MIDDLE AND LOWER MILK RIVER WATER QUALITY MONITORING

Sampling and Analysis Plan

Prepared by:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Watershed Management Section, Water Quality Planning Bureau
1520 East 6th Avenue
Helena, MT 59620-0901

Approvals

_____ _____
Rosie Sada (WQPB Monitoring Section Manager) Date

_____ _____
Mindy McCarthy (WQPB QA Officer) Date

_____ _____
Pat Anderson (Phillips Conservation District) Date

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1.0 Introduction and Background information

The headwaters of the Milk River originate in the Rocky Mountains in northwest Montana and flows northeast into southern Alberta before turning southeast into Montana. It passes through Fresno Reservoir, and then east past Havre, turns north near Malta, then southeast, flowing past Glasgow. The Milk River joins the Missouri River about 12 miles downstream from Fort Peck Dam.

Currently in the 2008 Water Quality Integrated Report (combined 303(d) and 305(b) reports), the Milk River Watershed encompasses four segments of the Milk River, sixteen streams, and one reservoir. Common causes of impairment to beneficial uses are: sediment/siltation, metals, nutrients, temperature, pathogens, flow, and habitat alterations. In some cases data gaps exist, therefore more data is necessary to assess all the beneficial uses of the river, streams, and reservoir in the watershed. In other cases, potential sources require a more in-depth analysis for total maximum daily loads development (TMDL's).

To address some of the data gaps mentioned above, as part of the American Recovery and Reinvestment Act Stimulus Grant (ARRA), the Phillips Conservation District received a grant for $20,827 to continue monitoring the Milk River from Fresno reservoir to the Missouri River. This portion of the river encompasses three of the four segments currently listed in the 2008 Water Quality Integrated Report. The three listed segments are:

ID305B	WATERBODY SEGMENT DESCRIPTION	MILES	CAUSE_
MT40J001_020	MILK RIVER, Whitewater Creek to Beaver Creek	38.2	Alteration in stream-side or littoral vegetative covers; other flow regime alterations; iron; nitrates
MT40J001_010	MILK RIVER, Fresno Dam to Whitewater Creek	270.4	Mercury
MT40O001_010	MILK RIVER, Beaver Creek to the mouth (Missouri River)	135.9	Fecal coliform; lead; mercury

This collection effort will focus only on nutrients, total dissolved solids (TDS), total suspended solids (TSS), and metals. Mercury and pathogen samples will not be collected at this time due to constraints associated with the methodologies and requirements for collecting low level Hg and pathogens.

2.0 Objectives and Design of the project

2.1 Project Objectives

The main objectives of this sampling plan are:

A. To continue a baseline sampling for parameters of concern/interest

B. To fill data gaps to assist in future assessments

To accomplish the main objectives, the following data will be collected at each site:

- Nutrient samples [total nitrogen (TN), total phosphorus (TP), nitrite plus nitrate (NO_{2+3}), and ammonia (NH_{3+4})
- Metal samples (total recoverable and dissolved fractions)
- Total suspended solids (TSS) and total dissolved solids (TDS) samples
- Flow measurements, and
- *In situ* measurements of temperature (T), specific conductivity (SC), and pH. Dissolved oxygen (DO) will only be measured if it can be done at each site between 6-8 am (Suplee, 2008).

2.2 Study Design and Sampling Timeframe

Surface water data, flow, and physical parameters will be collected in the Middle and Lower Milk River mainstem (from Fresno Reservoir to the mouth). The proposed sites were chosen to include historic sampling locations, assess any effects from development, and detect potential inputs from wastewater treatment facilities, irrigated agriculture or other sources. Sampling events will take place during the algae growing season (July 1st to September 30th) to capture the requirements for the proposed numeric nutrient criteria (Suplee 2008). Thus, all parameters including flow (table 5.1) will be sampled two times.

3.0 FIELD SAMPLING METHODS

3.1 Sampling Sites

There are eleven proposed sampling sites (Table 3.1). Specific site locations were identified using GIS (ArcGIS 9.3).

3.2. Establishing Sites

A GPS unit will be used to navigate to the sites using the latitude and longitude listed in table 3.1. Ensure that the GPS unit is set on the correct map datum (NAD 83 state plane Montana) and the coordinate system to decimal degrees. Site locations may be adjusted due to site conditions and/or access. Be sure that you have at least 5 satellites before conducting the reading. Place a double flag on the site so it can be identified on the next sampling event. Complete site visit/chain of custody forms (SVF/COC). All forms, including examples, will be provided before field training.

Table 3.1 - Proposed Sampling Sites 2010

Site #	Site Description	Latitude (DD)	Longitude (DD)
MR-1	Below Fresno Reservoir (to establish a baseline	48.5888	-109.8960

	for the middle and lower Milk River)		
MR-2	Milk River at Lohman downstream bridge (near the downstream end of Havre area development)	48.5998	-109.3943
MR-3	Below Chinook WWTP above Lodge Creek (closer to WWTP)	48.5639	-109.1900
MR-4	Above Dodson WWTP (below Ft. Belknap Tribal Land, above a WWTP, and a band of irrigated agriculture)	48.3984	-108.2936
MR-5	Milk River downstream of Alkali Creek (upstream of Malta WWTP)	48.3445	-107.9432
MR-6	Below Malta WWTP (near the downstream end of a band of irrigated agriculture and other development) *	48.3792	-107.8210
MR-7	Below Frenchman Creek (To capture inputs from Whitewater and Frenchman Creeks)	48.5100	-107.2084
MR-8 *	Milk River at Hinsdale Town Park (below Beaver Creek)	48.3971	-107.0831
MR-9 *	Milk River at Page Crossing (below Buggy Creek (WWTP, possible CAFOs)	48.3017	-106.7804
MR-10	Below Glasgow WWTP, above Willow Creek (closer to WWTP)	48.1597	-106.6004
MR-11 *	USGS Gage at Nashua (furthest downstream site)	48.1301	-106.3655

* = Historic data

3.3 Sequential Order of Parameters to be Collected at Each Site

After the site has been established, the following parameters will be collected in sequential order:

1. Temperature, pH, conductivity and DO (if applicable).
2. Nutrients, TSS and TDS, metals, and cations (Ca, Mg, Na, and hardness)
3. Flow
4. Digital Photographs

3.4 DO, pH, Conductivity and Temperature Measurements

A YSI 85 will be used to measure temperature (^{o}C), DO (mg/L), and conductivity (uS). A hand-held pH meter will be used to measure pH at each site. Dissolved oxygen (DO) will **only** be measured if it can be done between 6-8 am (Suplee, 2008) at each site. See details about calibration in Section 6.0. Complete SVF/COC (All forms, including examples, will be provided before field training). Be sure that you are using the correct units for each parameter.

3.5 Water Sample Collection

Grab water samples will be collected from each of the eleven sites after completing the *in situ* measurements.

3.5.1 Nutrients, cations, metals (total recoverable), and TSS/TDS

Summary information is shown in Table 3.5. A 250 ml HDPE bottle will be used to collect for TP, NO_{2+3}, and NH_{3+4}. This sample will be preserved with sulfuric acid, and held on ice. Another 250 ml HDPE bottle will be used to collect for TN (no preservative) and held on ice. Cations (calcium, magnesium, sodium, and hardness) will be collected in a 250 ml HDPE bottle, preserved with nitric acid, and held on ice. Metals (total recoverable) will be collected in a 500 ml HDPE bottle, preserved with nitric acid, and held on ice. TSS and TDS will be collected in a 1000 ml HDPE bottle (no preservative), and held on ice.

Note the short holding time for TSS/TDS on Table 3.5!

Sample collection bottles will be rinsed three times with stream water before collecting the sample. After rinsing, fill the bottles with fresh water upstream from *any previous disturbances* to avoid contaminating the sample.

3.5.2 Dissolved Metals

For dissolved metals, a 60 cm^3 syringe and disposable filter are used. Water from each sample will be filtered through a 0.45 um filter. Then 100 ml of the filtrate will be placed in a 250 ml HDPE bottle and kept on ice until analyzed (Table 3.5). To collect the samples, fill the syringe with 50 ml of fresh water upstream from *any previous disturbances* to avoid contaminating the sample. Rinse the syringe three times, hen place a disposable filter on the syringe tip, and filter 30 ml to rinse the bottle three times before collecting the sample. You can use the same filter if you avoid touching the filter tip. After rinsing has been completed, collect the sample by filtering 100 ml into a 250 ml sample bottle. Sample will be preserved with nitric acid and held on ice. If the water is very rich in sediment, it may require several filters to collect 100 ml.

3.5.3 Replicates and Field blanks

Sample replicates will be randomly taken on 10% of the total samples for each parameter. Field blanks will be made during each sampling run ("trip") to evaluate contamination and detection levels under field conditions. During training, an example will be provided of how to collect replicates and field blanks.

Do not allow your hands to come into contact with the sampling bottle opening, syringe tip or the filter tip. After samples have been collected, add the appropriate preservative to each sample type, affix the lid securely and mix the sample well by inverting 3-5 times. Place the sample label (examples will be provided at training) on each bottle covering it with clear tape, and then place the bottle on ice. Be sure that the cooler is at least 3/4 full of ice. The cooler should be checked every morning to drain the water, and to add more ice if necessary. Complete SVF/COC (all forms, including example, will be provided at training).

Table 3.5. Sampling Volumes, Containers, Preservation, and Holding Times

Analyte	*Bottle Size (ml)*	*Bottle Type*	*Preservation and Storage*	*Holding Time*
TN	250	HDPE	Cool to <4°C (on ice)	30 days
TP, NO_2+NO_3, NH_3+NO_4,	250	HDPE	HSO_4, cool to <6°C (on ice)	28 days
Total Suspended Solids, Total Dissolved Solids	500	HDPE	Cool to <4°C (on ice)	7 days
Cations (including hardness)	250	HDPE	HNO_3, cool to <6°C (on ice)	28 days
Total Recoverable Metals	500	HDPE	HNO_3, cool to <6°C (on ice)	180 days
Dissolved Metals	250 needed)	HDPE	HNO_3, cool to <6°C (on ice)	180 days

3.6 Total Discharge

Total discharge will be measured using acoustic Doppler devices including the Sontek Flowtracker and the RDI StreamPro (USGS, 2005). If river conditions do not allow this method to be used, the float method will be used (USGS, 2005). In locations where USGS gauging stations are available, flow measurements are not necessary.

Complete SVF/COC (all forms, including examples, will be provided before field training).

3.7 Digital Photographs

Digital photographs will be taken at each site. The objective of the photos is to document visible changes in the stream flora over time. Photos may be a mix of close-ups and stream panoramas. The photo number will be recorded along with the transect identification on the photo log form. Complete SVF/COC (all forms, including examples, will be provided before field training).

4.0 Sample Handling Procedures

Appropriate sampling volumes, preservation, and holding times for water quality samples are shown in Table 3.5 above. A standard DEQ Water Quality Planning Bureau SVF/COC will be used to document and track samples collected for the project. This project follows the "internal" process. Thus, water quality samples will be delivered to DEQ by the Contractor, and WQPB Monitoring and Assessment staff will perform QC on field forms and samples before delivering in person the samples to Energy Lab after each sampling trip.

5.0 Laboratory Analytical Measurements

Table 5.1 Analytical Methods and Required Reporting Values

Parameter	*Method*	*Required Report Limit ug/L*
Total Suspended Solids (TSS)	EPA 160.2	4000
Total Dissolved Solids (TDS)	EPA 160.1	4000
Nutrients		
Total Persulfate Nitrogen (TPN)	A 4500-N C	50
Total Phosphorus as P (TP)	EPA 365.1	5
Nitrate-Nitrite as N (NO_2+NO_3-N)	EPA 353.2	10
Total Ammonia as N (NH_3+NH_4-N)	EPA 350.1	50
Dissolved Metals (0.45 um filtered)		
Aluminum	EPA 200.7	30
Antimony	EPA 200.8	3
Barium	EPA 200.7	5
Beryllium	EPA 200.7	1
Boron	EPA 200.7	10
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
Manganese	EPA 200.7	5
Nickel	EPA 200.7	10
Silver	EPA 200.8	0.5
Thallium	EPA 200.8	0.2
Uranium, Natural	EPA 200.8	30
Zinc	EPA 200.7	10
Total Recoverable Metals		
Total Recoverable Metals Digestion	EPA 200.2	N/A
Antimony	EPA 200.8	3
Arsenic	EPA 200.8	3
Barium	EPA 200.7	5
Beryllium	EPA 200.7	1
Boron	EPA 200.7	10
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
Manganese	EPA 200.7	5
Nickel	EPA 200.7	10
Selenium	EPA 200.8	1
Silver	EPA 200.8	0.5
Thallium	EPA 200.8	0.2
Uranium, Natural	EPA 200.8	30
Zinc	EPA 200.7	10
Cations		
Calcium	EPA 200.7	1000
Magnesium	EPA 200.7	1000
Sodium	EPA 200.7	1000
Calculated Results		
Total Hardness as $CaCO_3$	A2340 B (Calc)	1000

6.0 Quality Assurance and Quality Control Requirements

All QA/QC requirements will follow the MDEQ WQPB “internal” process. This means that this is a “hybrid” project between Phillips CD and MDEQ. MDEQ will provide the training, all field forms, bottles, preservatives, YSI 85, pH meter, filters, syringes, and coolers. MDEQ will also deliver the samples to the Energy Laboratory, and will QC all field samples, forms and results. The Phillips CD will collect the field samples and physical measurements, provide some equipment via DNRC (flow instruments). The QA/QC requirements are described in DEQ (2005).

6.1 Field Instrument Maintenance, Calibration & Measurements

Field instruments must undergo annual inspection and maintenance prior to the field season according to the manufacturer's specifications. This must occur within a timeframe that allows for any needed parts to be ordered and installed before general use. MDEQ will calibrate the YSI 85 and pH meter before field training.

If DO is measured, the YSI 85 dissolved oxygen meter must be calibrated for DO just prior to each sampling event in the field following the manual instructions and the training instructions. For specific conductivity and temperature, there is no need to calibrate the YSI 85 in the field. The pH meter will be checked against a 7.0 and 10.0 standard prior to each profile measurement in the field. Calibration logs for recording annual and daily calibrations must remain with the instruments for recording calibrations and maintenance. Record point-of-use calibration in instrument calibration logbook for all parameters calibrated. Training for use of field instruments and log forms will be given prior to the beginning of the field season.

7.0 Data Analysis, Record Keeping, and Reporting Requirements

An oral or written update after each sampling event will be sent directly to Phillips CD and the MDEQ Project Manager. After each sampling event along with the field water quality samples, original field forms and digital photographs will be provided to the MDEQ Project Manager, and copies to the Phillips CD. Laboratory data results will be sent to the MDEQ. QC and data entry into the MTEWQX database will be performed by MDEQ. After QC has been completed, electronic results and hardcopies will be sent to the Phillips CD. Lab bills will be sent directly to the Phillips CD, and will not be paid until QC has been completed. Site visit/chain of custody forms, written field notes, and digital photographs will be properly completed for all samples as shown in training.

8.0 Schedule

The final SAP will be ready by March 30, 2010. Training will be conducted either in May or June 2010 (date to be determined). Two sampling events will be completed in early July (week of July 6th) and August (week of August 9th) 2010. In the event that weather or river conditions do not allow sampling, a new date will be set.

9.0 Project Team and Responsibilities

This project will be carried out by the Phillips CD and MDEQ as a cooperative effort. MDEQ will provide training, QC of the field samples and results, sample deliveries to Energy Laboratory, and data entry into the MTEWQX database. Phillips CD will collect the field samples and manage the ARRA contract.

Personnel involved in this project are presented in Table 9.1.

Table 9.1 Project Team and Responsibilities

Name	*Organization*	*Project Responsabilities*
Rosie Sada	MDEQ	Oversight of Project /Management of Contract/Training
Kathie Makarowski/Zach Stetzner	MDEQ	QC field forms and samples/field sample deliverables to Energy Lab
Mindy McCarthy	MDEQ	SAP Revision and approval
Chris Shirley	MDEQ	QC of lab results
Jolene McQuillan	MDEQ	MTEWQX QC requirements and data entry
Pat Anderson	Phillips CD	Oversight of Project/Contract Management
Mike Dailey	DNRC Glasgow	Oversight of Project/Collection of samples-field work/Landowner access permission
Warren Kellogg	Watershed Specialist	Collection of samples-field work
Energy Laboratory	N/A	Chemical Analyses/deliverables of signed hardcopies and EDD's

10.0 REFERENCES

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