

**SITE SPECIFIC ADDENDUM
TO RAMS GENERAL WORK PLAN AND
SITE SAFETY AND HEALTH PLAN
Ironton Park/Calhoon Property, Colorado
12 August 2002**

1.0 INTRODUCTION

1.1 RAMS Program

The U.S. Army Corps of Engineers (USACE) has been provided authority for Restoration of Abandoned Mine Sites (RAMS) through the Water Resource Development Act (WRDA) 1999 Section 560. This program is a regionally focused and stakeholder responsive program for the restoration of abandoned and inactive non-coal mines where water resources (ecosystem/habitat) have been degraded by past mining practices. This authority is intended to allow the USACE to provide support to agencies that manage lands impacted by past mining.

1.2 Partnering Strategy

USACE will coordinate in advance to obtain stakeholder buy-in on all work proposed to be performed by Corps Districts to ensure that the proposed work is supportive of stakeholders efforts in the area. The U.S. Forest Service (USFS) will obtain the necessary right of entry (ROE) or other access agreement to the identified locations. Individuals from the USACE Omaha District and USFS Grand Mesa Uncompaghre Gunnison (GMUG) National Forest will perform the field work.

1.3 Work Plan and the Site-Specific Addendum

This document is prepared as the Site-Specific Addendum (SSA) to the Restoration of Abandoned Mine Sites Work Plan (USACE, 2002). The RAMS Work Plan was written to encompass all investigative activities to be accomplished by various districts of the USACE under the RAMS program. The purpose of this SSA is to present methods and procedures for conducting a site characterization of the Ironton Park/Calhoon Property involving surface water quality, mine waste, and sediment sampling.

This SSA describes the media, locations, analyses, frequencies, and techniques associated with the major field tasks outlined above and will be used in conjunction with the RAMS Work Plan. The RAMS Work Plan contains a more complete discussion of the RAMS program, along with a thorough discussion of the following: sampling requirements; field quality control; chemical data quality objectives; project organization and quality control responsibility; laboratory analytical and preparation procedures; sample collection, handling and documentation procedures; preventative maintenance procedures; calibration procedures and frequency; corrective action; and data reduction. This document references the RAMS Work Plan for the current field activities and contains site-specific information not included in the RAMS Work Plan.

2.0 PROJECT INFORMATION

2.1 Site Description

Ironton Park/Calhoun Property is located in Ouray County, Colorado. The project is under consideration for acquisition for the USFS GMUG National Forest. The site is located within the Red Mountain Historic Mining District in a setting of steep mountain slopes, precipitous peaks, and “U-shaped” glacially carved valley floors. Most ore deposits are located in the mineral belt associated with the San Juan volcanic field and the Silverton Caldera complex. Ironton Flats separates the Red Mountain Historic Mining District from the Ouray Historic Mining District.

The Red Mountain Historic Mining District is located in the center of a structural basin that is termed the “Red Mountain Sage”. This basin is bounded on the north by Ironton Park, on the south by Red Mountain Pass, on the west by Red Mountain and North Mineral Creeks, and on the east by the lower slopes of Red Mounts No. 2 and 3. Most of the mines in the district are located within or adjacent to the Silverton Caldera, and ore was produced mainly from the Henson and Burns Formations. Localized quartz latite porphyritic intrusions were emplaced within the two formations. Both these formations and the San Juan Formation are composed primarily of rhyodacitic flows, breccias, and tuffs. The San Juan Formation also contains the Gilpin Peak quartz latite tuff.

Chimneys and veins in igneous intrusions hosted significant ore deposits. These intrusions are a series of isolated volcanic pipes, centered mainly along a belt of latered and fractured rock in a zone of ring faults. The faults lie along the west and northwest sides of the Silverton Caldera. Igneous breccia pipes were also extensively mined. Ore shoots within the pipes and chimneys occur as irregularly shaped lenses and pods. They are composed of massive sulfides that were formed by open space filling in the upper cavernous parts of the pipes and by hydrothermal replacement at depth. Vertical zoning of mineralization occurred in and around the pipes. Increasing with depth, mineral assemblages are lead-rich to copper-silver rich to pyretic copper-arsenic ores. Principal sulfide minerals found in the deposits include pyrite, enargite, chalcopyrite, covellite, bornite, sphalerite, and galena. Associated economic minerals are pyrargyrite, proussite, stromeyerite, tennantite, and free gold. Gangue minerals include alunite, barite, fluorite, zunyite, diaspore, and pyrophyllite. Silicified rocks grade to argillic rocks and then to quartz-illitic rocks with increasing depth within the pipes.

Lead, iron, and zinc sulfides and sulfates, silver sulfosalts, and sulfobismuthates were concentrated within the faults and fracture zones. Rich veins containing these minerals were mined on the northwest side of the caldera. Typically, iron-bearing minerals such as marcasite, pyrite, chalcopyrite, pyrrhotite, pentlandite, cobaltite, enargite, tetrahedrite, and arsenopyrite are more abundant in Red Mountain mining district than in surrounding districts. Some of these minerals are more reactive to chemical, physical, and biological weathering than other base metal sulfides.

2.2 Project Goals

The goal of this investigation is to identify potential contaminant sources and collect environmental samples to determine whether or not significant contamination exists for the purpose of determining whether or not the USFS GMUG National Forest should accept the property. Project sampling locations were identified by the USFS on 30 July 2002. See Table 1 for list of sampling locations and media.

3.0 FIELD INVESTIGATION

3.1 Field Investigation Activities

Sampling locations have been identified but may be relocated based on observations during the field work (Table 1). The following Standard Operating Procedures (SOPs), located in Appendix A of the RAMS Work Plan, will be adhered to during the course of this field investigation: A1 (Surface Soil/Rock Sampling Equipment and Procedures); A4 (Soil/Rock Homogenization Equipment and Procedures), A5 (Lithologic Description of Surface and Subsurface Soil Samples), A7 (Investigative Derived Waste Procedures); A11 (Surface Water and Sediment Sampling Equipment and Procedures), A12 (Equipment Decontamination Procedures); A13 (Sample Handling, Documentation, and Tracking Procedures); and A14 (Field Documentation).

Sampling location coordinates obtained from a hand-held Global Positioning Satellite (GPS) device will be recorded in the field logbook in longitude and latitude. The device has an approximate accuracy of plus-or-minus 20 feet.

3.1.1 Surface Water Samples

The sampling locations are located upgradient and downgradient from potentially contaminated areas. The locations are designed to determine whether or not stream degradation is occurring as a result of these areas. Field measurements of pH, specific conductance, temperature, and turbidity will be obtained with a Horiba U-10 water quality checker. Probes for all of these specified parameters are housed in a single unit, making this equipment ideal for sampling sites where it is anticipated that access will be by foot. Surface water samples will be collected directly into the sample container, or, if flow rate is too low for this method, the samples will be collected with a disposable plastic cup and poured into the sample container. All excess water will be disposed of by pouring gently out on the stream bank adjacent to the sampling location. A total of 16 surface water samples (water quality samples) plus one Quality Control (QC) sample will be collected at the locations identified in Table 1 and will be analyzed for:

Target Constituent	Analytical Method
Metals	
Antimony, dissolved	EPA M200.8 ICP-Trace
Arsenic, dissolved	EPA M200.8 ICP-Trace

Target Constituent	Analytical Method
Cadmium, dissolved	EPA M200.8 ICP-Trace
Chromium, dissolved	EPA M200.8 ICP-Trace
Copper, dissolved	EPA M200.8 ICP-Trace
Iron, total	EPA M200.7 ICP
Lead, dissolved	EPA M200.8 ICP-Trace
Manganese, dissolved	EPA M200.7 ICP
Mercury, dissolved	EPA M200.8 ICP-Trace
Nickel, dissolved	EPA M200.8 ICP-Trace
Selenium, dissolved	EPA M200.8 ICP-Trace
Silver, dissolved	EPA M200.8 ICP-Trace
Zinc, dissolved	EPA M200.8 ICP-Trace
Chloride	EPA M325.2
Cyanide, free	EPA M335.3
Sulfate	EPA M375.3
Hardness as CaCO ₃	EPA SM2340B
Residue, Filterable (TDS) @ 18°C	EPA M160.1
PH	EPA M150.1
Conductivity @ 25°C	EPA M120.1

3.1.2 Mine Waste Samples

A total of 3 mine waste samples (surface rock/soil samples) plus one QC sample will be collected at the locations identified in Table 1 and will be analyzed for:

Target Constituent	Analytical Method
Total Metals (total digestion)	EPA 3051
Antimony	EPA 6010, ICP
Arsenic	EPA 6010, ICP
Cadmium	EPA 6010, ICP
Copper	EPA 6010, ICP
Lead	EPA 6010, ICP
Manganese	EPA 6010, ICP
Mercury	EPA 7470, CVAA
Nickel	EPA 6010, ICP
Selenium	EPA 6010, ICP
Silver	EPA 6010, ICP
Zinc	EPA 6010, ICP
SPLP Extraction	EPA 1312 – West
Antimony	EPA 1312/200.7, ICP
Arsenic	EPA 1312/200.7, ICP
Cadmium	EPA 1312/200.7, ICP
Copper	EPA 1312/200.7, ICP

Target Constituent**Analytical Method**

Lead	EPA 1312/200.7, ICP
Manganese	EPA 1312/200.7, ICP
Mercury	EPA 1312/245.1, CVAA
Nickel	EPA 1312/200.7, ICP
Selenium	EPA 1312/200.7, ICP
Silver	EPA 1312/200.7, ICP
Zinc	EPA 1312/200.7, ICP

3.1.3 Sediment Samples

A total of 14 sediment samples plus one QC sample will be collected at the locations identified in Table 1 and will be analyzed for:

Target Constituent**Analytical Method**

Total Metals (total digestion)	EPA 3051
Antimony	EPA 6010, ICP
Arsenic	EPA 6010, ICP
Cadmium	EPA 6010, ICP
Copper	EPA 6010, ICP
Lead	EPA 6010, ICP
Manganese	EPA 6010, ICP
Mercury	EPA 7470, CVAA
Nickel	EPA 6010, ICP
Selenium	EPA 6010, ICP
Silver	EPA 6010, ICP
Zinc	EPA 6010, ICP

3.2 Stream Discharge Equipment and Procedures

Flow rate measurements will be obtained using an FP201 Global Flow Probe hand-held flow meter with a 5- to 15-foot expandable handle. The flow meter has a 2-inch propeller sensor that rotates freely on a bearing shaft with no mechanical interconnections. Magnetic material in the propeller passes a pickup coil in the housing, thereby producing electrical impulses. The electrical impulses are then carried by wire to a readout display located on top of the handle, which amplifies and converts the signal into velocity readings measured in feet per second. Instantaneous, average and maximum velocity readings are displayed. The range of the flow meter is 0 to 25 feet per second, with accuracies of plus-or-minus 0.1 feet per second for instantaneous velocity, and plus-or-minus 0.01 feet per second for average and maximum velocity.

At each surface water sampling location, the stream channel will be subdivided into 1 to 5 segments of equal length depending on the width of the stream channel. Ideally, each segment will range from 3 to 5 feet across. The depth of the stream will be measured in the middle of

each segment. These measurements will be recorded in the field logbook. The cross-sectional area of each stream channel segment will be calculated for the stream segment.

After calculating the cross-sectional areas, velocity measurements will be obtained from each stream segment. The flow meter handle will be extended to the appropriate length and the flow probe placed in the middle of each stream segment for a minimum of 1 minute. The flow probe will be moved slowly back and forth from top to bottom during the 1-minute timeframe in order to obtain a vertical flow profile. The average and maximum flow velocities for each stream segment will be recorded in the field logbook. For each stream segment, the average velocity will then be multiplied by the cross-sectional area in order to determine the flow for that segment. Once the flow for each segment is obtained, all of the segment flows will be added together to obtain a total stream flow.

3.3 Sample Identification Scheme

The sample ID scheme presented in SOP A13 will be modified to the following designation.

UU-VVVV-XXXX-ZZ

where:

UU = Project designation will be replaced with **CO** (for Colorado RAMS)

VVVV = Designation of sampling area location will be replaced with **IPCP** (For Ironton Park – Calhoon Property)

XXXX = **WR** (waste rock/mine waste sample), **SW** (surface water sample) or **SD** (sediment sample) plus the two-digit sample location number

ZZ = 2 Character Designation for Samples, where:

01 = Normal Field Sample

02 = QC Duplicate

An example of the mine waste sample collected from the Large Waste Pile at Albany Gulch is:

CO-IPCP-WR17-01

The QC duplicate sample at this location would have the sample designation of:

CO-IPCP-WR17-02

4.0 CHEMISTRY REQUIREMENTS

Sample analytical and handling requirements are given in this section of the SSA Work Plan. Reference to the Final Restoration of Abandoned Mine Sites General Work Plan, July 2002, will be given.

4.1 Project and Data Quality Objectives

4.1.1 Project Objectives

Surface water, sediment, and mine waste samples from Ironton Park/Calhoon Property will be obtained for chemical analysis. For this project 16 surface water samples, 3 mine waste samples, and 14 sediment samples will be collected and analyzed by USACE.

4.1.2 Data Quality Objectives

The data quality objectives are based on that given in the General Work Plan, 2002. The analytical results will be used to gain information about the extent of mine-related contamination. The criteria in order to attain these goals are given in the General Work Plan, 2002 and/or given in this section. The MDL, MRL, and Quality Control criteria that will meet the data objectives for metals are given in Tables 6-5 and 6-6 of the General Work Plan, 2002. The MDL, MRL, and Quality Control criteria of the water leachate that will be analyzed for pH, acid concentration, conductivity, and metals are given in Table 6-7 of the General Work Plan, 2002.

4.2 Samples Obtained

Sample requirements are given in the following table:

SAMPLE REQUIREMENTS

Parameter	Field	Quality Control Duplicate	MS/MSD**	Total
Surface Water	16	1		17
Mine Waste Sample*	3	1		4
Sediment Sample	14	1		15

* Total metals of the soil and the SPLP leachate can all be obtained from the one sample from each area.

** Required MS/MSD can be obtained from samples above and no additional samples are required.

NOTE: Each bottle and the COC must include the LIMS # 6717

4.3 Preservation, Holding Time, and Shipment

Water samples shall be samples in a time table so they can be shipped to the lab within holding times. Holding times for soil metal samples are such that they all can be sent in one cooler.

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR SURFACE WATER SAMPLES

Parameter	Container	Preservation	Maximum Holding Times	
			Extraction	Analysis
Metals* (dissolved/total)	500 ml plastic			6 months Hg 28 days
Chloride	1 liter plastic			28 days
Sulfate				28 days

Parameter	Container	Preservation	Maximum Holding Times	
			Extraction	Analysis
Hardness as CaCO ₃	500 ml plastic	NaOH to pH >12		28 days
PH				24 hrs
Conductivity @ 25 ⁰ C				28 days
Residue, Filterable (TDS) @ 18 ⁰ C				7 days
Cyanide, free				14 days

* Dissolved metals: Sb, As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, Ag, Zn. Total metals: Fe. One sample can be sent in for metals, but it must be written on the COC and sample label that an aliquot for total Fe must be removed before filtering.

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR MINE WASTE SAMPLES

Parameter	Container	Preservation	Maximum Holding Times	
			Extraction	Analysis
Metals* **	1 x 8 oz glass	-		6 months Hg 28 days
Metals (SPLP)* **		-		6 months Hg 28 days

* Metals: Sb, As, Cd, Cu, Pb, Mn, Hg, Ni, Se, Ag, Zn.

** One sample can be sent in for metals and SPLP Extraction metals, but it must be written on the COC and sample label that part of the soil must be used for the SPLP Extraction.

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR SEDIMENT SAMPLES

Parameter	Container	Preservation	Maximum Holding Times	
			Extraction	Analysis
Metals*	8 oz glass	-		6 months Hg 28 days

* Metals: Sb, As, Cd, Cu, Pb, Mn, Hg, Ni, Se, Ag, Zn.

The soil metal samples may be batched (held on site) before shipping, but should be sent to the laboratory at least once a week. The sample/samples will be analyzed and the sensitivity and quality control samples acceptance criteria will meet that set by the Environmental Chemistry Branch Laboratory criteria and/or as per the Draft General Work Plan, Restoration of Abandoned Mine Sites, June 2002.

4.4 Labeling and Shipment Procedures.

The filled sample bottles and jars will be labeled as specified in the General Work Plan, 2002. The Laboratory Identification Management System (LIMS) number is: **LIMS # 6717.**

The labeled bottles will be placed in the cooler with the appropriate chain-of-custody. The cooler will be shipped by overnight mail to the laboratory:

US Army Corps of Engineers
 Environmental Chemistry Branch (ECB) Laboratory
 ATTN: WES-EE-Q (Sample Custodian)
 420 South 18th Street
 Omaha NE 68102
 Telephone: (402) 444-4314.

4.5 Sample Analysis

The following analytical methods will be used for the field samples and appropriate required quality control samples for this site:

<u>Parameter</u>	<u>Method</u>	<u>Matrix</u>
Metals	EPA SW 6010B/7470 series for Hg	water
Chloride	EPA 325.2	water
Sulfate	EPA 375.3	water
Hardness (CaCO ₃)	EPA	water
TDS	EPA 160.1	water
Cyanide, Free	EPA 335.3	water
pH	EPA 150.1	water
Conductivity	EPA 120.1	water
Metals	EPA SW 6010B/7470 series for Hg	soil/sediment
Metals (SPLP)	EPA SW 1312/6010B/7470 series for Hg	leachate

5.0 SAFETY REQUIREMENTS

Information on health and safety issues associated with this field effort may be found in the RAMS Site Safety and Health Plan (SSHP), July 2002. For this field effort, a Modified Level D will be used for PPE. PPE will consist of steel-toed, steel-shank safety boots or appropriate hiking boots if additional traction is required for the terrain, safety glasses, and latex or nitrile gloves during sample collection.

6.0 QUALITY CONTROL REVIEW

Quality control review consists of an evaluation of the field procedures and analytical procedures and a review of the data to ensure appropriate QC compliance were met.

6.1 Field Quality Control

All documentation in field logbooks will be reviewed by the project team for completeness. A review of the placement or coordinates of the sample will be performed to ensure that this correlates to sample nomenclature. Placement and frequency of the quality control samples will

be reviewed to ensure compliance to set criteria. Location coordinates, flow rate measurements, cross-sectional area calculations, and discharge calculations will be reviewed for completeness and accuracy by the project technical team.

6.2 Laboratory Quality Control

Upon completion of analysis, the analyst will calculate the final sample results and associated QC results from the raw data. The analyst will review all raw data for any peaks that appear suspect or will have any effect on the data. The analyst will review all analytical instrument parameters such as internal standards, retention times, and controls to ensure compliance. The analyst will also review accuracy of equations including units and also quality control results for the analytical batch. When the analyst has completed the analysis of the samples, a second level of data and instrument review will be performed by another laboratory person. This will give a check on instrument performance, interpretation, and calculation of the data results. Before the data package is released, a third level of review will be performed by the Quality Control Officer of the lab to ensure complete data accuracy and compliance. The sample temperature upon receiving the samples, holding times, and a complete case narrative of the quality control will be submitted along with each data package. The three levels of laboratory review of the data package will be performed on 100 % of the data.

6.3 Data Evaluation

The project chemist will make a separate review of a portion of the data package obtained from the laboratory. This will include a review of the Case Narrative that is included in the data package. If no noted deficiencies are encountered, it can be assumed that the data package as obtained from the laboratory is of sufficient quality that batch validation can be performed. The batch data evaluation will be performed on 100 % of the data package obtained from the laboratory. In performing this, the evaluator will use the National Functional Guidelines as a guide. The parameters and QC results that are used in the validation are:

- Holding times
- Sample temperatures during shipment and before analysis
- Blanks (trip and method)
- LCS
- MS/MSD
- Surrogates

Data evaluation consists of comparing the above six items along with other checks as given in section 5.7 of the General Work Plan, 2002 to set project criteria and flagging the data values accordingly. The evaluation should show how the holding times and shipment and holding temperatures are met and any noncompliance along with how the analytical batch blanks and spikes samples meet set criteria. Data tables will be produced for all analytical data along with the resulting data qualification flags.

7.0 REPORT REQUIREMENTS

The report for this field effort will consist of:

- a brief summary of field activities,
- a map of final sampling locations,
- a table of sampling location coordinates in longitude and latitude, flow rate velocities, stream channel cross-sectional area, and calculated discharge rate,
- a table of analytical results for all parameters and comparison to state standards, if any, and
- a brief summary of data quality based on data evaluation.

**TABLE 1
IRONTON PARK/CALHOON PROPERTY SAMPLE LOCATIONS**

Sample Location	Water Quality Sample	Mine Waste Sample	Sediment Sample
Eastern Side of Ironton Park			
Red Mtn. Crk - S. Property Line (PL)	SW-01		
Red Mtn. Crk - S. Property Line (PL)			SD-02
RMC - Bank/Floodplain (tailings)			SD-03
<i>* RMC - Floodplain (tailings)</i>			<i>SD-04</i>
Gray Copper Crk - S. PL	SW-05		
GCC - before RMC Jct	SW-06		
RMC - after GCC Jct	SW-07		
RMC - Floodplain (tailings)			SD-08
Clear Seep - before RMC	SW-09		
RMC - after clear seep Jct	SW-10		
Albany Gulch Meadow - Upper			SD-11
Albany Gulch Meadow - Lower			SD-12
Smelter Site - Gray Material			SD-13
Smelter Site - Pipe Material			SD-14
Smelter Site - Slag Material			SD-15
Smelter Site - Brick Material			SD-16
Albany Gulch - Large Waste Pile		WR-17	
Albany Gulch - Gray Waste Pile		WR-18	
Albany Gulch - Adit Discharge	SW-19		
Brooklyn Gulch - Adit Discharge	SW-20		
<i>* Hendrick Gulch - Adit Discharge</i>	<i>SW-21</i>		
Western Side of Ironton Park			
Red Mtn. Crk - N. Property Line (PL)	SW-22		
Western Side - Large Waste Pile		WR-23	
Western Side - Adit Discharge	SW-24		
Full Moon Gulch - S. Property Line	SW-25		
Above Iron Bog			SD-26
Iron Bog			SD-27
Small Lake stained with iron deposits	SW-28		
Below Beaver Dam			SD-29
Black Pond			SD-30
Black Pond	SW-31		
Crystal Lake Inlet	SW-32		
Crystal Lake Outlet Spillway	SW-33		
Crystal Lake Above Headgate	SW-34		
Crystal Lake			SD-35
<i>* Western Side - Floodplain (tailings)</i>			<i>SD-36</i>
<i>* Western Side - Floodplain (tailings)</i>			<i>SD-37</i>
<i>* Western Side - Floodplain (tailings)</i>			<i>SD-38</i>

** Forest Service will take this sample*