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# ASHLEY CREEK NUTRIENT, FLOW, AND INSTREAM LAKE STRATIFICATION SAMPLING - 2015

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## *Sampling and Analysis Plan*

### Prepared for:

#### MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

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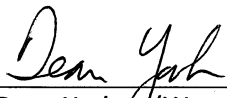
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## 1.0 INTRODUCTION AND BACKGROUND INFORMATION

This project is to support nutrient total maximum daily load (TMDL) and water quality model refinement in the Flathead-Stillwater TMDL Planning Area (TPA) of Montana. Nutrient TMDLs and associated source assessment modeling for the TPA were completed in 2014 with the TMDLs being approved by the U.S. Environmental Protection Agency in December 2014 (DEQ and EPA 2014). The focus of this project will be on collecting nutrient samples and standard field parameter samples at multiple locations along upper and middle Ashley Creek and on several tributaries of Ashley Creek and performing flow monitoring at the Ashley Lake outlet to refine the model used for nutrient TMDL source assessment. In addition sampling will occur to determine if stratification of Lone Lake and Lake Monroe occurs and additional nutrient sampling needs to occur.

Ashley Creek is located in Flathead County, Montana. It is in the *Flathead Lake* (17010208) 4<sup>th</sup> level Hydrologic Unit Code (HUC), and is located within the Northern Rockies Level III Ecoregion (**Figure 1-1**). The Ashley Creek watershed is 325 mi<sup>2</sup> (841 km<sup>2</sup>) in size, and Ashley Creek is 43 miles (69 kilometers) in length. The stream is divided into three water quality assessment units. From Ashley Lake to Smith Lake is defined as Montana water quality assessment unit MT76O002\_010 (upper Ashley Creek), and from Smith Lake to the Kalispell Airport Road as MT76O002\_020 (middle Ashley Creek). Upper Ashley Creek had total nitrogen and middle Ashley Creek had total nitrogen and total phosphorus as nutrient probable causes on the 2014 303(d) list. TMDLs for each of these pollutants were written in 2014 (DEQ and EPA 2014). Sampling described in this sampling and analysis plan will occur in these two segments.

Existing water quality data for upper Ashley Creek shows what appears to be a large nutrient load entering somewhere between Ashley Lake and just downstream of Smith Lake (see DEQ and EPA 2014). Within this area, there are very few existing data points. In addition, this area includes a large wetland complex, several smaller lakes, moderate agriculture use, septic systems, and three significant tributaries. In the current TMDL document, this unexplained load is referred to as the “wetland complex” load, and is theorized to be from the large wetland complex in the area and the unique soils present. The sampling described herein will involve gathering more data help to refine the nutrient source assessment for the area between Ashley and Smith lakes. Nutrient sampling will be done at the outlet of Ashley Lake; above and below Lone Lake and Lake Monroe, and Smith Lake; and upstream of three major tributaries to Ashley Creek. Lone Lake and Lake Monroe will be sampled with a YSI 600 for temperature, dissolved oxygen, conductivity, and pH to determine if they stratify during the summer and have the potential for nutrient release when turnover occurs in the fall. The nutrient samples combined with flows will facilitate the development of a simple mass-balance model and help to gain insight into what mechanisms are at work within the area, ultimately refining our source assessment for Ashley Creek and improving restoration planning.

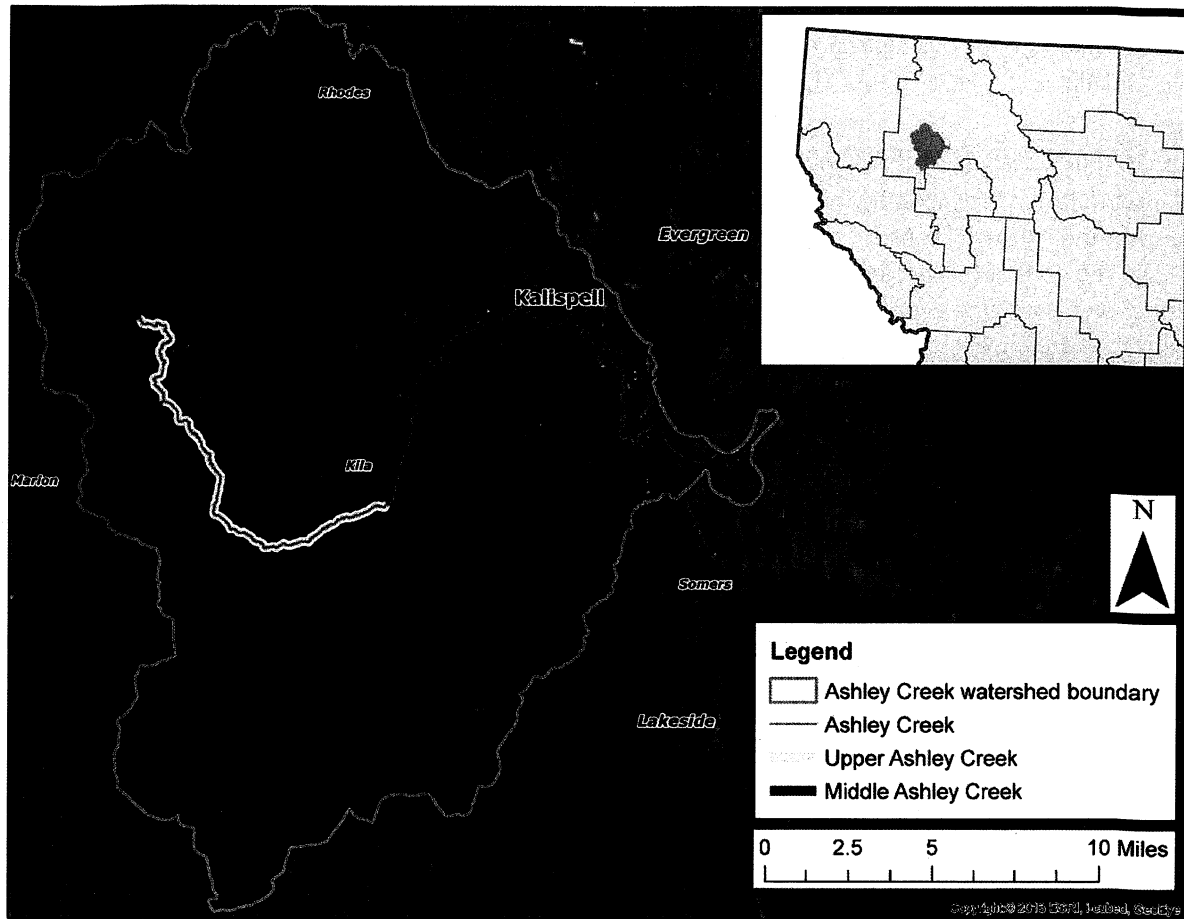


Figure 1-1. Location Map of Ashley Creek

## 2.0 OBJECTIVES AND DESIGN OF THE INVESTIGATION

### 2.1 PROJECT OBJECTIVES

The objectives of this project are as follows:

- Gain further insight into the Smith Lake “wetland complex” source in the current Ashley Creek Loading Simulation Program in C++ (LSPC) model
- Construct a simple mass-balance model for Ashley Creek from Ashley Lake to downstream of Smith Lake
- Provide data that will help refine the Ashley Creek portion of the Flathead Lake LSPC model and provide better overall loading estimates to Flathead Lake

The specific data collection goals for this field work are:

- Measure physical parameters (stream flow, temperature, dissolved oxygen, pH, and conductivity) *in situ*
- Collect nutrient (total persulfate nitrogen [TPN], total phosphorus [TP], nitrate-nitrite [nitrate], and total ammonia nitrogen [ammonia]) samples at multiple locations in the upper and middle Ashley Creek watershed

- Measure flow at the outlet of Ashley Lake at least twice per month and collect staff gauge readings daily using a camera to develop a stage discharge relationship for flow out of Ashley Lake

## 2.2 SAMPLING TIMEFRAME

The nutrient and lake stratification sampling will be done between July 1 and September 30, 2015. This is during the “growing season” for the Northern Rockies Level III Ecoregion (Suplee and Sada de Suplee, 2011). The goal of this project is to sample nutrients and lake stratification one time each month.

During each sampling event, effort will be made to collect all samples on the same day to represent a synoptic sampling event. The nutrient sampling may be extended to year-round (pending resources, weather conditions, and stakeholder interest) to help determine nutrient dynamics in upper and middle Ashley Creek throughout the year. Flow and gage data collection at the Ashley Lake outlet will occur throughout 2015 as conditions allow flow to be measured and photographs of the gage to be taken.

## 3.0 FIELD SAMPLING METHODS

### 3.1 SELECTION OF SITES

Table 3-1 lists the monitoring sites to be sampled during the field effort, and Figure 3-1 shows the location of each site. Time, weather, and other accessibility factors may dictate dropping some sites from the list or moving site locations while in the field. Five of the sites are at established DEQ locations. The sites were chosen because they will provide meaningful data for the project. Some of the sites are easily accessible via road access points or bridge crossings and some are located on public lands or private lands where landowner permission has been granted in the past. Other sites are new and the final sampling location and whether sampling can take place will be contingent upon gaining landowner permission to access sites.

**Table 3-1. Monitoring site names and locations**

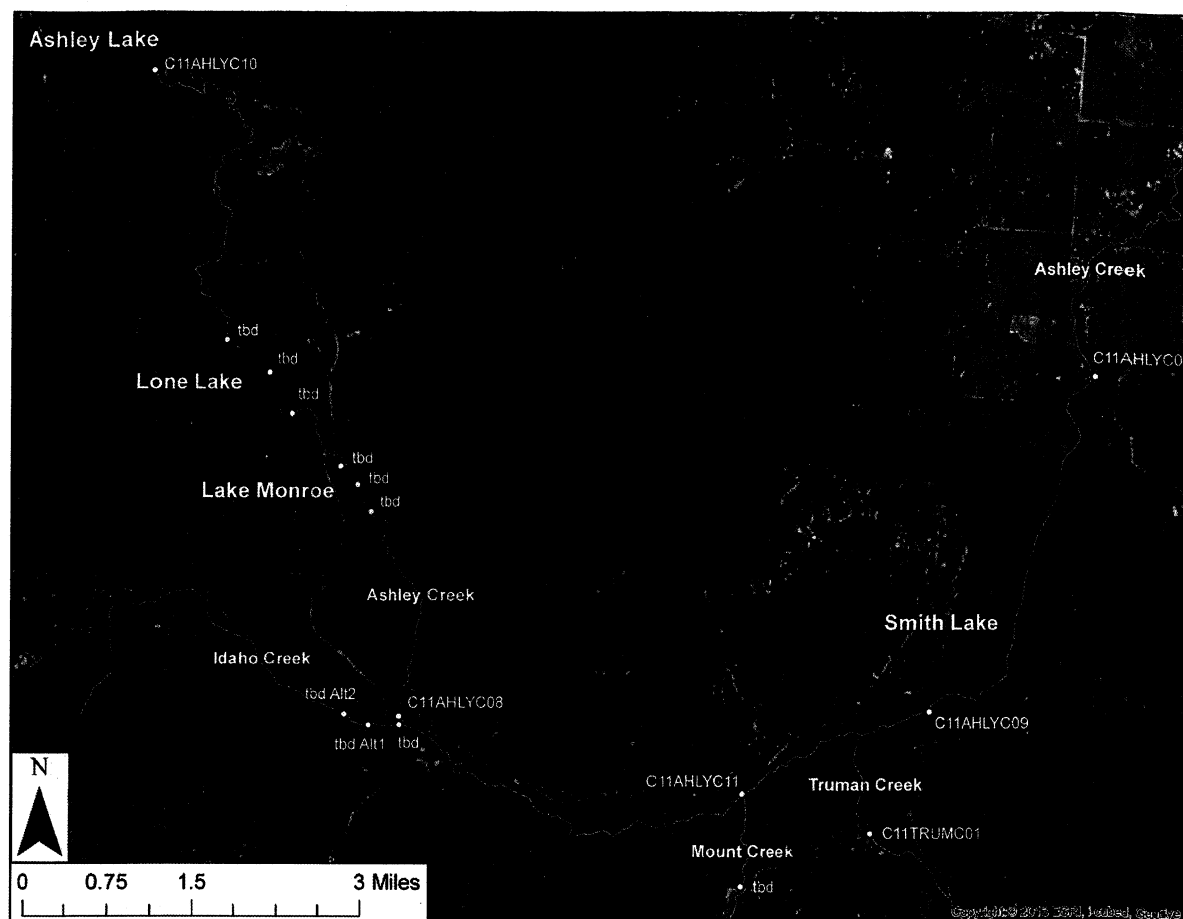
<u>Site ID</u>	<u>AUID</u>	<u>Site Name</u>	<u>FINAL Latitude</u>	<u>FINAL Longitude</u>	<u>Rationale</u>
C11AHLYC10	MT76O002_010	Ashley Creek d/s Ashley Lake and d/s discharge structure on lake	48.180	-114.618	Calculate load of Ashley Creek as it leaves Ashley Lake; develop stage-discharge relationship
tbd	MT76O002_010	Ashley Creek at inlet of Lone Lake	48.14638 <sup>1</sup>	-114.60016 <sup>1</sup>	Calculate lake nutrient load contribution
tbd	MT76O002_010 <sup>2</sup>	Lone Lake Center	48.14261	-114.59154	Determine if lake is stratified
tbd	MT76O002_010	Ashley Creek downstream of Lone Lake	48.13756 <sup>1</sup>	-114.58669 <sup>1</sup>	Calculate lake nutrient load contribution
tbd	MT76O002_010	Ashley Creek upstream of Monroe Lake	48.13128 <sup>1</sup>	-114.57658 <sup>1</sup>	Calculate lake nutrient load contribution
tbd	MT76O002_010 <sup>2</sup>	Lake Monroe Center	48.12911 <sup>1</sup>	-114.57304 <sup>1</sup>	Determine if lake is stratified
tbd	MT76O002_010	Ashley Creek downstream of	48.12579 <sup>1</sup>	-114.57017 <sup>1</sup>	Calculate lake nutrient load contribution

		Monroe Lake			
C11AHLIC08	MT76O002_010	Ashley Creek at Hwy 2 crossing	48.100	-114.562	Calculate nutrient loading upstream of confluence with Idaho Creek
tbd	None	Idaho Creek near mouth	48.09892 <sup>1</sup>	-114.5618 <sup>1</sup>	Calculate nutrient loading from Idaho Creek
tbd	None	Idaho Creek near mouth	48.09865 <sup>1</sup>	-114.56794 <sup>1</sup>	Alternate 1 to Idaho Creek near mouth
tbd	None	Idaho Creek on state land near mouth	48.09981 <sup>1</sup>	-114.57278 <sup>1</sup>	Alternate 2 to Idaho Creek near mouth
C11AHLIC11	MT76O002_010	Ashley Creek upstream Mount Creek confluence	48.093	-114.495	Calculate nutrient loading upstream of confluence with Mount and Truman creeks
tbd	None	Mount Creek at Browns Meadow Road crossing	48.08119	-114.49411	Calculate nutrient loading from Mount Creek
C11TRUMC01	None	Truman Creek at Browns Meadow Road crossing	48.08900	-114.47000	Calculate nutrient loading from Truman Creek
C11AHLIC09	MT76O002_010	Ashley Creek upstream Smith Lake at Smith Lake Road crossing	48.105	-114.460	Calculate nutrient loading upstream of Smith Lake
C11AHLIC05	MT76O002_020	Ashley Creek near Smith Lake at bridge	48.149	-114.432	Calculate nutrient load of Ashley Creek as it leaves Smith Lake

<sup>1</sup> Denotes that the coordinates are not final

<sup>2</sup> The lake is part of the upper Ashley Creek segment

Note: tbd – to be determined



**Figure 3-1. Proposed Sampling Locations for Field Effort**

## **3.2 PHYSICAL PARAMETERS**

### **3.2.1 *In Situ* Measurements**

During the nutrient sampling event at each site, a YSI 85 field meter will be used to collect *in situ* measurements of temperature, dissolved oxygen, and specific conductance, and a portable pH meter will be used to measure pH. These measurements will be collected prior to the collection of water samples and flow or other physical disturbances to the water column or substrate occurs. This data will be used to describe the ambient water quality conditions at each sampling location and relate to nutrient concentration and load data when appropriate. At Lone Lake and Lake Monroe, a YSI 600 will be used to measure temperature, dissolved oxygen, specific conductivity, and pH at half meter increments to determine if the lake is stratified. If the lakes do stratify fall nutrient sampling may occur to determine if there is a seasonal spike in nutrient concentrations as a result of fall turnover in the lakes. See details about instrument calibration in **Section 6.0**.

### **3.2.2 Flow Measurement when collecting nutrients**

After *in situ* measurements and water quality samples have been collected, flow will be measured at each site using either the quantitative flow meter method or the semi-quantitative float method (DEQ 2012). The quantitative flow meter method is preferred; however, the float method is acceptable when



high flows or other conditions pose a safety hazard and prevent wading. Flow measurements will facilitate the calculation of nutrient loads at each sampling site to be used in a simple mass-balance model for Ashley Creek.

### 3.2.2 Flow Measurement and staff gage at the Ashley Lake Outlet

Flow will be measured at least twice each month at the same transect at the Ashley Lake outlet. The flow measurement collected when nutrient samples are collected can count towards one of these measurements. Flow measurements should be collected approximately evenly throughout the month (e.g., once every two weeks if two measurements are collected, once every week if four are collected). A trail camera will be placed so that it can photograph the staff gage at the Ashley Lake outlet once every hour. The flow information gained from this data collection will be used to develop a daily stage-discharge relationship for Ashley Creek at the lake outlet and be used to update the flow input into the Ashley Creek portion of the Flathead Lake LSPC model. This information will help DEQ generate more accurate nutrient loading values from the Flathead Lake LSPC model.

### 3.2.3 Digital Photographs

Digital photographs will be taken at each site. The photo number will be recorded along with the location identifier and a description.

## 3.3 WATER SAMPLE COLLECTION

### 3.3.1 Nutrient Samples

All sample bottles and lids will be triple-rinsed with a small amount of ambient stream water prior to grabbing the final sample. TPN will be collected in a single 250ml HDPE bottle and kept on ice (not frozen) until analyzed. TP, nitrate, and ammonia will each be collected in their own 250ml HDPE bottle, preserved with sulfuric acid, and kept on ice (not frozen) until analyzed. Detailed methodology can be found in DEQ (2012). Summary information is shown in Table 3-2.

**Table 3-2. Sampling Volumes, Containers, Preservation, and Holding Times**

<u>Analyte</u>	<u>Bottle Size</u>	<u>Container</u>	<u>Preservation</u>	<u>Storage</u>	<u>Holding time</u>
Total Persulfate Nitrogen (TPN)	250 ml	HDPE bottle	None	Cool to <6 °C (on ice)	28 days
Total Phosphorus (TP)	250 ml	HDPE bottle	Sulfuric acid	Cool to <6 °C (on ice)	28 days
Nitrate-Nitrite (Nitrate)	250 ml	HDPE bottle	Sulfuric acid	Cool to <6 °C (on ice)	28 days
Total Ammonia Nitrogen (ammonia)	250 ml	HDPE bottle	Sulfuric acid	Cool to <6 °C (on ice)	28 days

## 4.0 SAMPLE HANDLING PROCEDURES

Field samples will be collected and preserved in accordance with Section 3. DEQ personnel will be responsible for proper labeling, sample custody documentation and storage in accordance with the

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specifications in the Field Procedures Manual (DEQ 2012). Water chemistry samples will be delivered to Energy Laboratory, Inc. for analysis.

## 5.0 LABORATORY ANALYTICAL MEASUREMENTS

Chemistry samples will be analyzed according to the methods listed in **Table 5-1**. In addition, **Table 5-1** lists the required reporting limits to effectively evaluate the data to meet the project objectives.

**Table 5-1. Analytical Methods and Required Reporting Values**

<u>Analyte</u>	<u>Method</u>	<u>Req. Reporting Limit (ug/L)</u>
Total Persulfate Nitrogen (TPN)	A 4500-N-C	40
TP	EPA 365.1	3
Nitrate-Nitrite (nitrate)	EPA 353.2	10
Total Ammonia Nitrogen (ammonia)	EPA 350.1	50

## 6.0 QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

All QA/QC requirements followed by MT DEQ "internal process" will be instituted for this project. Specific procedures that will be implemented include calibrating field meters and collecting field QC samples. The QA/QC requirements are described in DEQ (2005).

### 6.1 CALIBRATING FIELD METERS

#### **YSI 85 meter calibration**

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

#### **Hand-held pH meter calibration**

The pH meter will be pre-calibrated in the laboratory using the two-point method (pH 7.0 and 10.0 standards), and checked against a 7.0 and 10.0 standard each day of sampling in the field, according to the instrument's operations manual.

#### **YSI 600 meter calibration**

Pre-calibration of the YSI 600 meter will be undertaken in the laboratory before each sampling trip. The YSI meter will also be calibrated in the field just prior to measuring dissolved oxygen for site-specific altitude at each site following the instructions in the YSI 600 operations manual.

### 6.2 FIELD QUALITY CONTROL SAMPLES

#### **Field Duplicate samples**

For each type of routine water chemistry parameter, duplicate samples will be collected during each trip for at least 10% of the total number collected throughout the sampling season. Sites where duplicate samples will be prepared will be randomly selected. When collecting duplicate samples, a sampling

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location will be chosen that allows for two samples to be taken side-by-side upstream from any previous disturbances. To collect duplicate samples, all procedures performed in collecting, labeling and preserving the routine sample will be followed so that two identical samples have been collected at the same site. Duplicate samples will be submitted to the analytical laboratory along with routine samples.

#### **Field blanks**

Field blanks are prepared in the field each time that routine water samples are to be delivered to the analytical laboratory. Field blanks are prepared in the field after sampling the last site of a multi-site sampling trip, or mid-trip if sample holding times require samples to be delivered to the lab part-way through a multi-site sampling trip. Field blanks will be prepared using distilled water provided by the analytical laboratory which field personnel will keep in clean, triple-rinsed HDPE bottles. One field blank will be prepared and submitted per routine sample type collected throughout the trip. Preparing field blanks will follow the same sample collection, labeling and preservation procedures as those used to collect routine samples, except that distilled water is used instead of stream water.

## **7.0 HANDLING SAMPLING RECORDS**

Site Visit Forms, field forms, and digital photos will be processed by WQPB staff using QA/QC procedures described in procedures as indicated in DEQ (2005, 2012). Analytical laboratories will provide results to DEQ in the required EDD format. DEQ will perform the necessary data evaluations on results and will manage the data in accordance with DEQ (2005). The spatial location will be recorded in geographic coordinates (in decimal degrees) using the NAD 1983 datum.

## **8.0 SCHEDULE**

All work will be done between July 1 and December 31, 2015. At a minimum, nutrient samples will be collected once per month between July 1 and September 30 with monthly sampling continuing until December, resources and conditions permitting. Samples will be delivered to Energy Laboratories, Inc. as soon as possible after returning to Helena (holding time is 28 days). Lake stratification sampling will occur once per month during July, August, and September. Flow measurements will be collected at the Ashley Lake outlet at least twice per month at approximately even time intervals during the July – December time period.

## **9.0 PROJECT TEAM AND RESPONSIBILITIES**

The Watershed Management and Water Quality Monitoring and Assessment Sections will conduct this project. Darrin Kron will oversee the overall monitoring & assessment component, Paul Kusnierz will lead the field effort, with potential assistance from a Watershed Protection Section staff member and volunteers. The Water Quality Monitoring and Assessment Section will provide technical assistance with equipment, pre-calibration of instruments, and delivery of samples to Energy Laboratories, Inc.

## **10.0 REFERENCES**

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DEQ (Montana Department of Environmental Quality). 2005. 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/PDF/SOPs/WQPBQAP-02.pdf>.*

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