SITE-SPECIFIC ADDENDUM TO
RESTORATION OF ABANDONED MINES SITE WORK PLAN
UPPER SLATE RIVER
30 July 2002

1 INTRODUCTION

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.

This document is a Site-Specific Addendum (SSA) to the Restoration of Abandoned Mine Sites Work Plan, dated July 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 upper Slate River and tributary drainages involving surface water sampling and flow rate measurements. USACE Omaha District and Colorado DMG personnel will perform fieldwork. U.S. Forest Service personnel will compile the water quality results with data from other sources to characterize water quality in the region. Additional stakeholders providing input or exhibiting interest in this project include U.S. Forest Service and Geology and the Bureau of Land Management.

This SSA describes the media, locations, analyses, frequencies, and techniques associated with the major field tasks planned for upper Slate River 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 PROJECT INFORMATION

The Slate River and Washington Gulch are located near Crested Butte in Northern Gunnison County, Colorado. Excessive concentrations of iron and manganese have been identified in surface waters, indicating weathering of pyritic materials and acid rock drainage formation. The sources of the metals are suspected to be waste rock and tails from silver and gold mining and milling processes in the region. The project proposes to consolidate existing water quality data in the region (to be performed by USFS), identify draining mines and other points of potential

loading, measure water quality and flow rates at predetermined locations, and prepare a report for distribution to all partners summarizing all and proposing future work.

This project is the third priority for funding by the Colorado DMG. Slate River flows to the Gunnison, which eventually joins the Colorado River. The project will provide initial water quality data and begin a survey of the extent of abandoned mines in this watershed. The areas of potential contamination seem to be quite large, and this initial sampling may need to cover both low flow and high flow seasons.

3 FIELD INVESTIGATION ACTIVITIES

The project goals have been established based on a watershed approach. The following goals have been identified for this project:

- Develop a basic understanding of the geologic and hydrogeologic framework of the watershed.
- Determine which potential source areas are impacting basin-wide water quality by the release of mine-related contaminants to the environment and what the magnitude of the impact is on the environment through measurement of flow rates and collection of water quality samples.

Water quality data for the area will be consolidated for support of the Colorado RAMS database. A handheld Global Positioning Satellite (GPS) survey of the watershed will be performed to identify draining mines and other potential loading sources. Flow rate measurements will be obtained, and surface water quality samples will be collected and analyzed at the laboratory. Results will be presented with maps of sampling locations in a brief data summary report.

USACE, USFS, and Colorado DMG have selected twenty locations in upper Slate River and tributaries to sample for water quality analysis. They are identified in the table below and depicted on Figure 1. Fieldwork is scheduled for August 6 through 9, 2002, during the low flow season. Rights of Entry (ROEs) have not been obtained for five of the twenty locations. If ROE has not been obtained before mobilizing to the field, they will be omitted.

Sample number	Sample location description	ROE
SW01	Slate River below Oh-Be-Joyful Creek	
SW02	Oh-Be-Joyful Creek below Wolverine Creek	
SW03	Wolverine Creek above Oh-Be-Joyful Creek	
SW04	Redwell Basin above Oh-Be-Joyful Creek	
SW05	Unnamed tributary west of Redwell Oh-Be-Joyful Creek	
SW06	Oh-Be-Joyful Creek above unnamed tributary west of Redwell	
SW07	Slate River below Poverty Gulch	No
SW08	Poverty Gulch above Slate River	
SW09	Baxter Basin above Poverty Gulch	
SW10	Poverty Gulch below Cascade Mountain	
SW11	Unnamed tributary west of Baxter, above Poverty Gulch	
SW12	Poverty Gulch above unnamed tributary west of Baxter	
SW13	Poverty Gulch above Last Road Crossing	

Sample number	Sample location description	ROE
SW14	Slate River Road 0.2 mi above Poverty Gulch Road	
SW15	Slate rive about 1.5 mi above Poverty Gulch Road	
SW16	Washington Gulch below Mining	
SW17	Unnamed tributary above Washington Gulch	No
SW18	Washington Gulch above unnamed tributary	No
SW19	Coal Creek above Slate River	No
SW20	Slate River Below Coal Creek	No

3.1 Rights of Entry

USACE has obtained permission to enter and sample surface water on property owned by the USFS. Proposed sample locations on privately owned property cannot be sampled until the owner has signed a ROE granting permission for USACE personnel to enter and sample. The ROE column in the table above denotes sample locations for which the owners have not granted permission to enter and sample. These locations will be sampled after the owners sign and return to USACE the ROE documentation.

The property owner for sample location SW07 has granted verbal permission to enter and sample. The day before the sample team enters the area, the owner requests notification so livestock can be moved. The samplers must call Mrs. Berg at (970) 349-0882 the day before sampling SW07 to make final arrangements.

3.2 Surface Water Sampling Equipment and Procedures

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. 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 access will be on foot.

Surface water samples will be collected in accordance with SOP 11. Samples for dissolved metals and anions analysis 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. Samples for total metals analysis will be collected with a disposable plastic cup and poured into the pre-preserved sample container to prevent possible preservative loss. All excess water will be disposed by pouring gently out on the stream bank adjacent to the sampling location. Do not overfill pre-preserved sample containers.

3.3 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 assuming the measured depth is consistent across each stream segment. These measurements will be recorded by drawing a diagram in the field logbook. The cross-sectional area of each stream channel segment will be calculated by counting the number of squares in the stream segment, and will be recorded in the field logbook.

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, then multiply the average velocity by the cross-sectional area 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. The date, time, and GPS coordinates in longitude and latitude for each sampling location will be recorded in the field logbook.

3.4 Documentation

Field documentation will be performed in accordance with SOP 14 except sample location surveying will be GPS coordinates and the location will not be staked or otherwise marked. Stream cross-sections will be recorded in the field logbook.

Sample documentation will be performed in accordance with SOP 13. All sample labels and chains of custody must identify the laboratory information management number (LIMS) for this project, **LIMS # 6705**. Sample labels for dissolved metals analysis must be marked “filter and acid-preserve at lab”.

Sample identification follows SOP A13 will use the following format:

CO–USR–SW??–##

Where –SW?? is the sample number from the table above, and

–## is the sample type, either –01 for a normal sample or –02 for a QC duplicate sample.

4 CHEMISTRY REQUIREMENTS

4.1 Data Quality Objectives

The data quality objectives are based on those given in the RAMS Work Plan, July 2002. The analytical results will be used to gain information about the extent of metals loading from various mine sites into the associated creeks. The criteria in order to attain these goals are given in the RAMS Work Plan, July 2002, and/or given in this section. The Method Detection Limit (MDL), Method Reporting Limit (MRL), and QC criteria that will meet the data objectives for metals are given in Tables 6-5 and 6-6 of the RAMS Work Plan, July 2002. The MDL, MRL, and QC criteria that will meet the data objectives for alkalinity, chloride and sulfate are given in Table 6-7 of the RAMS Work Plan, July 2002.

4.2 Sample Requirements

A total of 20 surface water sample locations will be investigated. Field personnel will measure flow rate, pH, conductivity and temperature at the sample location. They will collect samples of water for laboratory analysis for alkalinity, total metal, dissolved metals, and water quality anions. Specific requirements are in the table below. Extra containers of sample will be collected at one location for QC. That location will be selected in the field and will require a normal sample, a duplicate sample, and a MS/MSD sample, providing a total of 22 samples for laboratory analysis.

Parameter	Method	Container	Preservative
Total metals	SW-846 3005/6010B	1- 500 mL plastic with preservative	HNO_3 to pH<2, ice
Dissolved metals	SW-846 3005/6010B	1- 500 mL plastic	HNO_3 to pH<2 *, ice
Alkalinity	EPA Method 310.2	1-500 mL plastic	Ice
Chloride	EPA Method 325.2		
Sulfate	EPA Method 375.2		
pH	Horiba U-10	NA	NA
Conductivity	Horiba U-10	NA	NA
Temperature	Horiba U-10	NA	NA
Flow rate	FP201 Global Flow Probe	NA	NA

* Dissolved metals samples cannot be preserved with acid until after filtered. The laboratory will filter and acid-preserve these samples.

The laboratory will provide twenty-five 500-mL plastic sample containers containing nitric acid for total metals analysis and fifty unpreserved 500-mL plastic sample containers, sample shipping coolers, and blank labels. All other equipment will be purchased or obtained from USACE.

4.3 Sample Shipment

Samples requiring laboratory analysis will be shipped by FEDEX to

U.S. Army Corps of Engineers
ECB Laboratory
ATTN: WES-EE-Q (Sample Custodian)
420 South 18th Street
Omaha NE 68102

The point of contact at laboratory is Laura Percifield, at telephone (402) 444-4314.

4.4 Analysis requirements

Environmental Chemistry Branch (ECB) Laboratory will perform analysis on surface water samples collected from upper Slate River and tributaries. The table below identifies the parameters, methods, and holding time for the planned activities. They include:

- Alkalinity
- Aluminum
- Arsenic
- Cadmium
- Calcium
- Zinc
- Chromium
- Chloride
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Potassium
- Silver
- Sulfate

The laboratory will filter and preserve with nitric acid samples for dissolved metals analysis. Laboratory documentation will be organized under **LIMS # 6705**.

Parameter	Method	Holding time
Total metals (Al, As, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, K, Ag, Zn)	SW-846 3005/6010B	6 months
Dissolved metals (Al, As, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, K, Ag, Zn)	SW-846 3005/6010B	6 months
Alkalinity	EPA Method 310.2	14 days
Chloride	EPA Method 325.2	28 days
Sulfate	EPA Method 375.2	28 days

5 SAFETY REQUIREMENTS

General health and safety requirements are identified in the RAMS Site Safety and Health Plan (SSHP), July 2002. Relevant sections for this field effort are identified in the Site-Specific Job Hazard Assessments in Section 12. Personnel working on site must read relevant sections of the

SSHP and comply with the requirements they contain. Personnel must sign the acknowledgement form on page viii before the Site Safety and Health office will permit work on site. The Site Safety and Health Officer must ensure Tailgate Safety Meetings are performed regularly and documented on the form in Section 12 of the SSHP. For this field effort, person protective equipment is Modified Level D, consisting of steel-toed, steel-shank safety boots or appropriate hiking boots if additional traction is required for the terrain, and latex or nitrile gloves during sample collection.

6 QUALITY CONTROL REVIEW

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

6.1 Field Quality Control

The project team will review for completeness all documentation found in the field logbook. 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 quality control results for the analytical batch. When the analyst has completed the analysis of the samples, another laboratory analyst will perform a second level of data and instrument review. This will give a check on instrument performance, interpretation, and calculation of the data results. Before the data package is released, the laboratory Quality Control Officer will perform a third level of review 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),
- Laboratory Control Samples,
- Matrix Spike/Matrix Spike Duplicates, and
- Surrogates.

Data evaluation consists of comparing the above six items along with other checks as given in Section 5.7 of the RAMS Work Plan, July 2002 to set project criteria and flagging the data values accordingly. The evaluation should show how the holding times and shipment/holding temperatures are met, any non-compliance, 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 REPORT REQUIREMENTS

The report for this field effort will consist of:

- a 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 surface water standards, if any,
- a summary of data quality based on data evaluation, and
- recommendations for future investigation, if any, in the drainage.

Through Colorado DMG and the USFS, USACE will coordinate with local interest groups and share results from this investigation with all partners.