Montana Department of Environmental Quality

Quality Assurance Project Plan (QAPP)

Sampling and Water Quality Assessment of Streams and Rivers in Montana, 2005

Water Quality Planning Bureau
Updated May 2005

1. Approvals

(Signature on file)

George Mathieus, DEQ Bureau Chief, WQ Planning Bureau — Date

(Signature on file)

Robin Rung, Contracts Administration, WQ Planning Bureau — Date

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Rosie Sada, DEQ Environmental Program Manager, Monitoring Section — Date

(Signature on file)

QAPP preparer: Mark Bostrom, QA Officer, Data Management Section — Date

Table of Contents

List of Attachments:

Attachment 1 – 2005 Field Season Monitoring Plans

A. Workplans wadeable streams and rivers (DEQ)

Attachment 2 – DEQ Field Forms

Addendums (as of 08/25/05)

SAP for Non-wadable rivers

1. Marias River
2. Milk River
3. Gallatin River
4. Missouri River

Table 4.0 update to reflect proposed RRVs in DEQ-7

Group A. Project Management

2. Distribution List

To save paper, this QA Project Plan will be made available through the DEQ website at http://www.deq.state.mt.us/wqinfo/QAProgram/index.asp

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Deb Grimm – Energy Laboratories
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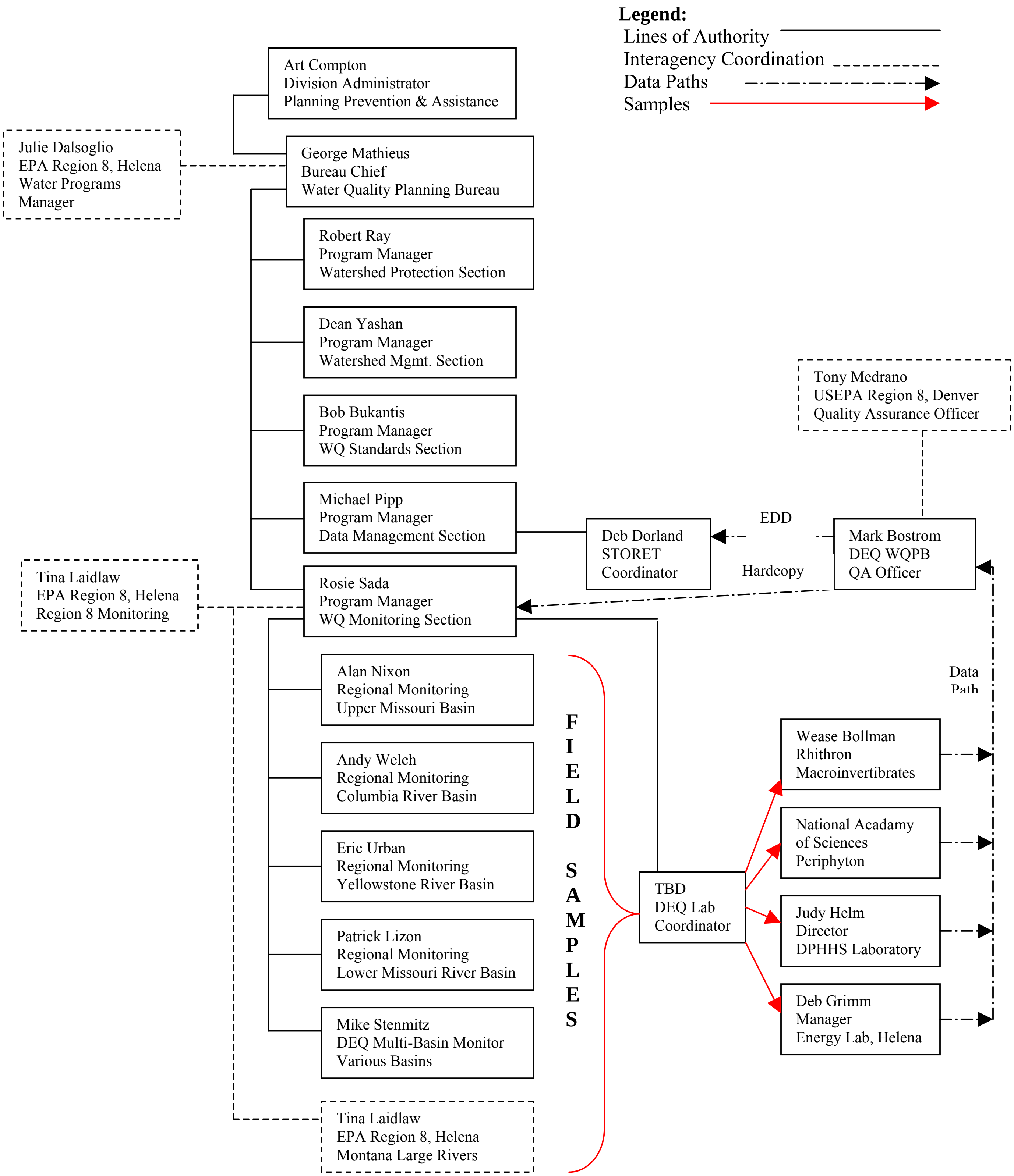
Macroinvertebrate Contractor
Wease Bollman - Rhithron

Periphyton Contractor
TBD

3. Project/Task Organization

The Montana Department of Environmental Quality (DEQ), Water Quality Planning Bureau (herein Bureau) is responsible for field sampling and water quality assessment of waterbodies included in this Quality Assurance Project Plan (QAPP). EPA Region 8's Montana Operations Office provides assistance with the field sampling effort for non-wadeable rivers. Chemical and biological analysis of field samples are provided by the professional contractors identified in Figure 1.0 and reported back to DEQ for beneficial use support determinations. Field and analytical requirements of this QAPP will be included in any contracts or task orders between subcontractors and DEQ.

Figure 1.0 - EPA/DEQ Monitoring Organizational Chart



4. Problem Definition and Background

An unknown number of the waterbodies in Montana may have anthropogenic impacts that result in non-attainment of water quality standards. The objective of monitoring and assessing waters as per 40 CFR Part 130.4 and Montana Code Annotated 75-5-702 is to identify which of those waterbodies are water quality limited segments (not meeting standards) and to report these conclusions to the people of Montana and the U.S. Congress in the (biennial) Montana Integrated Water Quality Report (MIWQR).

The main focus of the 2005 monitoring season will be to complete water quality assessments for waters that were delisted following the 1998 303(d) list because they lacked a credible basis to support their beneficial use support determinations. This delisting prompted a lawsuit against EPA and DEQ by Friends of the Wild Swan, et al., and resulted in a judgment that EPA/DEQ must complete TMDLs for all impaired waterbodies as shown on the 1996 303(d) list.

The first step in TMDL development is Problem Identification[1]. Problem identification for TMDL development is actually an extension of the 303 (d) listing process because it begins with the conclusion from the listing process. That conclusion is, "What water quality standards are not being attained and what beneficial uses are affected?"

Following the delisting decision and subsequent court order, it was often found that problem identification using the information supporting the 1996 list was difficult because the data available to compare against the standard, or the standard itself (particularly narrative standards), lacked the scientific rigor necessary to understand the linkage between beneficial use support, causes of impairment, and sources of impairment. A field data collection effort was often required to obtain a scientifically valid basis identifying or refining the problem.

Based on this, delisted waters were deemed "reassessment" waters and included in the 2000, 2002, and 2004 303(d) lists as an appendix. TMDL development continued for both the 1996 listed waters and waters identified in subsequent water quality reports (overlap was necessary due to the watershed approach adopted by the TMDL program).

The goal of this QAPP is to provide a framework for completing water quality assessments for the remaining reassessment waters so they are included in the 2006 MIWQR as assessed waterbodies (rather than as an appendix). These assessments will have the scientific rigor necessary to begin the TMDL process (problem identification) with a reasonable amount of certainty that the necessary effort and funds will not be wasted on waterbodies fully supporting their beneficial uses, or with the incorrect impairment cause identified.

5. Project Description/Task Description

5.1. Reassessment Project

The reassessment project is essentially the first stage of the water quality restoration sequence (monitoring and water quality assessment) where waters with impairments are identified and the likely causes and sources identified for subsequent corrective actions. Under Montana Law, *sufficient and credible data* must be established before a water quality assessment is performed

[1] Problem Identification is the first step of the TMDL Establishment Process presented in "Draft Guidance for Water Quality Based Decisions: The TMDL Process. EPA Office of Water, EPA 841-D-99-001, August 1999

(to determine beneficial use support status.) Montana Law also requires that *all existing and readily available data* be considered for water quality assessments. The implications of these two requirements are that water quality assessments may or may not include a field collection effort by DEQ (based on the availability and quality of existing data), and that the water quality assessment method must use data from various sources. Therefore, for all waters in Montana where a complete and current water quality assessment has not been made, the questions are:

Using the state's water quality assessment method, is sufficient credible data (SCD) available from for a beneficial use support determination?

- *If "yes", complete the water quality assessment by determining beneficial use support.*
- *If "no", then prepare and execute a sample design to obtain sufficient credible data.*

5.1.1. Pre-field season planning

Figure 2.0 – Reassessment Pre-field season planning process

Identify waterbodies requiring water quality assessments
- Appendix B of 2004 Integrated Report
- Previous assessments that did not address all beneficial uses
- Waters identified as priority from public comment

Collect readily available data and begin *draft* assessment using SOP WQPBWQM-001
- Is Sufficient Credible Data available?

Yes → Waterbody will be evaluated from existing data rather than monitored.

No ↓

Review land use information and maps to determine preliminary stream reaches.
- Collect maps and historical land use information from http://nris.state.mt.us
- Review changes in geomorphology/landforms/geology/soils
- Changes in land use patterns or public/private ownership
- Confluences with tributaries
- Maximum length of a single reach should not exceed 20 miles

What will determine if this segment is impaired?
- Numeric and narrative standards (WQB-7).
- Is *regional reference site available?*
  - Was its data collected with methods that are comparable (DEQ or other agency)?
  - Alternative approaches (e.g., internal, historical, models, studies, expert opinion)
- Identify potential sites on segment for use as internal reference site.

Develop a sampling design that will adequately represent each stream reach. Considerations influencing the sampling design:
- What are the time and resource constraints? (done by 2006 MIWQR submittal due date)
- Are there site access constraints? (e.g., Private property, roadless areas)
- Are there point sources or likely non-point sources that must be considered?
- Is the standard suite of parameters (biological/habitat/chemistry) sufficient?
- Rigor of existing data (only cover data gaps or collect full sampling suite?)
  - Age and representativeness of preexisting data
  - Previous use support determinations

→ **Document and execute sampling plan.**

5.1.2. Identification of waters requiring water quality assessment

In 2000, DEQ delisted numerous waters identified as impaired in the 1998 303(d) list due to a change in Montana Law requiring sufficient credible data to be established to support listings. This created a backlog of roughly 490 waters requiring reassessment as soon as possible to determine their water quality impairment status.

The waters that were delisted in 2000 are included in Appendix B of the 2004 MIWQR. In Appendix B, waters that have had additional data collected and have been assessed are identified with the year this action was completed. The remaining waters are the backlog that must have water quality assessments completed by the submission date for the 2006 MIWQR.

Also, comments from the public collected during the reporting cycle may demonstrate an urgent need to include a certain waterbody or waterbodies in the next round of waters considered for water quality assessment. There are very few of these included for the 2006 reporting cycle because greater urgency has been assigned to waters delisted in 2000.

5.1.3. Identification of Readily Available Data

DEQ is required by state and federal law to use all readily available data for water quality assessments. Because of this, previously existing data is considered prior to planning a field data collection effort because it may influence the monitoring design or preclude the need for a monitoring effort altogether. Preexisting data is either primary data (data collected by or for DEQ), or secondary data (data collected by other agencies or organizations for other purposes). Primary data typically has greater water quality assessment value because the methods and data quality are known, allowing direct comparison to state water quality standards.

Previous Water Quality Reports (1996 303(d) list) - The first source of pre-existing data considered is previous water quality assessments. Some of the data and information contained in pre-1998 303(d) listings may have present assessment value. Other data may not because it does not represent current conditions or has data quality issues that limit its comparability to water quality standards. Regardless, historical data is not simply discarded. It often provides valuable information about historical conditions of the waterbody, allowing assessors to understand the ability of the waterbody to recover (or not) from natural and anthropogenic impacts.

When a previous beneficial use support determination is available (most 1996 listings), the causes and sources of impairment identified must be considered in the current sampling design. This becomes a verification of the basis for the original listing.

Considering Secondary Data - Secondary data (External data) is solicited by DEQ as required in 40 CFR and Montana Code Annotated (MCA). This results in many different types of data being forwarded to DEQ that may or may not add to the basis of the assessment.

Sources of Secondary Data - Information from other agencies and organizations may improve the temporal and spatial coverage of water quality assessments beyond what DEQ can accomplish in one or two field visits. Although not limited to the following, the most common sources of secondary data are:

Physical/Chemistry

<u>U.S. Department of the Interior</u> - USGS water quality-monitoring data: The physical and chemical data collected by the USGS and made publicly available through the Internet at

http://waterdata.usgs.gov/nwis/sw USGS data is the most common external chemistry data source for DEQ. Information from the USGS is collected under known protocols and analyzed using published analytical methods. USGS data often has greater temporal coverage than is possible with DEQ's schedule for completion. USGS monitoring sites are easy to locate (lat/long.). Comparability with Montana's water quality standards is very good (e.g., total recoverable to total recoverable). USGS data is typically collected for the *purpose* of characterizing water quality, which aligns with the goals of the DEQ. Consideration of technical components, spatial /temporal coverage, data quality, and data currency still apply to USGS data to verify its *present* assessment value.

Physical/Habitat

U.S. Department of Agriculture - USFS Habitat Data (R1/R4, EA's, EIS's, Fire data, Timber Harvests, Road Densities): U.S. Forest Service data is typically eco-system scale and generally has greater focus in the physical/habitat category than in the biology or chemistry data types. The habitat data included in USFS reports may exceed DEQ's stream reach assessment method in rigor and direct measurements. Other USFS information such as road densities, and new and old timber harvests are collected by the DEQ from http://nris.state.mt.us during pre-field season planning.

U.S. Department of Agriculture – NRCS (Riparian Assessment) Land use information collected by the NRCS is useful for understanding the relationship between land use and waterbody potential. Also, DEQ uses the NRCS Riparian Assessment method as the base (reach scale) habitat assessment method in its field protocols. Data collected by DEQ and NRCS using the Riparian Assessment method should be comparable.

Biology

Montana Fish, Wildlife and Parks - (Fish counts, Fish stocking records, field observations of dewatered steams): Montana FWP has vital information on the biological and physical integrity of fisheries in Montana. DEQ's field monitoring does not include a direct measure of fish populations at present and relies on FWP fish counts for direct measure of fisheries health. Therefore, fish population data from FWP may provide the only *direct* measure for a beneficial use support determination of cold or warm water fisheries.

The list of dewatered streams compiled from field observations of FWP biologists is one of the few information sources that reflect the effects of dewatering from both man-made uses and natural dewatering. This information may be used as supporting documentation under the "weight-of-evidence" and "independent evidence" approaches in the state's assessment method (SOP WQPBWQM-001). Documentation of the field observations must be provided by FWP for DEQ to consider the "overwhelming evidence" approach.

Other sources of data include but are not limited to:

- U.S. Bureau of Reclamation (BOR)
- U.S. Bureau of Land Management (BLM)
- Montana State Library & Natural Resource Information System (NRIS)
- Montana Bureau of Mines and Geology (MBMG)
- Montana State University (MSU)
- University of Montana (UM)
- Montana Tech of the University of Montana (MT)

- Plum Creek Timber Co.
- The Seven Montana Tribal Governments
- AVISTA utilities
- U.S. Army Corps of Engineers (USACE)
- U.S. Fish and Wildlife Service (USFWS)
- Montana Nature Conservancy
- Montana Department of Transportation (MDOT)
- All Montana Conservation Districts
- Riparian/Wetland Research Program, Montana Forest & Conservation Station
- American Wildlands
- Friends of the Wild Swan
- Montana Environmental Information Center
- Montana Power Company
- Champion International
- Montana Dakota Utilities
- All known local volunteer water quality groups.

5.1.4. Review of Readily Available Data- Draft WQ Assessment

A review of the existing and readily available data for the waterbody will determine if a new data collection effort is necessary. This review is best accomplished by performing a *draft* water quality assessment using Montana's water quality assessment method (Appendix 2). If the existing data meets the sufficient credible data threshold, the assessment will be finalized and submitted for the 2006 MIWQR.

5.1.5. Field sampling

Following a decision that sufficient credible data is not available (Figure 2.0, Page 8), a field effort will be required and new data generated to complete the water quality assessment for each unassessed segment.

5.1.5.1. Additional information required for field sampling

A detailed review of the segment is required to develop the most economical and thorough sampling design for characterizing the segment. This includes the determination of representative sampling sites and their accessibility. The background data required for these considerations includes historical land use information, maps and landowner information, all of which is available for the NRIS website at http://nris.state.mt.us/interactive.html.

Landowners should be contacted to gain access to potential sampling sites on private land. In some regions, local conservation districts may play a vital role in mediating with private landowners to establish permission to access or cross private land and, as a rule of thumb, should be contacted first.

Local watershed groups may have recent data for the waterbody that have not yet been forwarded to DEQ. Local watershed groups also may wish to participate in the collection of data and should be encouraged to do so to solidify a working relationship with DEQ.

Contact with private landowners must be courteous and professional regardless of the attitudes and responses that may be returned. Denial of access to private property will have to be taken into account in the sampling design.

5.1.5.2. Site selection – Determining stream reaches

Pre fieldwork continues with the preliminary determination of stream reaches within the segment. Reaches should be estimated based on the following:

- Changes in landforms/geology soils
- Changes in land use patterns or public/private ownership
- Confluences with tributaries
- Maximum length of a single reach should not exceed 20 miles

The reaches established in pre fieldwork planning will be used to estimate the minimum number of samples to be collected for biological and chemistry samples. This information will be used to budget the resources needed for the field season and to determine the best route for the field crew to follow. More information on how to determine reaches is included later in this QAPP (Sampling Process Design, pages 21-28).

5.1.6. Field Season Schedule

The 2005 schedules for field sampling are included as Attachment 1. For the 2005 field season there are two attachments: A. Field season work plan for the investigations, and B. Sampling and Analysis Plan (SAP) for Non-Wadeable rivers DEQ and The field-sampling period is constrained by the index period used for biological investigations (June 21 to September 21). This index period was determined by David Richards[2] for mountain streams and may vary slightly for valleys, foothills, and plains. Generally, sampling will occur as follows:

Mountains, valleys, and foothills in summer and early autumn (June 21 to October 15), following runoff. The mountainous regions are *generally* considered the Columbia and Upper Missouri River Basins.

In the foothills and plains in early spring to early autumn (May 1 to September 15) to capture sites when adequate water is present for aquatic habitat. Plains are *generally* the Lower Missouri and Yellowstone River Basins.

5.1.7. Sampling Areas

The field sampling work plans included in **Attachment 1** identify sampling areas as follows:

- Watershed (TPA)
- Segment names as shown in the Assessment Database (ADB)
- USGS HUC# to 4th field
- Segment ID number (unique number for describing segment in ADB)
- Segment size in miles for streams & rivers, area for lakes and reservoirs (as shown in ADB and verified against National Hydrography Database - NHD).

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[2] Richards, D.C. 1996. The Use of Aquatic Macroinvertebrates as Water Quality Indicators in Mountain Streams of Montana. M.S. thesis. Montana State University, Bozeman. 166 pp.

5.1.8. *Sampling Area Location*

Maps and aerial photograph obtained from the Natural Resource Information System http://nris.state.mt.us/interactive.html during pre-season planning are used to identify potential sampling area locations. Copies of these maps are retained at DEQ in support of the field sampling work plans included in Attachment 1. Field crews will take the original printout of their maps to the field for the sampling event (there are too many maps (~200) to include as attachments to this document). Individual sampling sites may not be identified in the work plans or on maps unless a previously established site is determined to be the best location for sampling during preseason planning.

Unless identified, monitors will make sampling site selections in the field based on several factors including site access (private property and geographical access) and representativeness of the sampling site to the stream reach being sampled. Determination of representative sampling sites requires the field crew to use professional judgment. More information on site selection is given in the sampling process design section of this QAPP.

Historical Land use information - The maps obtained for Attachment 1 may also include site history information such as industrial point sources, land under agricultural use, silviculture, mining sites, areas of significant habitat alterations, roads and other land or water disturbance activities.

Previous Investigations and Regulatory Involvement - Previous water quality assessments are included in the draft water quality assessments prepared during pre-field season planning. Water Quality Assessments are available in the DEQ/MDMB water quality library. Information contained in previous assessments may be summarized and incorporated into the field season monitoring work plans (Attachment 1).

6. Quality Objectives and Criteria

6.1. Data Quality Objectives Process

The DQO process was used to prepare this QAPP as described below.

6.1.1. *DQO Process for Beneficial use Support Determination (Assessment)*

Statement of Specific Problem – The beneficial use support is unknown for a large number of previously unassessed waterbody segments and waters delisted in 2000 due to lack of sufficient credible data. What sufficient credible data is needed to assess all beneficial uses designated for the waterbody?

Identify the Decision – Determination of Impaired/Not Impaired for each beneficial use included in a waterbody's class (use class - ARM) as indicated by an exceedence of state numeric standards (WQB-7) or narrative criteria (ARM).

Identify inputs to the decision – Information sources - Preexisting data from both primary and secondary sources. Data that can be collected with a single field collection effort (Habitat/biology/chemistry). Basis for action level - sufficient credible data (SCD Score of 6) to proceed to beneficial use support determination. Beneficial use support determination made based on state numeric standards (WQB-7) and narrative criteria (ARM).

Define boundaries of the study – Temporal - single season. Spatial – segments divided into homogenous reaches. Sample characteristics – Habitat, Biology, Chemistry.

Develop a Decision Rule – For sufficient credible data, use Tables 1-8 of the state's Water Quality Assessment Method (SOP WQPBWQM-001). For Beneficial Use Support determination, use state numeric standards as shown in circular WQB-7; State narrative criteria in Montana Law (ARM); and Tables 9-14 of the state's Water Quality Assessment Method.

Specify Tolerable limits on decision error – State's assessment methodology includes Tables 1 – 8, which are designed to assign numeric confidence levels (on an ordinal scale) based on the technical components, spatial/temporal coverage, quality control, and data currency components of all "readily available data". Each category of data (biology, habitat, and chemistry) are scored on a scale of 1 – 4, where data scoring a 1 is too uncertain to use in an assessment and 4 is excellent and will provide great confidence in impairment/non-impairment determinations. The sum of all categories (biology, habitat, and chemistry - discounting any scores of 1) must be a minimum of 6 to proceed with a full beneficial use support determination.

Optimize the design for obtaining data – Preexisting data + biology (macroinvertebrates & Periphyton), physical/habitat (DEQ Stream Reach Assessment and/or NRCS Riparian Assessment), and Field and Laboratory Chemistry (Field Parameters + TMDL Suite) collected at a minimum of two sites per reach within the segment.

6.2. Data Quality Indicators (DQI's) - Analytical Laboratories

Chemical results are compared to numeric standards and require greater confidence in the results because one or more errant values that exceed the numeric standards will likely lead to an impairment determination (due to limited availability of "a large data sets" comprised of three years quarterly monitoring data, or 96-hour average). For the Reassessment Project, DEQ requires QC summaries to be provided along with analytical results so that Data Quality Indicators can be used to assess the quality of the data.

6.2.1. Precision

Precision is the degree of mutual agreement between or among independent measurements of a similar property (reported as standard deviation [SD], percent relative standard deviation [%RSD], or relative percent difference [RPD]).

Standard Deviation:

$$s = \sqrt{\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{(n-1)}}$$

Percent Relative Standard Deviation (%RSD):

$$\%RSD = \frac{s}{\bar{x}} \times 100\%$$

where:
s = Standard Deviation,
n = total number of samples,
x_i = each individual value used to calculate mean, and
x = mean of n values.

Standard Deviation and Percent Relative Standard Deviation (%RSD) are measures of variance with more than two samples. When duplicates or replicate measurements have two samples, Relative Percent Difference (RPD) is used to determine the degree of mutual agreement.

Relative Percent difference (RPD):

$$RPD = \frac{(sampleresult - duplicateresult)}{(sampleresult + duplicatereslt)/2} \times 100\%$$

Duplicates document the effect of the sample homogeneity and matrix limitations on method performance. Duplicates alone are not used to judge laboratory performance but in combination with other precision controls such as matrix spike duplicates or laboratory control sample duplicates. Frequency of sample specific controls must follow the same frequency as analytical batch controls (1 per batch, maximum batch size of 20 analytical samples per batch).

6.2.2. Accuracy

Accuracy is the degree of agreement of a measurement with a known or true value. To determine accuracy, a laboratory or field value is compared to a known or true concentration. Measures of accuracy include calibrations, laboratory control samples (LCS) and sample specific controls such as surrogates, matrix spikes (MS) and matrix spike duplicates (MSD).

The laboratories are responsible for method accuracy in initial and continuing calibrations in accordance with the analytical methods requested by DEQ. Measurements associated with the control of calibrations such as Relative Response Factor (RRF), Response Factor (RF), Calibration Factor (CF), and Percent Difference (%D) will not be discussed here.

Spiked Samples

Samples spiked with a known concentration of a constituent (LCS and MS) are the most common measures of accuracy in analytical laboratories. Laboratory control samples are prepared by spiking laboratory reagent water with a known concentration and comparing the final result against this value to determine % Recovery.

% Recovery (LCS):

$$\%\mathrm{Recov}ery = \frac{analyticalresult}{truevalue} \times 100\%$$

For Matrix spikes, the calculation is similar but must account for the concentration of the constituent in the sample.

% Recovery (MS):

$$\%\mathrm{Recov}ery = \frac{(spikedsampleresult - sampleresult)}{amountspiked} \times 100\%$$

6.2.3. Completeness

A limited number of samples are collected by DEQ for each stream reach (minimum of 2). This is due to many factors including the schedule for completion of all year 2000 delisted sites (~400 segments in 1 ½ years), human resources availability, and site access. Any loss of samples due to spillage, instrument failures, or laboratory mistakes may make it difficult to complete the assessment with any kind of certainty. Return trips to remote sites are costly and inefficient. The completeness goal for assessment monitoring is 95%.

6.2.4. Representativeness

Representativeness is the expression of the degree to which data accurately and precisely represents a characteristic of an environmental condition or a population. This could mean the area of interest, the method of taking individual samples or both. Achieving a representative sampling of a segment from a limited number of sampling points is a challenge given the seasonal and annual variability of some streams (especially intermittent streams) and the patchiness of the biological data type. Further, site access may limit the total number of available sites to a few with conditions better or worse that the remainder of the segment.

With this in mind, DEQ uses a multi-metric, weight-of-evidence approach in water quality assessments. With this approach, multiple lines of evidence measuring different aspects of the ecosystem should weed out an anomalous result obtained from a single data assemblage.

6.2.5. Comparability

Comparability expresses the confidence with which one data set can be compared to another. To achieve a comparable result, both the field collection method and the analytical method must be comparable. This is achieved through the use of Standard Operating Procedures (SOPs – DEQ or USGS) for field collection and the *use* of the same analytical methods published by the EPA, APHA - Standard Methods, or USGS in the laboratory. To assess comparability for assessment monitoring, a QC laboratory will be sent sample splits from randomly selected sites during the field season. The acceptance criteria for the results from the two laboratories will be the intra-laboratory precision indicated in the *referenced* analytical methods (e.g., Standard Methods) for any sample results >5x the laboratories Method Detection Limit (MDL). For methods that do include an intra-laboratory precision value, Field Replicate precision criteria (page 33) will apply.

In addition to the intra-laboratory precision, comparability refers to reporting data in comparable units (or to the same taxonomic resolution for biology) so direct comparisons are simplified. For analytical methods, these units are included in the Table of Methods, Detection Limits and Units.

6.2.6. Sensitivity - Detection Limits

The Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero. The MDL is determined by analyzing seven (7) aliquots of a representative matrix spiked with the target analyte at a concentration near the estimated MDL. The entire analytical method must be performed to account for any variance within preparation, extraction, distillation or digestion steps. The variance of the seven results is calculated and subsequently the standard deviation. The standard deviation is multiplied by the student's t value (3.143 for seven results) to obtain the raw MDL. The value obtained as the raw MDL should be rounded (up) to the appropriate significant figure for reporting purposes. The MDL is used as the end point for reporting sample results and as a control point for negative controls as Method Blanks.

The MDL is a numeric value where the concentration of a target analyte can be determined to be greater than zero. At the MDL, method precision is infinite because readings below the MDL are reported as zero (all values with <99% confidence that value is greater than zero). The point where quantification becomes reproducible within the precision criteria for the method must be established. This is typically called the Practical Quantitation Limit (PQL) or Level of Quantitation (LOQ) and is an important limit for data users to understand when considering values reported near the detection limit, *particularly when limited numbers of samples are available to base decisions upon*. The PQL is set at either 3-5x the MDL or at the lowest concentration standard of the calibration curve (R^2=0.9995). Although somewhat arbitrary, the PQL factors into the determination of method precision control for sample duplicates. When the sample duplicate values are above the PQL, the relative percent difference (RPD) between the two values must meet the method criteria. When sample duplicate values are below the PQL, method precision control is deferred to the Matrix Spike/Matrix Spike Duplicate samples.

<u>Detection Limit Low Enough to Assess Uses</u>
Many of the State numeric standards for aquatic life use support (ALUS) are low to sub-part per billion (ppb) values that if exceeded by a magnitude of 25% to 50%, in (potentially) a single sample, could result in a determination of "impaired". The PQL should be considered when making ALUS impairment decisions with a limited number of samples.

It is imperative that detection limits required to accurately assess the beneficial uses are:
- Low enough to assess the beneficial use based on numeric standards,
- Valid MDLs of the entire method,
- Updated at least annually, and routinely demonstrated to be in control by the laboratories negative controls.

6.3. Data Quality Indicators (DQI's) – Biological Contractors

In the past, DEQ has had few controls specified for the quality of biological data, yet relied heavily on the results for making beneficial use support determinations. For the 2005 field season, the quality of biological data will be assessed with a rigor similar to analytical chemistry data. DEQ cites information from the NABS *Bridges* publication, "<u>Determining the quality of taxonomic data</u>, James Stribling, Steven Moulton II, and Gary T. Lester" for information included in DQI's for the 2005 field season.

6.3.1. Accuracy

Accuracy applied to taxonomy is defined as the nearness of a measurement to an analytical truth. For taxonomy, the analytical truth is:
1. The most currently accepted taxonomic literature,
2. A reference collection, verified by appropriate taxonomic specialists, or
3. Type material (e.g., holotype)

For samples collected during the 2005 field season, DEQ is using the 2003 version of the International Taxonomic Identification System (ITIS) for macroinvertebrates and the USGS NAWQA taxa list for periphyton. A system for verifying contractor's reference collections is being developed at DEQ but has not been implemented as of the revision (6/2005).

6.3.2. Precision

Precision is defined as nearness of different measures of the same property. Simply stated, it is a measure of repeatability. Taxonomic precision is evaluated by comparing the results of a randomly selected sample that is processed by 2 taxonomists or laboratories. The randomly selected samples represent a subset of the total collected for:

- A project,
- Multiple projects within a sampling year, or
- ≥1 projects over several sampling years. For the 2005 field season the frequency of duplicate measurements will be 5% (1 duplicate measurement per 20 samples processed)[3]. Precision can be quantified for both taxonomic identifications and enumerations.

Percent Difference in Enumeration (PDE)

Precision of counts is determined by calculating % difference in enumeration (PDE) as follows:

$$PDE = \left(\frac{|n1 - n2|}{n1 + n2} \right) \times 100$$

Where, $n1$ is the number of specimens counted in a sample by the 1st taxonomist or laboratory, and $n2$, the 2nd. The purpose of this calculation is to highlight those samples where counts might differ substantially and to focus attention on reason(s) for the miscounts.

The 2005 field season will be the first data set collected using this Quality Control measure so set control limits derived from control charts are not available. DEQ will have ~5% of the samples obtained during the field season recounted by a second contractor or taxonomist to obtain this measurement. The *Measurement Quality Objective (MQO)* will be 5% for the 200 field season. PDE greater than 5% will prompt a review of the two laboratories or two taxonomists to determine the source of enumeration error. The DEQ QA officer or biological specialist from DEQ WQ Standards will perform this review.

Percent Taxonomic Disagreement (PTD)

Taxonomic Results can be compared between 2 taxonomists or laboratories by counting the number of agreements, from which a % taxonomic disagreement (PTD) is calculated:

$$PTD = \left[1 - \left(\frac{COMPpos}{N} \right) \right] \times 100$$

Where, *COMPpos* is the number of agreements (positive comparisons), and *N* is the total number of specimens in the larger of the 2 counts. Agreements are, in part, contingent on the targeted level of identification, i.e., species, genus, family or higher. For example, if genus is the target, and one taxonomist provides a name for a specimen at the species level, whereas the other leaves the name at the genus level, it would count as an agreement. However, if one identification is at the genus level and the re-identification is at family, it would count as a disagreement. The lower the PTD value, the greater the overall taxonomic precision, indicating relative consistency in sample treatment.

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[3] Biological data is used in assessment monitoring for ALUS, fisheries, and primary contact recreation. Water quality assessments are preliminary investigations and a higher frequency isn't warranted.

The 2005 field season will be the first data set collected using this Quality Control measure so set control limits derived from control charts are not available. DEQ will have ~5% of the samples obtained during the field season re identified by a second contractor to obtain this measurement. The MQO goal for PTD is 15%. Disagreement on re identified samples greater than 15% will prompt a review of the two laboratories to determine the source of enumeration error. The DEQ QA officer or biological specialist from DEQ WQ Standards will perform this review.

6.3.3. Bias

Bias is defined as statistical or method error caused by systematically favoring some outcomes over others and can be characterized as the degree of departure from a true value.

Taxonomic bias exists if there are consistent misinterpretations of dichotomous keys or morphological features, poor processing of samples (e.g., poor slide-mounting techniques), or inadequate optical equipment.

Sampling bias exists if the sampler consistently chooses sampling sites that are either better than or worse than a representative site for the stream reach. To address sampling bias, DEQ holds annual training in the use of the biological sampling procedures. This training begins with a discussion of the selection of a representative sampling site within a stream reach. Further, DEQ employs teams of two persons in a sampling team who independently judge representative sites while viewing the reach. The two person teams work together to arrive at a final site selection based on the independent evaluations.

6.3.4. Completeness

Completeness measured for the project relates the total number of valid data points obtained versus the plan. For taxonomy, completeness is further measured by satisfying the specified hierarchal level specified for identification in the DEQ SOPs. The completeness goal for biological analyses is 95.

6.3.5. Representativeness

Representativeness is the expression of the degree to which data accurately and precisely represents a characteristic of an environmental condition or a population. This could mean the area of interest, the method of taking the individual samples or both. The idea of representativeness is incorporated into the sampling design by the requirement that a minimum number of samples be taken and the multi metric approach. Replicate samples will be taken for the same set of samples evaluated for precision. This will allow for a measure of the representativeness of the sampling method to be determined in relation to the precision of the enumeration and identification of individual species. Replicate samples will be taken at the beginning middle and end of the field season for each major basin.

6.3.6. Comparability

Comparability of biological results to other results, particularly to “reference condition” is critical for the data to be used in the evaluation of beneficial use support. Comparability between samples includes the consistent identification of samples to the same level (e.g., species) and is therefore partially determined by the precision measures above. The index period for sampling has been determined to be June 21 to September 21 for mountainous regions and ~May 21 to September 21 for plains regions. Where an external reference condition is not previously established, or is from a substantially different time or collected under severe conditions (drought or very wet conditions), other samples in within the waterbody being assessed may be the only data points comparable for determining reference conditions (internal reference at a point in headwaters or a point otherwise unaffected by peripheral influences, taken during the same sampling event).

6.3.7. Sensitivity

Sensitivity for taxonomy is covered in the accuracy and precision sections above.

6.4. Special Training/Certifications

The employment criteria for DEQ staff "Water Quality Specialist" performing beneficial use support assessments assures that all staff have a minimum level of education and experience relevant to the task at hand.

6.4.1. Field season training – DEQ field crews

Prior to the beginning of the field season, training is given to all field crews on the use of:

- In-house training: Field forms, STORET labels, and field instrument calibration (April 28th, Mark Bostrom, Rosie Sada, Michael Suplee, Alan Nixon, and Andy Welch)
- Field day training: Sampling methods, habitat assessment methods, (May 12&13, 2005 by Rosie Sada, Monitoring Program Manager)
    - Geomorphology (Channel Cross Section, Wohlman Pebble counts)
    - YSI and Horiba Meters
    - Sample collection methods
        - Traveling kick net (macroinvertebrate sampling),
        - Periphyton sampling techniques,
        - Rock-hoop-core methods for Chlorophyll-a,
        - Grab sampling for water chemistry.
    - DEQ Stream Reach Assessment (Habitat)

All field personnel from DEQ participating in the 2005 field season are expected to attend this training prior to initiating the field season sampling events. Documentation of training and the persons attending are kept on file in the office of the DEQ QA Officer.

6.4.2. Field season training - EPA field crew

The training for the EPA region 8 field crews assisting DEQ during the 2005 field season will be lead by Tina Laidlaw, EPA Region 8 – Helena. Ms. Laidlaw attended the DEQ field training in May and will transfer this training, along with guidance provided in the DEQ Field Procedures Manual (SOP WQPBWQM-020), to the EPA region 8 crews.

6.4.3. Training - laboratories and biological contractors

External contractors are responsible for providing personnel qualified for the methods requested. A copy of the Laboratories Quality Assurance Plans (LQAP) describing the training programs for Energy Laboratories and the Department of Public Health and Human Services laboratory are on file with the QA officer.

7. Documentation and Records

Documentation of the measurements, observations and conditions of each site monitored is critically important for a decision to be made and validated at a later date. Each field crew is

given a packet of forms and checklists for each site to document activities. The basic instruction manual for completing this packet is the DEQ Field Procedures Manual (SOP SWQPWQM-020). The DEQ Field Procedures Manual is available for review at the QA website http://www.deq.state.mt.us/wqinfo/QAProgram/index.asp
Examples of all field forms used for the 2005 field season are included as Attachment 2.

Adherence to the methods described in the Field Procedures Manual will result in all required metadata and measurements on the field forms to produce a STORET compatible deliverable.

7.1. Document Retention

All hardcopy and electronic information produced from assessment monitoring will be retained indefinitely at DEQ in the WQPB library or on the DEQ network. Electronic records retained on the DEQ network are backed up by the Information Technology Section routinely to assure that important records and data are not lost.

This QAPP and all attachments is available for review on the web at http://www.deq.state.mt.us/wqinfo/QAProgram/index.asp
All individuals and organizations identified in the distribution list on page 4 will be notified of the final approval and its location on the web.

Group B. Data Generation and Acquisition

1. Sampling Process Design

The DEQ field season monitoring plans are included as Attachment 1 to this QAPP. The sampling design used for (reassessment) water quality assessments uses incrementally smaller divisions of the waterbody to define spatial divisions.

Constraints on the sampling design due to private property access issues and inaccessible sites are addressed in the section discussing the determination of stream reaches and selection of sampling sites.

1.1. Spatial divisions and hierarchy

DEQ uses a spatial hierarchy of *segment, reach, and sampling* site to describe waterbodies at incrementally smaller scales for water quality assessments.

Segment is the waterbody as defined in the assessment database (ADB). In the ADB, a segment is identified by a unique Segment ID (Example: MT41I006_200) and Segment Name (Description: McClellan Creek from headwaters to the mouth at Prickly Pear Creek) and is the *smallest unit for which an impairment determination is made.*

Reaches are subdivisions of segments that represent significantly different extents based on geomorphology, land use, or other peripheral influences. Very short segments are often homogenous throughout their entire length and may be considered a single reach. Longer segments, or segments with a combination of changes in geomorphology, land use, significant adits, and tributaries may prompt division into many reaches.

Sampling sites are the points selected by the field crews to represent a portion of the reach. Two sampling sites are necessary to adequately characterize a reach. A sampling site between two adjacent reaches can serve as a (single) mid-point site for the two reaches.

1.2. Spatial and temporal limits of data types

DEQ does not have the time or resources to employ a routine monitoring schedule for all of the streams in Montana to determine natural variations over time and throughout their entire length. Because of this, DEQ uses a suite of multiple data types that are reviewed using a weight-of-evidence approach for beneficial use support decisions.

1.2.1. Physical/Habitat Assessments

For 2005, Habitat Assessments are being performed on both the site scale and the reach scale.

The site scale habitat assessment includes selected observations from the EMAP program along with a few of the supplemental observations from the DEQ/NRCS Riparian Assessment.

The reach scale habitat assessment is essentially the NRCS Riparian Assessment method with several EMAP (reach scale) observations included.

The field forms used to conduct these two assessments are included as Attachment 2.

The STORET Station ID and latitude/longitude from the lowermost (downstream) sampling point are used to identify the sampling location for *reach scale* measurements.

Geomorphology measurements are *sub-reach scale* measurements documenting the physical conditions of a representative sampling site. Geomorphology measurements document physical conditions resulting over relatively long time period.

Geomorphology measurements have both primary and optional methods as described below. Optional methods are used where time allows and their inclusion adds significant weight to the data used for assessment.

1. DEQ channel cross section (Primary) – includes documentation of flow and channel type in text and photo points. Used to determine sites for substrate measures.
2. Rosgen's Stream Classification System (Optional) -- streams tend to organize themselves around a likely combination of variables based on physical and chemical laws. This tendency to seek equilibrium reflects landscape conditions in a watershed.
3. Wolman pebble counts (Primary) – substrate pebble count used to determine imbeddedness and redds for propagation of salmonid species.
4. Percent fines (Optional) – Extension of Wolman pebble count analyzing the size distribution of the percent fines.
5. Riffle Stability Index (RSI- Optional) – Analysis of substrate size and stream energy.

Geomorphology measurements are sampling site specific; they are identified with the STORET Station ID and latitude/longitude used for each site.

1.2.2. Biological methods

The biological assemblages (macroinvertebrate, periphyton, and chlorophyll-a) measure in-stream health at the point of sampling but also can indicate alterations in the physical or chemical properties of the waterbody for a short extent upstream. Biological communities reflect impacts relatively quickly and recover in a shorter time period than habitat and physical conditions. Because of this, they are used to extend the temporal extent of the assessment to include recent acute conditions, periodic chronic conditions, or both.

Biological measurements are variable from year to year and may be patchy throughout the segment, reach, and sampling site. Collecting a truly representative sample in a *single sampling event* is difficult but can be achieved with a reasonable amount of certainty by applying the sampling techniques described in bureau SOP WQPBWQM-009. Determining a representative site and collecting a representative sample is discussed in detail on pages 30 and 31.

To document site-specific conditions for macroinvertebrates and periphyton, a *sampling site* scale macroinvertebrate habitat assessment is performed and forwarded to the taxonomist.

The following biological assemblages are collected at each sampling site unless otherwise noted in the field sampling plans.

1. Macroinvertebrate sample – assemblage integrates physical and chemical disturbances. One of the measures of aquatic life use support.
2. Chlorophyll-a – indicator of excessive nutrient loading in waterbody. Measure of contact recreation use support.
3. Periphyton - assemblage integrates physical and chemical disturbances. Good biological indicator due to:
    a. a naturally high number of species
    b. a rapid response time to both exposure and recovery
    c. identification to a species level by experienced biologists
    d. ease of sampling, requiring few people
    e. tolerance or sensitivity to specific changes in environmental condition are known for many species

Biological samples are sampling site specific; they will be identified with the STORET Station ID and latitude/longitude used for each site.

1.2.3. *Chemistry and field measurements*

Grab samples for chemistry (water and sediment samples) and field instrument measurements are the easiest to collect but only represent the water body at the sampling point and at the time of sample collection. Diurnal variance fluctuations in the waterbody can influence chemical measurements. However, the schedule for completion of the reassessment project precludes multiple sampling events to understand this cycle (therefore, diurnal cycles will become a consideration for TMDL projects addressing “problem identification”). The sampling methods are described in SOP WQPBWQM-020 – DEQ Field Procedures Manual.

Chemistry and field measurements are sampling site specific; they will be identified with the STORET Station ID and latitude/longitude used for each site.

1.3. Determining Stream Reaches and Sampling sites

There are two approaches to determining stream reaches and sampling sites - estimation based on length and selecting reaches and sites from maps.

Estimation based on the length of the segment is used in the preseason planning for budgeting the level of effort and analytical costs that will be associated with the field season. Estimation does not specifically identify where reaches begin or end (latitude/longitude), or where representative sampling sites are located within those reaches. The length criteria for selecting a minimum number of reaches and sampling sites within a segment takes into account the spatial and temporal limits of the data types, resulting in a field sampling effort that meets the sufficient credible data criteria in Montana's water quality assessment method (SOP WQPBWQM-001).

Estimation based on length does not consider pre-existing data or site access as variables influencing the total number of samples.

Table 3.0 Estimating Stream Reaches and Sampling Sites

Segment Length (mi.)	Est. # of Reaches	Est. # of Samples	Comments
< 5.5	1	2	One reach assumes homogeneity for the entire segment. More reaches may be necessary to adequately represent distinct portions of the reach. Samples at the mouth and headwaters of each reach. Additional sites may be necessary to characterize tributaries or other peripheral influences.
5.5 - 20	2	3	Two reaches, headwaters and mouth reach. More reach breaks may be needed based on changes in geomorphology, land use, and significant tributaries. Samples at the upper and lower parts of each reach. Sampling site at reach break point may serve as as a midpoint for adjacent reaches. Additional sampling sites may be necessary within reach.
20 - 40	3	4	Three reaches; headwaters, middle third, and mouth reach. More reach breaks may be needed based on changes in geomorphology, land use, and significant tributaries. Samples at the upper and lower parts of each reach. Sampling sites at reach break points may serve as as a midpoint for adjacent reaches. Additional sampling sites may be necessary within reach.
40 - 60	4	5	Four reaches; headwaters, two of four, three of four, and mouth reach. More reach breaks may be needed based on changes in geomorphology, land use, and significant tributaries. Samples at the upper and lower parts of each reach. Sampling sites at reach break points may serve as as a midpoint for adjacent reaches. Additional sampling sites may be necessary within reach.
60 - 80	5	6	Five reaches; headwaters, two of five, three of five, four of five, and mouth reach. More reach breaks may be needed based on changes in geomorphology, land use, and significant tributaries. Samples at the upper and lower parts of each reach. Sampling sites at reach break points may serve as as a midpoint for adjacent reaches. Additional sampling sites may be necessary within reach.
80 - 100	6	7	Six reaches; headwaters, two of six, three of six, four of six, five of six and mouth reach. More reach breaks may be needed based on changes in geomorphology, land use, and significant tributaries. Samples at the upper and lower parts of each reach. Sampling sites at reach break points may serve as as a midpoint for adjacent reaches. Additional sampling sites may be necessary within reach.
>100	6+	7+	Segments greater than 100 miles occur primarily in the plains region. Reaches should not exceed 20 miles. Samples taken at the upper and lower parts of each reach. Sampling sites at reach break points may serve as as a midpoint for adjacent reaches. Additional sampling sites may be necessary within reach.

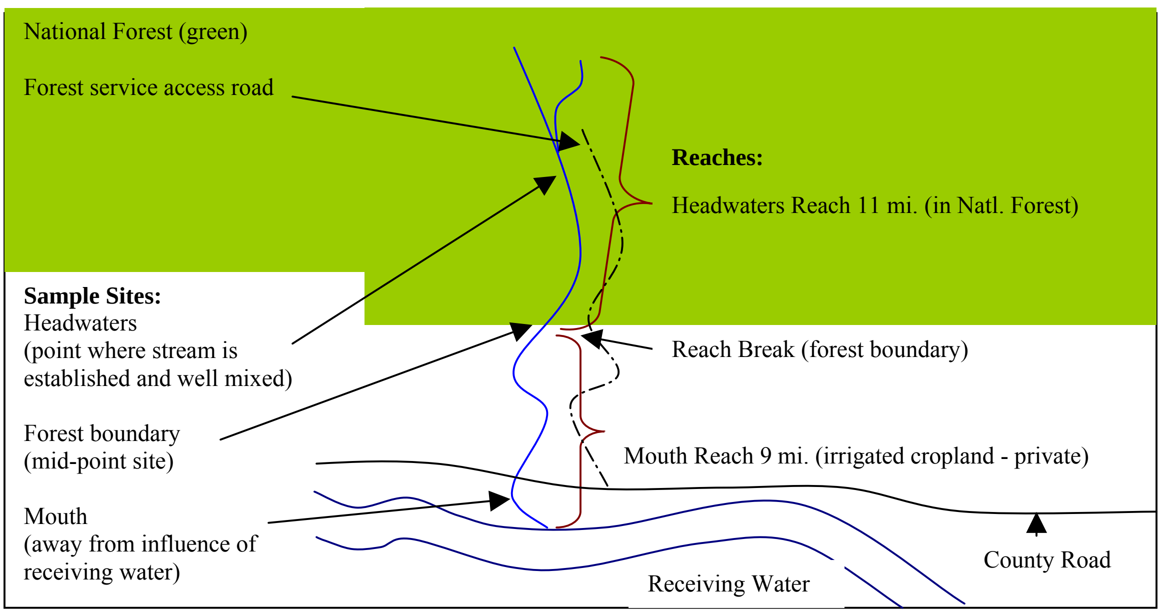
Determining preliminary stream reaches and sampling sites from maps is the second stage in planning a field effort. The results of this effort serve as the sampling framework for field crews.

Maps acquired from the State library website http://nris.state.mt.us/interactive.html include topographical maps, maps of historical land use activities, identification of private property owners (from cadastral), and other activities that may influence the sampling design. Also, readily available data from other agencies and organizations as well as previous water quality assessments are considered in this sampling design.

The recording of preliminary reach divisions and potential sampling sites are made on topographical maps. These preliminary points are marked on the map but not recorded in latitude and longitude unless they are from previously established sampling events from a reliable source (DEQ, USGS, or other agency using GPS (NAD 83 datum)). Preliminary points established in the sampling design will be verified using handheld GPS in the field and recorded on the site visit forms (Attachment 2).

Field crews determining reach breaks and sampling points from maps will look for changes in geomorphology, land use, private or public ownership, and significant peripheral influences such as tributaries, known point sources, abandoned mines, roads, bridges, dams or other structures that could contribute to impairment of beneficial uses. Figures 3.1 and 3.2 provide examples of various considerations that could influence the selection of reach breaks and sampling sites.

Figure 3.1 Reaches and sampling sites on a 20-mile segment (private property access granted)



Reaches are determined by differences in land use (in the example, irrigated cropland vs. public forest) and should generally follow the numbers estimated by total distance (Figure 3.0, page 24). Similarly, the number of sampling sites should generally follow the minimum number based on length. Other considerations are:

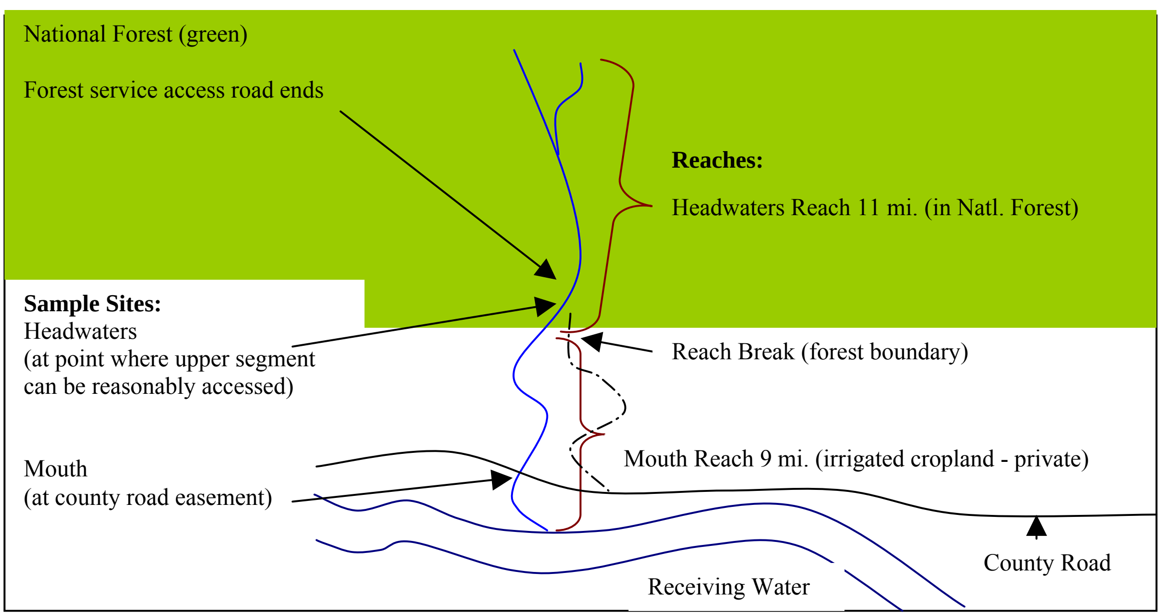
- Location of the upper sampling site in the headwaters reach considers the point where the small streams converge to form the main water body and are well mixed. The example has an access road allowing this headwaters sampling site to be established and sampled.
- The mid-point sampling site can serve as the lower sampling point for the headwaters reach and the upper sampling point for the mouth reach.
- The sampling site at the mouth is located upstream from its confluence with the receiving waterbody so that influences from the receiving water body are minimized.

In Figure 3.1, good stream access provides a number of potential sites to be considered by the field crew when selecting representative sampling sites at the mouth, reach break point and in the headwaters. The minimum number criteria based on length are met with the reach-break sampling site serving as a mid-point site. Further, adequate habitat assessments can be made by walking upstream and downstream from each sampling point and at points where the forest service access road allows the field crew to walk to the waterbody.

This design should result in data with acceptable technical components, spatial and temporal coverage, data quality, and data currency to achieve sufficient credible data provided all three data types (habitat, biology, and chemistry) are collected following DEQ procedures.

Figure 3.2 uses a similar water body but demonstrates how site access issues (roads & permission) dramatically influences the sampling design. In this example, the forest service access road does not go to the headwaters and private property access was denied. These two (common) limitations reduce the certainty that the data are representative of the segment and may preclude the use of the headwaters reach as an internal reference site.

Figure 3.2 Reaches and sampling sites on a 20-mile segment (private property access denied and limited public lands access)



In this example, the sampling design is limited by access. Sample site selection in the mouth reach is constrained to the area within the county road easement. This could limit the representativeness of the biological samples to the reach. Further, the habitat assessment for the mouth reach will have less certainty because access is limited to observations made at the bridge and possibly at points on the forest service road where the reach can be viewed (but not walked). Further, the sampling constraints may place more weight (in the weight-of-evidence test) on the chemistry samples taken at the county bridge and mid-point (two samples rather than three).

Limited access in the headwaters reach may require substantial effort to meet the two samples per reach minimum criteria. Some other considerations are:

- Is a regional reference site available? (If not, establishing a valid internal reference in the headwaters may necessary to proceed with the beneficial use determination.)
- If internal reference will be used, what certainty can be assigned to a single sampling point at the reach break? (Consider variability within methods and review maps to determine segment variability between upper and lower portion of headwaters reach)

1.3.1. Representative sampling sites

DEQ may not be able to revisit segments for years and, as demonstrated in figures 3.1 and 3.2, the sampling design consists of few sampling points to represent the waterbody. The field crews will use professional judgment to select the most representative site that can be sampled with methods available in the DEQ field procedures manual. For this, several simple guidelines apply.

1.3.1.1. Riffles, runs and pools (biological, chemistry, and field parameters)

Most of DEQ's biological and chemistry sampling methods were developed for sampling in well-developed riffles. Subsequently, the data collected for regional reference sites as well as the indices used by taxonomists to determine the health of biological communities come primarily from riffle environments. When a sampling site has a number of riffles, a riffle will be selected that is representative (average conditions) of the others.

The representative riffle will be far enough from peripheral influences so that the water column is well mixed across the site and is not influenced by down stream waterbodies (e.g., receiving body of water).

If riffles are poorly developed, dominated by boulders, or the stream is comprised of runs and pools, or is an intermittent pool-to-pool stream, the field crew will sample the stream with alternative techniques included in the DEQ Field Procedures Manual *after determining what the resulting data will be compared against.* For these, an internal reference site approach may be necessary.

1.3.1.2. Habitat Assessment (Reach scale measurement)

The conditions noted in the assessment are average conditions throughout the reach. Severe conditions at a single point should be noted but not extrapolated to the entire reach. This is particularly true for unobserved sections. Where site access is limited to a small portion of a reach, this must be noted on the assessment form in a statement describing the total distance observed and any circumstances that could result in uncertainty.

For example:

Certainty that the Habitat Assessment is representative of the entire reach is Fair. DEQ was denied private property access for the mouth reach. This Stream Reach Assessment describes the portion of the reach visible from the county road crossing, and visible down stream from the forest service boundary. (<20% of entire reach observed). The actual habitat conditions in the unobserved portion (>80%) are not known but do not appear to be significantly different based on Digital Ortho Quads and aerial photography obtained during pre-field season planning.

Or

This Stream Reach Assessment is very certain to represent the habitat conditions of the entire reach. DEQ was able to observe 85% of the reach from the mouth to the national forest *boundary through a combination of private property access granted by landowners and within the field of view available from the forest service access road.*

Describing the observed portion (by percentage) and correlating its relevance to the reach *while in the field* provides documentation for staff performing water quality assessments at a later date related to the certainty associated with the observations made.

The lowermost sampling site (STORET Station ID) will be used to identify the reach scale assessment with the reach that it applies to. The total number of reach scale habitat assessments performed will correspond to the number of reaches determined for the *segment*.

2. Sampling Methods

The field crews will use professional judgment to determine appropriate sampling methods for sites selected to represent each reach in the segment. The DEQ Field Procedures Manual (SOP WQPBWQM-020) describes the sampling methods that are available for the 2005 field season. Should the field crew determine that the available methods are not appropriate, they must justify an alternate technique by providing a method reference and demonstrate what their data will be compared against (standard or reference condition).

In the selection of methods, the field crew will consider the availability of a regional reference site. If one is not currently available, it may be necessary to establish (or reestablish) the regional reference site or use an internal reference approach.

2.1. Summary of Water Quality Assessment Monitoring Event (including methods)

1) "Ground Truth" stream reaches identified during pre-season planning.
2) Determine representative sampling site(s) within each reach.
3) Sample sites from downstream to upstream.
4) Initiate all required Field Forms for each sampling event.
    a) Identify sampling site with GPS and record Lat./Long on Site Visit Form (Datum NAD83).
5) Field Measurements and Chemical Sampling:
    a) Calibrate Field Meter and measure pH, conductivity, temperature, and dissolved oxygen (DO). Record values on site visit form. Turbidity can be measured on a Horiba U-10 but is most often an observed result based on the clarity of the water.
    b) Collect grab samples for water chemistry (Commons, Nutrients, TR Metals, TSS) and indicate sample identifiers and method of collection on site visit form
    c) Collect sediment samples and indicate sample identifiers and method of collection on site visit form (if mining sources are in the area).

6) Biological Sampling:
    a) Select representative riffle or pool. Collect macroinvertebrate sample using best available method.
    b) Conduct Macroinvertebrate habitat assessment
    c) Collect a periphyton sample from an undisturbed area of sampling site.

d) Determine Chlorophyll-*a* collection procedure(s), i.e. rock, hoop, phytoplankton and/or core method(s), and take samples. Indicate sample identifiers and method of collection on site visit form.

7) Physical/Habitat Measurements:
   a) Conduct Site Scale Habitat Assessment
   b) Complete Supplemental Site Information
   c) Characterize streambed material
      i) Wolman pebble count
   d) Measure channel cross-section and record.
      i) Determine stream classification (Rosgen - Optional)
   e) Measure discharge (Marsh-McBirney meter) or estimate flow and record results and method on Site Visit Form.

8) Verify that all pertinent field forms are completed:
   a) Site Visit Form
   b) Macroinvertebrate habitat assessment form
   c) Site Habitat Assessment
   d) Supplemental Site Form
   e) Laser Level or Non-Laser Channel Cross-Section
   f) Stream Classification (Optional)
   g) Total Discharge
   h) Chain-of-Custody (fill out upon return to vehicle)

9) Note: for 2005 Habitat Assessments are performed on two scales (site and reach). The Reach scale information is recorded after the second sampling site in the stream reach has completed and as much of the reach as possible has been viewed.

3. Sample Handling and Custody

DEQ sampling crews are responsible for the integrity of the sample from the time of collection until shipment to the DEQ Laboratory Coordinator. This responsibility includes proper storage, preservation and establishing the sample custody documentation.

3.1. Shipment or Delivery

DEQ will ship samples as needed to meet the EPA required holding times (Table 4.0, Page 31) and temperature requirements. The shortest holding time included in the standard suite of analyses is 7 days (TSS). When sampling crews are in the field for more than a week, they will use UPS or Greyhound bus to ship samples to the DEQ laboratory coordinator. Shipments will be made on Wednesdays to allow sufficient time for transportation, sample receipt, and login. If

All samples will be placed on dry ice or sufficient regular ice to drop the temperature of the samples to 4^{o}C within 6 hours of sampling. 4oC will be maintained throughout shipping until received by the laboratory. The laboratory will keep samples in a refrigerator maintained at a constant 4^{o}C until the time of analysis.

3.1.1. Chain of Custody (COC)

Chain-of-custody will be maintained for all DEQ samples from field sampling until the results are returned to DEQ. An example chain-of-custody is provided in Attachment 2, Field Forms. The sampling personnel must initiate the chain-of-custody before samples are placed in cold storage (this is typically when crews return to their vehicle). Upon receipt by the DEQ laboratory coordinator, the COC will be signed (by the lab coordinator) and checked for missing information. If any information is missing, the DEQ monitor will be contacted as soon as possible for resolution of the missing information. The DEQ QA Officer will be notified of all chain-of-custodies that arrive with missing information to determine if custody has been broken and sites resampled. The DEQ laboratory coordinator will take the samples to the laboratory and have the laboratory sample custodian sign the COC. Once in the possession of the laboratory, the COC is considered complete.

3.1.2. Samples for Chemistry

Table 4.0 details the standardized analytical chemistry measurements that will be used for water quality assessments. This table includes both standard and optional parameters, analytical methods, reporting limits, EPA holding times, and the required preservatives.

Samples requiring preservative will be preserved in the field using a measured amount of acid preservative provided by the laboratory. Acid is added to the sample, *not* visa verse.

The standard suite will require four bottles to be taken at each monitoring site.

1. A 1-liter HDPE bottle for Alkalinity, TSS, Sulfate and Chloride, unpreserved.
2. A 250 ml (State Lab) or 500 ml. (Energy) HDPE bottle for Nitrate/Nitrite, TKN, and Total Phosphorus, preserved with 1.25 ml of Sulfuric Acid (to pH <2.)
3. A 250 ml (State Lab) or 500 ml. (Energy) HDPE bottle for total recoverable metals (Sb, As, Ba, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, Se, Ag, Tl, Zn, and Hg) preserved with 1.25 ml of Nitric Acid (to pH <2.)
4. A 50 ml HDPE bottle (field filtered) for dissolved Aluminum, preserved with two drops of Nitric Acid (to pH <2.) Note: this sample is collected in a syringe (raw), a filter apparatus attached and that will be filtered in the field for dissolved aluminum analysis.

3.1.2.1. ***<u>Optional sample for sediment</u>***

A sediment sample may be taken if sedimentation is an issue for the segment (see Grab Samples for sediment page 28). Sediment samples will be taken in a 1 Liter HDPE wide mouth bottle, unpreserved.

Table 4.0 Standard TMDL Suite for Water Quality Assessment: Analytical Methods, Detection Limits, Holding Times, Bottles & Preservation

Parameter	EPA Method	Req. Report Limit ug/L	Holding time in Days	Bottle	Preservative
Commons					
Alkalinity (Bicarb., Carb.)	EPA 130.1	100	14	1L HDPE	4oC
TSS	EPA 160.2	1000	7	1L HDPE	4oC
Sulfate	EPA 300.0	50	28	1L HDPE	4oC
Chloride	EPA 300.0	50	28	1L HDPE	4oC
*Total Dissolved Solids (TDS)	EPA 160.1	1000	7	1L HDPE	4oC
Nutrients					
Nitrate-Nitrite as N	EPA 353.2	10	28	500ml HDPE	H2SO4, 4oC
TKN	EPA 351.2	100	28	500ml HDPE	H2SO4, 4oC
Phosphorus - Total	EPA 365.2	1	28	500ml HDPE	H2SO4, 4oC
Dissolved Metals (0.45 um)					
Aluminum	EPA 200.7	30	180	250ml HDPE	Filt., HNO3, 4oC
Calcium	EPA 200.7	200	180	250ml HDPE	Filt., HNO3, 4oC
Potassium	EPA 200.7	200	180	250ml HDPE	Filt., HNO3, 4oC
Magnesium	EPA 200.7	200	180	250ml HDPE	Filt., HNO3, 4oC
Sodium	EPA 200.7	200	180	250ml HDPE	Filt., HNO3, 4oC
Total Recoverable Metals					
Hardness (may be calc. From 200.7)	EPA 130.1	200	180	500ml HDPE	HNO3, 4oC
***Total Recoverable Metals*	EPA 200.2		180	500ml HDPE	HNO3, 4oC
*Mercury	EPA 200.8	0.01	180	500ml HDPE	HNO3, 4oC
Antimony	EPA 200.8	3	180	500ml HDPE	HNO3, 4oC
Arsenic	EPA 200.8	3	180	500ml HDPE	HNO3, 4oC
Barium	EPA 200.7	5	180	500ml HDPE	HNO3, 4oC
Beryllium	EPA 200.7	1	180	500ml HDPE	HNO3, 4oC
Cadmium	EPA 200.8	0.08	180	500ml HDPE	HNO3, 4oC
Chromium	EPA 200.8	1	180	500ml HDPE	HNO3, 4oC
Copper	EPA 200.8	1	180	500ml HDPE	HNO3, 4oC
Iron	EPA 200.7	50	180	500ml HDPE	HNO3, 4oC
Lead	EPA 200.8	0.5	180	500ml HDPE	HNO3, 4oC
Manganese	EPA 200.7	5	180	500ml HDPE	HNO3, 4oC
Nickel	EPA 200.7/8	10	180	500ml HDPE	HNO3, 4oC
Selenium	EPA 200.8	1	180	500ml HDPE	HNO3, 4oC
Silver	EPA 200.8	1	180	500ml HDPE	HNO3, 4oC
Thallium	EPA 200.8	0.2	180	500ml HDPE	HNO3, 4oC
Zinc	EPA 200.7	10	180	500ml HDPE	HNO3, 4oC
Calculations					
Cation/Anion Balance (CAB)	Calc				
Sodium Absorbtion Ratio (SAR)	Calc				

* Optional Analyses based on potential source in watershed or need to characterize.
** Total Metals may be requested for a sediment sample.

4. Quality Control

4.1. Inspection/Acceptance of Supplies and Consumables

Supplies and consumables used for assessment monitoring must be free of contaminants that could result in false positive result and an incorrect impairment decision.

The laboratory will provide sample bottles used for chemistry samples. These are to be new bottles (not recycled/cleaned bottles from previous submittals). The manufacturer of the bottles or reagents verifies their product to be free of contaminants by providing the results of assays. The laboratories providing sample bottles and preservatives retain the results of these assays.

4.2. Field sampling quality control

4.2.1. Field Blanks

DEQ will verify that site conditions and reagents are not sources of contamination by performing field blanks at the beginning, middle, and end of the season.

Field blanks will originate at the laboratory by supplying DEQ with reagent water (ASTM Type II) and sample bottles. A sample bottle will be selected from the same lot used as used by DEQ for field samples and filled with the laboratories reagent water. It will be preserved in the field along with samples taken from the site. The field blank will be identify as such, recorded on the Chain-of-custody and returned to the laboratory with the shipment of samples:

Field blanks will be submitted for the following parameters:

- Total recoverable metals (Sb, As, Ba, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, Se, Ag, Tl, Zn, and Hg)
- Alkalinity, Sulfate, TSS, TDS, and Chloride
- Nitrate/Nitrite, TKN, and Total Phosphorus

Field blanks will <u>not</u> be used for the following measurements: Chlorophyll-a, periphyton, macroinvertebrates, or the field parameters (pH, Conductivity, Turbidity, Temperature, and Dissolved Oxygen.)

The criteria for field blanks will be the same as for Method Blanks (page 33).

4.2.2. Field Replicates (sampling reproducibility <u>and</u> laboratory precision)

Field replicates are used to assess both the reproducibility of the sampling technique and the precision of the analytical method. Other factors such as homogeneity of the sampled media can influence field replicates. Because these QC samples indicate the entire sample process they become very important for understanding the variability of the final results. Where the variance is high, a larger number of samples would have to be taken to arrive at higher certainty that the decisions made with the data are not in error.

4.2.2.1. <u>Field Replicate Schedule</u>

Each field crew will submit Replicate samples at the beginning, middle, and end of their sampling season.

QC Sample Type	Criteria*	Measurement	Outlier Action
Field Replicate - Water	35% RPD	Sampling & Lab Precision Sample Homogeneity	Qualify data, review field SOPs w/ sampler, compare results with sample duplicate.
Field Replicate – Solid	50% RPD	Sampling & Lab Precision Sample Homogeneity	Qualify data, review field SOPs w/ sampler, compare results with sample duplicate.

4.3. Laboratory Quality Control

4.3.1. Method Blanks

Method Blanks (a.k.a. Reagent Blanks) are used to assess possible contamination during the preparation and processing steps. The method blank must be processed along with and under the same conditions as the associated samples to include all steps of the analytical procedure. Method Blanks must be analyzed at a minimum of 1 per preparation batch with a maximum batch size of 20 environmental samples of the same matrix.

QC Sample Type	Criteria*	Measurement	Outlier Corrective Action
Method Blank - Water	< MDL	Method Contamination	Reprep/reanalyze batch
Method Blank – Solid	< MDL	Method Contamination	Reprep/reanalyze batch

* Per reference method or as listed, whichever is lower.

4.3.2. Laboratory Spiked Samples

A Laboratory Control Samples (LCS) is used to evaluate the performance of the entire method including all preparation and analysis steps. Results of the LCS are compared to method criteria indicating if the method is in control. All samples associated with an out of control LCS must be reanalyzed. The LCS is processed along with samples including all preparation steps of the method. The LCS is analyzed at a minimum of 1 per preparation batch with a maximum batch size of 20 samples of the same matrix. The LCS is spiked at 10 – 20 x the MDL to reflect the methods ability to accurately measure low-level concentrations of the target analyte. LCS is not used for tests such as pH, color, temperature, DO or turbidity. Methods with long lists of analytes (typicallly organic analyses) use a representative list of analytes to measure method control.

QC Sample Type	Criteria*	Measurement	Outlier Action
LCS - Water	80-120% Rec.	Method Accuracy	Reprep/reanalyze batch
LCS – Solid**	70-130% Rec.	Method Accuracy	Reprep/reanalyze batch

*Per reference method if included. Spiked concentration within 10-20 x the MDL. LCS for analysis of solid samples typically is an aqueous matrix following through the method.
**Where the use of a solid matrix LCS is required by the method (e.g., Ottawa Sand) recovery limits are acceptable

4.3.3. Matrix Spikes

Matrix Spikes & Matrix Spike Duplicates (MS/MSD) indicates the effect of the matrix on both the precision and accuracy of the results generated using the selected method. MS/MSD are replicate aliquots of an analytical sample, spiked with a known concentration of the target analyte. Spike concentrations should be 3 – 5 x the parent sample concentration, or 20 – 50x the MDL. Matrix spikes alone are not used to judge laboratory performance because they are matrix specific. If sample duplicates (above) are below the practical quantitation level, the MS/MSD can be used to determine method precision.

QC Sample Type	Criteria*	Measurement	Outlier Action**
MS/MSD - Water	Accuracy: 75-125 %Recovery Precision: 20% RPD	Preparation efficiency, Matrix interference, Method Accuracy Sample Homogeneity	Determine Cause, Reprep/reanalyze batch or flag data per method requirements.
MS/MSD - Solid	Accuracy: 65-135 %Recovery Precision: 35% RPD	Preparation Efficiency, Matrix Interference, Method Precision, Sample Homogeneity	Determine Cause, Reprep/reanalyze batch or flag data per method requirements.

* Per reference method or as listed, whichever is more stringent.
** Matrix Spike out of control may reflect: non-homogenous samples, sample concentrations >4x spike concentration, matrix interference, poor extraction efficiency, or loss of method control.

4.3.4. Surrogate Spikes

Surrogates are used to measure the recovery characteristics of *every* matrix by the addition of a known concentration of a compound similar in chemistry to the target analytes. No tests requiring surrogates are planned for the 2005 field season.

4.3.5. Sample Duplicates (laboratory precision)

Defined as replicate aliquots of the same sample taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. The sample duplicate provides a useable measure of precision only when target analytes are found in the sample chosen for duplication. For this reason, Matrix Spikes and Matrix Spike Duplicates discussed above are also used to assess matrix and laboratory precision.

QC Sample Type	Criteria*	Measurement	Outlier Action
Matrix Duplicate - Water	20% RPD	Lab Precision, Sample Homogeneity	Corrective actions per method and/or qualify data.
Matrix Duplicate – Solid	35% RPD	Lab Precision, Sample Homogeneity	Corrective actions per lab SOP and/or qualify data.

* Per reference method if more stringent than listed. For concentrations detected above Practical Quantitation Limit (PQL)

4.4. Field Instruments

The precision and accuracy of field instruments are not tested using quality control samples. Precision and accuracy statements for the Horiba and YSI meters are included in the instrument operations manuals.

5. Instrument/Equipment Testing, Inspection, and Maintenance

5.1. Field Equipment - Pre season Maintenance and Initial Calibration

DEQ will prepare all field equipment for the 2005 field season prior to the field training sessions. Equipment will undergo routine maintenance, initial calibration and subsequently field tested at the training day.

5.2. Analytical Laboratories and Biological Contractors

Contractors are responsible for the routine maintenance of their equipment per manufacturers instructions. Procedures and frequency for equipment inspection and maintenance must be described in the laboratories Laboratory Quality Assurance Plan (LQAP). A copy of the LQAPs for Energy Laboratories and the Department of Public Health and Human Services laboratory are on file with the QA officer.

6. Instrument/Equipment Calibration and Frequency

6.1. Calibration - Laboratory

Analytical method calibration criteria are specified in the reference analytical method from EPA, APHA, or USGS. Calibrations can include initial and continuing calibrations as well as internally calibrated methods such as the Method of Standard Additions (MSA). The reporting of a result under a referenced method is a statement by the laboratory that the calibration criteria for that method have been performed, examined and pass the control limits established in the method. Results reported under a reference method without the calibrations and control limits specified in the method will not be accepted by DEQ.

6.2. Calibration – Field Instruments

Initial calibration of field instruments will be performed prior to the field season. Continuing calibration will occur according to the frequency prescribed in the instrument manufacturers instructions (reiterated in the DEQ Field Procedures Manual (SOP WQPBWQM-020)). All calibrations will be documented in calibration logs stored with the instrument by indicating date and operator.

Corrective actions for failed calibrations are detailed in the instrument manufacturers operating manual. Failure to perform and record calibration of field instrument will result in resampling the field site for the field parameters.

7. Non-direct measurements

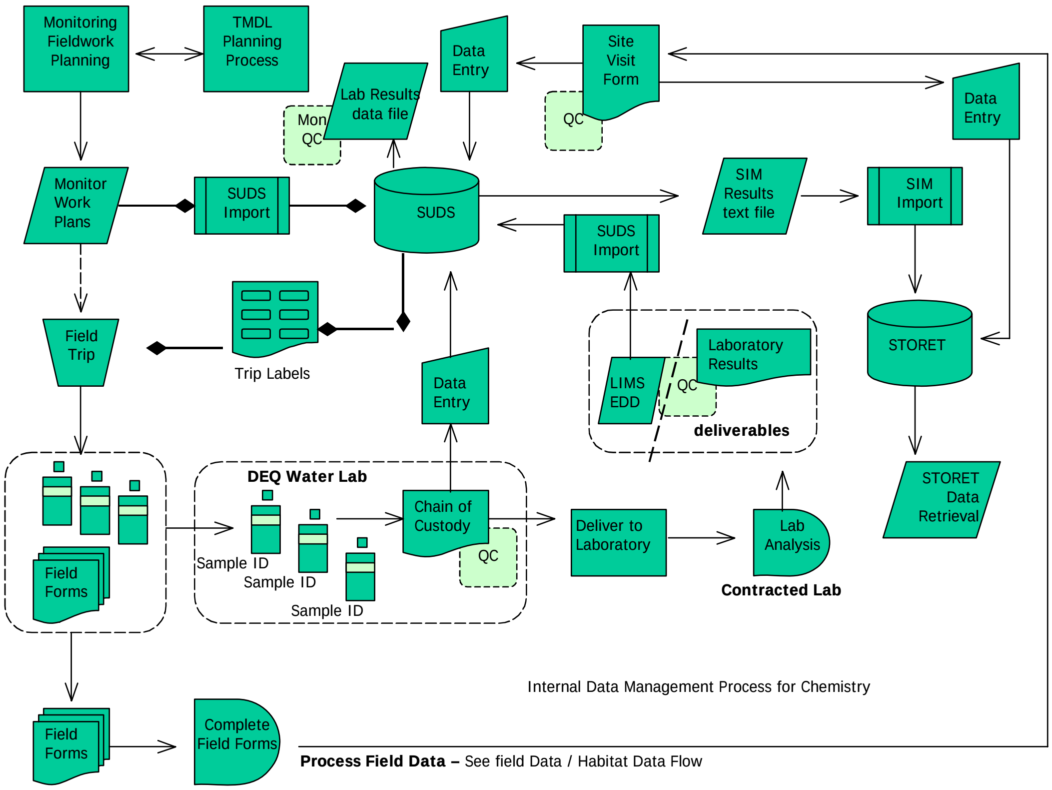
Non-direct measurements are data collected using professional judgment and observation. Examples of these are the Habitat Assessments (DEQ Stream Reach Assessment and NRCS Riparian Assessment). Non-direct measurements are controlled through the use of standardized questions or by prompting the observer to look for certain physical features and provide comment.

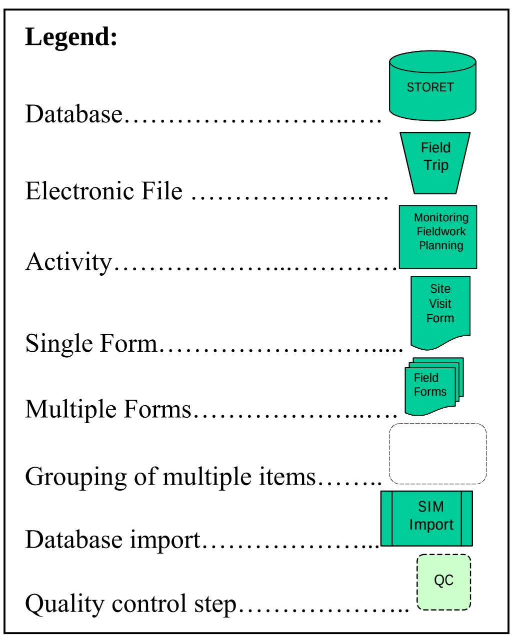
Rather than calibrating non-direct measurements, training and feedback is provided to standardize observations and comments among users. Field training for the habitat assessment methods is given in the annual DEQ field-training day.

8. Data Management

Figure 5.0 describes the flow of information from the planning phase through completion of the analyses and the final entry into STORET.

Figure 5.0 Data Flow Path(s)





8.1. Field Forms

DEQ uses a series of field forms to document the various field measurements and observations made by field crews. Some of these forms are used for capturing data for STORET while others are used to provide commentary information for assessors. Instructions for completing field forms are given at the annual field season training.

Core forms are the required forms for a field event. Non-core forms are supplemental forms used for optional geomorphology measurements.

All field forms for the 2005 field season are included in Attachment 2

Core Forms

- Site Visit Form
- Macroinvertibrate Habitat Assessment Form (Riffle/Run Prevalence) or,
    - Macroinvertibrate Habitat Assessment Form (Glide/Pool Prevalent Streams)
- Total Discharge
- Laser Level Channel Cross-section or,
    - Channel Cross-section (non-laser)
- Substrate Pebble Count (dot-dash)
- Site Map
- Site Scale Habitat Assessment (includes supplementary pages as follows)
    - Supplementary Site Information
    - Summary
    - Discussion of Reference Condition
    - Photograph locations and Descriptions
- Reach Scale Habitat Assessment (NRCS Riparian Assessment + Reach scale components from EMAP and DEQ)

Non-Core Forms

- Rosgen Stream Classification (optional)
- Stream Slope
- Percent Fines
- Riffle Stability Index

8.2. Laboratory Reports and Electronic Deliverables

Analytical laboratories and biological contractors are required to return result in a STORET Import Module (SIM) compatible format. This file must be a text file with values separated by commas (csv). The format for a SIM compatible deliverable was revised several times over the past year. Please check with Deb Dorland at 444-2407 to verify the most recent version of the SIM format. The most current format (as of the publishing date of this QAPP) is provided in Table 5.1.

Table 5.1 Interim SIM Compatible EDD

SIM FieldName	Descriptive Name	Data Type	Max Length	Required	***Remarks***
ProjectID	Project Name	free text			Client defined - correlates to Project ID - Client will likely provide a *Project Name*
TripID	Tracking #	free text			Client defined code to group data deliverables (sometimes a *Project-Year*)
SampleID	Sample ID	free text		X	Client defined sample identification - **Station designation** or sample tracking number
ActivityID	Lab Sample ID	text	12	X	Laboratory defined sample ID; Alpha numeric **12 character limit** with no spaces.
Medium	Medium	defined list		X	If the matrix is not does not correspond to a value on the Medium list, please report laboratory defined matrix.
ActivityComment	Sample Comment	free text	255		Laboratory sample remark or qualifier - applicable to the entire sample.
ActivityStartDate	Collection Date	date/time	N/A	X	Valid Date - must be reported separate from collection time.
ActivityStartTime	Collection Time	date/time	N/A		Valid Time - must be reported separate from collection date.
Characteristic	Analyte	defined list	60	X	Laboratory analyte reported will match STORET List of Values for *Characteristic* - DEQ may be able to facilitate translation* of analytes reported using SIM.
ResultValue	Result	numeric or list	10	X	Please report result value in a single field. Acceptable values are numeric, or text options from the ResultValue list. DEQ may be able to facilitate translation* of text values using SIM.
ResultValueUnits	Result units	defined list	N/A	X	Laboratory will match STORET List of Values for units - DEQ may be able to facilitate translation* of text values using SIM.
ValueType		defined list	N/A	X	Required for "Calculated" or "Estimated" values. Others default to "Actual".
DetectionLimit	Reporting limit	numeric		X	Detection Limit - Analytical Method detection limit.
DetectionLimitUnits	Reporting units	defined list	10	X	Detection Limit units are required. Please provide units as for ResultValueUnits.
DetectionLimitComment		free text	255		Comments specific to or impacting the Detection Limit for a given analysis.
AnalysisDate	Analysis Date	date/time	N/A	X	Valid Date - must be reported separate from analysis time.
AnalysisTime		date/time	N/A		Valid Time - must be reported separate from analysis date.
FieldLabProcedure	Method	defined list	N/A	X	Laboratory will match STORET List of Values for analytical methods - DEQ may be able to facilitate translation* of analytical methods using SIM.
SampleFraction	Sample Fraction Analyzed, as "Dissolved"	defined list	N/A	X	Laboratory will match STORET List of Values for Sample Fraction - Many analytes require the Sample Fraction field be provided. This is indicated in the longLists.xls spreadsheet reference, available on request. DEQ may be able to facilitate translation* of sample fraction using SIM.
LabSamplePrepProcedure	Prep method	defined list	N/A		List of Values for Prep Procedures for acid sample digestions, etc.
ResultComment	Result Comment	free text	255		Lab *result* remark or qualifier. Separate fields als exist for Detection Limit Comment or qualifier, and Sample Comment.
Personnel	collected by	free text			laboratory will capture this information if provided in the sample submittal process
LaboratoryID	Acronym for Laboratory	defined list	8 char	X	Suggest lab define an acronym of 8 characters or less to populate this column. Contact DEQ data management to establish in the DEQ STORET database.
LaboratoryBatchID	Batch Run Identifier	text	10 char		Batch Run ID

Acceptable interim file format will be a **csv** file, a delimited text file (ASCII) or an Excel spreadsheet.

STORET Lists of Acceptable Values for characteristics, Methods, prep-procedures, units will be provided in a separate spreadsheet, "longLists.xls".

This is an Interim format. There may be minor modifications to this format in the future depending on software upgrades.

effort would result in a custom configuration or translation that processes the data provided into the pre-determined values each time it is imported using SIM.

Group C. Assessment and Oversight

1. Assessments and Response Actions

1.1. Laboratories and Biological Contractors

At the beginning of 2005, the QA Officer obtained a current copy of the laboratories Laboratory Quality Assurance Plan (LQAP) and the Method Detection Limits (MDL) for the analyses in Table 4.0. The MDLs were reviewed to assure that the required method sensitivity is available and any method adjustments needed were made. The LQAP was reviewed to determine if the QA systems, including Laboratory Information Management System (LIMS) is available for the season.

The DEQ QA Officer will visit the two (2) analytical laboratories used for the 2005 field season during the middle of the field season. This visit will include an inspection of the general hygiene and instrument availability of the two laboratories.

Biological contractors were selected based upon a request for qualifications in May. DEQ staff from the water quality standards section will visit the contractors on an as needed basis to examine the operations and provide feedback resulting from the quality control measurements described on pages 19-22.

1.2. Assessment of Field Activities and Corrective Actions

The DEQ monitoring program manager and DEQ QA Officer will visit select field crews once during the 2005 field season. This assessment of field crews will serve as follow-up to the field training provided at the beginning of the field season by providing immediate feedback and corrective actions to crews. Each field crew will be visited once, for an entire day. This will result in 2-3 assessments.

The specific items that will be reviewed are:

Field planning and preparedness
- Work plan available and being followed?
- Adequate supplies and consumables?

Reach and site selection
- Discussion between field crewmembers on representative site selection?
- Was site access an issue and how was this mitigated in the sampling design?

Sampling methodology
- Sampling sequence
- Sampling performed in accordance with SOPs
- Field instruments calibrated and log filled out?
- Samples properly preserved, packed?

Documentation and Submittal
- Forms filled out at the time of sampling?
- Courier arranged for mid-week samples?

- STORET labels available and used?

2. Reports to Management

2.1. Laboratory and Field Crew Assessments

The DEQ QA officer and Water Quality Monitoring Section Supervisor will conduct field reviews of the sampling crews to determine conformity with training, guidance, and standard operating procedures. Results of this field audit will be reported to the WQPB Monitoring section supervisor and bureau chief.

Recommendations resulting from laboratory and field crew visits will be articulated to the crews at the time of the visit and followed up with written comments. The Water Quality Monitoring Section Supervisor will retain copies of written comments from the QA officer. These reports to management will be completed two weeks following the visit.

2.2. Results of Analytical Report and QC Summary Reviews

Review of analytical reports and QC summaries is expected to be an ongoing effort. Where systemic problems are indicated, the QA Officer will present a description of the problem and suggested corrective actions to the laboratory. Depending on the nature and extent of the issues involved, assessments of data may be copied to the WQPB Bureau Chief for guidance and response.

Group D. Data Validation and Usability

1. Data Review, Verification, and Validation

Data returned from the laboratories and biological contractors will be QC reviewed but not validated to the level of raw data unless systemic problems become evident from review of results and QC summaries. Review of analytical reports and quality control summaries are adequate for the decision impaired/not impaired and the selection of probable cause and sources.

1.1. Data Review by Laboratories and Biological Contractors

It is the responsibility of the laboratory to provide analytical results conforming to the requirements of the methods that they perform. These methods must be reported under a reference analytical method from EPA, Standard Methods, USGS, or other recognized organization. Where a substantial modification to a recognized method is being performed, the reference must note this by including “mod” or “modified” following the method citation.

1.2. Review by the Laboratory Coordinator

The first review of data returned from laboratories and biological contractors will be a completeness review performed by the DEQ laboratory coordinator. The completeness review will include checking the results returned against the chain-of-custody, comparing electronic deliverable against the hardcopy to verify that all results are included in both, and checking the invoices against the completed analytical report. Compliance with the 95% completeness goal will be determined on an ongoing basis as data is returned incrementally from the laboratories. If completeness falls below 95%, an investigation of the problem(s) that caused the loss of data will be performed so that corrective actions may be applied.

1.3. Review by QA Officer

The QC review by the QA Officer will include review of the QC Summary for each analytical report to determine compliance with the project required Precision, Accuracy, Comparability, and Sensitivity.

Precision will be verified by reviewing the results of duplicate and MS/MSD results in the QC summary against the criteria included in the Data Quality Indicators and Quality Control Sections of this QAPP (pages 17-21 and 29-32, respectively) of this QAPP.
Accuracy will be verified by comparing the results of the Laboratory Control Samples (LCS) with the criteria established in the Quality Control Section (pgs. 29-32) of this QAPP for laboratories and the taxa lists and reference collections required in the DEQ SOPs in SOP WQPBWQM-009.
Comparability & Sensitivity will be verified by comparing the methods and detection limits identified in the reports against those required in on pages 28-29 of this QAPP. For biological results, the use of external reference conditions must be from the timeframe in the index period.

If any of the above criteria are not met, a request for the laboratory to reanalyze (if holding times allow) will be made by the QA Officer or data either rejected or flagged accordingly.

1.4. Review by Regional Monitors

The quality control review provided by the monitors (sampling personnel) will include verifying representativeness of the result used for assessment with the results of field replicates. It is important that the monitors themselves consider representativeness, as they will be basing a decision on the certainty of the results to adequately characterize the segment. Further field personnel have site-specific knowledge available from their field notes to augment the results of duplicate and replicates samples from the QA officer. Consideration will include whether sampled media allowed representative sampling to occur. If outlier values in either the replicate sampling or odd results are suspected, the QA officer and monitor will collaborate to make a decision on the certainty of the results and the level of certainty that should be assigned to the data.

1.5. Data Validation

Where analytical results are being routinely returned from an analytical laboratory or biological contractor with repeated failure to meet the DQI's specified in this QAPP, the QA officer may request all raw data for a data set and perform a full data validation according to the guidance from EPA's Guidance on Environmental Data Verification and Data Validation, EPA QA/G-8.

2. Reconciliation with User Requirements

Monitors are responsible for reconciliation of the sample results and environmental information they collect during the field season with the beneficial use support determinations for each segment.

Attachment 1

2005 Field Season Monitoring Plans

2005 Field Plan

								Use Support							# samples per stream															Lakes		Other				Est. Month
Category	Group	Watershed	Segment name	HUC#	ID Number	Size	Units	Aqua Life	Cold Fish	Warm Fish	Drinking	Swim (Rec)	Agriculture	Industry	1996 Causes	2004 Causes	# Sites	Common Ions	Metals (w)	Nutrients	TSS	TDS	Metals (s)	Macros	Periphyton	Chl *a* (Phytoplank)	Chl *a* (rocks)	Chl *a* (hoop)	Chl *a* (core)	DO (Lakes)	Secchi Depth (Lakes)	Aquarods	Multi-parameter sondes	Bacteria	Temperature Data Loggers	
Reassessment	Columbia	LITTLE BLACKFOOT	SPOTTED DOG CREEK from forest boundary to the mouth (Little Blackfoot R)	17010201	MT76G004_032	10	Mi	X	X		X	P	X	X	siltation	flow alteration	2	2	2	2	2	0	0	2	2	0	2	0	0							July
Reassessment	Columbia	FLINT-ROCK	SMART CREEK T9N, R13W	17010202	MT76E003_110	11.2	Mi	X	X		X	X	F	F	Siltation, Thermal modifications, Flow alterations, Other habitat alterations	Non-SCD	2	2	2	2	2	0	0	2	2	0	2	0	0							July
Reassessment	Columbia	FLINT-ROCK	CAMP CREEK from headwaters to town of Philipsburg	17010202	MT76E003_130	1.8	Mi	X	X		F	X	F	F	Metals	Non-SCD	1	1	1	1	1	0	1	1	1	0	1	0	0							July
Reassessment	Columbia	BITTERROOT	N BURNT FORK CREEK, from Burnt Fk Bitterroot R to Bitterroot R	17010205	MT76H004_200	10.4	Mi	P	P		X	X	X	X	None	Nitrogen, Nutrients, Phosphorus, Siltation	2	2	2	2	2	0	0	2	2	0	2	0	0							July
Reassessment	Columbia	MIDDLE FORK FLATHEAD	CHALLENGE CREEK from headwaters to mouth (Granite Cr)	17010207	MT76I002_040	4.3	Mi	F	F		X	F	F	F	Siltation, Other habitat alterations	Pending DW	1	1	1	1	1	0	0	1	1	0	1	0	0							July
Reassessment	Columbia	FLATHEAD LAKE	SPRING CREEK from headwaters to mouth (Ashley Cr)	17010208	MT76O002_040	4.5	Mi	X	X		X	X	X	X	other habitat alterations, organic enrichment/ low DO, taste and odor, suspended solids	Non-SCD	1	1	1	1	1	0	0	1	1	0	1	0	0							July
Reassessment	EPA	MARIAS	MARIAS RIVER from Tiber Reservoir to Two Medicine R - Cut Bank Creek confluence	10030203	MT41P001_010	60	Mi	X	X		X	X	F	F	Nutrients, Salinity/TDS/Chlorides, Suspended Solids	Non-SCD	3	3	3	3	3	3	0	?	0	3	0	0	0							July
Other-TMDL	EPA	MARIAS	MARIAS RIVER from Tiber Dam to County Road X-ing in T29N,R6E,Sec17	10030203	MT41P001_021	10.8	Mi	X	X		X	F	F	F	Flow Alteration, Other Habitat Alterations	Flow Alteration, Other Habitat Alteration	1	1	1	1	1	0	0	?	0	1	0	0	0							July
Other-TMDL	EPA	MARIAS	MARIAS RIVER from County Road X-ing in T29N,R6E,Sec 17 to mouth (Missouri R)	10030203	MT41P001_022	70.89	Mi	P		P	X	F	F	F	Flow Alteration, Other Habitat Alterations	Flow Alteration	4	4	4	4	4	0	0	?	0	4	0	0	0							July
Reassessment	EPA	EAST GALLATIN	EAST GALLATIN RIVER from headwaters to Bridger Cr	10020008	MT41H003_010	7	Mi	X	X		X	X	X	X	Flow Alt, Other Habitat Alt	Non-SCD	2	2	2	2	2	0	2	2	2	0	2	0	0							August
Reassessment	EPA	EAST GALLATIN	EAST GALLATIN RIVER from Bridger Cr to Reese Cr	10020008	MT41H003_020	14.6	Mi	X	X		X	X	X	X	Flow Alt, Other Habitat Alt, Siltation, Nutrients, pH	Non-SCD	4	4	4	4	4	0	4	4	4	0	4	0	0							August
Reassessment	EPA	EAST GALLATIN	EAST GALLATIN RIVER from Reese Cr to the mouth (Gallatin R)	10020008	MT41H003_030	18.9	Mi	X	X		X	X	X	X	Flow Alt, Other Habitat Alt, Siltation, Nutrients, pH, Suspended Sloids, Unionized Ammonia	Non-SCD	3	3	3	3	3	0	3	3	3	0	3	0	0							August
Other TMDL	EPA	UPPER SMITH	N F SMITH RIVER from Lake Sutherlin to mouth	10030103	MT41J002_011	19.5	Mi	F	F		F	P	X	F	Flow Alteration, Siltation	Algal growth/Chl *a*, N, nutrients, pathogens, phosphorus	2	2	2	2	2	0	2	2	2	0	2	0	0							August
Other TMDL	EPA	UPPER SMITH	SHEEP CREEK from headwaters to mouth (Smith R)	10030103	MT41J002_030	36.7	Mi	X	X		N	N	F	F	Flow Alteration, Other habitat alterations, siltation	Pathogens, Metals, Mercury	3	3	3	3	3	0	3	3	3	0	3	0	0							August
Reassessment	EPA	UPPER SMITH	BENTON GULCH from headwaters to mouth (Smith R)	10030103	MT41J002_050	12.7	Mi	X	X		X	N	X	X	Flow Alteration, Other habitat alterations, siltation	Pathogens	2	2	2	2	2	0	2	2	2	0	2	0	0							August
Reassessment	EPA	UPPER SMITH	CAMAS CREEK from junction of Big and Little Camas Cr to mouth (Smith R)	10030103	MT41J002_110	13.8	Mi	X	X		X	N	X	X	Flow alteration, Other habitat alterations	Pathogens	2	2	2	2	2	0	2	2	2	0	2	0	0							August
Reassessment	EPA	UPPER MILK	MILK RIVER from Eastern U.S. border crossing to Fresno Res.	10050002	MT40F003_010	31.9	Mi	X		X	X	X	X	X	Siltation, Flow Alteration, Nutrients, Other Habitat Alterations	Non-SCD	2	2	2	2	2	0		?	0	2	0	0	0							August
Other-TMDL	EPA	MIDDLE MILK	MILK RIVER from Fresno Dam to Whitewater Creek	10050004	MT40J001_010	270.4	Mi	X		X	NS	X	F	F	Flow Alteration, Nutrients, Other Habitat Alterations	Metals, Mercury	3	3	3	3	3	0		3	0	3	0	0	0							August
Other-TMDL	EPA	MIDDLE MILK	MILK RIVER from Whitewater Creek to Beaver Creek	10050004	MT40J001_020	38.2	Mi	X		X	NS	X	F	F	Flow Alteration, Nutrients, Other Habitat Alterations, Other Inorganics, Salinity/TDS/Chlorides	Metals, Mercury	1	1	1	1	1	1	1	1	0	1	0	0	0							August
Other-TMDL	EPA	LOWER MILK	MILK RIVER from Beaver Creek to mouth (Missouri R.)	10050012	MT40O001_010	135	Mi	X		X	NS	TH	P	P	Flow Alteration, Nutrients, Other Habitat Alterations, Other Inorganics, Salinity/TDS/Chlorides	Pathogens, Metals, Nutrients, Mercury	4	4	4	4	4	1	1	1	0	4	0	0	0							August
Reassessment	EPA	UPPER MO-CANYON FERRY	MISSOURI RIVER from headwaters to Toston Dam	10030101	MT41I001_011	21	Mi	X	X		X	X	X	X	Suspended Solids, Nutrients, Thermal Mod	Non-SCD	3	3	3	3	3	0	3	3	3	0	3	0	0							September
Reassessment	EPA	UPPER MO-DEARBORN	MISSOURI RIVER from Little Prickly Pear Cr to Sheep Cr.	10030102	MT41Q002_050	15.9	Mi	X	X		X	F	X	X	Flow Alt, Siltation, Metals, Nutrients, Other Inorganics, Suspended Solids	Non-SCD	3	3	3	3	3	0	3	3	3	0	3	0	0							September
1996 List	EPA	SOUTH FORK FLATHEAD	SOUTH FORK FLATHEAD RIVER from Hungry Horse Dam to mouth	17010209	MT76J001_010	5.1	Mi	X	X		X	P	F	F	Flow alteration, Other habitat alterations	Flow Alteration	1	1	1	1	1	0	0	1	1	0	1	0	0							September
Reassessment	EPA	LOWER CLARK FORK	CLARK FORK RIVER between Cabinet Gorge Reservoir and Noxon Dam	17010213	MT76N001_020	2.8	Mi	X	X		X	X	X	X	siltation, other habitat alterations, pathogens	Non-SCD	1	1	1	1	1	0	0	1	1	0	1	0	0							September
Reassessment	Lower Missouri	UPPER MUSSELSHELL	ANTELOPE CREEK, Headwaters to the mouth	1040201	MT40A002_020	31.2	Mi	X		X	X	X	X	X	Not on 1996 list	Non-SCD	3	3	3	3	3	0	0	3	3	0	3	3	0							July
Reassessment	Lower Missouri	UPPER MUSSELSHELL	TRAIL CREEK, Headwaters to mouth (North Fork Musselshell R)	1040201	MT40A002_030	9.3	Mi	X		X	X	X	X	X	Not on 1996 list	Non-SCD	2	2	2	2	2	0	0	2	2	0	2	2	0							July
Reassessment	Lower Missouri	FORT PECK RESERVOIR	CK CREEK, Ruby Cr (Near Headwaters) to Fort Peck Reservoir	10040104	MT40E002_080	43.8	Mi	X		X		X			Other habitat alterations, siltation	Non-SCD	4	4	4	4	0	0	0	4	4	0	4	4	4							June
Reassessment	Lower Missouri	FORT PECK RESERVOIR	SULLIVAN CREEK, tributary to Rock Cr near Landusky	10040104	MT40E002_110	0.7	Mi	X	X	X		X				Non-SCD	1	1	1	1	1	0	1	1	1	0	1	1	1							June
Reassessment	Lower Missouri	MIDDLE MILK	BEAVER CREEK, Beaver creek reservoir to mouth (Milk R)	10050004	MT40J002_010	22	Mi	X	X	X	X	X	X	X	Flow Alteration, Nutrients, Siltation, Thermal Modification	Non-SCD	3	3	3	3	3	0	0	3	3	0	3	3	3							August
Reassessment	Lower Missouri	MIDDLE MILK	BULLHOOK CREEK, headwaters to mouth (Milk R)	10050004	MT40J002_020	23.2	Mi	X	X	X	X	X	X	X	Nutrients, Siltation, Thermal Modification	Non-SCD	3	3	3	3	3	0	0	3	3	0	3	3	3							August
Reassessment	Lower Missouri	MIDDLE MILK	LITTLE BOXELDER CREEK, headwaters to mouth (Milk R)	10050004	MT40J002_030	43.1	Mi	X	X	X	X	X	X	X	Nutrients, Siltation, Thermal Modification	Non-SCD	4	4	4	4	4	0	0	4	4	0	4	4	4							August
Reassessment	Lower Missouri	LODGE	LODGE CREEK, from Canadian Border to mouth (Milk R)	10050007	MT40J003_010	73.4	Mi	X		X	X	X	X	X	Noxious Aquatic Plants, Nutrients, Organic Enrichment/DO, Other Inorganics, Salinity/TDS/Chlorides	Non-SCD	5	5	5	5	5	0	0	5	5	0	5	5	5							August
Reassessment	Lower Missouri	PEOPLES	PEOPLES CREEK,Headwaters to the Fort Belknap Reservation Boundary.	10050009	MT40I001_020	47.7	Mi	X		X	X	X	X	X	flow alteration, salinity/TDS/chlorides, suspended solids, thermal modifications	Non-SCD	4	4	4	4	4	4	0	4	0	4	4	4	4							July
Reassessment	Lower Missouri	PEOPLES	BIG HORN CREEK, Zortman Mine to Fort Belknap Reservation	10050009	MT40I001_030	0.8	Mi	X	X		X	X	X	X	metals	Non-SCD	1	1	1	1	1	0	1	1	1	0	1	1	1							June
Reassessment	Lower Missouri	COTTONWOOD	BLACK COULEE, Headwaters to the mouth (Cottonwood Cr)	10050010	MT40J005_010	18.9	Mi	X		X	X	X	X	X	flow alteration, siltation	Non-SCD	2	2	2	2	2	0	0	2	2	0	2	2	2							June
Reassessment	Lower Missouri	COTTONWOOD	COTTONWOOD CREEK, Black Coulee to the mouth (Milk R)	10050010	MT40J005_020	54.1	Mi	X		X	X	X	X	X	flow alteration, siltation, suspended solids	Non-SCD	4	4	4	4	4	0	0	4	4	0	4	4	4							June
Reassessment	Lower Missouri	WHITEWATER	WHITEWATER CREEK, Canadian border to the mouth (Milk R)	10050011	MT40K001_010	61.7	Mi	X		X	X	X	X	X	flow alteration, nutrients, siltation	Non-SCD	5	5	5	5	5	0	0	5	5	0	5	5	5							July
Reassessment	Lower Missouri	LOWER MILK	CHERRY CREEK from headwaters to the mouth (Milk R)	10050012	MT40O002_010	38.3	Mi	X		X	X	X	X	X	flow alteration, other habitat alterations	Non-SCD	3	3	3	3	3	0	0	3	3	0	3	3	3							May
Reassessment	Lower Missouri	LOWER MILK	BUGGY CREEK from headwaters to the mouth (Milk R)	10050012	MT40O002_020	41.8	Mi	X		X	X	X	X	X	flow alteration, other habitat alterations	Non-SCD	4	4	4	4	4	0	0	4	4	0	4	4	4							June
Reassessment	Lower Missouri	LOWER MILK	BEAVER CREEK from headwaters to mouth at Willow Cr	10050012	MT40O002_040	14.7	Mi	X		X	X	X	X	X	metals, suspended solids	Non-SCD	2	2	2	2	2	0	2	2	2	0	2	2	2							May

2005 Field Plan

								Use Support							# samples per stream															Lakes		Other				Est. Month
Category	Group	Watershed	Segment name	HUC#	ID Number	Size	Units	Aqua Life	Cold Fish	Warm Fish	Drinking	Swim (Rec)	Agriculture	Industry	1996 Causes	2004 Causes	# Sites	Common Ions	Metals (w)	Nutrients	TSS	TDS	Metals (s)	Macros	Periphyton	Chl *a* (Phytoplank)	Chl *a* (rocks)	Chl *a* (hoop)	Chl *a* (core)	DO (Lakes)	Secchi Depth (Lakes)	Aquarods	Multi-parameter sondes	Bacteria	Temperature Data Loggers	
Reassessment	Lower Missouri	FRENCHMAN	FRENCHMAN CREEK, Canadian border to the mouth (Milk R)	10050013	MT40L001_010	74.5	Mi	X		X	X	X	X	X	flow alteration, nutrients, other habitat alterations	Non-SCD	**5**	5	5	5	5	0	0	5	0	5	5	5	5							July
Reassessment	Lower Missouri	BEAVER	BEAVER CREEK, Headwaters to the Fort Belknap Reservation boundary	10050014	MT40M001_011	4.8	Mi	X	X		X	X	X	X	flow alteration, other habitat alterations, siltation	Non-SCD	**1**	1	1	1	1	0	0	1	0	1	1	1	1							June
Reassessment	Lower Missouri	BEAVER	BEAVER CREEK, Fort Belknap Reservation boundary to Black Coulee	10050014	MT40M001_012	148.3	Mi	X	X		X	X	X	X	flow alteration, other habitat alterations, siltation	Non-SCD	**8**	8	8	8	8	0	0	8	0	8	8	8	8							July
Reassessment	Lower Missouri	BEAVER	FLAT CREEK, Headwaters to mouth (Beaver Cr)	10050014	MT40M002_010	33.2	Mi	X	X		X	X	X	X	nutrients, other habitat alterations, siltation, turbidity	Non-SCD	**3**	3	3	3	3	0	0	3	0	3	3	3	3							July
Reassessment	Lower Missouri	BEAVER	LARB CREEK, Headwaters to mouth (Beaver Cr)	10050014	MT40M002_020	73.8	Mi	X	X		X	X	X	X	other habitat alterations	Non-SCD	**5**	5	5	5	5	0	0	5	5	0	5	5	5							June
Reassessment	Lower Missouri	ROCK	EAGLE CREEK,Headwaters to the mouth (Willow Cr)	10050015	MT40N001_010	16	Mi	X		X	X	X	X	X	flow alteration, suspended solids, thermal modifications	Non-SCD	**2**	2	2	2	2	0	0	2	2	0	2	2	2							June
Reassessment	Lower Missouri	CHARLIE-LITTLE MUDDY	CHARLIE CREEK from East and Middle Charlie Cr to the mouth (Missouri R)	10060005	MT40S004_010	31.2	Mi	X		X		X			other habitat alterations, salinity/TDS/chlorides, siltation	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							May
Reassessment	Lower Missouri	CHARLIE-LITTLE MUDDY	HARDSCRABBLE CREEK from headwaters to mouth (Missouri R)	10060005	MT40S004_020	32.6	Mi	X		X		X			other habitat alterations, salinity/TDS/chlorides, siltation	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							May
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	MAGPIE GULCH from the headwaters to the mouth (Canyon Ferry Res)	10030101	MT41I002_110	12.7	Mi	X	X		X	X	X	X	Flow alt, Other habitat alt	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							June
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	SIXTEENMILE CREEK from Lost Cr to the mouth (Missouri R)	10030101	MT41I002_120	46.6	Mi	X	X		X	X	X	X	Nutrients, Organic Enrichment/DO, Other Habitat Alt, Siltation	Non-SCD	**3**	3	3	3	3	0	3	3	3	0	3	0	0							June
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	WHITE GULCH from headwaters to the mouth (Canyon Ferry Res)	10030101	MT41I002_130	13.2	Mi	X	X		X	X	X	X	Flow alt, Other habitat alt	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							June
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	CAVE GULCH from headwaters to mouth (Canyon Ferry Reservoir)	10030101	MT41I002_150	6.4	Mi	X	X		X	X	X	X	Flow Alt, Other Habitat Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							June
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	BOULDER CREEK from 3 Miles above mouth to mouth (Confederate Gulch)	10030101	MT41I002_160	3	Mi	X	X		X	X	X	X	Other Habitat Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							June
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	BEAVER CREEK, Headwaters to Nelson	10030101	MT41I005_011	13.3	Mi	X	X		X	F	X	F	Flow Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							June
Reassessment	Upper Missouri	RED ROCKS-UPPER	JONES CREEK, from Headwaters to Winslow Cr.	10020001	MT41A004_130	7.1	Mi	X	X		X	X	X	X	Flow Alt, Other Habitat Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							July
Other-TMDL	Upper Missouri	BIG HOLE-LOWER	CANYON CREEK, from Headwaters to the mouth (Big Hole R)	10020004	MT41D002_030	17.8	Mi	X	X		X	P	X	F	Flow Alt, Metals, Other Habitat Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							July
Other-TMDL	Upper Missouri	BIG HOLE-LOWER	MOOSE CR, headwaters to the mouth (Big Hole R at Maiden Rock)	10020004	MT41D002_050	12.3	Mi	X	X		X	P	X	F	Flow Alt, Other Habitat Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							July
Other-TMDL	Upper Missouri	BIG HOLE-LOWER	WILLOW CREEK, from Headwaters to the mouth (Big Hole R)	10020004	MT41D002_110	21	Mi	X	X		X	X	X	X	Flow Alt, Other Habitat Alt, Siltation	Non-SCD	**3**	3	3	3	3	0	3	3	3	0	3	0	0							July
Other-TMDL	Upper Missouri	BIG HOLE-MIDDLE	FRENCH CR from headwaters to the mouth (Deep Cr)	10020004	MT41D003_050	9.4	Mi	X	X		X	P	X	F	Metals	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							July
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	BATTLE CREEK from headwaters to the mouth (Sixteenmile Cr - Missouri R)	10030101	MT41I002_020	20.4	Mi	X	X		X	X	X	X	Siltation, Suspended Solids	Non-SCD	**3**	3	3	3	3	0	3	3	3	0	3	0	0							August
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	DRY CREEK from headwaters to the mouth (Missouri R)	10030101	MT41I002_080	16.7	Mi	X	X		X	X	X	X	Flow Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							August
Reassessment	Upper Missouri	BELT	LITTLE BELT CREEK, from the mouth three miles upstream	10030105	MT41U002_040	3	Mi	X	X		X	X	X	X	Flow Alt, Nutrients, Other Habitat Alt., Siltation	Non-SCD	**1**	1	1	1	1	0	1	1	1	0	1	0	0							August
1996 List	Upper Missouri	BIG HOLE-MIDDLE	AMERICAN CREEK from headwaters to mouth (California Creek)	10020004	MT41D003_060	6.5	Mi	F	F		F	F	F	F	Other habitat alterations, siltation	Fully Supporting	**2**	2	2	2	2	0	0	2	2	0	2	2	0							September
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	BEAVER CREEK, Nelson to the mouth (Missouri R below Hauser Dam)	10030101	MT41I005_012	5.3	Mi	X	X		X	F	X	F	Flow Alt, Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							September
Reassessment	Upper Missouri	UPPER MISSOURI-HOLTER	SHEEP CREEK from headwaters to mouth (Little Prickly Pear Cr)	10030101	MT41I005_070	5.9	Mi	X	X		X	X	X	X	Siltation	Non-SCD	**2**	2	2	2	2	0	2	2	2	0	2	0	0							September
Reassessment	Upper Missouri	UPPER MISSOURI-HOLTER	WOODSIDING GULCH Tributary to Little Prickly Pear Cr. T13N R4W Sec 33	10030101	MT41I005_080	2.2	Mi	X	X		X	X	X	X	Other Habitat Alt	Non-SCD	**1**	1	1	1	1	0	1	1	1	0	1	0	0							September
Reassessment	Upper Missouri	UPPER MO-CANYON FERRY	TROUT CREEK from headwaters to the mouth (Hauser Lake)	10030101	MT41I005_020	20.1	Mi	X	X		X	X	X	X	Other Habitat Alt, Siltation	Non-SCD	**3**	3	3	3	3	0	3	3	3	0	3	0	0							September
Reassessment	Yellowstone	STILLWATER	STILLWATER RIVER from the West Fork to the mouth (Yellowstone R)	10070005	MT43C001_020	35.9		X	X		X	X	X	X	flow alts; other habitat alts	Non-SCD	**5**	5	5	5	5	0	0	5	5	0	5	5	5							August
Reassessment	Yellowstone	STILLWATER	BUTCHER CREEK from headwaters to highway 78	10070005	MT43C002_082	2.2		X	X		X	X	X	X	nutrients, other habitat alts, siltation, **suspended solids**	Non-SCD	**2**	2	2	2	2	0	0	2	2	0	2	2	2							August
Reassessment	Yellowstone	CLARKS FK YELLOWSTN	WEST RED LODGE CREEK, from Absaroka-Beartooth Wilderness boundary to mouth (Red Lodge Cr)	10070006	MT 43D002_080	12	Mi	X	X		X	X	X	X	Other inorganic, Salinity/TDS/Chlorides, Suspended Solids	Non-SCD	**2**	2	2	2	2	2	0	2	2	0	2	2	2							September
Reassessment	Yellowstone	CLARKS FK YELLOWSTN	RED LODGE CREEK from headwaters to Cooney Reservoir	10070006	MT43D002_050	16.5	Mi	X	X		X	X	X	X	Siltation	Non-SCD	**2**	2	2	2	2	0	0	2	2	0	2	2	2							September
Other-TMDL	Yellowstone	CLARK'S FORK YELLOWSTONE	ROCK CREEK, from West Fork Rock Cr to Red Lodge Creek	10070006	MT43D002_131	26.9	Mi	P	P		X	P	X	X	Flow Alteration, Nutrients, Other Habitat Alterations	Dewatering, Flow Alteration	**3**	3	3	3	3	0	0	3	3	0	3	3	0							August
Reassessment	Yellowstone	CLARKS FK YELLOWSTN	ROCK CREEK, from state line to West Fork Rock Creek	10070006	MT43D002_132	16.5	Mi	F	F		F	F	F	F	Flow Alteration, Nutrients, Other Habitat Alterations	Disagreed with call	**2**	2	2	2	2	0	0	2	2	0	2	2	2							September
Reassessment	Yellowstone	CLARK'S FORK YELLOWSTONE	ROCK CREEK, from state line to West Fork Rock Creek	10070006	MT43D002_132	16.5	Mi	F	F		F	F	F	F	Flow Alteration, Nutrients, Other Habitat Alterations	none	**2**	2	2	2	2	0	0	2	2	0	2	2	0							August
Reassessment	Yellowstone	CLARKS FK YELLOWSTN	SOUTH FORK BRIDGER CREEK tributary to Bridger Cr	10070006	MT43D002_180	7.8	Mi	X	X		X	X	X	X	Suspended Solids	Non-SCD	**2**	2	2	2	2	0	0	2	2	0	2	2	2							September
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	STELLAR CREEK from headwaters to mouth (Little Porcupine Cr)	10100001	MT42K002_070	38.1	Mi	X		X		X			Warm Water Fishery	Non-SCD	**4**	4	4	4	0	0	0	4	4	0	4	4	4							June
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	SARPY CREEK from Crow Indian Reservation to mouth (Sarpy Cr)	10100001	MT42K002_090	87	Mi	X		X		X			Not on List	Non-SCD	**6**	6	6	6	6	0	0	6	6	0	6	6	6							May
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	EAST FORK SARPY CREEK from headwaters to mouth (Sarpy Creek)	10100001	MT42K002_100	31.5	Mi	X		X		X			Agriculture, Aquatic Life, Warm Water Fishery	Non-SCD	**3**	3	3	3	3	0	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	EAST FORK ARMELLS CREEK From Colstrip to mouth (Armells Cr)	10100001	MT42K002_110	30.8	Mi	X		X		X			Agriculture, Aquatic Life, Swimmable, Warm Water Fishery	Non-SCD	**3**	3	3	3	3	0	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	WEST FORK ARMELLS from headwaters to mouth	10100001	MT42K002_120	31.7	Mi	X		X		X			Agriculture, Aquatic Life, Swimmable, Warm Water Fishery	Non-SCD	**3**	3	3	3	3	0	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	LITTLE PORCUPINE from headwaters to mouth (Yellowstone R)	10100001	MT42K002_160	108.4	Mi	X		X		X			Agriculture, Aquatic Life, Warm Water Fishery	Non-SCD	**9**	9	9	9	9	0	0	9	9	9	9	9	9							June
Reassessment	Yellowstone	LOWER YELLOWSTONE-SUNDAY	EAST FORK ARMELLS CREEK from headwaters to Colstrip	10100001	MT42K002_170	21.5	Mi	X		X		X			Aquatic Life, Swimmable, Warm Water Fishery	Non-SCD	**3**	3	3	3	3	0	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE	BENNIE PEER CREEK from North Dakota border to the mouth (Yellowstone R)	10100004	MT42M002_010	9.3		X		X		X			flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**	Non-SCD	**2**	2	2	2	2	2	0	2	2	0	2	2	2							June

2005 Field Plan

								Use Support							# samples per stream															Lakes		Other				Est. Month
Category	Group	Watershed	Segment name	HUC#	ID Number	Size	Units	Aqua Life	Cold Fish	Warm Fish	Drinking	Swim (Rec)	Agriculture	Industry	1996 Causes	2004 Causes	# Sites	Common Ions	Metals (w)	Nutrients	TSS	TDS	Metals (s)	Macros	Periphyton	Chl *a* (Phytoplank)	Chl *a* (rocks)	Chl *a* (hoop)	Chl *a* (core)	DO (Lakes)	Secchi Depth (Lakes)	Aquarods	Multi-parameter sondes	Bacteria	Temperature Data Loggers	
Reassessment	Yellowstone	LOWER YELLOWSTONE	FOURMILE CREEK from headwaters to the North Dakota border	10100004	MT42M002_020	23.5		X		X		X			flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE	FIRST HAY CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_030	29.4		X		X		X			flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE	LONETREE CREEK from North and South Forks to the mouth (Yellowstone R)	10100004	MT42M002_040	19		X		X		X			flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**, other inorganics, thermal mods	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							May
Reassessment	Yellowstone	LOWER YELLOWSTONE	FOX CREEK and NORTH FORK FOX CREEK, Headwaters to mouth (Yellowstone R)	10100004	MT42M002_050	69.1		X		X	X	X	X	X	flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**, other inorganics,	Non-SCD	**6**	6	6	6	6	6	0	6	6	0	6	6	6							July
Reassessment	Yellowstone	LOWER YELLOWSTONE	O'BRIEN CREEK from the state line to the mouth (Yellowstone R)	10100004	MT42M002_060	13.1		X		X		X			other habitat alts, **suspended solids**	Non-SCD	**2**	2	2	2	2		0	2	2	0	2	2	2							June
Reassessment	Yellowstone	LOWER YELLOWSTONE	CRANE CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_070	21.5		X		X		X			flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							June
Reassessment	Yellowstone	LOWER YELLOWSTONE	SMITH CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_080	41.5		X		X		X			flow alt, other habitat alt, salinity/TDS/chloride, **suspended solids**	Non-SCD	**4**	4	4	4	4	4	0	4	4	0	4	4	4							June
Reassessment	Yellowstone	LOWER YELLOWSTONE	SHADWELL CREEK from the state line to the mouth (Yellowstone R)	10100004	MT42M002_090	18.5		X		X		X			salinity/TDS/chlorides, **suspended solids**	Non-SCD	**2**	2	2	2	2	2	0	2	2	0	2	2	2							June
Reassessment	Yellowstone	LOWER YELLOWSTONE	BURNS CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_110	48.9		X		X		X			flow alts, salinity/TDS/chlorides, **suspended solids**	Non-SCD	**4**	4	4	4	4	4	0	4	4	0	4	4	4							June
Reassessment	Yellowstone	LOWER YELLOWSTONE	MORGAN CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_120	18.3		X		X		X			flow alterations, **suspended solids**	Non-SCD	**2**	2	2	2	2	0	0	2	2	0	2	2	2							July
Reassessment	Yellowstone	LOWER YELLOWSTONE	CABIN CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_150	96.8		X	X		X	X	X	X	Nutrients, other inorganics, salinity/TDS/chlorides	Non-SCD	**8**	8	8	8	8	8	0	8	8	0	8	8	8							September
Reassessment	Yellowstone	LOWER YELLOWSTONE	BRAKETT CREEK from headwaters to the mouth (Cherry Cr)	10100004	MT42M002_160	39.9		X	X		X	X	X	X	flow alt, salinity/TDS/chlorides	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							September
Reassessment	Yellowstone	LOWER YELLOWSTONE	CHERRY CREEK from headwaters to 20 miles above the mouth	10100004	MT42M002_172	43.4		X	X		X	X	F	F	Salinity/TDS/chlorides, **suspended solids**	Non-SCD	**4**	4	4	4	4	4	0	4	4	0	4	4	4							September
Reassessment	Yellowstone	LOWER YELLOWSTONE	SEARS CREEK from headwaters to the mouth (Yellowstone R)	10100004	MT42M002_180	12.3		X		X		X			other habitat, salinity/TDS/chlorides	Non-SCD	**2**	2	2	2	2	2	0	2	2	0	2	2	2							June
Reassessment	Yellowstone	O'FALLON	SANDSTONE CREEK from headwaters to mouth (O'Fallon Cr)	10100005	MT42L001_020	72.1	Mi	X		X		X			Other inorganic, Salinity/TDS/Chlorides	Non-SCD	**5**	5	5	5	5	5	0	5	5	0	5	5	5							June
Reassessment	Yellowstone	UPPER LITTLE MISSOURI	LITTLE MISSOURI, from Hwy 323 bridge to North Dakota border	10110201	MT39F001_021	63	Mi	X		X		X			Sslinity/TDS/Chlorides, Siltation, Suspended Solids	Non-SCD	**5**	5	5	5	5	5	0	5	5	0	5	5	5							June
Reassessment	Yellowstone	UPPER LITTLE MISSOURI	LITTLE MISSOURI, from Wyoming border to Hwy 323 bridge	10110201	MT39F001_022	40	Mi	X		X		X			Sslinity/TDS/Chlorides, Siltation, Suspended Solids	Non-SCD	**3**	3	3	3	3	3	0	3	3	0	3	3	3							June
Reassessment	Yellowstone	UPPER LITTLE MISSOURI	WILLOW CREEK from N and S FK confluence to mouth	10110201	MT39F001_030	23.8	Mi	X		X		X			Not on List	Fully supporting-No SCD found	**3**	3	3	3	3			3	3		3	3	3							June

Attachment 2

DEQ Field Forms

Place Site Visit Label Here

Site Visit Form
(One Station per page)

STORET Project ID:____________________

Trip ID :____________________

Date ______________________ Personnel ______________________

Waterbody ______________________ Location ______________________

Station ID ______________ Visit # ______ HUC ______________ County ______________

Lat ______________ Long ______________ GPS Datum (Circle One): NAD 27 **NAD 83** WGS84 Lat/Long Verified? ☐ By ______

Lat/Long obtained by method other than GPS? Y ☐ N ☐ If Y what method used? If by map, provide map scale ______________

Samples Taken:			**Sample ID** (Provide for **all** samples)	**Sample Collection Procedure**
Water	☐	Nut. ☐ Met. ☐ Com. ☐ Dis. Al ☐		GRAB
Sediment	☐			SED-1
Chlorophyll a	☐			CHLPHL-2 HOOP CORE OTHER:
Algae/Macrophytes	☐			PERI-1 OTHER:
Macroinvertebrate	☐	Macroinvertebrate Habitat Asmt. ☐		KICK HESS JAB OTHER:
Kick/Jab length (ft):		Kick Duration / # Jabs:	No of Jars:	Mesh Size: 1200 1000 500 OTHER:
Habitat Assessment	☐	Scale: Reach ☐ Site ☐ Other HA ☐ Type:		
Substrate	☐	Pbl. Count ☐ % Fines ☐ RSI ☐		
Channel X-Section	☐			
Photographs	☐	Digital ☐ Film ☐		
Other:				
Flow:	__________ cfs	Method: Meter ☐ Float ☐ Staff Gage ☐ Visual Estimate ☐		
Flow Comments:	Dry Bed ☐ No Measurable Flow ☐ Others:			

Measurements:	**Time:**	
Meter Number:		
Temp: (°C)	W	A °C °F
pH:		
SC: (µmho/cm)		
DO: (mg/L)		
TUR: Clear ☐ Slight ☐ Turbid ☐ Opaque ☐		
Turbidity Comments:		

Site Visit Comments:

Revised 3/2005

Site Visit Form Instructions

1. Place a Site Visit Code label in the upper left corner.
2. Place a “Trip Label” in the upper right corner. (Covering Project ID and Trip ID with label is okay)
3. **STORET Project ID**: If you do not have a “Trip Label”, enter the Project ID assigned by the Data Management Section. If you do not know the Project ID contact Data Management.
4. **Trip ID:** If you do not have a “Trip Label”, enter the Trip ID assigned by the Data Management Section. If you do not know the Trip ID contact Data Management.
5. **Date**: Enter the date of the station visit.
6. **Personnel**: Enter the name(s) of the personnel conducting field activities.
7. **Waterbody**: Enter the name of the waterbody such as “Missouri River”.
8. **Location**: This is an opportunity to expand on the waterbody name. Such as “upstream from bridge on Forest Service road 100” rather than just “Coal Creek”. When the station is entered into STORET a combination of the Waterbody Name and Location will be used for the Station Name. For confidentiality please DO NOT use proper names of people in the location field.
9. **Station ID**: If a re-visit to a site enter the established STORET Station ID. Otherwise leave the field blank. Data mgmt. will generate a Station ID when Site Visit Forms are submitted (DEQ only).
10. **Visit #**: Enter “1” if this is a new station. Otherwise enter the visit number.
11. **HUC**: If you do not have a “Trip Label”, enter the fourth code (8 digit) HUC the station falls within.
12. **County**: Enter the county in which the station resides.
13. **Lat/Long**: Latitude and Longitudes should be obtained in decimal degrees using a GPS unit reading **NAD83** whenever possible. If this is not possible a lat/long obtained through map interpolation or a mapping program is acceptable as long as the map datum (NAD27, WGS84 etc.) used is circled on the field form and the method used is specified. If the lat/long is derived from a topographic map the map scale (1:24,000, etc.) should be noted on the form. Also note in the Comments field the reason a GPS reading was unavailable.
14. **GPS Datum**: Circle the GPS Datum your GPS unit is set to read. Data management would like to have all GPS units set to read **NAD83** for consistency.
15. **Verified**: Latitudes and Longitudes should be verified immediately upon return from the field. Verify by plotting on a paper map or using a mapping website. Once the lat/long has been verified check the “Verified” box and put your initials in the space next to “By”.

    Lat/Long readings should be verified immediately upon return from the field, preferably by mapping. Verification identifies readings that are grossly in error. Do not make minor adjustments to measured values during verification. Instead, report the measured values. They are assumed to be correct within the limitations of the measurement system. Gross errors should be corrected as follows: 1) Draw a single line through the erroneous value(s) and initial. Do not erase or dispose of the original reading. 2) Write the corrected value in the comment field along with the method and datum used to derive the value.
16. **Lat/Long obtained by method other than GPS?** Check Yes or No. If “Yes,” describe what method was used to obtain the lat/long. If a map was used note the map scale. If a mapping website was used note the datum the website uses.
17. **Samples Taken**: Check the boxes next to each type of activity if you conduct that type of activity during your station visit.
18. **Sample ID**: Write the Activity ID (Sample ID) for all of the samples you collect in the field.
19. **Flow**: Record flow and check the box next to method used. Record applicable flow comments.
20. **Field Measurements**: Record your field measurements in the spaces provided.
21. **Meter Number:** Write the number of the meter used to take field measurements (DEQ Only).
22. **Site Visit Comments**: Use the “Comments” field to record comments about the GPS reading, Station Description, travel directions and general comments about the station visit.

MACROINVERTEBRATE HABITAT ASSESSMENT FIELD FORM — **RIFFLE/RUN PREVALENCE**

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel:

HABITAT PARAMETER	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
1A. Riffle Development	Well-developed riffle; riffle as wide as stream & extends two times width of stream.	Riffle as wide as stream but length less than two times width.	Reduced riffle area that is not as wide as stream & its length less than two times width.	Riffles virtually non-existent
1A. score:	9-10	6-8	3-5	0-2
	Comments:			
1B. Benthic Substrate	Diverse substrate dominated by cobble.	Substrate diverse with abundant cobble, but bedrock, boulders, fine gravel, or sand prevalent.	Substrate dominated by bedrock, boulders, sand, or silt; cobble present.	Monotonous fine gravel, sand, silt, or bedrock substrate.
1B. score:	9-10	6-8	3-5	0-2
	Comments:			
2. Embeddedness	Gravel, cobble, or boulder particles are between 0-25% surrounded by fine sediment (particles less than 6.35 mm [.25"]).	Gravel, cobble, or boulder particles are between 25-50 % surrounded by fine sediment.	Gravel, cobble, or boulder particles are between 50-75% surrounded by fine sediment.	Gravel, cobble, or boulder particles are over 75% surrounded by fine sediment.
2. score:	16-20	11-15	6-10	0-5
	Comments:			
3. Channel Alteration (channelization, straightening, dredging, other alterations)	Channel alterations absent or minimal; stream pattern apparently in natural state.	Some channelization present, usually in areas of crossings, etc. Evidence of past alterations (before past 20 years) may be resent, but more recent channel alteration is not present.	New embankments present on both banks; 40-80% of the stream reach channelized & disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized & disrupted.
3. score:	16-20	11-15	6-10	0-5
	Comments:			
4. Sediment Deposition	Little or no enlargement of bars & less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old & new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, & bends; moderate deposition in pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
4. score:	16-20	11-15	6-10	0-5
	Comments:			

5. Channel Flow Status	**Water fills baseflow channel; minimal amount of channel substrate exposed.**	**Water fills > 75% of the baseflow channel; < 25% channel substrate exposed.**	**Water fills 25-75% of the baseflow channel; riffle substrates mostly exposed.**	**Very little water in channel, & mostly present as standing pools.**
5. score:	**16-20**	**11-15**	**6-10**	**0-5**
	Comments:			
6. Bank Stability (score each bank) NOTE: Determine left or right side while facing downstream.	**Banks stable; no evidence of erosion or bank failure; little apparent potential for future problems.**	**Moderately stable; infrequent, small areas of erosion mostly healed over.**	**Moderately unstable; moderate frequency & size of erosional areas; up to 60% of banks in reach have erosion; high erosion potential during high flow.**	**Unstable; many eroded areas; "raw" areas frequent along straight sections & bends; obvious bank sloughing; 60-100% of banks have erosion scars on sideslopes.**
6. score:	**9-10**	**6-8**	**3-5**	**0-2**
	Left Side			
	Right Side			
7. Bank Vegetation Protection (score each bank) NOTE: reduce scores for annual crops & weeds which do not hold soil well (e.g. knapweed).	**Over 90% of the streambank surfaces covered by stabilizing vegetation; vegetative disruption minimal or not evident; almost all plants allowed to grow naturally.**	**70-90% of the streambank surfaces covered by vegetation; disruption evident, but not affecting full plant growth potential to any great extent; more than one-half of potential plant height evident.**	**50-70% of the streambank surfaces covered in vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of potential plant height remaining.**	**Less than 50% of the streambank surfaces covered by vegetation; extensive disruption of vegetation; vegetation removed to 2 inches or less.**
7. score:	**9-10**	**6-8**	**3-5**	**0-2**
	Left Side			
	Right Side			
8. Vegetated Zone Width (score each side)	**Width of vegetated zone > 100 feet.**	**Width of vegetated zone 30-100 feet.**	**Width of vegetated zone 10-30 feet.**	**Width of vegetated zone < 10 feet.**
8. score:	**9-10**	**6-8**	**3-5**	**0-2**
	Left Side			
	Right Side			
TOTAL SCORE:		**Score compared to maximum possible:**		

MACROINVERTEBRATE HABITAT ASSESSMENT FIELD FORM		GLIDE/POOL PREVALENT STREAMS		
Date:		Site Visit Code:		
Waterbody:		Station ID:		
Personnel:				
Habitat Parameter	**Optimal**	**Sub-optimal**	**Marginal**	**Poor**
1. Bottom Substrate -- Available Cover	Greater than 50% mix of snags, submerged logs, undercut banks, rubble or other stable habitat & at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat is obvious; substrate unstable or lacking.
1. score:	16-20	11-15	6-10	0-5
	Comments:			
2. Pool Substrate Characterization	Mixture of substrate materials with gravel & firm sand prevalent; root mats & submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats & submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
2. score:	16-20	11-15	6-10	0-5
	Comments:			
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
3. score:	16-20	11-15	6-10	0-5
	Comments:			
4. Channel Alteration (channelization, dredging, straightening, other alterations)	Channel alteration absent or minimal; stream with normal, sinuous pattern.	Some channel alteration present, usually in areas of crossings, evidence of past channel alterations (prior to past 20 years) may be present, but more recent channel alteration is not present.	New embankments present on both banks; channelization may be extensive, usually in urban areas or drainage areas of agriculture lands; > 80% of stream reach channelized & disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
4. score:	16-20	11-15	6-10	0-5
	Comments:			
5. Sediment Deposition	Less than 20% of bottom affected; minor accumulation of fine & coarse material at snags & submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent & substantial sediment movement during storm events.	Channelized; mud, silt, &/or sand in braided or nonbraided channels; pools almost absent due to deposition.
5. score:	16-20	11-15	6-10	0-5
	Comments:			

6. Channel Sinuosity	**The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line.**	**The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.**	**The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.**	**Channel straight; waterway has been channelized for a long distance.**
6. score:	**16-20**	**11-15**	**6-10**	**0-5**
	Comments:			
7. Channel Flow Status	**Water reaches base of both lower banks & minimal amount of channel substrate is exposed.**	**Water fills > 75% of the available channel; or < 25% of channel substrate is exposed.**	**Water fills 25-75% of the available channel &/or riffle substrates are mostly exposed.**	**Very little water in channel & mostly present as standing pools.**
7. score:	**16-20**	**11-15**	**6-10**	**0-5**
	Comments:			
8. Bank Vegetation Protection (score each bank) NOTE: Determine left or right side by facing downstream.	**More than 90% of the stream bank surfaces covered by native vegetation including trees, understory shrubs, or non-woody macrophytes; vegetation disruption minimal or not evident; almost all plants allowed to grow naturally. (9-10)**	**70-90% of the streambank surfaces covered by native vegetation; one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height rem**	**50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.**	**Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.**
8. score:	**9-10**	**6-8**	**3-5**	**0-2**
	Left Side	Comments:		
	Right Side			
9. Bank Stability (score each bank)	**Banks stable; no evidence of erosion or bank failure; little potential for future problems.**	**Moderately stable; infrequent, small areas of erosion mostly healed over.**	**Moderately unstable; up to 60% of banks in reach have areas of erosion; high erosion potential during floods.**	**Unstable; many eroded areas; "raw" areas frequent along straight sections & bends; obvious bank sloughing; 60-100% of bank has erosional scars.**
9. score:	**9-10**	**6-8**	**3-5**	**0-2**
	Left Side	Comments:		
	Right Side			
10. Riparian Vegetation Zone Width (score each side)	**Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.**	**Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.**	**Width of riparian zone 6-12 meters; human activities have impacted a great deal.**	**Width of riparian zone < 8 meters; little or no riparian vegetation due to human activities.**
10. score:	**9-10**	**6-8**	**3-5**	**0-2**
	Left Side	Comments:		
	Right Side			
TOTAL SCORE		**Score compared to maximum possible:**		

SITE INFORMATION

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel:

DIRECTIONS TO SITE

LANDOWNER INFORMATION

If you did NOT sample this site, check one below

☐ NON-SAMPLEABLE - PERMANENT	☐ NON-SAMPLEABLE - TEMPORARY
☐ Dry- visited	Not wadeable - need a different crew
☐ Wetland (No definable channel)	NO ACCESS
☐ Map Error - No evidence channel/waterbody ever present	☐ Access permission denied
☐ Other (explain in comments)	☐ Temporarily Inaccessible - Fire etc. (explain in comments)

SITE CHARACTERISTICS (200m radius)

Waterbody Character	Pristine	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1 Highly Disturbed
	Appealing	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1 Unappealing
Beaver	Beaver Signs:	☐ Absent	☐ Rare	☐ Common		
	Beaver Flow Modifications:	☐ None	☐ Minor	☐ Major		
Dominant Land Use	Dominant Land use around 'X'	☐ Forest	☐ Agriculture	☐ Range	☐ Suburban/Town	☐ Urban
	If Forest, Dominant Age Class		☐ 0 - 25 yrs	☐ 25 - 75 yrs	☐ > 75 yrs	
Hydrologic Influence	☐ None	☐ Spring-fed	☐ d/s of lake	☐ d/s of impoundment		
	☐ Other (explain in comments)					

WEATHER

GENERAL COMMENTS

PLEASE COMPLETE BOTH SIDES OF FORM **Site visit Code:** ____________________

HUMAN INFLUENCE	**0** = Not Present **P** = >10m **C** = Within 10m **B** = On Bank	
	Left Bank	**Right Bank**
Wall/Dike/Revetment/ Riprap/Dam	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Buildings	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Pavement/Cleared Lot	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Road/Railroad	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Pipes (inlet/outlet)	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Landfill/Trash	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Park/Lawn	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Row Crops	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Pasture/Range/Hay Field	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Logging Operations	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B
Mining Activity	☐O ☐P ☐C ☐B	☐O ☐P ☐C ☐B

COMMENTS

FISH COVER/OTHER	0 = Absent 0% 1 = Sparse (<10%) 2 = Moderate (10 - 40%) 3 = Heavy (40 - 75%) 4 = Very Heavy (>75%)	
	Actual Cover in Channel (circle one)	**Potential** (circle one)
Filamentous Algae	☑0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Macrophytes	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Woody Debris >0.3 m (large)	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Brush/Woody Debris <0.3m (small)	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Live Trees or Roots	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Overhanging Veg. =<1m of surface	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Undercut Banks	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Boulders	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Artificial Structures	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4
Moss	☐0 ☐1 ☐2 ☐3 ☐4	☐0 ☐1 ☐2 ☐3 ☐4

COMMENTS

TOTAL DISCHARGE

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel:

**Distance from initial point (ft.)	**Depth (ft.)	**Velocity (at point) (ft./sec.)	**Width (ft.)	**Area (sq. ft.)	**Discharge (ft^3/sec)

Total Discharge = **ft^3/sec**

NOTE:

First blank is used to mark the bank.

Begin measurements from the left bank (determine left bank while looking downstream).

Initial point is often the tape reading of the waterline & has no depth or velocity to measure.

If this is the case, the first measurement is made at the first point where there is adequate depth (at least 0.2 ft) and measurable velocity.

The value for the "Distance from initial point" field is not necessarily the tape reading. Make sure it is reflective

If there is a sharp drop in water level near the bank, you must compensate for the discharge that is occurring

At points where there is stagnant water or backflow effects, begin and end measurements at the edge of where

Read depths on wading rod ignoring the "pile-up" effect of water on the rod.

Velocity is measured at six-tenths depth from the water surface by moving the probe support so that the foot

25 to 30 cross-sections are adequate to reduce the level of error.

Sections should be spaced so none contain more than 10% of the flow. Ideal measurements have less than

Substrate DEQ

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel:

PEBBLE COUNT								
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	*Characteristic Group: PEBL-CNT*		
						Sum	% of Total	Cum. Total
1	Silt / Clay		< 1					
2	Sand		1 - 2					
3	Very Fine	GRAVELS	2 - 4					
4	Fine	GRAVELS	4 - 6					
5	Fine	GRAVELS	6 - 8					
6	Medium	GRAVELS	8 - 12					
7	Medium	GRAVELS	12 - 16					
8	Coarse	GRAVELS	16 - 22					
9	Coarse	GRAVELS	22 - 32					
10	Very Coarse	GRAVELS	32 - 45					
11	Very Coarse	GRAVELS	45 - 64					
12	Small	COBBLES	64 - 90					
13	Small	COBBLES	90 - 128					
14	Large	COBBLES	128 - 180					
15	Large	COBBLES	180 - 256					
16	Small	BOULDERS	256 - 362					
17	Small	BOULDERS	362 - 512					
18	Medium	BOULDERS	512 - 1024					
19	Large	BOULDERS	1024 - 2048					
20	Bedrock	BOULDERS	> 2048					
21	Total # Samples							

CHANNEL CROSS-SECTION (LASER)

Date: **Site Visit Code:**
Waterbody: **Station ID:**
Personnel: **Survey Equipment:**

	Station Distance (ft.)	**Back-Sight** (ft.)	**Height of Instrument** (ft.)	**Fore-Sight** (ft.)	**Height; Depth or Elevation** (ft.)	**CELL WIDTH** (ft.)	**MEAN CELL DEPTH** (ft.)	**CELL AREA** (sq. ft.)	**Notation** *(e.g.: Lbkf, LWE, THWG, RWE, Rbkf)	
2									**Lbkf**	**First line entry must be Lbkf. (Begin and end data entry using the Bankfull locations)**
3										
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75									
		TOTAL CROSS-SECTIONAL AREA:							**sq. ft.**

* Notations: Lbkf: Left bankfull, Rbkf: Right bankfull, LWE: Left Water Edge, RWE: Right Water Edge, THWG:Thalweg

CHANNEL CROSS-SECTION (NON-LASER)

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel: **Survey Equipment:**

STATION (ft.)	**DEPTH** (ft.)	**CELL WIDTH** (ft.)	**MEAN CELL DEPTH** (ft.)	**CELL AREA** (sq. ft.)	**NOTATION**
(reading taken from the tape across the cross section)	(vertical distance from streambed to elevation @ bkf)	(e.g.: STATION 2 - STATION 1)	e.g.: 1/2(DEPTH 1+ DEPTH 2)	(CELL WIDTH X MEAN CELL DEPTH)	*(e.g.: Lbkf, LWE, THWG, RWE, Rbkf)
	TOTAL CROSS-SECTIONAL AREA:				**sq. ft.**

* Notations: Lbkf: Left bankfull, Rbkf: Right bankfull, LWE: Left Water Edge, RWE: Right Water Edge, THWG:Thalweg

ROSGEN STREAM CLASSIFICATION

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel:

Bankfull Width (W_{bkf}) ________ Ft.

WIDTH of the stream channel, at bankfull stage elevation, in a riffle section

Mean DEPTH (d_{bkf}) ________ Ft.

Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section.

________ Sq. Ft.

AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.

Width/Depth RATIO (W_{bkf} / d_{bkf}) ________

Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.

Maximum DEPTH (d_{mbkf}) ________ Ft.

Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and thalweg elevations, in a riffle

WIDTH of Flood-Prone Area (W_{fpa}) ________ Ft.

Twice maximum DEPTH, or (2 x d_{mbkf}) = the stage/elevation at which flood-prone area WIDTH is determined. (riffle section)

Entrenchment Ratio (ER) ________

The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH. (W_{fpa} / W_{bkf}) (riffle section)

Channel Materials (Particle Size Index) D50 ________ mm.

The D50 particle size index represents the median diameter of channel materials, as sampled from the channel surface, between

Water Surface SLOPE (S) ________ Ft./Ft.

Channel slope = "rise" over "run" for a reach approximately 20-30 bankfull channel widths in length, with the "riffle to riffle" water

Channel SINUOSITY (K) ________

Sinuosity is an index of channel pattern, determined from a ratio of stream length divided by valley length (SL/VL); or estimated

Stream Type ________

Comments:

SUBSTRATE DEQ

Date: **Site Visit Code:**

Waterbody: **Station ID:**

Personnel:

RSI BAR 30 COUNT (mm)			Average Size =		

Percent Fines

Date:	**Site Visit Code:**
Waterbody:	**Station ID:**
Personnel:	

Station	Count	Percent
1		
2		
3		
4		
5		
6		
	AVERAGE	

REACH ASSESSMENT

Date:	**Site Visit Code(s):**
Waterbody:	**STORET Station ID:**
Personnel:	
Length of Reach:	**Reach Description:**

Level of certainty. Please describe the level of certainty of the assessment based on how much access there is to the stream reach and rank the level of certainty (1-4)

Score = 1 No access. You were unable to walk the stream at any location. Only aerial interpretations are available
Score = 2 Limited access. You were only able to walk the stream in 1-3 locations and observations from an adjacent
Score = 3 You were able to access multiple points along the stream and/or a large percentage of the stream could be
Score = 4 Nearly the entire stream reach could be accessed.

Examples of statements would be:

"This habitat assessment is based upon observations at the sampling site at the mouth, within the field of view from two (2) stream culvert crossings and within the field of view from the forest reach break sampling site (~25% of entire reach observed). The actual habitat conditions in the unobserved portion are not likely to be substantially different based on aerial photography obtained during field season planning. Certainty that this assessment is representative of the entire reach is fair.

OR

"DEQ was able to observe 85% of the reach from the mouth to the national forest boundary through a combination of private property access granted by landowners and the field of view available from Route 66. This Stream Reach Assessment is very certain to represent the habitat conditions of the entire reach."

The level of certainty is: ______

COMMENTS

______

______

______

______

______

REACH ACTIVITIES AND DISTURBANCES OBSERVED

INTENSITY: Blank=not observed **L**=Low **M**=Moderate **H**= Heavy

Residential		Stream Management		Industrial	
☐ L ☐ M ☐ H	Residence	☐ L ☐ M ☐ H	Liming	☐ L ☐ M ☐ H	Industrial Plants
☐ L ☐ M ☐ H	Maintained Lawns	☐ L ☐ M ☐ H	Chemical Treatment	☐ L ☐ M ☐ H	Mines/Quarries
☐ L ☐ M ☐ H	Construction	☐ L ☐ M ☐ H	Angling Pressure	☐ L ☐ M ☐ H	Oil/Gas Wells
☐ L ☐ M ☐ H	Pipes, Drains	☐ L ☐ M ☐ H	Dredging	☐ L ☐ M ☐ H	Power Plants
☐ L ☐ M ☐ H	Dumping	☐ L ☐ M ☐ H	Channelization	☐ L ☐ M ☐ H	Logging
☐ L ☐ M ☐ H	Roads	☐ L ☐ M ☐ H	Water Level Fluctuations	☐ L ☐ M ☐ H	Evidence of Fire
☐ L ☐ M ☐ H	Bridge/Culverts	☐ L ☐ M ☐ H	Fish Stocking	☐ L ☐ M ☐ H	Odors
☐ L ☐ M ☐ H	Sewage Treatment	☐ L ☐ M ☐ H	Dams	☐ L ☐ M ☐ H	Commercial

Agricultural		Recreation	
☐ L ☐ M ☐ H	Cropland	☐ L ☐ M ☐ H	Hiking Trails
☐ L ☐ M ☐ H	Pasture	☐ L ☐ M ☐ H	Parks, Campgrounds
☐ L ☐ M ☐ H	Livestock Use	☐ L ☐ M ☐ H	Primitive Parks, Camping
☐ L ☐ M ☐ H	Orchards	☐ L ☐ M ☐ H	Trash/Litter
☐ L ☐ M ☐ H	Poultry	☐ L ☐ M ☐ H	Surface Films
☐ L ☐ M ☐ H	Irrigation Equipment		
☐ L ☐ M ☐ H	Water Withdrawal		

REACH ASSESSMENT

Date:	**Site Visit Code(s):**
Waterbody:	**STORET Station ID:**
Personnel:	

COMMENTS

Fish Barriers, Entrainment - Culverts, water diversions, dams and other structures can often have a serious impact on fish populations by either preventing access to an upper or lower stream reach or by literally removing the fish from the stream. Please describe any possible fish barriers or entrainment of fish into water diversions.

REACH ASSESSMENT

Date:	**Site Visit Code(s):**
Waterbody:	**STORET Station ID:**
Personnel:	

TORRENT EVIDENCE	
Please X any of the following that are evident	
EVIDENCE OF TORRENT SCOURING:	
☐	01 - Stream channel has a recently devegetated corridor two or more times the width of the low flow channel. This corridor lacks riparian vegetation with possible exception of fireweed, even-aged alder or cottonwood seedlings, grasses, or other herbaceous plants.
☐	02 - Stream substrate cobbles or large gravel particles are NOT IMBRICATED. (Imbricated means that they lie with flat sides horizontal and that they are stacked like roof shingles -- imagine the upstream direction as the top of the "roof.") In a torrent scour or deposition channel, the stones are laying in unorganized patterns, lying "every which way." In addition many of the substrate particles are angular (not "water worn.")
☐	03 - Channel has little evidence of pool-riffle structure. (For example, could you ride a mountain bike down the channel?)
☐	04 - The stream channel is scoured down to bedrock for substantial portion of reach.
☐	05 - There are gravel or cobble berms (little levees) above the bankfull level.
☐	06 - Downstream of the scoured reach (possibly several miles), there are massive deposits of sediment, logs, and other.
☐	07 - Riparian trees have fresh bark scars at many points along the stream at seemingly unbelievable heights above the channel bed.
☐	08 - Riparian trees have fallen into the channel as a result of scouring near their roots.
EVIDENCE OF TORRENT DEPOSITS:	
☐	09 - There are massive deposits of sediment, logs, and other debris in the reach. They may contain wood and boulders that, in your judgement, could not have been moved by the stream at even extreme flood stage.
☐	10 - If the stream has begun to erode newly laid deposits, it is evident that these deposits are "MATRIX SUPPORTED." This means that the large particles, like boulders and cobbles, are often not touching each other, but have silt, sand, and other fine particles between them (their weight is supported by these fine particles -- in contrast to a normal stream deposit, where fines, if present, normally "fill-in" the interstices between coarser particles.)
NO EVIDENCE:	
☐	11 - No evidence of torrent scouring or torrent deposits.

COMMENTS

Is there evidence of ice scour? If there is, please document any natural effects (such as scoured stream banks with exposed soil) that ice scour may have on the stream bank stability.

REACH ASSESSMENT- CONTINUATION

Date: **Site Visit Code:**

Waterbody: **STORET Station ID:**

Personnel:

Note: The scoring is only used to test precision and to help describe the relative condition of the habitat and water quality. **The cumulative score is not used for the assessment.** Statements with bold print scores indicate moderate or severe impairment to aquatic life beneficial uses.

This form was designed for conducting assessments that consider all human-caused impacts and effects to a stream that may occur anytime during the year. For, example, if the stream is known to be chronically de-watered during the summer the effects of from chronic from de-watering on fish habitat and temperature should be considered even if the assessment is conducted during the high flow during the spring. Therefore, the assessment should consider historical information and the documentation of interviews with local resource managers and landowners that were conducted to determine historic land uses and current management approaches.

1) Aquatic life substrate habitats

In moderate to high gradient streams, fine sediment deposition can reduce the quality and quantity of aquatic life habitats by filling spaces (interstices) between substrate particles and causing embeddedness (i.e., cobbles and gravels are cemented together and difficult to move), blanketing of surface substrate, and/or a reduction in pool volume. The effect often includes the suffocation of fish eggs and the destruction of macroinvertebrate and fish habitat. In low to moderate gradient stream reaches, sediment deposition may have the additional effect of burying the aquatic vegetation.

a) Stream Bottom (in moderate to high gradient streams with riffle/run dominated habitats)

8 = Stony substrate size is diverse with obvious interstices, and appears relatively stable. Some sand or silt may be present, but substrate is not embedded.

5 = Stony substrate is interspersed with silt and sand. Cobbles are partially embedded and not easily moved. There are also usually slight depositions of sand and silt at the fringes of the stream channel and in the pools.

2 = Silt and/or sand is prevalent in the substrate; gravels and cobbles are fully embedded and difficult to move; Pool substrates have areas covered by moderate to heavy depositions of fine sediment.

0 = Substrate is unstable and is primary sand and/or silt. Stony substrate is absent or buried.

b) Stream Bottom (in low to moderate gradient stream reaches that are perennial or intermittent with pool and/or glide dominated habitats)

8 = Mixture of substrate material with gravel or firm sand prevalent and/or vascular root mats and submerged vegetation abundant.

5 = Mixture of gravel with soft sand and silt common; and/or some vascular root mats and submerged vegetation.

2 = Mixture of soft sand, silt or clay; gravel is uncommon and little or no vascular root mats or submerged vegetation present.

0 = All mud or clay, or channelized with sand bottom and no vascular root mats or submerged vegetation.

Scoring used a) moderate to high gradient or b) low gradient ______________________

Potential Score ______________ **Actual Score** ______________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate.

COMMENTS: ____

2) Fish habitats

Fish and their fry need a variety of habitat types to flourish. This usually includes a mix of deep and shallow pools and security cover that are created by vegetation, woody debris, boulders, undercut banks, etc. The type of habitat that is important is dependant of the stream type. For example, woody debris and overhanging vegetation are often important for small Rosgen A and B stream reaches that are in a forested environment, while large deep pools and aquatic vegetation are important for Rosgen C channels in the prairie. Please note that short-term climatic effects such as high flows or drought should be considered when assessing fish habitat.

8 = Abundant mixture of deep, shallow, large and small pools (streams reaches in the prairie would likely have long deep pools); habitats created by woody debris, overhanging vegetation, boulders, root wads, undercut banks and/or habitats provided by aquatic vegetation are abundant.

5 = Shallow pools more prevalent than deep pools; limited habitats created by woody debris, overhanging vegetation, boulders, root wads, undercut banks and/or habitats provided by aquatic vegetation are limited.

2 = Majority of pools are small and shallow or pools are absent; Habitats created by woody debris, overhanging vegetation, boulders, root wads, or undercut banks and/or habitats provided by aquatic vegetation are rare or nonexistent

0 = There is not enough water to support a fishery due to human-induced dewatering

N/A = Streams would not support fish under natural conditions due to insufficient flow.

Potential Score ____________________ **Actual Score** ________________________

COMMENTS: ____

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3) Temperature Indicators

Elevated temperatures often have a negative impact on the fishery and aquatic life, especially for cold-water streams that are located within the mountains, intermountain valley and prairie foothills of western Montana. In small streams the lack of canopy cover, overhanging vegetation and physical features such as undercut banks are often factors that causes elevated temperatures. The storage of water by dams, the widening of a stream channel and decreases in pool depth that expose a larger volume of the stream's water to solar radiation have the potential to elevate stream temperatures in both small and large streams. Another practice that can severely elevate the stream temperature is irrigation, either by chronic de-watering or through warm surface-water irrigation "return-flows". In addition, intensive land use practices such as timber harvesting, agriculture and urbanization often alters the stream's hydrograph by reducing the amount of precipitation that recharges to the groundwater and increasing peak flows. This often results in significant reductions in late-summer groundwater influx to the stream, which may also elevate stream temperatures.

Note: Temperature stressors (especially de-watering) should be assessed during critical low flow periods or else you should inquire locally about this with fish biologists, conservation districts, etc

6 = The stream reach has adequate shading, a stable geomorphology and sufficient flow or return flow to prevent the water temperature from becoming a stressor (Note: prairie streams and E channels may not have much potential for shading from vegetation and elevated temperatures from beaver ponds are considered to be natural).

4 = The lack of shading, increased stream width/depth ratios, and flow alterations (e.g., irrigation withdrawal/return, storage by dams, etc.) may contribute to slightly elevated water temperatures.

2 = The lack of shading, increased stream width/depth ratios, and flow alterations (e.g., irrigation withdrawal/return, storage by dams, etc.) likely contributes to moderately elevated water temperatures and impacts to aquatic life. Intensive land uses within the watershed may have an effect on the amount of groundwater discharging into the stream during the summer.

0 = The lack of shading, increased stream width/depth ratios, and flow alterations (e.g., irrigation withdrawal/return, storage by dams, etc.) is significant enough that elevated water temperatures likely cause severe impacts to the aquatic life. Intensive land uses within the watershed may have a severe effect on the amount of groundwater discharging into the stream during the summer.

Potential Score ____________________ **Actual Score** ________________________

COMMENTS: ____

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4) Flow

The lack of flow or unnatural flow alterations often negatively impact aquatic life habitats for a variety of reasons including loss of habitat, increased salinity (i.e., low flow in prairies streams) or increased sediment. The effects from de-watering should be assessed during critical low flow periods or else you should inquire locally about this with fish biologists, conservation districts, etc. You should also consider and evaluate the effects from local land uses, inter-basin transfer (too much water) and hydrologic alterations such as dikes and dams which may prevent a stream's ability to access its historic flood plain or cause a stream reach to become de-watered, etc.

8 = There are no noticeable alterations to the flow

6 = Changes in flow are noticeable, however flows appear to be adequate for aquatic life.

4 = Flows support aquatic life, but habitat, especially riffles are drastically reduced or impacted and the pools are shallow; or there may not be a sufficient amount of flow during the spring runoff that accesses the floodplain (impacts of storage reservoirs). Or there are unnatural flows (volume and/or duration) that are likely to impact aquatic life. Intermittent prairie streams may have pools with high salinities caused by evaporation.

2 = The amount of water is insufficient to support a diversity of aquatic life, especially fish. Pools dominate and are shallow and disconnected.

0 = All water has been diverted from the stream channel or flows are so low that they would not support aquatic life.

Potential Score ____________________ **Actual Score** _________________________

COMMENTS: ____

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5) Nutrient Indicators

Nitrogen and phosphorus are the nutrients that usually limit algal growth and abundance, therefore, the abundance of algae, and sometimes vascular aquatic plants are often used as a measure of nutrient enrichment during the summer months.

Phytoplankton are algae that are suspended in the water column and causes the water to appear to be turbid and green. They are usually found in unstable prairie streams where aquatic plants and benthic algae communities are not able to establish.

Microalgae (diatoms) are useful ecological indicators because they are found in abundance in most aquatic environments. A healthy stream has a sufficient amount of microalgae to cause the rocks to be slippery. These algae are often observed as a green or brown growth on the stream substrate (e.g., cobbles). Excessive microalgae growth is often an indicator of high nutrient levels.

A large amount of filamentous algae may indicate that nutrient levels are high. However, there are exceptions. For example, filamentous algae can be found in cold clear streams that are near ground water discharge areas. In these cases, the filamentous algae tend to be short and patchy, the density is usually low, and occurrences are not widespread.

A few detrimental effects of excessive algae include: reduced aesthetic and recreational opportunities; impairment of aquatic life caused by the depletion of dissolved oxygen; clogging of pumps for agricultural and industrial uses; or an unpleasant taste or odor that may impact the ability to use the water as a source of drinking water.

Toxics, light, temperature, de-watering, and scouring also affect algae growth. Please include comments regarding the current conditions that stimulate or hinder the growth of algae, including weather, light, temperature, scouring, etc.

Estimate the % of the substrate that is covered with filamentous algae or aquatic plants ____________________

8 = A thin layer of algae is barely visible or rocks are slippery, patches of filamentous algae are short and occur occasionally.

6 = Accumulation of algae layer is easily visible on cobbles and along the channel edge. Filamentous algae may be present but filaments are short and patchy and occurrences are not widespread. For prairie streams rooted aquatic vegetations are often abundant

3 = There are thick micro-algae (diatom) layers on the cobble and/or long filamentous algae are common. Prairie streams (pools) may appear to be green or have small-suspended particles (not clay or silt) due to phytoplankton growth.

0 = Algae mats cover the bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (toxic conditions; e.g., from mining drainage).

Potential Score ____________________ **Actual Score** _________________________

COMMENTS: ____

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Date: | **Site Visit Code(s):**

Waterbody: | **STORET Station ID:**

Personnel:

Adapted from: UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MONTANA (1)
5/1/2004

RIPARIAN ASSESSMENT WORKSHEET

Geomorphic Considerations

Question 1. Stream Incisement (Downcutting):

8 = Channel stable, no active downcutting occurring; or, old downcutting apparent but a new, stable riparian area has formed within the incised channel. There is perennial riparian vegetation well established in the riparian area. (Stage 1 and 5, Schumm's model, Figure

6 = Channel has evidence of old downcutting that has begun stabilizing, vegetation is beginning to establish, even at the base of the falling banks, soil disturbance evident. (Schumm Stage 4)

4 = Small headcut, in early stage, is present. Immediate action may prevent further degradation. (early Schumm Stage 2)

2 = Unstable, channel incised, actively widening, limited new riparian area/floodplain, floodplain not well vegetated. The vegetation that is present is mainly pioneer species. Bank failure is common. (Schumm Stage 3)

0 = Channel deeply incised, resembling a gully, little or no riparian area, active downcutting is clearly occurring. Only occasional or rare flood events access the flood plain. Tributaries will also exhibit downcutting or signs of downcutting. (Schumm Stage 2)

The presence of active headcuts should nearly always keep the stream reach from being rated Sustainable.

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS:

Question 2. Percent of Streambanks with Active Lateral Cutting:

8 = Lateral bank erosion is in balance with the stream and its setting - less than 5% of streambanks in the reach show management-induced lateral erosion.

5 = There is a minimal amount of active lateral bank erosion occurring - 5-10% of the streambanks show management-induced lateral erosion.

3 = There is a moderate amount of active lateral bank erosion occurring - 11-15% of the streambanks show management-induced lateral erosion.

0 = There is excessive lateral bank erosion occurring - greater than 15% of the streambanks show management-induced lateral erosion.

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS:

Question 3. The Stream is in Balance with the Water and Sediment Supplied by the Watershed:

6 = The stream tends to be narrow and deep. There are no indications that the stream is widening or getting shallower. There may be some well-washed gravel and cobble bars present. Pools are common (B and naturally occurring D channels are exceptions).

4 = The stream has widened and/or has become shallower due to disturbances that have caused the banks to become unstable or from dewatering which reduces the amount of water and energy needed to effectively move the sediment through the channel (note sediment sources may also be from offsite sources). Point bars are often enlarged by gravel with silt and sand common, and new bars are forming. Pools are common, but may be shallow (B and naturally occurring D channels are exceptions).

2 = The stream tends to be very wide and shallow. Point bars are enlarged by gravel with abundant sand and silt, and new bars are forming that often force lateral movement of the stream. Mid channel bars are often present. For prairie streams there is often a deep layer of sediment on top of the gravel substrate. The frequency of pools is low (B and naturally occurring D channels are exceptions).

0 = The stream has poor sediment transport capability which is reflected by poor channel definition. The channel is often braided having at least 3 active channels (Naturally occurring D channels are exceptions). Pools are filled with sediment or are not existent.

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS:

Vegetative Considerations

Question 4. Percent of Streambank with Vegetation (Kind) having a Deep, Binding Rootmass: (see Appendix I for stability ratings for most riparian, and other, species)

6 = More than 85% of the streambank comprised of plant species with deep, binding root masses

4 = 65% to 85% of the streambank comprised of plant species with deep, binding root masses

2 = 35% to 65% of the streambank comprised of plant species with deep binding root masses

0 = Less than 35% of the streambank comprised of plant species with deep binding root masses

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS:

Question 5. Riparian/Wetland Vegetative Cover (Amount) in the Riparian Area/Floodplain and Streambank:

6 = More than 95% of the riparian/wetland canopy cover has a stability rating > 6

4 = 85%-95% of the riparian/wetland canopy cover has a stability rating > 6

2 = 75%-85% of the riparian/wetland canopy cover has a stability rating > 6

0 = Less than 75% of the riparian/wetland canopy cover has a stability rating > 6

NOTE: A low score for this item may be enough to keep the stream reach from being rated Sustainable

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS:

Question 6. Noxious Weeds :

3 = 0-1% of the riparian area has noxious weeds

2 = 1-5% of the riparian area has noxious weeds

1 = 5-10% of the riparian area has noxious weeds

0 = Over 10% of the riparian area has noxious weeds

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS (List all noxious weeds):

Question 7. Disturbance-Caused Undesirable Plants:

3 = 5% or less of the riparian area with undesirable plants

2 = 5-10% of the riparian area with undesirable plants

1 = 10-15% of the riparian area with undesirable plants

0 = Over 15% of the riparian area with undesirable plants

Potential Score ____________ **Actual Score** ____________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS (List all nuisance and undesirable weeds):

Question 8. Woody Species Establishment and Regeneration: (Note: Skip this question if the riparian area has no potential for woody species)

8 = All age classes of desirable woody riparian species present (see Figure 2).

6 = One age class of desirable woody riparian species is clearly absent, all others well represented. Often, it will be the middle age group's) absent. Having mature individuals and at least one younger age class present indicates the potential for recovery.

4 = Two age classes (seedlings and saplings) of native riparian shrubs and/or two age classes of native riparian trees are clearly absent, or the stand is comprised of mainly mature species. Other age classes well represented.

2 = Disturbance induced, (i.e., facultative, facultative upland species such as rose, or snowberry) or non-riparian species dominate. Woody species present consist of decadent/dying individuals. (Refer back to question 1 if this is the situation. The channel may have incised.)

0 = A few woody species are present (<10% canopy cover), but herbaceous species dominate (at this point, the site potential should be re-evaluated to ensure that it has potential for woody vegetation). OR, the site has at ≥ 5% canopy cover of Russian olive and/or salt cedar. On sites with long-term manipulation or disturbance, woody species potential is easily underestimated.

Potential Score ________________ **Actual Score** ________________________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS: ______________________________

Functional Considerations

Question 9. Utilization of Trees and Shrubs: (Note: Skip this question if the riparian area has no potential for woody species)

4 = 0-5% of the available second year and older stems are browsed

3 = 5%-25% of the available second year and older stems are browsed

2 = 25%-50% of the available second year and older stems are browsed.

1 = More than 50% of the available second year and older stems are browsed. Many of the shrubs have either a "clubbed" growth form, or they are high-lined or umbrella shaped.

0 = There is noticeable use (10% or more) of unpalatable and normally unused woody species.

Potential Score ________________ **Actual Score** ________________________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS: ______________________________

Question 10. Riparian Area/Floodplain Characteristics are Adequate to Dissipate Energy and Trap Sediment.

8 = The floodplain is readily accessed during average high-flow events (2-year flood event). Bankfull elevation and floodplain elevation are near the same. Active flood or overflow channels exist in the riparian/floodplain. Large rock and woody debris are common within the active channel (where appropriate) to adequately dissipate stream energy and trap sediment. Riparian vegetation is near potential for the reach. There is little evidence of excessive erosion or disturbance which reduces energy dissipation and sediment capture on the adjacent floodplain/riparian area. There are no headcuts where either overland flow and/or flood channel flows return to the main

6 = The floodplain meets the characteristics of the rating above (8), but demonstrates limitations in the kind and amount of large rock or woody debris present. Riparian/floodplain vegetative structure is below that required to dissipate energy. Evidence of incipient erosion and/or headcuts is readily present.

4 = The floodplain is accessed, but only during very high flow events (> 10-year flood event). Rock and/or woody material is present, but generally of insufficient size to fully dissipate stream energy. Some sediment is being captured. There may be occasional evidence of surface erosion and human alteration, but generally not extensive enough to have affected channel development.

2 = Inadequate rock and/or woody material available for dissipation of energy or sediment capture. There is some streambank erosion due to human alterations and occasional headcuts where overland flows or flood channel flows return to the main channel.

0 = Riparian/floodplain areas reflect the following conditions: 1) the floodplain is seldom accessed during any high flow event, 2) flood or overflow channels do not exist, and 3) large rock or woody debris is not present in the active channel for energy dissipation and sediment trapping. Streambank and/or floodplain erosion and/or evidence of human alteration is common. G- and F-type channels (Rosgen) would typically reflect these conditions.

Potential Score ____________________ **Actual Score** ______________________________

Please explain the rationale for the score; include comments regarding potential and document with photograph if appropriate

COMMENTS: ____

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SUMMARY

		SCORE		
		Potential	**Actual**	**Possible**
Question 1:	**Stream Incisement**	______	______	0, 2, 4, 6, 8
Question 2:	**Lateral Cutting**	______	______	0, 3. 5, 8
Question 3:	**Stream Balance**	______	______	0, 2, 4, 6
Question 4:	**Deep, Binding Rootmass**	______	______	N/A, 0, 2, 4, 6
Question 5:	**Riparian/Wetalnd Vegetative Cover ***	______	______	N/A, 0, 2, 4, 6
Question 6:	**Noxious Weeds**	______	______	0, 1, 2, 3
Question 7:	**Undesirable Plants**	______	______	0, 1, 2, 3
Question 8:	**Woody Species Establishment**	______	______	N/A, 0, 2, 4, 6, 8
Question 9:	**Browse Utilization**	______	______	N/A, 0, 1, 2, 3, 4
Question 10:	**Riparian Area/Floodplain Characteristics ***	______	______	N/A, 0, 2, 4, 6, 8
	TOTAL	______	______	(60 Possible)

(POTENTIAL SCORE FOR MOST BEDROCK OR BOULDER STREAMS) (36)
(questions 1, 2, 3, 6, 7, 10)

(POTENTIAL SCORE FOR MOST LOW ENERGY "E" STREAMS) (48)
(questions 1 – 7, 10)

RATING = $\frac{\textbf{Actual Score}}{\textbf{Potential Score}}$ **=** ______ **X 100 =** ______ **Rating**

80 - 100% = Sustainable

50 - 80% = At Risk

> 50% = Not Sustainable

*** Only in certain, specific situations can both of these receive an "N/A".**

Please clarify the rational for your rating, including comments regarding potential. Can the limitations be addressed by the decisionmaker?

COMMENTS:

PHOTOGRAPH LOCATIONS AND DESCRIPTIONS OF REACH AND/OR SITES

Date: **Site Visit Code(s):**

Waterbody: **STORET Station ID:**

Personnel:

Photo No: ______ Lat ______ Long ______

Description: ______

Photo No: ______ Lat ______ Long ______

Description: ______

Photo No: ______ Lat ______ Long ______

Description: ______

Photo No: ______ Lat ______ Long ______

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Photograph Locations and Descriptions - Continued

Photo No: ________ Lat ______________________________ Long ______________________________

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Description: ____

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DISCUSSION OF REFERENCE CONDITION (optional)

Date: **Site Visit Code(s):**

Waterbody: **STORET Station ID:**

Personnel:

DISCUSSION OF REFERENCE CONDITION -CONTINUED

SUMMARY (optional)

Date: **Site Visit Code(s):**

Waterbody: **STORET Station ID:**

Personnel:

SUMMARY -CONTINUED