LITTLE BLACKFOOT TMDL PLANNING AREA CHEMISTRY AND CHLOROPHYLL MONITORING

Data Submittal and Quality Review Report, Revision 1
January 27, 2009

State of Montana Term Contract SPB05-894P-II, DEQ Agreement No. 208052


Little Blackfoot River, Montana

Montana Department of Environmental Quality
Watershed Management Section, Water Quality Planning Bureau
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Table of Contents

Appendices

1.0 INTRODUCTION

The enclosed submittal is the culmination of three chemistry (nutrients and metals) and chlorophyll monitoring events conducted by HydroSolutions Inc (HydroSolutions) in the Little Blackfoot Watershed Total Maximum Daily Load Planning Area (TPA) for the Montana Department of Environmental Quality (DEQ). The project was managed by Lisa Kusnierz and supervised by Dean Yashan of the DEQ Water Quality Planning Bureau. Work was completed under State of Montana Term Contract # SPB05-894P-II, DEQ contract number 208052 Task Order 1. HydroSolutions' project manager is Luke Osborne.

Tasks in the Scope of Work include: 1) Spring 2008 high flow nutrient and metals monitoring and 2) Summer 2008 metals and nutrient monitoring. Field work was completed over three separate monitoring events by HydroSolutions staff.

- Spring 2008 chemistry monitoring: May 27-30, 2008 (spring 2008 sampling event)
- Summer 2008 chemistry and chlorophyll monitoring: July 21-26, 2008 (summer 2008 sampling event)
- Late Summer 2008 chemistry and chlorophyll monitoring: September 29 – October 2, 2008 (late summer 2008 sampling event).

Northern Analytical Laboratories Inc., in Billings, Montana provided laboratory analysis for the project.

A Sampling and Analysis Plan (SAP) for chemistry and chlorophyll monitoring in the Little Blackfoot TPA was completed by the DEQ Water Quality Planning Bureau. The SAP provides background information on the watershed, a list of impaired water bodies in the watershed, objectives and design of the study, a list of the sampling sites, and description of sampling methods and analytical procedures, and quality control requirements. Copies of the SAP are on file with the DEQ Water Quality Planning Bureau.

The purpose of this submittal is to 1) transmit data collected and analyzed during the three monitoring events, 2) document deviations to the SAP, 3) provide results from the quality check completed on the laboratory data, and 4) describe any access issues encountered during field monitoring events. Site visit forms, the results from the laboratory analysis and other supporting documents for this project are included in the Appendices and are organized by sample site name as listed in the SAP. This submittal is being transmitted in paper (one copy) and digitally by compact disc and includes the following Appendices:

Appendix A: Watershed and Sample Site Map
Appendix B: STORET Data Upload Confirmation Sheet
Appendix C: Montana DEQ Quality Control Checklist
Appendix D: Sample Site Photo log
Appendix E: Laboratory Reports and Chain of Custodies
Appendix F: Site Visit Forms

Appendices D-F are included digitally as Adobe PDF files. Also included as separate electronic files in the digital transmittal are:

- STORET data spreadsheets (Microsoft Excel)
- Laboratory electronic analytical data spreadsheets (Microsoft Excel)
- QA/QC calculation spreadsheet (Microsoft Excel)
- All Photo files: sample site plus chlorophyll (.JPG)
- Discharge and Cross-Section Calculations (Microsoft Excel)
- Shape file of sampling locations (.SHP)

A photo log is provided as a record of each sample site as taken during the initial visit during the Spring 2008 event. All other photos are sorted by sample site location and contained in digital folders for each site. Descriptions of each photo are provided on the site visit forms in Appendix F.

2.0 DEVIATIONS TO THE SAMPLING AND ANALYSIS PLAN

This section describes the deviations from the investigation procedures and field methods outlined in the SAP as well as the rationale for the deviations.

Sample Sites
The SAP defined 37 separate sampling sites in the Little Blackfoot TPA. Sample sites were modified from the original coordinates for a variety of reasons; this table lists the sites that were moved significantly (more than a couple hundred yards) from their original location. Sample site coordinates were recorded on the initial visit to the site by global positioning system (GPS). Any changes to the site location with additional visits were also recorded. Table 1 summarizes deviations in sample site location, rationale for the deviation, and the sample site modification. Final sample site location coordinates are listed in the enclosed STORET station identification spreadsheet and also included as metadata in the enclosed digital shape file.

TABLE 1. SUMMARY OF SAMPLE SITE LOCATIONS

Sample Site	Rationale for sample site deviation	Sample site modification or corrective action
DOG4	Located on posted private property	Moved upstream to Forest Service property
ONT1	Inaccessible during spring 2008 due to Snow	Come back in summer
ONT1	Sample site located incorrectly in relation to wetlands	DEQ resampled at wetlands
TGH4	Located on private property; owner unavailable	Moved upstream to neighboring property
LBF6	Located on private property	Moved upstream to Elliston swimming hole public access
LBF8	Located on busy Highway 12 bridge	Moved downstream to county bridge
LBF9	Site inaccessible due to road construction	Moved upstream to accessible site
SIX1	Very low flow	Move downstream to reach with higher flow
CAR1	Original coordinates wrong	Move upstream to site described in site
SPD2	Not accessible	Moved to Upstream to accessible site
TGH1	Sample site located incorrectly	Resample in future events

The upper most sample site in Telegraph Creek (THG1) was not sampled in the location as specified in the SAP. Following the naming convention in the SAP (where the first sampling site on a named stream was located highest in the watershed) we assumed that the coordinate for TGH1 was listed incorrectly in the SAP. The coordinate for TGH1, as we sampled it, is located roughly at the same latitude as TGH1 in SAP, but on a different tributary. The "completeness count" in section 3.L below is reduced to account for this mis-located sample site.

Stream Flow Measurement

Flow measurements were collected at most sample sites except where noted below. A flow meter was the primary tool used to measure flow. During the spring 2008 sampling event, flow was measured at sites where the stream was accessible with chest waders and conditions were safe to wade. A bridge crane was planned to be used to measure flow at sample sites located with bridge access. Use of the bridge crane was limited even at those sample sites due to the force of the river on the flow weight. The flow weight weighed 15 pounds, but was insufficient to maintain steady conditions for the flow meter in the stream to return stable measurements. The weight was "pushed" out by the flow of the stream and swung back and forth in the stream. At these sites a graduated painter's stick with attached flow meter was used as a measuring rod to gage the site and calculate flow.

At sample sites where flow exceeded safe wading conditions and the bridge crane could not be used, the velocity float method (as described in the DEQ field procedures manual) was used to estimate flow. As described in the SAP, sample sites where the velocity float method was used, a mark of the high water mark was made and then that channel cross section was measured in the subsequent sampling event. At sites where conditions did not permit marking the high water level, the most recent high water mark was noted and channel cross section was measured at that location in the subsequent sampling event. The high water mark in the Spring 2008 sampling event corresponded very nearly to bankfull or slightly less than bankfull conditions at many of the sites. The float method flow estimates provided in the STORET database are based on channel cross section measurements of the marked high water level or other visible evidence of the high water mark. During the spring 2008 event the velocity float method was used to estimate flow at the following sites: LBF2, LBF5, LBF6, LBF7, LBF8, and LBF9.

Since sample site LBF10 is located concurrent to USGS stream gaging station 12324590, Little Blackfoot River near Garrison, Montana, that station's flow data was used in lieu of an estimated flow during the Spring 2008 event. The USGS gaged mean stream flow at site LBF10 is compared with estimated and measured flow in Table 2. The relative percent difference, or precision, of the USGS mean flow compared to the estimated flow at LBF10 on 5/29/2008 is +44 percent. This difference may indicate that the velocity float method over estimates the actual flow in a stream, although more duplicate flow data would need to be collected to evaluate this supposition. The calculated precision for USGS gaged stream flow and measured flow was +5 percent during the Summer 2008 event. The calculated precision for USGS gaged stream flow and measured flow was -23 percent during the Late Summer 2008 event. This difference may be accounted for in the difference between the mean stream flow for the day and the actual stream flow at the time of the field measurement.

TABLE 2. COMPARISON OF USGS GAGED STREAM FLOW WITH ESTIMATED AND MEASURED VALUES AT SAMPLE SITE LBF10.

Date	USGS Daily Mean Flow (CFS) [1]	Estimated or Measured Flow [2]	Value (CFS)	Precision [3] (%)
5/29/08	846	Estimated	1317	44
7/26/08	90	Measured	94	5
9/30/08	53	Measured	42	-23

NOTES:

1. Daily mean flow is the average flow recorded for one day at the USGS station 12324590, Little Blackfoot River near Garrison, Montana. Actual flows during field measurements vary from the mean value.
2. The estimated value at site LBF10 is based on the velocity float method performed at LBF9 on 5/29/08; the high water level was marked and measured in the subsequent sampling event. Measured flow values are calculated using area-velocity measurements at site LBF10.
3. Precision is calculated based on the relative percent difference between the USGS mean flow and the estimated or measured flow.

Chlorophyll Monitoring

In most locations, chlorophyll monitoring activities (data collection) were conducted in accordance with DEQ's "Sample Collection and Laboratory Analysis of Chlorophyll-Standard Operating Procedures (06/05/08) and the methods prescribed in the SAP. A pace count was used to delineate the chlorophyll sampling unit instead of using a tape measure. During the handling of template collected samples, plastic sealable bags (Ziplock bags) were used instead of centrifuge tubes. This method of sample handling was directed by Northern Analytical Labs prior to beginning field work.

During the Late Summer 2008 event substrate on rocks were collected from each respective sampling transect and consolidated. The rocks bearing the substrate were lined up and photographed together, each rock in the respective photograph is equivalent to one transect.

As described in the SAP, chlorophyll samples were taken at sample sites where it was determined to have 'considerable' (>50 milligrams per square meter, mg/m^2) algal growth. This was estimated by visual assessment of the reach in comparison to algal density photographs provided by DEQ in the SAP. Table 3 summarizes the sites determined not to have considerable algal growth for the summer and late summer sampling events based on visual assessment. Private access was not permitted at sample site LBF5 and chlorophyll samples were not collected there. In lieu of collecting samples, photographs were directed to be taken. Photographs were not taken during the Late Summer 2008 sampling event. Chlorophyll samples were collected at all other nutrient site during the respective sampling event.

TABLE 3: SUMMARY OF SITES WITH LIMITED ALGAL GROWTH

Nutrient sites considered to have less than 50 mg/m^2 algal growth at the time of the site visit based on visual assessment	
Summer 2008	**Late summer 2008**
CAR1	DOG4
DOG4	LBF4
DOG6	LBF5
LBF4	SNO2
LBF5	SNO3
LBF6	SNO4
LBF7	
LBF8	
LBF9	
SNO1	
SNO2	
SNO3	
SPD1	
SPD2	

Quality Control Samples
Field duplicates, field blanks, and filter blanks (quality control samples) were typically taken at a frequency specified in the SAP (10%). There are a few instances that quality control samples were taken at a frequency less than the specified frequency. The frequency of quality control samples taken is listed in sections 3.D and 3.E below.

3.0 DATA QUALITY ASSURANCE QUALITY CONTROL SUMMARY

Water samples from the spring 2008, summer 2008, and late summer 2008 sampling event in the Little Blackfoot TPA were delivered to Northern Analytical Laboratories, in Billings, Montana following the completion of each round of sample collection. The analytical results for these samples were reviewed. A summary of our review of the data quality control follows and is based on the DEQ quality control checklist.

A: Conditions of samples upon receipt
Table 4 summarizes the conditions of the samples upon receipt to the lab for each monitoring event.

TABLE 4: SUMMARY OF NORTHERN ANALYTICAL LABS SAMPLE RECEIPT CHECKLIST

Sample Receipt Checklist	Spring 2008 Water	Summer 2008 Water	Summer 2008 Sediment	Summer 2008 Chlorophyll	Late Summer 2008 Water	Late Summer 2008 Chlorophyll
Chain of custody present?	Yes	Yes	Yes	Yes	Yes	Yes
Chain of custody signed when relinquished and received?	Yes	Yes	Yes	Yes	Yes	Yes
Chain of custody agrees with sample labels?	Yes	No	No	No	Yes	Yes
Custody seals on sample bottles?	No/NR	No/NR	No/NR	No/NR	No/NR	No/NR
Samples in proper container/bottles?	Yes	Yes	Yes	Yes	Yes	Yes
Sample containers intact?	Yes	Yes	Yes	Yes	Yes	Yes
Sufficient sample volume for indicated test?	Yes	Yes	Yes	Yes	Yes	Yes
Ice/Frozen Blue Ice present in shipping container?	No	No	No	No	Yes	Yes
Container temperature	6.4°C, 7.2°C,9.8 °C,6.2°C	12°C all around	6.6°C	6.6°C	1.2°C,0.1° C,0.6°C,0. 8°C	1.2°C,0.1°C, 0.6°C,0.8°C
All samples received within holding time?	Yes	Yes	Yes	Yes	Yes	Yes
Metals bottles pH<2?	Yes	Yes	NA	NA	NA	NA
Nutrient bottles pH<2?	Yes	Yes	NA	NA	Yes	NA
Cyanide bottles pH<12?	Yes	Yes	NA	NA	NA	NA

Notes: NA=Not applicable NR=Not required

The notes on several of the Sample Receipt Checklists indicate no ice was present on the samples when they were delivered to the lab. The samples were properly packed in ice the entire time while in the field and were stored in at 4°C refrigerator prior to transport to the lab. Any temperature increase above 4°C occurred during transport to the lab or during check in at the lab.

B: All field documentation complete
A review of the field sheets indicate that all field documentation for the samples was completed.

C: Holding times
A review of the laboratory results indicate that all holding times were met.

D: Field duplicates collected at the proper frequency as specified in the SAP
Field duplicates were collected at the frequency listed in Table 5.

TABLE 5: FREQUENCY OF FIELD DUPLICATES

Duplicate Water Sample Frequency				
	Metals Sites	**Nutrient Sites**	**Cn Sites**	**Overall**
Spring 2008	16%	14%	50%	22%
Summer 2008	12%	14%	100%	22%
Late Summer 2008	NA	9%	NA	9%

E: Field blanks collected at the proper frequency as specified in the SAP
Field blanks were collected at the frequency listed in Table 6.

TABLE 6: FREQUENCY OF FIELD BLANKS COLLECTED

Field Blank Frequency				
	Metals Sites	**Nutrient Sites**	**Cn Sites**	**Overall**
Spring 2008	8%	14%	50%	17%
Summer 2008	12%	9%	0%	14%
Late Summer 2008	NA	9%	NA	9%

F: Sample IDs match those provided in the SAP. Field Duplicates are clearly marked on all samples and noted as such in lab results.
All sample IDs match those provided in the SAP. Field duplicates are clearly marked on sample and noted as such in lab results. The duplicate sample IDs were labeled with "site name-Dup" on the field sheet, on the sample bottle, and in the lab report.

G: Analyses carried out as described within the SAP
Analytical methods, photo documentation, and field protocols were carried out as described in the SAP. Deviations to the SAP are summarized in section 2.0.

H: Reporting detection limit met the project-required detection limit
The project required detection limits were not met for the following analytes:

- Arsenic in sediment (Total Recoverable Metal)
- Cadmium in sediment (Total Recoverable Metal)
- Lead in sediment (Total Recoverable Metal)

The detection limit for Arsenic, Cadmium, and Lead in sediment was increased over the project required reporting limit due to sample matrix interference (sample dilution). All analytical values for these analytes exceed the detection limit.

The reporting limit for Selenium and Silver in sediment metals was increased in some samples due to the presence of iron in the sample. The project required reporting limit established in the SAP for Selenium, Silver, or Nickel for sediment metals was listed as "standard."

I: All blanks were less than the project-required detection limit

Blanks that were detected to have equaled to or exceeded the project required detection limits are listed in Table 7. Relatively high concentrations of total phosphorus were detected in 2 of 2 nutrient field blanks during the Summer 2008 sampling event. During this event distilled water purchased at a grocery store was used in lieu of de-ionized water from the lab.

TABLE 7: SUMMARY OF FIELD BLANK DETECTIONS

Monitoring Event	Sample name	Lab Number	Analyte	Detected value (mg/l)	Detection Limit (mg/l)
Spring 2008	Field Blank-2	2008060011-27	Nitrate-Nitrite as N	0.01	0.01
Spring 2008	Field Blank-3	2008060011-30	Nitrate-Nitrite as N	0.01	0.01
Spring 2008	Field Blank-4	2008060011-41	Lead (dissolved)	0.0007	0.0005
Spring 2008	Field Blank-4	2008060011-41	Nitrate-Nitrite as N	0.01	0.01
Summer 2008	FB-1	2008070181-18	Total Phosphorus as P	0.031	0.005
Summer 2008	FB-1	2008070181-18	Nitrate-Nitrite as N	0.01	0.01
Summer 2008	FB-2	2008070181-36	Total Phosphorus as P	0.057	0.005
Summer 2008	FB-2	2008070181-36	Nitrate-Nitrite as N	0.01	0.01
Late Summer 2008	SNO-4-FB	2008100053-18	Nitrate-Nitrite as N	0.01	0.01
Late Summer 2008	SPD-4-FB	2008100053-23	Nitrate-Nitrite as N	0.01	0.01

J: Laboratory blanks/duplicates/matrix spikes/lab control samples were analyzed at a 10% frequency.

Laboratory quality control water samples were analyzed at a frequency listed in Tables 8, 9, and 10. Laboratory quality control samples were analyzed at a frequency which is consistent with standard laboratory practices.

TABLE 8: FREQUENCY OF QUALITY CONTROL SAMPLES ANALYZED FOR WATER

Water samples			
	Spring 2008	Summer 2008	Late Summer 2008
Lab Duplicates	11%	9%	12%
Matrix Spikes	11%	9%	12%
Method Blanks	6%	7%	8%
Lab Control Samples	6%	7%	8%

TABLE 9: FREQUENCY OF QUALITY CONTROL SAMPLES ANALYZED FOR SEDIMENT

Sediment samples			
	Spring 2008	Summer 2008	Late Summer 2008
Lab Duplicates	NA	12%	NA
Matrix Spikes	NA	12%	NA
Method Blanks	NA	8%	NA
Lab Control Samples	NA	8%	NA

TABLE 10: FREQUENCY OF QUALITY CONTROL SAMPLES ANALYZED FOR CHLOROPHYLL

Chlorophyll-a Samples			
	Spring 2008	Summer 2008	Late Summer 2008
Lab Duplicates	NA	13%	14%
Matrix Spikes	NA	13%	14%
Method Blanks	NA	13%	5%
Lab Control Samples	NA	13%	5%

K: Laboratory blanks/duplicates/matrix spikes/lab control samples were all within the required control limits defined in the SAP

Northern Analytical Labs included the following footnotes in the case narrative of their analytical results concerning quality control samples that did not meet required control limits:

For summer 2008 sampling event sediment samples:
(2) The recovery of the matrix spike is outside the stated quality control limit. However, the sample result was greater than four times the spike added: therefore, no corrective action was required.

For summer 2008 sampling event water samples:
(3) The recovery or replication is outside the stated quality control limit. Corrective action was not required. The associated sample results do not require qualification.

For spring 2008 and late summer 2008 sampling events water samples:
(4) The recovery of this analyte in the matrix spike and/or its spike duplicate did not meet the quality control limits. The recovery of the analyte in the laboratory control sample met the control limits. This indicates the presence of matrix interference in the sample. The associated sample results have been footnoted with a data qualifier.

Table 11 lists the quality control samples that did not meet required control limits.

TABLE 11: SUMMARY OF QUALITY CONTROL SAMPLES THAT DID NOT MEET REQUIRED CONTROL LIMITS

Sample Name	Lab number	Analyte	Value (Footnote)
MATRIX SPIKE OF 2008060011-6	2008060011-49	Nitrate + Nitrite as N	88 (4)
MATRIX SPIKE OF 2008060011-16	2008060011-51	Nitrate + Nitrite as N	88 (4)
MATRIX SPIKE OF 2008060011-26	2008060011-55	Nitrate + Nitrite as N	88 (4)
MATRIX SPIKE OF 2008070181-25	2008070181-52	Lead as Pb (Dissolved)	120 (3)
MATRIX SPIKE OF 2008070181-39	2008070181-54	Lead as Pb (Dissolved)	121 (3)
MATRIX SPIKE OF 2008070182-3	2008070182-28	Iron Dry Basis	(2)
MATRIX SPIKE OF 2008070182-3	2008070182-28	Lead Dry Basis	(2)
MATRIX SPIKE OF 2008070182-3	2008070182-28	Zinc Dry Basis	(2)
MATRIX SPIKE OF 2008070182-12	2008070182-30	Iron Dry Basis	(2)
MATRIX SPIKE OF 2008070182-24	2008070182-32	Iron Dry Basis	(2)
MATRIX SPIKE OF 2008100053-11	2008100053-28	Nitrate + Nitrite as N	82 (4)

L: Project Data Quality Objectives

Data Quality Objectives established in the SAP for this project include representativeness (spatial and temporal), comparability, and completeness. An assessment of DQOs is summarized below.

- **Representativeness** refers to the extent to which measurements represent an environmental condition in time and space. Design of the study ensured that this objective was met. Sampling sites were chosen to represent the potential of landscape characteristics and land use/land cover influences existing in the watershed to influence the analyte concentrations in the listed waters. Sampling sites were identified by assessment of aerial and topographic maps and field surveying to capture the variability in land use and watershed characteristics potentially contributing to pollutant concentrations in streams including: land use/land cover (e.g. known mined areas, forest, grass, riparian area, geology, and soils), watershed residence times, and stream order. This study was designed to be conducted over three temporal periods during the spring runoff, mid-summer flow, and late-summer low flow of 2008.

- **Comparability** is the applicability of the project's data to the project's decision rule. The decision rules used for this project are the acute and chronic aquatic life criteria listed in Department Circular DEQ-7. All methods selected conform to the requirement listed in footnotes 3, 4, 9, 12, 19, and 29 of DEQ-7.

- **Completeness** is a measure of the amount of data prescribed for assessment activities and the usable data actually collected, expressed as a percentage. The overall project goal is 90% completeness.

- **Analytical Completeness:** During the spring 2008, the Ontario Mine wetland sampling site (ONT1) was inaccessible due to snow and the upper most Telegraph Creek site (TGH1) was sampled in a location other than that in the SAP. All other sites were visited and samples were collected and analyzed. A completeness of **95%** is assessed for the spring 2008 sampling event analytical activities. During the summer 2008 the upper most Telegraph Creek site (TGH1) was sampled in the same wrong location. All other sites were visited and samples were collected and analyzed. A completeness of **97%** is assessed for the summer 2008 sampling event analytical activities. Each of the designated sample sites and the prescribed samples were collected during the late summer 2008 sampling events. A completeness of **100%** is assessed for the analytical activities for those sampling events. An overall completeness of **97%** is assessed for this project for analytical activities.

- **Physical Parameter (flow measurement and field measurements) Completeness:** ONT1 was inaccessible during the spring 2008 sampling event and a flow measurement was not taken. Since ONT1 is a wetland, a flow measurement could not be taken. During the spring 2008 event, sampling site Little Blackfoot River-9 (LBF9) was sampled, but field parameters were not recorded. The upper-most Telegraph Creek site (TGH1) was sampled in the wrong location during the spring 2008. A completeness of **92%** is assessed for the spring 2008 sampling event for physical parameters. During the summer 2008 sampling event the uppermost Telegraph Creek site was again sampled in the same wrong location. A completeness of **97%** is assessed for physical parameter collection during the summer 2008 sampling event. Each of the designated sample sites and the prescribed field parameters including flow were collected during the late summer 2008 sampling events. A completeness of **100%** is assessed for the physical parameter collection during this sampling event. An overall completeness of **96%** is assessed for this project for physical parameters.

Project Data Quality Indicators

Data Quality Indicators (DQIs) are quantitative criteria established for the data acquired within this design to assure it is of sufficient quality for its intended use. The DQIs established in the SAP for this project include sensitivity, precision, bias, and accuracy.

- **Sensitivity** refers to the limit of a measurement to reliably detect a characteristic of a sample. For analytical methods, sensitivity is expressed as the method detection limit (MDL). Sensitivity quality controls for all laboratory methods will follow the frequency and criteria specified in the analytical method or as described in the Laboratory's Quality Assurance Plan (LQAP).

  The criteria used to assess field method sensitivity for water and sediment samples shall be the analytical result of the field blank less than that of the project reporting limit. Field blanks that fail this criteria will be qualified for all associated project data if the result is less than 10 times the detected value in the field blank. Table 7 lists field blanks that exceeded project reporting limits. The associated results that are qualified with result qualifer "B" are assumed to be all of the data collected on the same day as the field blank that failed criteria above for that analyte. The

appropriate associated data is qualified in the STORET database. Result qualifier "B" is defined as, "detection in the field and/or trip blank."

Nitrate-Nitrite as Nitrogen (N) was detected in each of the field blanks during this project at a value equal to the detection limit; therefore, all Nitrate-Nitrite results that fail the criteria are qualified. Total phosphorus was detected in both of the field blanks during the summer 2008 monitoring event; therefore, all of the total phosphorus results that fail the criteria are qualifed for that monitoring event.

- **Precision** refers to the degree of agreement among repeated measurements of the same characteristic. This project relies on analytical and field duplicates to assess precision based on their relative percent difference (RPD).

  Laboratory precision quality control for all laboratory methods follows the frequency specified in the analytical method or as described in the Laboratory's Quality Assurance Plan (LQAP). The criteria used to assess analytical method precision shall be:

  - Water samples: 20 % RPD for duplicate results > 5 times the MDL
  - Sediment sample: 35% RPD for duplicate results > 5 times the MDL

  Laboratory duplicates did not exceed the above criteria.

  Overall precision evaluates field duplicates. The criteria used to assess overall precision shall be:

  - Water samples: 25 % RPD for duplicate results > 5 times the MDL
  - Sediment samples: 40% RPD for duplicates > 5 times the MDL

  Laboratory results were reviewed and evaluated for overall precision. There were 4 duplicate results that failed the above criteria. Associated qualified results include data for:

  - Lead (total recoverable) in the Dog Creek drainage collected on May 28, 2008 for values less than 0.03 milligrams per liter (mg/L)
  - Manganese (total recoverable) in the Dog Creek drainage collected on May 28, 2008 for values less than 0.14 mg/L
  - Total Phosphorus in the Dog Creek drainage collected on May 28, 2008 for values less than 0.23 mg/L
  - Total Phosphorus in the Snow Creek drainage collected on October 1, 2008 for values less than 0.32 mg/L

- **Bias** is directional error from the true value. In this context, it is an extension of the representativeness concept applied to an individual sample. Bias can occur either at sample collection or during measurement. **Accuracy** is the combination of high precision and low bias. Accuracy of individual measurements will be assessed by reviewing the Laboratory Control Samples (LCS) and Matrix Spike results. The criteria used for this assessment will be the limits that the laboratory has developed through control charting of each method's performance.

Table 11 lists quality control samples that failed to meet required control limits. The data associated with footnote (4) is qualified with result qualifier "J", which is defined as, "estimated: the analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample." The associated J-qualified results are listed in the STORET data base as well as shown on the laboratory reports and digital outputs.

Summary of results of QC analysis, issues encountered, and how issues were addressed

The above section provides a summary of quality control analysis. No issues arose during quality control evaluations that need to be addressed.

Completed QC checklist before STORET upload

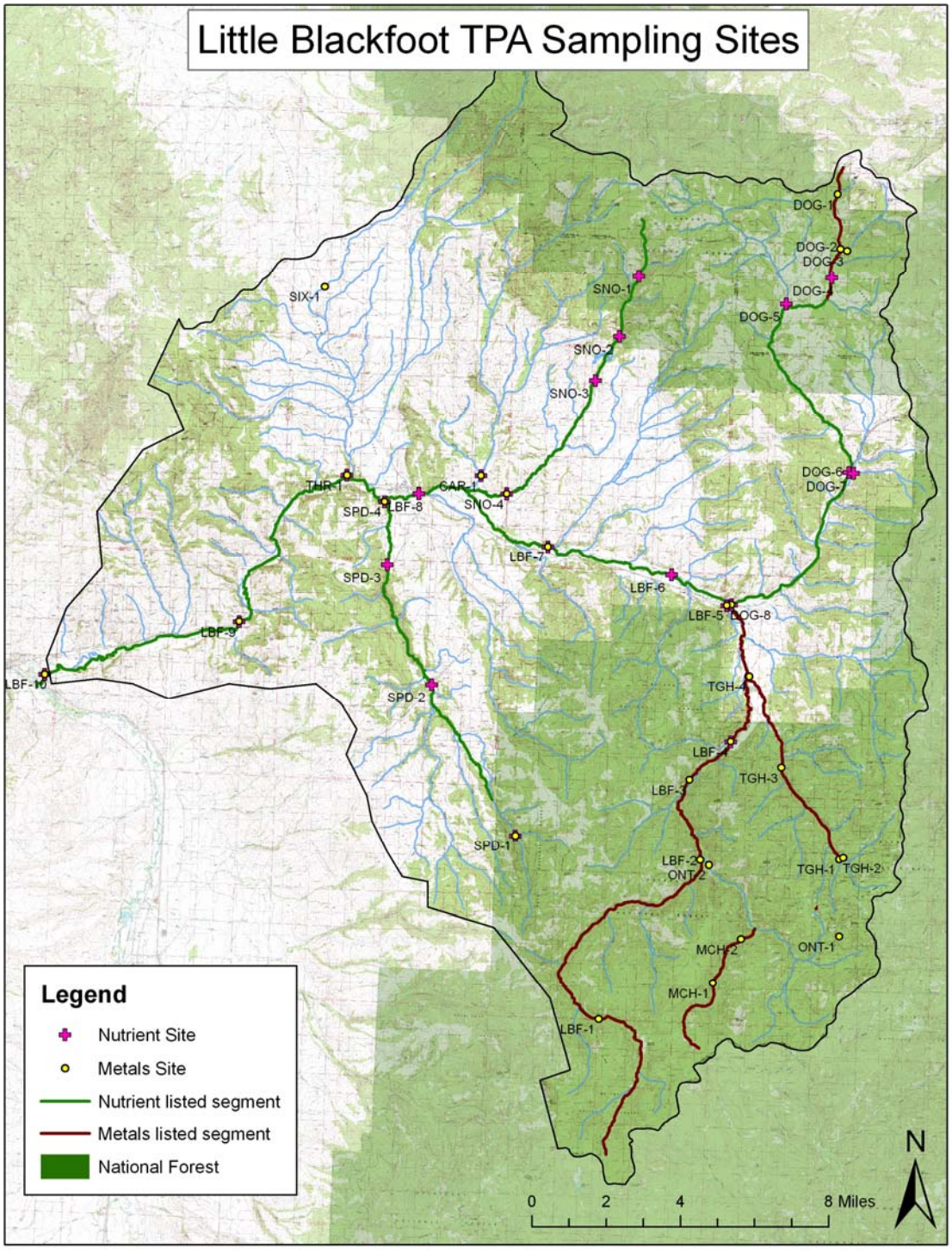
The quality control checklist was completed and data was reviewed prior to upload to the STORET database.

4.0 SAMPLE SITE ACCESS

Lisa Kusnierz coordinated land owner access for most sites where necessary. HydroSolutions obtained any additional access while in the field. Access to sites in the upper portion of the watershed was dependent on weather conditions and snowpack depth.

Appendix A

Watershed and Sample Site Map


Little Blackfoot TPA Sampling Sites
DOG-1
DOG-2
DOG-3
DOG-4
DOG-5
DOG-6
DOG-7
DOG-8
SNO-1
SNO-2
SNO-3
SNO-4
SIX-1
THR-1
GAR-1
SPD-4
LBF-8
SPD-3
LBF-7
LBF-6
LBF-5
LBF-9
LBF-10
SPD-2
SPD-1
TGH-4
TGH-3
TGH-1
TGH-2
LBF-4
LBF-3
LBF-2
ONT-2
ONT-1
MCH-2
MCH-1
LBF-1
Legend
Nutrient Site
Metals Site
Nutrient listed segment
Metals listed segment
National Forest
N
0
2
4
8 Miles

Appendix B

STORET Data Upload Conformation Sheet

Event Log Detail

ID	Type	Message	Context
289115	Message	Start: 15:52:05	
289116	Message	Migrated 1 projects.	
289117	Message	Finish: 15:52:05	

Suppress Warnings | Distinct Errors | Return to Previous

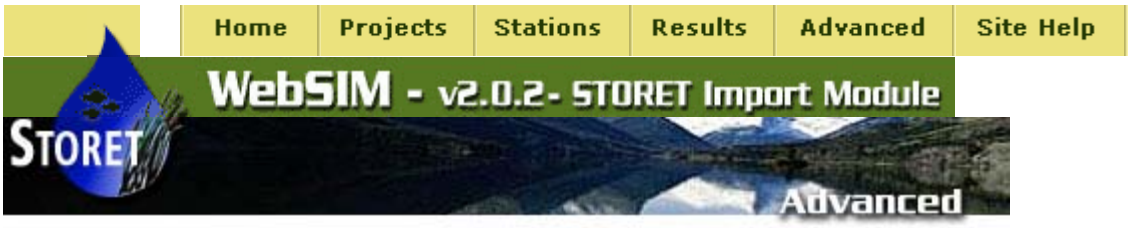
STORET Home - EPA Office of Water - Gold Systems, Inc.

Event Log Detail

ID	Type	Message	Context
288997	Message	Start: 15:38:25	
288998	Message	Migrated 37 stations.	
288999	Message	Finish at: 15:38:26	

Suppress Warnings | Distinct Errors | Return to Previous

STORET Home - EPA Office of Water - Gold Systems, Inc.



Event Log Detail

ID	Type	Message	Context
289123	Message	Start: 15:54:05	
289124	Message	Migrated 95 activities, 561 results.	
289125	Message	Finish: 15:54:13	

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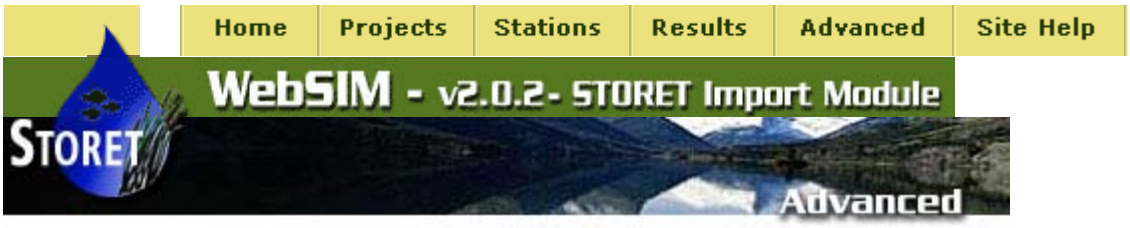

Event Log Detail

ID	Type	Message	Context
294680	Message	Start: 16:33:40	
294681	Message	Migrated 181 activities, 1802 results.	
294682	Message	Finish: 16:33:49	

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Appendix C

Montana DEQ Quality Control Checklist

Montana DEQ Quality Control Checklist

___Condition of samples upon receipt
- __Cooler/sample temperature
- __Proper collection containers
- __All containers intact
- __Sample pH of acidified samples <2

___All field documentation complete. If incomplete areas cannot be completed, document the issue.

___Holding times met

___Field duplicates collected at the proper frequency (specified in SAP)

___Field blanks collected at the proper frequency (specified in SAP)

___All sample IDs match those provided in the SAP. Field duplicates are clearly marked on samples and noted as such in lab results.

___Analyses carried out as described within the SAP (e.g. analytical methods, photo documentation, field protocols)

___Reporting detection limit met the project-required detection limit

___All blanks were less than the project-required detection limit

___If any blanks exceeded the project-required detection limit, associated data is flagged

___Laboratory blanks/duplicates/matrix spikes/lab control samples were analyzed at a 10% frequency

___Laboratory blanks/duplicates/matrix spikes/lab control samples were all within the required control limits defined within the SAP

___Project DQOs and DQIs were met (as described in SAP)

___Summary of results of QC analysis, issues encountered, and how issues were addressed (corrective action)

___Completed QC checklist before STORET upload

Table D-1. Data qualifiers and descriptions.

Result Qualifier	Result Qualifier Description
B	Detection in field and/or trip blank
D	Reporting limit (RL) increased due to sample matrix interference (sample dilution)
H	EPA Holding Time Exceeded
J	Estimated: The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
R	Rejected: The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
U	Not Detected: The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
UJ	Not Detected/Estimated: The analyte was not detected at a level greater than or equal to the adjusted CRQL or the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

Table D-2. Quality control terminology and descriptions.

FIELD QC		
Term	**Description**	**Purpose/Usage**
Trip Blanks	Used only for VOC (Volatile Organic Chemicals). Alias VOA (volatile organic analysis)	To determine if cross contamination occurs between samples.
Field Blank	Reagent water exposed to field sampling conditions	Monitors contamination resulting from field activities and or ambient levels of analytes present at time of sampling.
Field Duplicate	Two independent samples taken under the same conditions. For solids; two samples which are co-located (taken side by side.) Water samples would be two independent samples taken at the same location at the same time.	To determine the homogeneity of the samples collected.
Field Replicate	A single sample is obtained, homogenized, then slit into multiple samples	Monitors laboratory precision independent of laboratory operations.
LABORATORY BATCH QC		
Acronym	**Description**	**Definition**
LRB/Method Blank	Laboratory Reagent Blank	An aliquot of reagent water or other blank matrices that are treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, and internal standards that are used with other samples. The LRB is used to determine if method analytes or other interferences are present.
LFB/LCS	Laboratory Fortified Blank; Laboratory Control Sample	Reagent water spiked with a known amount of analyte. Ideally treated exactly like a MS/LFM. Control used to determine bias in sample spikes.

MS/LFM	Matrix Spike/Laboratory Fortified Matrix .	An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The LFM is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the LFM corrected for background concentrations
MSD/LFMD	Matrix Spike Duplicate/Laboratory Fortified Matrix Duplicate	Determine method precision in sample concentrations are < 5X the RL.
DUP	Duplicate	Determine method precision in sample concentrations are > 5X the RL.
QCS	Quality Control Sample	A solution of method analytes of known concentrations which is used to fortify an aliquot of reagent water or sample matrix. The QCS is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check either laboratory or instrument performance
SRM	Standard Reference Material	Primarily used as a QCS to verify instrument calibration.
LABORATORY ANALYSIS QC		
Acronym	**Description**	**Definition**
ICB	Initial Calibration Blank	Monitors instrument drift at low end of cal curve.
CCB	Continuing Calibration Blank	Monitors instrument drift at low end of cal curve.
ICV	Initial Calibration Blank	Monitors instrument drift at a defined concentration near the mid range of cal curve.
CCV	Continuing Calibration Blank	Monitors instrument drift at a defined concentration near the mid range of cal curve.
IPC	Instrument Performance Check	Monitors instrument drift at a defined concentration near the mid range of cal curve.
MS/LFM	Matrix Spike/Laboratory Fortified Matrix .	An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The LFM is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the LFM corrected for background concentrations
MSD/LFMD	Matrix Spike Duplicate/Laboratory Fortified Matrix Duplicate	Determine method precision in sample concentrations are < 5X the RL.
DUP	Duplicate	Determine method precision in sample concentrations are > 5X the RL.

QCS	Quality Control Sample	A solution of method analytes of known concentrations which is used to fortify an aliquot of reagent water or sample matrix. The QCS is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check either laboratory or instrument performance
SRM	Standard Reference Material	Primarily used as a QCS to verify instrument calibration.
IDL	Instrument detection limit	Signal just above baseline. 3-5x the STD DEV of 7 replicates of a blank. Not used for quantification.
MDL	Method detection limit	Statistical determination of the lowest concentration of an analyte with 95% certainty the analyte is present.
PQL	Practical Quantitation Limit	3-5x the MDL. Lowest level that quantification is determined
RL	Reporting Limit	Value a Laboratory reports results. Usually the PQL.

Appendix D

Sample Site Photo Log

Included Separately in Digital Format

Appendix E

Laboratory Reports and Chain of Custodies

Included Separately in Digital Format

Appendix F

Site Visit Forms

Included Separately in Digital Format