
FLAT, SCOTCHMAN, AND MINERS GULCHES SAMPLING PROJECT — 2010

Sampling and Analysis Plan

Prepared for:

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TABLE OF CONTENTS

1.0 Introduction and Background Information	1
2.0 Objectives and Design of the Investigation.....	1
2.1 Project Objectives	1
2.2 Sampling Timeframe	1
3.0 Field Sampling Methods	2
3.1 Selection of Sites	2
3.2 Physical Parameters	4
3.2.1 <i>In Situ Measurements</i>	4
3.2.2 <i>Flow Measurement</i>	4
3.3 Water Sample Collection.....	4
3.3.1 <i>Nutrients and other Water Chemistry Samples</i>	4
3.4 Periphyton Samples.....	4
3.5 Benthic Chlorophyll- <i>a</i> and Ash Free Dry Weight	5
3.6 Macroinvertebrates	5
3.7 Sediment Assessment.....	5
3.8 Digital Photographs.....	6
4.0 Sample Handling Procedures	6
5.0 Laboratory Analytical Measurements	6
6.0 Quality Assurance and Quality Control Requirements.....	8
7.0 Data Analysis, Record Keeping, and Reporting Requirements	8
8.0 Schedule	8
9.0 Project Team and Responsibilities	8
10.0 References	8

1.0 Introduction and Background Information

Flat and Scotchman gulches, Granite County, Montana, are B1 tributaries of Rock Creek and Upper Willow Creek respectively. The upper portions of both gulches are primarily located on public land (Bureau of Land Management and United States Forest Service). Private land can be found on the lower reaches of both gulches. The Bureau of Land Management requested in 2008 that both water bodies be removed from the 303 (d) list as being impaired for aquatic life and coldwater fishes due to sediment and nutrients. A private landowner also requested that Flat Gulch be removed. This project is being conducted to determine whether delisting of either or both of these gulches is warranted for either of the causes. Two sampling trips took place in 2009. An additional year of sampling is needed in order to have enough chemical, physical-habitat and biological data to be able to make beneficial use determinations for all their beneficial uses. In addition, a new sediment assessment method is under development (Kusnierz and Welch, 2010) and will be used on Flat and Scotchman gulches during the 2010 field season.

In addition, during 2010 and 2011, nearby Miners Gulch, Granite County, Montana, will also be reassessed for sediment. This B1 tributary of Upper Willow Creek was last sampled in 2004. This gulch will also be sampled for chemical, physical-habitat and biological data to be able to make beneficial use determinations for all its beneficial uses.

2.0 Objectives and Design of the Investigation

2.1 Project Objectives

The goals for the sampling project described in this SAP are as follows:

1. Measure common ions, metals (total recoverable (TR), dissolved (D) and sediment (S) fractions), total suspended solids (TSS), total dissolved solids (TDS), nutrients (total nitrogen (TN), total phosphorus (TP), nitrate + nitrite (NO₂₊₃), ammonia (NH₃₊₄)), chlorophyll-*a*, and *in situ* measurements of temperature, conductivity (EC), and pH.
2. Assess the macroinvertebrate and periphyton assemblages.
3. Assess sediment quality and pool quantity and quality at base-flow conditions
4. Measure flow throughout the summer.

2.2 Sampling Timeframe

Sampling will occur during the "growing season" for the Middle Rockies Level III Ecoregion (July 1 – September 30, 2010). At least 28 days will pass between sampling events at each site (Suplee and Sada, 2010).

3.0 Field Sampling Methods

3.1 Selection of Sites

Specific site locations within those gulches will be identified using GIS and topographic maps. The selected sites follow the guidelines and definitions found in Suplee and Sada de Suplee (2010). The sites sampled on Flat and Scotchman gulches will be the same as those sampled in 2009. Sampling will occur at two sites on Miners Gulch that were sampled in 2004 and an additional new site near the headwaters (Figure 3.1; Table 3.1). These sites are proposed locations. Changes might be made based on land access or other unforeseen problems

Table 3.1 Sites to be visited on Flat, Scotchman, and Miners gulches in 2010.

Waterbody Name	Station ID	Latitude (NAD 83)	Longitude (NAD 83)
Flat Gulch - 3	C02FLATG02	46.34050	-113.5850
Flat Gulch - 4	C02FLATG10	46.34652	-113.5767
Flat Gulch - 1	C02FLATG01	46.35750	-113.5688
Scotchman Gulch - 4	C02SCTMG03	46.36910	-113.4992
Scotchman Gulch - 2	C02SCTMG02	46.37170	-113.5370
Scotchman Gulch - 3	C02SCTMG10	46.37986	-113.5469
Scotchman Gulch - 1	C02SCTMG01	46.38550	-113.5681
Miners Gulch - 1	CO2MNRSG10	46.42339	-113.5419
Miners Gulch - 2	CO2MNRSG20	46.40382	-113.5107
Miners Gulch -3	Not yet assigned	46.43514	-113.5539

Scotchman Gulch will be sampled once for cations, anions and metals (total recoverable (TR), Dissolved (D) and sediment (S)), twice for total suspended solids (TSS), total dissolved solids (TDS), and nutrients (TN, TP, NO₂₊₃, and NH₃₊₄). Sediment parameters and macroinvertebrate samples will be collected once. Flat Gulch will be sampled twice for cations, anions and metals (TR and D), three times for TSS, TDS and nutrients (TN, TP, NO₂₊₃, and NH₃₊₄). Sediment parameters and macroinvertebrate samples will be collected once. Miners Gulch will be sampled three times for common ions, metals (TR, D and S), TSS, TDS and nutrients (TN, TP, NO₂₊₃, and NH₃₊₄). Chlorophyll-*a* will be sampled once. Rosgen stream type, sediment parameters and macroinvertebrate samples will be collected once. Additional chlorophyll-*a* samples might be collected from Flat and Scotchman gulches if deemed necessary (i.e., observation of excessive algal growth at a site).

Flat, Scotchman, and Miners gulches MAP 38, B2

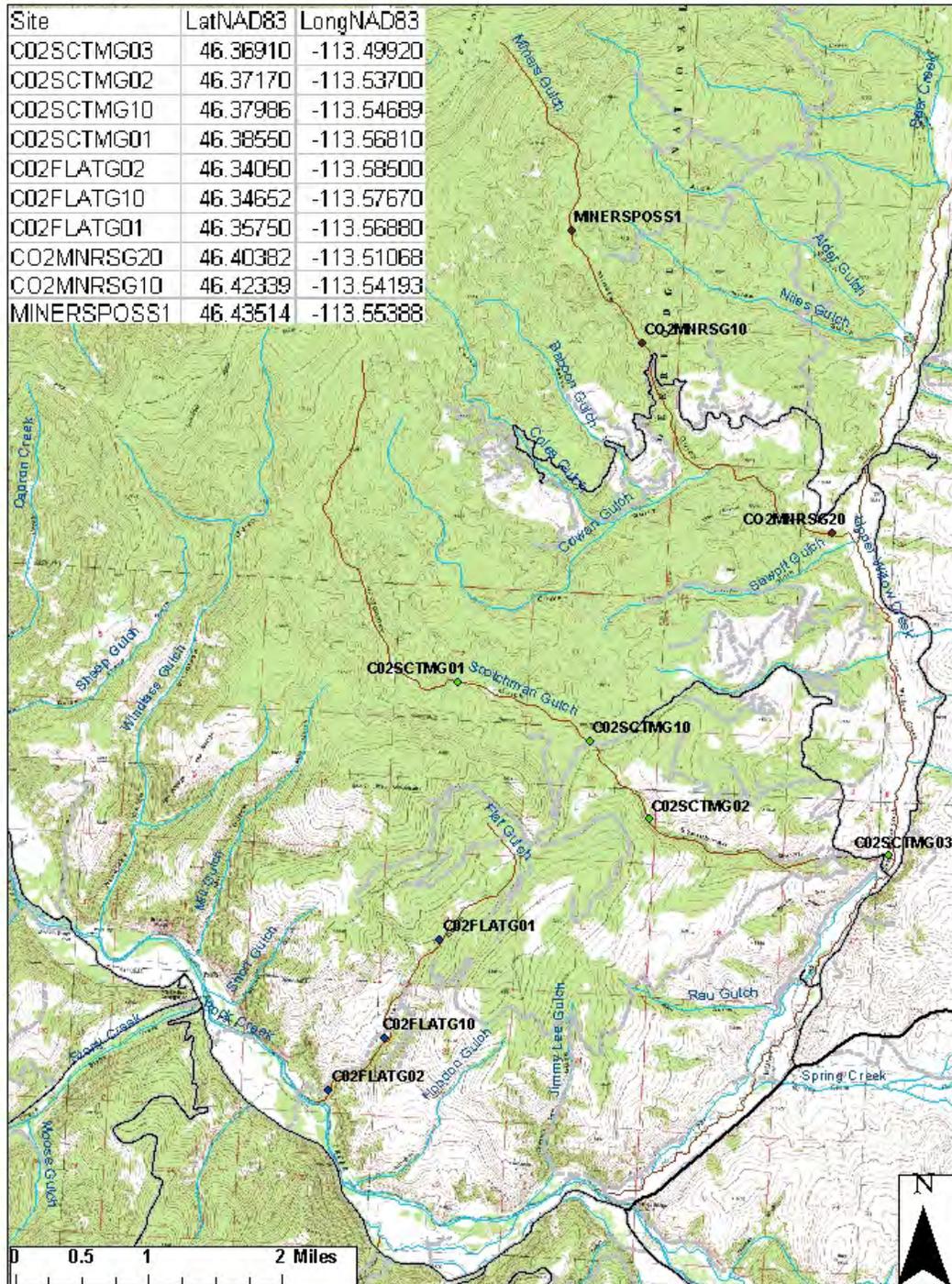


Figure 3.1. Location of sampling sites on Flat, Scotchman, and Miners gulches, Granite County, Montana.

3.2 Physical parameters

3.2.1 *In Situ Measurements*

During low flow sampling events (July – September), a YSI 85 meter will be used to measure temperature, dissolved oxygen, and specific conductance at each sampling site. These measurements will be collected prior to the collection of water samples or other physical disturbances to the water column or substrate. A portable pH meter will be used to measure pH at each site. See details about calibration in Section 6.0.

3.2.2. *Flow Measurement*

Flow will be measured at each sampling site during each sampling event (MDEQ 2010).

3.3 Water Sample Collection

Water samples will be collected at each site after completing the *in situ* YSI 85 measurements. All water samples from the stream will be placed in new high-density polyethylene (HDPE) bottles. Sample replicates will be randomly taken on 10% of the total samples for each parameter. Trip blanks will be made at the end of each “trip loop”

3.3.1 *Nutrients and other Water Chemistry Samples*

Soluble Nutrients and dissolved metals: For nitrate + nitrite (NO_{2+3}) and total ammonia ($\text{NH}_3 + \text{NH}_4$), water from each sample will be filtered through a 0.45 um filter. Two-hundred and fifty ml of the filtrate will be placed in a HDPE bottle and frozen until analyzed (Table 3.3). Filtration will be accomplished with a large syringe connected to a disposable filter capsule or a reusable filter holder. A small amount of deionized water followed by a small amount of the sample will be washed through the filter before the filtered sample is collected. All sample bottles will be new, high-density polyethylene (HDPE). Sample bottles will be pre-rinsed three times with a small amount of the filtered sample before collecting the final filtered sample. Dissolved metals will be field filtered into a 250 ml HDPE bottle, preserved with nitric acid, and held on ice (not frozen). Only 100 ml are necessary.

Total Nutrients, TSS & TDS, Turbidity, Common Ions, and metals: Summary information is shown in Table 3.3. A 250 ml HDPE bottle will be used to collect TP and TN and will immediately be frozen. Common ions will be collected in two 250 ml HDPE bottles and held on ice (not frozen). One bottle will be tested for cations (including hardness and cation/anion balance) and the other for anions (including total alkalinity). The common cation sample will be preserved with nitric acid and held on ice (not frozen). The common anion sample will be held on ice (not frozen) without preservative. TSS and TDS will be collected in a 1000 ml HDPE bottle and held on ice (not frozen). NOTE THE SHORT HOLDING TIME (Table 3.3). Total recoverable metals will be collected in a 1000 ml HDPE bottle, preserved with nitric acid and held on ice (not frozen). Sediment metals will be collected in a 2000 ml HDPE bottle and held on ice (not frozen). All sample bottles will be new and triple rinsed with de-ionized water before collecting the sample.

3.4 Periphyton Samples

Periphyton samples will be collected only at Miners Gulch at each site. The sample will be placed in a 50 ml centrifuge tube and preserved with formalin (see Table 3.3). Detailed methodology can be found in MDEQ (2010).

Table 3.3. Sampling Volumes, Containers, Preservation, and Holding Times.

Analyte	Bottle Size	Container	Preservation and Storage	Holding Time
TP, TN	250 ml	Acid-washed polyethylene	Freeze	45 days
NO ₂ +NO ₃ , NH ₃ +NH ₄	250 ml	Acid-washed polyethylene	Field filter 0.45 µm Freeze	45 days
Total Suspended Solids, Total Dissolved Solids	1000 ml	Acid-washed polyethylene	Cool to <4 °C (on ice)	7 days
Common Cations (including hardness)	250 ml	Acid-washed polyethylene	1.5 ml conc. HNO ₃ , cool to <4°C (on ice)	28 days
Common Anions (including total alkalinity)	250 ml	Acid-washed polyethylene	Cool to <4°C (on ice)	28 days
Total Recoverable Metals	1000 ml	Acid-washed polyethylene	5 ml conc. HNO ₃ , cool to <4°C (on ice)	6 months
Total Dissolved Metals	250 ml	Acid-washed polyethylene	Field filter 0.45 µm, 5 ml conc. HNO ₃ , cool to <4°C (on ice)	6 months
Sediment Metals	2000 ml	Acid-washed polyethylene	Cool to <4°C (on ice)	6 months
Periphyton	50 ml	Centrifuge tube	formalin	NA
Macroinvertebrates	1000 ml	Polyethylene	ETOH	NA
Benthic chlorophyll a (hoop method)	NA	Large zip-loc bag	Freeze, dry ice	45 days
Benthic chlorophyll a (template method)	50 ml	Centrifuge tube	Freeze, dry ice	45 days
Benthic chlorophyll a (template method Chlorophyll-a)	50 ml	Centrifuge tube	Freeze, dry ice	45 days

3.5 Benthic Chlorophyll-*a* and Ash Free Dry Weight

Benthic chlorophyll *a* will be collected at 11 transects only at Miners Gulch. Samples will be collected either using the template, hoop, or core methods, depending on the dominant substrate and/or algae type present. Hoop chlorophyll-*a* samples will be stored in zip-lock bags wrapped in aluminum foil, template samples on filters in Petri dishes and wrapped in foil, and cores in centrifuge tubes wrapped in aluminum foil. All samples will be frozen (MT DEQ 2010) (see Table 3.1). Ash-free dry weight (AFDW) will be calculated from the same samples of chlorophyll *a* (MDEQ 2010).

3.6 Macroinvertebrates

Sampling of macroinvertebrates will take place once at each sampling site using the “targeted riffle” procedure (Peck *et al.*, 2006). Macroinvertebrate samples will be stored in 1 L bottles topped off with ethanol.

3.7 Sediment Assessment

A sediment assessment will be performed once at each site at base-flow conditions. The method to be followed can be found in Appendix B of Kusnierz and Welch (2010).

3.8 Digital Photographs

Digital photographs will be taken at transect F of each site (metal sites). On the nutrient sites, photographs will be taken at each transect (A-K). The objective of the photos is to document visible changes in the stream flora as time passes, and as such photos may be a mix of close-ups and stream panoramas. The photo number will be recorded along with the transect identification.

4.0 Sample Handling Procedures

This project follows the WQPB "internal process". Appropriate storage times for water quality samples discussed in Sections 3.3 to 3.7 are shown in Table 3.3 above. Water quality samples will be delivered to the State Laboratory, macroinvertebrate samples will be delivered to *Rhithron*, Inc, and periphyton samples will be sent to the Academy of Sciences.

5.0 Laboratory Analytical Measurements

TABLE 5.1 Analytical Methods and Required Reporting Limits

<i>Analyte</i>	<i>Method</i>	<i>Analytical Detection Limit</i>
Total Phosphorus (TP)	EPA 365.1	0.001 mg/l
Total Nitrogen (TN)	4500-N B or C	0.01 mg/l
Nitrate + Nitrite-Nitrogen (NO ₂ +NO ₃ -N)	EPA 353.2	0.005 mg/l
Total Ammonia-Nitrogen (NH ₃ +NH ₄ -N)	EPA 350.1	0.05 mg/l
Total Suspended Solids (TSS)	EPA 160.2	4.0 mg/l
Total Dissolved Solids (TDS)	EPA 160.1	4.0 mg/l

Table 5.2. Further Analytical Methods and Required Reporting Limits.

Analyte	Preferred Method	Req. Report Limit (µg/l)
Specific Conductance	SM2510B	
Sulfate	EPA 300.0	50
Chloride	EPA 300.0	50
	EPA 310.2/A2320	
Alkalinity (Bicarb., Carb.)	B	1000
Calcium, Magnesium, Potassium, Sodium	EPA 200.7	1000
Total Hardness as CaCO ₃	A2340 B (Calc)	1000
Sodium Absorption Ratio (SAR)	Calc	
Cation-Anion Milliequivalent	SM 1050 A	
Chlorophyll-a	A 10200 H	
Ash Free Dry Weight (AFDW)	A 10300 C (5)	

Table 5.3. Further Analytical Methods and Required Reporting Limits.

Water Sample - Dissolved Metals		
Metal	Method	Req. Report Limit (ug/L)
Aluminum	EPA 200.7	30
Arsenic	EPA 200.8	3
Cadmium	EPA 200.8	0.08
Chromium	EPA 200.8	1
Copper	EPA 200.8	1
Iron	EPA 200.7	50
Lead	EPA 200.8	0.5
Silver	EPA 200.8	0.5
Zinc	EPA 200.7	10
Water Sample - Total Recoverable Metals		
Metal	Method	Req. Report Limit (ug/L)
Arsenic	EPA 200.8	3
Cadmium	EPA 200.8	0.08
Chromium	EPA 200.8	1
Copper	EPA 200.8	1
Iron	EPA 200.7	50
Lead	EPA 200.8	0.5
Selenium	EPA 200.8	1
Silver	EPA 200.8	0.5
Zinc	EPA 200.7	10
Total Hardness	A2340B (calculated)	1000
Total Recoverable Metals Digestion	EPA 200.2	N/A
Sediment Sample - Metals		
Metal	Method	Req. Report Limit (mg/kg - dry weight)
Arsenic	EPA 200.8	1
Cadmium	EPA 200.8	0.2
Chromium	EPA 200.8	9
Copper	EPA 200.8	15
Iron	EPA 200.7	10

Lead	EPA 200.8	5
Mercury	EPA 7471B	0.05
Zinc	EPA 200.7	20
Total Recoverable Metals Digestion	EPA 200.2	N/A

6.0 Quality Assurance and Quality Control Requirements

All QA/QC requirements followed by MT DEQ "internal process" will be instituted for this project. The QA/QC requirements are described in MT DEQ (2005).

YSI Calibration and pH hand help meter:

YSI 85 meter

Pre-calibration of the YSI 85 meter will be undertaken in the laboratory. The YSI meter will also be calibrated just prior to measuring dissolved oxygen for site-specific altitude at each site following the instructions indicated in the YSI 85 manual.

Hand-held pH meter

The pH meter will be pre-calibrated in the laboratory using the two-point method (pH 4.0 and 7).0 standards, and checked against a 4.0 and 7.0 standard prior to each measurement in the field.

7.0 Data Analysis, Record Keeping, and Reporting Requirements

This project will follow the WQPB "internal process". Site Visit/Chain of Custody forms, field forms digital photos, and lab will be processed by WQPB staff following QA/QC procedures as indicated in section 6.0. The GPS coordinate system datum used will be NAD 1983 State Plane Montana, in decimal degrees, to at least the third decimal.

8.0 Schedule

The Water Quality Monitoring and Assessment staff will sample the three gulches as indicated in section 3.1. Data collection should be completed no later than September 30, 2010 (Suplee and Sada de Suplee, 2010).

9.0 Project Team and Responsibilities

The Water Quality Monitoring and Assessment Section will lead this project. Paul Kusnierz will lead the monitoring and assessment project. Steve Fernandes and Andy Welch will assist with the field data collection.

10.0 References

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