UPPER CLARK FORK TMDL PLANNING AREA SAMPLING PROJECT - 2010: NUTRIENTS & SULFATES

Sampling and Analysis Plan

Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
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Approvals

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1.0 Introduction and Background Information

This project is to support TMDL development in the Upper Clark Fork TMDL Planning Area (TPA) and 303(d) list assessments. The focus will be on nutrients and metals only. This Sampling and Analysis Plan (SAP) aims to meet requirements for the completion of source assessments and loading estimates for nutrients and metals listed streams in this TPA, and to have enough data to assess the streams based on the proposed nutrient criteria (Suplee and Sada, 2010) and metals proposed assessment method (in development).

The Upper Clark Fork TPA is within Powell, Granite, Deer Lodge, and Silver Bow Counties, Montana. The total extent of this TPA is 420,864 acres, or approximately 658 square miles, and it comprises part of the Clark Fork River watershed. Waterbodies in this TPA flow through both publicly-owned (United States Forest Service, State of Montana and Bureau of Land Management) and privately-owned land. The streams in the Upper Clark Fork TPA are within the 4th code HUC 17010201, and they have been assigned a B-1 beneficial use classification (ARM 17.30.623).

The Water Quality Planning Bureau (WQPB) of the Montana Department of Environmental Quality (MDEQ) has identified 21 impaired (Category 5) streams within the Upper Clark Fork TPA; however only the streams identified in Table 1.1 will be sampled in 2010. Table 1.1 shows the waterbody segments to be sampled in 2010 with the pollutants of concern (nutrients, sulfates) within the Upper Clark Fork TPA. Priority areas are based on the TMDL work plan produced by the Watershed Management Section.

2.0 Objectives and Design

2.1 Project Objectives

The main objective of this project is to provide monitoring and assessment support in synchronization with the TMDL Program's schedule for development of nutrients and metals TMDLs in the Upper Clark Fork TPA.

The goals for this project are as follows:

1. Measure physical parameters (temperature, DO, pH, and conductivity) *in situ*.
2. Collect total suspended solids (TSS), nutrients, chlorophyll-a and periphyton in those streams listed for nutrients.
3. Measure flow during each sampling event throughout summer to assist in TMDL nutrients and metals load allocations.

2.2 Sampling Timeframe

TSS, nutrients, chlorophyll-a and periphyton will occur during the "growing season" for the Middle Rockies Level III Ecoregion (July 1 – September 30, 2010) (Suplee and Sada, 2010).

Table 1.1 –Waterbody Segments within the Upper Clark Fork TPA to be sampled in 2010 and the 303(d) listings.		
Waterbody Segment Name	**Waterbody ID**	**Pollutant**
CABLE CREEK	MT76G002_030	Chlorophyll-a
DEMPSEY CREEK	MT76G002_100	Nitrate/Nitrite (Nitrite + Nitrate as N)
DUNKLEBERG CREEK (& ditch)	MT76G005_072	Nitrogen (Total)
GOLD CREEK	MT76G005_092	Nitrogen (Total)
HOOVER CREEK-lower	MT76G005_082	Nitrogen (Total)
HOOVER CREEK-upper	MT76G005_081	Not listed. Will be sampled for nutrients (source assessment)
LOST CREEK	MT76G002_072	Nitrate/Nitrite (Nitrite + Nitrate as N), Sulfates
PETERSON CREEK-Lower	MT76G002_132	Not listed. Will be sampled for nutrients (source assessment)
PETERSON CREEK-Upper	MT76G002_131	Nitrogen (Total), Phosphorus (Total)
STORM LAKE CREEK	MT76G002_040	Chlorophyll-a
WILLOW CREEK-Lower	MT76G002_062	Not listed. Will be sampled for nutrients (source assessment)
WILLOW CREEK-Upper	MT76G002_061	Phosphorus (Total)

3.0 Field Sampling Methods

3.1 Selection of Sites

Specific site locations within those streams will be identified using GIS and topographic maps. The selected sites follow the guidelines and definitions found in Suplee and Sada (2010) unless a specific location is to be sampled because a pollutant source was identified. These sites are proposed locations. Changes might be made based on land access or other unforeseen problems. A complete list of the stream segments, sites, and the respective sampling needs at each site can be found in Appendix A.

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. During high flow sampling events (June), flow will be measured using either the quantitative flow meter method or using the semi-quantitative float method when streams are not wadeable (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 during each sampling run ("trip").

3.3.1 Chemistry Samples

Nutrients, sulfates and TSS: Summary information is shown in Table 3.1. TP and NO_{2+3} will be collected in a 250 ml HDPE bottle. This sample will be preserved with sulfuric acid, and held on ice. TN will be collected in another 250 ml HDPE bottle, no preservative, and held on ice. Sulfate will be collected in a 250 ml HDPE bottle, no preservative, and held on ice. TSS will be collected in a 500 ml HPDE bottle, no preservative, and held on ice (Table 3.3).

NOTE THE SHORT HOLDING TIME FOR TSS. Detailed methodology can be found in MDEQ (2010).

3.4 Periphyton Samples

Periphyton samples will be collected only at some sites (Appendix A). 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).

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

Benthic chlorophyll *a* will be collected at 11 transects only at some sites (Appendix A). Samples will be collected either using the template, hoop, or core methods, depending on the dominant substrate and/or algae type present. These samples will be composited in the lab according to the collection method (i.e., hoops, cores, templates). 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 3.3). Ash-free dry weight (AFDW) will be calculated from the same samples of chlorophyll *a* (MDEQ 2010).

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

Analyte	Bottle Size	Container	Preservation	Storage	Holding time
TN	250 ml	HDPE bottle	None	Cool to <6 °C (on ice)	28 days
TP, NO_2+NO_3	250 ml	HDPE bottle	Sulfuric acid	Cool to <6 °C (on ice)	28 days
Sulfate	250 ml	HDPE bottle	None	Cool to <6 °C (on ice)	28 days

Total Suspended Solids	500 ml	HDPE bottle	None	Cool to <6 °C (on ice)	7 days
Chlorophyll-a	N/A	Ziplock bag (hoop), Petri dish (template), or centrifuge tube (core)	None	Dry ice	45 days
Periphyton (species presence)	50 ml	Centrifuge Tube	Formalin	No ice	NA

3.6 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 3.6 are shown in Table 3.3 above. Water quality samples will be delivered to Energy Laboratory and periphyton samples will be sent to the Academy of Sciences.

5.0 Laboratory Analytical Measurements

TABLE 5.1 Analytical Methods and Required Reporting Values.

Water Sample – Nutrients		
Analyte	**Method**	**Req. Report Limit (ug/L)**
Total Persulfate Nitrogen (TPN)	A 4500-N-C	50
Total Phosphorus as P	EPA 365.1	5
Nitrate-Nitrite as N	EPA 353.2	10
Water Sample - Suspended Solids		
Analyte	**Method**	**Req. Report Limit (ug/L)**
TSS	EPA 2540D	4000
Others		
Parameter	**Method**	**Req. Report Limit**
Sulfate	EPA 300.0	50 ug/L
Chlorophyll -a	A 10200H	N/A

Ash Free Dry Weight	A 10300 (C5)	N/A

6.0 Quality Assurance and Quality Control Requirements

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

6.1 Instrument Calibration

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 5 streams within the Upper Clark Fork TPA at 64 proposed sites (Appendix A). Low flow sampling will begin in July 2010. Data collection should be completed no later than September 30, 2010 (Suplee and Sada, 2010).

9.0 Project Team and Responsibilities

The Water Quality Monitoring and Assessment Section will lead the monitoring component. Rosie Sada will oversee the overall Monitoring and Assessment component. Al Nixon will lead the monitoring and assessment component. Lisa Kusnierz (Watershed Management Section) will lead the TMDL component.

10.0 References

MT DEQ (Montana Department of Environmental Quality), 2010. Water Quality Planning Bureau Field Procedures Manual for Water Quality Assessment Monitoring. In progress.

MT DEQ (Montana Department of Environmental Quality), 2010. Ultra-low level mercury Standard Operating Procedure. Draft. Montana Department of Environmental Quality, Water Quality Planning Bureau.

MT DEQ (Montana Department of Environmental Quality), 2005b. Quality Assurance Project Plan (QAPP) Sampling and Water Quality Assessment of Streams and Rivers in Montana, 2005. *Available at:* http://www.deq.state.mt.us/wqinfo/QAProgram/WQPBQAP-02.pdf.

Suplee, M., and R. Sada de Suplee. 2010. Guidance Document: Assessment Methodology for Determining Wadeable Stream Impairment due to Excess Nutrients (Nitrogen and Phosphorus). Draft. Montana Department of Environmental Quality, Water Quality Planning Bureau.

Appendix A

Upper Clark Fork TPA proposed 2010 Sampling Site locations and
Proposed number of samples to be collected per parameter per site

Site No.	Water Body Name	LAT (DD)	LONG (DD)	TSS #	Nutrients	Chlorophyll-a /AFDW	Periphyton
1-a	Hoover Creek	46.6065	-113.0089	3	3	1	-
1-b	Hoover Creek	46.6267	-112.9946	3	3	1	-
1-c	Hoover Creek	46.6490	-112.9773	3	3	1	-
1-d	Hoover Creek	46.6717	-112.9642	3	3	1	-
1-e	Hoover Creek	46.6774	-112.9586	3	3	1	-
1-f	Hoover Creek	46.6861	-112.9350	3	3	1	-
1-g	Hoover Creek	46.7035	-112.9215	3	3	1	-
1-h	Hoover-only if H2O in trib	46.7143	-112.9207	3	3	1	-
1-i	Hoover Creek	46.7174	-112.9229	3	3	1	-
2-a	Dunkleberg Creek	46.5999	-113.0378	3	3	1	-
2-b	Dunkleberg Creek	46.5982	-113.0373	3	3	1	-
2-c	Dunkleberg Creek	46.5922	-113.0332	3	3	1	-
2-d	Dunkleberg Creek	46.5918	-113.0337	3	3	1	-
2-e	Dunkleberg Creek	46.5820	-113.0447	3	3	1	-
2-f	Dunkleberg Creek	46.5694	-113.0657	3	3	1	-
3-a	Gold Creek	46.5819	-112.9097	3	3	1	1
3-b	Gold Creek	46.5631	-112.9248	3	3	1	1
3-c	Gold Creek	46.5523	-112.9299	3	3	1	1
3-d	Gold Creek	46.5357	-112.9528	3	3	1	1
3-e	Gold Creek	46.5260	-112.9802	3	3	1	1
3-f	Gold Creek	46.5110	-112.9919	3	3	1	1
4-a	Peterson Creek-lower segment	46.3895	-112.7355	2	2	1	-
4-b	Peterson Creek-lower segment	46.3877	-112.7204	2	2	1	-
4-c	Peterson Creek-lower segment	46.3639	-112.6898	2	2	1	-
4-d	Peterson Creek-lower segment	46.3611	-112.6887	2	2	1	-
4-e	Peterson Creek-lower segment	46.3188	-112.6638	2	2	1	-
4-f	Peterson Creek-upper segment	46.3169	-112.6629	3	3	1	1
4-g	Peterson Creek-upper segment	46.2845	-112.6141	3	3	1	1
4-h	Peterson Creek-upper segment	46.2790	-112.6018	3	3	1	1
4-i	Peterson Creek-upper segment	46.2763	-112.5800	3	3	1	1
5-a	Dempsey Creek	46.3161	-112.7395	2	2	1	-
5-b	Dempsey Creek	46.3090	-112.7555	2	2	1	-
5-c	Dempsey Creek	46.3089	-112.7540	2	2	1	-
5-d	Dempsey Creek	46.3035	-112.7720	2	2	1	-
5-e	Dempsey Creek(Morrison Ditch)	46.2885	-112.8221	2	2	1	-
5-f	Dempsey Creek	46.2904	-112.8261	2	2	1	-
5-g	Dempsey Creek	46.3094	-112.8714	2	2	1	-
5-h	Dempsey Creek	46.3194	-112.9092	2	2	1	-
5-i	Dempsey Creek	46.3102	-112.9572	2	2	1	-
6-a	Lost Creek	46.2185	-112.7742	2	2	1	-
6-b	Lost Creek	46.1963	-112.8182	2	2	1	-
6-c	Lost Creek	46.1618	-112.8891	2	2	1	-
6-d	Lost Creek	46.1619	-112.8919	2	2	1	-
6-e	Lost Creek	46.1964	-112.9805	2	2	1	-
7-a	Willow Creek	46.1154	-112.8058	2	2	1	-
7-b	Willow Creek	46.0949	-112.8193	2	2	1	-
7-c	Willow Creek	46.0757	-112.8304	2	2	1	-
7-d	Willow Creek	46.0718	-112.8814	2	2	1	-
7-e	Willow Creek	46.0694	-112.8859	2	2	1	-
7-f	Willow Creek	46.0510	-112.9027	2	2	1	-
7-g	Willow Creek	46.0488	-112.9029	2	2	1	-
7-h	Willow Creek	46.0401	-112.9111	2	2	1	-
7-i	Willow Creek	46.0388	-112.9112	2	2	1	-
7-j	Willow Creek	46.0308	-112.9062	2	2	1	-
8-a	Cable Creek	46.1683	-113.1563	3	3	1	1
8-b	Cable Creek	46.1692	-113.1793	3	3	1	1
8-c	Cable Creek	46.1920	-113.1929	3	3	1	1
8-d	Cable Creek	46.1972	-113.1996	3	3	1	1
8-e	Cable Creek	46.2147	-113.2096	3	3	1	1
9-a	Storm Lake Cr-Silver Lake ditch	46.1722	-113.1834	3	3	1	1
9-b	Storm Lake Creek	46.1570	-113.2118	3	3	1	1
9-c	Storm Lake Creek	46.1150	-113.2487	3	3	1	1
9-d	Storm Lake Creek	46.0888	-113.2675	3	3	1	1
9-e	Storm Lake Creek	46.0769	-113.2679	3	3	1	1

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7-h	Willow Creek	46.0401	-112.9111	2	2	1	-
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Total Suspended Solids (TSS); *Ash Free Dry Weight (AFDW)*