			10.6		13.5	
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.013	0/2	0.002 U		0.002 U	
Vanadium	Total	mg/L	0.00029	0.00044	0.00037	2/2			0.00044		0.00029	
Zinc	Total	mg/L	0.0005 U	0.00119	0.00072	1/2	0.078	0/2	0.0005 U		0.00119	
Major Ions												
Silica (SiO2)		mg/L	16.5	16.5	16.5	1/1					16.5	
Other												
Hardness[4]		mg/L	65.7	73.7	69.7	2/2			65.7		73.7	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-23
Catching Creek
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/22/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Parameters						
Flow		gpm			246.8565	
pH		su	6.5 to 8.5	0/1	7.06	
Metals						
Aluminum	Total	mg/L			0.032	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.112	
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U
Cadmium	Total	mg/L	0.00071	0/1	0.0001	U
Calcium	Total	mg/L			15.5	
Chromium	Total	mg/L	0.011	0/1	0.00067	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0071	0/1	0.0003	U
Iron	Total	mg/L	0.3	0/1	0.0229	
Lanthanum	Total	mg/L			0.0018	
Lead	Total	mg/L	0.0015	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			3.99	
Manganese	Total	mg/L	0.05	0/1	0.00044	
Molybdenum	Total	mg/L			0.00055	
Nickel	Total	mg/L	0.0134	0/1	0.0002	U
Potassium	Total	mg/L			1.67	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			12.5	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.00043	
Zinc	Total	mg/L	0.064	0/1	0.0005	U
Other						
Hardness[2]		mg/L			55.1	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-24
Cattle Creek
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/18/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
pH		su	6.5 to 8.5	0/1	7.53	
Metals						
Aluminum	Total	mg/L			0.083	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.00698	
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U
Cadmium	Total	mg/L	0.0009	0/1	0.0001	U
Calcium	Total	mg/L			18.5	
Chromium	Total	mg/L	0.011	0/1	0.00059	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0092	0/1	0.0003	U
Iron	Total	mg/L	0.3	0/1	0.0263	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0022	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			6.83	
Manganese	Total	mg/L	0.05	0/1	0.00438	
Molybdenum	Total	mg/L			0.00077	
Nickel	Total	mg/L	0.0134	0/1	0.0002	U
Potassium	Total	mg/L			1.48	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			7.44	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.00095	
Zinc	Total	mg/L	0.082	0/1	0.00159	
Other						
Hardness[2]		mg/L			74.2	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-25
Location CY1
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/18/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
pH		su	6.5 to 8.5	0/1	7.57	
Metals						
Aluminum	Total	mg/L			0.074	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.00472	
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U
Cadmium	Total	mg/L	0.0008	0/1	0.0001	U
Calcium	Total	mg/L			16.3	
Chromium	Total	mg/L	0.011	0/1	0.00057	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0081	0/1	0.0003	U
Iron	Total	mg/L	0.3	0/1	0.0153	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0018	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			5.64	
Manganese	Total	mg/L	0.05	0/1	0.00191	
Molybdenum	Total	mg/L			0.00051	
Nickel	Total	mg/L	0.0134	0/1	0.0002	U
Potassium	Total	mg/L			0.977	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			5.68	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.00093	
Zinc	Total	mg/L	0.072	0/1	0.00091	
Other						
Hardness[2]		mg/L			63.8	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-26
Location CY2
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/22/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurement						
pH		su	6.5 to 8.5	0/1	7.49	
Metals						
Aluminum	Total	mg/L			0.046	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.0356	
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U
Cadmium	Total	mg/L	0.00066	0/1	0.0001	U
Calcium	Total	mg/L			9.99	
Chromium	Total	mg/L	0.011	0/1	0.00146	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0066	0/1	0.0003	U
Iron	Total	mg/L	0.3	0/1	0.0236	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0013	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			6.25	
Manganese	Total	mg/L	0.05	0/1	0.00047	
Molybdenum	Total	mg/L			0.0004	U
Nickel	Total	mg/L	0.0134	0/1	0.0002	U
Potassium	Total	mg/L			1.78	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			9.44	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.00058	
Zinc	Total	mg/L	0.06	0/1	0.00082	
Other						
Hardness[2]		mg/L			50.6	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-27
Iron Mt. Creek
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/15/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Flow		gpm			233.3916	
pH		su	6.5 to 8.5	0/1	7.95	
Metals						
Aluminum	Total	mg/L			0.023	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.0205	
Beryllium	Total	mg/L	0.0053	0/1	0.000017	
Cadmium	Total	mg/L	0.0012	1/1	0.00277	
Calcium	Total	mg/L			24.7	
Chromium	Total	mg/L	0.011	0/1	0.00092	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.012	1/1	0.0404	
Iron	Total	mg/L	0.3	0/1	0.0055	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0033	0/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			9.91	
Manganese	Total	mg/L	0.05	0/1	0.00533	
Molybdenum	Total	mg/L			0.0004	U
Nickel	Total	mg/L	0.0134	0/1	0.00305	
Potassium	Total	mg/L			0.582	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			5.06	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.00049	
Zinc	Total	mg/L	0.11	1/1	0.414	
Other						
Hardness[2]		mg/L			103	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.
2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-28
Location M1.3
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/15/1999 Value	Surface Water 6/15/1999 Qualifier	Surface Water 10/5/1999 Value	Surface Water 10/5/1999 Qualifier	Surface Water 10/26/1999 Value	Surface Water 10/26/1999 Qualifier	Surface Water 1/24/2000 Value	Surface Water 1/24/2000 Qualifier	Surface Water 3/21/2000 Value	Surface Water 3/21/2000 Qualifier	Surface Water 7/18/2000 Value	Surface Water 7/18/2000 Qualifier	Surface Water 2/22/2001 Value	Surface Water 2/22/2001 Qualifier
Field Measurements																						
Conductivity		µS/cm	70	70	70	1/1									70							
Conductivity		µS/cm	68	176	126	3/3			134		176				68							
Flow		gpm	991.9	13330.3	5882.7	3/3			3325.8		991.9						13330.3					
pH		su	7.47	7.82	7.72	5/5	6.5 to 8.5	0/5	7.8		7.82		7.72		7.47		7.71					
Temperature		deg C	9	16.2	11.25	4/4			16.2		10		9		9.8							
Metals																						
Aluminum	Dissolved	mg/L	0.1 U	0.287	0.08213	4/8					0.034		0.036		0.287		0.1 U		0.1 U		0.1	
Aluminum	Total	mg/L	0.068	0.068	0.068	1/1			0.068													
Antimony	Dissolved	mg/L	0.001 U	0.005 U	0.00225 U	0/8	0.146	0/8			0.003 U		0.003 U		0.003 U		0.001 U		0.005 U		0.001 U	
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.146	0/1	0.003 U													
Arsenic	Dissolved	mg/L	0.001 U	0.025	0.0051	2/7	0.048	0/7			0.002 U		0.0072		0.002 U		0.001 U				0.001 U	
Arsenic	Total	mg/L	0.002 U	0.002 U	0.002 U	0/1	0.048	0/1	0.002 U													
Barium	Dissolved	mg/L	0.002 U	0.0322	0.01804	7/8	1	0/8			0.0296		0.0322		0.012		0.0139		0.0251		0.0154	
Barium	Total	mg/L	0.0205	0.0205	0.0205	1/1	1	0/1	0.0205													
Beryllium	Dissolved	mg/L	0.00001 U	0.00021	0.00034	2/8	0.0053	0/8			0.00001 U		0.000209		0.000033		0.001 U		0.001 U		0.001 U	
Beryllium	Total	mg/L	0.00002	0.00002	0.00002	1/1	0.0053	0/1	0.00002													
Boron		mg/L	0.0248	0.0248	0.0248	1/1					0.0248											
Cadmium	Dissolved	mg/L	0.0001 U	0.0006	0.00043	2/8	0.0007	5/8			0.0003		0.0001 U		0.0006		0.001 U		0.001 U		0.001 U	
Cadmium	Total	mg/L	0.00037	0.00037	0.00037	1/1	0.0007	0/1	0.00037													
Calcium	Dissolved	mg/L	5.58	18.3	12.3313	8/8					18.3		16.8		5.58		7.33		17.4		10.3	
Calcium	Total	mg/L	12.5	12.5	12.5	1/1			12.5													
Chromium	Dissolved	mg/L	0.0002 U	0.00426	0.00098	2/8	0.011	0/8			0.0002 U		0.00426		0.00095		0.001 U		0.001 U		0.001 U	
Chromium	Total	mg/L	0.00052	0.00052	0.00052	1/1	0.011	0/1	0.00052													
Cobalt	Dissolved	mg/L	0.001 U	0.00289	0.001	3/8					0.0002		0.00289		0.00044		0.002 U		0.002 U		0.002 U	
Cobalt	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1			0.0002 U													
Copper	Dissolved	mg/L	0.00259	0.0337	0.01332	8/8	0.0069	5/8			0.00259		0.0167		0.0337		0.0195		0.00697		0.00501	
Copper	Total	mg/L	0.00684	0.00684	0.00684	1/1	0.0069	0/1	0.00684													
Iron	Dissolved	mg/L	0.1 U	0.351	0.7156	4/8	0.3	2/8			0.0141		0.0767		0.351		0.1 U		0.1 U		0.133	
Iron	Total	mg/L	0.0267	0.0267	0.0267	1/1	0.3	0/1	0.0267													
Lanthanum	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/3					0.001 U		0.001 U		0.001 U							
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/1			0.001 U													
Lead	Dissolved	mg/L	0.001 U	0.0062	0.00146	1/8	0.0014	3/8			0.003 U		0.0062		0.003 U		0.001 U		0.001 U		0.001 U	
Lead	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.0014	1/1	0.003 U													
Lithium	Dissolved	mg/L	0.0004 U	0.00613	0.00344	2/3					0.00613		0.004		0.0004 U							
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1			0.0004 U													
Magnesium	Dissolved	mg/L	2.85	6.25	4.71	8/8					6.25		5.99		2.85		3.05		6.24		4.25	
Magnesium	Total	mg/L	4.75	4.75	4.75	1/1			4.75													
Manganese	Dissolved	mg/L	0.01 U	0.0108	0.00569	3/8	0.05	0/8			0.001		0.0108		0.0087		0.01 U		0.01 U		0.01 U	
Manganese	Total	mg/L	0.00358	0.00358	0.00358	1/1	0.05	0/1	0.00358													
Molybdenum	Dissolved	mg/L	0.0004 U	0.00215	0.00085	1/3					0.0004 U		0.00215		0.0004 U							
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1			0.0004 U													
Nickel	Dissolved	mg/L	0.002 U	0.00382	0.0015	3/7	0.0134	0/7			0.00058		0.00382		0.00207		0.002 U		0.002 U		0.002 U	
Nickel	Total	mg/L	0.00097	0.00097	0.00097	1/1	0.0134	0/1	0.00097													
Potassium	Dissolved	mg/L	1 U	1.28	0.58838	3/8					0.625		1.28		0.302		1 U		1 U		1 U	
Potassium	Total	mg/L	0.454	0.454	0.454	1/1			0.454													
Selenium	Dissolved	mg/L	0.001 U	0.0035	0.00113	1/8	0.01	0/8			0.003 U		0.0035		0.003 U		0.001 U		0.001 U		0.001 U	
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.01	0/1	0.003 U													
Silver	Dissolved	mg/L	0.0002 U	0.001 U	0.0007 U	0/8	0.00012	8/8			0.0002 U		0.0002 U		0.0002 U		0.001 U		0.001 U		0.001 U	
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.00012	1/1	0.0002 U													
Sodium	Dissolved	mg/L	2.91	7.62	5.02875	8/8					7.16		7.62		2.91		3.08		6.34		4.23	
Sodium	Total	mg/L	5.48	5.48	5.48	1/1			5.48													
Thallium	Dissolved	mg/L	0.001 U	0.0119	0.00205	1/8	0.013	0/8			0.002 U		0.0119		0.002 U		0.001 U		0.001 U		0.001 U	
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/1	0.013	0/1	0.002 U													
Vanadium	Dissolved	mg/L	0.005 U	0.0018	0.00197	3/8					0.00021		0.0018		0.00127		0.005 U		0.005 U		0.005 U	
Vanadium	Total	mg/L	0.00065	0.00065	0.00065	1/1			0.00065													
Zinc	Dissolved	mg/L	0.005 U	0.175	0.07879	7/8	0.063	3/8			0.0234		0.0563		0.156		0.175		0.0477		0.0544	
Zinc	Total	mg/L	0.0658	0.0658	0.0658	1/1	0.063	1/1	0.0658													

Table A-29
Location M7.9
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/15/1999 Value	Surface Water 6/15/1999 Qualifier	Surface Water 10/5/1999 Value	Surface Water 10/5/1999 Qualifier	Surface Water 10/26/1999 Value	Surface Water 10/26/1999 Qualifier	Surface Water 1/24/2000 Value	Surface Water 1/24/2000 Qualifier	Surface Water 3/21/2000 Value	Surface Water 3/21/2000 Qualifier	Surface Water 7/18/2000 Value	Surface Water 7/18/2000 Qualifier	Surface Water 2/22/2001 Value	Surface Water 2/22/2001 Qualifier
Major Ions																						
Alkalinity		mg/L	21	48	34.5	2/2					48				21							
Ammonia as N		mg/L as N	0.02	U	0.05	U	0.03	U	0/3				0.02	U			0.02	U	0.05	U				
Chloride		mg/L	1.7		20.7		10.5		3/3	230	0/3		9.1				1.7		20.7					
Fluoride		mg/L	0.1	U	0.5	U	0.23333	U	0/3				0.1	U			0.1	U	0.5	U				
Nitrate & Nitrite as N		mg/L	0.005	U	0.0521		0.0273		1/2				0.005	U			0.0521							
Nitrate as N		mg/L as N	0.1	U	0.1	U	0.1	U	0/1										0.1	U				
Nitrite as N		mg/L as N	0.1	U	0.1	U	0.1	U	0/1										0.1	U				
Orthophosphate as P		mg/L as P	0.005	U	0.0071		0.0048		1/2								0.005	U	0.0071					
Phosphorus		mg/L	0.035	U	0.035	U	0.035	U	0/1										0.035	U				
Silica (SiO2)		mg/L	18.3		137		77.65		2/2				18.3						137					
Sulfate		mg/L	7.15		22.6		15.5167		3/3				22.6				7.15		16.8					
Total Phosphate as P		mg/L	0.02		0.02		0.02		1/1								0.02							
Other																						
Dissolved Organic Carbon		mg/L	3	U	2		1.75		1/2								2		3	U				
Hardness[4]		mg/L	25.7		71.5		53.625		4/4				50.8		71.5		66.5		25.7					
Total Organic Carbon		mg/L	3	U	3		1.83333		2/3						1				3		3	U		
Total Suspended Solids		mg/L	1	U	2		2.5		1/3						1	U			2		10	U		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-29
Location M7.9
Historical Results

Analyte	Analyte 2	Unit	Surface Water 4/30/2001 Value	Surface Water 4/30/2001 Qualifier	Surface Water 2/23/2004 Value	Surface Water 2/23/2004 Qualifier
Field Measurements						
Conductivity		µS/cm				
Conductivity		µS/cm				
Flow		gpm				
pH		su				
Temperature		deg C				
Metals						
Aluminum	Dissolved	mg/L	0.1	U	0.1	U
Aluminum	Total	mg/L				
Antimony	Dissolved	mg/L	0.001	U	0.001	U
Antimony	Total	mg/L				
Arsenic	Dissolved	mg/L	0.025		0.001	U
Arsenic	Total	mg/L				
Barium	Dissolved	mg/L	0.002	U	0.0151	
Barium	Total	mg/L				
Beryllium	Dissolved	mg/L	0.001	U	0.001	U
Beryllium	Total	mg/L				
Boron		mg/L				
Cadmium	Dissolved	mg/L	0.001	U	0.001	U
Cadmium	Total	mg/L				
Calcium	Dissolved	mg/L	14.9		8.04	
Calcium	Total	mg/L				
Chromium	Dissolved	mg/L	0.001	U	0.001	U
Chromium	Total	mg/L				
Cobalt	Dissolved	mg/L	0.002	U	0.001	U
Cobalt	Total	mg/L				
Copper	Dissolved	mg/L	0.00576		0.0163	
Copper	Total	mg/L				
Iron	Dissolved	mg/L	0.1	U	10	U
Iron	Total	mg/L				
Lanthanum	Dissolved	mg/L				
Lanthanum	Total	mg/L				
Lead	Dissolved	mg/L	0.001	U	0.001	U
Lead	Total	mg/L				
Lithium	Dissolved	mg/L				
Lithium	Total	mg/L				
Magnesium	Dissolved	mg/L	5.56		3.49	
Magnesium	Total	mg/L				
Manganese	Dissolved	mg/L	0.01	U	0.01	U
Manganese	Total	mg/L				
Molybdenum	Dissolved	mg/L				
Molybdenum	Total	mg/L				
Nickel	Dissolved	mg/L			0.002	U
Nickel	Total	mg/L				
Potassium	Dissolved	mg/L	1	U	1	U
Potassium	Total	mg/L				
Selenium	Dissolved	mg/L	0.001	U	0.001	U
Selenium	Total	mg/L				
Silver	Dissolved	mg/L	0.001	U	0.001	U
Silver	Total	mg/L				
Sodium	Dissolved	mg/L	5.28		3.61	
Sodium	Total	mg/L				
Thallium	Dissolved	mg/L	0.001	U	0.001	U
Thallium	Total	mg/L				
Vanadium	Dissolved	mg/L	0.005	U	0.005	U
Vanadium	Total	mg/L				
Zinc	Dissolved	mg/L	0.005	U	0.115	
Zinc	Total	mg/L				

Table A-29
Location M7.9
Historical Results

Analyte	Analyte 2	Unit	Surface Water 4/30/2001 Value	Surface Water 4/30/2001 Qualifier	Surface Water 2/23/2004 Value	Surface Water 2/23/2004 Qualifier
Major Ions						
Alkalinity		mg/L				
Ammonia as N		mg/L as N				
Chloride		mg/L				
Fluoride		mg/L				
Nitrate & Nitrite as N		mg/L				
Nitrate as N		mg/L as N				
Nitrite as N		mg/L as N				
Orthophosphate as P		mg/L as P				
Phosphorus		mg/L				
Silica (SiO2)		mg/L				
Sulfate		mg/L				
Total Phosphate as P		mg/L				
Other						
Dissolved Organic Carbon		mg/L				
Hardness[4]		mg/L				
Total Organic Carbon		mg/L				
Total Suspended Solids		mg/L				

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadr

Table A-29
Location M7.9
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/15/1999 Value	Surface Water 6/15/1999 Qualifier	Surface Water 10/5/1999 Value	Surface Water 10/5/1999 Qualifier	Surface Water 10/26/1999 Value	Surface Water 10/26/1999 Qualifier	Surface Water 1/24/2000 Value	Surface Water 1/24/2000 Qualifier	Surface Water 3/21/2000 Value	Surface Water 3/21/2000 Qualifier	Surface Water 7/18/2000 Value	Surface Water 7/18/2000 Qualifier	Surface Water 2/22/2001 Value	Surface Water 2/22/2001 Qualifier
Field Measurements																						
Conductivity		µS/cm	66	66	66	1/1									66							
Conductivity		µS/cm	63	234	152.333	3/3			160		234				63							
Flow		gpm	956.0	17989.1	7725.9	3/3			4232.5		956.0						17989.1					
pH		su	7.5	7.78	7.65	5/5	6.5 to 8.5	0/5	7.78		7.65		7.62		7.5		7.76					
Temperature		deg C	9	16.3	11.925	4/4			16.3		10		9		12.4							
Metals																						
Aluminum	Dissolved	mg/L	0.1 U	0.33	0.09788	5/8					0.027		0.019		0.33		0.1 U		0.1 U		0.1	
Aluminum	Total	mg/L	0.025	0.025	0.025	1/1			0.025													
Antimony	Dissolved	mg/L	0.001 U	0.005 U	0.00225 U	0/8	0.146	0/8			0.003 U		0.003 U		0.003 U		0.001 U		0.005 U		0.001 U	
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.146	0/1	0.003 U													
Arsenic	Dissolved	mg/L	0.001 U	0.007	0.00157	1/7	0.048	0/7			0.002 U		0.007		0.002 U		0.001 U				0.001 U	
Arsenic	Total	mg/L	0.002 U	0.002 U	0.002 U	0/1	0.048	0/1	0.002 U													
Barium	Dissolved	mg/L	0.0211	0.401	0.1167	8/8	1	0/8			0.11		0.18		0.0211		0.0297		0.0918		0.401	
Barium	Total	mg/L	0.0617	0.0617	0.0617	1/1	1	0/1	0.0617													
Beryllium	Dissolved	mg/L	0.00001 U	0.0002	0.00034	2/8	0.0053	0/8			0.00001 U		0.000201		0.000021		0.001 U		0.001 U		0.001 U	
Beryllium	Total	mg/L	1.8E-05	1.8E-05	1.8E-05	1/1	0.0053	0/1	0.000018													
Boron	Unknown	mg/L	0.0526	0.0526	0.0526	1/1					0.0526											
Cadmium	Dissolved	mg/L	0.0001 U	0.00035	0.00039	2/8	0.00074	5/8			0.00022		0.0001 U		0.00035		0.001 U		0.001 U		0.001 U	
Cadmium	Total	mg/L	0.00026	0.00026	0.00026	1/1	0.00074	0/1	0.00026													
Calcium	Dissolved	mg/L	5.21	23.8	13.5063	8/8					19.9		23.8		5.21		7.36		18.7		10.6	
Calcium	Total	mg/L	12.8	12.8	12.8	1/1			12.8													
Chromium	Dissolved	mg/L	0.0002 U	0.00421	0.00096	2/8	0.011	0/8			0.0002 U		0.00421		0.00083		0.001 U		0.001 U		0.001 U	
Chromium	Total	mg/L	0.00026	0.00026	0.00026	1/1	0.011	0/1	0.00026													
Cobalt	Dissolved	mg/L	0.001 U	0.00243	0.00096	3/8					0.00041		0.00243		0.00032		0.002 U		0.002 U		0.002 U	
Cobalt	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1			0.0002 U													
Copper	Dissolved	mg/L	0.00144	0.0243	0.00986	8/8	0.0075	4/8			0.00144		0.0121		0.0243		0.014		0.00642		0.00433	
Copper	Total	mg/L	0.00507	0.00507	0.00507	1/1	0.0075	0/1	0.00507													
Iron	Dissolved	mg/L	0.1 U	0.15	0.07931	5/8	0.3	0/8			0.0121		0.0804		0.103		0.1 U		0.1 U		0.139	
Iron	Total	mg/L	0.0186	0.0186	0.0186	1/1	0.3	0/1	0.0186													
Lanthanum	Dissolved	mg/L	0.001 U	0.0018	0.00093	1/3					0.001 U		0.0018		0.001 U							
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/1			0.001 U													
Lead	Dissolved	mg/L	0.001 U	0.0057	0.0014	1/8	0.0016	3/8			0.003 U		0.0057		0.003 U		0.001 U		0.001 U		0.001 U	
Lead	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.0016	1/1	0.003 U													
Lithium	Dissolved	mg/L	0.0016	0.0106	0.00728	3/3					0.0106		0.00964		0.0016							
Lithium	Total	mg/L	0.00237	0.00237	0.00237	1/1			0.00237													
Magnesium	Dissolved	mg/L	2.19	6.58	4.4325	8/8					5.88		6.58		2.19		2.9		5.9		3.98	
Magnesium	Total	mg/L	4.39	4.39	4.39	1/1			4.39													
Manganese	Dissolved	mg/L	0.01 U	0.00786	0.00497	3/8	0.05	0/8			0.00066		0.00786		0.00625		0.01 U		0.01 U		0.01 U	
Manganese	Total	mg/L	0.00275	0.00275	0.00275	1/1	0.05	0/1	0.00275													
Molybdenum	Dissolved	mg/L	0.0004 U	0.00164	0.00079	2/3					0.0004 U		0.00164		0.00052							
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1			0.0004 U													
Nickel	Dissolved	mg/L	0.002 U	0.00326	0.0013	3/7	0.0134	0/7			0.00068		0.00326		0.00116		0.002 U		0.002 U		0.002 U	
Nickel	Total	mg/L	0.00096	0.00096	0.00096	1/1	0.0134	0/1	0.00096													
Potassium	Dissolved	mg/L	1 U	1.27	0.60613	3/8					0.685		1.27		0.394		1 U		1 U		1 U	
Potassium	Total	mg/L	0.614	0.614	0.614	1/1			0.614													
Selenium	Dissolved	mg/L	0.001 U	0.0052	0.00134	1/8	0.01	0/8			0.003 U		0.0052		0.003 U		0.001 U		0.001 U		0.001 U	
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/1	0.01	0/1	0.003 U													
Silver	Dissolved	mg/L	0.0002 U	0.002 U	0.00093 U	0/8	0.00012	8/8			0.002 U		0.0002 U		0.0002 U		0.001 U		0.001 U		0.001 U	
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/1	0.00012	1/1	0.0002 U													
Sodium	Dissolved	mg/L	3.55	24.4	9.935	8/8					13.7		24.4		3.55		4.49		12.4		7.01	
Sodium	Total	mg/L	9.54	9.54	9.54	1/1			9.54													
Thallium	Dissolved	mg/L	0.001 U	0.0116	0.0024	2/8	0.013	0/8			0.0041		0.0116		0.002 U		0.001 U		0.001 U		0.001 U	
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/1	0.013	0/1	0.002 U													
Vanadium	Dissolved	mg/L	0.005 U	0.0018	0.00198	3/8					0.00014		0.0018		0.0014		0.005 U		0.005 U		0.005 U	
Vanadium	Total	mg/L	0.00041	0.00041	0.00041	1/1			0.00041													
Zinc	Dissolved	mg/L	0.00363	0.124	0.06292	8/8	0.067	4/8			0.00363		0.0377		0.104		0.124		0.0363		0.0443	
Zinc	Total	mg/L	0.0451	0.0451	0.0451	1/1	0.067	0/1	0.0451													

Table A-30
Location M9.8
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/15/1999		Surface Water 10/5/1999		Surface Water 10/26/1999		Surface Water 1/24/2000		Surface Water 3/21/2000		Surface Water 7/18/2000		Surface Water 2/22/2001	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																						
Alkalinity		mg/L	20	45	32.5	2/2					45				20							
Ammonia as N		mg/L as N	0.02 U	0.05 U	0.03 U	0/3					0.02 U				0.02 U		0.05 U					
Chloride		mg/L	2.9	30	18.5	3/3	230	0/3			30				2.9		22.6					
Fluoride		mg/L	0.1 U	0.5 U	0.23333 U	0/3					0.1 U				0.1 U		0.5 U					
Nitrate & Nitrite as N		mg/L as N	0.005 U	0.034	0.01825	1/2					0.005 U				0.034							
Nitrate as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1											0.1 U					
Nitrite as N		mg/L as N	0.1 U	0.1 U	0.1 U	0/1											0.1 U					
Orthophosphate as P		mg/L as P	0.0051	0.006	0.00555	2/2									0.006		0.0051					
Phosphorus		mg/L	0.035 U	0.035 U	0.035 U	0/1											0.035 U					
Silica (SiO2)		mg/L	17.4	124	70.7	2/2					17.4						124					
Sulfate		mg/L	5.14	18.9	10.7033	3/3					18.9				5.14		8.07					
Total Phosphate as P		mg/L as P	0.03	0.03	0.03	1/1									0.03							
Other																						
Dissolved Organic Carbon		mg/L	3 U	3	2.25	1/2									3		3 U					
Hardness[4]		mg/L	23.3	86.5	58.425	4/4			50.1		73.8		86.5		23.3							
Total Organic Carbon		mg/L	3 U	3	1.83333	2/3					1				3		3 U					
Total Suspended Solids		mg/L	1 U	2	2.5	1/3					1 U				2		10 U					

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-30
Location M9.8
Historical Results

Analyte	Analyte 2	Unit	Surface Water 4/30/2001 Value	Surface Water 4/30/2001 Qualifier	Surface Water 2/23/2004 Value	Surface Water 2/23/2004 Qualifier
Field Measurements						
Conductivity		µS/cm				
Conductivity		µS/cm				
Flow		gpm				
pH		su				
Temperature		deg C				
Metals						
Aluminum	Dissolved	mg/L	0.1	U	0.157	
Aluminum	Total	mg/L				
Antimony	Dissolved	mg/L	0.001	U	0.001	U
Antimony	Total	mg/L				
Arsenic	Dissolved	mg/L	0.001	U	0.001	U
Arsenic	Total	mg/L				
Barium	Dissolved	mg/L	0.0726		0.0274	
Barium	Total	mg/L				
Beryllium	Dissolved	mg/L	0.001	U	0.001	U
Beryllium	Total	mg/L				
Boron	Unknown	mg/L				
Cadmium	Dissolved	mg/L	0.001	U	0.001	U
Cadmium	Total	mg/L				
Calcium	Dissolved	mg/L	15		7.48	
Calcium	Total	mg/L				
Chromium	Dissolved	mg/L	0.001	U	0.001	U
Chromium	Total	mg/L				
Cobalt	Dissolved	mg/L	0.002	U	0.001	U
Cobalt	Total	mg/L				
Copper	Dissolved	mg/L	0.00481		0.0115	
Copper	Total	mg/L				
Iron	Dissolved	mg/L	0.1	U	0.15	
Iron	Total	mg/L				
Lanthanum	Dissolved	mg/L				
Lanthanum	Total	mg/L				
Lead	Dissolved	mg/L	0.001	U	0.001	U
Lead	Total	mg/L				
Lithium	Dissolved	mg/L				
Lithium	Total	mg/L				
Magnesium	Dissolved	mg/L	4.89		3.14	
Magnesium	Total	mg/L				
Manganese	Dissolved	mg/L	0.01	U	0.01	U
Manganese	Total	mg/L				
Molybdenum	Dissolved	mg/L				
Molybdenum	Total	mg/L				
Nickel	Dissolved	mg/L			0.002	U
Nickel	Total	mg/L				
Potassium	Dissolved	mg/L	1	U	1	U
Potassium	Total	mg/L				
Selenium	Dissolved	mg/L	0.001	U	0.001	U
Selenium	Total	mg/L				
Silver	Dissolved	mg/L	0.001	U	0.001	U
Silver	Total	mg/L				
Sodium	Dissolved	mg/L	9.64		4.29	
Sodium	Total	mg/L				
Thallium	Dissolved	mg/L	0.001	U	0.001	U
Thallium	Total	mg/L				
Vanadium	Dissolved	mg/L	0.005	U	0.005	U
Vanadium	Total	mg/L				
Zinc	Dissolved	mg/L	0.0778		0.0756	
Zinc	Total	mg/L				

Table A-30
Location M9.8
Historical Results

Analyte	Analyte 2	Unit	Surface Water 4/30/2001 Value	Surface Water 4/30/2001 Qualifier	Surface Water 2/23/2004 Value	Surface Water 2/23/2004 Qualifier
Major Ions						
Alkalinity		mg/L				
Ammonia as N		mg/L as N				
Chloride		mg/L				
Fluoride		mg/L				
Nitrate & Nitrite as N		mg/L as N				
Nitrate as N		mg/L as N				
Nitrite as N		mg/L as N				
Orthophosphate as P		mg/L as P				
Phosphorus		mg/L				
Silica (SiO2)		mg/L				
Sulfate		mg/L				
Total Phosphate as P		mg/L as P				
Other						
Dissolved Organic Carbon		mg/L				
Hardness[4]		mg/L				
Total Organic Carbon		mg/L				
Total Suspended Solids		mg/L				

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for

Table A-30
Location M9.8
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 7/18/2000	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Dissolved	mg/L			0.1	U
Antimony	Dissolved	mg/L	0.146	0/1	0.005	U
Arsenic	Dissolved	mg/L	0.048	0/1	0.001	U
Barium	Dissolved	mg/L	1	0/1	0.002	U
Beryllium	Dissolved	mg/L	0.0053	0/1	0.001	U
Cadmium	Dissolved	mg/L	No Hardness		0.001	U
Calcium	Dissolved	mg/L			0.1	U
Chromium	Dissolved	mg/L	0.011	0/1	0.00131	
Cobalt	Dissolved	mg/L			0.002	U
Copper	Dissolved	mg/L			0.00275	
Iron	Dissolved	mg/L	0.3	0/1	0.1	U
Lead	Dissolved	mg/L	No Hardness		0.001	U
Magnesium	Dissolved	mg/L			0.1	U
Manganese	Dissolved	mg/L	0.05	0/1	0.01	U
Nickel	Dissolved	mg/L	0.0134	0/1	0.002	U
Potassium	Dissolved	mg/L			1	U
Selenium	Dissolved	mg/L	0.01	0/1	0.001	U
Silver	Dissolved	mg/L	0.00012	1/1	0.001	U
Sodium	Dissolved	mg/L			1	U
Thallium	Dissolved	mg/L	0.013	0/1	0.001	U
Vanadium	Dissolved	mg/L			0.005	U
Zinc	Dissolved	mg/L	No Hardness		0.005	U

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-31
Martin Creek
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/16/1999 Value	Surface Water 6/16/1999 Qualifier	Surface Water 10/5/1999 Value	Surface Water 10/5/1999 Qualifier	Surface Water 10/26/1999 Value	Surface Water 10/26/1999 Qualifier	Surface Water 1/26/2000 Value	Surface Water 1/26/2000 Qualifier	Surface Water 3/22/2000 Value	Surface Water 3/22/2000 Qualifier
Field Measurements																		
Conductivity		µS/cm	61	109	85	2/2			109						61			
Flow		gpm	98.7	98.7	98.7	1/1			98.7									
pH		su	7.14	7.44	7.31	5/5	6.5 to 8.5	0/5	7.34		7.3		7.44		7.14		7.31	
Temperature		deg C	11	13.5	12	4/4			13.5		11		11		12.5			
Metals																		
Aluminum	Dissolved	mg/L	0.039	0.458	0.186	4/4					0.039		0.094		0.458		0.153	
Aluminum	Total	mg/L	0.084	0.084	0.084	1/1			0.084									
Antimony	Dissolved	mg/L	0.001	U	0.003	U	0.0025	U	0/4	0.146	0/4		0.003	U	0.003	U	0.003	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.146	0/1	0.003	U							
Arsenic	Dissolved	mg/L	0.001	U	0.0071		0.0024		1/4	0.048	0/4		0.002	U	0.0071		0.002	U	0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.048	0/1	0.002	U							
Barium	Dissolved	mg/L	0.0129		0.0231		0.01603		4/4	1	0/4		0.0151		0.0231		0.0129		0.013	
Barium	Total	mg/L	0.0152		0.0152		0.0152		1/1	1	0/1	0.0152								
Beryllium	Dissolved	mg/L	0.00001	U	0.00021		0.00018		2/4	0.0053	0/4		0.00001	U	0.000205		0.00002		0.001	U
Beryllium	Total	mg/L	6.8E-05		6.8E-05		6.8E-05		1/1	0.0053	0/1	0.000068								
Cadmium	Dissolved	mg/L	0.0001	U	0.00018		0.0002		1/4	0.00051	1/4		0.00018		0.0001	U	0.0001	U	0.001	U
Cadmium	Total	mg/L	0.00019		0.00019		0.00019		1/1	0.00051	0/1	0.00019								
Calcium	Dissolved	mg/L	5.71		14.1		9.26		4/4				10.5		14.1		5.71		6.73	
Calcium	Total	mg/L	9.45		9.45		9.45		1/1			9.45								
Chromium	Dissolved	mg/L	0.0002	U	0.00465		0.00161		2/4	0.011	0/4		0.0002	U	0.00465		0.0012		0.001	U
Chromium	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.011	0/1	0.0002	U							
Cobalt	Dissolved	mg/L	0.0002	U	0.00244		0.00105		2/4				0.0002	U	0.00244		0.00065		0.002	U
Cobalt	Total	mg/L	0.00037		0.00037		0.00037		1/1			0.00037								
Copper	Dissolved	mg/L	0.0003	U	0.00942		0.00586		3/4	0.0049	3/4		0.0003	U	0.00942		0.00761		0.00625	
Copper	Total	mg/L	0.0011		0.0011		0.0011		1/1	0.0049	0/1	0.0011								
Iron	Dissolved	mg/L	0.011		0.515		0.2285		4/4	0.3	1/4		0.011		0.151		0.515		0.237	
Iron	Total	mg/L	0.0226		0.0226		0.0226		1/1	0.3	0/1	0.0226								
Lanthanum	Dissolved	mg/L	0.001	U	0.0017		0.0009		1/3				0.001	U	0.0017		0.001	U		
Lanthanum	Total	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U							
Lead	Dissolved	mg/L	0.001	U	0.0069		0.0026		1/4	0.00086	4/4		0.003	U	0.0069		0.003	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.00086	1/1	0.003	U							
Lithium	Dissolved	mg/L	0.0004	U	0.00504		0.00324		2/3				0.00504		0.00448		0.0004	U		
Lithium	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U							
Magnesium	Dissolved	mg/L	2.52		6.42		4.1375		4/4				4.63		6.42		2.52		2.98	
Magnesium	Total	mg/L	4.31		4.31		4.31		1/1			4.31								
Manganese	Dissolved	mg/L	0.0002	U	0.00597		0.00294		2/4	0.05	0/4		0.0002	U	0.00069		0.00597		0.01	U
Manganese	Total	mg/L	0.00129		0.00129		0.00129		1/1	0.05	0/1	0.00129								
Molybdenum	Dissolved	mg/L	0.0004	U	0.00201		0.00095		2/3				0.0004	U	0.00201		0.00065			
Molybdenum	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U							
Nickel	Dissolved	mg/L	0.0002	U	0.00361		0.00173		2/4	0.0134	0/4		0.0002	U	0.00361		0.00221		0.002	U
Nickel	Total	mg/L	0.00246		0.00246		0.00246		1/1	0.0134	0/1	0.00246								
Potassium	Dissolved	mg/L	1	U	1.57		0.886		3/4				0.883		1.57		0.591		1	U
Potassium	Total	mg/L	1.19		1.19		1.19		1/1			1.19								
Selenium	Dissolved	mg/L	0.001	U	0.0044		0.00198		1/4	0.01	0/4		0.003	U	0.0044		0.003	U	0.001	U
Selenium	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.01	0/1	0.003	U							
Silver	Dissolved	mg/L	0.0002	U	0.001	U	0.0004	U	0/4	0.00012	4/4		0.0002	U	0.0002	U	0.0002	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.00012	1/1	0.0002	U							
Sodium	Dissolved	mg/L	2.94		6.11		4.2025		4/4				4.7		6.11		2.94		3.06	
Sodium	Total	mg/L	4.24		4.24		4.24		1/1			4.24								
Thallium	Dissolved	mg/L	0.001	U	0.0107		0.0033		1/4	0.013	0/4		0.002	U	0.0107		0.002	U	0.001	U
Thallium	Total	mg/L	0.0021		0.0021		0.0021		1/1	0.013	0/1	0.0021								
Vanadium	Dissolved	mg/L	0.005	U	0.00191		0.00148		3/4				0.00016		0.00191		0.00135		0.005	U
Vanadium	Total	mg/L	0.00043		0.00043		0.00043		1/1			0.00043								
Zinc	Dissolved	mg/L	0.00662		0.0162		0.01253		4/4	0.044	0/4		0.00662		0.0141		0.0162		0.0132	
Zinc	Total	mg/L	0.00327		0.00327		0.00327		1/1	0.044	0/1	0.00327								
Other																		
Hardness[4]		mg/L	15.3		61.7		35.725		4/4			41.3		15.3		61.7		24.6		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-32
MREF1
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/21/1999		Surface Water 5/20/2003	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier
Field Measurements												
Flow		gpm	8.9766	8.9766	8.9766	1/1			8.9766			
pH		su	7.45	7.45	7.45	1/1	6.5 to 8.5	0/1	7.45			
Metals												
Aluminum	Total	mg/L	0.063	0.1	0.0815	2/2			0.063		0.1	
Antimony	Total	mg/L	0.001 U	0.003 U	0.002 U	0/2	0.146	0/2	0.003 U		0.001 U	
Arsenic	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.048		0.002 U		0.002 U	
Barium	Total	mg/L	0.00712	0.339	0.17306	2/2	1	0/2	0.00712		0.339	
Beryllium	Total	mg/L	0.00001 U	0.001 U	0.00051 U	0/2	0.0053	0/2	0.00001 U		0.001 U	
Cadmium	Total	mg/L	0.0001 U	0.001 U	0.00055 U	0/2	0.00084	1/2	0.0001 U		0.001 U	
Calcium	Total	mg/L	9.52	12.6	11.06	2/2			12.6		9.52	
Chromium	Total	mg/L	0.001 U	0.00164	0.00107	1/2	0.011	0/2	0.00164		0.001 U	
Cobalt	Total	mg/L	0.0002 U	0.001 U	0.0006 U	0/2			0.0002 U		0.001 U	
Copper	Total	mg/L	0.0003 U	0.002 U	0.00115 U	0/2	0.0086	0/2	0.0003 U		0.002 U	
Iron	Total	mg/L	0.1 U	0.0138	0.0319	1/2	0.3	0/2	0.0138		0.1 U	
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/1			0.001 U			
Lead	Total	mg/L	0.001 U	0.003 U	0.002 U	0/2	0.0020	1/2	0.003 U		0.001 U	
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/1			0.0004 U			
Magnesium	Total	mg/L	4.29	9.03	6.66	2/2			9.03		4.29	
Manganese	Total	mg/L	0.002 U	0.00037	0.00069	1/2	0.05	0/2	0.00037		0.002 U	
Molybdenum	Total	mg/L	0.00073	0.00073	0.00073	1/1			0.00073			
Nickel	Total	mg/L	0.00031	0.00031	0.00031	1/1	0.0134	0/1	0.00031			
Potassium	Total	mg/L	0.1 U	1.01	0.53	1/2			1.01		0.1 U	
Selenium	Total	mg/L	0.003 U	0.00111	0.00206	1/2	0.01		0.003 U		0.00111	
Silver	Total	mg/L	0.0002 U	0.001 U	0.0006 U	0/2	0.00012		0.0002 U		0.001 U	
Sodium	Total	mg/L	3.46	3.71	3.585	2/2			3.71		3.46	
Thallium	Total	mg/L	0.001 U	0.002 U	0.0015 U	0/2	0.013		0.002 U		0.001 U	
Vanadium	Total	mg/L	0.005 U	0.00066	0.00158	1/2			0.00066		0.005 U	
Zinc	Total	mg/L	0.005 U	0.00127	0.00189	1/2	0.077		0.00127		0.005 U	
Other												
Hardness[4]		mg/L	68.5	68.5	68.5	1/1			68.5			

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-33
Russell Creek 0.9
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/21/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Total	mg/L			0.187	
Antimony	Total	mg/L	0.146	1/1	0.003	U
Arsenic	Total	mg/L	0.048	1/1	0.002	U
Barium	Total	mg/L	1	1/1	0.0274	
Beryllium	Total	mg/L	0.0053	1/1	0.00001	U
Cadmium	Total	mg/L	0.0008	1/1	0.0001	U
Calcium	Total	mg/L			15.1	
Chromium	Total	mg/L	0.011	1/1	0.00105	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0081	1/1	0.0003	U
Iron	Total	mg/L	0.3	1/1	0.129	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0018	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			6.38	
Manganese	Total	mg/L	0.05	1/1	0.00506	
Molybdenum	Total	mg/L			0.00055	
Nickel	Total	mg/L	0.0134	1/1	0.0002	U
Potassium	Total	mg/L			1.29	
Selenium	Total	mg/L	0.01	1/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			8.19	
Thallium	Total	mg/L	0.013	1/1	0.002	U
Vanadium	Total	mg/L			0.00101	
Zinc	Total	mg/L	0.073	1/1	0.00057	
Other						
Hardness[2]		mg/L			63.9	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-34
Russell Creek 5.5
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 1/26/2000 Value	Surface Water 1/26/2000 Qualifier	Surface Water 2/14/2000 Value	Surface Water 2/14/2000 Qualifier	Surface Water 11/8/2001 Value	Surface Water 11/8/2001 Qualifier
Field Measurements														
Flow		gpm	15.0	25.0	20.0	2/2			25.0		15.0			
pH		su	2.96	3.01	2.985	2/2	6.5 to 8.5	2/2	3.01		2.96			
Temperature		deg C	9.1	9.1	9.1	1/1			9.1					
Metals														
Aluminum	Dissolved	mg/L	8.4	59.6	34	2/2			8.4		59.6			
Aluminum	Total	mg/L	0.193	62.6	21.991	3/3			0.193		62.6		3.18	
Antimony	Dissolved	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.146	0/2	0.003 U		0.003 U			
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.146	0/2	0.003 U		0.003 U			
Arsenic	Dissolved	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.048	0/2	0.002 U		0.002 U			
Arsenic	Total	mg/L	0.002 U	0.005 U	0.003 U	0/3	0.048	0/3	0.002 U		0.002 U		0.005 U	
Barium	Dissolved	mg/L	0.0114	0.0391	0.02525	2/2	1	0/2	0.0391		0.0114			
Barium	Total	mg/L	0.0123	0.0591	0.0357	2/2	1	0/2	0.0591		0.0123			
Beryllium	Dissolved	mg/L	0.00038	0.0022	0.00129	2/2	0.0053	0/2	0.000382		0.0022			
Beryllium	Total	mg/L	2.5E-05	0.00227	0.00115	2/2	0.0053	0/2	0.000025		0.00227			
Boron		mg/L	0.003 U	0.003 U	0.003 U	0/1			0.003 U					
Cadmium	Dissolved	mg/L	0.0739	0.424	0.24895	2/2	0.0024	2/2	0.0739		0.424			
Cadmium	Total	mg/L	0.00408	0.437	0.17203	3/3	0.0024	3/3	0.00408		0.437		0.075	
Calcium	Dissolved	mg/L	24.4	91.5	57.95	2/2			24.4		91.5			
Calcium	Total	mg/L	10.8	96.4	53.6	2/2			10.8		96.4			
Chromium	Dissolved	mg/L	0.00094	0.00828	0.00461	2/2	0.011	0/2	0.00094		0.00828			
Chromium	Total	mg/L	0.00022	0.00863	0.00443	2/2	0.011	0/2	0.00022		0.00863			
Cobalt	Dissolved	mg/L	0.0105	0.0519	0.0312	2/2			0.0105		0.0519			
Cobalt	Total	mg/L	0.00093	0.0546	0.02777	2/2			0.00093		0.0546			
Copper	Dissolved	mg/L	5.79	40.2	22.995	2/2	0.026	2/2	5.79		40.2			
Copper	Total	mg/L	0.287	42.3	16.0223	3/3	0.026	3/3	0.287		42.3		5.48	
Iron	Dissolved	mg/L	2.16	18.7	10.43	2/2	0.3	2/2	2.16		18.7			
Iron	Total	mg/L	0.0122	20	6.71207	3/3	0.3	1/3	0.124		20		0.0122	
Lanthanum	Dissolved	mg/L	0.0032	0.0495	0.02635	2/2			0.0032		0.0495			
Lanthanum	Total	mg/L	0.001 U	0.0513	0.0259	1/2			0.001 U		0.0513			
Lead	Dissolved	mg/L	0.003 U	0.0093	0.0054	1/2	0.011	0/2	0.003 U		0.0093			
Lead	Total	mg/L	0.003 U	0.0083	0.0041	1/3	0.011	0/3	0.003 U		0.0083		0.005 U	
Lithium	Dissolved	mg/L	0.00173	0.0124	0.00707	2/2			0.00173		0.0124			
Lithium	Total	mg/L	0.0004 U	0.0134	0.0068	1/2			0.0004 U		0.0134			
Magnesium	Dissolved	mg/L	7.39	25.8	16.595	2/2			7.39		25.8			
Magnesium	Total	mg/L	2.99	27.6	15.295	2/2			2.99		27.6			
Manganese	Dissolved	mg/L	0.767	4.22	2.4935	2/2	0.05	2/2	0.767		4.22			
Manganese	Total	mg/L	0.0742	4.55	1.90473	3/3	0.05	3/3	0.0742		4.55		1.09	
Molybdenum	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2			0.0004 U		0.0004 U			
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2			0.0004 U		0.0004 U			
Nickel	Dissolved	mg/L	0.0233	0.119	0.07115	2/2	0.0134	2/2	0.0233		0.119			
Nickel	Total	mg/L	0.00558	0.125	0.05556	3/3	0.0134	2/3	0.00558		0.125		0.0361	
Potassium	Dissolved	mg/L	0.436	1.39	0.913	2/2			0.436		1.39			
Potassium	Total	mg/L	0.261	1.49	0.8755	2/2			0.261		1.49			
Selenium	Dissolved	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.01	0/2	0.003 U		0.003 U			
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.01	0/2	0.003 U		0.003 U			
Silver	Dissolved	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.00012	2/2	0.0002 U		0.0002 U			
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.00012	2/2	0.0002 U		0.0002 U			
Sodium	Dissolved	mg/L	3.67	5.14	4.405	2/2			3.67		5.14			
Sodium	Total	mg/L	2.93	5.49	4.21	2/2			2.93		5.49			
Thallium	Dissolved	mg/L	0.002 U	0.0036	0.0023	1/2	0.013	0/2	0.0036		0.002 U			
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.013	0/2	0.002 U		0.002 U			
Vanadium	Dissolved	mg/L	0.0001 U	0.0001 U	0.0001 U	0/2			0.0001 U		0.0001 U			
Vanadium	Total	mg/L	0.0001 U	0.00013	0.00009	1/2			0.00013		0.0001 U			
Zinc	Dissolved	mg/L	14.5	52.6	33.55	2/2	0.24	2/2	14.5		52.6			
Zinc	Total	mg/L	1.39	52	24.33	3/3	0.24	3/3	1.39		52		19.6	

Table A-35
Seep B
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 1/26/2000		Surface Water 2/14/2000		Surface Water 11/8/2001	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions														
Ammonia as N		mg/L as N	0.2	0.2	0.2	1/1			0.2					
Chloride		mg/L	2.1	2.1	2.1	1/1	230	0/1	2.1					
Fluoride		mg/L	1	1	1	1/1			1					
Nitrate & Nitrite as N		mg/L as N	0.236	0.236	0.236	1/1			0.236					
Orthophosphate as P		mg/L as P	0.014	0.014	0.014	1/1			0.014					
Silica (SiO2)		mg/L	14.9	14.9	14.9	1/1			14.9					
Sulfate		mg/L	295	930	612.5	2/2			930				295	
Sulfide		mg/L	0.05 U	0.05 U	0.05 U	0/1	0.002	1/1					0.05 U	
Total Phosphate as P		mg/L as P	0.04	0.04	0.04	1/1			0.04					
Other														
Hardness[4]		mg/L	91.4	344	256.467	3/3			91.4		334		344	
Total Organic Carbon		mg/L	2	2	2	1/1			2					
Total Suspended Solids		mg/L	5 U	5 U	5 U	0/1							5 U	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.

2. The median was calculated for pH instead of mean.

3. Some method reporting limits exceed the SL.

4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-35
Seep B
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/16/1999 Value	Surface Water 6/16/1999 Qualifier	Surface Water 10/5/1999 Value	Surface Water 10/5/1999 Qualifier	Surface Water 10/26/1999 Value	Surface Water 10/26/1999 Qualifier	Surface Water 1/25/2000 Value	Surface Water 1/25/2000 Qualifier	Surface Water 3/22/2000 Value	Surface Water 3/22/2000 Qualifier	Surface Water 2/23/2001 Value	Surface Water 2/23/2001 Qualifier
Field Measurements																				
Conductivity		µS/cm	105	105	105	1/1									105					
Conductivity		µS/cm	100	157	127.333	3/3			125		157				100					
Flow		gpm	320.0	8689.3	2482.6	5/5			579.0		320.0		652.1		8689.3		2172.3			
pH		su	7.11	7.69	7.39	5/5	6.5 to 8.5	0/5	7.13		7.69		7.58		7.11		7.39			
Temperature		deg C	9	11.2	10.3	4/4			11.2		10		11		9					
Metals																				
Aluminum	Dissolved	mg/L	0.1	U	0.093	0.05263	3/8				0.039		0.039		0.093		0.1	U	0.1	U
Aluminum	Total	mg/L	0.079		0.079	0.079	1/1		0.079											
Antimony	Dissolved	mg/L	0.001	U	0.003	U	0.00175	U	0/8	0.146	0/8		0.003	U	0.003	U	0.003	U	0.001	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.146	0/1	0.003	U							
Arsenic	Dissolved	mg/L	0.001	U	0.002		0.00088		2/8	0.048	0/8		0.002	U	0.002	U	0.002		0.001	U	0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.048	0/1	0.002	U							
Barium	Dissolved	mg/L	0.00449		0.00603		0.00522		8/8	1	0/8		0.00517		0.0059		0.00449		0.00464		0.0049	
Barium	Total	mg/L	0.00486		0.00486		0.00486		1/1	1	0/1	0.00486								
Beryllium	Dissolved	mg/L	0.00001	U	3.9E-05		0.00032		2/8	0.0053	0/8		0.00001	U	0.000023		0.000039		0.001	U	0.001	U
Beryllium	Total	mg/L	6.4E-05		6.4E-05		6.4E-05		1/1	0.0053	0/1	0.000064								
Boron		mg/L	0.0233		0.0233		0.0233		1/1				0.0233							
Cadmium	Dissolved	mg/L	0.001	U	0.0043		0.00221		7/8	0.00067	6/8		0.00047		0.00028		0.0043		0.00303		0.0021	
Cadmium	Total	mg/L	0.00093		0.00093		0.00093		1/1	0.00067	1/1	0.00093								
Calcium	Dissolved	mg/L	9.54		23.6		17.9175		8/8				18.7		15.5		9.54		10.9		18.8	
Calcium	Total	mg/L	12.1		12.1		12.1		1/1			12.1								
Chromium	Dissolved	mg/L	0.0002	U	0.00185		0.00053		2/8	0.011	0/8		0.0002	U	0.0002		0.0002	U	0.001	U	0.001	U
Chromium	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.011	0/1	0.0002	U							
Cobalt	Dissolved	mg/L	0.0002	U	0.00113		0.00067		1/8				0.0002	U	0.0002	U	0.00113		0.002	U	0.002	U
Cobalt	Total	mg/L	0.00021		0.00021		0.00021		1/1			0.00021								
Copper	Dissolved	mg/L	0.00706		0.185		0.08515		8/8	0.0067	8/8		0.00706		0.0488		0.185		0.12		0.07	
Copper	Total	mg/L	0.0202		0.0202		0.0202		1/1	0.0067	1/1	0.0202								
Iron	Dissolved	mg/L	0.1	U	0.145		0.68369		3/8	0.3	1/8		0.0256		0.145		0.0989		0.1	U	0.1	U
Iron	Total	mg/L	0.088		0.088		0.088		1/1	0.3	0/1	0.088								
Lanthanum	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/3				0.001	U	0.001	U	0.001	U				
Lanthanum	Total	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U							
Lead	Dissolved	mg/L	0.001	U	5.41		0.67706		1/8	0.0014	4/8		0.003	U	0.003	U	0.003	U	0.001	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.0014	1/1	0.003	U							
Lithium	Dissolved	mg/L	0.0004	U	0.00519		0.00197		2/3				0.00519		0.00052		0.0004	U				
Lithium	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U							
Magnesium	Dissolved	mg/L	0.1	U	7.89		4.30125		7/8				4.46		4.1		3.48		3.48		5.08	
Magnesium	Total	mg/L	3.8		3.8		3.8		1/1			3.8								
Manganese	Dissolved	mg/L	0.01	U	0.13		0.06433		7/8	0.05	5/8		0.00206		0.0196		0.13		0.082		0.077	
Manganese	Total	mg/L	0.0184		0.0184		0.0184		1/1	0.05	0/1	0.0184								
Molybdenum	Dissolved	mg/L	0.0004	U	0.0004	U	0.0004	U	0/3				0.0004	U	0.0004	U	0.0004	U				
Molybdenum	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U							
Nickel	Dissolved	mg/L	0.0002	U	0.00387		0.00216		6/7	0.0134	0/7		0.0002	U	0.00064		0.00387		0.0026		0.00212	
Nickel	Total	mg/L	0.00201		0.00201		0.00201		1/1	0.0134	0/1	0.00201								
Potassium	Dissolved	mg/L	0.1	U	0.867		0.44613		3/8				0.484		0.867		0.168		1	U	1	U
Potassium	Total	mg/L	0.766		0.766		0.766		1/1			0.766								
Selenium	Dissolved	mg/L	0.001	U	0.00928	U	0.00291	U	0/8	0.01	0/8		0.003	U	0.003	U	0.003	U	0.001	U	0.001	U
Selenium	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.01	0/1	0.003	U							
Silver	Dissolved	mg/L	0.0002	U	0.001	U	0.0007	U	0/8	0.00012	8/8		0.0002	U	0.0002	U	0.0002	U	0.001	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.00012	1/1	0.0002	U							
Sodium	Dissolved	mg/L	2.92		8.44		4.5625		8/8				4.47		4.49		2.92		2.98		3.91	
Sodium	Total	mg/L	4.08		4.08		4.08		1/1			4.08								
Thallium	Dissolved	mg/L	0.001	U	0.002	U	0.00138	U	0/8	0.013	0/8		0.002	U	0.002	U	0.002	U	0.001	U	0.001	U
Thallium	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.013	0/1	0.002	U							
Vanadium	Dissolved	mg/L	0.005	U	0.00077		0.00178		3/8				0.00034		0.00077		0.00066		0.005	U	0.005	U
Vanadium	Total	mg/L	0.00058		0.00058		0.00058		1/1			0.00058								
Zinc	Dissolved	mg/L	0.005	U	1.04		0.475		7/8	0.06	6/8		0.0501		0.0754		1.04		0.766		0.794	
Zinc	Total	mg/L	0.232		0.232		0.232		1/1	0.06	1/1	0.232								

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/16/1999		Surface Water 10/5/1999		Surface Water 10/26/1999		Surface Water 1/25/2000		Surface Water 3/22/2000		Surface Water 2/23/2001	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																				
Alkalinity		mg/L	15	42	28.5	2/2					42				15					
Ammonia as N		mg/L as N	0.02	U	0.05	U	0.03	U	0/3			0.02	U			0.02	U	0.05	U		
Chloride		mg/L	1.2	18.9	7.23333	3/3	230	0/3			1.6				1.2		18.9			
Fluoride		mg/L	0.1	U	0.5	U	0.23333	U	0/3			0.1	U			0.1	U	0.5	U		
Nitrate & Nitrite as N		mg/L as N	0.0289		0.0454		0.03715		2/2			0.0289				0.0454					
Nitrate as N		mg/L as N	0.11		0.11		0.11		1/1									0.11			
Nitrite as N		mg/L as N	0.1	U	0.1	U	0.1	U	0/1									0.1	U		
Orthophosphate as P		mg/L as P	0.005	U	0.01		0.00625		1/2							0.005	U	0.01			
Phosphorus		mg/L	0.035	U	0.035	U	0.035	U	0/1									0.035	U		
Silica (SiO2)		mg/L	23.7		152		87.85		2/2			23.7						152			
Sulfate		mg/L	26.2		31		28.5667		3/3			31				28.5		26.2			
Total Phosphate as P		mg/L as P	0.02		0.02		0.02		1/1							0.02					
Other																				
Dissolved Organic Carbon		mg/L	3	U	2		1.75		1/2							2		3	U		
Hardness[4]		mg/L	38.1		64.9		51.075		4/4		45.7		64.9		55.6		38.1				
Total Organic Carbon		mg/L	1	U	2		1.33333		1/3				1	U			2		3	U	
Total Suspended Solids		mg/L	1	U	9		4.83333		1/3				1	U			9		10	U	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Analyte	Analyte 2	Unit	Surface Water 5/1/2001 Value	Surface Water 5/1/2001 Qualifier	Surface Water 2/23/2004 Value	Surface Water 2/23/2004 Qualifier	Surface Water 9/19/2005 Value	Surface Water 9/19/2005 Qualifier
Field Measurements								
Conductivity		µS/cm						
Conductivity		µS/cm						
Flow		gpm						
pH		su						
Temperature		deg C						
Metals								
Aluminum	Dissolved	mg/L	0.1	U	0.1	U	0.1	U
Aluminum	Total	mg/L						
Antimony	Dissolved	mg/L	0.001	U	0.001	U	0.001	U
Antimony	Total	mg/L						
Arsenic	Dissolved	mg/L	0.001	U	0.001	U	0.00101	
Arsenic	Total	mg/L						
Barium	Dissolved	mg/L	0.00603		0.00467		0.00596	
Barium	Total	mg/L						
Beryllium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U
Beryllium	Total	mg/L						
Boron		mg/L						
Cadmium	Dissolved	mg/L	0.0033		0.00372		0.001	U
Cadmium	Total	mg/L						
Calcium	Dissolved	mg/L	22.9		23.4		23.6	
Calcium	Total	mg/L						
Chromium	Dissolved	mg/L	0.001	U	0.001	U	0.00185	
Chromium	Total	mg/L						
Cobalt	Dissolved	mg/L	0.002	U	0.001	U	0.001	U
Cobalt	Total	mg/L						
Copper	Dissolved	mg/L	0.0652		0.171		0.0141	
Copper	Total	mg/L						
Iron	Dissolved	mg/L	0.1	U	10	U	0.1	U
Iron	Total	mg/L						
Lanthanum	Dissolved	mg/L						
Lanthanum	Total	mg/L						
Lead	Dissolved	mg/L	0.001	U	0.001	U	5.41	
Lead	Total	mg/L						
Lithium	Dissolved	mg/L						
Lithium	Total	mg/L						
Magnesium	Dissolved	mg/L	5.87		7.89		0.1	U
Magnesium	Total	mg/L						
Manganese	Dissolved	mg/L	0.071		0.128		0.01	U
Manganese	Total	mg/L						
Molybdenum	Dissolved	mg/L						
Molybdenum	Total	mg/L						
Nickel	Dissolved	mg/L			0.00334		0.00244	
Nickel	Total	mg/L						
Potassium	Dissolved	mg/L	1	U	1	U	0.1	U
Potassium	Total	mg/L						
Selenium	Dissolved	mg/L	0.00928	U	0.001	U	0.002	U
Selenium	Total	mg/L						
Silver	Dissolved	mg/L	0.001	U	0.001	U	0.001	U
Silver	Total	mg/L						
Sodium	Dissolved	mg/L	4.34		8.44		4.95	
Sodium	Total	mg/L						
Thallium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U
Thallium	Total	mg/L						
Vanadium	Dissolved	mg/L	0.005	U	0.005	U	0.005	U
Vanadium	Total	mg/L						
Zinc	Dissolved	mg/L	0.005	U	0.894		0.178	
Zinc	Total	mg/L						

Analyte	Analyte 2	Unit	Surface Water 5/1/2001 Value	Qualifier	Surface Water 2/23/2004 Value	Qualifier	Surface Water 9/19/2005 Value	Qualifier
Major Ions								
Alkalinity		mg/L						
Ammonia as N		mg/L as N						
Chloride		mg/L						
Fluoride		mg/L						
Nitrate & Nitrite as N		mg/L as N						
Nitrate as N		mg/L as N						
Nitrite as N		mg/L as N						
Orthophosphate as P		mg/L as P						
Phosphorus		mg/L						
Silica (SiO2)		mg/L						
Sulfate		mg/L						
Total Phosphate as P		mg/L as P						
Other								
Dissolved Organic Carbon		mg/L						
Hardness[4]		mg/L						
Total Organic Carbon		mg/L						
Total Suspended Solids		mg/L						

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for C

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/8/2005	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Total	mg/L			16.62	
Barium	Total	mg/L	1	0/1	0.0176	
Beryllium	Total	mg/L	0.0053	0/1	0.0015	
Cadmium	Total	mg/L	No Hardness		0.091	
Calcium	Total	mg/L			100	
Chromium	Total	mg/L	0.011	0/1	0.0029	U
Cobalt	Total	mg/L			0.022	
Copper	Total	mg/L	No Hardness		9.6	
Iron	Total	mg/L	0.3	0/1	0.055	
Lithium	Total	mg/L			0.0124	
Magnesium	Total	mg/L			38.2184	
Manganese	Total	mg/L	0.05	1/1	3.5	
Nickel	Total	mg/L	0.0134	1/1	0.076	
Potassium	Total	mg/L			0.7978	
Sodium	Total	mg/L			7.112	
Strontium	Total	mg/L			0.2038	
Sulfur	Total	mg/L			172.4235	
Tin	Total	mg/L			0.0229	
Vanadium	Total	mg/L			0.0016	U
Zinc	Total	mg/L	No Hardness		24.8	
Major Ions						
Phosphorus		mg/L			0.0935	U
Silica (SiO2)		mg/L			13.1536	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-37
Location SFA1
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/8/2005		Surface Water 7/6/2005	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier
Metals												
Aluminum	Total	mg/L	42.76	50.02	46.39	2/2			50.02		42.76	
Barium	Total	mg/L	0.0106	0.0171	0.01385	2/2	1	0/2	0.0171		0.0106	
Beryllium	Total	mg/L	0.0049	0.0058	0.00535	2/2	0.0053	1/2	0.0049		0.0058	
Cadmium	Total	mg/L	0.247	0.25	0.2485	2/2	No Hardness		0.247		0.25	
Calcium	Total	mg/L	186	211	198.5	2/2			186		211	
Chromium	Total	mg/L	0.0029	U	0.0029	U	0.0029	U	0/2	0.011	0/2	0.0029	U	0.0029	U
Cobalt	Total	mg/L	0.059	0.061	0.06	2/2			0.061		0.059	
Copper	Total	mg/L	27.1	27.4	27.25	2/2	No Hardness		27.4		27.1	
Iron	Total	mg/L	0.09	0.26	0.175	2/2	0.3	0/2	0.26		0.09	
Lithium	Total	mg/L	0.0136	0.0144	0.014	2/2			0.0144		0.0136	
Magnesium	Total	mg/L	0	73.7233	36.8617	2/2			73.7233		0	
Manganese	Total	mg/L	9.6	9.8	9.7	2/2	0.05	2/2	9.8		9.6	
Nickel	Total	mg/L	0.2	0.207	0.2035	2/2	0.0134	2/2	0.207		0.2	
Potassium	Total	mg/L	1.7697	2.2577	2.0137	2/2			1.7697		2.2577	
Sodium	Total	mg/L	11.2165	13.7778	12.4972	2/2			11.2165		13.7778	
Strontium	Total	mg/L	0.405	0.4424	0.4237	2/2			0.405		0.4424	
Sulfur	Total	mg/L	375.194	425	400.097	2/2			375.1936		425	
Tin	Total	mg/L	0.0347	0.0429	0.0388	2/2			0.0347		0.0429	
Vanadium	Total	mg/L	0.0016	U	0.0016	U	0.0016	U	0/2		0.0016	U	0.0016	U
Zinc	Total	mg/L	65.9	66	65.95	2/2	No Hardness		65.9		66	
Major Ions												
Phosphorus		mg/L	0.3616	0.3877	0.37465	2/2			0.3877		0.3616	
Silica (SiO2)		mg/L	20.4213	21.5132	20.9673	2/2			20.4213		21.5132	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.

2. The median was calculated for pH instead of mean.

3. Some method reporting limits exceed the SL.

Table A-38
Location SFA2
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/8/2005		Surface Water 7/6/2005	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier
Metals												
Aluminum	Total	mg/L	48.12	61.63	54.875	2/2			61.63		48.12	
Barium	Total	mg/L	0.0144	0.0182	0.0163	2/2	1	0/2	0.0182		0.0144	
Beryllium	Total	mg/L	0.0066	0.0067	0.00665	2/2	0.0053	2/2	0.0067		0.0066	
Cadmium	Total	mg/L	0.29	0.311	0.3005	2/2	No Hardness		0.311		0.29	
Calcium	Total	mg/L	225	239	232	2/2			225		239	
Chromium	Total	mg/L	0.0029	U	0.0029	U	0.0029	U	0/2	0.011	0/2	0.0029	U	0.0029	U
Cobalt	Total	mg/L	0.067	0.077	0.072	2/2			0.077		0.067	
Copper	Total	mg/L	31.6	34.6	33.1	2/2	No Hardness		34.6		31.6	
Iron	Total	mg/L	0.19	0.22	0.205	2/2	0.3	0/2	0.22		0.19	
Lithium	Total	mg/L	0.0152	0.0235	0.01935	2/2			0.0235		0.0152	
Magnesium	Total	mg/L	0	0	0	2/2			0		0	
Manganese	Total	mg/L	10.9	12	11.45	2/2	0.05	2/2	12		10.9	
Nickel	Total	mg/L	0.22	0.2633	0.24165	2/2	0.0134	2/2	0.2633		0.22	
Potassium	Total	mg/L	2.2695	2.5882	2.42885	2/2			2.2695		2.5882	
Sodium	Total	mg/L	13.4224	15.1152	14.2688	2/2			13.4224		15.1152	
Strontium	Total	mg/L	0.4854	0.4912	0.4883	2/2			0.4854		0.4912	
Sulfur	Total	mg/L	463.21	481	472.105	2/2			463.2098		481	
Tin	Total	mg/L	0.0501	0.0572	0.05365	2/2			0.0501		0.0572	
Vanadium	Total	mg/L	0.0016	U	0.0016	U	0.0016	U	0/2		0.0016	U	0.0016	U
Zinc	Total	mg/L	76.1	81	78.55	2/2	No Hardness		81		76.1	
Major Ions												
Phosphorus		mg/L	0.4032	0.4861	0.44465	2/2			0.4861		0.4032	
Silica (SiO2)		mg/L	23.5338	24.0315	23.7827	2/2			24.0315		23.5338	

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.

2. The median was calculated for pH instead of mean.

3. Some method reporting limits exceed the SL.

Table A-39
Location SFA3
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/8/2005	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Total	mg/L			67.81	
Barium	Total	mg/L	1	0/1	0.0201	
Beryllium	Total	mg/L	0.0053	1/1	0.0078	
Cadmium	Total	mg/L	No Hardness		0.347	
Calcium	Total	mg/L			242	
Chromium	Total	mg/L	0.011	0/1	0.0029	U
Cobalt	Total	mg/L			0.083	
Copper	Total	mg/L	No Hardness		39.4	
Iron	Total	mg/L	0.3	1/1	0.31	
Lithium	Total	mg/L			0.0303	
Magnesium	Total	mg/L			0	
Manganese	Total	mg/L	0.05	1/1	13.5	
Nickel	Total	mg/L	0.0134	1/1	0.2869	
Potassium	Total	mg/L			2.3853	
Sodium	Total	mg/L			14.381	
Strontium	Total	mg/L			0.5178	
Sulfur	Total	mg/L			514.8649	
Tin	Total	mg/L			0.0563	
Vanadium	Total	mg/L			0.0016	U
Zinc	Total	mg/L	No Hardness		90.4	
Major Ions						
Phosphorus		mg/L			0.5143	
Silica (SiO2)		mg/L			25.4921	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-40
Location SFA4
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/8/2005	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Total	mg/L			129.39	
Barium	Total	mg/L	1	0/1	0.0242	
Beryllium	Total	mg/L	0.0053	1/1	0.0136	
Cadmium	Total	mg/L	No Hardness	0/1	0.479	
Calcium	Total	mg/L			253	
Chromium	Total	mg/L	0.011	0/1	0.0056	
Cobalt	Total	mg/L			0.123	
Copper	Total	mg/L	No Hardness	0/1	57.4	
Iron	Total	mg/L	0.3	1/1	3.19	
Lithium	Total	mg/L			0.0639	
Magnesium	Total	mg/L			0	
Manganese	Total	mg/L	0.05	1/1	20.5	
Nickel	Total	mg/L	0.0134	1/1	0.5032	
Potassium	Total	mg/L			2.2918	
Sodium	Total	mg/L			16.8608	
Strontium	Total	mg/L			0.7207	
Sulfur	Total	mg/L			702.7183	
Tin	Total	mg/L			0.0748	
Vanadium	Total	mg/L			0.0016	U
Zinc	Total	mg/L	No Hardness	0/1	115.6	
Major Ions						
Phosphorus		mg/L			0.7826	
Silica (SiO2)		mg/L			33.3005	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-41
Location SFA5
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/8/2005	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Metals						
Aluminum	Total	mg/L			0.092	
Barium	Total	mg/L	1	0/1	0.0195	
Beryllium	Total	mg/L	0.0053	0/1	0.0002	U
Cadmium	Total	mg/L	No Hardness	0/1	0.003	
Calcium	Total	mg/L			59	
Chromium	Total	mg/L	0.011	0/1	0.0029	U
Cobalt	Total	mg/L			0.0056	
Copper	Total	mg/L	No Hardness	0/1	0.007	
Iron	Total	mg/L	0.3	0/1	0.027	
Lithium	Total	mg/L			0.0235	
Magnesium	Total	mg/L			20.0825	
Manganese	Total	mg/L	0.05	0/1	0.0049	
Nickel	Total	mg/L	0.0134	0/1	0.0042	
Potassium	Total	mg/L			0.3938	
Sodium	Total	mg/L			5.1508	
Strontium	Total	mg/L			0.1067	
Sulfur	Total	mg/L			62.7925	
Tin	Total	mg/L			0.014	
Vanadium	Total	mg/L			0.0016	U
Zinc	Total	mg/L	No Hardness	0/1	1.9	
Major Ions						
Phosphorus		mg/L			0.0935	U
Silica (SiO2)		mg/L			9.7789	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-42
Location SFB1
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 10/19/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Conductivity		µS/cm			1401	
Flow		gpm			0.1	
pH		su	6.5 to 8.5	1/1	3	
Metals						
Aluminum	Dissolved	mg/L			30	
Antimony	Dissolved	mg/L	0.146	0/1	0.01	U
Arsenic	Dissolved	mg/L	0.048	0/1	0.01	U
Barium	Dissolved	mg/L	1	0/1	0.004	U
Beryllium	Dissolved	mg/L	0.0053	1/1	0.012	
Cadmium	Dissolved	mg/L	No Hardness		0.4	
Calcium	Dissolved	mg/L			220	
Chromium	Dissolved	mg/L	0.011	0/1	0.01	U
Cobalt	Dissolved	mg/L			0.13	
Copper	Dissolved	mg/L	No Hardness		43	
Iron	Dissolved	mg/L	0.3	1/1	0.35	
Lead	Dissolved	mg/L	No Hardness		0.0059	
Magnesium	Dissolved	mg/L			110	
Manganese	Dissolved	mg/L	0.05	1/1	16	
Mercury	Dissolved	mg/L	0.000012	1/1	0.0002	U
Nickel	Dissolved	mg/L	0.0134	1/1	0.29	
Potassium	Dissolved	mg/L			4.6	
Selenium	Dissolved	mg/L	0.01	1/1	0.024	
Silver	Dissolved	mg/L	0.00012	1/1	0.01	U
Sodium	Dissolved	mg/L			10	
Thallium	Dissolved	mg/L	0.013	1/1	0.2	
Vanadium	Dissolved	mg/L			0.01	
Zinc	Dissolved	mg/L	No Hardness		130	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-43
Location SFL
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/16/1999 Value	Surface Water 6/16/1999 Qualifier	Surface Water 10/7/1999 Value	Surface Water 10/7/1999 Qualifier	Surface Water 10/26/1999 Value	Surface Water 10/26/1999 Qualifier	Surface Water 1/25/2000 Value	Surface Water 1/25/2000 Qualifier	Surface Water 3/22/2000 Value	Surface Water 3/22/2000 Qualifier	Surface Water 2/23/2001 Value	Surface Water 2/23/2001 Qualifier	Surface Water 5/1/2001 Value	Surface Water 5/1/2001 Qualifier	Surface Water 2/23/2004 Value	Surface Water 2/23/2004 Qualifier
Field Measurements																								
Conductivity		µS/cm	47	121	85	3/3			87		121				47									
Flow		gpm	76.3	300.7	188.5	2/2			300.7		76.3													
pH		su	7.16	7.28	7.27	5/5	6.5 to 8.5	0/5	7.25		7.28		7.27		7.16		7.28							
Temperature		deg C	8.9	11.8	10.425	4/4			11.8		11		10		8.9									
Metals																								
Aluminum	Dissolved	mg/L	0.1 U	0.096	0.0555	2/6							0.037		0.096		0.1 U		0.1 U		0.1 U		0.1 U	
Aluminum	Total	mg/L	0.02	0.093	0.0565	2/2			0.093		0.02													
Antimony	Dissolved	mg/L	0.001 U	0.003 U	0.00167 U	0/6	0.146	0/6					0.003 U		0.003 U		0.001 U		0.001 U		0.001 U		0.001 U	
Antimony	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.146	0/2	0.003 U		0.003 U													
Arsenic	Dissolved	mg/L	0.001 U	0.002 U	0.00133 U	0/6	0.048	0/6					0.002 U		0.002 U		0.001 U		0.001 U		0.001 U		0.001 U	
Arsenic	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.048	0/2	0.002 U		0.002 U													
Barium	Dissolved	mg/L	0.00396	0.00787	0.00513	6/6	1	0/6					0.00787		0.00396		0.00432		0.00479		0.00579		0.00406	
Barium	Total	mg/L	0.00531	0.00593	0.00562	2/2	1	0/2	0.00531		0.00593													
Beryllium	Dissolved	mg/L	0.00001 U	2.4E-05	0.00034	1/6	0.0053	0/6					0.000024		0.00001 U		0.001 U		0.001 U		0.001 U		0.001 U	
Beryllium	Total	mg/L	0.00001 U	0.00005	2.8E-05	1/2	0.0053	0/2	0.00005		0.00001 U													
Boron		mg/L	0.0162	0.0162	0.0162	1/1					0.0162													
Cadmium	Dissolved	mg/L	0.0001 U	0.00011	0.00036	1/6	0.00042	4/6					0.0001 U		0.00011		0.001 U		0.001 U		0.001 U		0.001 U	
Cadmium	Total	mg/L	0.0001 U	0.0001	7.5E-05	1/2	0.00042	0/2	0.0001 U		0.0001													
Calcium	Dissolved	mg/L	5.27	15	10.355	6/6							13.2		5.27		7.12		13.8		15		7.74	
Calcium	Total	mg/L	8.48	13.3	10.89	2/2			8.48		13.3													
Chromium	Dissolved	mg/L	0.0002 U	0.00103	0.00074	1/6	0.011	0/6					0.0002 U		0.0002 U		0.001 U		0.001 U		0.00103		0.001 U	
Chromium	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.011	0/2	0.0002 U		0.0002 U													
Cobalt	Dissolved	mg/L	0.0002 U	0.002 U	0.00123 U	0/6							0.0002 U		0.0002 U		0.002 U		0.002 U		0.002 U		0.001 U	
Cobalt	Total	mg/L	0.0002 U	0.00046	0.00028	1/2			0.00046		0.0002 U													
Copper	Dissolved	mg/L	0.002 U	0.00642	0.00329	4/6	0.004	2/6					0.00403		0.00642		0.0029		0.002 U		0.002 U		0.00241	
Copper	Total	mg/L	0.0003 U	0.00114	0.00065	1/2	0.004	0/2	0.00114		0.0003 U													
Iron	Dissolved	mg/L	0.1 U	0.223	0.10686	4/6	0.3	0/6					0.223		0.14		0.1 U		0.181		0.1 U		0.104	
Iron	Total	mg/L	0.121	0.126	0.1235	2/2	0.3	0/2	0.126		0.121													
Lanthanum	Dissolved	mg/L	0.001 U	0.001 U	0.001 U	0/2							0.001 U		0.001 U									
Lanthanum	Total	mg/L	0.001 U	0.001 U	0.001 U	0/2			0.001 U		0.001 U													
Lead	Dissolved	mg/L	0.001 U	0.003 U	0.00167 U	0/6	0.00062	6/6					0.003 U		0.003 U		0.001 U		0.001 U		0.001 U		0.001 U	
Lead	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.00062	2/2	0.003 U		0.003 U													
Lithium	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2							0.0004 U		0.0004 U									
Lithium	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2			0.0004 U		0.0004 U													
Magnesium	Dissolved	mg/L	1.53	3.05	2.34667	6/6							3.05		1.53		1.93		2.68		2.87		2.02	
Magnesium	Total	mg/L	2.41	2.89	2.65	2/2			2.41		2.89													
Manganese	Dissolved	mg/L	0.01	0.0394	0.0177	6/6	0.05	0/6					0.0394		0.01		0.011		0.016		0.017		0.0128	
Manganese	Total	mg/L	0.0174	0.0226	0.02	2/2	0.05	0/2	0.0174		0.0226													
Molybdenum	Dissolved	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2							0.0004 U		0.0004 U									
Molybdenum	Total	mg/L	0.0004 U	0.0004 U	0.0004 U	0/2			0.0004 U		0.0004 U													
Nickel	Dissolved	mg/L	0.002 U	0.00039	0.00072	2/5	0.0134	0/5					0.00039		0.00021		0.002 U		0.002 U				0.002 U	
Nickel	Total	mg/L	0.00197 U	0.00087	0.00093	1/2	0.0134	0/2	0.00197 U		0.00087													
Potassium	Dissolved	mg/L	1 U	0.826	0.53067	2/6							0.826		0.358		1 U		1 U		1 U		1 U	
Potassium	Total	mg/L	0.345	0.852	0.5985	2/2			0.852		0.345													
Selenium	Dissolved	mg/L	0.001 U	0.00145	0.00099	1/6	0.01	0/6					0.003 U		0.003 U		0.001 U		0.001 U		0.00145		0.001 U	
Selenium	Total	mg/L	0.003 U	0.003 U	0.003 U	0/2	0.01	0/2	0.003 U		0.003 U													
Silver	Dissolved	mg/L	0.0002 U	0.001 U	0.00073 U	0/6	0.00012	6/6					0.0002 U		0.0002 U		0.001 U		0.001 U		0.001 U		0.001 U	
Silver	Total	mg/L	0.0002 U	0.0002 U	0.0002 U	0/2	0.00012	2/2	0.0002 U		0.0002 U													
Sodium	Dissolved	mg/L	2.55	4.49	3.53833	6/6							4.49		2.55		3.08		3.81		4.07		3.23	
Sodium	Total	mg/L	3.87	4.19	4.03	2/2			3.87		4.19													
Thallium	Dissolved	mg/L	0.001 U	0.002 U	0.00133 U	0/6	0.013	0/6					0.002 U		0.002 U		0.001 U		0.001 U		0.001 U		0.001 U	
Thallium	Total	mg/L	0.002 U	0.002 U	0.002 U	0/2	0.013	0/2	0.002 U		0.002 U													
Vanadium	Dissolved	mg/L	0.005 U	0.0007	0.00188	2/6							0.00057		0.0007		0.005 U		0.005 U		0.005 U		0.005 U	
Vanadium	Total	mg/L	0.00023	0.00038	0.00031	2/2			0.00038		0.00023													
Zinc	Dissolved	mg/L	0.5 U	0.0167	0.0523	5/6	0.036	1/6					0.00891		0.0167		0.0149		0.0107		0.0126		0.5 U	
Zinc	Total	mg/L	0.00397	0.00455	0.00426	2/2	0.036	0/2	0.00397		0.00455													

Table A-44
SFREF1
Historical Results

Analyte	Analyte 2	Unit	Historical Range			Historical Frequency of Detection	Freshwater Water Quality Criteria		Surface Water 6/16/1999		Surface Water 10/7/1999		Surface Water 10/26/1999		Surface Water 1/25/2000		Surface Water 3/22/2000		Surface Water 2/23/2001		Surface Water 5/1/2001		Surface Water 2/23/2004	
			Min	Max	Mean[1,2]		Screening Level	Criteria Exceedances[3]	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier	Value	Qualifier
Major Ions																								
Silica (SiO2)	Total	mg/L	22	22	22	1/1					22													
Other																								
Hardness[4]		mg/L	15.1	45.6	27.8	4/4			31.1		15.1		45.6		19.4									

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-44
SFREF1
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/27/2002	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurement						
Flow		gpm			363.528	
pH		su	6.5 to 8.5	0/1	8.3	
Metals						
Aluminum	Dissolved	mg/L			0.107	J
Arsenic	Dissolved	mg/L	0.048	0/1	0.0062	U
Cadmium	Dissolved	mg/L	0.00077	1/1	0.0025	U
Copper	Dissolved	mg/L	0.0078	0/1	0.0062	U
Iron	Dissolved	mg/L	0.3	0/1	0.012	UJ
Lead	Dissolved	mg/L	0.0017	1/1	0.0062	U
Manganese	Dissolved	mg/L	0.05	0/1	0.0062	UJ
Nickel	Dissolved	mg/L	0.0134	0/1	0.0062	U
Zinc	Dissolved	mg/L	0.07	0/1	0.0062	U
Major Ions						
Sulfate		mg/L			44	
Sulfide		mg/L	0.002	1/1	0.05	U
Other						
Hardness[2]		mg/L			61.2	
Total Suspended Solids		mg/L			5	U

Key:

U = Nondetect

J = Estimated

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-45
SFREF2
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 10/19/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Conductivity		µS/cm			158	
Flow		gpm			0.1	
pH		su	6.5 to 8.5	1/1	6.2	
Metals						
Aluminum	Dissolved	mg/L			0.087	U
Antimony	Dissolved	mg/L	0.146	0/1	0.01	U
Arsenic	Dissolved	mg/L	0.048	0/1	0.01	U
Barium	Dissolved	mg/L	1	0/1	0.004	U
Beryllium	Dissolved	mg/L	0.0053	0/1	0.001	U
Cadmium	Dissolved	mg/L	No Hardness		0.001	U
Calcium	Dissolved	mg/L			18	
Chromium	Dissolved	mg/L	0.011	0/1	0.01	U
Cobalt	Dissolved	mg/L			0.01	U
Copper	Dissolved	mg/L	No Hardness		0.01	U
Iron	Dissolved	mg/L	0.3	0/1	0.05	U
Lead	Dissolved	mg/L	No Hardness		0.002	U
Magnesium	Dissolved	mg/L			4.1	
Manganese	Dissolved	mg/L	0.05	0/1	0.01	U
Mercury	Dissolved	mg/L	0.000012	1/1	0.0002	U
Nickel	Dissolved	mg/L	0.0134	0/1	0.01	U
Potassium	Dissolved	mg/L			2	U
Selenium	Dissolved	mg/L	0.01	1/1	0.02	U
Silver	Dissolved	mg/L	0.00012	1/1	0.01	U
Sodium	Dissolved	mg/L			2.4	
Thallium	Dissolved	mg/L	0.013	1/1	0.05	U
Vanadium	Dissolved	mg/L			0.01	U
Zinc	Dissolved	mg/L	No Hardness		0.05	U

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

Table A-46
Location SFU
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/27/2002	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Flow		gpm			15.0	
pH		su	6.5 to 8.5	0/1	8.2	
Metals						
Aluminum	Dissolved	mg/L			0.062	U
Arsenic	Dissolved	mg/L	0.048	0/1	0.0062	U
Cadmium	Dissolved	mg/L	0.00065	1/1	0.0025	U
Copper	Dissolved	mg/L	0.0064	0/1	0.0062	U
Iron	Dissolved	mg/L	0.3	0/1	0.0296	
Lead	Dissolved	mg/L	0.0013	1/1	0.0062	U
Manganese	Dissolved	mg/L	0.05	0/1	0.0062	U
Nickel	Dissolved	mg/L	0.0134	0/1	0.0062	U
Zinc	Dissolved	mg/L	0.058	0/1	0.0062	U
Major Ions						
Sulfate	Dissolved	mg/L			15.8	
Sulfide	Dissolved	mg/L	0.002	1/1	0.05	U
Other						
Hardness[2]	Dissolved	mg/L			49	
Total Suspended Solids	Dissolved	mg/L			9	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-47
Location T1
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/27/2002	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Flow		gpm			30.0	
pH		su	6.5 to 8.5	0/1	7.9	
Metals						
Aluminum	Dissolved	mg/L			0.062	U
Arsenic	Dissolved	mg/L	0.048	0/1	0.0062	U
Cadmium	Dissolved	mg/L	0.0012	1/1	0.007	
Copper	Dissolved	mg/L	0.013	1/1	0.134	
Iron	Dissolved	mg/L	0.3	0/1	0.013	
Lead	Dissolved	mg/L	0.0037	1/1	0.0062	U
Manganese	Dissolved	mg/L	0.05	0/1	0.0062	U
Nickel	Dissolved	mg/L	0.0134	0/1	0.0062	U
Zinc	Dissolved	mg/L	0.12	1/1	1.98	
Major Ions						
Sulfate	Dissolved	mg/L			95.5	
Sulfide	Dissolved	mg/L	0.002	1/1	0.05	U
Other						
Hardness[2]	Dissolved	mg/L			112	
Total Suspended Solids	Dissolved	mg/L			5	U

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-48
Location T1A
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/27/2002	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Flow		gpm			5.0	
pH		su	6.5 to 8.5	0/1	6.9	
Metals						
Aluminum	Dissolved	mg/L			0.062	U
Arsenic	Dissolved	mg/L	0.048	0/1	0.0062	U
Cadmium	Dissolved	mg/L	0.0015	1/1	0.0116	
Copper	Dissolved	mg/L	0.016	1/1	0.262	
Iron	Dissolved	mg/L	0.3	0/1	0.012	U
Lead	Dissolved	mg/L	0.005	1/1	0.0062	U
Manganese	Dissolved	mg/L	0.05	1/1	0.128	
Nickel	Dissolved	mg/L	0.0134	0/1	0.0102	
Zinc	Dissolved	mg/L	0.14	1/1	3.22	
Major Ions						
Sulfate	Dissolved	mg/L			144	
Sulfide	Dissolved	mg/L	0.002	1/1	0.05	U
Other						
Hardness[2]	Dissolved	mg/L			142	
Total Suspended Solids	Dissolved	mg/L			5	U

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-49
Location T2
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/27/2002	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Flow		gpm			5.0	
pH		su	6.5 to 8.5	0/1	6.7	
Metals						
Aluminum	Dissolved	mg/L			3.32	
Arsenic	Dissolved	mg/L	0.048	0/1	0.0062	U
Cadmium	Dissolved	mg/L	0.0026	1/1	0.0428	
Copper	Dissolved	mg/L	0.029	1/1	3.02	
Iron	Dissolved	mg/L	0.3	0/1	0.0361	
Lead	Dissolved	mg/L	0.012	0/1	0.0062	U
Manganese	Dissolved	mg/L	0.05	1/1	1.23	
Nickel	Dissolved	mg/L	0.0134	1/1	0.0341	
Zinc	Dissolved	mg/L	0.26	1/1	15.6	
Major Ions						
Sulfate	Dissolved	mg/L			343	
Sulfide	Dissolved	mg/L	0.002	1/1	0.05	U
Other						
Hardness[2]	Dissolved	mg/L			290	
Total Suspended Solids	Dissolved	mg/L			16	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-50
Location T2A
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/17/1999 Value	Surface Water 6/17/1999 Qualifier	Surface Water 10/4/1999 Value	Surface Water 10/4/1999 Qualifier	Surface Water 1/24/2000 Value	Surface Water 1/24/2000 Qualifier	Surface Water 3/21/2000 Value	Surface Water 3/21/2000 Qualifier
Field Measurements																
Conductivity		µS/cm	41	122	81.5	2/2					122		41			
Flow		gpm	3088.0	14017.0	8552.5	2/2			14017.0		3088.0					
pH		su	7.59	8.14	7.73	3/3	6.5 to 8.5	0/3			8.14		7.59		7.73	
Temperature		deg C	11.2	16.3	13.75	2/2					16.3		11.2			
Metals																
Aluminum	Dissolved	mg/L	0.1	U	0.101	0.067	2/3					0.05		0.101		0.1	U
Aluminum	Total	mg/L	0.056		0.056	0.056	1/1			0.056						
Antimony	Dissolved	mg/L	0.001	U	0.003	U	0.00233	U	0/3	0.146	0/3		0.003	U	0.003	U	0.001	U
Antimony	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.146	0/1	0.003	U					
Arsenic	Dissolved	mg/L	0.001	U	0.002		0.00117		1/3	0.048	0/3		0.002	U	0.002		0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.048	0/1	0.002	U					
Barium	Dissolved	mg/L	0.00862		0.0286		0.01594		3/3	1	0/3		0.0286		0.00862		0.0106	
Barium	Total	mg/L	0.0169		0.0169		0.0169		1/1	1	0/1	0.0169						
Beryllium	Dissolved	mg/L	0.00001	U	2.6E-05		0.00018		1/3	0.0053	0/3		0.00001	U	0.000026		0.001	U
Beryllium	Total	mg/L	0.00001	U	0.00001	U	0.00001	U	0/1	0.0053	0/1	0.00001	U					
Cadmium	Dissolved	mg/L	0.0001	U	0.001	U	0.0004	U	0/3	0.00044	1/3		0.0001	U	0.0001	U	0.001	U
Cadmium	Total	mg/L	0.0001	U	0.0001	U	0.0001	U	0/1	0.00044	0/1	0.0001	U					
Calcium	Dissolved	mg/L	3.2		11.7		6.50333		3/3				11.7		3.2		4.61	
Calcium	Total	mg/L	7.7		7.7		7.7		1/1			7.7						
Chromium	Dissolved	mg/L	0.0002	U	0.00069		0.00043		1/3	0.011	0/3		0.0002	U	0.00069		0.001	U
Chromium	Total	mg/L	0.00043		0.00043		0.00043		1/1	0.011	0/1	0.00043						
Cobalt	Dissolved	mg/L	0.0002	U	0.00054		0.00055		1/3				0.0002	U	0.00054		0.002	U
Cobalt	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1			0.0002	U					
Copper	Dissolved	mg/L	0.0003	U	0.00192		0.00102		1/3	0.0043	0/3		0.0003	U	0.00192		0.002	U
Copper	Total	mg/L	0.0003	U	0.0003	U	0.0003	U	0/1	0.0043	0/1	0.0003	U					
Iron	Dissolved	mg/L	0.1	U	0.178		0.08017		2/3	0.3	0/3		0.0125		0.178		0.1	U
Iron	Total	mg/L	0.0175		0.0175		0.0175		1/1	0.3	0/1	0.0175						
Lanthanum	Dissolved	mg/L	0.001	U	0.002		0.00125		1/2				0.002		0.001	U		
Lanthanum	Total	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U					
Lead	Dissolved	mg/L	0.001	U	0.003	U	0.00233	U	0/3	0.00069	3/3		0.003	U	0.003	U	0.001	U
Lead	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.00069	1/1	0.003	U					
Lithium	Dissolved	mg/L	0.0004	U	0.00605		0.00313		1/2				0.00605		0.0004	U		
Lithium	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U					
Magnesium	Dissolved	mg/L	1.52		3.97		2.46667		3/3				3.97		1.52		1.91	
Magnesium	Total	mg/L	2.81		2.81		2.81		1/1			2.81						
Manganese	Dissolved	mg/L	0.01	U	0.00279		0.0028		2/3	0.05	0/3		0.0006		0.00279		0.01	U
Manganese	Total	mg/L	0.00096		0.00096		0.00096		1/1	0.05	0/1	0.00096						
Molybdenum	Dissolved	mg/L	0.0004	U	0.00046		0.00033		1/2				0.0004	U	0.00046			
Molybdenum	Total	mg/L	0.00043		0.00043		0.00043		1/1			0.00043						
Nickel	Dissolved	mg/L	0.0002	U	0.00215		0.00108		1/3	0.0134	0/3		0.0002	U	0.00215		0.002	U
Nickel	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.0134	0/1	0.0002	U					
Potassium	Dissolved	mg/L	1	U	0.771		0.49767		2/3				0.771		0.222		1	U
Potassium	Total	mg/L	0.791		0.791		0.791		1/1			0.791						
Selenium	Dissolved	mg/L	0.001	U	0.003	U	0.00233	U	0/3	0.01	0/3		0.003	U	0.003	U	0.001	U
Selenium	Total	mg/L	0.003	U	0.003	U	0.003	U	0/1	0.01	0/1	0.003	U					
Silver	Dissolved	mg/L	0.0002	U	0.001	U	0.00047	U	0/3	0.00012	3/3		0.0002	U	0.0002	U	0.001	U
Silver	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.00012	1/1	0.0002	U					
Sodium	Dissolved	mg/L	2.29		6.04		3.54333		3/3				6.04		2.29		2.3	
Sodium	Total	mg/L	4.07		4.07		4.07		1/1			4.07						
Thallium	Dissolved	mg/L	0.001	U	0.0021		0.0012		1/3	0.013	0/3		0.0021		0.002	U	0.001	U
Thallium	Total	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.013	0/1	0.002	U					
Vanadium	Dissolved	mg/L	0.0001	U	0.00059		0.00105		1/3				0.0001	U	0.00059		0.005	U
Vanadium	Total	mg/L	0.0005		0.0005		0.0005		1/1			0.0005						
Zinc	Dissolved	mg/L	0.0005	U	0.00263		0.00179		1/3	0.038	0/3		0.0005	U	0.00263		0.005	U
Zinc	Total	mg/L	0.00077		0.00077		0.00077		1/1	0.038	0/1	0.00077						
Other																
Hardness[4]		mg/L	14.2		45.6		30.2		3/3			30.8		45.6		14.2		

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-51
Location WC1
Historical Results

Analyte	Analyte 2	Unit	Historical Range Min	Historical Range Max	Historical Range Mean[1,2]	Historical Frequency of Detection	Freshwater Water Quality Criteria Screening Level	Freshwater Water Quality Criteria Criteria Exceedances[3]	Surface Water 6/18/1999 Value	Surface Water 6/18/1999 Qualifier	Surface Water 5/20/2003 Value	Surface Water 5/20/2003 Qualifier
Field Measurements												
Flow		gpm	202.0	202.0	202.0	1/1			202.0			
pH		su	7.53	7.53	7.53	1/1	6.5 to 8.5	0/1	7.53			
Metals												
Aluminum	Total	mg/L	0.1	U	0.067	0.0585	1/2			0.067		0.1	U
Aluminum	Dissolved	mg/L	0.1	U	0.1	U	0.1	U	0/1			0.1	U
Antimony	Total	mg/L	0.001	U	0.003	U	0.002	U	0/2	0.146	0/2	0.003	U	0.001	U
Antimony	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.146	0/1			0.001	U
Arsenic	Total	mg/L	0.002	U	0.002	U	0.002	U	0/2	0.048	0/2	0.002	U	0.002	U
Arsenic	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.048	0/1			0.001	U
Barium	Total	mg/L	0.00302		0.00351		0.003265		2/2	1	0/2	0.00351		0.00302	
Barium	Dissolved	mg/L	0.00255		0.00255		0.00255		1/1	1	0/1			0.00255	
Beryllium	Total	mg/L	0.00001	U	0.001	U	0.000505	U	0/2	0.0053	0/2	0.00001	U	0.001	U
Beryllium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.0053	0/1			0.001	U
Cadmium	Total	mg/L	0.0001	U	0.001	U	0.00055	U	0/2	0.00069	1/2	0.0001	U	0.001	U
Cadmium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.00069	1/1			0.001	U
Calcium	Total	mg/L	12.5		14		13.25		2/2			14		12.5	
Calcium	Dissolved	mg/L	13.1		13.1		13.1		1/1					13.1	
Chromium	Total	mg/L	0.001	U	0.0005		0.0005		1/2	0.011	0/2	0.0005		0.001	U
Chromium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.011	0/1			0.001	U
Cobalt	Total	mg/L	0.0002	U	0.001	U	0.0006	U	0/2			0.0002	U	0.001	U
Cobalt	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1					0.001	U
Copper	Total	mg/L	0.0003	U	0.002	U	0.00115	U	0/2	0.0069	0/2	0.0003	U	0.002	U
Copper	Dissolved	mg/L	0.002	U	0.002	U	0.002	U	0/1	0.0069	0/1			0.002	U
Iron	Total	mg/L	0.1	U	0.0258		0.0379		1/2	0.3	0/2	0.0258		0.1	U
Iron	Dissolved	mg/L	0.1	U	0.1	U	0.1	U	0/1	0.3	0/1			0.1	U
Lanthanum	Total	mg/L	0.001	U	0.001	U	0.001	U	0/1			0.001	U		
Lead	Total	mg/L	0.001	U	0.003	U	0.002	U	0/2	0.0014	1/2	0.003	U	0.001	U
Lead	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.0014	0/1			0.001	U
Lithium	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U		
Magnesium	Total	mg/L	3.81		4.32		4.065		2/2			4.32		3.81	
Magnesium	Dissolved	mg/L	3.74		3.74		3.74		1/1					3.74	
Manganese	Total	mg/L	0.00346		0.00678		0.00512		2/2	0.05	0/2	0.00678		0.00346	
Manganese	Dissolved	mg/L	0.00287		0.00287		0.00287		1/1	0.05	0/1			0.00287	
Molybdenum	Total	mg/L	0.0004	U	0.0004	U	0.0004	U	0/1			0.0004	U		
Nickel	Total	mg/L	0.0002	U	0.0002	U	0.0002	U	0/1	0.0134	0/1	0.0002	U		
Potassium	Total	mg/L	0.1	U	0.654		0.352		1/2			0.654		0.1	U
Potassium	Dissolved	mg/L	0.1	U	0.1	U	0.1	U	0/1					0.1	U
Selenium	Total	mg/L	0.003	U	0.00119		0.001345		1/2	0.01	0/2	0.003	U	0.00119	
Selenium	Dissolved	mg/L	0.00142		0.00142		0.00142		1/1	0.01	0/1			0.00142	
Silver	Total	mg/L	0.0002	U	3.33		1.66505		1/2	0.00012	2/2	0.0002	U	3.33	
Silver	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.00012	1/1			0.001	U
Sodium	Total	mg/L	1	U	4.03		2.265		1/2			4.03		1	U
Sodium	Dissolved	mg/L	3.38		3.38		3.38		1/1					3.38	
Thallium	Total	mg/L	0.001	U	0.002	U	0.0015	U	0/2	0.013	0/2	0.002	U	0.001	U
Thallium	Dissolved	mg/L	0.001	U	0.001	U	0.001	U	0/1	0.013	0/1			0.001	U
Vanadium	Total	mg/L	0.005	U	0.00101		0.001755		1/2			0.00101		0.005	U
Vanadium	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0/1					0.005	U
Zinc	Total	mg/L	0.005	U	0.00064		0.00157		1/2	0.062	0/2	0.00064		0.005	U
Zinc	Dissolved	mg/L	0.005	U	0.005	U	0.005	U	0/1	0.062	0/1			0.005	U
Other															
Hardness[4]		mg/L	52.8		52.8		52.8		1/1			52.8			

Key:

U = Nondetect

Notes:

1. The mean was calculated using 1/2 the detection limit for non-detect values.
2. The median was calculated for pH instead of mean.
3. Some method reporting limits exceed the SL.
4. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-52
Location WFCC1.1
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/18/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
pH		su	6.5 to 8.5	0/1	7.45	
Metals						
Aluminum	Total	mg/L			0.069	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.00443	
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U
Cadmium	Total	mg/L	0.00069	0/1	0.0001	U
Calcium	Total	mg/L			14.1	
Chromium	Total	mg/L	0.011	0/1	0.00053	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0069	0/1	0.0003	U
Iron	Total	mg/L	0.3	0/1	0.0163	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0014	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			4.33	
Manganese	Total	mg/L	0.05	0/1	0.00107	
Molybdenum	Total	mg/L			0.00053	
Nickel	Total	mg/L	0.0134	0/1	0.0002	U
Potassium	Total	mg/L			0.77	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			0.489	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.0008	
Zinc	Total	mg/L	0.062	0/1	0.0005	U
Other						
Hardness[2]		mg/L			53.1	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-53
Location WFCC2.8
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 6/18/1999	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Flow		gpm			2980.2	
pH		su	6.5 to 8.5	0/1	7.66	
Metals						
Aluminum	Total	mg/L			0.076	
Antimony	Total	mg/L	0.146	0/1	0.003	U
Arsenic	Total	mg/L	0.048	0/1	0.002	U
Barium	Total	mg/L	1	0/1	0.00332	
Beryllium	Total	mg/L	0.0053	0/1	0.00001	U
Cadmium	Total	mg/L	0.00073	0/1	0.0001	U
Calcium	Total	mg/L			14.8	
Chromium	Total	mg/L	0.011	0/1	0.00034	
Cobalt	Total	mg/L			0.0002	U
Copper	Total	mg/L	0.0073	0/1	0.0003	U
Iron	Total	mg/L	0.3	0/1	0.0108	
Lanthanum	Total	mg/L			0.001	U
Lead	Total	mg/L	0.0016	1/1	0.003	U
Lithium	Total	mg/L			0.0004	U
Magnesium	Total	mg/L			4.85	
Manganese	Total	mg/L	0.05	0/1	0.00072	
Molybdenum	Total	mg/L			0.00048	
Nickel	Total	mg/L	0.0134	0/1	0.0002	U
Potassium	Total	mg/L			0.896	
Selenium	Total	mg/L	0.01	0/1	0.003	U
Silver	Total	mg/L	0.00012	1/1	0.0002	U
Sodium	Total	mg/L			4.98	
Thallium	Total	mg/L	0.013	0/1	0.002	U
Vanadium	Total	mg/L			0.00115	
Zinc	Total	mg/L	0.066	0/1	0.00073	
Other						
Hardness[2]		mg/L			57	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-54
Location WFCC7.4
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 8/27/1998	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier
Field Measurements						
Dissolved Oxygen	Total	mg/L			9.3	
Dissolved Oxygen	Total	percent of saturation			94	
Flow		gpm			224.4	E
pH Lab	Total	su	6.5 to 8.5	0/1	8.1	
pH Field	Total	su	6.5 to 8.5	0/1	8.1	
Specific Conductance Lab	Total	µS/cm			166	
Specific Conductance Field	Total	µS/cm			160	
Temperature		deg C			13.8	
Metals						
Aluminum	Dissolved	mg/L			0.0021	
Antimony	Dissolved	mg/L	0.146	1/1	0.001	U
Arsenic	Dissolved	mg/L	0.048	1/1	0.001	U
Barium	Dissolved	mg/L	1	1/1	0.008	
Beryllium	Dissolved	mg/L	0.0053	1/1	0.001	U
Cadmium	Dissolved	mg/L	0.00087	1/1	0.001	U
Chromium	Dissolved	mg/L	0.011	1/1	0.001	
Cobalt	Dissolved	mg/L			0.001	U
Copper	Dissolved	mg/L	0.0088	1/1	0.001	U
Iron	Dissolved	mg/L	0.3	1/1	0.01	U
Lead	Dissolved	mg/L	0.0021	1/1	0.001	U
Magnesium	Dissolved	mg/L			7.3	
Manganese	Dissolved	mg/L	0.05	1/1	0.004	U
Manganese	Dissolved	mg/L	0.05	1/1	0.001	U
Molybdenum	Dissolved	mg/L			0.001	U
Nickel	Dissolved	mg/L	0.0134	1/1	0.001	U
Selenium	Dissolved	mg/L	0.01	1/1	0.001	U
Silver	Dissolved	mg/L	0.00012	1/1	0.001	U
Uranium (natural)	Dissolved	mg/L			0.001	U
Zinc	Dissolved	mg/L	0.079	1/1	0.001	U
Major Ions						
Alkalinity	Dissolved	mg/L as CaCO3			71	
Ammonia	Dissolved	mg/L as N			0.002	U
Ammonia plus organic nitrogen	Dissolved	mg/L as N			0.1	U
Ammonia plus organic nitrogen	Total	mg/L as N			0.1	U
Bicarbonate	Dissolved	mg/L			87	
Calcium	Dissolved	mg/L			16.5	
Carbon dioxide	Total	mg/L			1.3	
Chloride	Dissolved	mg/L	230	1/1	2.28	
Fluoride	Dissolved	mg/L			0.1	U
Hydrogen ion	Total	mg/L			0.00001	
Nitrate plus nitrite	Dissolved	mg/L as N			0.059	
Nitrite	Dissolved	mg/L as N			0.001	U
Orthophosphate	Dissolved	mg/L			0.021	
Orthophosphate	Dissolved	mg/L as P			0.007	
Phosphorus	Total	mg/L as P			0.012	
Phosphorus	Dissolved	mg/L as P			0.01	

Table A-55
USGS-7
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 8/27/1998	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier
Major Ions (Con't)						
Potassium	Dissolved	mg/L			2.44	
Silica	Dissolved	mg/L as SiO2			15.7	
Sodium	Dissolved	mg/L			4.98	
Sodium adsorption ratio		number			0.3	
Sodium fraction of cations		percent in equivalents of major cations			13	
Sulfate	Dissolved	mg/L			4.82	
Other						
Acid neutralizing capacity	Total	mg/L as CaCO3			77	
Hardness[2]		mg/L as CaCO3			71	
Residue	Dissolved	mg/L			97	
Residue	Dissolved	tons per day			0.13	E
Residue	Dissolved	tons per acre			0.13	
Residue on evaporation	Dissolved	mg/L			97	

Key:

U = Nondetect

E = USGS Estimated

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-55
USGS-7
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 9/14/1998	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier
Field Measurements						
Dissolved Oxygen	Total	mg/L			9.3	
Dissolved Oxygen	Total	percent of saturation			97	
Flow		gpm			31.416	E
pH Lab	Total	su	6.5 to 8.5	0/1	7.3	
pH Field	Total	su	6.5 to 8.5	0/1	8	
Specific Conductance Lab	Total	µS/cm			412	
Specific Conductance Field	Total	µS/cm			404	
Temperature		deg C			13.2	
Metals						
Aluminum	Dissolved	mg/L			0.0086	
Antimony	Dissolved	mg/L	0.146	1/1	0.001	U
Arsenic	Dissolved	mg/L	0.048	1/1	0.001	U
Barium	Dissolved	mg/L	1	1/1	0.027	
Beryllium	Dissolved	mg/L	0.0053	1/1	0.001	U
Cadmium	Dissolved	mg/L	0.0019	1/1	0.00783	
Chromium	Dissolved	mg/L	0.011	1/1	0.001	U
Cobalt	Dissolved	mg/L			0.001	U
Copper	Dissolved	mg/L	0.02	1/1	0.0965	
Iron	Dissolved	mg/L	0.3	1/1	0.01	U
Lead	Dissolved	mg/L	0.0072	1/1	0.001	U
Magnesium	Dissolved	mg/L			17.4	
Manganese	Dissolved	mg/L	0.05	1/1	0.0069	
Manganese	Dissolved	mg/L	0.05	1/1	0.0066	
Molybdenum	Dissolved	mg/L			0.001	U
Nickel	Dissolved	mg/L	0.0134	1/1	0.00485	
Selenium	Dissolved	mg/L	0.01	1/1	0.001	U
Silver	Dissolved	mg/L	0.00012	1/1	0.001	U
Uranium (natural)	Dissolved	mg/L			0.001	U
Zinc	Dissolved	mg/L	0.18	1/1	1.45	
Major Ions						
Alkalinity	Dissolved	mg/L as CaCO3			46	
Ammonia	Dissolved	mg/L as N			0.002	U
Ammonia plus organic nitrogen	Total	mg/L as N			0.1	U
Bicarbonate	Dissolved	mg/L			57	
Calcium	Dissolved	mg/L			46.5	
Carbon dioxide	Total	mg/L			1.1	
Chloride	Dissolved	mg/L	230	1/1	2.72	
Fluoride	Dissolved	mg/L			0.11	
Hydrogen ion	Total	mg/L			0.00001	
Nitrate	Dissolved	mg/L as N			0.1	
Nitrate	Dissolved	mg/L			0.456	
Nitrate plus nitrite	Dissolved	mg/L as N			0.104	
Nitrite	Dissolved	mg/L as N			0.001	
Nitrite	Dissolved	mg/L			0.003	
Orthophosphate	Dissolved	mg/L as P			0.001	U
Phosphorus	Total	mg/L as P			0.001	U

Table A-56
USGS-8
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 9/14/1998	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier
Metals (Con't)						
Phosphorus	Dissolved	mg/L as P			0.001	
Potassium	Dissolved	mg/L			0.63	
Silica	Dissolved	mg/L as SiO2			16.4	
Sodium	Dissolved	mg/L			6.2	
Sodium adsorption ratio		number			0.2	
Sodium fraction of cations		percent in equivalents of major cations			7	
Sulfate	Dissolved	mg/L			141	
Other						
Acid neutralizing capacity	Total	mg/L as CaCO3			52	
Hardness[2]		mg/L as CaCO3			190	
Noncarbonate hardness Field	Dissolved	mg/L as CaCO3			140	
Residue	Dissolved	mg/L			259	
Residue	Dissolved	tons per day			0.06	E
Residue	Dissolved	tons per acre			0.4	
Residue on evaporation	Dissolved	mg/L			295	

Key:

U = Nondetect

E = USGS Estimated

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-56
USGS-8
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 9/15/1998	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier
Field Measurements						
Dissolved Oxygen	Total	mg/L			9.4	
Dissolved Oxygen	Total	percent of saturation			95	
Flow		gpm			1256.64	
pH Lab	Total	su			7.9	
pH Field	Total	su			8.1	
Specific Conductance Lab	Total	µS/cm			156	
Specific Conductance Field	Total	µS/cm			146	
Temperature		deg C			12.9	
Metals						
Aluminum	Dissolved	mg/L			0.0084	
Antimony	Dissolved	mg/L	0.146	1/1	0.001	U
Arsenic	Dissolved	mg/L	0.048	1/1	0.001	U
Barium	Dissolved	mg/L	1	1/1	0.007	
Beryllium	Dissolved	mg/L	0.0053	1/1	0.001	U
Cadmium	Dissolved	mg/L	0.000818499	1/1	0.001	U
Chromium	Dissolved	mg/L	0.011	1/1	0.001	U
Cobalt	Dissolved	mg/L			0.001	U
Copper	Dissolved	mg/L	0.008290083	1/1	0.0042	
Iron	Dissolved	mg/L	0.3	1/1	0.028	
Lead	Dissolved	mg/L	0.001874666	1/1	0.001	U
Magnesium	Dissolved	mg/L			5.06	
Manganese	Dissolved	mg/L	0.05	1/1	0.0093	
Manganese	Dissolved	mg/L	0.05	1/1	0.0088	
Molybdenum	Dissolved	mg/L			0.001	U
Nickel	Dissolved	mg/L	0.0134	1/1	0.001	U
Selenium	Dissolved	.	0.01	1/1	0.001	U
Silver	Dissolved	mg/L	0.00012	1/1	0.001	U
Uranium (natural)	Dissolved	mg/L			0.001	U
Zinc	Dissolved	mg/L	0.074536912	1/1	0.0332	
Major Ions						
Alkalinity	Dissolved	mg/L as CaCO3			48	
Ammonia	Dissolved	mg/L as N			0.004	
Ammonia	Dissolved	mg/L as NH4			0.01	
Ammonia plus organic nitrogen	Dissolved	mg/L as N			0.1	U
Ammonia plus organic nitrogen	Total	mg/L as N			0.1	U
Bicarbonate	Dissolved	mg/L			59	
Calcium	Dissolved	mg/L			17.9	
Carbon dioxide	Total	mg/L			0.8	
Carbonate	Dissolved	mg/L			0	
Chloride	Dissolved	mg/L	230	1/1	2.41	
Fluoride	Dissolved	mg/L			0.1	U
Hydrogen ion	Total	mg/L			0.00001	
Nitrate	Dissolved	mg/L as N			0.04	
Nitrate	Dissolved	mg/L			0.199	
Nitrate plus nitrite	Dissolved	mg/L as N			0.046	
Nitrite	Dissolved	mg/L as N			0.001	

Table A-57
USGS-9
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 9/15/1998	
			Screening Level	Criteria Exceedances[3]	Value	Qualifier
Major Ions (Con't)						
Nitrite	Dissolved	mg/L			0.003	
Orthophosphate	Dissolved	mg/L			0.009	
Orthophosphate	Dissolved	mg/L as P			0.003	
Phosphorus	Total	mg/L as P			0.007	
Phosphorus	Dissolved	mg/L as P			0.004	
Potassium	Dissolved	mg/L			0.41	
Silica	Dissolved	mg/L as SiO2			20	
Sodium	Dissolved	mg/L			4.86	
Sodium adsorption ratio		number			0.3	
Sodium fraction of cations		percent in equivalents of major cations			14	
Sulfate	Dissolved	mg/L			20.1	
Other						
Acid neutralizing capacity	Total	mg/L as CaCO3			50	
Hardness[2]		mg/L as CaCO3			66	
Noncarbonate hardness Field	Dissolved	mg/L as CaCO3			17	
Residue	Dissolved	mg/L			100	
Residue	Dissolved	tons per day			0.82	
Residue	Dissolved	tons per acre			0.15	
Residue on evaporation	Dissolved	mg/L			108	

Key:

U = Nondetect

Notes:

1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-57
USGS-9
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 9/15/1998	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Field Measurements						
Dissolved Oxygen	Total	mg/L			9.5	
Dissolved Oxygen	Total	percent of saturation			95	
Flow		gpm			134.64	
pH Lab	Total	su			7.9	
pH Field	Total	su			8	
Specific Conductance Lab	Total	µS/cm			259	
Specific Conductance Field	Total	µS/cm			248	
Temperature		deg C			12.3	
Metals						
Aluminum	Dissolved	mg/L			0.0022	
Antimony	Dissolved	mg/L	0.146	1/1	0.001	U
Arsenic	Dissolved	mg/L	0.048	1/1	0.001	U
Barium	Dissolved	mg/L	1	1/1	0.041	
Beryllium	Dissolved	mg/L	0.0053	1/1	0.001	U
Cadmium	Dissolved	mg/L	0.0012	1/1	0.00112	
Chromium	Dissolved	mg/L	0.011	1/1	0.001	U
Cobalt	Dissolved	mg/L			0.001	U
Copper	Dissolved	mg/L	0.013	1/1	0.0076	
Iron	Dissolved	mg/L	0.3	1/1	0.01	U
Lead	Dissolved	mg/L	0.0036	1/1	0.001	U
Magnesium	Dissolved	mg/L			11.4	
Manganese	Dissolved	mg/L	0.05	1/1	0.0048	
Manganese	Dissolved	mg/L	0.05	1/1	0.0048	
Molybdenum	Dissolved	mg/L			0.001	U
Nickel	Dissolved	mg/L	0.0134	1/1	0.00111	
Selenium	Dissolved	mg/L	0.01	1/1	0.001	U
Silver	Dissolved	mg/L	0.00012	1/1	0.001	U
Uranium (natural)	Dissolved	mg/L			0.001	U
Zinc	Dissolved	mg/L	0.11	1/1	0.134	
Major Ions						
Alkalinity	Dissolved	mg/L as CaCO3			57	
Ammonia	Dissolved	mg/L as N			0.002	U
Ammonia plus organic nitrogen	Dissolved	mg/L as N			0.1	U
Ammonia plus organic nitrogen	Total	mg/L as N			0.1	U
Bicarbonate	Dissolved	mg/L			69	
Calcium	Dissolved	mg/L			27.1	
Carbon dioxide	Total	mg/L			1.3	
Chloride	Dissolved	mg/L	230	1/1	3.07	
Fluoride	Dissolved	mg/L			0.1	U
Hydrogen ion	Total	mg/L			0.00001	
Nitrate	Dissolved	mg/L as N			0.07	
Nitrate	Dissolved	mg/L			0.319	
Nitrate plus nitrite	Dissolved	mg/L as N			0.075	
Nitrite	Dissolved	mg/L as N			0.003	
Nitrite	Dissolved	mg/L			0.01	
Orthophosphate	Dissolved	mg/L			0.009	

Table A-58
USGS-10
Historical Results

Analyte	Analyte 2	Unit	Freshwater Water Quality Criteria		Surface Water 9/15/1998	
			Screening Level	Criteria Exceedances[1]	Value	Qualifier
Major Ions (Con't)						
Orthophosphate	Dissolved	mg/L as P			0.003	
Phosphorus	Total	mg/L as P			0.004	
Phosphorus	Dissolved	mg/L as P			0.005	
Potassium	Dissolved	mg/L			0.54	
Silica	Dissolved	mg/L as SiO2			15.9	
Sodium	Dissolved	mg/L			5.78	
Sodium adsorption ratio		number			0.2	
Sodium fraction of cations		percent in equivalents of major cations			10	
Sulfate	Dissolved	mg/L			58.3	
Other						
Acid neutralizing capacity	Total	mg/L as CaCO3			61	
Hardness[2]		mg/L as CaCO3			110	
Noncarbonate hardness Field	Dissolved	mg/L as CaCO3			58	
Residue	Dissolved	mg/L			157	
Residue	dissolved	tons per day			0.14	
Residue	Dissolved	tons per acre			0.23	
Residue on evaporation	Dissolved	mg/L			169	

Key:

U = Nondetect

Notes:

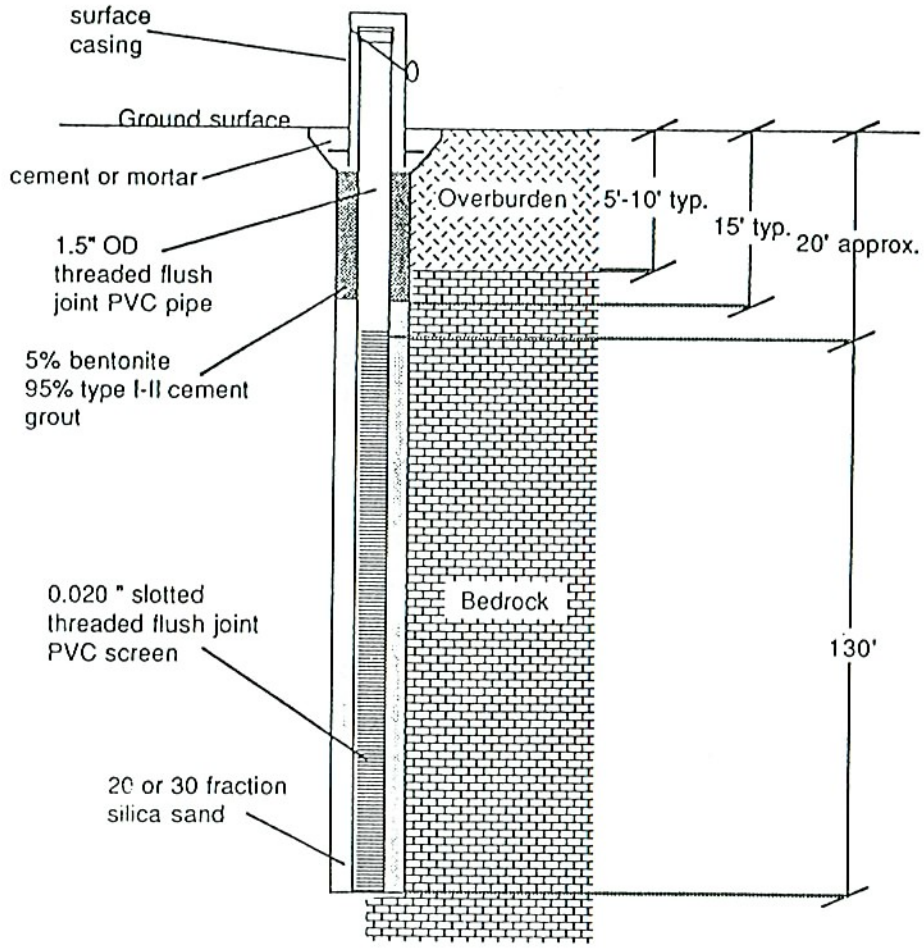
1. Some method reporting limits exceed the SL.

2. The mean hardness from each sampling location was used to compute SL for Cadmium, Copper, Lead, and Zinc.

Table A-58
USGS-10
Historical Results

Appendix B
Groundwater Well Installation Details and Drilling Logs

Norecol Groundwater Wells



Hole diameter 2.37" nominal
Surface casing (removed before grouting) "NX" casing (3.5" nominal OD)
Grout annulus thickness approximately 0.6" in bedrock; 1" in overburden.

Grouting technique:

1) Water pumped into standpipe from water obtained from another borehole, until water level reaches ground surface
2) Grout placed in hole on top of sand pack by gravity feed through tremmie pipe (from bottom of grouted section), and poured for last 5-6 feet from surface. The grout displaces the water standing in the annulus.
3) The well is then topped up with water once more, and then left to allow the grout to set.
4) The well will be developed and sampled with a dedicated manual intertial pump system (Waterra) until bailed water is clear and three consecutive consistent conductivity measurements are achieved.

PIEZOMETER INSTALLATION FORMOSA SILVER PEAK	
Figure no. 2.3.2-2	FORMOSA EXPLORATION INC.
Date Nov. 1989	Drawn by NORECOL

Area where core consistently broken into pieces < 10 cm in length.

SUMMARIZED DRILL RECORD - SILVER PEAK.

E: T1 ELEVATION TOP OF PIPE 1024.74 (metres a.m.s.l.) STICK-UP: 0.66 (metres)

DEPTH (below ground) metres.	FRACTURE ZONE *	ALTERATION	INSTALLATION	ROCK DESCRIPTION.
2.5			4" PVC PIPE; BENTONITE	CASING. Overburden
5		limonite on fractures		Andesite to Dacite Lapilli Tuff dark grey-green fine-grained matrix ≤ 25% white fine-grained hosts, lenses lapilli fragments. pervasive limonite staining of rock.
10				
15				
20				Crossed by numerous white, coarse-grained quartz stringers up to 4 cm wide
25				
30			SCREENED PVC PIPE; SILICA SAND	Fragmental Tuff some zones finer grained, more felsic; hosts darker
35		limonite on fractures		crossed by numerous white, coarse-grained quartz stringers up to 4 cm wide.
40				
45		limonite on fractures		End of hole 46.0m

* Area where core consistently broken into pieces < 10 cm in length.

SUMMARIZED DRILL RECORD - SILVER PEAK.

HOLE: T2 ELEVATION TOP OF PIPE 1018.76 (metres a.m.s(.)) STICK-UP: 0.69 (metres).

DEPTH (below ground) metres.	FRACTURE ZONE*	ALTERATION	INSTALLATION	ROCK DESCRIPTION.
				CASING: Overburden
3.7, 5, 10, 15, 20, 23.5, 24.4, 25		limonite on fractures	BLANK PVC PIPE; BENTONITE	Andesite to Dacite Lapilli Tuff grey-green fine to coarse-grained matrix ≤40% hosts: pale to white feldspathic & siliceous subangular to lensey lapilli few broken quartz stringers, pieces ≤ 1 cm wide moderate limonite staining of rock Moderate clay alteration of upper 23.5 m Frequent zones of severe fracturing & faulting; fractures predominantly open and limonite stained.
				Andesite Dyke / Sill
30, 35, 40, 45		limonite on fractures	SLOTTED PVC PIPE; SILICA SAND	Andesite to Dacite Lapilli Tuff few white, course-grained quartz stringers up to 4 cm wide.

End of hole: 45.0

* Area where core consistently broken into pieces < 10 cm in length.

SUMMARIZED DRILL RECORD - SILVER PEAK.

: T 3 ELEVATION TOP OF PIPE 1012.45 STICK-UP: 0.58

DEPTH (below ground) metres.	FRACTURE ZONE *	ALTERATION & COMMENTS	INSTALLATION	ROCK DESCRIPTION.
				CASING: Overburden.
5		intensely broken core fragments 1cm to 3cm possibly faulted.		Andesite to Dacite Lapilli Tuff grey to brown fine-grained matrix ≤ 40% hosts, white, angular to rounded, siliceous lapilli moderate clay alteration to 35.0 m joints open and limonite-stained few white, coarse grained quartz stringers
10				
15				
20			Same as T1 & T2	
25				
30		intensely broken core, fragments 1 cm to 3 cm		
35		strong fault zone		
40				
45		limonite on fractures		

* Area where core consistently broken into pieces < 10 cm in length.

SUMMARIZED DRILL RECORD - SILVER PEAK.

HOLE: T4 ELEVATION TOP OF PIPE 1022.94 STICK-UP: 0.65

DEPTH (below ground) metres.	FRACTURE ZONE *	ALTERATION	INSTALLATION	ROCK DESCRIPTION.
2.7				CASING : Overburden
5		limonite on fractures		Andesite to Dacite Lapilli Tuff grey-green, fine to coarse-grained matrix ≤ 50% host, white, siliceous, subangular to rounded lapilli
10				
15				few white quartz stringers up to 3cm wide common hairline fractures {weak clay alteration to 13.1m depth}
20		limonite on fractures	same as T1 & T2	few faulted intervals; most breakage along iron-stained semi-smooth joints.
25				
30		limonite on fractures		
35				silicified
				Andesite to Dacite Dyke / Sill
40		minimal/trace limonite on fractures		silicified Andesite to Dacite Lapilli Tuff fractures without iron-staining
45				End of hole: 45.8 m

Dynamac Groundwater Wells

STATE OF OREGON

MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

WELL I.D.# 436830 ✓ MW-1

Start Card # 125763

(1) OWNER/PROJECT:

WELL NO. MW 1

Name O+C Reverted Grant Roseburg Dist Office

Address 777 NW Garden Valley Blvd

City Roseburg State OR Zip 97470

(2) TYPE OF WORK:

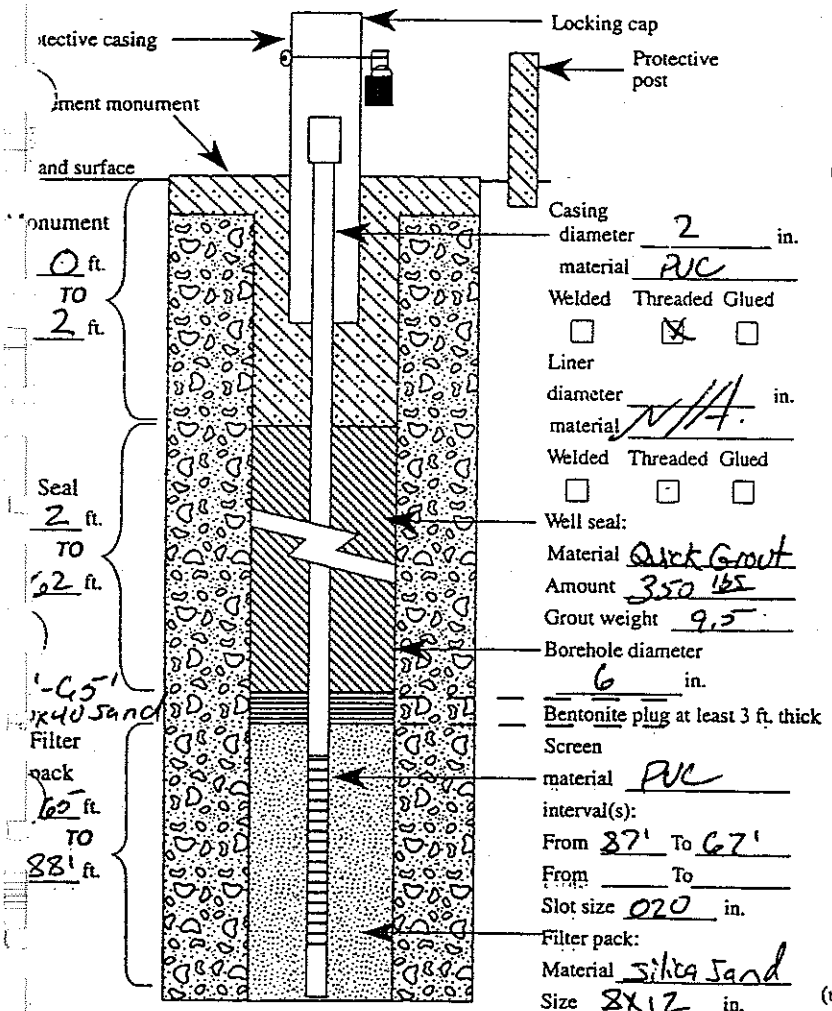
- [x] New construction
- [ ] Alteration (Repair/Recondition)
- [ ] Conversion
- [ ] Deepening
- [ ] Abandonment

(3) DRILLING METHOD

- [x] Rotary Air
- [ ] Rotary Mud
- [ ] Cable
- [ ] Hollow Stem Auger
- [ ] Other _____

(4) BORE HOLE CONSTRUCTION

Special Standards Yes [ ] No [x] Depth of completed well 88' ft.



Casing diameter 2 in.
material PVC
Welded [ ] Threaded [x] Glued [ ]

Liner diameter N/A in.
material N/A
Welded [ ] Threaded [ ] Glued [ ]

Well seal:
Material Quick Grout
Amount 350 lbs
Grout weight 9.5
Borehole diameter 6 in.
Bentonite plug at least 3 ft. thick

Screen material PVC
interval(s): From 87' To 67'
From ____ To ____
Slot size 020 in.

Filter pack:
Material Silica Sand
Size 8x12 in.

(5) WELL TEST:

- [ ] Pump
- [ ] Bailer
- [ ] Air
- [ ] Flowing Artesian

Permeability _____ Yield _____ GPM

Conductivity _____ PH _____

Temperature of water _____ °F/C Depth artesian flow found _____ ft.

Was water analysis done? [ ] Yes [ ] No

By whom? _____

Depth of strata to be analyzed. From _____ ft. to _____ ft.

Remarks: _____

Name of supervising Geologist/Engineer _____

ORG 917

(6) LOCATION OF WELL By legal description

Well Location: County Douglas

Township 31S (N or S) Range 6W (E or W) Section 23

1. NW 1/4 of NW 1/4 of above section.

2. Either Street address of well location Silver Butte Mine

or Tax lot number of well location ~~S2000~~

3. ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

(7) STATIC WATER LEVEL:

N/A Ft. below land surface. Date not encountered.

Artesian Pressure _____ lb/sq. in. Date _____

(8) WATER BEARING ZONES:

Depth at which water was first found N/A

From	To	Est. Flow Rate	SWL
		N/A	

(9) WELL LOG:

Ground elevation _____

Material	From	To	SWL
[redacted] Basalt	0	88'	

Date started 10-22-99 Completed 10-22-99

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

MWC Number 10464

Signed [signature] Date 10-26-99

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 10024

Signed [signature] Date 10-27-99

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

STATE OF OREGON

MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

Well ID# L36829 MW-2

Start Card # 125764

(1) OWNER/PROJECT: WELL NO. MW2

Name O+C Revested Grant Roseburg Dist. Office

Address 777 NW Garden Valley Blvd

City Roseburg State OR Zip 97470

(2) TYPE OF WORK:

[X] New construction [ ] Alteration (Repair/Recondition)

[ ] Conversion [ ] Deepening [ ] Abandonment

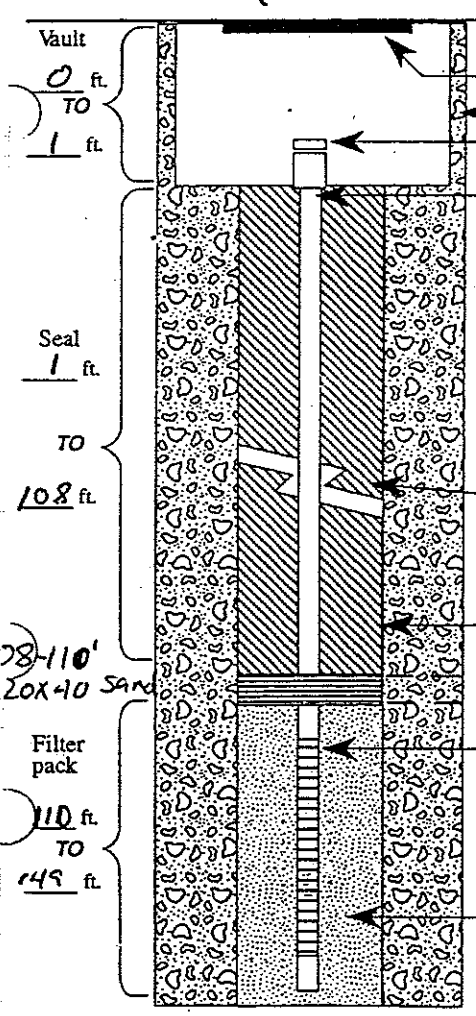
(3) DRILLING METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable

[ ] Hollow Stem Auger [ ] Other

(4) BORE HOLE CONSTRUCTION

Special Standards Yes [ ] No [X] Depth of completed well 149' ft.



Casing diameter 2 in.

material PVC

Welded [ ] Threaded [X] Glued [ ]

Liner diameter N/A in.

material

Welded [ ] Threaded [ ] Glued [ ]

Well seal:

Material Quick crete

Amount 550 lbs

Grout weight 9.5

Borehole diameter 6 in.

Bentonite plug at least 3 ft. thick

Screen material PVC

interval(s): From 113' To 148'

From To

Slot size 020 in.

Filter pack:

Material Silica Sand

Size 8X12 in.

(5) WELL TEST:

[X] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Permeability Yield GPM

Conductivity PH

Temperature of water 56° °F/C Depth artesian flow found ft.

Was water analysis done? [X] Yes [ ] No

By whom? Dynamic, Phil Warner

Depth of strata to be analyzed. From ft. to ft.

Remarks:

Name of supervising Geologist/Engineer

(6) LOCATION OF WELL By legal description:

Well Location: County Douglas

Township 31S (N or S) Range 6W (E or W) Section 23

1. NW 1/4 of NW 1/4 of above section.

2. Either Street address of well location Silver Butte Mine

or Tax lot number of well location 4000

3. ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

(7) STATIC WATER LEVEL:

58' Ft. below land surface. Date 10-23-99

Artesian Pressure lb/sq. in. Date

(8) WATER BEARING ZONES:

Depth at which water was first found 67'

From	To	Est. Flow Rate	SWL
67	69	1 gpm	
130	149'	3 gpm	67'

(9) WELL LOG: Ground elevation

Material	From	To	SWL
Basalt	0	67'	
Fractured Basalt	67'	149'	67'

Date started 10-22-99 Completed 10-23-99

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

MWC Number 10464

Signed Date 10-26-99

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 10024

Signed Date 10-27-99

DRG1T2 ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

STATE OF OREGON

ONITORING WELL REPORT

(...required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

WELL I.D.# L36328 MW-3

Start Card # 124474 ✓

OWNER/PROJECT: WELL NO. MW-3

...me O+C Revested Grant Roseburg Dist Office

Address 777 NW Garden Valley Blvd

...y Roseburg State OR Zip 97470

) TYPE OF WORK:

☒ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable

☐ Hollow Stem Auger ☐ Other

(6) LOCATION OF WELL By legal description

Well Location: County Douglas

Township 31S (N or S) Range 6W (E or W) Section 23

1. NW 1/4 of NW 1/4 of above section.

2. Either Street address of well location Silver Butte Mine

or Tax lot number of well location 90000

3. ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

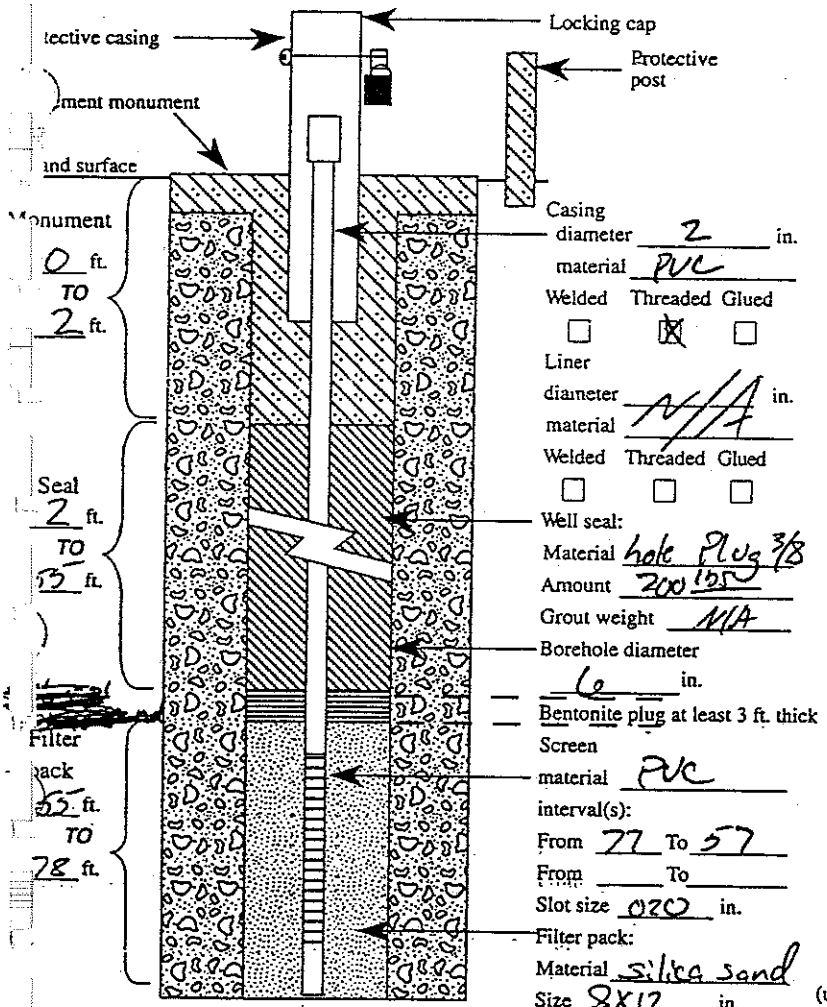
(7) STATIC WATER LEVEL:

N/A Ft. below land surface. Date not encountered

Artesian Pressure _____ lb/sq. in. Date _____

BORE HOLE CONSTRUCTION

Special Standards Yes ☐ No ☒ Depth of completed well 78' ft.



Casing diameter 2 in.

material PVC

Welded ☐ Threaded ☒ Glued ☐

Liner diameter N/A in.

material

Welded ☐ Threaded ☐ Glued ☐

Well seal:

Material hole Plug 3/8

Amount 200 lbs

Grout weight N/A

Borehole diameter 6 in.

Bentonite plug at least 3 ft. thick

Screen material PVC

interval(s): From 77 To 57

From ____ To ____

Slot size 020 in.

Filter pack: Material Silica Sand

Size 8X12 in.

(8) WATER BEARING ZONES:

Depth at which water was first found N/A

From	To	Est. Flow Rate	SWL

(9) WELL LOG: Ground elevation _____

Material	From	To	SWL
Basalt	0	78	N/A

Date started 10-23-99 Completed 10-23-99

WELL TEST:

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability _____ Yield _____ GPM

Conductivity _____ PH _____

Temperature of water _____ °F/C Depth artesian flow found _____ ft.

Was water analysis done? ☐ Yes ☐ No

By whom? N/A

Depth of strata to be analyzed. From _____ ft. to _____ ft.

Remarks: _____

Name of supervising Geologist/Engineer _____

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

MWC Number W464

Signed _____ Date 10-26-99

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 10024

Signed _____ Date 10-27-99

OR9113

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Silver Butte Drill Log

Borehole Number MW-1		
1. Company Name Dynamac Corporation	2. Drilling Subcontractor Cascade Drilling	Sheet: 1 of 4
3. Project Silver Butte BLM2-30R	4. Location Encapsulation Mound	
5. Name of Driller Cascade Drilling Jason Layton	6. Manufacturers Designation of Drill Rig	
7. Sizes and Types of Drilling and Sampling Equipment casing 6X7" Drill and drive open hole	8. Borehole Location Southeast edge of encapsulation mound	
	9. Surface Elevation	
	10. Date Started 10/22/99	11. Date Completed 10/22/99
12. Overburden Thickness [ft] 2	15. Depth Groundwater Encountered [ft] 67'-71'	
13. Depth Drilled into Bedrock [ft] 85	16. Depth to Water and Elapsed Time After Drilling [ft] 87.2' @ 18 hours	
14. Total Depth of Borehole [ft] 87	17. Other Water Level Measurements [ft]	

18. Geotechnical Samples	Disturbed	Undisturbed	19. Total Number of Core Samples (Box No.)
None			None

20. Samples for Chemical Analysis	VOC	Metals	Other (Specify)	Other (Specify)	Other (Specify)	21. Total Core Recovery
None						

22. Disposition of Borehole	Backfilled	Monitoring Well	Other (Specify)	23. Signature of Field Geologist/Engineer
	No	Yes		

Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
fDt	1	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained					
	2						
	3						
	4						
	5						
fDt	6	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained					extremely weathered
	7						
	8						
	9						Drove surface casing to 8'
	10						
fDt	11	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained					
	12						
	13						
	14						

Silver Butte Drill Log							Borehole Number MW-1
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 2 of 4
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen. Read(HNu) [ppm]	Geotech. Sample/ Core Box #	Analytical. Sample No.	Blow Counts % Recovery	Remarks
	15						
fDt	16 17 18 19 20	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained					weathered rock pulverized to very fine material
fDt	21 22 23 24 25	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained					sample taken for XRF @ 20'
fDt	26 27 28 29 30	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					
fDt	31 32 33 34 35	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					more competent rock, harder
fDt	36 37 38 39 40	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					
fDt	41 42	FOLIATED DACITIC TUFF light gray to tan, intensely foliated, fine grained. Inclusions of quartz.					

Silver Butte Drill Log							Borehole Number MW-1
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 3 of 4
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen. Read (HNu) [ppm]	Geotech. Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	43						
	44						
	45						
fDt	46	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					less competent rock
	47						
	48						
	49						
	50						
fDt	51	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					
	52						
	53						
	54						
	55						
fDt	56	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					
	57						
	58						more competent rock
	59						
	60						
fDt quick grout slurry to top of hole	61	FOLIATED DACITIC TUFF light tan foliated tuff, fine grained. Inclusions of quartz.					
	62						
	63						
	64						
	65						
fDt	66	FOLIATED DACITIC TUFF light gray to tan, intensely foliated, fine grained. Inclusions of quartz.					
	67						
	68						less competent rock,
	69						hit water at 67 to 70 feet < 1 gpm fracture zone
	70						

Silver Butte Drill Log							Borehole Number MW-1
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 4 of 4
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
fDt	71 72 73 74 75	FOLIATED DACITIC TUFF light gray to tan, intensely foliated, fine grained. Inclusions of quartz.					more competent rock return to thinner fractured zone, alternating with competent bedrock
fDt	76 77 78 79 80	FOLIATED DACITIC TUFF light gray to green, foliated tuff, fine grained. Inclusions of quartz and ferruginous chert.					let hole setup for 10' to determine water level; no water continue drilling competent rock hard
fDt	81 82 83 84 85	FOLIATED DACITIC TUFF light gray to green, foliated tuff, fine grained. Inclusions of quartz and ferruginous chert.					and dense. Very highly fractured, infilled with quartz
fDt stop drilling	86 87 88 89 90	FOLIATED DACITIC TUFF light gray to green, foliated tuff, fine grained. Inclusions of quartz and ferruginous chert. end of borehole					very competent and hard; drilling stopped at 88'

Silver Butte Drill Log

Borehole Number	MW-2
1. Company Name	Dynamac Corporation
2. Drilling Subcontractor	Cascade Drilling
Sheet:	1 of 6
3. Project	Silver Butte BLM2-30R
4. Location	Encapsulation Mound
5. Name of Driller	Cascade Drilling Jason Layton
6. Manufacturers Designation of Drill Rig	
7. Sizes and Types of Drilling and Sampling Equipment	casing 6X7" Drill and drive open hole
8. Borehole Location	Below Formosa 1 adit
9. Surface Elevation	
10. Date Started	10/22/99
11. Date Completed	10/23/99
12. Overburden Thickness [ft]	0
13. Depth Drilled into Bedrock [ft]	150
14. Total Depth of Borehole [ft]	150
15. Depth Groundwater Encountered [ft]	70' (58' after completion)
16. Depth to Water and Elapsed Time After Drilling [ft]	94.6 @ 20 hours
17. Other Water Level Measurements [ft]	
18. Geotechnical Samples	None
Disturbed	
Undisturbed	
19. Total Number of Core Samples (Box No.)	None
20. Samples for Chemical Analysis	None
VOC	
Metals	
Other (Specify)	
Other (Specify)	
Other (Specify)	
21. Total Core Recovery	
22. Disposition of Borehole	
Backfilled	No
Monitoring Well	Yes
Other (Specify)	
23. Signature of Field Geologist/Engineer	

Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
Bft	1 2 3 4 5	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	6 7 8 9 10	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	11 12 13 14	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					Competent bedrock.

Silver Butte Drill Log							Borehole Number MW-2
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 2 of 6
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen. Read(HNu) [ppm]	Geotech. Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	15						
Bft	16 17 18 19 20	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	21 22 23 24 25	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					More competent bedrock.
Bft	26 27 28 29 30	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	31 32 33 34 35	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					Start of fractured zone. Intensely fractured.
Bft	36 37 38 39 40	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					
Bft	41 42	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt.					End of fractured zone.

Silver Butte Drill Log							Borehole Number MW-2
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 3 of 6
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen. Read (HNu) [ppm]	Geotech. Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	43 44 45	Inclusion of quartz and chlorite.					
Bft	46 47 48 49 50	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					Small fractured zone. Intensely fractured.
Bft	51 52 53 54 55	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					Water encountered.
Bft	56 57 58 59 60	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					Orange and brown staining.
Bft	61 62 63 64 65	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	66 67 68 69 70	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					End of fractured zone, back into competent bedrock.

Silver Butte Drill Log							Borehole Number MW-2
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 4 of 6
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
Bft	71 72 73 74 75	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					Start of fractured zone
Bft	76 77 78 79 80	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					Producing lots of water
Bft	81 82 83 84 85	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					End of fractured zone, into competent bedrock
Bft	86 87 88 89 90	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	91 92 93 94 95	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					
Bft	96 97 98	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Tan, very fine grained basalt. Inclusion of chlorite.					Large fractured zone. Possible fault. Producing water

Silver Butte Drill Log							Borehole Number MW-2
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 5 of 6
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	99 100						
Bft	101 102 103 104 105	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					
Bft	106 107 108 109 110	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					bedrock competency increases
Bft	111 112 113 114 115	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					Fractured zone between 113' and 115' producing water at approximately 1 gpm.
Bft	116 117 118 119 120	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					
Bft	121 122 123 124 125	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					Fractured zone, some calcite infilling.
Bft	126						

Silver Butte Drill Log							Borehole Number MW-2
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 6 of 6
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	127						
	128						
	129						
	130						
Bft	131	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					
	132						
	133						
	134						
	135						
Bft	136	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite.					competent bed rock
	137						
	138						
	139						
	140						
Bft	141	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite. Some inclusions of pyrite/chalcopyrite					
	142						
	143						
	144						
	145						
Bft	146	BASALTIC FLOWS AGGLOMERATES AND TUFFS, Green and tan fine grained basalt. Inclusion of quartz and chlorite. Some inclusions of pyrite/chalcopyrite					start of fractured zone
	147						
	148						
stop drilling	149	stop drilling at 149.6' bgs					

Silver Butte Drill Log		Borehole Number MW-3
1. Company Name Dynamac Corporation	2. Drilling Subcontractor Cascade Drilling	Sheet: 1 of 4

3. Project Silver Butte BLM2-30R	4. Location Silver Butte
5. Name of Driller Cascade Drilling Jason Layton	6. Manufacturers Designation of Drill Rig
7. Sizes and Types of Drilling and Sampling Equipment	8. Borehole Location Across road from 404 adit
	9. Surface Elevation
	10. Date Started: 10/23/1999 11. Date Completed: 10/23/1999
12. Overburden Thickness [ft] 5	15. Depth Groundwater Encountered [ft] N/A
13. Depth Drilled into Bedrock [ft] 75	16. Depth to Water and Elapsed Time After Drilling [ft]
14. Total Depth of Borehole [ft] 80	17. Other Water Level Measurements [ft]

18. Geotechnical Samples	Disturbed	Undisturbed	19. Total Number of Core Samples (Box No.)
None			None

20. Samples for Chemical Analysis	VOC	Metals	Other (Specify)	Other (Specify)	Other (Specify)	21. Total Core Recovery
None						

22. Disposition of Borehole	Backfilled	Monitoring Well	Other (Specify)	23. Signature of Field Geologist/Engineer
	No	Yes	background	

Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	1 2 3 4 5						
fDt	6 7 8 9 10	FOLIATED DACITIC TUFF. Light tan intensely foliated, fine grained.					extremely weathered
fDt	11 12 13 14	FOLIATED DACITIC TUFF. Light tan intensely foliated, fine grained.					extremely weathered

Silver Butte Drill Log							Borehole Number MW-3
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 2 of 4
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen. Read(HNu) [ppm]	Geotech. Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	15						
fDt	16 17 18 19 20	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					some iron oxide staining
fDt	21 22 23 24 25	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					non-competent rock
fDt	26 27 28 29 30	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					non-competent rock some iron oxide staining
fDt	31 32 33 34 35	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					non-competent rock
fDt	36 37 38 39 40	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	41 42	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining

Silver Butte Drill Log							Borehole Number MW-3
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 3 of 4
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen. Read (HNu) [ppm]	Geotech. Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
	43 44 45						
fDt	46 47 48 49 50	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	51 52 53 54 55	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	56 57 58 59 60	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	61 62 63 64 65	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	66 67 68 69 70	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					

Silver Butte Drill Log							Borehole Number MW-3
1. Company Name Dynamac Corporation			2. Drilling Subcontractor Cascade Drilling				Sheet: 4 of 4
Lith [ft]	Depth [ft]	Description of Lithology	Field Screen Read (HNu) [ppm]	Geotech Sample/ Core Box #	Analytical Sample No.	Blow Counts % Recovery	Remarks
fDt	71 72 73 74 75	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	76 77 78 79	FOLIATED DACITIC TUFF Interfingered light tan tuff and green chlorite. Intensely foliated					iron oxide staining
fDt	80	end of hole					stop drilling at 80'

Hart Crowser Groundwater Wells

Key to Exploration Logs

Sample Descriptions

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, and grain size, and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT with additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits and push probe explorations is estimated based on visual observation and is presented parenthetically on test pit and push probe exploration logs.

SAND and GRAVEL Density	Standard Penetration Resistance in Blows/Foot
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	>50

SILT or CLAY Density	Standard Penetration Resistance in Blows/Foot	Approximate Shear Strength in TSF
Very soft	0 - 2	<0.125
Soft	2 - 4	0.125 - 0.25
Medium stiff	4 - 8	0.25 - 0.5
Stiff	8 - 15	0.5 - 1.0
Very Stiff	15 - 30	1.0 - 2.0
Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture.
Damp	Some perceptible moisture, probably below optimum.
Moist	Probably near optimum moisture content.
Wet	Much perceptible moisture, probably above optimum.

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling Symbols

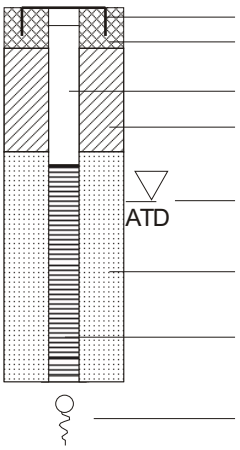
BORING AND PUSH PROBE SYMBOLS

- Split Spoon
- Tube (Shelby, Push Probe)
- Cuttings
- Core Run
- Temporarily Screened Interval
- N — Standard Penetration Resistance
- * — No Sample Recovery
- PID — Photoionization Detector Reading

TEST PIT SOIL SAMPLES

- Grab (Jar)
- Bag
- Shelby Tube

Groundwater Observations and Monitoring Well Construction



- Flush Mounted Monument
- Concrete Surface Seal
- Well Casing
- Bentonite Seal
- Groundwater Level on Date or (ATD) At Time of Drilling
- Sand Pack
- Well Screen
- Groundwater Seepage (Test Pits)

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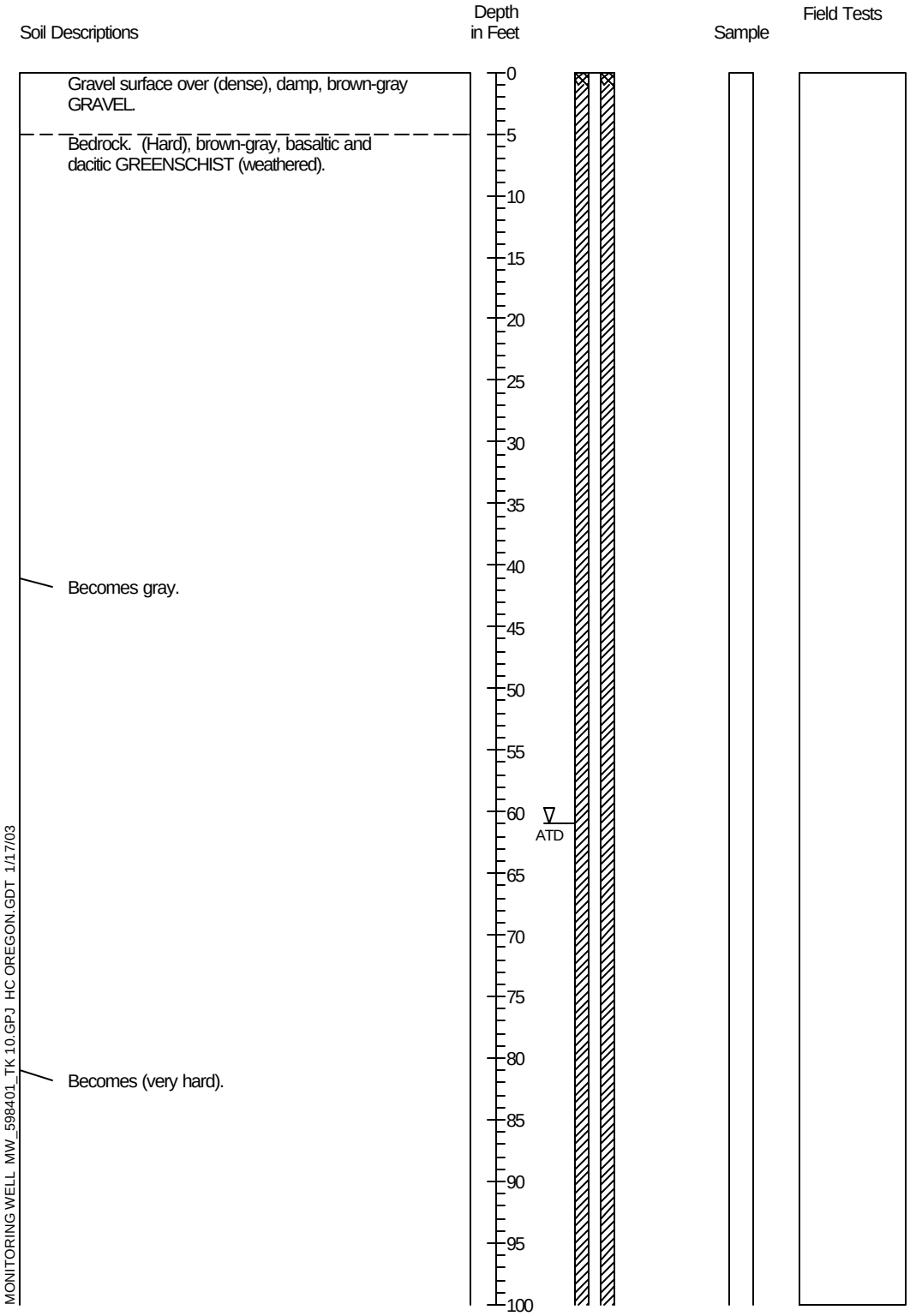
5984-01/Task 10 12/01-2/02
Figure A-1

Monitoring Well Log MW-4



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Start Card: L55962 Well ID#: 146321
5. Casing Stickup in Feet: TBD
   Top of PVC in Feet: TBD
   Inside Diameter of PVC: 2"

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5984-01/Task 10 *2/02*

Figure A-2 *1/3*

Monitoring Well Log MW-4

Soil Descriptions	Depth in Feet	Sample	Field Tests
(Soft), brown, basaltic and dacitic GREENSCHIST.	100		
	105		
Becomes (hard) and gray.	110		
	115		
	120		
	125		
	130		
	135		
	140		
	145		
	150		
	155		
	160		
	165		
	170		
Becomes green-gray.	175		
	180		
	185		
	190		
	195		
	200		

MONITORING WELL MW_598401_TK 10.GPJ HC OREGON.GDT 1/17/03

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Start Card: L55962 Well ID#: 146321
5. Casing Stickup in Feet: TBD
   Top of PVC in Feet: TBD
   Inside Diameter of PVC: 2"

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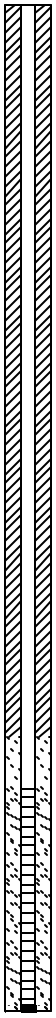
5984-01/Task 10 *2/02*

Figure A-2 *2/3*

Monitoring Well Log MW-4

Soil Descriptions	Depth in Feet	Sample	Field Tests
(Hard), dark gray, basaltic and dacitic GREENSCHIST.	200		
	205		
	210		
	215		
	220		
	225		
	230		
	235		
	240		
	245		
Becomes green.	250		
	255		
	260		
	265		
Bottom of Boring at 270.0 Feet. Completed 2/20/02.	270		
	275		
	280		
	285		
	290		
	295		
	300		



MONITORING WELL MW_598401_TK 10.GPJ HC OREGON.GDT 1/17/03

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Start Card: L55962 Well ID#: 146321
5. Casing Stickup in Feet: TBD
   Top of PVC in Feet: TBD
   Inside Diameter of PVC: 2"

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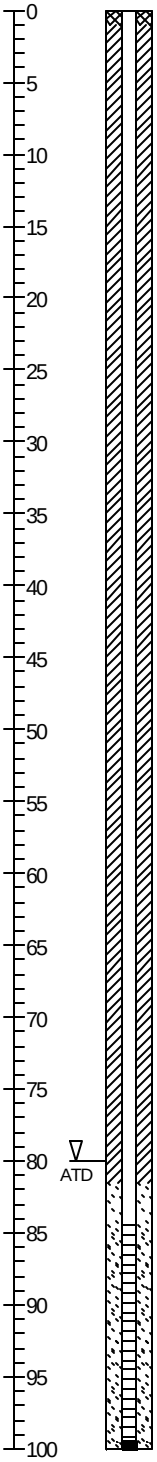
5984-01/Task 10 *2/02*

Figure A-2 *3/3*

Monitoring Well Log MW-5

Soil Descriptions	Depth in Feet	Sample	Field Tests
Gravel surface over (medium dense), moist, orange-tan GRAVEL with some silt.	0, 5, 10, 15, 20		
Bedrock. (Hard), light-tan, dacitic TUFF.	20, 25, 30		
Becomes off-white.	30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80		
Grades to basaltic GREENSCHIST.	80, 85, 90, 95, 100		



Bottom of Boring at 100.0 Feet.
Completed 2/21/02.

MONITORING WELL MW_598401_TK 10.GPJ HC OREGON.GDT 1/17/03

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Start Card: L55963 Well ID#: 146322
5. Casing Stickup in Feet: TBD
   Top of PVC in Feet: TBD
   Inside Diameter of PVC: 2"

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5984-01/Task 10 *2/02*

Figure A-3