DRAFT

Wooley Valley Mine

2014 Existing Conditions Report

March 2015

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LIST OF ABBREVIATIONS AND ACRONYMS

AST	above-ground storage tank
BLM	Bureau of Land Management
CCC	Criteria Chronic Concentration (or Aquatic Life Chronic Criteria)
CMC	Criteria Maximum Concentration (or Aquatic Life Acute Criteria)
COC	chemical of concern
EPA	Environmental Protection Agency
IAC	Idaho Administrative Code
IDEQ	Idaho Department of Environmental Quality
IMA	Idaho Mining Association
MCL	maximum contaminant level
NWCC	Northwest Colorado Consultants
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
Resource Area	Southeastern Idaho Phosphate Resource Area
SWEQ	snow water equivalent
TMDL	total maximum daily load
USDA	United States Department of Agriculture
USEPA	United States Environmental Protect Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WVM	Wooley Valley Mine

1.0 INTRODUCTION

1.1 SITE BACKGROUND

1.1.1 Location

The Wooley Valley Mine (WVM) is located approximately 15 miles northeast of Soda Springs, Caribou County, Idaho, primarily on National Forest Service (NFS) land on the Caribou-Targhee National Forest (see Figure 1-1). The Site coordinates are:

- Latitude: 42º49'8" to 42º51'47"
- Longitude: 111º24'34" to 111º25'4"

The WVM is located in Sections 32 and 33 of Township 6 South, Range 43 East, and Sections 3, 10, 11, 13, 14, 23, 24 and 25 of Township 7 South, Range 43 East of the Boise Meridian in southeast Idaho.

1.1.2 Site Ownership and History

Predecessors of Solvay USA Inc. (formerly Rhodia Inc.) have conducted phosphate mine-related operations at the WVM on NFS land covered by the federal phosphate leases described below, and on NFS land not included in the leases, under special use permits issued and administered by the NFS. From 1955 until approximately 1967, J.A. Terteling Company and related entities performed initial development work on the WVM and associated leases. The WVM was mined by the Stauffer Chemical Company and then by the Rhone-Poulenc Basic Chemicals Company from approximately 1966 through 1994. In 1988 and 1989, Stauffer Chemical Company changed its name to Stauffer Chemical Company Division of Rhone-Poulenc Inc., then to Rhone-Poulenc Basic Chemicals Company. In 1992, Rhone-Poulenc Basic Chemicals Company merged with and into Rhone-Poulenc Inc. Rhone-Poulenc Inc. was incorporated in New York in 1948 and has changed its name several times throughout the years.

1.1.3 Phosphate Mining Background

Phosphate mining has been an ongoing activity within the Southeast Idaho Phosphate Resource Area (Resource Area) since the Conda Mine started operations in 1919. Exploratory mining activities took place in the area even earlier. Today, phosphate mines are being operated in the region with the ore derived from these mines being processed into phosphate fertilizer and elemental phosphorus at local manufacturing facilities. From 1919 to the present, phosphate mining and ore processing have been an important economic foundation for Southeast Idaho.

The elevation of the Resource Area ranges from 4,528 feet above mean sea level (MSL) near the Gay Mine to approximately 9,957 feet above MSL at Meade Peak, which is located east of Georgetown, Idaho. The area is sparsely populated with concentrated population centers in Pocatello, Idaho Falls, For Hall, Blackfoot, Montpelier, and Soda Springs, Idaho. Agriculture, including dry and irrigated farmland and livestock grazing, recreation, and timber harvest are the dominant land uses.

Phosphate ore bodies in Southeast Idaho have been uplifted and dip at various angles from 0 to 90 degrees. Mining operations generally start at the outcrop and extend to a depth where surface mining is no longer economical. The mine pits can extend for several miles along the outcrop and to several hundred feet in depth. The mining sequence is typically initiated by clearing and grubbing vegetation and salvaging topsoil, when available, from areas that will be disturbed. If external waste piles are required, the areas are prepared similarly to the mining panels. External waste piles are typically located as near to the mine panel as possible to minimize haulage. As ore and overburden are removed from the designated mine pit, mining on the next panel is prepared and initiated. As mining continues, the overburden is typically backfilled into the mined-out pit. Past and current mining operations include drilling, blasting, loading, hauling, and shipping of ore and overburden from mined pits.

1.1.4 WVM Mining Background

While the WVM was developed and mined in the typical mining fashion as described above, the WVM is currently an inactive, reclaimed phosphate ore mine consisting of leases on US Forest Service (USFS) (75%), Bureau of Land Management (BLM) (5%), and private lands (20%). The current WVM Site consists of three reclaimed mining areas referred to as Units I, III and IV. The associated Federal leases and period of mining is as follows:

Mine Unit	Name	Leases	Period of Mining
I	Blackfoot Narrows	I-004775	1955 to 1969
III	Little Long Valley (Including Panels A thru F)	I-004373, I-000097, I-015040	1976 to 1989
IV	Mill Canyon	I-004374	1968 to 1974

Solvay USA Inc. is the current holder of these leases. Unit I is located at the southern end of the WVM site and consists of the Unit I pit and Unit I waste dump. The Unit I pit extends from the northwest to the southeast and is approximately 1 mile long. Caribou County currently operates a rock quarry within Unit I pit. The external Unit I waste dump is located immediately to the west of the Unit I pit. Unit III is located at the northern end of the WVM site and consists of the Unit III Pit and Unit III waste dump. The Unit III pit extends from the northwest to the southeast and is approximately 2.9 miles long. Much of the Unit III pit has been partially backfilled with overburden and middle waste shales. The external Unit III waste dump is located immediately to the east of the northern end of the Unit III pit. Unit IV is located to the north of the Unit I and consists of the Unit IV pit and Unit IV waste dump. The Unit IV pit extends from the northwest to the southeast and is approximately 1.1 miles long. The external Unit IV waste dump is located immediately to the east and west of the of the Unit IV pit. All three of these mine units have been reclaimed.

The WVM Site, for purposes of this report, includes areas and facilities that were disturbed and/or constructed as part of the mining operation, including mined areas and pits, waste dumps, and haul roads. It should be noted that other activities have been occurring (and continue to occur) at or near the WVM which are not under the control of Solvay USA Inc. These activities include (but are not necessarily limited to):

- Phosphate rock mining activities of Nu-West Mining Inc. (Agrium) which include:

- Use, control and maintenance of the main haul road (and associated facilities and buildings) running from WVM Unit I to the Rasmussen Ridge Mine; and
- Use, control and maintenance of the stockpiling and loadout operations on the main haul road north of WVM Unit I.

- Limestone quarry operations within Unit I mine pit operated by Caribou County under a permit from BLM.
- Cattle grazing operations (and all associated activities) under permits from USFS.
- Periodic weed control by USFS.

No attempt was made in this report to distinguish any impacts of these current Site operations from historical WMV operations.

There are no existing facilities (i.e., buildings, equipment, stockpiles, or other storage) at the WVM that are under the control of Solvay USA Inc. There are reclaimed mine pits, waste dumps (consisting of mining overburden and middle waste shales), and an access road. No future mining operations are anticipated by Solvay USA Inc. at the WVM.

Remaining buildings, roads, rail sidings, and a loadout facility that was formerly used by WVM located immediately north of Unit I have been transferred to Agrium and are currently being used as part of the Rasmussen Ridge Mine operation.

1.2 PHYSIOGRAPHY, GEOLOGY, AND HYDROGEOLOGY

1.2.1 Physiography

The physiography of the WVM Site is typical of the middle Rocky Mountain physiographic province described as the Wyomide ranges. The predominant physiographic features are north-south tending ranges and valleys. The elevation differences between valley bottoms and ridge tops range from 2,000 to 4,000 feet. The valley floors typically have gentle slopes and are 1 to 5 miles wide. The physiography is largely a reflection of east-vergent folding and thrusting of Paleozoic sedimentary rocks, including the Phosphoria Formation. Valleys are typically filled with alluvium.

Climatic conditions are influenced locally by the north-south tending ranges, which lie at high angles to the predominantly westerly airflows. The area, including WVM has a semiarid climate characterized by hot summers, cold winters, and frequent southwesterly winds. The climate is moderated by predominantly moist, warm air masses moving inland from the North Pacific Ocean. Occasional Arctic air masses bring extreme cold. The mean annual precipitation throughout the area ranges from 20 to 30 inches, mainly in the form of snow.

1.2.2 Geology and Hydrogeology

WVM is located on an outcrop of the Meade Peak Phosphatic Shale Member of the Phosphoria Formation, which was laid down in the Permian age. Younger rocks from the Triassic, Jurassic, and Cretaceous age cover the Phosphoria where it is not exposed. The bedrock is structurally complex due to numerous faults in the area. Specific information on the bedrock geology and

hydrogeology for the WVM Site is not available. However, based upon previous studies of other mines in the area, the bedrock units at the Site are expected to include, from youngest to oldest, the Triassic Dinwoody formation, the Permian Phosphoria formation, the Pennsylvanian and Permian Grandeur Limestone, and the Pennsylvanian Wells formation. Although phosphate deposits are also found in the Dinwoody and Wells formations, the Phosphoria formation contains sedimentary deposits from which commercial grade phosphate ore is produced. The Wells formation has been alternately described as a well-cemented sandstone with low permeability where unweathered and as the most transmissive bedrock unit in the region. The Meade Peak member of the Phosphoria formation is very impermeable except where fractured and weathered. The overlying Rex Chert member of the Phosphoria formation is of low permeability except where fractured. Limestone layers in the upper and lower portions of the Dinwoody formation are locally permeable. Numerous springs exist in the WVM Site area. These springs issue from fractured limestone and the more permeable sandstone beds and are a source of water for several of the perennial surface water bodies in the area.

1.2.3 Surface Water

WVM is located in the drainage area of the Blackfoot River, a tributary of the Snake River. The Blackfoot River in the Resource Area is used for mining, livestock watering, irrigation and recreation. The city of Blackfoot, Idaho, the nearest town on the Blackfoot River to the WVM, is more than to river miles downstream and uses well water as a drinking water source. Surface water is not used as a drinking water source (other than occasional recreational use) in the Resource Area.

Surface water bodies within the immediate vicinity of the WVM include Angus Creek, the Angus Creek Pond, Mill Canyon Creek, the Blackfoot River, and unnamed drainages tributary to the Blackfoot river and Angus Creeks. Angus Creek, a perennial stream, flows parallel to the WVM haul road towards the northwest through the Little Long Valley, then toward the northeast, and then flows southeast through the Rasmussen Valley until it flows into the Blackfoot River.

1.2.4 Groundwater

Though groundwater at and near the WVM site is not utilized for public water supply systems, it is extracted for domestic, livestock, and industrial uses. Though regional bedrock geology has been studied, hydrogeologic characteristics specific to the WVM site have not been reported. However, there are a number of springs on the site that appear to be emerging from fractured limestone and more permeable sandstone beds. The WVM site spring water typically flows into surface water bodies on the site, i.e., Angus Creek.

There are 20 known production wells across the Resource Area of which 12 are located within four miles of the WVM site. The total depth for eleven of these wells ranges from 60 to nearly 300 feet below ground surface (bgs), and the twelfth well is 810 feet deep. Two of the 12 local production wells are located adjacent to the site: PW014 is located near the western boundary of WVM Unit I, and PW015 is located west of Unit I near an unnamed drainage. While limited groundwater data exists for these local wells, specific information on the relationship between groundwater in the alluvium and the underlying bedrock units is not available for WVM.

1.3 REPORT PURPOSE AND ORGANIZATION

The purpose of this report is to present a summarized compilation of available, historical information on potential contamination of soil, surface water, groundwater, vegetation, and biota at or near the WVM Site. This report is organized as follows:

- Section 2.0 - Summary Description of Past Studies and Data Collection Efforts
- Section 3.0 - Soil and Sediment Data Relevant To Existing Conditions
- Section 4.0 - Surface Water Data Relevant To Existing Conditions
- Section 5.0 - Groundwater Data Relevant To Existing Conditions
- Section 6.0 - Vegetation and Biota Data Relevant To Existing Conditions
- Section 7.0 – General Conclusions
- Section 8.0 - References

2.0 SUMMARY OF PAST STUDIES AND DATA COLLECTION EFFORTS

Environmental data collection activities at the Wooley Valley Mine (WVM) site and the surrounding region began in the late 1990s. Historical data from these studies that represent current site conditions are presented in this section and include surface water, groundwater, sediment, soil, vegetation, and biological data from a number of past studies conducted at the site and across the region. Relevant historical data that represent current existing conditions at the former WVM site stem from five primary studies summarized below in Table 2-1.

Table 2-1
List of Past Studies Relevant to 2014 Existing Conditions
Wooley Valley Mine Site, Caribou County, Idaho

Study Description	Primary Data Type	Data Collection Period	Sponsoring Entity
WVM Investigation, Remediation, and Closure of Petroleum Handling Areas	Soil	1998 – 2007	Solvay USA, Inc.[(a)]
Southeast Idaho Phosphate Resource Area Studies and Surveys	Surface water, groundwater, biological	1997 - 2001	Idaho Mining Association
Regional Surface Water Total Maximum Daily Load (TMDL) Monitoring	Surface water	2002 - 2006	IDEQ
WVM Surface Water Monitoring	Surface water	2012 and 2014	USDA Forest Service and Solvay USA, Inc.[(a)]
WVM Ongoing Wetlands Studies (led by Dr. Michael S. Amacher)	Water, soil, biological	1999 – 2011	USFS, Rocky Mountain Research Station

[(a)]Formerly Rhodia, Inc.
IDEQ – Idaho Department of Environmental Quality
USDA – United States Department of Agriculture
USFS – United States Forest Service

Other than the Petroleum Handling Area investigation and remediation sampling that focused on petroleum hydrocarbons, these investigative studies and data collection efforts focused primarily on six target metals: selenium, cadmium, manganese, nickel, vanadium, and zinc. Relative to published background concentrations, significant concentrations of these target metals were detected in the disturbed rock units across the mining region. Cadmium and selenium concentrations in waste materials have been reported at 100 to 1,000 times higher than average concentrations in the continental crust (USGS and USFS, 1977).

Brief descriptions of these past studies and their associated data collection activities are presented in the following subsections. Data deemed relevant to current existing conditions at the WVM site are presented in Sections 3.0 through 6.0 of this report and corresponding sampling locations are shown in Figure 2-1.

2.1 INVESTIGATION, REMEDIATION, AND CLOSURE OF FORMER PETROLEUM HANDLING AREAS

Petroleum hydrocarbon and volatile organic compound (VOC) data for soils were collected at the former petroleum handling areas during investigation and remediation activities from 1998

through 2002. A subset of these data are considered relevant to current existing conditions and are presented in this report.

2.1.1 Background

The former petroleum handling areas are centrally located at the site, and include the Truck Shop and the Fuel Storage Area (see Figure 1-2). Vehicle repair and maintenance activities were performed at the Truck Shop, and refueling was conducted at the Fuel Storage Area. Impacts from historic petroleum releases were observed during site demolition and reclamation activities conducted in 1995 (Montgomery Watson, 2001).

In August 1998 a preliminary assessment of potential contamination in the petroleum handling areas was conducted and soils were found to have been impacted. Remediation activities began in 1999 and included stormwater diversion, impacted soil excavation, on-site land treatment (bioremediation), and final regrading. The Idaho Department of Environmental Quality (IDEQ) granted closure for the Fuel Storage Area on September 13, 2001 (IDEQ, 2001), and for the Truck Shop area on January 2, 2003 (IDEQ, 2003), and for the on-site petroleum Land Treatment Area (LTA) located at the Truck Shop on November 13, 2007 (IDEQ, 2007).

2.1.2 Documents Containing Relevant Data for the Petroleum Handling Areas

Hydrocarbon data for soils were collected during the preliminary assessment, during remedial action, and after cleanup standards were achieved for the Truck Shop and the Fuel Storage Area. Data relevant to current existing conditions at the WVM Fuel Handling Areas were originally reported in the documents listed in Table 2-2.

Table 2-2
Former Petroleum Handling Area Documents Containing Data
Relevant to 2014 Existing Conditions
Former Wooley Valley Mine Site, Caribou County, Idaho

Document Title	Relevant Data Type	Submittal Date	Reference
Preliminary Site Assessment Petroleum Handling Areas, Wooley Valley Mine	Investigation test pit soil samples	March 1999	Montgomery Watson, 1999
Phase I Remedial Action Report, Former Wooley Valley Mine Truck Shop	Excavation confirmation soil samples	March 2002 (Revised)	Montgomery Watson, 2002
Phase I Remedial Action Report Former Wooley Valley Mine Fuel Storage Area	Excavation confirmation soil samples	March 2001	Montgomery Watson, 2001
Progress Report and Final Closure Recommendation Wooley Valley Mine Fuel Storage Area	Final treatment performance soil samples	August 2001	MWH, 2001
Former Wooley Valley Mine Truck Shop Response to Final Closure Recommendation	Above-ground storage tank area test pit soil samples	December 2002	NWCC, 2002
Field Sampling and Risk Based Closure Assessment Report, Wooley Valley Mine Truck Shop Land Treatment Area (LTA) Caribou County, Idaho	Final treatment performance soil samples	July-07	MWH, 2007

Petroleum handling area data were collected during the preliminary assessment and during remediation. Data collected during these site activities that are relevant to 2014 existing conditions consist of a subset of the soil laboratory analytical data as presented in Section 3.0 of this report.

2.1.3 Data Objectives

Soil data relevant to 2014 existing conditions were collected at the WVM Truck Shop and Fuel Storage Area from 1999 through 2007 to achieve the following objectives:

- Characterize the nature and extent of petroleum hydrocarbon impacted soils ([Montgomery Watson, 1999] and [NWCC, 2002]).
- Confirm that remedial action excavation activities adequately removed affected materials (Montgomery Watson, 2000).
- Document that existing conditions remaining in sides and bases of excavations met closure criteria (established at 1,000 milligrams per kilogram [mg/kg] total petroleum hydrocarbons [TPH] and Idaho Risk-Based Corrective Action [RBCA] Tier 0 standards) ([Montgomery Watson, 2001] and [Montgomery Watson, 2002]).
- Conduct performance monitoring for material being remediated in on-site treatment areas ([Montgomery Watson, 2000], [Montgomery Watson 2001], [Montgomery Watson, 2002], and [MWH, 2007]). These data do not represent existing conditions except for the final data set that indicate remediation goals were met; therefore, only the 2007 data are included in this report.
- Document that closure criteria were met and remedial actions were complete (MWH, 2007).

Data collected for remedial action performance monitoring are not included in this report because they do not represent 2014 existing conditions at the site. However, soil data for areas that did not require remediation, and confirmation data collected to ensure that soils left behind after excavation and on-site treatment met remediation criteria, are included in this report (Section 3.0).

2.2 IDAHO MINING ASSOCIATION REGIONAL STUDIES

Environmental data were collected at the WVM site from 1997 through 2001 as part of area-wide Idaho Mining Association (IMA) studies to assess impacts of phosphate mining across the Southeast Idaho Phosphate Resource Area (Resource Area) which encompasses at least 14 different mines. Samples were collected and analyzed for surface water, groundwater, soil, sediment, vegetation, and various biota. Data collected at the WVM site are considered relevant to current existing conditions and are presented in this report.

2.2.1 Background

Two incidents of chronic selenosis in horses pastured near historic phosphate mines in 1998 prompted concern regarding the potential for selenium releases resulting from phosphate-mining activities across the Resource Area (Montgomery Watson, 1999a). Therefore, various state and

federal agencies, in conjunction with the IMA Selenium Subcommittee (composed of a group of phosphate production companies) formed the Southeast Idaho Selenium Working Group to respond to selenium issues in a thorough, consistent, and cost-effective manner.

Therefore, the occurrence and potential release of metals associated with phosphate mining activities in the Resource Area were investigated. Most of the mines were inactive during these studies. The IMA formed a Selenium Subcommittee in 1997 to identify the origin and environmental characteristics of selenium and other metals found in phosphate-mining waste rock in Resource Area.

2.2.2 Data Sources

Environmental data relevant to existing conditions at WVM were collected as part of these regional data-collection efforts funded by the IMA, and are presented in the documents listed in Table 2-3. Sampling locations are shown on Figure 2-1, and each relevant data set is presented and discussed in Sections 3 through 5 this report.

Table 2-3
Regional IMA Documents Containing Data Relevant to 2014 Existing Conditions
Wooley Valley Mine Site, Caribou County, Idaho

Document Title	Relevant Data Type	Number of Relevant Sample Locations	Submittal Date	Reference
Fall 1997 Interim Surface Water Survey Report	Surface water	5	February 1998	Montgomery Watson, 1998
Final 1998 Regional Investigation Report	Surface water Sediment Groundwater Soil Vegetation	9	December 1999	Montgomery Watson, 1999a
1999-2000 Regional Investigation Data Report for Surface Water, Sediment and Aquatic Biota Sampling Activities, September 1999	Surface water Sediment Vegetation Aquatic biota	8	April 2001	Montgomery Watson, 2001a
Final Spring 2001 Area-Wide Investigation Data Transmittal	Surface water Soil	12	March 2002	MWH, 2002
Final Summer 2001 Area-Wide Investigation Data Summary	Soil Vegetation Mammal Invertebrates	1	July 2002	MWH, 2002a

2.2.3 Data Objectives

IMA regional studies data were collected to meet the following objectives:

- Assess potential impacts of phosphate-mining operations on surface water (Montgomery Watson, 1998)

- Determine if concentrations of target elements (selenium, cadmium, manganese, nickel, vanadium, zinc) have adverse impact on data used to develop preliminary risk assessments for human and environmental receptors (Montgomery Watson, 1999a).
- Characterize extent and magnitude of selenium and cadmium concentrations in surface water, sediments, and select bio media, and assess acceptable levels (Montgomery Watson, 2001a)
- Fill surface water and soil regional data gaps at Resource Area mine sites (MWH, 2002)
- Fill data gaps to assess exposure pathways to higher and lower trophic levels (MWH, 2002a).

Regional study data collected for larger mammals (e.g., elk) and birds are not presented in this report because the ranges of these animals are significantly larger than the WVM area. Therefore, any impacts on large mammals and birds cannot be attributed exclusively to potential contaminant sources at the WVM site due to the close proximity of a number of other phosphate mine sites. Data pertaining to larger mammals and birds cannot be used to assess impacts exclusively from the WVM site.

2.3 IDEQ TMDL DATA COLLECTION

Total maximum daily load (TMDL) surface water data collection was conducted annually from 2001 through 2006 to assess whether water quality was protective of aquatic life in streams located in the Resource Area. Surface water samples were collected from streams at, and/or downstream of, a number of mines across the region and were analyzed for selenium and at least seven toxic metals. The number of sample locations collected annually ranged from 13 to 27, though only one sample location was at the WVM site, on Upper Angus Creek, which was sampled from 2003 through 2006.

2.3.1 Background

Resource Area investigations conducted prior to 2001 demonstrated that selenium, cadmium, and other trace metals were present in the watersheds at concentrations potentially harmful to aquatic life. Though the presence of selenium and other constituents in the watersheds is ultimately a result of underlying geology and mineralogy, mining activity has likely accelerated the rate of weathering processes and subsequent releases of constituents into surface waters. The IDEQ initiated TMDL sampling in 2001 based on concerns over possible impacts of mining activity on the watersheds.

2.3.2 Documents Containing Relevant Data

Surface water sampling was conducted each spring on Upper Angus Creek from 2003 through 2006. The sampling station (UACTT033) was located in WVM Unit 3 as shown in Figure 2-1.

Table 2-4
Regional IDEQ TMDL Documents Containing Data Relevant to 2014 Existing Conditions
Wooley Valley Mine Site, Caribou County, Idaho

Document Title	Relevant Data Type	Number of Relevant Sample Locations	Submittal Date	Reference
Final 2003 Supplement to 2001 Total Maximum Daily Load Baseline Monitoring Report	Surface water	1	January 2004	Tetra Tech, 2004
Selenium Area Wide Investigation 18-21 May 2004	Surface water	1	March 2005	IDEQ, 2005
Selenium Project 9-13 May 2005	Surface water	1	December 2005	IDEQ, 2005a
Selenium Project 8-19 May 2006	Surface water	1	December 2006	IDEQ, 2006

Additional regional TMDL data (collected in May 2002) are presented in the *Final 2002 Supplement to 2001 TMDL Baseline Monitoring Report* (TetraTech, 2002). However, 2002 results cannot be attributed to WVM because sampling was not conducted at the WVM site, and the nearest sampling locations are not close enough to WVM to attribute any water quality impacts solely to the WVM site. (Multiple mines are located upstream of the nearest 2002 TMDL sampling locations.)

2.3.3 Data Objectives

The IDEQ TMDL sampling events were conducted to meet the following objectives:

- Fulfill data needs of concurrent human health and ecological risk assessments (Tetra Tech, 2002)
- Establish baseline surface water quality (Tetra Tech, 2002)
- Provide data to assess whether water quality is protective of aquatic life (Tetra Tech, 2004)
- To assess water quality impacts from Phosphate mining operations and help prioritize needed remedial activities (IDEQ, 2005, 2005a, and 2006).

2.4 WVM RECENT SURFACE WATER SAMPLING

USFS surface water data collection was conducted in 2012 and 2014 to "support future site characterization of the historic Wooley Valley Mine" ([CH2MHILL, 2013] and [CH2MHILL, 2014]). Surface water samples were collected across the WVM site from drainages, streams, springs, seeps, and ponds and analyzed for total and dissolved metals.

An additional sampling event was conducted in the spring of 2014 at the request of the Bureau of Land Management (MWH, 2014). Surface water samples were collected from Angus Creek and a number of its tributaries as well as seeps emanating from the WVM site in the Angus Creek drainage.

2.4.1 Documents Containing Relevant Data

Results are provided in three separate surface water data reports ([CH2MHILL, 2013], [CH2MHILL, 2014], and [MWH, 2014]) that outline objectives of the work and present the data. Surface water data were collected at 28 sampling locations for the USFS studies, and at 14 locations for the 2014 spring tributary sampling.

2.4.2 Data Objectives

The primary objective of the USFS 2012 and 2014surface water studies were to characterize the main surface water features at the WVM site evident during the spring runoff.

The spring 2014 sampling event was conducted to collect data to assess potential impacts to adjacent tributaries of the Blackfoot River.

2.5 USFS ROCKY MOUNTAIN RESEARCH STATION ONGOING STUDIES

Dr. Michael S. Amacher, of the United States Forest Service (USFS) Rocky Mountain Research Station, has been conducting studies involving collection of environmental and biological data at the WVM site since 1999. Wetlands in the vicinity of WVM Unit IV have been studied to assess effects of annual vegetation burning and surface-applied gypsum on selenium concentrations. Media sampled include, but may not be limited to, the following:

- Soil
- Surface water
- Vegetation

Raw data sets for these studies were sent to MWH in electronic format in 2013. Copies of these data sets are included in Appendix A. Formal reports are not yet available.

3.0 SOIL AND SEDIMENT DATA RELEVANT TO EXISTING CONDITIONS

WVM site soils and sediments were impacted by historical petroleum product handling and mining activities. Vehicle maintenance and petroleum product storage resulted in petroleum contamination of soils at the former Truck Shop and Fuel Storage Area(Montgomery Watson, 1999), and mining activities in Units I, III and IV produced waste rock containing elevated concentrations of metals such as selenium, cadmium, manganese, vanadium, chromium, nickel, and zinc (Ecology and Environment, 2000). Historical WVM site petroleum and metals data representative of current conditions are summarized in this section.

3.1 FORMER PETROLEUM HANDLING AREAS – TRUCK SHOP AND FUEL STORAGE AREA

Data were collected at the former Petroleum Handling Areas, located in the center of the WVM site, from 1998 through 2002 (Figure 2-1). Data relevant to 2014 existing conditions from these sampling efforts are presented in Tables 3-1 through 3-9. (Refer to Section 2.1 for background information and overall data objectives for the petroleum handling areas.)

3.1.1 Historical Data Relevant to 2014 Existing Conditions – Former Truck Shop Area

The following data sets represent existing conditions at the former Truck Shop Area:

- Preliminary assessment data collected in areas where soil remediation was not conducted
- Confirmatory soil sampling data from samples collected from walls and floors of excavations during the excavation phase of soil remediation
- Final treatment performance samples collected after remediation was complete.

3.1.1.1 Preliminary Assessment Data

Preliminary assessment and investigation data collected in areas that were not remediated are assumed to represent 2014 existing conditions. Soil samples were analyzed for constituents known to have been used in the vicinity of each sample location. For example, soil samples collected from seven test pits located nearest the oil tank and workshop area were collected and analyzed for heavy oil range TPH using Method 418.1. However, soil collected from one test pit (TP1-TS) located in the vicinity of the gasoline tank was analyzed for gasoline range hydrocarbons using EPA Method 8015 Modified. These data were collected in areas where soils were not ultimately remediated, therefore they are considered relevant to existing conditions. Test pit locations are shown in Figure 3-1 and soil sample analytical data are presented in Table 3-1 (Montgomery Watson, 1999).

Additional soil data were collected in the vicinity of the Truck Shop's former above-ground storage tank (AST) area in June 2002 at the request of IDEQ (NWCC, 2002). Six additional test pits were excavated and sampled and/or screened for presence of petroleum hydrocarbons, volatile organic compounds (VOCs), and total lead. Laboratory analytical results for these samples are also listed in Table 3-1, and include results for samples from four test pits. Test pit and sample locations are shown in Figure 3-1.

TPH results are all well below the soil cleanup standard of 1,000 mg/kg that was established for the remedial action at the petroleum handling areas. Two June 2002 samples contained measurable total lead concentrations, though it was expected that the amount of leachable lead in these samples would be less than the maximum contaminant limit under the Resource Conservation and Recovery Act (RCRA) standard for leachable lead (5.0 milligrams per liter) (NWCC, 2002).

In addition to analytical data, June 2002 test pit samples were screened in the field for organic vapors with a combustible gas meter (NWCC, 2002). Only one sample had a measurable response. These field screening results are presented in Table 3-2.

3.1.1.2 Soil Remediation Confirmation Data

Remediation confirmation data collected from the walls and floors of remedial excavations in 1999 represent current existing conditions because these data represent soils left in place. Approximately half of the 1999 confirmation samples were analyzed for Risk-Based Corrective Action (RBCA) organic chemicals of concern (COCs) using EPA Methods 8260 and 8270, and half were analyzed for presence of TPH using Method 418.1 Modified (Montgomery Watson, 2002). Confirmation sample results for the Truck Shop area organic constituents and RBCA Tier 0 threshold values (IDEQ, 2002a) are listed in Table 3-3. Results indicate that, with the exception of one 0.5 mg/kg exceedance for Naphthalene, all sampled soils met Tier 0 criteria for waste oil site closure for unrestricted use under RBCA guidance in place at the time the remediation was conducted. Confirmation sample results for TPH are listed in Table 3-4. The average TPH concentration for soils proposed to remain in place was 884 mg/kg (cleanup standard was 1,000 mg/kg).

In addition, three composited soil samples were collected from what was assumed to be unaffected soils (see "unaffected stockpile sample locations" shown in Figure 3-1). One sample (SPS2-10) was analyzed for TPH using EPA Method 418.1, and two samples (SPS1-04 and SPS3-10) were analyzed for organic compounds using EPA Methods 8260 and 8270. These results, presented in Table 3-5, indicated that material stockpiled in the "unaffected material stockpile" could be returned to the excavation or used for reclamation during final site closure; therefore, these data represent existing conditions assuming these soils were left on the site and used for backfill and final grading in the Truck Shop area.

3.1.1.3 Final Treatment Performance Data – Truck Shop Area

Land treatment of petroleum impacted soils at the Truck Shop Area was conducted from 1999 until 2007 when performance monitoring samples indicated cleanup goals had been met. The final four composite soil treatment performance samples were collected in June 2007, as documented in the *Field Sampling and Risk Based Closure Assessment Report* (MWH, 2007). Samples were analyzed according to EPA Methods 8260B and 8270C, and results are presented in Table 3-6.

3.1.2 Historical Data Relevant to Existing Conditions – Former Fuel Storage Facility Area

The former Fuel Storage Area was used for fuel (diesel) storage and fueling of heavy vehicles and equipment for the WVM. Heavy mining equipment was prepared for off-site shipment at this facility as well, which resulted in scattered areas of residual sludge composed of dirt, oil and grease. Diesel fuel was stored in four to five above ground tanks surrounded by a 3-foot earth containment berm containment, and an eight-inch steel pipe conveyed stormwater and fuel from the containment structure to an oil/fuel collection sump (retention pond) (Montgomery Watson, 2001).

The following data sets represent 2014 existing conditions at the former Fuel Storage Area:

- Confirmatory soil sampling data from samples collected from walls and floors of excavations during the excavation phase of soil remediation
- "Unaffected Material" stockpile sampling data that was used as backfill after soil remediation efforts were complete.
- Treatment performance data, showing that treated soils met cleanup standards.

Because all Fuel Storage Area soil sample results from the 1999 preliminary assessment were collected from areas where soils were ultimately excavated and treated, they do not represent current existing conditions and are not presented here. However, results from samples collected to confirm remediation excavations were complete, results for stockpiled material used for backfill, and final data collected at the end of land treatment operations are relevant (Montgomery Watson, 2001). Excavation confirmation sample locations are shown in Figure 3-2 and corresponding data are presented in Table 3-7, clean stockpile sample data are presented in Table 3-8, and final land treatment soil sampling results are presented in Table 3-9.

3.2 IDAHO MINING ASSOCIATION REGIONAL SOIL DATA

Soil and sediment data were collected across the Resource Area, including the WVM site, as part of IMA regional studies conducted from 1999 to 2002. Background and data objectives for these data collection efforts are described in Section 2.2 and documents containing relevant data are listed in Table 2-3 of this report (Montgomery Watson, 1998, 1999a, 2001a, 2002, and 2002a). Soil and sediment data were collected at overburden dump seep locations, ponds, and stream locations and analyzed for a suite of laboratory analytes and parameters, including the following target elements:

- Selenium
- Cadmium
- Manganese
- Nickel
- Vanadium
- Zinc

IMA soils and sediment data relevant to 2014 existing conditions at the WVM site are summarized in Table 3-10. Geotechnical results, field-measured parameters, and laboratory analytical data for target elements and other constituents are included. Sample locations are shown on Figure 2-1.

Data are presented as reported in their respective source documents (see footnotes on Table 3-10 for sources). Raw analytical data, including estimated results below laboratory reporting and method detection limits, are shown for samples analyzed in 1999 and 2001. However, data collected in 2002 are shown as validated in accordance with the U.S. Environmental Protection Agency's (USEPA's) data validation functional guidelines (USEPA, 1994).

4.0 SURFACE WATER DATA RELEVANT TO EXISTING CONDITIONS

The WVM site is located in the Blackfoot River drainage area, which is a tributary to the Snake River, where surface water is used for mining, livestock, and irrigation and provides habitat for cold water biota (Ecology and Environment, 2000). Generally surface water is not used as a drinking source within 15 miles of the WVM site, though it may occasionally be used for drinking by recreational users of this area. However, site surface water is a drinking water source for livestock and wildlife.

The majority of the WVM site is drained by Angus Creek, a perennial stream, which is located in the Upper Blackfoot Watershed and flows into the Blackfoot River. Two unnamed intermittent drainages convey water directly from Unit IV directly to the Blackfoot River; a small drainage extends northeast from Unit III towards the Blackfoot Reservoir, and drainage from Unit 1 flows into two small intermittent drainages that extend southward, directly into the Blackfoot River that conveys water into the Blackfoot Reservoir. A number of intermittent drainages, seeps, springs and ponds are located on the WVM site.

The WVM site also encompasses a small area (northernmost portion of Unit III) that is located in the southeast corner of the Little Blackfoot River watershed, as illustrated in Figure 4-1. Surface water flows through an intermittent stream northward in the Enoch valley to the Little Blackfoot River which eventually flows into the Blackfoot Reservoir.

Surface water data were collected at the WVM site during two primary regional studies and one site-specific study as outlined in Table 2-1. Selenium, cadmium, and other trace metals have been detected in surface waters (i.e., ponds, seeps, drainages, and streams) at the WVM site and across the Resource Area. Surface water data from samples collected on the WVM site, or downgradient of the site at locations where runoff or groundwater inflow from other mines would not confound results, are presented in this report.

4.1 SURFACE WATER QUALITY CRITERIA

As defined by the Clean Water Act and Idaho state law, water quality standards link beneficial uses with criteria for protection of those uses (IDEQ, 2002). Aquatic life has been identified as a beneficial use for all perennial streams in the Resource Area, including Upper Angus Creek which originates and runs through the WVM site. Surface water analytical results for toxic metals were compared to Idaho criteria for aquatic life. Idaho acute and chronic aquatic life criteria presented in this report are defined as:

- Acute criteria, or Criteria Maximum Concentrations (CMCs). CMCs are maximum instantaneous, or one-hour average concentrations determined to "ensure adequate protection of sensitive species of aquatic organisms from acute toxicity."
- Chronic criteria, or Criteria Chronic Concentrations (CCCs). CCCs are four-day average concentrations that ensure "adequate protection of sensitive species of aquatic organisms from chronic toxicity."

Promulgated Idaho CMC and CCC concentrations are considered safe for aquatic life if they are not exceeded more than once every three years (IAC, 2013).

The primary constituent of concern for potentially impacted waters in the phosphate mining region has been selenium, which has a CCC of 0.005 milligrams per liter (mg/l) and a CMC of 0.02 mg/l. Aquatic life criteria for a number of other metals, such as cadmium, are functions of sample hardness. Generic aquatic life criteria, assuming a hardness concentration of 100 mg/l, are listed in tables presented in this report for initial comparative purposes for cadmium, nickel, zinc, copper, lead, and silver (IAC, 2013). These values are likely conservative because hardness data for surface waters at the WVM site are typically greater than 100 mg/l. For cases where surface water data exceed or are near the generic criteria, sample-specific aquatic life criteria (CMCs and CCCs) were calculated to assess whether the data actually exceed the Idaho aquatic life criteria using the IDEQ Metals Criteria Calculator (IDEQ, 2013).

Though surface water within 15 miles is not used as a drinking water source (Ecology and Environment, 2000), historical surface water data were also compared to Federal drinking water maximum contaminant levels (MCLs), which are typically greater than Idaho CMC and CCC values. The MCLs for selenium and cadmium are 0.05 mg/l and 0.005 mg/l, respectively. MCLs for other constituents are also listed in data tables presented in this report for comparative purposes.

4.2 IMA REGIONAL DATA FOR WVM

Surface water samples were collected from a number of sampling locations at the WVM site as part of regional IMA studies from 1997 to 2001. Laboratory analytical and field-measured parameter data for samples collected from ponds and reservoirs are presented in Table 4-1, and data for samples collected from streams and seeps are presented in Table 4-2. Sampling locations are shown in Figure 2-1. Data reported for 1997, 1998, and 1999 are raw laboratory results, and include all estimated concentrations below reporting and method detection limits, including negative numbers. Given the combination of trace concentrations detected in the region and low regulatory action levels (Montgomery Watson, 2002), the intent of preserving these estimated numbers was to limit high bias in the low end of the data set. However, data presented for 2001 are validated according to USEPA's data validation functional guidelines (USEPA, 1994).

Potentially relevant water quality criteria for surface waters at the WVM site include Federal drinking water maximum contaminant levels (MCLs) and Idaho aquatic life criteria. These criteria are listed alongside the IMA historical data in Tables 4-1 and 4-2.

4.2.1 WVM Surface Water Concentrations Detected Above Federal and State Criteria

4.2.1.1 Results for Ponds and Reservoirs

During the IMA sampling events standing water bodies were sampled at the following locations from 1997 through 2001:

- Units III and IV ponds
- Tailings ponds (#1, #2, and #3)
- Upper Angus Creek Reservoir.

Sample results exceeding Federal drinking water standards or Idaho aquatic life criteria are shown in bold in Table 4-1. Results shown in italic type are raw laboratory data reported below laboratory reporting limits. Selenium was the only constituent detected in pond or reservoir data above drinking water standards (MCL for selenium is 0.05 mg/l). The highest selenium concentrations were detected in Unit III ponds (at 0.0980 and 0.0746 mg/l, though these results are identified as "trace" concentrations), and Unit IV ponds (up to 0.080 mg/l) as shown in Table 4-1. Additionally, chronic aquatic life criteria (CCCs) were exceeded for selenium in Unit III.

Cadmium results in five 1998 tailings pond samples (sampling stations TP001, TP002, and TP003), though detected at trace concentrations and reported as raw data, exceed generic CCCs (calculated using 100 mg/l hardness [IAC, 2013]) as listed in Table 4-1. Sample-specific aquatic life criteria were calculated for these samples using hardness data for each sample, and the historical cadmium data were confirmed to exceed the CCC for cadmium (IDEQ, 2013). (Results are included in Appendix B). However, these cadmium concentrations were reported below the laboratory reporting limit, and the data were not validated using USEPA's guidelines.

4.2.1.2 Results for Seeps and Streams

During IMA regional sampling events from 1998 through 2001, seeps and streams at or near the WVM site were sampled at the following locations:

- Units I, II, and IV overburden dump seeps
- Unit I drainage (flows south directly to the Blackfoot River)
- Unit IV drainages (flow east or south directly to the Blackfoot River)
- Angus Creek at Unit IV
- Angus Creek (approximately 1 mile downstream of the WVM parcel boundary).

Federal drinking water MCLs were exceeded at two WVM overburden dump seep locations. Both selenium and/or cadmium were detected above MCLs (0.05 and 0.005 mg/l, respectively) in overburden dump seep samples in Units I and IV in 1998 and 1999 (Table 4-2). The highest concentrations were detected in samples collected from the Unit IV Overburden Dump Seep, at 1.4 and 0.029 mg/l for selenium and cadmium, respectively.

In addition, Idaho aquatic life criteria for selenium were exceeded in samples collected from two of the WVM site overburden dump seep locations and from one stream location. As shown in Table 4-2, the CMC for selenium (0.02 mg/l) was exceeded in 1998 in samples collected from the overburden dump seep at Unit III, and the CCC for selenium (0.005 mg/l) was exceeded in 2001 in samples collected from overburden dump seeps at Units I and III. (Results that exceed the selenium MCL also exceed acute and chronic aquatic life criteria.)

Cadmium concentrations were detected above generic Idaho chronic aquatic life criteria listed in Table 4-2 in the downstream Angus Creek sample collected in September 1998 and the Unit III overburden dump seep sample collected in May 2001. However, the generic criteria presented in Table 4-2 were calculated using an assumed hardness concentration of 100 mg/l (IAC, 2013) and are listed for initial comparative purposes only. Sample-specific aquatic life criteria (dependent on laboratory hardness data) were calculated for the two samples with cadmium data above the

generic CCC (IDEQ, 2013). The sample-specific CCC for the Unit III seep sample was calculated to be 0.0014 mg/l, which is higher than the concentration detected in May 2001 in the Unit III seep sample. However, the sample-specific CCC for the 1998 Angus Creek sample was calculated at 0.0010 mg/l, which is lower than the cadmium concentration detected for this sample of 0.0018 mg/l. Therefore, the 1998 cadmium concentration in the Angus Creek sample exceeds its sample-specific chronic aquatic life criterion, while the 1998 Unit III seep sample result does not.

4.3 IDEQ TOTAL MAXIMUM DAILY LOAD (TMDL) DATA FOR WVM

Surface water sampling to monitor TMDL was conducted at a number of mines in the Resource Area from 2001 through 2006, though only data collected at WVM are presented in this report. As part of this study, surface water samples were collected annually at just one location at the WVM site, on Upper Angus Creek (sampling stations 1 and UACTT033), as shown on Figure 2-1. Laboratory analytical results and field-measured parameters for samples collected from 2003 through 2006 are listed in Table 4-3. Though the Upper Angus Creek sampling location was not included in the original 2001 baseline data collection effort, it was included in a 2003 sampling round intended to supplement the 2001 baseline monitoring data (Tetra Tech, 2004), and in sampling rounds conducted annually thereafter through 2006.

In summary, toxic constituents were not detected above drinking water MCLs in any of the samples collected from the WVM Upper Angus Creek sampling locations. However, selenium concentrations exceeded the CMC of 0.020 mg/l in 2005 and the CCC of 0.005 mg/l for aquatic life in three samples, the split sample collected in 2003 (UACTT033-SPL) and samples collected in 2005 and 2006 (results are listed in bold type in Table 4-3).

Overall conclusions from the TMDL reports indicate that selenium loads across the Resource Area appear to correlate with yearly fluctuations in snow water equivalent (SWEQ). The highest selenium concentrations were reported for years when SWEQ and percent of normal SWEQ were relatively high.

4.4 2012 AND 2014 SURFACE WATER DATA

Surface water samples were collected at a variety of locations across the WVM site in 2012 and 2014 to assess water quality flowing onto and away from the site. Drainages, streams, springs, seeps, and ponds were sampled during spring months of 2012 and 2014 at Units I, IIIA, IIIB, and IV. Surface water sampling locations are shown in Figure 2-2.

4.4.1 USFS Surface Water Data Reports

Surface water was sampled by the USFS to support future site characterization of the WVM site. Sampling locations are shown in Figure 2-2 of this report and data are presented in the *Revised Final Surface Water Data Report – Wooley Valley Mine* (CH2MHill, 2013) and the *Final Surface Water Data Report – Wooley Valley Mine* (CH2MHill, 2014). Primary sample locations were selected to characterize potential impacts of mining activities at on the site, and additional sample locations were selected for the purpose of assessing background concentrations. Target metals concentrations exceeded MCLs or Idaho Aquatic Life Criteria at the following primary sample locations:

Unit I	Unit IIIA	Unit IIIB	Unit IV
U1- PPD-02-P	U3-PPD-01-P U3-PPD-01-2 U3-PPD-02-P U3-STR-03-P U3-STR-04-P U3-STR-05-P U3-SWP-02-P U3-SWP-04-P U3-SWP-05-P U3-WRS-01-P U3-WRS-02-P	U3-SWP-RST130-P U3-SWP-06-P U3-SWP-RST130	U4-PPD-01-P U4-STR-01-P U4-SWP-01-P U4-SWP-BLM-P U4-WRS-01-2 U4-WRS-01-P U4-WRS-02-P U4-WRS-02A1 U4-WRS-04-P U4-WRS-05-P

Sampling stations where target metals were detected above regulatory limits are summarized for each Unit at the WVM site in Tables 4-4 and 4-5, and are discussed in the following subsections. Additional samples were collected to assess background concentrations at presumed upgradient locations, and are designated with "BKG" in their sample station identifications in Figure 2-2.

Table 4-4
Summary of Target Metals Detected Above MCLs or Aquatic Life Criteria
USFS Spring 2012 Surface Water Sampling Event
Wooley Valley Mine Site, Caribou County, Idaho

Unit	Number of Samples Analyzed	Number of Samples With Detections Above MCLs or Aquatic Life Criteria	Maximum Concentrations Above MCLs or Aquatic Life Criteria	
			Total (mg/l)	Dissolved (mg/l)
Unit I	1	1	Selenium 0.133 Cadmium 0.566 Nickel 5.05 Zinc 29.3	Selenium 0.137 Cadmium 0.588 Nickel 5.14 Zinc 28
Unit IIIA	14	10	Selenium 0.221 Cadmium 0.00078	Selenium 0.222 --
Unit IIIB	5	1	Selenium 0.0053 Lead 0.0046	-- --
Unit IV	8	6	Selenium 0.608 Cadmium 0.0278 Nickel 0.157 Zinc 1.05	Selenium 0.62 Cadmium 0.0274 Nickel 0.156 Zinc 1.09

Table 4-5
Summary of Target Metals Detected Above MCLs or Aquatic Life Criteria
USFS Spring 2014 Surface Water Sampling Event
Wooley Valley Mine Site, Caribou County, Idaho

Unit	Number of Samples Analyzed	Number of Samples With Detections Above MCLs or Aquatic Life Criteria	Maximum Concentrations Above MCLs or Aquatic Life Criteria	
			Total (mg/l)	Dissolved (mg/l)
Unit I	2	1	Selenium 0.149 Cadmium 0.801 Nickel 6.05 Zinc 41.7	Selenium 0.148 Cadmium 0.758 Nickel 5.8 Zinc 42.2
Unit IIIA	18	11	Selenium 0.381 Cadmium 0.00069	Selenium 0.376 --
Unit IIIB	5	2	Selenium 0.0175	Selenium 0.0176
Unit IV	10	9	Selenium 0.37 Cadmium 0.0126 Nickel 0.15 Zinc 0.717	Selenium 0.417 Cadmium 0.0127 Nickel 0.123 Zinc 1.09

Because hardness data are not available for the samples collected, sample-specific aquatic life criteria could not be calculated, and generic aquatic life criteria (assuming a hardness of 100 mg/l) were used along with drinking water MCLs to screen the data for presentation and discussion in this report. Sampling results from the 2012 and 2014 USFS surface water sampling events are summarized below in Sections 4.4.1.1 through 4.4.1.5.

4.4.1.1 Unit I

Data Collected in 2012. Eight sample locations were proposed for Unit I, but due to dry conditions all inflow and outflow drainages were dry and only one sample was collected from the pit pond in April 2012 (locations shown in Figure 2-2). Results indicate both selenium and cadmium concentrations were detected above MCLs in the sample collected from the pit pond at Unit I. Nickel and zinc also exceeded generic aquatic life criteria. Refer to the 2012 report (CH2MHILL, 2013) for a complete list of data.

Data Collected in 2014. Nine sample locations, and two alternates, were proposed for Unit I, but due to dry conditions samples were collected from only two of the locations from the pit ponds which were fed by seeps. Results for cadmium, nickel, selenium, and zinc exceeded Idaho CCC criteria and cadmium and nickel exceeded their respective MCLs in one pit pond sample. Refer to the 2014 report (CH2MHILL, 2014) for a complete list of analytical results.

4.4.1.2 Unit IIIA

Data Collected in 2012. Of 17 sample locations proposed for Unit IIIA, 14 were sampled in April of 2012, including ponds, creeks, seeps, and springs. Results indicate the generic selenium aquatic life CMC (and CCC) were exceeded at four locations: two stormwater collection basins that appeared to be full year-round, and the northern and southern pit ponds. The selenium CCC was exceeded in six additional locations: the northern pit pond, two tributaries, one spring, one

stormwater collection basin, and two waste rock seeps. Cadmium was detected above the generic aquatic life CCC in just one sample collected at a stormwater collection basin. A complete list of data for Unit IIIA are presented in the 2012 report (CH2MHILL, 2013).

Data Collected in 2014. Of 21 samples identified for the 2014 sampling event (including two Bureau of Land Management [BLM] locations), 19 were sampled. The Idaho CCC value for selenium was exceeded in three pit pond samples, three basin samples, and two waste rock seeps/creeks samples. Cadmium exceeded the Idaho CCC value in one basin sample. Additionally, the selenium MCL was exceeded at two pit pond sample locations and one basin sample. Refer to the 2014 report (CH2MHILL, 2014) for tabulated data.

4.4.1.3 Unit IIIB

Data Collected in 2012. Surface water samples were collected in April 2012 for all five proposed sampling locations for Unit IIIB. Locations include a pit pond, two stormwater collection basins, waste rock drainage, and one waste rock seep. Selenium was detected above aquatic life criteria in one sample at one location, just downstream of Angus Creek Reservoir, where the generic aquatic life CCC value was slightly exceeded. Cadmium did not exceed its MCL or Idaho aquatic life criteria in samples collected from Unit IIIB. Refer to the 2012 report (CH2MHILL, 2013) for a complete list of Unit IIIB data.

Data Collected in 2014. Nine of the eleven planned locations were sampled (two locations were dry). Selenium concentrations exceeded the Idaho CCC value in two basin samples. Data are presented in the 2014 report (CH2MHILL, 2014).

4.4.1.4 Unit IV

Data Collected in 2012. Of 20 sample locations proposed for sampling at Unit IV, eight were sampled in April 2012 and included four seeps, one stormwater collection pond, two unnamed creeks, and one pit pond. Selenium was detected above its MCL (0.05 mg/l) at four locations, the pit pond and three of the four seeps sampled. Selenium exceeded its generic aquatic life CCC at one seep location. Cadmium was detected above its MCL of 0.005 mg/l at one seep location (selenium also exceeded its MCL at this location) and the pit pond location. Cadmium also exceeded its generic aquatic life CMC at two locations, the stormwater collection pond on the east side of the unit and one waste rock seep. Cadmium also exceeded its generic chronic aquatic life CCC at one seep location. Refer to the 2012 report for a complete list of data for Unit IV (CH2MHILL, 2013).

Data Collected in 2014. The 21 planned sampling locations for Unit IV included one BLM location and seven alternate locations. Of these, 11 were sampled. The Idaho CCC value for selenium was exceeded in one pit pond sample, one stream sample, one basin sample, and five waste rock seeps/creeks samples. Cadmium exceeded the Idaho CCC value in one pit pond sample, one basin sample, and five waste rock seeps/creeks samples. Nickel was also detected above its Idaho CCC value, in one waste rock seeps/creeks sample. Additionally, the selenium MCL was exceeded at one pit pond sample location and at four waste rock seeps/creeks sample locations. Refer to the 2014 report (CH2MHILL, 2014) for tabulated data.

4.4.1.5 Background Sampling

Data Collected in 2012. A total of eight potential background samples were collected in 2012, one from Unit IIIA, five from Unit IIIB, and two from Unit IV. Not all proposed potential background samples were collected due to dry conditions. Seven of the background samples were collected from unnamed drainages located upstream of the mine and one was collected from an upstream spring. Background sample locations are shown in Figure 2-2 and are identified with "BKG" in their station identifications.

Results from two of the Unit IIIB background samples exceeded generic aquatic life criteria for selenium and/or cadmium. Refer to the 2012 report (CH2MHILL, 2013) for potential background results collected in 2012. Total concentrations of selenium exceeded regulatory standards at three" background" sampling locations (in Unit IIIB) and cadmium exceeded regulatory standards at one "background" location. However, some background sampling locations were located close to a former haul road, which has resulted in a questioning of whether these locations can be designated as natural background sampling locations.

Data Collected in 2014. Background samples were collected at seven locations in 2014. Background sampling locations identified to be sampled for Unit 1 were not sampled due to dry conditions. Background samples collected from flowing springs and streams located upgradient of the mine pit likely represent natural background conditions near the WVM.

Results from the 2014 background samples did not indicate any target metals above aquatic life criteria or MCLs except for one cadmium result at one location (in Unit IIIB). Total cadmium was detected above the Idaho CCC limit at one background sampling location, but this background location is located close enough to a former haul road to raise the question of whether this sample is representative background conditions. Refer to the 2014 report (CH2MHILL, 2014) for tabulated results and further discussion.

4.4.2 Spring 2014 Surface Water Sampling for the Bureau of Land Management

Additional surface water sampling was conducted in the spring of 2014 at the request of the Bureau of Land Management (BLM) to evaluate whether metals were migrating from the WVM site into adjacent tributaries of the Blackfoot River. Samples were collected from Angus Creek and its tributary inputs, including surface water and seep flow emanating from the former WVM in the Angus Creek drainage. All 14 sampling locations are shown on Figure 4-2, and laboratory analytical results for target metals detected above aquatic life criteria are summarized below in Table 4-6.

Though primary drinking water standards were not exceeded in any samples, selenium exceeded the CCC limit in four samples. All four exceedances were detected in samples collected from intermittent streams, three were collected from streams that flow into Angus Creek and one from a stream that discharges directly into the Blackfoot River. Results for samples collected directly from Angus Creek did not exceed drinking water or aquatic life criteria limits. Refer to the *Spring 2014 Surface Water Sampling Report* (MWH, 2014) for a full data report and further discussion.

Table 4-6
Summary of Target Metals Detected Above MCLs or Aquatic Life Criteria
Spring 2014 Surface Water Sampling Event Requested by the BLM
Wooley Valley Mine Site, Caribou County, Idaho

Unit	Number of Samples Analyzed	Number of Samples With Detections Above MCLs or Aquatic Life Criteria	Maximum Concentrations Above MCLs or Aquatic Life Criteria	
			Total (mg/l)	Dissolved[a] (mg/l)
Unit I	0	--	--	--
Unit IIIA	5	1	Selenium 0.0098	--
Unit IIIB	6	2	Selenium 0.0139	--
Unit IV	1	1	Selenium 0.0156	--
Blackfoot River Tributaries	2	0	--	--

[a] Analyses for total concentrations of target metals were conducted (filtered samples for dissolved analyses were not collected)
NA – not applicable

5.0 GROUNDWATER DATA RELEVANT TO EXISTING CONDITIONS

Though groundwater at and near the WVM site is not utilized for public water supply systems, it is extracted for domestic, livestock, and industrial uses (Ecology and Environment, 2000). Though regional bedrock geology has been studied, hydrogeologic characteristics specific to the WVM site have not been reported. However, there are a number of springs on the site that appear to be emerging from fractured limestone and more permeable sandstone beds (Ecology and Environment, 2000). The WVM site spring water typically flows into surface water bodies on the site.

5.1 1998 GROUNDWATER SAMPLING

Groundwater samples were collected from 20 production wells across the Resource Area in May and September of 1998 (MW, 1999a). Of these 20 production wells, 12 are located within four miles of the WVM site shown on Figure 2-1. The total depth for eleven of these wells ranges from 60 to nearly 300 feet below ground surface (bgs), and the twelfth well is 810 feet deep (Ecology and Environment, 2000). Most of these wells are in the vicinity of other mines, therefore any apparent impacts to the water quality in these wells cannot be attributed solely to the WVM.

Two production wells are located adjacent to the site: PW014 is located near the western boundary of WVM Unit I, and PW015 is located west of Unit I near an unnamed drainage (see Figure 2-1). Metals and water quality parameter data for these two wells are listed in Table 5-1. The additional ten production wells located within four miles of the WVM site are shown on the map in Figure 2-1, and selenium concentrations for 1998 samples collected for all twelve wells are listed in Table 5-2. Selenium concentrations in these production wells range between 0.0000064 to 0.033 mg/l (the MCL is 0.05 mg/l).

6.0 VEGETATION AND BIOTA DATA RELEVANT TO EXISTING CONDITIONS

Though surface and groundwater at the WVM site are not used for public drinking water, surface water and vegetation are used by wildlife and domestic stock, and the Blackfoot River supports fish and other aquatic life. In addition, animals that are consumed by humans use site surface water and eat vegetation at the site (i.e., game birds, larger ungulates, waterfowl, sheep and cattle). Vegetation can accumulate selenium and other metals from contaminated soils, and poisoning of livestock and wildlife can be caused by ingestion of selenium-accumulating forage plants (USFWS, 1985). Vegetation and biota data have been collected at the WVM site as part of regional IMA studies (Montgomery Watson, 2001a, and MWH, 2002a).

6.1 VEGETATION

Vegetation sampling was conducted at the WVM site in 1998, 1999, and 2001 as part of the IMA regional studies. Vegetation samples were collected at overburden dump seeps and stream sampling locations (Figure 2-1) and analyzed for a suite of metals. Laboratory analytical results are presented in Table 6-1. The highest concentrations were detected in samples collected near the Unit IV seep (DS012) and Angus Creek at WVM Unit IV (ST-130). Target metals in these samples were detected within the following ranges:

- Selenium – 0.14 to 48 mg/kg
- Cadmium – 0.069 to 0.79 mg/kg
- Manganese – 11 to 440 mg/kg
- Nickel – 0.91 to 8.4 mg/kg
- Vanadium – 0.41 to 0.98 mg/kg
- Zinc – 25 to 80 mg/kg

Reports do not identify plant species sampled.

Additionally, three submergent macrophyte (underwater vegetation) samples were collected in Angus Creek just downstream of the WVM site and analyzed for selenium and cadmium. Results indicate selenium concentrations ranged from 1.4 to 1.6 mg/kg, and cadmium concentrations ranged from below the reporting limit to 1.9 mg/kg (Table 6-1).

6.2 BIOTA

Aquatic life, invertebrate, and small mammal samples were collected at the Angus Creek sampling station (ST-130) located in WVM Unit IV. Small mammals captured across the region for this IMA study include mice, chipmunks, and squirrel (MWH, 2002a). Laboratory analytical results are shown in Table 6-2a.

Fish and benthic macroinvertebrate (small animals living on the bottom of streams, i.e., insects) samples were collected at the downstream Angus Creek sampling station located approximately one mile east of the WVM site boundary (ST-129). Laboratory analytical results for these samples are listed in Table 6-2b. Selenium and cadmium concentrations in fish tissue ranged from 0.19 to 3.0 mg/kg and from below reporting limits to 0.56 mg/kg, respectively.

Concentrations were relatively higher in the benthic macroinvertebrate sample, with selenium and cadmium concentrations of 5.5 mg/kg and 3.3 mg/kg, respectively.

7.0 SUMMARY

7.1 GENERAL CONCLUSIONS

Environmental data were collected for a number of local and regional studies from 1997 to 2012 at the WVM Site, and those data deemed most representative of 2014 existing conditions are summarized in this document. Sampled media include soil, sediment, surface water (i.e., ponds, seeps, streams), groundwater (nearby production wells), vegetation, and biota. Primary target metals for historical studies include selenium, cadmium, manganese, nickel, vanadium, and zinc. Of these, selenium has been the primary focus due to its known regional impacts on livestock and suspected potential impacts on wildlife. While data from the WVM Site are very limited and would not be sufficient to perform human health/ecological risk assessments or a feasibility study, the following are preliminary, general conclusions for the WVM Site current conditions.

7.2 SEDIMENT AND SOILS

7.2.1 Hydrocarbons at the Fuel Storage Area and Truck Shop

While hydrocarbon contamination (fuels and oils) was documented at the former Truck Shop and Fuel Storage areas, on-site soil remediation conducted from 2000 through 2007 appears to have been effective. Preliminary assessment sampling and confirmation soil sampling data indicate that soils in these areas met treatment goals, RBCA Tier 0 Threshold values and 1,000 mg/kg for TPH. The Idaho Department of Environmental Quality (IDEQ) granted closure for the Fuel Storage Area on September 13, 2001, and for the Truck Shop area on January 2, 2003, and for the on-site petroleum Land Treatment Area (LTA) located at the Truck Shop on November 13, 2007. Given that continuing biological activity has likely reduced hydrocarbon levels even further since that time, further investigation or remediation for hydrocarbons at these locations (or elsewhere on the Site) is not warranted.

7.2.2 Metals in Sediments and Soils

Soil and sediment data were collected across the Resource Area, including limited sampling on the WVM site, as part of IMA regional studies conducted from 1999 to 2002. However, soil and sediment sampling were focused at overburden dump seep, pond, and stream locations. These samples were analyzed for selenium, chromium, manganese, nickel, vanadium, and zinc. Soils on waste dumps, within pits, and on roads were not characterized. While some soil and sediment sample results indicate increased concentrations of some metals (e.g., selenium and cadmium), background concentrations of metals for soils and sediment at the WVM Site have not been determined and need additional evaluation.

7.3 SURFACE WATER

Concentrations of both selenium and cadmium have exceeded aquatic life criteria and MCLs in some flowing surface water samples (e.g., streams),. . While selenium concentrations greater than the Federal MCL (0.05 mg/l) were detected in samples collected from WVM ponds and waste dump seeps, characterization of standing surface waters (ponds) is very limited. Historical surface water analytical data for target metals are typically higher during peak snowmelt conditions and during years with relatively higher precipitation and snow water equivalent.

Background concentrations for surface water need additional evaluation. Concentrations of a number of constituents detected in surface water samples from potential background locations in 2012 and 2014 exceed MCLs and aquatic life criteria, and locations of some of these samples are in question due to proximity to former haul roads. Therefore, additional evaluation and/or sampling are needed to establish background levels for surface water at the site.

7.4 GROUNDWATER

While there are no wells on the WVM Site, selenium and cadmium concentrations in groundwater samples collected from twelve production wells (completed from 60 to 810 feet bgs) within four miles of the site were all below their drinking water MCLs. Hydrogeologic or laboratory analytical data for groundwater directly beneath the WVM site are not available.

7.5 VEGETATION AND BIOTA

7.5.1 Vegetation

Vegetation sampling was performed across the Resource Area, including limited sampling on the WVM site, as part of IMA regional studies conducted from 1999 to 2002. However, as with soil and sediment, sampling was focused at overburden dump seep and stream locations. Samples were analyzed for target metals including selenium, cadmium, manganese, nickel, vanadium, and zinc. Reports do not identify plant species sampled. Additionally, three submergent macrophyte (underwater vegetation) samples were collected in Angus Creek just downstream of the WVM site and analyzed for selenium and cadmium. Vegetation on waste dumps, within pits, and on roads was not characterized. While vegetation sample results indicate increased concentrations of some metals (e.g., selenium and cadmium), background metals concentrations for vegetation at the WVM Site have not been determined and need additional evaluation.

7.5.2 Biota

Limited aquatic life, invertebrate, and small mammal samples were collected at one WVM location (the Angus Creek sampling station located in WVM Unit IV) and analyzed for selenium and cadmium. Small mammals captured for this IMA study include mice, chipmunks, and squirrels. Fish and benthic macroinvertebrate (small animals living on the bottom of streams, i.e., insects) samples were collected at the downstream Angus Creek sampling station located approximately one mile east of the WVM site boundary. While biota sample results indicate some increased concentrations of some metals (e.g., selenium and cadmium), background concentrations of metals for biota at the WVM Site have not been determined and need additional evaluation.

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