Beneficial Use Reconnaissance Program Field Manual for Streams

State of Idaho
Department of Environmental Quality

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Cover image: Sylvan Creek in the Clearwater National Forests.

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Table of Contents

Abstract vii
Acronyms, Abbreviations, and Symbols ix
Introduction 1
Purpose and Scope of this Manual 2
Organization of this Manual 3
Overview of BURP Field Activities 4
1 Planning BURP Field Activities for Streams 4
1.1 Review Related Data 5
1.2 Coordinate Aquatic Monitoring Statewide 5
1.3 Determine Size Classification 6
1.3.1 Use of the Terms Streams and Rivers 6
1.3.2 Water Body Size Determinations 6
1.3.3 Method for Classifying a Stream or River 6
1.4 Site Selection Process 7
1.4.1 Water Body Identification and Representativeness 7
1.4.2 Steps in the Site Pre-Selection Process 9
1.4.3 Random Site Verification Process 10
2 Preparing for BURP Field Activities 12
2.1 Determine Property Ownership 12
2.2 Get Permission to Access Private Property 12
2.3 Gather Materials 14
3 Conducting BURP Field Activities 15
3.1 Visit Potential Sites 15
3.2 Make Final Site Selections 15
3.3 Perform and Record Monitoring Activities in the Field 16
3.3.1 Recommended Sequence for Monitoring 16
3.3.2 Location 20
3.3.3 Stream 23
3.3.4 In Situ 28
3.3.5 Sample 31
3.3.6 Flow 35
3.3.7 Pebble 39
3.3.8 Width (Depth, Canopy, and Banks Data) 41
3.3.9 Longitudinal Habitat Distribution (Long) 48
3.3.10 Pools 52
3.3.11 Habitat 55
3.3.12 Comments 59

3.3.13 Fish Collection and Fish Data (Fish Col) ... 59
3.3.14 Bacteria (E. coli) Check Sheet ... 65
4 Completing Follow-Up of BURP Field Activities ... 69
4.1 When Leaving a Site ... 69
4.1.1 Perform Quality Control ... 69
4.1.2 Decontaminate Equipment ... 70
4.1.3 Leave the Site How You Found It ... 73
4.1.4 Contact the Landowner ... 73
4.2 Back in the Office ... 73
5 Quality Assurance and Quality Control ... 73
5.1 BURP Coordinator Workshops ... 73
5.2 Crew Training ... 74
5.3 Supervision of Crew Adherence to Standards ... 74
5.4 Field Audits ... 74
5.5 Quality Assurance ... 75
5.5.1 Sample Handling ... 75
5.5.2 Sample Vouchering ... 75
5.5.3 Equipment Calibration ... 75
5.5.4 Data Handling ... 75
5.6 Data Analysis and Interpretation ... 81
6 Safety ... 81
6.1 CPR, First Aid, and Wilderness Training ... 81
6.2 Hazardous Situations and Substances ... 82
6.2.1 Hazardous Materials ... 82
6.2.2 Abandoned Mining Sites ... 82
6.2.3 Laboratory Waste and Drug Paraphernalia ... 82
6.3 Electrofishing ... 82
References ... 84
Glossary ... 91
Appendix A. Sample Invitation Letter to an Aquatic Monitoring Coordination Meeting ... 97
Appendix B. Informative Flyer About BURP Monitoring Activities ... 99
Appendix C. Field Equipment Checklist ... 103
Appendix D. Safety Data Sheets (SDS) ... 107
Appendix E. Formalin Health and Safety ... 143
Appendix F. Habitat Assessment Charts ... 147
Appendix G. Electrofishing Safety Orientation and Acknowledgement ... 151
Appendix H. DEQ Fish Taxon Codes ... 157
Appendix I. Electrofishing Checklist ... 163

List of Tables

Table 1. Criteria for determining water body size classification of Idaho flowing water bodies... 7
Table 2. Nonsampleable categories, explanations, and field form notes. ... 11
Table 3. Description of Rosgen stream types. ... 25
Table 4. Wetted width and number of measurements necessary for wetted depth calculation. ... 45
Table 5. Embeddedness scores based on embedded percentage. ... 57
Table 6. Recommended initial and maximum settings for electrofishers. ... 61

List of Figures

Figure 1. Annual work cycle and use of monitoring results. ... 2
Figure 2. The four phases of BURP field activities. ... 3
Figure 3. Typical timing of the four phases of BURP field work. ... 4
Figure 4. Parts of the planning phase. ... 4
Figure 5. Relationship between 4th field hydrologic unit codes (HUC), water body ID (WBID) and assessment units (AU). ... 8
Figure 6. Placement of a BURP reach in an AU. ... 9
Figure 7. Steps in the preparing for field activities phase. ... 12
Figure 8. Example of a private property owner contact record. ... 14
Figure 9. Steps in the conducting field activities phase. ... 15
Figure 10. A typical BURP reach, showing where each variable is measured. ... 18
Figure 11. Switchboard on electronic field forms. ... 19
Figure 12. Location form. ... 20
Figure 13. Example error message for incomplete data entry. ...
Figure 14. General stream form. ... 23
Figure 15. Rosgen stream type illustrations and descriptions. ... 24
Figure 16. Entrenchment ratio. ... 25
Figure 17. Stream orders. ... 26
Figure 18. Sinuosity. ... 27
Figure 19. In situ form. ... 28
Figure 20. Sample collection form. ... 32
Figure 21. Flow form. ... 36
Figure 22. Illustration of discharge measurement locations ... 37
Figure 23. Illustration of alternate flow method. ... 38
Figure 24. Pebble form. ... 39
Figure 25. Width form. ... 41
Figure 26. Bankfull and wetted width measurement locations. ... 43
Figure 27. Rating curve to assist in identifying bankfull height ... 44
Figure 28. Where to conduct measurements for horizontal distance of undercut banks ... 46
Figure 29. Reflection seen in densiometer. ... 47
Figure 30. Position of densiometer. ... 47
Figure 31. Longitudinal habitat distribution (long) form. ... 48
Figure 32. Pools form. ... 52

Figure 33. Where to measure some of the pool variables at each pool. 53
Figure 34. Where to measure pool depths (maximum and tail out), length, and width..... 54
Figure 35. Habitat form..... 55
Figure 36. Fish collection form..... 62
Figure 37. Fish data form..... 63
Figure 38. Fish with Floy tag attached through mouth and gills. 64
Figure 39. DEQ sample label..... 65
Figure 40. Sample of a bacteria check sheet..... 67
Figure 41. Steps in the follow-up phase..... 69
Figure 42. Site QC check. Notice the forms with missing data are underlined on the switchboard..... 70
Figure 43. Locating data from GETAC field database using Coordinator's Desktop Review. 76
Figure 44. Review data and transfer form. 78
Figure 45. Error message showing site ID and field where an apostrophe was found..... 78
Figure 46. Error message showing a change in pool number..... 79
Figure 47. Review data and transfer form following QC check..... 80

Abstract

The purpose of the Beneficial Use Reconnaissance Program (BURP) is to help Idaho meet the requirements of the federal Clean Water Act by monitoring and determining the support status of Idaho's water bodies. BURP started in 1993 as a pilot project and has evolved into an ongoing program.

BURP conducts monitoring activities at selected sites, emphasizing sampling and analysis to support assessments of biological assemblages and physical habitat structure of streams. These assessments support characterization of individual stream integrity and the total quality of Idaho's waters. The Idaho Department of Environmental Quality's (DEQ's) past monitoring and assessment practices and the US Environmental Protection Agency's rapid bioassessment protocols provided the foundation for BURP monitoring protocols.

This manual describes the planning, preparation, sampling, and follow-up phases of BURP monitoring. This field manual includes a process for selecting representative sampling sites and information about a suite of variables to sample. Each variable is defined and the rationale for using it is given, along with a description of the field methods used to measure or collect it. The main variables include stream channel classification, temperature, conductivity, macroinvertebrate assemblages, fish assemblages, periphyton assemblages, bacteria (*E. coli*), amphibians, discharge, substrate, width/depth, canopy closure, large organic debris, pool complexity, habitat types, bank cover and stability, and habitat assessment. The manual describes how to make a record for each reach that includes a standardized stream name, exact reach location (latitude and longitude), and photographs.

This field manual provides information needed for consistency and safety in monitoring among DEQ crews along with other entities interested in following these methods. This manual is an important part of the quality assurance/quality control of BURP stream monitoring data.

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Acronyms, Abbreviations, and Symbols

µmhos	micromhos
µS/cm	microsiemens per centimeter
AU	assessment unit
BURP	Beneficial Use Reconnaissance Program
CALM	Consolidated Assessment and Listing Methodology
cfs	cubic feet per second
cm	centimeter
CPR	cardiopulmonary resuscitation
CS	covered and stable
CUS	covered and unstable
DEQ	Idaho Department of Environmental Quality
EDMS	Environmental Data Management System
EF	electrofishing
EPA	United States Environmental Protection Agency
GIS	geographic information system
GNIS	Geographic Names Information System
GPS	Global Positioning System
HUC	hydrologic unit code
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
LOD	large organic debris
LWD	large woody debris
LWE	left wetted edge
m	meter
mg/L	milligrams per liter
mL	milliliter

Mm	millimeter
SDS	safety data sheet
PEL	permissible exposure limit
ppm	parts per million
QA	quality assurance
QC	quality control
RWE	right wetted edge
T&E	threatened and endangered (species)
UCS	uncovered and stable
UCUS	uncovered and unstable
USGS	United States Geological Survey
WBID	water body identification system (usually related to a unique identification number)

Introduction

The Beneficial Use Reconnaissance Program (BURP) has evolved from a pilot project into an ongoing program at the center of Idaho's water quality monitoring and assessment efforts. The 1993 pilot project aimed at integrating biological and chemical monitoring with physical habitat structure assessment to characterize the integrity of a stream and the quality of its water (McIntyre 1993). The project was initiated by Idaho's Division of Environmental Quality (now the Idaho Department of Environmental Quality [DEQ]) to meet the Clean Water Act requirements of monitoring and assessing biological conditions and developing biocriteria. The pilot project relied heavily on protocols for monitoring physical habitat and macroinvertebrates developed by Idaho State University and DEQ in the early 1990s. It closely followed the rapid bioassessment protocols for use in streams and rivers developed by the US Environmental Protection Agency (EPA) (Barbour et al. 1999; Plafkin et al. 1989).

The successful 1993 pilot was expanded statewide in 1994 (McIntyre 1994; Steed and Clark 1995) and is now an ongoing program. BURP staff consists of a state office central contact person, regional water quality staff assigned to coordinate the BURP program, and technical support staff. The program contact person in the state office provides overall planning, budget control, and oversight. The program is implemented by the regional BURP coordinators who prepare for and direct each year's field work by developing methods, hiring crews, conducting centralized training, supplementing centralized training as needed with regional information, and directing field work. Throughout the season, BURP coordinators ensure data (chiefly electronic field forms) and samples are properly submitted for analysis. The regional BURP coordinators plan and supervise their fieldwork each year in accordance with the annual work plan. Technical staff members in the DEQ State Office manage the BURP database, ensure quality assurance requirements are met, and provide technical expertise as requested. The activities in the BURP work cycle, along with the way the results of BURP monitoring are used, are shown in Figure 1.

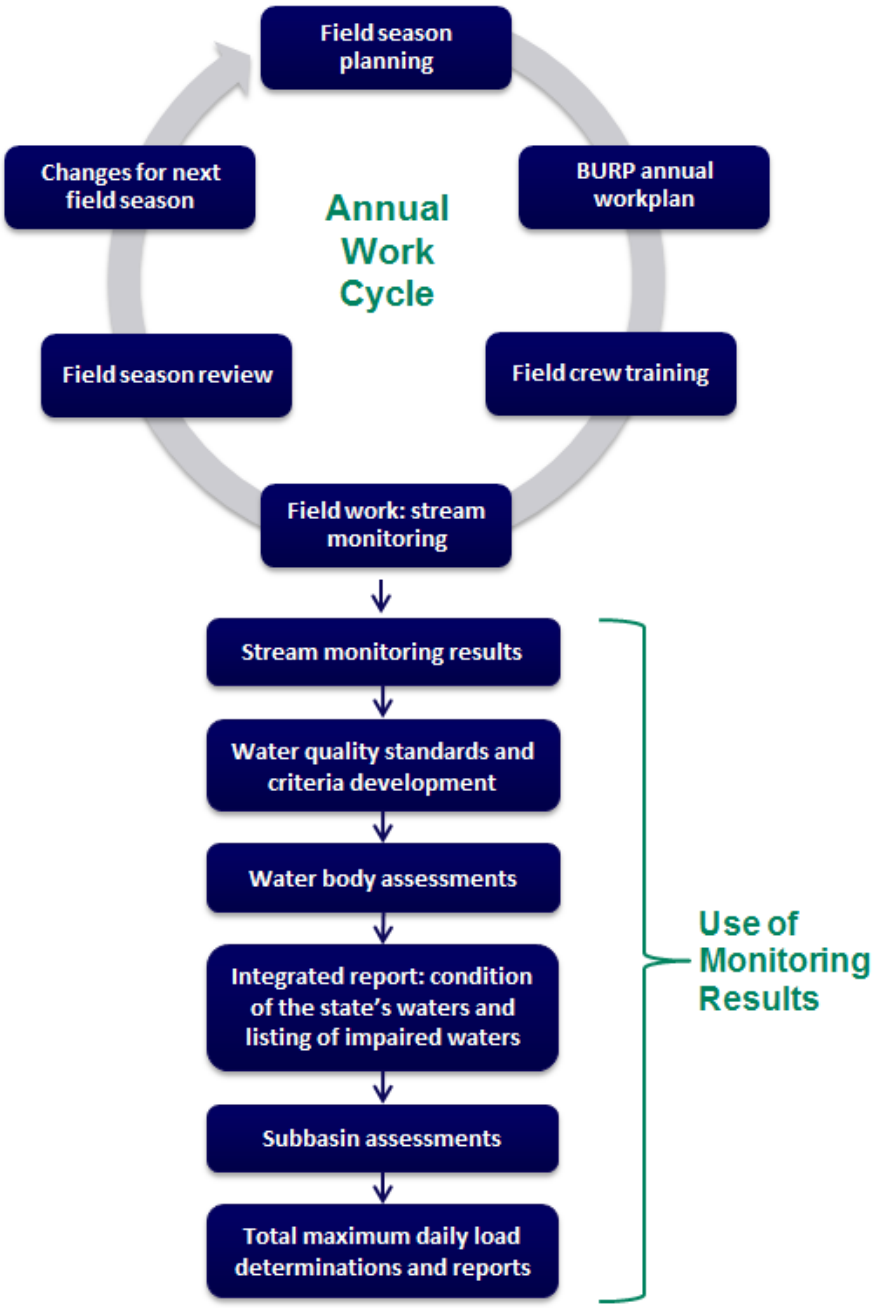


Figure 1. Annual work cycle and use of monitoring results.

Purpose and Scope of this Manual

The purpose of this field manual is to ensure statewide consistency in BURP stream monitoring and data collection activities. This manual describes how BURP data are collected, laying out the assumptions, methods, and equipment required. The manual provides BURP crew members with specific protocols used in BURP monitoring surveys. Information is included for each monitoring variable, including rationales for using each variable and for the method used to

monitor that variable. Further information regarding annual objectives, pilot studies, and anticipated monitoring locations are provided in the annual BURP work plan.

This manual does not describe the analysis and interpretation of the data collected. Interpretation of BURP data and any other relevant water quality information is described in DEQ's *Water Body Assessment Guidance* (Grafe et al. 2002), which outlines the process DEQ uses to determine the beneficial use support status of designated and existing beneficial uses.

Organization of this Manual

This manual is divided into six main sections. The first four correspond with the four phases of BURP field activities (Figure 2).

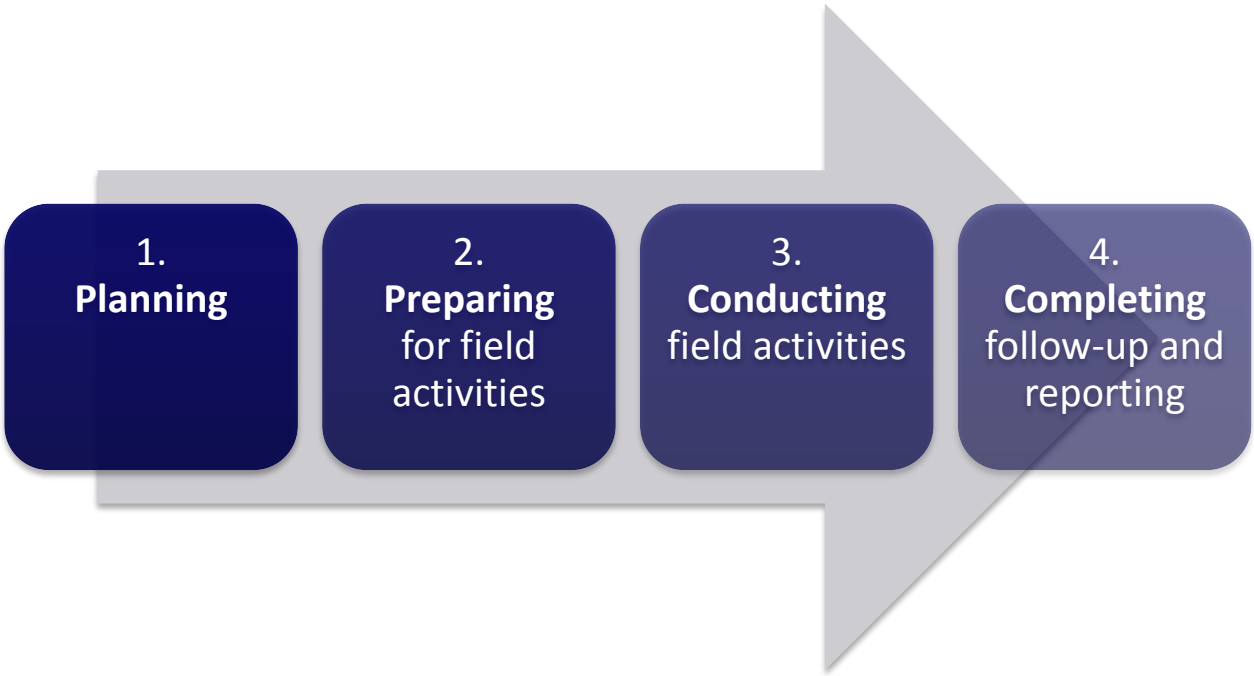


Figure 2. The four phases of BURP field activities.

Section 1 discusses planning, and section 2 covers preparing for field activities. Section 3 addresses the detailed protocol methods used by BURP field crews. Its organization follows that of the electronic field forms that are filled out as monitoring activities are conducted at a site, so that each variable recorded during a BURP survey is discussed in this manual in the same order and under the same name as it appears on the field forms. Within section 3, each page of the field forms has a subsection and each variable a further subsection. Section 4 describes activities that must be completed after a BURP survey. Section 5 discusses quality assurance and quality control (QA/QC), while section 6 discusses safety.

Overview of BURP Field Activities

These four phases (planning, preparing, conducting, and completing) make up the annual BURP cycle. The typical time of year for each phase is shown in Figure 3.

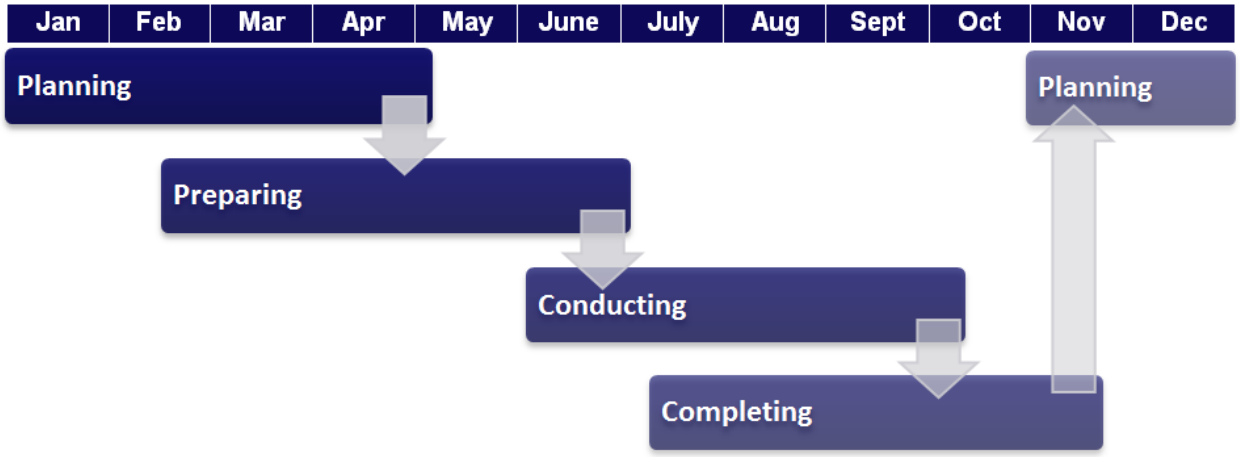


Figure 3. Typical timing of the four phases of BURP field work.

1 Planning BURP Field Activities for Streams

The planning phase is broken down into four tasks: review related data, coordinate aquatic monitoring, determine the size classification of targeted water bodies, and pre-select BURP monitoring sites (final site selections are made in the field) (Figure 4).

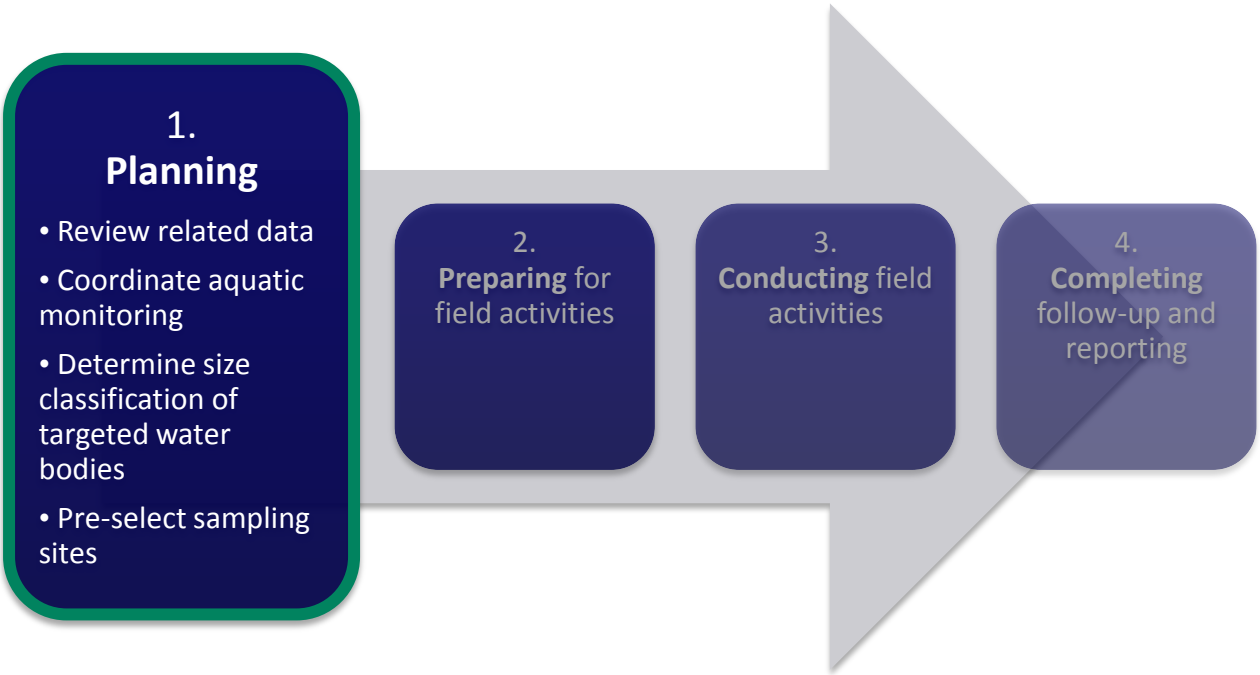


Figure 4. Parts of the planning phase.

1.1 Review Related Data

Stream and geographic data and other information from outside DEQ should be reviewed for each monitoring reach when preparing to monitor water bodies. To identify potential data sources, the regional BURP coordinator should try to obtain data and information about the targeted water bodies from resources such as the following:

- State agencies
  - Idaho Department of Fish and Game (IDFG)
  - Idaho district health departments
  - Idaho Department of Water Resources (IDWR)
  - DEQ internal sources
- Federal agencies
  - US Bureau of Land Management
  - US Bureau of Reclamation
  - Natural Resources Conservation Service
  - US Bureau of Mines
  - US Fish and Wildlife Service
  - US Forest Service
  - US Geological Survey (USGS)
  - EPA
- Tribal nations
  - Native American tribal nations with an interest in or information about the water bodies to be studied
- Academic institutions
  - Universities
  - Professional academies
- Information repositories
  - Environmental Data Management System (EDMS)—an IDWR database
  - STORET—an EPA database
- Miscellaneous resources
  - Geographic information system (GIS) coverages from DEQ and other agencies
  - Hydropower companies
  - Private companies in timber, mining, and other related industries
  - Internet searches
  - Other appropriate resources

Information obtained from these sources should be included with the information used to select sampling sites and also kept with the site or water body file so it may be incorporated in the assessment process as recommended in the *Water Body Assessment Guidance* (Grafe et al. 2002).

1.2 Coordinate Aquatic Monitoring Statewide

Each DEQ regional office should either facilitate or participate in an annual monitoring coordination meeting, as recommended by the *Consolidated Assessment and Listing*

Methodology (CALM) (EPA 2002), which identifies the need to coordinate or inventory monitoring activities. To be successful, this effort requires input and participation from all state, federal, tribal, and private entities engaged in aquatic monitoring. An effective coordination meeting will reduce duplication of effort, improve program efficiency, increase sharing of scientific and biological data and sources, and facilitate networking among all agencies and personnel involved in aquatic monitoring. Appendix A contains a sample invitation letter for an aquatic monitoring coordination meeting.

1.3 Determine Size Classification

DEQ found that only two size categories were necessary to represent small to large water body characteristics for bioassessment purposes and therefore classifies water bodies as either streams or rivers. This size distinction is critical in BURP methodology because DEQ uses different monitoring protocols and bioassessment tools for assessing the aquatic life support status of streams versus rivers. The methods in this manual are for streams only, so it must be determined whether the water bodies where BURP monitoring is planned are classified as streams by DEQ.

1.3.1 Use of the Terms Streams and Rivers

The *Water Body Assessment Guidance* (Grafe et al. 2002) uses water body size criteria to distinguish between two classes of flowing water: streams and rivers. Previously, the smaller stream classification was referred to as “wadeable streams” or “small streams.” However, the distinctions between “wadeable” and “nonwadeable” are not always clear. Similarly, the meaning of “small” was not always uniformly defined. DEQ decided to simply call the smaller size classification “streams” and the larger classification “rivers.” These classifications are specific to DEQ and may not be defined the same way in other sources.

1.3.2 Water Body Size Determinations

Through literature review and data analysis, DEQ found that no single criterion entirely distinguishes among water body sizes in Idaho. Consequently, DEQ uses three criteria to determine water body size: stream order, average wetted width at base flow, and average depth at base flow. The method for making this determination is given below. Supporting analysis for this method is detailed in “Water Body Size Criteria” (Grafe 2002).

1.3.3 Method for Classifying a Stream or River

DEQ rates water bodies against each criterion, as shown in Table 1. The ultimate goal of classifying water body size is to ensure the proper monitoring and assessment protocols are used. A water body is determined to be a wadeable stream if it meets two of the three criteria for small/stream in Table 1. If a water body originally considered to be a stream has physical and biological characteristics indicative of a river, the river protocols should be used instead of the stream protocols in this manual.

Table 1. Criteria for determining water body size classification of Idaho flowing water bodies.

Criteria			Corresponding Size Category
Stream Order	Avg. Wetted Width at Base Flow (m)	Avg. Depth at Base Flow (m)	
≥ 5	≥ 15	≥ 0.4	Large/River
< 5	< 15	< 0.4	Small/Stream

1.4 Site Selection Process

The site selection process entails office and field steps to ensure efficiency and representativeness. Although only the pre-selection steps are part of the planning phase, the entire site selection process is briefly outlined here. The pre-selection steps are presented in detail here; the final selection steps are presented in sections 2 and 3.

According to the *Surface Water Ambient Monitoring Plan* (Pappani 2012), two methods of site selection are available: targeted selection and random design. Both of these methods are used to answer the overall question of the condition of the state's waters. Targeted site selection is representative of entire water bodies and is critical to assessment of a particular water body. Randomly selected sites are used to estimate an overall condition of the state's waters. Specifically, the site selection process accomplishes the following:

- Determines how many sites are needed to characterize the beneficial use status of the stream.
- Helps ensure that sampling sites represent the streams they are intended to represent.
- Field verifies that sites initially selected in the office can be used.

1.4.1 Water Body Identification and Representativeness

A water body identification number (WBID) usually represents a small watershed and is used in Idaho's water quality standards to geolocate waters in the state. The scale of a WBID is generally comparable to a 6th-field (12-digit hydrologic unit code [HUC]) watershed, although some may be larger or smaller. The assessment unit (AU) is a grouping of waters within a WBID into a meaningful unit for assessment purposes. Most AUs are grouped based on stream order and land use; however, DEQ staff members have the option to further delineate AUs based on additional information. Therefore, the number of WBIDs in Idaho is presently a fixed total, whereas the total number of AUs will continue to change based on current and future assessment decisions. Figure 5 illustrates the scale differences among HUCs, WBIDs, and AUs.

DEQ uses stream order to define AUs within WBIDs to characterize comparable water body segments and ensure representative monitoring sites. In essence, AUs allow DEQ to compare streams and interpret site data. As outlined in the *Surface Water Ambient Monitoring Plan* (Grafe 2004), DEQ attempts to representatively monitor all AUs. To effectively monitor all the streams in Idaho, any one BURP reach should not represent more than one AU. (First- and second-order streams are combined when defining AUs.) In other words, if a WBID has three AUs, then at least one BURP reach per AU must be established to assess beneficial use support status for the AU. Regional BURP coordinators sometimes also consider Rosgen stream type when choosing

reaches for BURP monitoring. Each reach's length must equal 30 times the general bankfull width or a minimum of 100 meters (m). Figure 6 illustrates placement of a BURP reach in an AU.

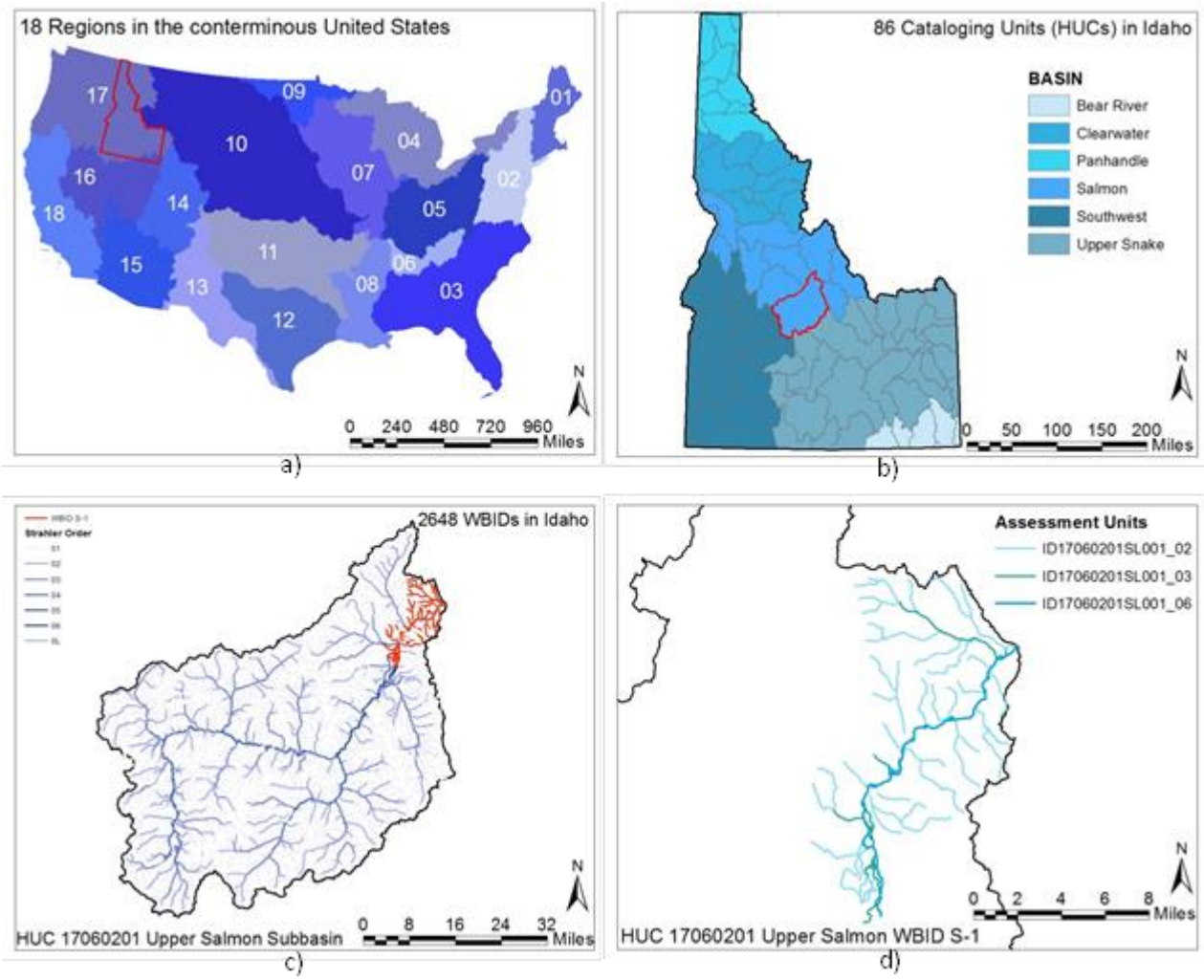


Figure 5. Relationship between 4th field hydrologic unit codes (HUC), water body ID (WBID) and assessment units (AU). a) Level 1 Regions in the nation. b) 86 Level 4 HUCs in Idaho. The highlighted HUC is 17060201 Upper Salmon Subbasin in central Idaho. c) HUC 17060201, Upper Salmon River Subbasin, with WBID S-1 highlighted in red. d) WBID S-1 subdivided into three different AUs.

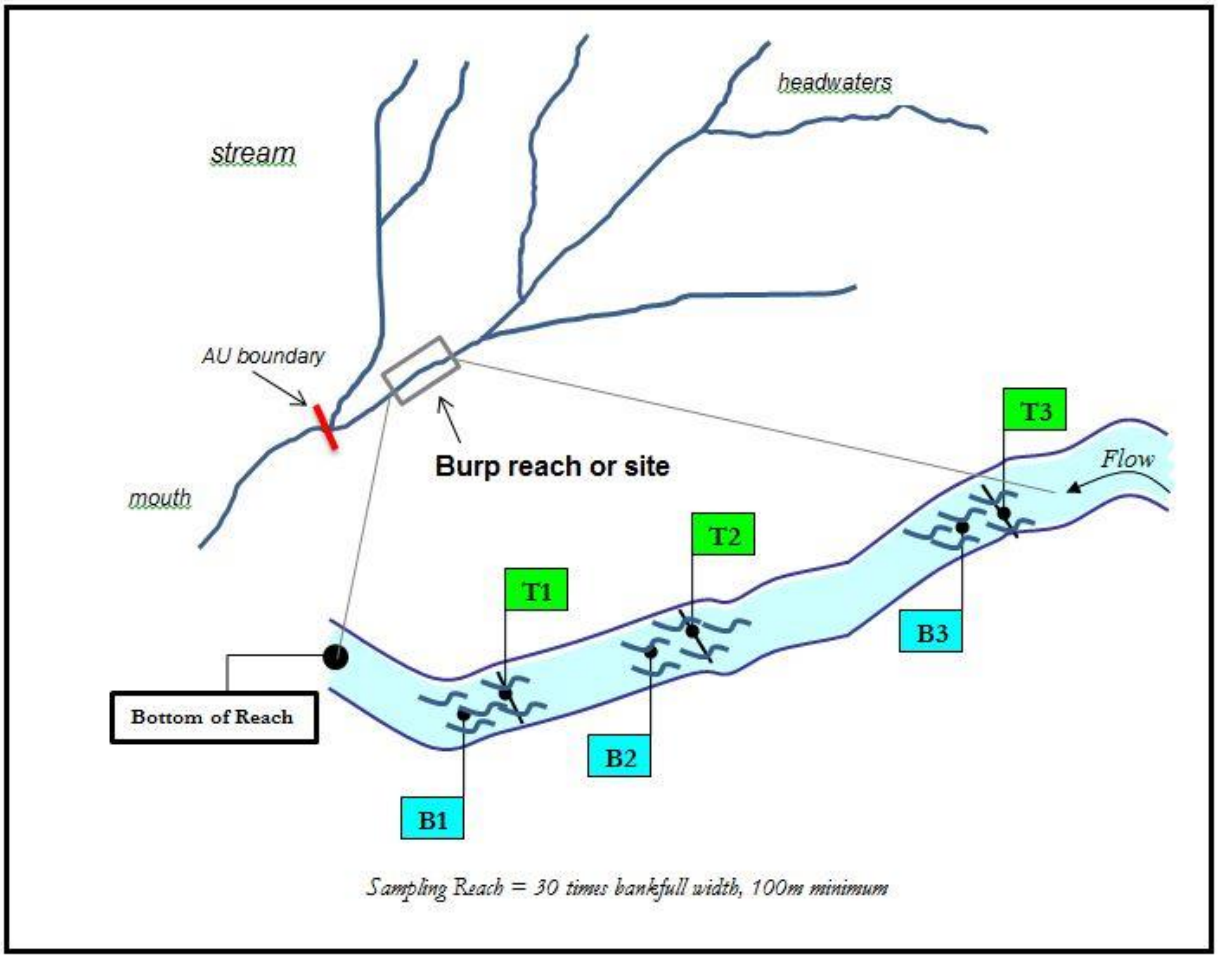


Figure 6. Placement of a BURP reach in an AU.

1.4.2 Steps in the Site Pre-Selection Process

To ensure assessments can be applied to longer stream reaches or entire streams, the BURP monitoring sites must be representative. DEQ uses standard pre-selection steps to identify potentially representative sites. These pre-selection steps are done in the office before the field season starts. The emphasis is to conduct BURP monitoring on unassessed assessment units with federal permitted activities or discharges and then unassessed assessment units in general. The BURP coordinator starts by consulting with other resource agency representatives, reviewing existing stream data, investigating aerial photos, and gathering other information.

Next, the BURP coordinator selects several reaches that appear to represent the AU for a particular water body. The following in-office procedures summarize this pre-selection process and its documentation.

- Examine 1:24,000 scale topographical map(s) and aerial imagery that include the water body to be monitored.
- Determine AUs for the entire length of the water body. Remember that first- and second-order streams are usually combined into one AU within a WBID (Grafe et al. 2002). In

these cases, use the second-order portion to represent the water body. Select the first stream order only if it is defined as a separate AU by DEQ staff.

- Identify major land use changes (based on forest practices, grazing, agriculture, development, or other uses) and mark them on the map or aerial photo. Note that these may be determined or modified when the field crew visits the site.

GIS software may be used in place of a paper map.

1.4.3 Random Site Verification Process

The randomly generated site lists are generated in two parts: a primary site list and an alternate site list. The random site is referred to as the x-site and every effort to sample primary x-sites should be made; however, some sites are considered nonsampleable. See section 1.4.3.1 and 1.4.3.3 for more about nonsampleable sites. If a primary x-site is not sampled, this must be documented by creating a BURP site identification number and listing the reason why the site was not sampled according to the following protocols. Then the next sequentially numbered x-site from the alternate site list must be monitored so that the total number of sites laid out in the *Surface Water Ambient Monitoring Plan* (Pappani 2012) is monitored. The electronic field forms provide two fields that help delineate the status of sampling at a random site. These fields are the *Site Type* and *Stream Condition Factors*.

1.4.3.1 Safety and Accessibility

Although every effort should be made to access the exact x-site, safety concerns can make this impractical. Crew safety is the primary concern, and should the crew feel that either accessing or working at a site is unsafe, it should be dropped and the next alternate site picked up. Cliffs, high flows, and unsafe trails are examples of these safety issues. If a site cannot be reached due to barriers that may not be present at some future date (e.g., forest fire, high water, temporary road closure, unsafe weather conditions) the site should be recorded as “Random-Target Not Sampled,” the stream condition factor noted as inaccessible, and a comment made in the comments section regarding the reasons why the site was deemed inaccessible. The site type and stream condition factor is explained further in section 3.3.2.13.

Accessing a remote site is left to the discretion of the regional coordinator. As a guideline for those sites located in remote, roadless, or wilderness areas, at least a 2-hour hike should be attempted to access the site.

1.4.3.2 Sampleable Categories

Random sites are first evaluated to determine if they meet the target definition (i.e., if they fit the BURP streams protocol). Sites that are evaluated as target are considered for monitoring. If the random site is monitored, the site type is “Random-Target Sampled” and the stream condition factor is “Sampled.” The site type and stream condition factor is explained further in section 3.3.2.13.

1.4.3.2.1 Threatened and Endangered (T&E) Species Present

The presence of spawning salmon or other spawning threatened and endangered species may preclude any attempts to sample. If the site is monitored, then the site type is “Random-Target

Sampled" and the stream condition factor is "Sampled." If the site is not monitored at all (no data collected) due to the presence of these listed species, then the site type is "Random-Target Not Sampled" and the stream condition factor is "T&E Species." The site type and stream condition factor is explained further in section 3.3.2.13.

1.4.3.3 Nonsampleable Categories

Determination of site sampleability is part of the site verification process and should be completed prior to BURP field activities whenever possible. Table 2 shows reasons for a site to be considered nonsampleable, along with directions on how to record this on the field forms.

Table 2. Nonsampleable categories, explanations, and field form notes.

Category	Explanation	Site Type	Stream Condition Factor
No Flow	Streams where standing water is present but there is no flow	Random–Non Target	No flow
Dry Channel	Visible stream channel is present but there is no flowing stream present within a reach centered on the x-site that is 30 times as long as the bankfull width.		Dry
	• Determined at the time of sampling	Random–Non Target	
	• Determined from another source and/or field verified before the actual sampling visit	Rejected, Not Visited, Dry	
Marshland/ Wetland (no definable stream channel)	Water is present but with no definable stream channel.	Random–Non Target	Marshland
	When wetlands surround a definable stream channel, restrict sampling to within the stream channel above and below the x-site. If the x-site lands within the marshland/wetland, move x-site to a point in the stream channel closest to x-site and record new latitude and longitude readings.	Random–Target	Sampled
Beaver Complex	Stream is submerged under a lake or pond due to natural (e.g., beaver dam) impoundment.	Random–Non Target	Beaver Complex
No Riffles	Stream does not have any riffles within sampled reach.	Random–Target Sampled	No riffle
High Flow	Water bodies that fall into the small/stream category as defined in section 1.3.2 but are too high to safely sample	Random–Non Target	High flow
Nonwadeable	Reach length is *not wadeable* and *does not adhere* to the definition of stream as outlined in section 1.3.2.	Random–Non Target	Non Wadeable Reach
Access Permission Denied	Landowner denied access to property.	Random–Target Not Sampled	Denied Access
Permanently Inaccessible	Site is unlikely to be sampled by anyone due to physical barriers that prevent access to the site (e.g., cliffs).	Random–Target Not Sampled	Inaccessible
Limited Access	Site is unlikely to be *fully* sampled by anyone due to physical barriers that prevent access to the whole reach length (e.g., cliffs)	Random–Target Not Sampled	Limited Access
Sample Container	This category should be used for sites with incomplete	Random–	Sample Lost

Broken/Damaged/ Lost	macroinvertebrate, periphyton, or fish voucher samples.	Target Sampled

2 Preparing for BURP Field Activities

Preparing for field work includes determining property ownership of pre-selected sites, getting permission to access the property if it is private, pre-selecting different sites if permission is not granted, and gathering equipment and supplies (Figure 7).

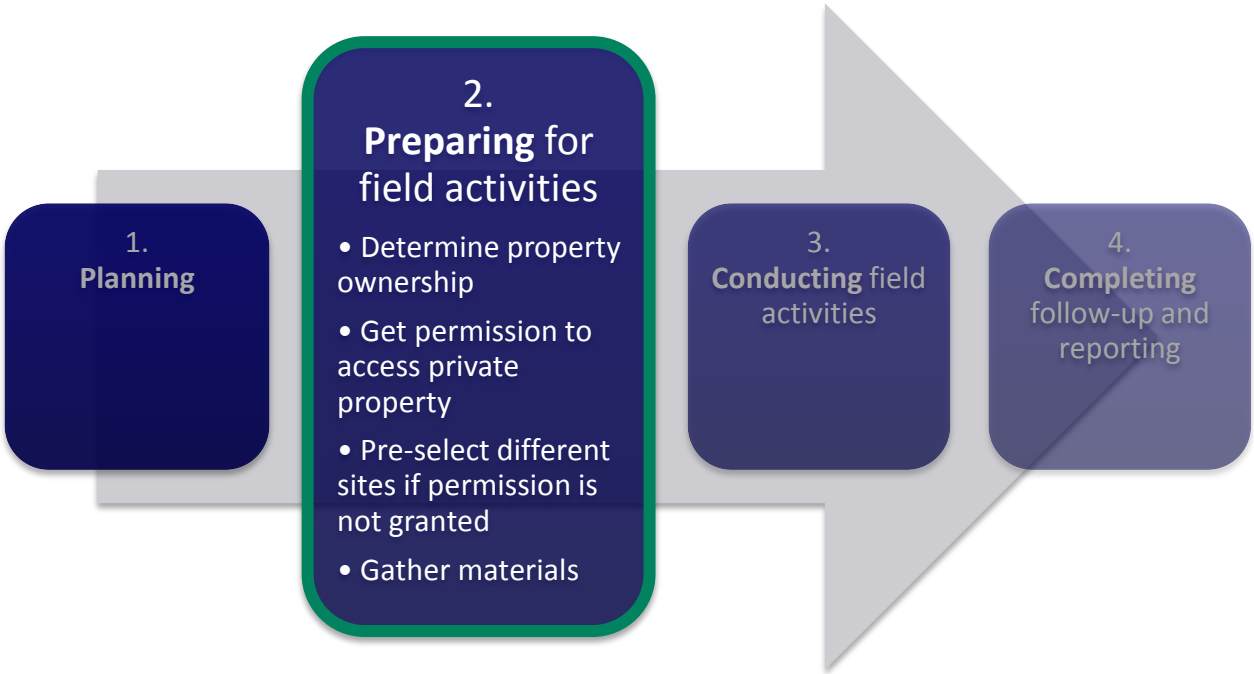


Figure 7. Steps in the preparing for field activities phase.

2.1 Determine Property Ownership

The BURP coordinator will identify and contact the property owner. Crew members may be required to make follow-up contacts. Establish that the contact is the appropriate authority for the property in question.

2.2 Get Permission to Access Private Property

Each regional office is responsible for securing landowner permission to access private property for BURP monitoring. Follow the steps below to help ensure good working relationships with landowners whose cooperation allows comprehensive monitoring.

1. Contact the property owner either by phone or in person. According to BURP policy, the BURP coordinator will make the initial contact. An optional informative brochure (see Appendix B) may be either mailed or hand-delivered to the appropriate party, but it cannot be substituted for getting permission by telephone or in person. The

brochure provides DEQ contact information so the landowner/representative can follow-up with DEQ if necessary.

2. When talking with landowners, be courteous and honest while explaining the intent and purpose of the visit. Answer their questions and assure them that BURP methods will not damage their property or the resource.
    a. *If permission is granted* but the site visit is scheduled for a later time (as it often is), inform the owner that you will contact him or her on or immediately before the day of the site visit (before going to the site). If the landowner or appropriate representative will be unavailable at that time, confirm permission for the visit.
    b. *If permission is granted* and the owner has time, ask questions about the site, particularly regarding site history and characteristics (fish sightings, typical high water levels, flooding events, etc.). This information can be valuable and not readily available elsewhere. Let the owner know his knowledge and input are valued. As a general rule, listen more and talk less. Be sure to include this information in the "comments" form (see step 6).
    c. *If permission is **not** granted*, never argue or try to persuade; simply thank the person and hang up the phone or leave the property and find another representative site.
3. Document the landowner contact in accordance with BURP policy. The private property owner contact record (Figure 8) provides an easy way to document the contact's name, address, and phone number; the time, date, and place of the visit or telephone call; and the results of the contact (was permission granted or denied?). This record should be filled out while talking to the landowner or immediately after and then filed in the site or water body file.

Private Property Owner Contact Record
Beneficial Use Reconnaissance Program

Land Owner: _____ Other Contact(s): _____

Ownership of property in question confirmed? ☐ Yes ☐ No

Address: _____

Phone Number: (____) _____

Date of Contact: _____ Time of Contact: _____ Contacted: ☐ By Phone ☐ In Person

Permission Granted: ☐ Yes ☐ No

Notes about accessing property (things to watch out for, avoid, etc.):

Directions to property:

If site was visited, thank you card sent on (date): _____.

Figure 8. Example of a private property owner contact record.

2.3 Gather Materials

In the spring, BURP coordinators gather and prepare the materials to be used during the field season, including paperwork, supplies, gear, and vehicles. Appendix C contains a checklist that can be used to ensure nothing is overlooked. The coordinators ensure vehicles and gear have received any necessary maintenance and that paperwork and supplies are available or will be available when needed.

3 Conducting BURP Field Activities

Conducting field activities includes visiting pre-selected sites and either verifying or modifying site selections, performing monitoring activities, and filling in field forms. These steps are shown in Figure 9 and detailed below.

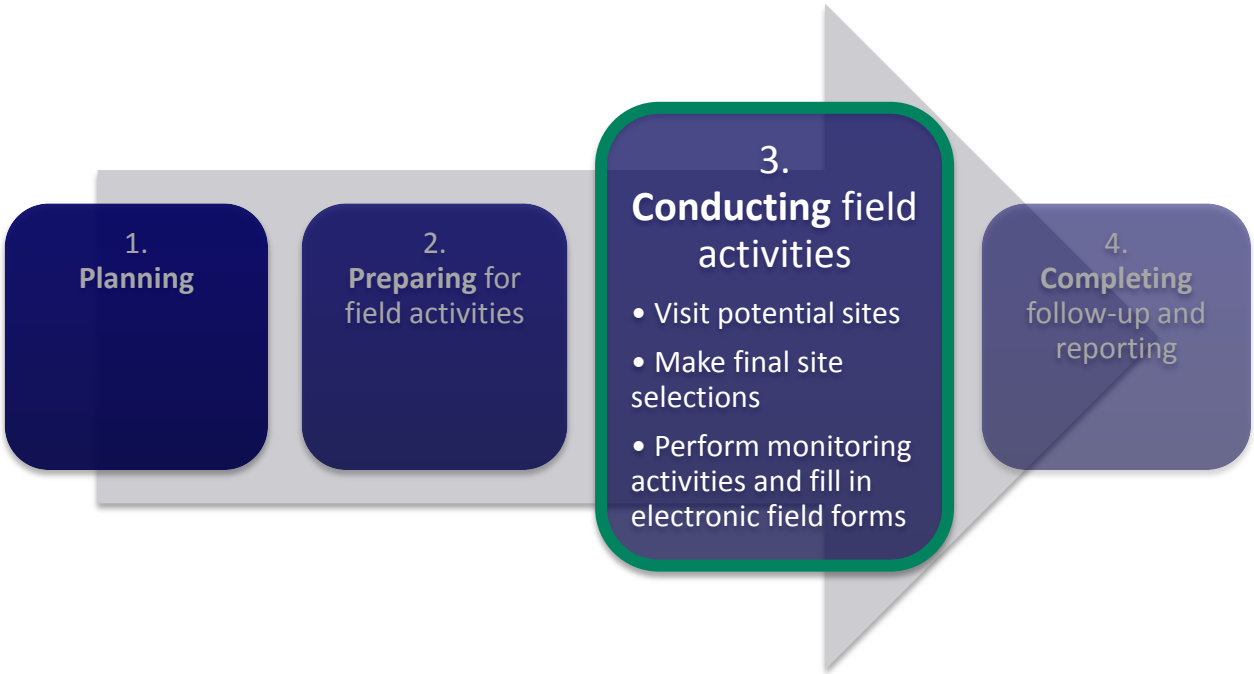


Figure 9. Steps in the conducting field activities phase.

3.1 Visit Potential Sites

If a potential site is privately owned and landowner permission was granted more than 2 days ago, contact the landowner or representative again to remind him or her of the planned visit and to confirm that you have permission. The BURP coordinator will usually make this contact.

When accessing a site, always leave each gate as you found it. Avoid livestock and on-site facilities whenever possible. If at all possible, avoid driving across soft terrain, which can leave damaging vehicle tracks. When placing site markers such as ribbons or stakes, note their locations so they can be removed when monitoring is complete.

3.2 Make Final Site Selections

Pre-selected sampling sites must be confirmed or changed. Upon reaching a site, ensure that it meets the water body size criteria for streams (see section 1.3.2) and is representative of the reach or entire stream (see section 1.4.1). If a pre-selected site is not appropriate, relocate to a more representative location. If a pre-selected site is a randomly generated x-site and is not sampleable, follow the protocols in section 1.4.3.

3.3 Perform and Record Monitoring Activities in the Field

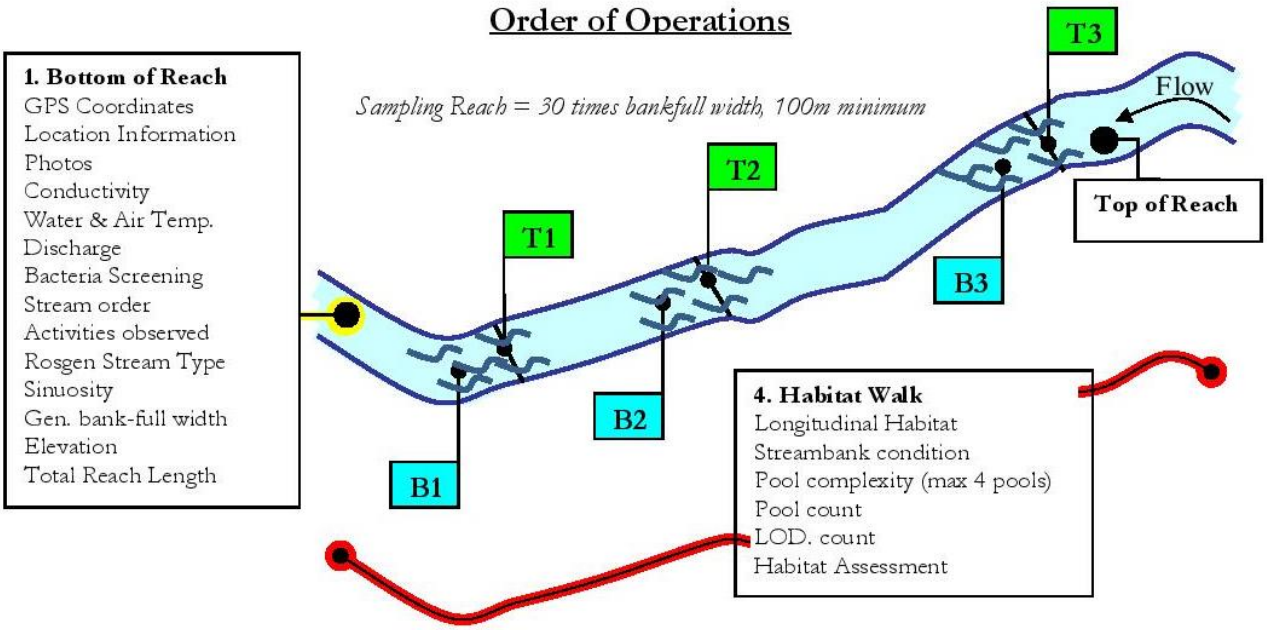
A recommended sequence for performing monitoring activities is outlined in section 3.3.1. This recommended sequence is an efficient way to conduct a BURP survey. However, this sequence may be adjusted to meet the needs of individual crews. Figure 10 shows the general layout of a typical BURP reach and indicates where each variable should be measured.

3.3.1 Recommended Sequence for Monitoring

1. Walk the stream reach prior to monitoring to examine for representativeness and measure general bankfull width. Determine the appropriate reach for surveying. The length should be 30 times the general bankfull width or a minimum of 100 m. If monitoring a randomly generated x-site, the x-site should be within the reach as close to the middle of the reach as possible.
2. Measure the appropriate distance and mark reach beginning and approximate ending points with flagging; being careful to stay out of the stream. The downstream end of the measured length is considered the beginning of the reach.
3. Take photographs of the site (see section 3.3.4.7).
4. Record GPS coordinates and location relative to landmarks on the “location” form and fill out the remaining location fields. Save waypoint to GPS, name waypoint as the BURP ID (see section 3.3.2).
5. Determine and record Rosgen stream type, stream order, sinuosity, and activities in the watershed and record on the “stream” form (see section 3.3.3).
6. Measure specific conductivity and temperature and record them on the “in situ” form (see section 3.3.4).
7. Measure stream discharge in a location with a relatively straight channel and uniform flow, where possible, and record on the “flow” form (see section 3.3.6).
8. Locate the first riffle upstream from the reach beginning point and establish the first transect (B1). At B1, perform the following:
    a. Collect a macroinvertebrate sample and record on the “sample” form (see section 3.3.5.2).
    b. Collect a periphyton sample and record on the “sample” form (see section 3.3.5.4).
    c. Measure canopy closure (shade) and record on the “width” form (see section 3.3.8.4).
    d. Conduct a pebble count immediately upstream from B1. Record the pebble count on the “pebble” form (see section 3.3.7.1).
9. Go 10 m above B1 and perform the following—record all on the “width” form:
    a. Make width, depth, and height measurements (see section 3.3.8.1).
    b. Measure undercut banks, if they are present (see section 3.3.8.3).
    c. Measure canopy closure again (see section 3.3.8.4).
10. Proceed to a mid-site riffle habitat unit and establish the second transect (B2). Repeat macroinvertebrate collection, periphyton collection, canopy closure measurements, and pebble count and record on the appropriate forms (see 8a–8d above).
11. Go 10 m above B2 and repeat width, depth, height, canopy, and any undercut bank measurements and record on the “width” form (see 9a–9c above).

12. Proceed to an upper-site riffle habitat unit and establish the third transect (B3). Repeat macroinvertebrate collection, periphyton collection, canopy closure measurements, and pebble count and record on the appropriate forms (see 8a–8d).
13. Go 10 m above B3 and repeat width, depth, height, canopy, and any undercut bank measurements and record on the "width" form (see 9a–9c).
14. Perform the following reach-wide measurements. In some cases, usually when the terrain is difficult, you may choose to do them as you work your way up the reach so you only have to move through the reach once.
    a. Count large organic debris (LOD) and record on the "long" form (see section 3.3.9.1).
    b. Conduct longitudinal habitat distribution measurements by characterizing and measuring pools, riffles, runs, and glides (Hawkins et al. 1993 is helpful for making these distinctions). Record on the "long" form (see section 3.3.9.3).
    c. Conduct a streambank condition (bank stability) survey by rating the amount of cover and stability of each bank. Record on the "long" form (see section 3.3.9.4).
    d. Assess pool complexity at a minimum of four pools within the site. Follow the pool definition given as one of the habitat types to identify pools. Record on the "pools" form (see section 3.3.9).
15. When all other activities are completed, gather the crew and complete the habitat assessment summary on the "habitat" form (see section 3.3.11).
16. Conduct fish sampling, if it is to be done, using electrofishing (see section 3.3.13). Make notes of fish and amphibians observed on the in the comments form (see section 3.3.12), even if none are collected or vouchered.
17. If doing a bacteria screening process, see section 3.3.14. Collect bacteria samples if the screening process indicates it is necessary and the schedule can accommodate the sample holding time (24 hours). Record on the "sample" form and bacteria screening sheet.
18. Decontaminate equipment and gear before leaving the site (see section 4.1.2).
19. Leave the site as it was (see section 4.1.3).

Contact the landowner (if possible) to thank him/her for allowing you access and to let him/her know you are finished and are leaving the site (see section 4.1.4).



1. Bottom of Reach

2. Bugs = B: Macroinvertebrates, Periphyton, Wolman Pebble Count, Canopy Closure

3. Transects = T (10m above B): Wetted Width, Wetted Depth, Undercut banks, Bank-Full Height, Bank-Full Width, Canopy Closure.

4. Habitat Walk over entire reach = 30 times general bankfull width, 100m minimum

5. Fish=Electrofishing (100m), Fish Observed, Amphibians Observed.

Figure 10. A typical BURP reach, showing where each variable is measured.

The BURP electronic field forms are designed to increase the efficiency of data transfer to a central database and reduce missing data. They are filled in and reviewed in the field by the crew, reviewed in the regional office by the regional coordinator, and then submitted to the central database. In some instances, a paper copy of the electronic field forms may be used. The data must be transferred to the electronic database before submitting to the central database.

The electronic forms are built and maintained in Microsoft Access by the state office. Upon opening the field forms program, a "switchboard" screen is displayed (Figure 11). The initial switchboard screen contains buttons relating to the various data forms that need to be filled out for each site. If the user does not have permissions to access the field forms, she will see an error message to contact the regional coordinator. If this message appears, contact the regional coordinator or the state office Monitoring and Assessment Coordinator, Jason Fales, to gain permission.

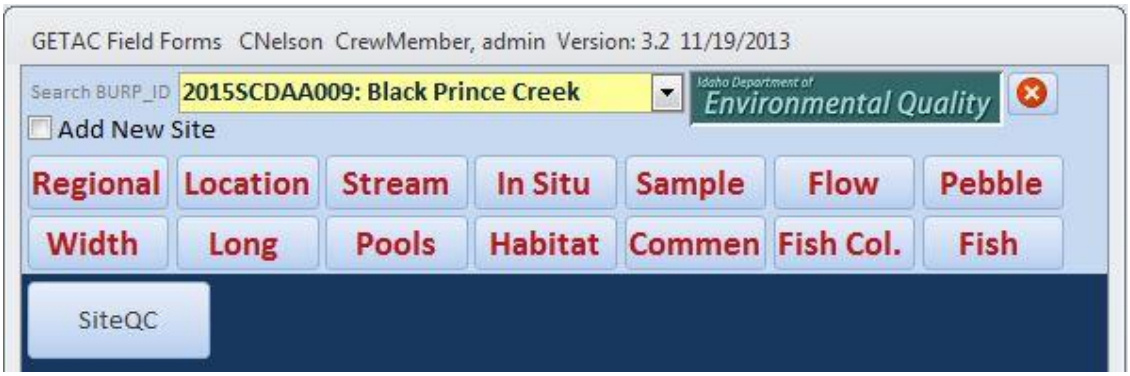


Figure 11. Switchboard on electronic field forms.

The following subsections correspond to each section of the field forms and the bacteria check sheet. Each subsection includes a sample of how the field form looks when properly filled in and a discussion of each variable on that page and the method or protocol used to measure it. Gray shaded fields are automatically populated.

The "Regional" button is filled out only once per season by the regional coordinator and does not need to be opened at any other time. As such, it is not discussed further below.

3.3.2 Location

An example of a properly filled out "location" form is provided in Figure 12.

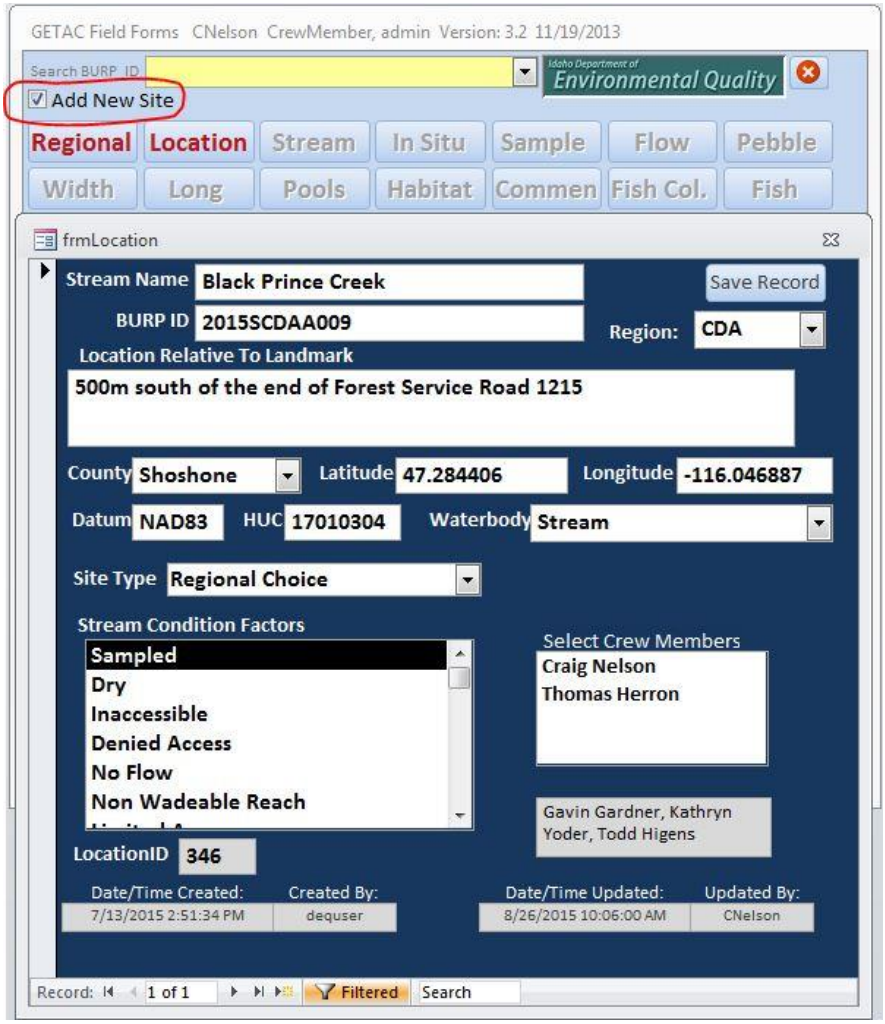


Figure 12. Location form.

3.3.2.1 Adding a New Location

To create a new location (BURP site ID), check the **Add New Site** box on the switchboard prior to clicking on the location button. If this box is not checked, the program will open the location screen and display information for the location selected in the yellow highlighted box or for the first record in the dataset if no location is selected in the box (Figure 12). The **Add New Site** box must be checked to get an empty screen ready to accept new data and create a new location record. (If the user intends to edit an already existing location, the **Add New Site** box must be unchecked.)

3.3.2.2 RegInfoID

The correct region must be selected for each site. This box is connected to predetermined values for county and crew and must be filled in before other boxes become active.

3.3.2.3 Stream Name

The correct name and location of the stream being monitored must be consistently used (Meixler 1999). Different sources will often have different spellings for the same stream, and many streams have the same name. For instance, Idaho has 46 Bear Creeks and Rock Creeks (USGS 2000). BURP has adopted the USGS Geographic Names Information System (GNIS) (USGS 2000) as the standard source for stream names for Idaho. Look up each stream name in the GNIS and verify the location and spelling (*http://geonames.usgs.gov/domestic/*). Use the properly spelled name on all BURP field forms, field notes, and labels concerning a particular monitoring site. Unnamed tributaries to named streams are to be labeled as "Unnamed Tributary to" followed by the named stream.

3.3.2.4 BURP ID

Each site has its own unique site identification number that provides information about the site. For example, for site 2002SLEWA001, 2002 represents the year, S means stream, LEW identifies the regional office, A identifies the "A" crew, and 001 are the numbers unique to the site. The next site that crew visits will have its identification number ending with 002, followed by 003, and so on.

3.3.2.5 Location Relative to Landmark

Provide a site description based on permanent landmarks, such as roads, tributaries, and prominent features. The description should be sufficient for a return trip by someone who was not present on the initial trip.

3.3.2.6 County

Select the county where the site is located. The list of counties to select from is populated once the appropriate region is selected ("RegInfoID"). If the correct county is not in the drop-down list, make sure you have correctly identified the region. If you need a county added to the list, contact the state office (Shawna Castle).

3.3.2.7 Latitude and Longitude

Obtain latitude and longitude from a GPS instrument. If the instrument is unable to get a reading, these coordinates can be appended to the final shapefile in ArcMap or within the GPS file. The "Latitude" and "Longitude" fields are numeric only fields that include *decimal degrees*.

3.3.2.8 Datum

The datum refers to the projection information used when displaying latitude and longitude data. The datum used for field measurements should be NAD83 and can be found on the GPS unit. If the datum on the GPS unit is other than NAD83, it should be corrected. NAD83 is the current standard for DEQ's GIS information.

3.3.2.9 HUC (Hydrologic Unit Code)

This code comes from a stream numbering system representing the USGS 4th-field hydrologic cataloging unit. The HUC denotes a watershed delineated on a 1:100,000 scale map. This numeric field will not accept letters and will only accept an 8-digit entry.

3.3.2.10 Waterbody

This field refers to the type of water being monitored. For BURP, this is most often "stream" and the program defaults to this value.

3.3.2.11 Crew Members

Select the crew members from the box on the right. These will appear in the text box labeled **Crew**.

3.3.2.12 Site Type

The **Site Type** box indicates which classification a particular site fits into. If a site is selected by the regional office staff to be representative of a particular AU, it is considered to be a "Regional Choice." If the site is randomly selected to generate the §305(b) report of the condition of the state's waters, then the site type is one of the "Random–" site types. Refer to section 1.4.3 for further information.

3.3.2.13 Stream Condition Factors

The **Stream Condition Factors** box lists if the site was sampled or reasons why a site wasn't sampled. Select one factor from this list.

A "Sampled" site is one where at least macroinvertebrate and habitat data were collected. An unsampled site is one where these data were not collected. If a site is not sampled, the reason corresponding to one given in section 1.4.3.3 must be selected. The default value for this list is "Sampled."

3.3.2.14 Save Record

Once all "location" fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information (Figure 13). By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

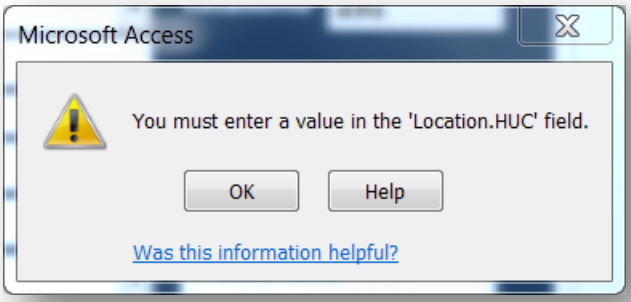


Figure 13. Example error message for incomplete data entry.

3.3.3 Stream

An example of a properly filled out "stream" form is provided in Figure 14. The program will automatically populate the BURP ID field based on the BURP ID selected on the switchboard. The user must make sure that the **Add New Site** box is *unchecked* when entering information other than on the location page (Figure 14).

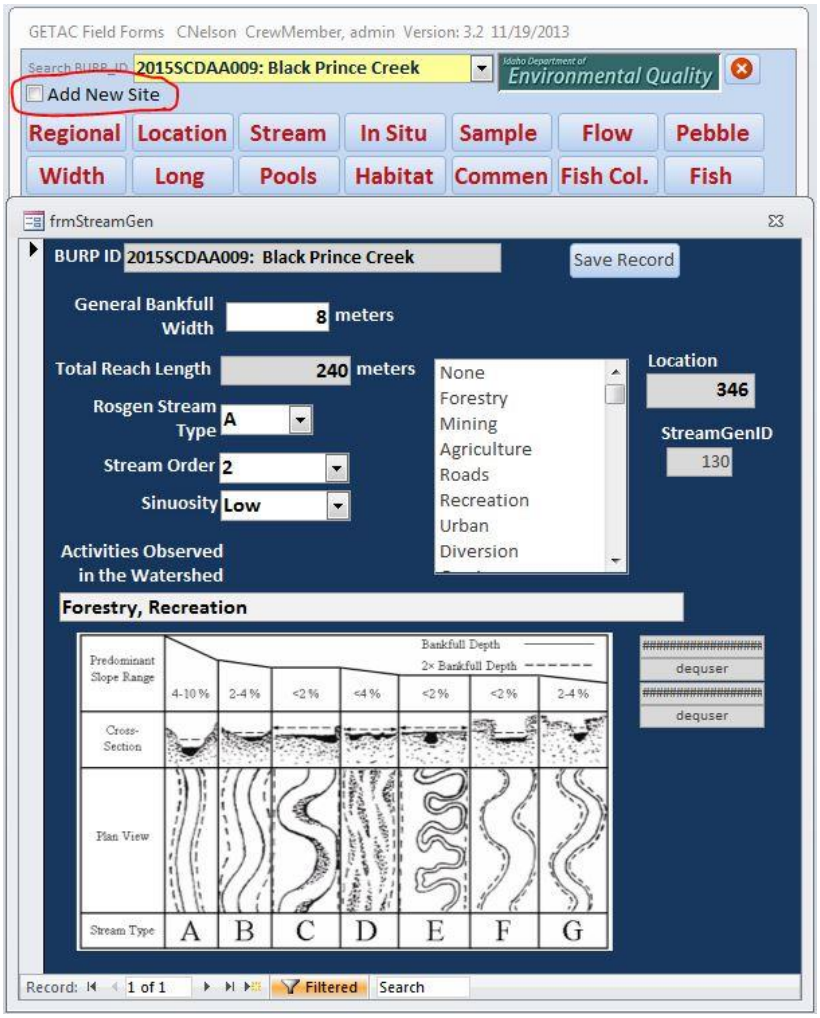


Figure 14. General stream form.

3.3.3.1 General Bankfull Width

The general bankfull width is the average channel width where the flow of water just fills the channel to the top of its banks and where the water begins to overflow onto the floodplain. Take several measurements, calculate the average, and record it in the box. For further discussion regarding bankfull width, see section 3.3.8 and Leopold et al. (1995).

3.3.3.2 Total Reach Length

The total reach length is calculated as either 30 times the general bankfull width or a minimum of 100 m, whichever is greater. The program will automatically determine the total reach length once the general bankfull width is entered.

3.3.3.3 Rosgen Stream Type

Streams in Idaho exhibit considerable variability in climates, hydrology, geology, land forms, and soils. Recognizing this, the BURP Technical Advisory Committee elected to use Rosgen and Silvey's (1996) stream classification system, level I, to compare streams. Rosgen and Silvey's system integrates dimension, pattern, and profile characteristics into one of seven geomorphic stream types (Figure 15).

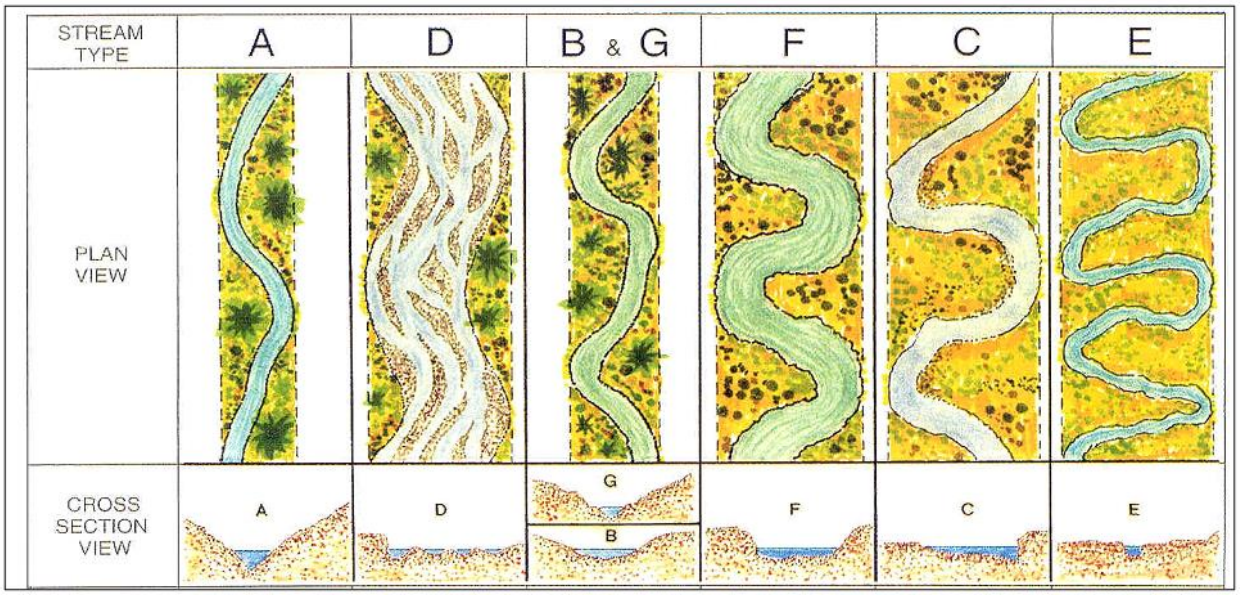


Figure 15. Rosgen stream type illustrations and descriptions (adapted from Rosgen and Silvey 1996, used with permission).

Use Table 3 to determine the stream type. If necessary, estimate or measure the bankfull width/depth ratio (using the width and depth of the channel at bankfull). The entrenchment ratio is explained below.

Table 3. Description of Rosgen stream types.

Entrench-ment Ratio	Gradient	Stream Type	Further Attributes
<1.4	>4%	A	Steep entrenched, cascading step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel. Typically of low stream order.
	2%–4%	G	Low bankfull width/depth ratio (<12). Narrow, deep bankfull channel (a gully). Step/pool and moderate gradients. Gradient may be < 2% in downcut meadow sections.
		F	High bankfull width/depth ratio (>12). Entrenched meandering riffle/pool channel on low gradients. Highly erodible banks and significant bar deposition. Little or no visible flood plain.
2.2–1.4		B	Riffle-dominated, moderate sinuosity. Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks. Often found in narrow, moderately sloping valleys.
>2.2	<2%	E	Very low bankfull width/depth ratio (<6) and high sinuosity. Low gradient, tortuously meandering stream with many pools and little deposition. Very efficient and stable. Often found in flat-bottomed valleys and alpine meadows.
		C	High bankfull width/depth ratio (>12) and moderate-high sinuosity. Low gradient, meandering riffle/pool alluvial channels with broad, well defined floodplains and point bars.
N/A	<4%	D	Multiple channels (three or more braids). Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks.

The most important attribute in characterizing a stream is *entrenchment*—a measure of how easily the stream can access its floodplain during flood stage, defined as twice bankfull depth. Bankfull depth is the depth that water would be at its bankfull stage, measured in the thalweg. Note that this is different from bankfull height. Entrenchment is characterized by comparing the width of the flood stage and bankfull channels (Figure 16). To calculate entrenchment ratio, measure or estimate the channel width at bankfull and twice bankfull depths. It would be helpful to take this measurement at one of the width/depth transects because the bankfull width has already been measured.

$$\text{Entrenchment Ratio} = \frac{\text{Width at } 2 \times \text{Bankfull Depth}}{\text{Bankfull Width}}$$

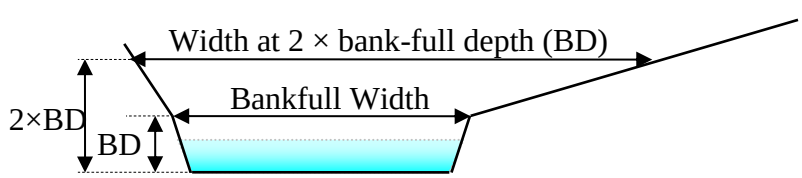


Figure 16. Entrenchment ratio.

When entrenchment ratio is low (≤1.4), the stream is entrenched and cannot readily access its floodplain. Entrenchment rations between 1.41 and 2.2 indicate a stream that is slightly or moderately entrenched. When entrenchment ration is high (>2.2), the stream is not entrenched, and can easily access its floodplain.

3.3.3.4 Stream Order

Stream order is a hierarchical ordering of streams based on the degree of branching. As shown in Figure 17, a first-order stream is an unforked or unbranched stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, etc. *Use a 1:100,000 scale map to determine stream order.*

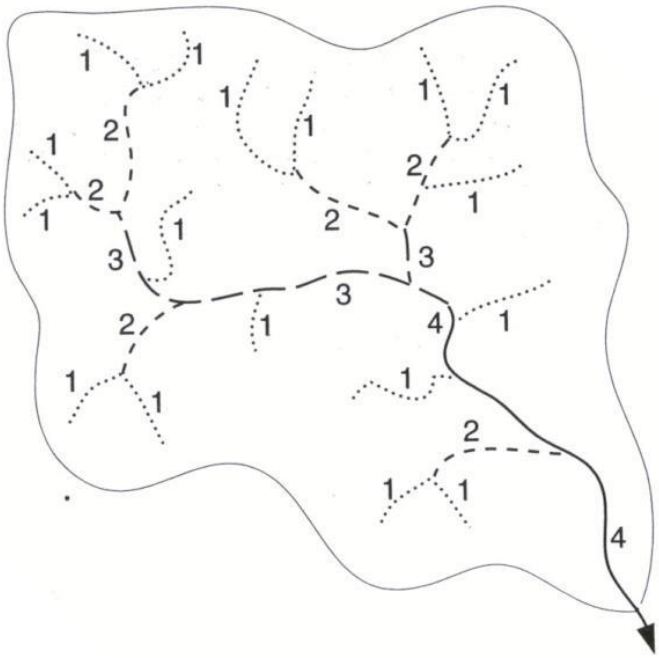


Figure 17. Stream orders.

3.3.3.5 Sinuosity

Sinuosity is a measure of the stream channel's tendency to meander back and forth within the stream valley. Strictly speaking, sinuosity is the ratio of the channel length between two points in a channel and the straight line distance between the same two points (Figure 18). Describing the sinuosity of the stream reach as low, moderate, high, or braided does not necessarily mean the entire stream has that level of sinuosity but that the portion of the stream being monitored can be described this way.

Stream channels with low sinuosity are relatively straight with few bends or meanders. A sinuosity ratio of 1–1.3 indicates low sinuosity. Stream channels with moderate sinuosity do not have many bends greater than 90 degrees and have a sinuosity ratio of 1.3–1.7. A high sinuosity rating should be given to streams with a significant number of bends and meanders greater than 90 degrees and a sinuosity ratio of greater than 1.7. Braided streams have a channel that has been divided into several smaller channels, typically due to an accumulation of deposits within the bankfull channel.

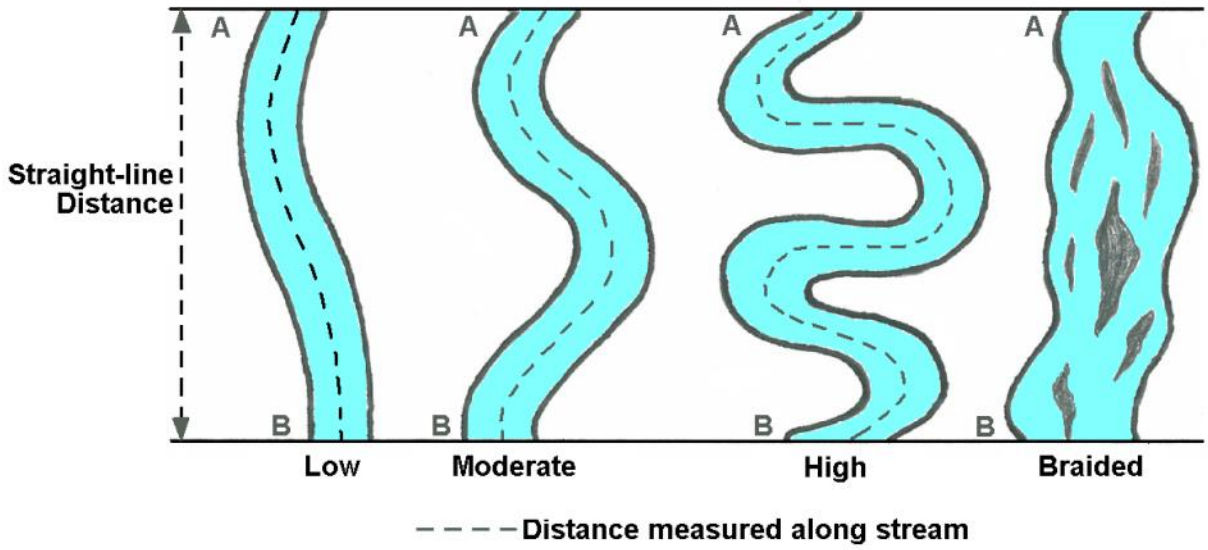


Figure 18. Sinuosity.

3.3.3.6 Activities Observed in Watershed

Record activities observed upstream of the BURP reach. Activities observed downstream of the reach need to be documented in the "comments" form. More than one activity can be selected.

3.3.3.7 Save Record

Once all "stream" fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.4 In Situ

An example of a properly filled out "in situ" form is provided in Figure 19.

Figure 19. In situ form.

3.3.4.1 Water Time

Record the time when in situ measurements are made. The user may either enter a time manually or click on the **Update** button to insert the current computer time.

3.3.4.2 Air Temp

A number of factors influence water temperatures in streams (DEQ 2000), including water source, ground water, precipitation runoff, solar radiation (including shading), air temperature, climate, and geologic setting (Stevens et al. 1975). These factors must be considered when designing any water temperature study, placing temperature sensing devices, and interpreting temperature data. Consequently, DEQ collects both air and water temperature data.

Take the air temperature at the downstream end of the reach in the riparian zone 1 m above and 1 m away from the stream. The thermometer should be placed in the shade. Use either a hand-

held thermometer or the temperature sensor on a specific conductivity or dissolved oxygen meter. Take the air temperature first while the thermometer is dry.

3.3.4.3 Water Temp

Take the water temperature in a shaded spot in the stream using a thermometer. Be sure the water is adequately mixed and not influenced by localized warm or cool water sources such as ground water, point sources, or direct sunlight. Shaded sites with moderately turbulent flows, such as the tail outs of lateral scour and plunge pools, are good locations. Leave the thermometer in the water several minutes until it stabilizes before you take a reading.

3.3.4.4 Conductivity

Conductivity is the ability of a solution to carry an electrical current. Conductivity is measured as micromhos per centimeter (μmhos/cm) or microsiemens per centimeter (Armantrout 1998). Conductivity is dependent on the total concentration of ionized substances dissolved in the water. Elements whose ionic forms contribute the most to these measures include calcium, magnesium, sodium, potassium, bicarbonate, sulfate, and chloride. Solutions of most inorganic compounds are relatively good conductors. Conversely, molecules of organic compounds that do not dissociate in aqueous solution conduct a current very poorly, if at all (Clesceri et al. 1998).

Several sources discuss the usefulness of conductivity data. Kunkle et al. (1987) found conductivity to be a useful indicator of mining and agricultural effects. Royer and Minshall (1996) found sites designated as degraded generally had higher conductivity values. Maret et al. (1997) reported conductivity is one environmental factor determining the distribution of fishes. Davis et al. (2001) report that conductance is an important water quality measure because the data can be used to estimate the total dissolved solids in the water. The conductivity of the water is important to electrofishing efforts (Kolz 1993; Reynolds 1983). Reynolds notes that a freshwater conductivity range of 100–500 μmhos/cm is best for electrofishing (Reynolds 1983).

The conductivity of potable waters in the United States generally ranges from 50 to 1,500 μmhos/cm (Clesceri et al. 1998). Hem (1985) reports the conductance values for natural ground and surface waters range from 50 to 50,000 μmhos/cm or more. Values of 2–41 μmhos/cm have been reported for melted snow in the western United States (Hem 1985).

Before measuring conductivity, ensure that the meter is clean, in good working condition, and calibrated. Always transport the instrument in a protective carrying case. Use fresh batteries and carry a spare set of batteries and/or a backup meter. Keep a log book with the meter and record all calibrations, maintenance, and repairs. Follow the manufacturer's recommendations concerning cleaning and storage.

Calibrate the instrument using a calibration solution within the same range of conductivity as the streams being monitored. Measure conductivity at the beginning of the reach using a calibrated conductivity-temperature meter before any crew member enters the stream. Place the meter in flowing water at mid depth. If using the YSI model 30, be sure the "ºC" indicator on the machine *is blinking*, indicating the instrument is measuring specific conductivity. Specific conductivity must be measured in the field to be reliable (Radkte et al. 1998). For in situ measurements, which are recommended, immerse the conductivity and temperature sensors in the water a

minimum of one minute to allow the sensors to equilibrate to water conditions. Record the conductivity (in microsiemens per centimeter) and temperature on the field form. Rinse the sensor in deionized or distilled water and store it properly.

3.3.4.5 pH

The activity of hydrogen ions in water is measured as pH. This is a measure of the acidity or basicity of a water body. Natural streams exhibit pH levels between 6 and 9 depending on the overall chemical constituents present. This field is not required and may be left blank if the crew does not take a pH measurement.

Calibrate the instrument using a calibration solution within the same range of pH as the streams being monitored. Measure pH at the beginning of the reach, using a calibrated pH-conductivity-temperature meter before any crew member enters the stream. Place the meter in flowing water at mid depth. For in situ measurements, which are recommended, immerse the sensors in the water a minimum of one minute to allow the sensors to equilibrate to water conditions. Record the pH value in the appropriate box. Rinse the sensor in deionized water and store it properly.

Measurement of pH is optional.

3.3.4.6 Dissolved Oxygen

Dissolved oxygen is the relative amount of oxygen present in the water body. It is dependent on the atmospheric pressure at the time of the reading and can be read in either percent saturation or milligrams per liter (mg/L). For these purposes, the dissolved oxygen reading should be taken in mg/L.

Calibrate the instrument following the manufacturer's instructions. Measure dissolved oxygen at beginning of the reach using a calibrated dissolved oxygen meter before any crew member enters the stream. Place the meter in flowing water at mid depth. For in situ measurements, which are recommended, immerse the sensors in the water a minimum of one minute to allow the sensors to equilibrate to water conditions. Record the dissolved oxygen value in mg/L in the field form. Rinse the sensor in deionized or distilled water and store it properly.

Measurement of DO is optional.

3.3.4.7 Photo Information

Photographic records provide visual details concerning riparian conditions and stream geomorphology. This visual information shows important stream characteristics such as land use, geomorphic channel units, habitat features, and bank conditions (Meador and Survey 1993). Such visual details complement field notes and habitat measurements. This type of documentation may also provide baseline information concerning qualitative changes of riparian conditions and land use and stream channel modifications.

Take digital photographs at each reach to document present conditions. A minimum of three photos of the stream site should be taken at the center of the downstream portion of the reach: one facing upstream, one facing downstream, and one panoramic photo. A panoramic view of the stream, riparian vegetation, and floodplain is very helpful.

Photos are extremely valuable to individuals reviewing or assessing the data. Therefore, be sure to photograph anything unusual, beneficial uses, pollution sources, etc. Consider taking photos at the upper end of the reach as well. Using a small hand-held location sign such as a dry erase board or chalk board is optional.

Photos should be downloaded and relabeled using the BURP ID and direction in the photo label. For example, the upstream photo from site 2010SDEQA001 should be labeled as follows:

2010SDEQA001.UP.

3.3.4.8 Save Record

Once all "in situ" fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.5 Sample

An example of a properly filled out "sample" form is provided in Figure 20.

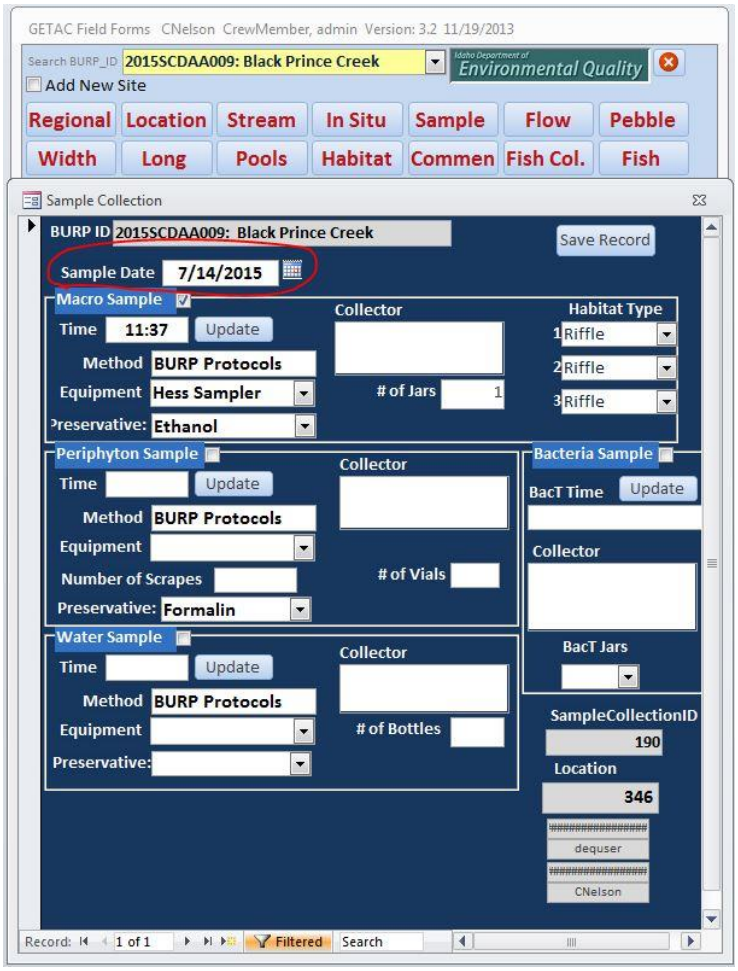


Figure 20. Sample collection form.

3.3.5.1 Sample Date

This required field **must** be filled in. Either select the sample date using the calendar icon to the right of the text box when the cursor is in the box or manually type in the date in the format mm/dd/yyyy. This field is used to generate the sample date for the BURP sampling event and can't be left blank.

3.3.5.2 Macroinvertebrate Samples

A macroinvertebrate is an animal without a backbone that is large enough to be seen at some point in its lifecycle without magnification and will be retained by a screen with 0.500-millimeter (mm) mesh (U.S. #30) (Armantrout 1998).

Sampling for macroinvertebrates is an *essential part* of the BURP process. This biological assemblage reflects the overall ecological integrity of a stream. Because most streams are monitored infrequently, chemical monitoring is not always representative of the long-term condition of the stream. The biological community is exposed to the stream's condition over a long period of time, and therefore provides an integrated representation of water conditions and better classification of support status. Macroinvertebrates are a useful assessment tool because

they are ubiquitous, include numerous species, and respond to physical and chemical impacts in the water column (Rosenberg and Resh 1993). Additionally, macroinvertebrates with certain environmental tolerances may provide some insight regarding pollutants (Johnson et al. 1993).

BURP collects macroinvertebrate samples from three separate riffle habitat units (B1, B2, and B3) spread evenly through the reach, following Clark and Maret (1993). In a typical BURP survey, the person who collects macroinvertebrates also collects periphyton either before or immediately after collecting the macroinvertebrates. To collect macroinvertebrates at each transect, first identify where riffle habitat begins and ends. Generate two random numbers using a random number table or stopwatch. Use one number as the lateral distance along the streambank to go upstream and the other as the perpendicular distance to go out across the stream. Place the sampler in this location. If the randomly chosen site does not provide an adequate seal for the sampler or sample, move the sampler as much as 1 m in any direction to improve sample collection.

Collect the macroinvertebrate sample using the chosen sampler (Hess is preferred but a Surber may also be used) with a 500-micron size net (Barbour et al. 1999; Hayslip 1993). The selected sampler must be used at all three transects for the reach. Brush all rocks and stir the substrate to a depth of 10 cm with a metal rod for a minimum of two minutes, with a goal of 3–5 minutes per sample. Place the scrubbed rocks in front of the sampler net. Take care not to damage the macroinvertebrates during all phases of sample collection. Handle all macroinvertebrate samples (in the field) over a white pan, including when transferring the sample from the net to the sample container. If portions of the sample fall into the white pan, wash it into the sample bottle with denatured alcohol. (See Appendix D for a safety data sheet [SDS] for denatured alcohol.)

Place the sample into a container, label it inside and out, and preserve with 95% ethanol (the container should be filled to the shoulder). If a container is more than 50% full of sample material (organic and inorganic components), the contents must be divided into two containers (a split sample). If a single sample is divided into more than one container, be sure the sample labels and field data forms clearly reflect the sample identity. If more than one container is used, *each label* must identify each container's relationship to the total number of containers for that site (e.g., 1 of 3, 2 of 3, and 3 of 3). For the sample labels, use archival grade heavy paper that can withstand storage in alcohol (such as Resistall Paper 36#). Use a pencil for writing the field information on the label. Put one label inside the jar and tape a label to the outside of the jar. At a minimum, each label must contain the following information: (1) stream name, (2) date, (3) site ID, (4) collector's name, and (5) jar count (e.g., 1 of 3, 2 of 3). After closing each sample container, gently invert it to mix the sample with the alcohol. Repeat this collection procedure at B2 and B3.

In the form, fill in the time the first sample was taken (click on the **Update** button to automatically enter the computer time), the method used (default is BURP Protocols), the person collecting the sample, the type of equipment used, the total number of sample jars for the site, and the habitat type sampled. After sampling the reach, thoroughly rinse all brushes, nets, and other items that have come in contact with the sample. Examine them carefully and remove any algae or other debris. Examine all equipment again before using it at the next BURP site and clean it to avoid sample contamination.

3.3.5.3 Water Sample

If a water chemistry sample is collected, the time, method, equipment, collector, and number of bottles must be recorded on the field form.

3.3.5.4 Periphyton Sample

Periphyton is microflora growing on the bottom of the stream or on other submerged substrates, including higher plants. Periphyton is a useful water quality indicator because of its wide distribution, numerous species, and rapid response to disturbance (Barbour et al. 1999). Periphyton integrates physical and chemical impacts because it exists in the water column. Diatoms, a type of periphyton, have frequently been identified as useful biological indicators, specifically in Montana, Kentucky, and Oklahoma and European countries (Rosen 1995; Round 1991). Periphyton information supplements fish and macroinvertebrate information because of differences in trophic levels, motility, and life history (Allan 1995). Additionally, if fish information is unavailable for a particular stream, data will still be available from two other biological assemblages (if both periphyton and macroinvertebrates are collected) to determine aquatic life support status.

Collect periphyton samples from three separate riffle habitats (B1, B2, and B3), just above where the macroinvertebrate sampler was placed. Use a modified 30-cc syringe with a 0.75-inch diameter and a small, stiff-bristled brush. Choose a stone from the wetted stream channel and carry it to the bank, making sure that the portion of the stone that was exposed to the sun remains on top. If no stone is available, use a piece of submerged wood, debris, or other hard surface. Firmly press the modified syringe over the stone, creating a seal, and add a small amount of water using an aspirator or eye dropper. Place the brush into the modified syringe and scrub the surface of the substrate until the attached algae are loose. When the algae have been sufficiently dislodged, use the aspirator to remove the mixture and place it into a 50-milliter (mL) centrifuge tube. Move the modified syringe to a new undisturbed portion of the substrate and do another scraping following the above procedure. A minimum of two scrapes should be done at each transect. Once all three transects have been sampled for periphyton, fill the vial to 40 mL with stream water and preserve by filling the remainder of the vial with 10% buffered formalin to a volume of 50 mL. (See Appendix D for an SDS for formalin and Appendix E for additional formalin handling information.)

In a typical BURP survey, the person who collects macroinvertebrates also collects periphyton immediately after collecting the macroinvertebrates. If the periphyton is sparse, scrape the rock more than twice to collect an adequate sample. The sample should be noticeably green in color.

Labels must include at least the following information: (1) stream name, (2) site ID, (3) date, (4) collector’s name, and (5) vial count (e.g., 1 of 3, 2 of 3). Label all sample containers (centrifuge tubes/vials) with labels printed on archival grade heavy paper that can withstand storage in formalin solution (such as Resistall Paper 36#) using a pencil to write on the label. Tape a label to the outside of the vial. Indicate on the vial if formalin has been added by writing a “P” (for “preserved”) on the top of the vial, and indicate that formalin was used on the sample label.

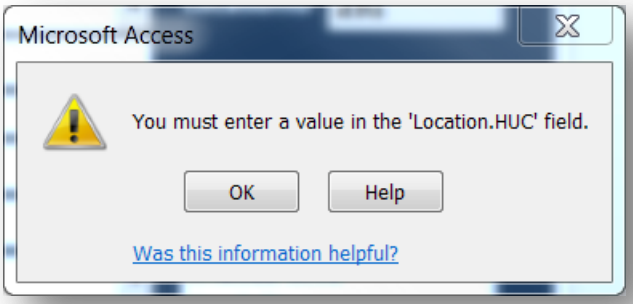
In the form, fill in the time the first sample was taken (click on the **Update** button to automatically enter the computer time), the method used (default is BURP Protocols), the person collecting the sample, the type of equipment used, and the total number of sample jars for the site.

When the monitoring season is over, send all periphyton samples to the Water Quality Division in the DEQ State Office.

3.3.5.5 Bacteria Sample

Refer to section 3.3.14 for more information on collecting a bacteria sample. If a bacteria sample is collected at the site, the time of sample collection, collector, and number of jars should be recorded on this form. More detailed bacteria sample information will be entered in a different sheet separate from these electronic field forms.

3.3.5.6 Save Record



Once all "sample" fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.6 Flow

Discharge, or flow, is the volume of water passing a given point per unit of time (Armantrout 1998). Davis et al. (2001) note that "discharge, at summer base flow, is a measure of minimum stream size and an indicator of potential habitat for fish and aquatic invertebrates." Nelson et al. (1992) found flow to be one of the physical attributes that distinguished streams from different geologic regions. Flow patterns affect habitat characteristics such as erosion (in part), distribution of aquatic assemblages, and movement of suspended materials. Other associated variables such as discharge and gradient may provide useful forms of stratification (Rankin 1995).

In general, flow is measured by the velocity-area method, where discharge is estimated by summing the product of the velocity and area of several equal-width cells across the stream channel. An example of a properly filled out "flow" form is provided in Figure 21.

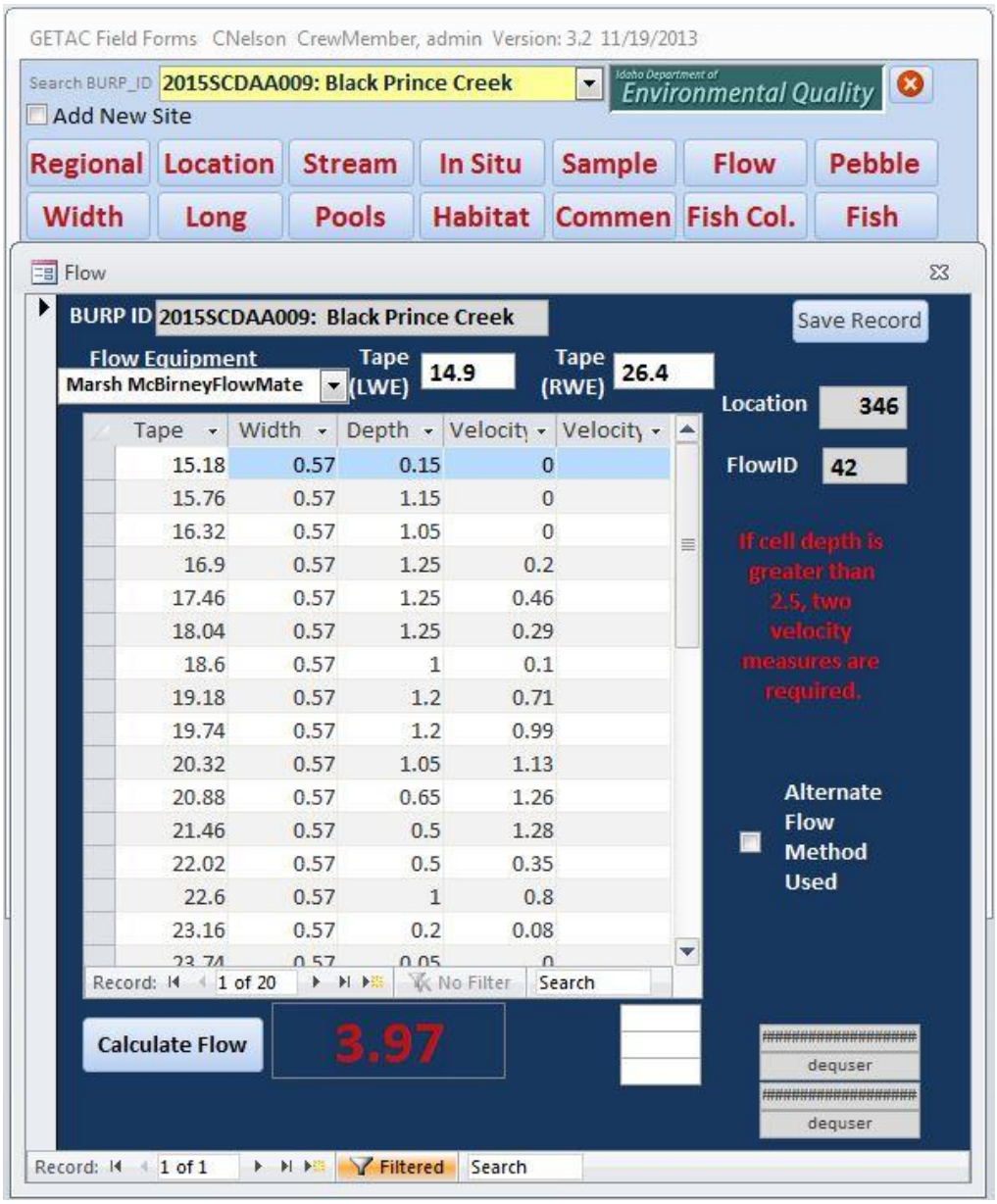


Figure 21. Flow form.

You may measure flow outside the reach if no suitable area is available within the reach; however, such a measurement should be taken no more than one reach length outside the survey reach and only where no other obvious inflow is taking place between the reach and the point chosen for measuring flow.

If using a pressure-sensitive electromagnetic flow meter (e.g., Marsh-McBirney Flowmate 2000), use the time-averaging function and set it for 10 second intervals. Record negative (-) readings of a pressure sensitive electromagnetic flow meter as zero.

Locate a straight, nonbraided stretch of the sampling reach. Place a measuring tape across the stream perpendicular to the flow. On the form, the user shall select the appropriate type of flow equipment to determine flow. If using a Marsh McBirney Flow Mate, the user may enter the tape

measurement reading at the left wetted edge (LWE) and the right wetted edge (RWE) and the program will calculate the cell width and tape measurement readings where depth and velocity measures should be taken (Figure 21). Take evenly spaced velocity measurements (a minimum of 0.5 feet per measurement in the center of the cell; see Figure 22) with 20 measurements from wetted bank to wetted bank so that no more than 5% of the total discharge is in each partial cross-section or cell (Harrelson et al. 1994).

If the depth is greater than 2.5 feet, a second velocity measure is required and the program will prompt the user for this second measure when the flow is calculated. Record depth and velocity from the top-set wading rod and electromagnetic velocity meter. For depths less than 2.5 feet, take one velocity measurement at 60% of the depth. For depths greater than 2.5 feet, take two velocity measurements for each partial cross section; one at 20% of the total depth and a second at 80% of the total depth.

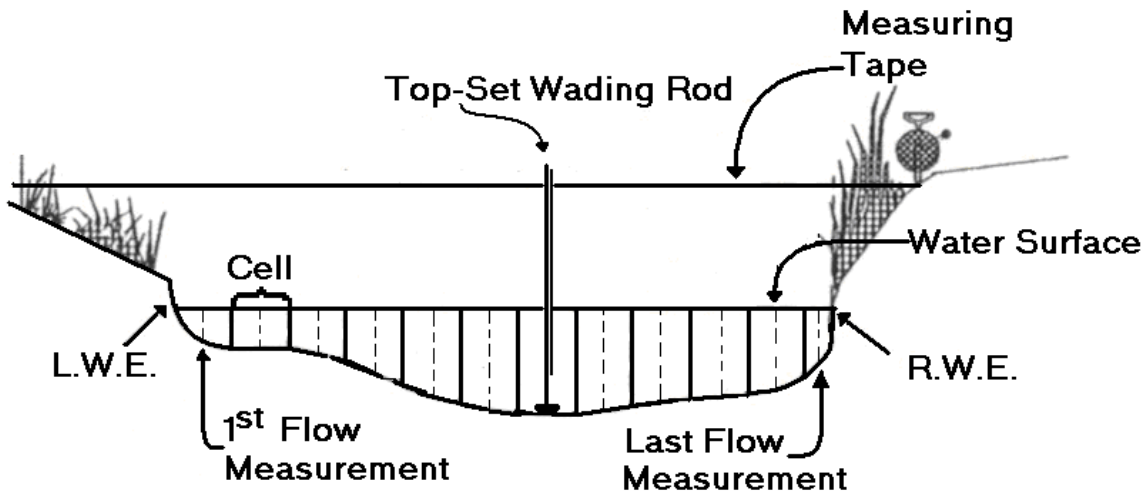


Figure 22. Illustration of discharge measurement locations (left wetted edge [LWE] and right wetted edge [RWE].

The entire stream width must be waded, so be particularly aware of personal safety while conducting flow measurements. If wearing waders, be sure the soles have adequate traction. If the stream cannot be safely waded, the river protocol should be used.

After all depth and velocity measures are taken and entered accordingly, the user can click on the **Calculate Flow** button and the flow will be calculated and entered into the “Flow” text box below the readings. If an alternate method of calculating flow is used (e.g., a neutrally buoyant object is timed in the stream), check the **Alternate Flow Method Used** box and enter the flow in the box that appears (Figure 23).

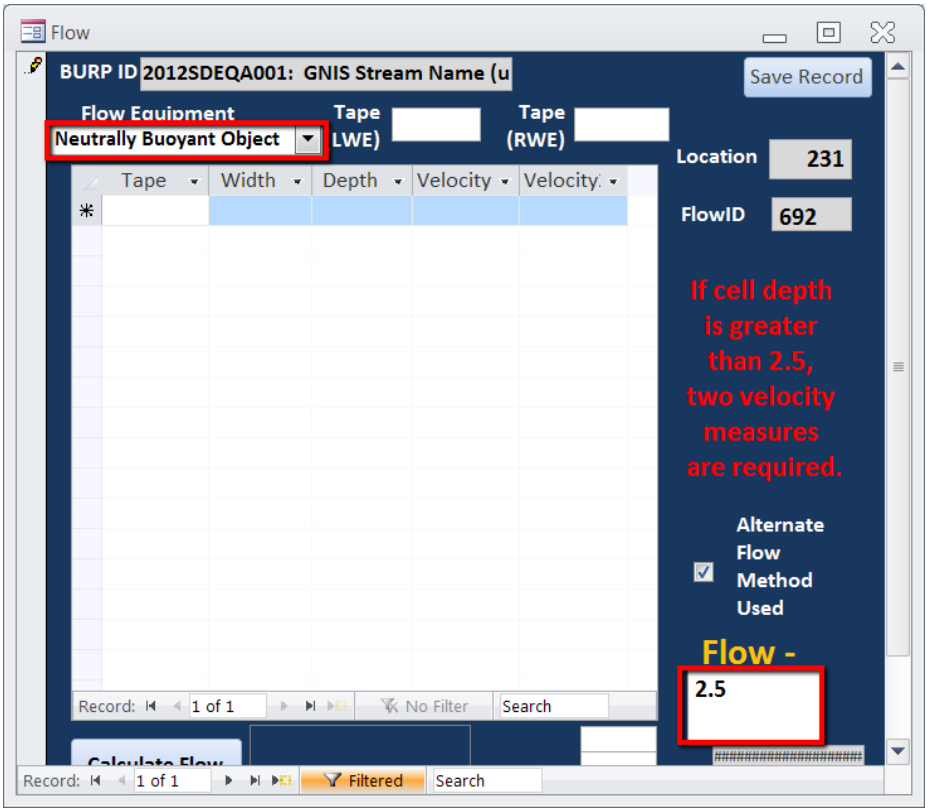


Figure 23. Illustration of alternate flow method.

3.3.6.1 Save Record

Once all "flow" fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.7 Pebble

An example of a properly filled out "pebble" (substrate) form is provided in Figure 24.

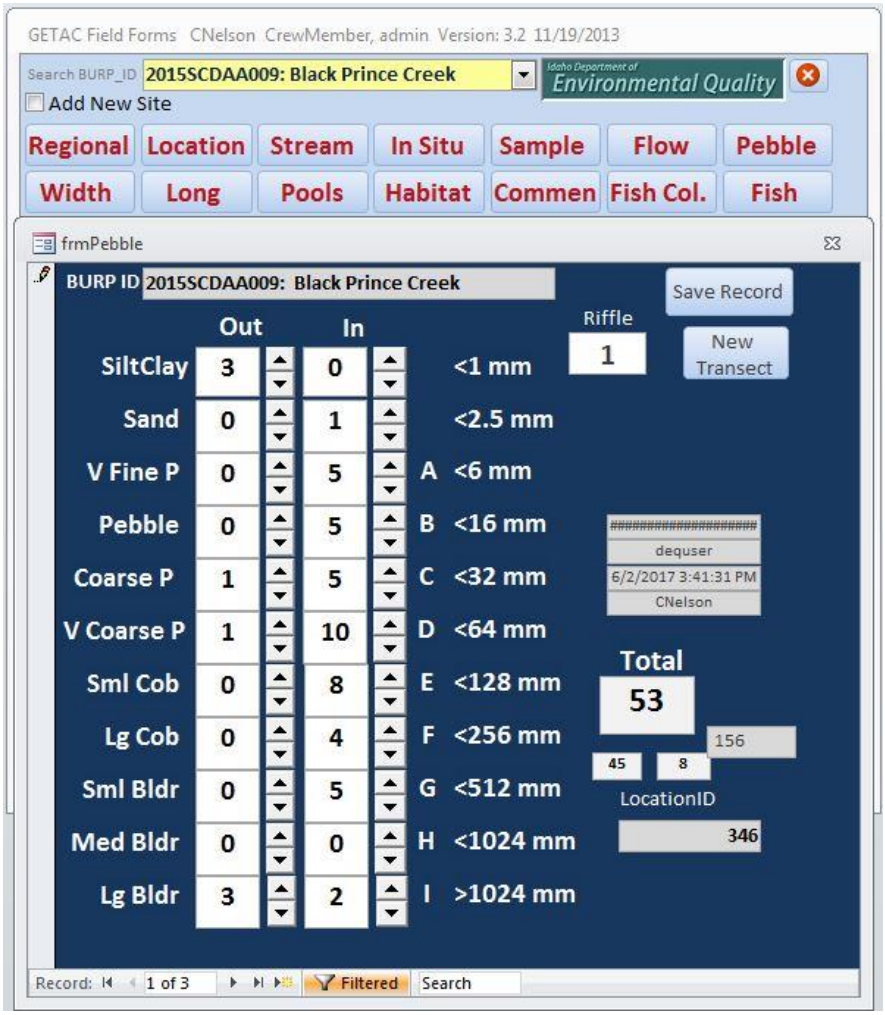


Figure 24. Pebble form.

3.3.7.1 Pebble Count

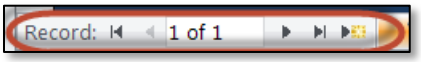
The BURP process uses a modified Wolman pebble count (Wolman and Union 1954) to quantify substrate size distribution in riffle habitats. This BURP pebble count method relies on surface fines, which are defined as material <2.5 mm in diameter (Fore and Bollman 2000). These are used as a sediment metric in the stream habitat index. Substrate is the mineral and organic material forming the bottom of a waterway or water body (Armantrout 1998). The stream substrate is the site of most biotic activity such as algae growth, insect growth and development, fish egg incubation, and small fish refuge (Davis et al. 2001). Fine sediment and its accumulation can be detrimental to salmonid spawning (a beneficial use) since it may limit the quality and quantity of the intergravel spaces that are critical for egg incubation (Maret et al. 1993; Scrivener and Brownlee 1989; Young et al. 1991). Several studies and state projects have found relative substrate size to be an important indicator of water quality effects due to activities in the watershed (McIntyre 1993; Overton et al. 1993; Skille 1991).

Conduct pebble counts (substrate measurements) at the same three transects (B1, B2, and B3) in the riffle habitat units where macroinvertebrate and periphyton samples were collected. Work in undisturbed substrate above where those samples were collected but within the riffle. If that is not possible, work within 1 m below where the samples were collected, in undisturbed riffle substrate. Begin at the bankfull level on one streambank and proceed across the riffle to the bankfull level on the opposite streambank. Select pebbles at equidistant intervals (e.g., heel to toe, one pace, etc.). At each interval, while looking away from stream bottom, pick up the first particle touched, and measure the intermediate axis. Record the particle size class and whether the particle was chosen from within (recorded as “in”) or outside (recorded as “out”) the wetted stream. Replace the particle downstream of the transect line. Disturb the bottom as little as possible. Measure a minimum of 50 particles per riffle for a total of 150 particles. Continue measuring and recording until the opposite streambank is reached, even if 50 pebbles have been counted before the transect is complete. Each successive pass must be upstream from the previous pass if multiple passes are required to reach the minimum 50 pebbles per riffle.

Each pebble count field automatically defaults to zero. Use the up and down arrows next to the field to increase or decrease accordingly. A running tally is kept in the total box to the right. This total helps ensure that at least 50 particles are counted for each transect. The user can also enter a numeric value into the box next to the up/down arrows.

3.3.7.2 Entering Data for Multiple Transects

When moving to a new transect, click the **New Transect** button. Make sure the transect number shown corresponds with the transect currently being measured. The user *must* click **Save Record** at the end of each transect. If there is any doubt as to how many transects have been tallied, the number of transects recorded can be determined by looking in the lower left-hand corner of the “pebble” form where Access captures Record # of #. If the crew is working on Transect 2, this should say Record 2 of 2. If the crew is working on Transect 3, this should say Record 3 of 3 and the Riffle text box should say 3.



3.3.7.3 Save Record

Once all “pebble” fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.8 Width (Depth, Canopy, and Banks Data)

An example of a properly filled out "width" form is provided in Figure 25.

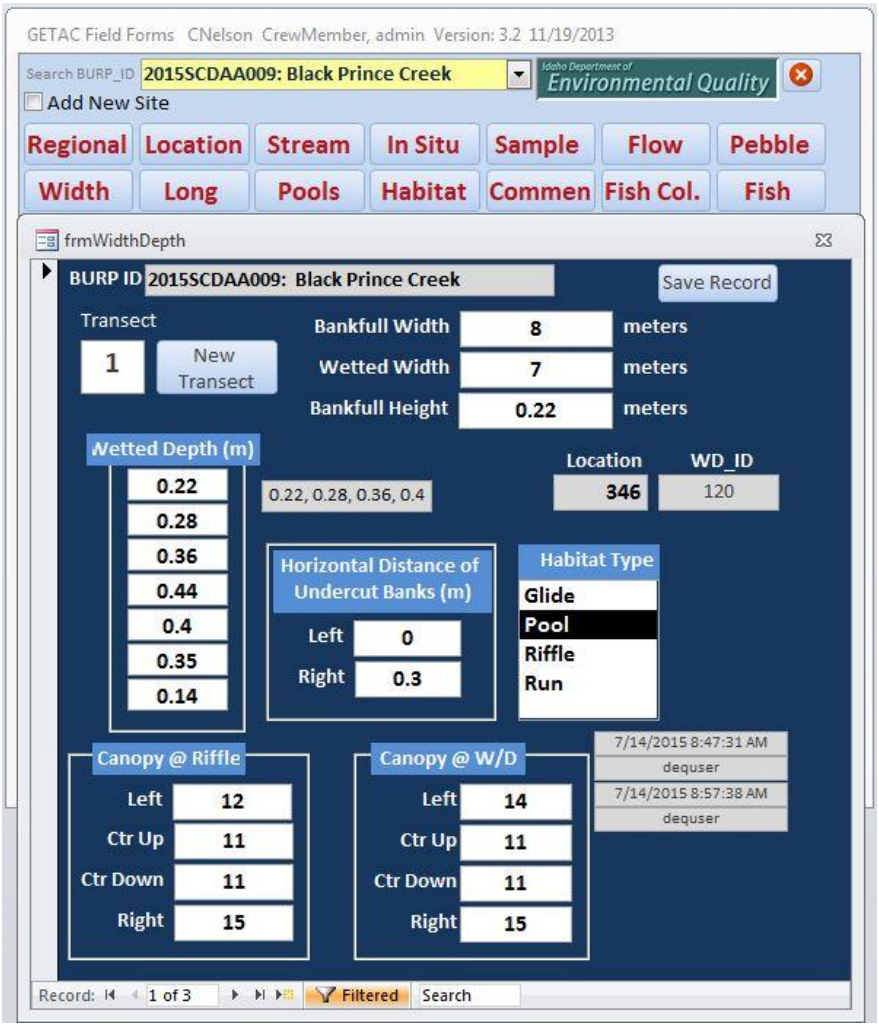


Figure 25. Width form.

The width/depth ratio, which is calculated later using information gathered in the field and provided in the "width" form, is defined as the ratio of the bankfull surface width to the mean depth of the bankfull channel and is key to understanding the distribution of available energy within a channel and the ability of various discharges occurring within the channel to move sediment (Rosgen and Silvey 1996). The width/depth ratio also provides a rapid, visual assessment of channel stability. Further, the width/depth ratio is valuable in describing channel cross-section shape, and ratio values can be compared to interpret shifts in channel stability following disturbances to channels or watersheds (Rosgen and Silvey 1996). Both depth and width can respond rapidly to changes in sediment load and/or discharge (Gordon et al. 1992; Overton et al. 1995). Width and depth measurements, along with discharge data, provide meaningful information about stream size and habitat characteristics. These variables have significant impact on the distribution of the aquatic community.

3.3.8.1 Bankfull Width, Wetted Width, and Bankfull Height

Bankfull stage (often called bankfull discharge) is the discharge with an average recurrent interval of 1.5 years in natural stream systems (Rosgen and Silvey 1996). A simple definition is the discharge that just fills the stream to its banks, meaning the stream water is just accessing its floodplain. Unfortunately, this flow level is not always apparent for all streams, so bankfull indicators and rating curves are used to help identify bankfull stage. DEQ provides a generalized rating curve for a cross reference to verify crew-identified bankfull discharge.

Bankfull indicators are clues used to locate where to measure bankfull levels. Examples of these clues include vegetative indicators such as mosses, grasses, shrubs, willows, and lichens. Vegetation such as lichens and mosses growing on streamside boulders is typically scoured off during the 1.5-year high flows, providing a visible, measurable bankfull height. Perennial vegetation that will not survive when constantly inundated often grows down the bank, just to the bankfull height. The base of willows, alders, and other shrubs is another indicator of bankfull height. A change in bed and bank material and an abrupt change in bank slope are also indicators. Flood-deposited material and the height of point bars can also help indicate bankfull height. Using a mixture of these bankfull indicators will provide the bankfull height.

The bankfull height should be fairly consistent throughout the stream reach (determined by multiple measurements). Conduct the procedure (detailed below) for measuring bankfull width and depth from the left bank to the right bank while facing upstream.

To collect width and depth measurements (Figure 26), first establish an additional transect 10 m upstream from each riffle habitat unit transect (B1, B2, and B3). If necessary, take the third set of measurements outside the defined reach. Record width and depth measurements on the “width” form.

1. Measure bankfull width and height:
   - Identify the bankfull stage (Leopold et al. 1995). Use the rating curve in Figure 27 (also found in Appendix F) to assist in identifying bankfull height. The rating curve indicates general bankfull depth, which is a different measure than the bankfull height. Bankfull depth is taken in the thalweg and is the distance from the streambed to the bankfull stage. Bankfull height is taken across the transect and is the distance from the surface of the water to the bankfull stage as shown in Figure 26.
   - Stretch, secure, and level the tape or appropriate measuring device across the bankfull width. Ensure the tape or appropriate measuring device is perpendicular to the flow. Measure and record bankfull width.
   - Measure and record the bankfull height from the surface of the water at the wetted edge to the tape at bankfull elevation.
2. Measure and record wetted width from the left to the right wetted edge of the stream.
3. Record the habitat type. This is a mandatory, single-selection field; choose only one for each transect.

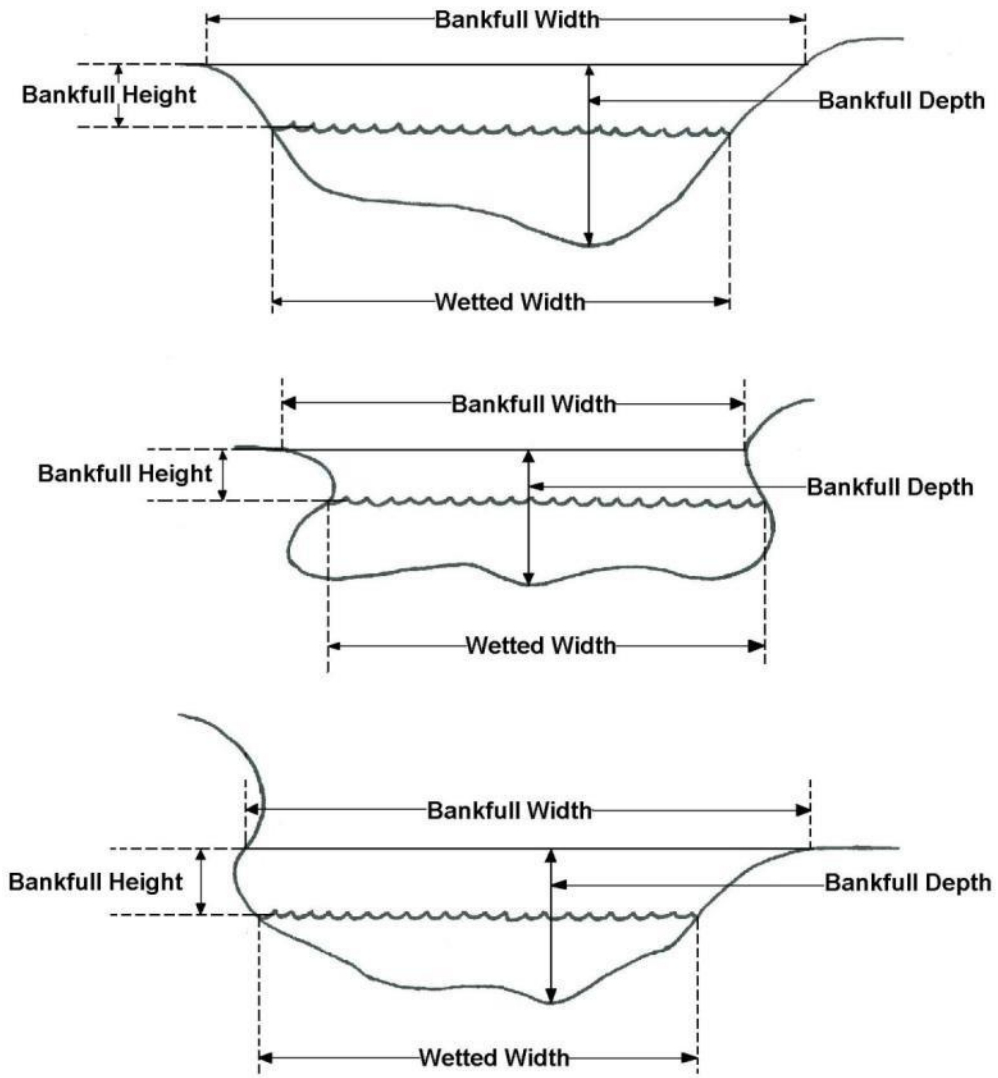


Figure 26. Bankfull and wetted width measurement locations.

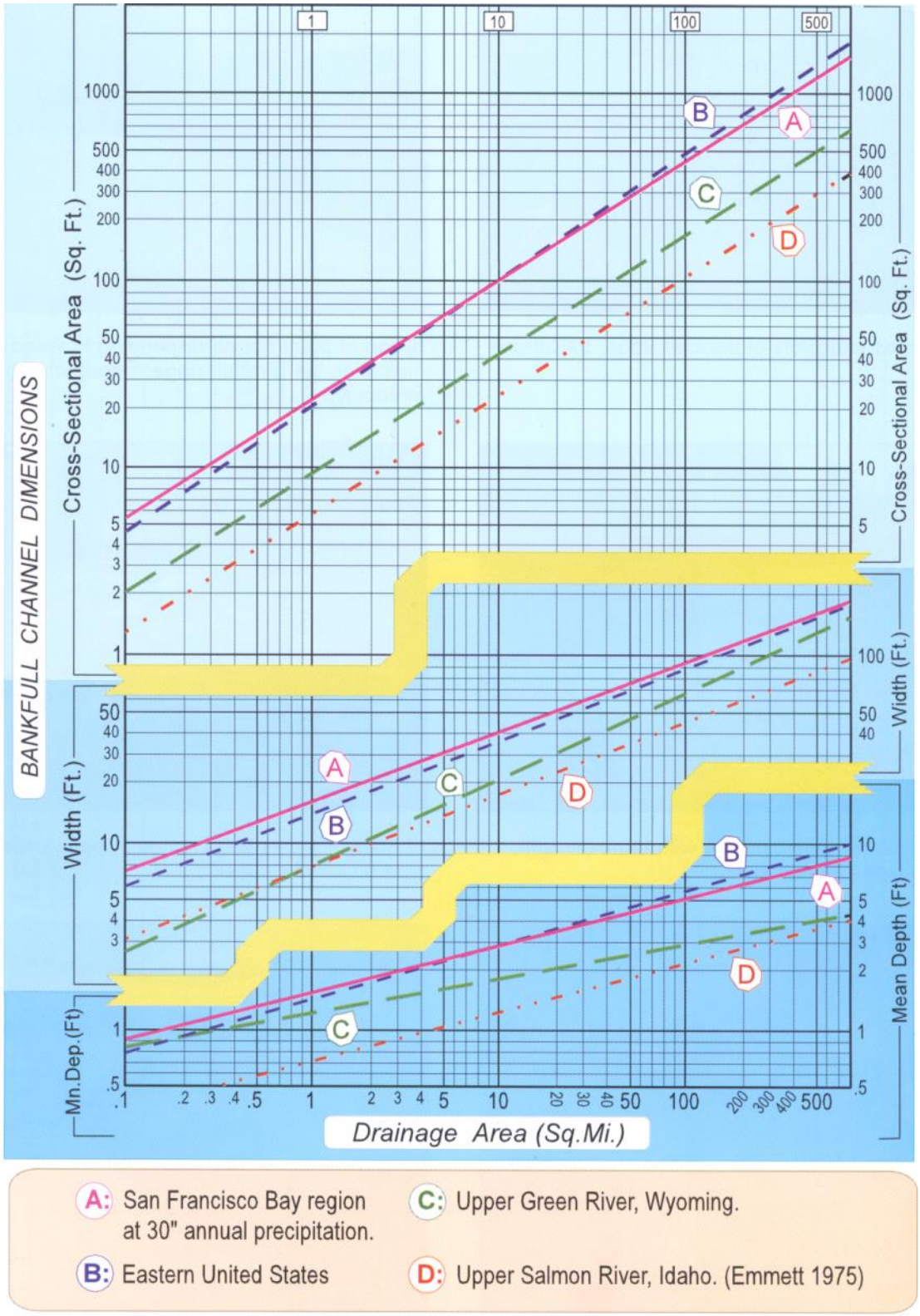


Figure 27. Rating curve to assist in identifying bankfull height (from Rosgen and Silvey 1996, used with permission).

3.3.8.2 Wetted Depth

Measure and record wetted depth measurements from the water surface to the channel bottom at evenly spaced intervals across the wetted width. Based on the wetted width, the program will determine the total number of depth measurements needed. A 0.00 value will appear in the number of wetted depth boxes equivalent to the number of wetted depth measures necessary (e.g., if wetted width is 1.4 m, five measurements are necessary so five of the wetted depth boxes will display 0.00). The program uses the following guideline (Table 4) to determine whether 3, 5, or 7 measurements are necessary (interval = wetted width divided by n+1):

Table 4. Wetted width and number of measurements necessary for wetted depth calculation.

Wetted Width	Number of Measurements (n)
≤1 meter	3
>1 but ≤4 meters	5
>4 meters	7

If a zero depth is encountered, record the zero on the form. When a width/depth transect is in a split channel, use one of two methods:

1. If the area between the channels is above the bankfull stage, take measurements in the channel with the most discharge.
2. If the area between the channels is below the bankfull stage, take measurements across both of the channels and indicate that it is a split channel in the “comments” form.

3.3.8.3 Horizontal Distance of Undercut Banks

Undercut banks provide cover for fish and are favorable to producing high fish biomass, especially in small streams (Platts et al. 1987). The undercut, if it exists, should be measured with the 2-meter rod to the nearest 0.1 m directly under the transect line from the point where the bank protrudes the furthest over the stream to the point furthest back under the bank (Figure 28). If more than one undercut occurs at the transect, record only the dominant (usually the larger) undercut. Repeat this procedure for the right bank. Record the distance of the undercut for left and right banks on the “width” form.

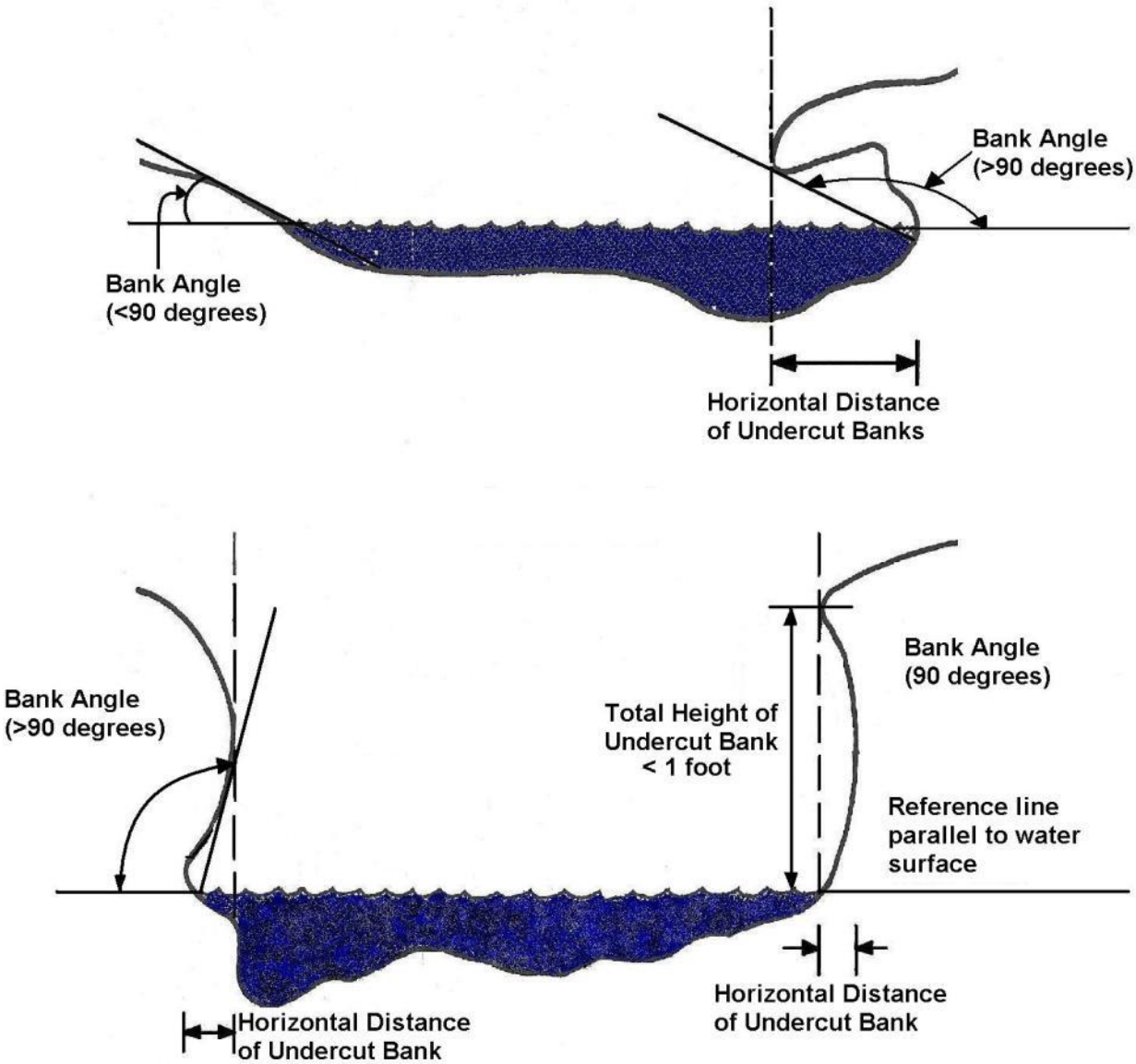


Figure 28. Where to conduct measurements for horizontal distance of undercut banks (adapted from Platts et al. 1987).

3.3.8.4 Canopy Closure

Canopy closure is the percentage of ground or water covered by shade from the outermost perimeter or natural spread of foliage from plants (Armantrout 1998).

Use a concave spherical densiometer to determine canopy cover. DEQ uses a densiometer modified with tape to show only 17 grid intersections (Bauer and Burton 1993). The 17 grid intersections are marked with dots (Figure 29). Hold the densiometer level. You should just see the top of your head in the reflection (Figure 29). Count the number of densiometer grid intersections obstructed by overhead vegetation. Densiometer readings should be taken at all three macroinvertebrate transects (B1, B2, and B3) as well as all three width/depth transects (T1, T2, T3) for a total of six cross-sections. Take four readings per cross-section: RWE and LWE

facing the bank, stream center facing upstream, and stream center facing downstream. When moving to change from the stream center facing upstream to stream center facing downstream positions, make sure the densiometer remains in the same spot. Hold the densiometer one foot above the water surface for all measurements. When measuring at RWE and LWE, face the bank and position the densiometer one foot in from the streambank and one foot above the water surface (Figure 30). Record measurements on the form for the riffle and width/depth transects.

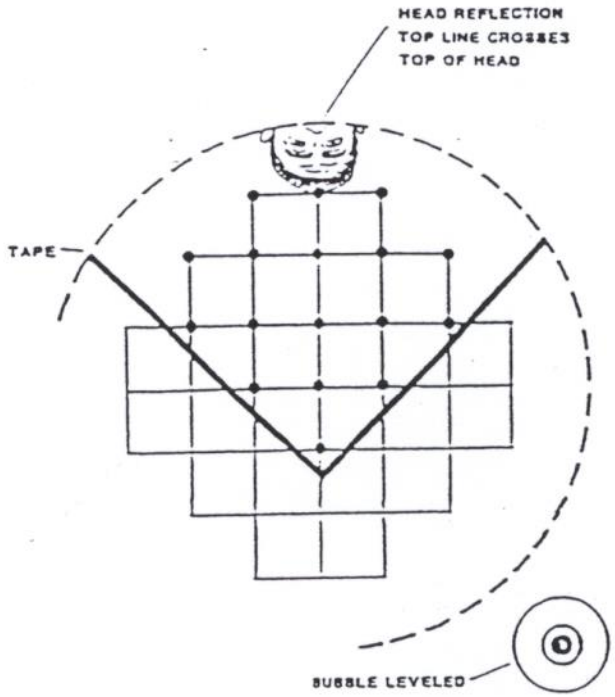


Figure 29. Reflection seen in densiometer.

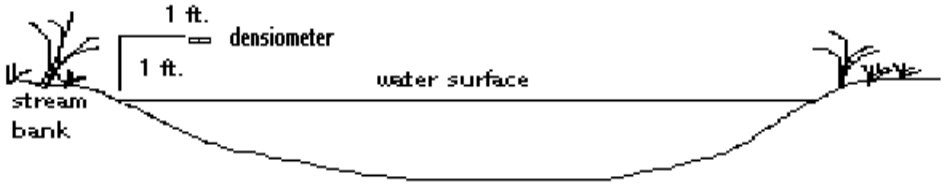
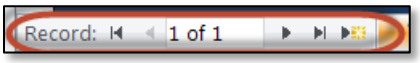


Figure 30. Position of densiometer.

3.3.8.5 Entering Data for Multiple Transects

The user *must* click **Save Record** at the end of each transect. When moving to a new transect, click the **New Transect** button. Make sure the transect number shown corresponds with the transect currently being measured. If there is any doubt as to how many transects have been tallied, the number of transects recorded can be determined by looking in the lower left-hand corner of the “width” form, where Access captures Record # of #. If the crew is working on

Transect 2, this should say Record 2 of 2. If the crew is working on Transect 3, this should say Record 3 of 3 and the transect text box should say 3.



3.3.8.6 Save Record

Once all "width" fields are completed, click **Save Record** to save data and return to the switchboard. Exit the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.9 Longitudinal Habitat Distribution (Long)

An example of a properly filled out "long" form is provided in Figure 31.

Figure 31. Longitudinal habitat distribution (long) form.

3.3.9.1 Large Organic Debris (LOD)

In the Pacific Northwest, organic debris, such as a dead log or a tree, is considered large organic debris (LOD) if it has a diameter greater than 10 centimeters (4 inches) and a length greater than 1 m (39 inches) (Armantrout 1998; Davis et al. 2001). The term LOD is synonymous with large woody debris (LWD) described in other literature.

LOD adds complexity to stream habitats, retains allochthonous matter and sediment, and imparts stability to streams under high flow conditions. Some species of salmonids show a high affinity for LOD (Rieman and McIntyre 1993). LOD reduces the export of organic matter and nutrients and provides protection and habitat for invertebrates and fish (Davis et al. 2001). Experimental studies done by Braudrick and Grant have shown that the two most important factors in the entrainment of LOD are the orientation of the LOD pieces and the presence/absence of rootwads (Braudrick and Grant 2000).

Count each piece of LOD that is predominantly greater than 10 centimeters in diameter and 1 m in length and is not alive. Count all LOD within the bankfull channel throughout the site. Occasionally, sites will have large accumulations of LOD. If a site has less than 100 pieces of LOD in the site, count them individually; if there are more than 100 pieces in the site, count by tens. Each piece counted *must meet* the minimum size requirement as noted on the field form. If there is an accumulation of pieces that do not meet the minimum size requirement, take a photo of the pile and make note of it in the “comments” form. Count only material naturally recruited from the drainage.

3.3.9.2 Pools

Count all the pools in the reach. Record the total number.

3.3.9.3 Longitudinal Habitat Distribution (Long Hab Distrib)

The longitudinal habitat distribution is defined as the proportions of the channel represented by relatively homogeneous areas whose depth, velocity, and substrate characteristics differ from adjoining areas (Armantrout 1998). An evaluation of habitat diversity is critical to any assessment of ecological integrity. Water velocity, in conjunction with depth, has been demonstrated to have a direct influence on the structure of benthic and fish communities (Oswood and Barber 1982; Plafkin et al. 1989). Chapman (1966) stated that physical habitat regulates fish abundance. Researchers have correlated various components of physical habitat with fish abundance and denoted habitat type as an important factor (Fraley et al. 1981; Graham et al. 1980; Hoelscher and Bjornn 1989; Hunt 1968; Irving 1987; Moore 1967; Pratt 1984; Shepard 1983; Shepard et al. 1982). Gorman and Karr (1978) took this relation one step further and found fish diversity, as well as abundance, increased with habitat diversity (Gorman and Karr 1978).

Habitat unit classification is geomorphic and flow dependent and may change with a change in discharge. Form a mental image of the various habitat types that you would expect given the current conditions, then determine the type of habitat units present along the longitudinal stream axis. Assign wetted portions of the main channel to one of the four habitat types. Complexes of multiple habitat units may be encountered. In these cases, measure and record the length of the

habitat type *occupying more than 50%* of the wetted channel width. Minor habitat units should be combined with adjacent units.

Following are the descriptions used by BURP to distinguish four types of habitat:

- Riffle — A portion of the stream with swiftly flowing, shallow water with a turbulent water surface. The turbulence is caused by completely or partially submerged obstructions, often the stream bottom. Cascades are one class of riffle characterized by swift current, exposed rocks and boulders, and considerable turbulence and consisting of stepped drops over steep slopes. Riffles that are swift, relatively deep, and have considerable surface turbulence, sometimes represented by standing waves, are called rapids. Rapids at high flow may be confused with runs.
- Run — Areas of the stream that have swift, uniform, nonturbulent flow; runs are deeper than riffles with a faster current velocity than pools and (typically) glides. The streambed can be flat beneath a run and the water surface is seldom broken. Surface gradient tends to roughly parallel overall stream gradient, and substrate particle size can vary but tends to be coarser than in glides.
- Glide — An area of the stream with slower current velocity and greater depths than riffles; the streambed can be concave or flat, and the channel width is frequently the greatest of the habitat classifications. The water surface gradient is nearly zero and the substrate tends to be finer than in runs. Glides are common to most modified stream channels that do not have distinguishable pool, run, and riffle habitats; current and flow are similar to that of a canal with smooth, laminar flow.
- Pool — A portion of the stream with reduced water velocity, water deeper than the surrounding areas, and the bottom often concave in shape forming a depression in the profile of the stream's thalweg that would retain water if there were no flow. Pools usually occur at outside bends (e.g., lateral scour) and around large obstructions (e.g., plunge pool). Pocket water pools refer to groups of small pools often in areas of otherwise fast or turbulent flow, usually caused by eddies behind boulders or other obstructions. Eddies are also associated with backwater pools. Water impounded upstream from channel blockage, typically caused by a log jam or beaver dam, is classed as a dammed pool. Flats are actually wide shallow pools often confused with glides. Pools end where the stream bottom approaches the water surface, also known as the pool tail out.

3.3.9.4 Streambank Condition

The streambank is defined as that part of the channel most susceptible to erosion during high-water events. Streambanks are important transition zones between aquatic and terrestrial systems (Stevenson and Mills 1999). When in good condition, these habitats are well vegetated, resistant to erosion, and provide cover and refuge for fish species. Banks stabilized by deeply rooted vegetation, rocks, logs, or other resistant materials are less susceptible to flow-related erosion, reduce water velocity along the stream perimeter, and aid in beneficial sedimentation (Bauer and Burton 1993). Human impacts and natural disturbances reduce bank vegetation, erosion resistance, structural stability, and fish cover value. Eroding streambanks support little or no riparian vegetation, resulting in a loss of stream shading and undercut banks, nutrient loading, and fewer terrestrial insects dropping into the stream (an important fish food source) (Overton

et al. 1995). The removal of streambank vegetation and soils reduces the structural stability of the stream channel and negatively affects fish productivity (Platts 1990; Platts and Nelson 1989).

Streambank condition is characterized by streambank cover and stability. Streambank cover refers to the percent surface protection (Stevenson and Mills 1999). It is generally viewed at the vegetative green line located below the bankfull level but above any natural undercutting bank scour. Evaluate streambank cover and stability according to the following descriptions. The streambank is categorized as covered and stable (CS), covered and unstable (CUS), uncovered and stable (UCS), or uncovered and unstable (UCUS) (modified from Cowley et al. 2006). Determine the streambank condition on the left bank and the right bank (when facing upstream). Use a 2-m stick, tape, or laser rangefinder to measure the total number of meters of streambank that fall into each of the four categories. These values are used to calculate what percent of the reach is characterized by each of the four bank conditions.

Streambanks are considered covered if any of the following are true (Cowley et al. 2006):

- Perennial vegetation groundcover is greater than 50%.
- Roots of vegetation cover greater than 50% of the bank (deep rooted plants such as willows and sedges provide such root cover).
- At least 50% of the bank surfaces are protected by rocks of cobble size (150 mm) or larger.
- At least 50% of the bank surfaces are protected by logs with 10-cm (4-inch) or larger diameter.
- At least 50% of the bank surfaces are protected by a combination of the above.

Bank stability pertains to the resistance of a bank to erosion (Armantrout 1998). Banks are considered stable if they meet the following criteria (Cowley et al. 2006):

- ***No*** obvious blocks of bank are broken away and lying adjacent to the bank breakage (i.e., no breakdown).
- The bank has ***not*** obviously slipped down; cracks may or may not be obvious, but no obvious slump feature is present (i.e., no slumping or false bank).
- ***No*** cracks are visibly obvious on the bank indicating that the bank is about to slump or move into the stream (i.e., no fracturing).
- The bank is mostly covered as defined above and the bank angle is less than 80 degrees from the horizontal (i.e., no vertical and eroding banks).

Classify each streambank into one of the following four condition categories based on the definitions of covered and stable presented above and record the length of each condition, for each bank, on the “long” form.

- Covered and stable (CS) (nonerosional) — Banks associated with gravel bars with perennial vegetation above the scour line are in this category.
- Covered and unstable (CUS) (vulnerable) — These banks are typically observed in meadows where breakdown, slumping, and/or fracturing is present along the bank, yet vegetative cover is abundant.
- Uncovered and stable (UCS) (vulnerable) — Uncovered, stable banks are typical of banks trampled by concentrations of ungulates. Such trampling flattens the bank so that

slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated.

- Uncovered and unstable (UCUS) (erosional and depositional) — These are bare, eroding streambanks and include all banks mostly uncovered that are at a steep angle to the water surface.

3.3.9.5 Save Record

Once all "long" fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.10 Pools

An example of a properly filled out "pools" form is provided in Figure 32.

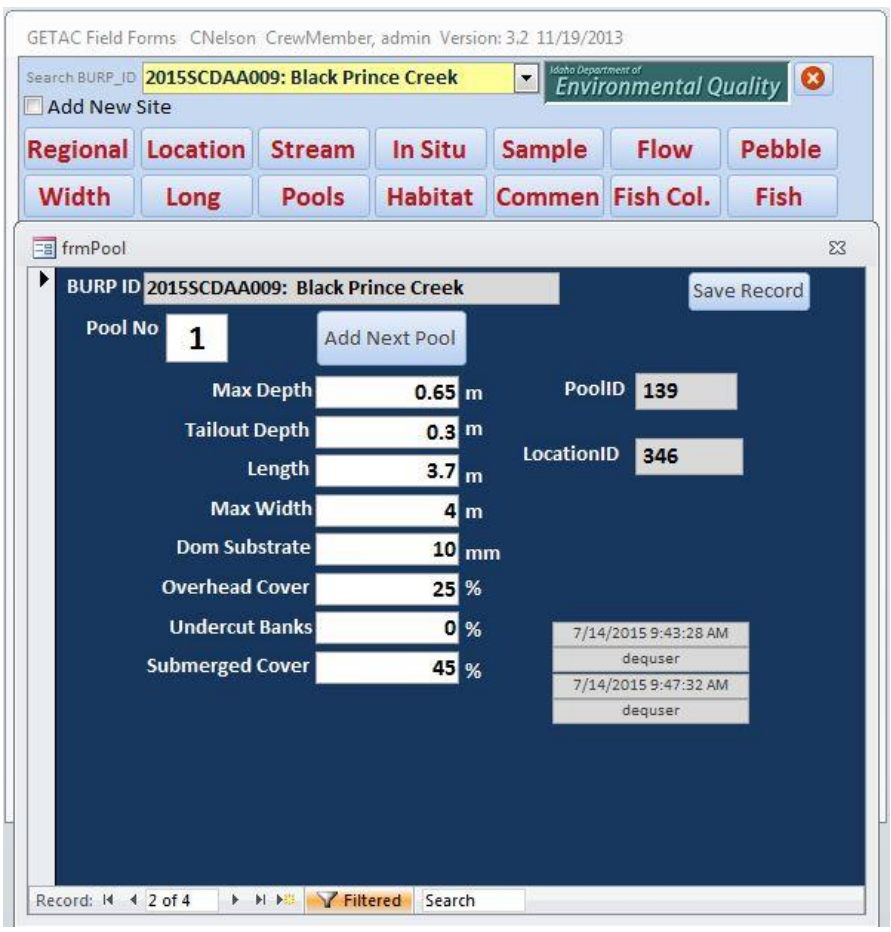


Figure 32. Pools form.

Pool quality refers to the diversity of habitats within a pool, which is largely a function of the amount of cover available in slow-velocity waters (Bauer and Burton 1993). Pool quality can be determined by calculating the Pool Quality Index, a calculation that incorporates measures of pool length, substrate, overhead cover, submerged cover, percentage of undercut banks, maximum pool depth, maximum pool width, and depth at pool tail out.

In a study of streams that differed by the amount of management in their watersheds, Overton et al. (1993) found pools in less impacted watersheds were more frequent, had higher volumes, and were of greater depth than those in more impacted watersheds. Beschta and Platts (1986) suggested that pool quality is equally as important as the number of pools in describing a healthy stream from a fisheries standpoint. DEQ may calculate the pool-to-riffle ratio, a measure of pool quantity, to evaluate and compare stream impacts. Figure 33 is a general illustration showing where some of the pool variables are measured**.**

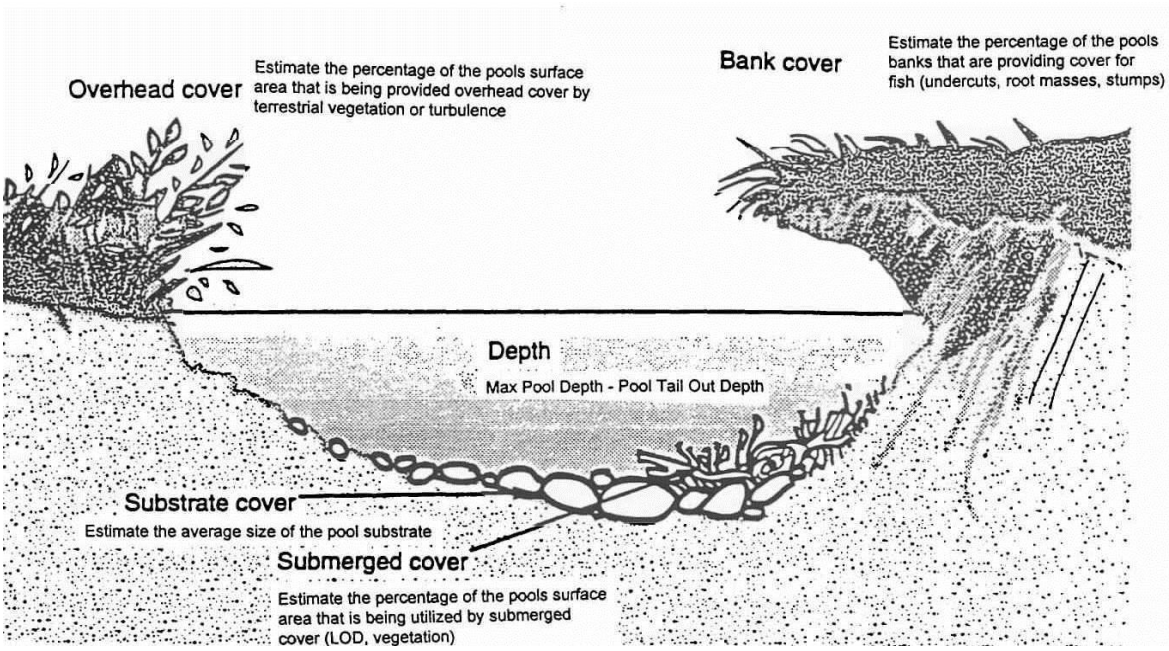


Figure 33. Where to measure some of the pool variables at each pool.

When multiple pools are present, select four representative pools that characterize the variety of pool types found within the reach, randomly distributed throughout the reach. A pool *does not* have to be greater than 50% of the longitudinal habitat to be used in the survey. If small pocket pools are present as well as larger pools, it is advisable to include one of these smaller pools as one of the four representative pools to help characterize the overall stream. Should there be fewer than four pools in the reach, measure what exists and explain this in the "comments" form.

Measure the variables of maximum pool depth, tail-out depth, pool length, maximum pool width, and undercut banks. Estimate the average (dominant) substrate size and the percentages for overhead cover and submerged cover. Each of these is described below. Enter all values in the appropriate field in the "pools" form.

- Maximum Pool Depth (m) — The deepest point in the pool as measured from the water surface (Figure 34).

- Tail-Out Depth (m) — The deepest point at which the water flows from the pool. This point is usually located along the downstream perimeter of the pool (Figure 34).
- Pool Length (m) — The distance from the upstream perimeter to the downstream perimeter of the pool (Figure 34).
- Maximum Pool Width (m) —The distance between the left and right perimeters of the pool when looking upstream (Figure 34).
- Predominant Substrate Size (mm) — The size of the most dominant substrate within the pool.
- Overhead Cover (%) — Any cover within 1 foot (0.3 m) of the pool surface that tends to obscure the view of the pool surface. Overhanging banks and vegetation are typical examples; turbulence of sufficient magnitude to obscure the view into the water column is also considered overhead cover. Estimate this as percent of total pool surface area covered. Record a value between 0 and 100.
- Undercut Banks (%) — The percent of undercut banks serving as cover along the pool's perimeter. Caution: One side of an evenly proportioned pool represents 50% of the possible total for undercut banks; some pools contact the bank on only one side (or less) of their perimeter. Record a value between 0 and 100.
- Submerged Cover (%) — Under surface cover as represented by plants, woody debris, boulders, cobble, geologic morphology, or any relatively permanent structure that provides refuge for aquatic fauna. Estimate as a percent of the pool bottom area providing or under the influence of subsurface cover. Record a value between 0 and 100.

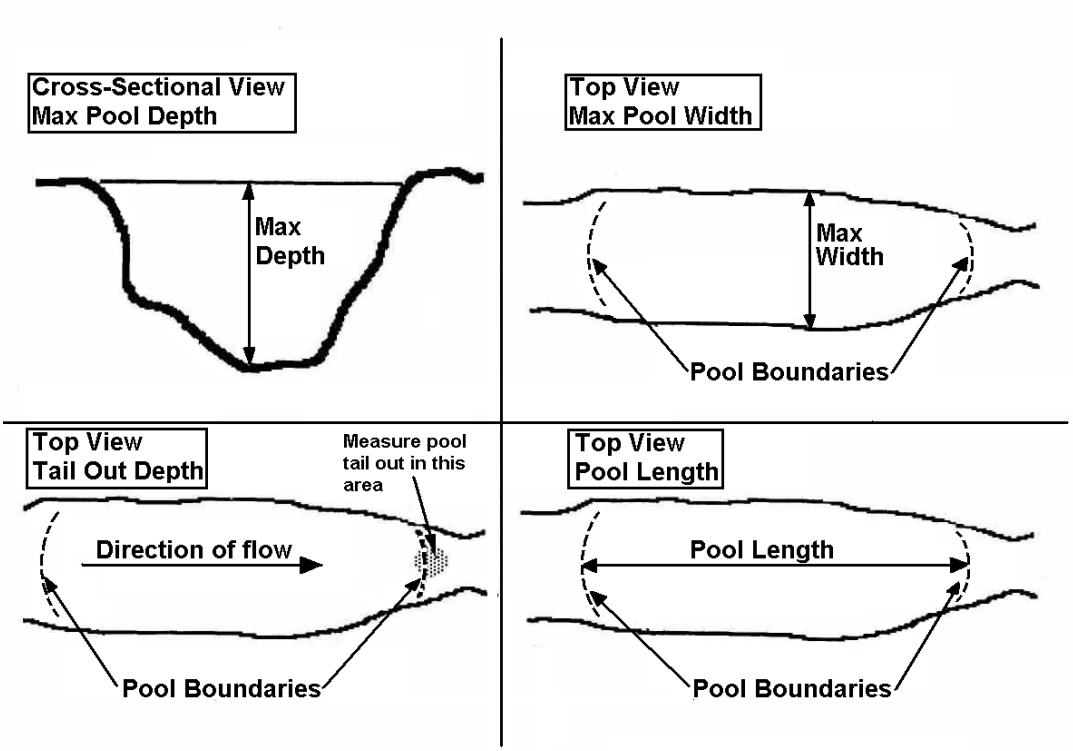


Figure 34. Where to measure pool depths (maximum and tail out), length, and width.

3.3.11 Habitat

An example of properly filled out “habitat” form is provided in Figure 35. Habitat is a specific type of place within an ecosystem occupied by an organism, population, or community that contains both living and nonliving components with specific biological, chemical, and physical characteristics including the basic life requirements of food, water, and cover or shelter. The habitat assessment is a combination of quantitative and qualitative measures of several habitat variables. Specifically, it is a modification of the habitat assessment method in the EPA monitoring handbook (Hayslip 1993). DEQ has modified the Hayslip approach to quantitatively calculate several of the variables.

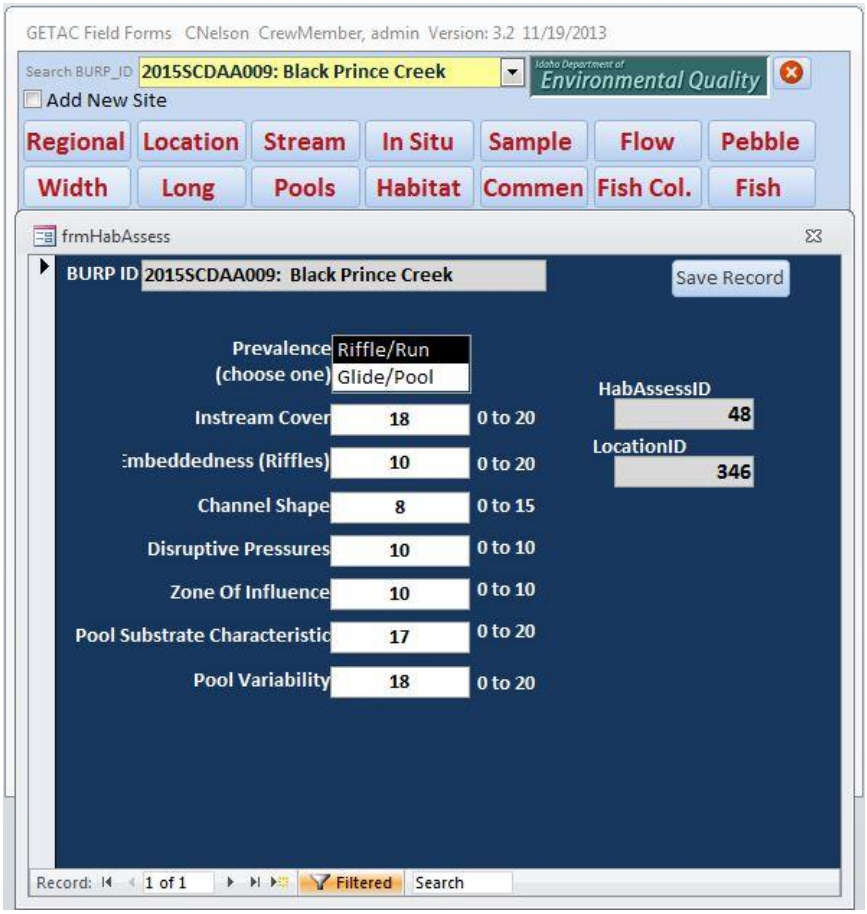


Figure 35. Habitat form.

Physical habitat quality can significantly influence the biological condition of aquatic communities. Under contract with DEQ, Fore and Bollman (2000) developed a stream habitat index as an analytical tool for assessing aquatic life beneficial uses for wadeable streams. Some of the BURP habitat assessment variables are components of the stream habitat index.

The habitat assessment assesses the entire reach. The entire crew assesses habitat. At the end of the BURP survey, gather all the crew members and review the questions for the qualitative variables discussed below. Refer to the DEQ laminated chart, also found in Appendix F of this manual. As a group, discuss each of the variables on the field form and decide on a score for

each. Evaluate the habitat for the present condition of the stream, without considering historical or future conditions. Record the scores in the appropriate boxes.

3.3.11.1 Prevalence

Choose the predominant habitat type.

3.3.11.2 Instream Cover (for fish)

Instream cover consists of areas with structure (e.g., boulders, rocks, logs, etc.) in a stream channel that provide aquatic organisms with shelter or protection from predators or competitors. These are also places with low water velocity where organisms can rest and conserve energy. The availability of instream cover is important in sustaining a variety of fish throughout their life cycles. Cover provides refuge from predators such as birds, terrestrial mammals, and other aquatic species. It also provides protection from sunlight and increased current velocities.

Determine pool substrate composition and characteristics, then rate instream cover from 0 to 20 according to type and variety (as explained in Appendix F). A mix of substrate types including root masses, aquatic plants, and sands and gravels receive a higher score. Reaches with only one substrate type receive a lower score, and those dominated by mud receive the lowest score. Rate the amount of instream cover based on the total cover observed from all of the following types:

- Vegetation — Provides cover for fish and other aquatic organisms and includes vegetation such as algal mats, macrophytes, and overhanging riparian vegetation. DEQs Water Quality Monitoring Report No. 8 (Cowley 1992) is helpful in evaluating vegetation cover.
- Clump — Irregular accumulation of debris along a stream channel that does not form major impediments to stream flow.
- Log — In general, a tree trunk or large limb, with or without the roots attached.
- Substrate — The mineral or organic material forming the bottom of the water body. See section 3.3.7.1 for further discussion.
- LOD — Large woody material (e.g., log or tree) with a diameter greater than 10 cm (4 inches) and a length greater than 1 m (39 inches).
- Turbulence — Stream flows in which the velocity at a given point varies erratically in magnitude and direction and disrupts reaches with laminar flow. Turbulence causes disturbance of the water surface and produces uneven surface levels, which results in poor visibility and good protective cover because air bubbles are entrained in the water.
- Root Wad — Root mass from a tree.

3.3.11.3 Embeddedness (in riffles)

Embeddedness is the degree to which very coarse pebbles and larger sizes of particles (cobbles and boulders) are surrounded or covered by fine sediment. This variable is primarily qualitative, since the quantitative methods provide little additional information for the purposes of beneficial use support and are very time consuming. To reduce the variability in qualitative assessments of embeddedness, DEQ provides centralized training to BURP crews on the ranges of embeddedness.

For BURP monitoring, fine sediments are defined as 6.35 mm or less and larger particles are 45–300 mm (Burton and Harvey 1990). Fine sediment particles fill the small interstitial spaces between larger particles causing reduced water flow and a reduction of habitat that is important for the overwintering of small fish, some fish spawning, and sediment-intolerant macroinvertebrates (Bain and Stevenson 1999). See the pebble count section (3.3.7.1) for further discussion of substrate considerations.

Determine the percentage of particles larger than very coarse pebbles that are surrounded or covered by sediment of 6.35 mm and less. Assign scores from 0 (100% embedded) to 20 (no embeddedness) based on the percentage of embeddedness; bedrock is considered 100% embedded (score of 0). For every 5% increase in embeddedness, reduce the score one point (Table 5).

Table 5. Embeddedness scores based on embedded percentage.

Embeddedness	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	
Score	20	19	18	17	16	15	14	13	12	11	
Embeddedness	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Score	10	9	8	7	6	5	4	3	2	1	0

3.3.11.4 Channel Shape

Channel shape is the angle formed by the downward sloping streambank as it meets the horizontal water's edge. Fish often congregate near the streambank for the cover it provides. If the bank has been cut away and moved back from the water column, valuable rearing habitat has been lost. Measuring the channel bank angle is effective for monitoring land uses that can change the morphology and relative location of the streambank (Platts et al. 1987). Measure or estimate bank angle at several locations throughout the reach in order to determine the appropriate score (0–15) for the channel shape.

3.3.11.5 Disruptive Pressures (annual impacts on streambank, directly adjacent to stream)

Disruptive pressure pertains to the anthropogenic impacts to the riparian zone. The measurement of disruptive pressures at each BURP site is a qualitative variable of the habitat assessment. This variable is used to determine seasonal human impacts on riparian zones. Seasonal impacts can include recreational activities (e.g., camping, hiking, fishing, hunting) and livestock grazing. Rate disruptive pressures from 0 to 10 according to the descriptions provided on the DEQ flip charts (Appendix F).

3.3.11.5.1 Zone of Influence (width of riparian vegetative zone, least buffered side)

The zone of influence pertains to the width of the riparian vegetation zone. This area is directly affected by nearby ditches, channels, or other drainage features. The presence and condition of riparian vegetation is important to the overall ecological health of the river and its floodplain. Healthy stands of riparian vegetation provide habitat for aquatic and terrestrial animals and

perform important physical functions (e.g., erosion control, sediment catchment). Stands of naturally occurring riparian vegetation can vary from river to river depending on climate and geomorphology.

The zone of influence is used to determine the overall human impacts on a riparian zone such as roads, logging, lawns, campgrounds, and urban areas. Rate the zone of influence (the width of the riparian vegetative zone) from 0 to 10 based on the least-buffered side. Use descriptions provided in the DEQ laminated flip charts (Appendix F) to select an appropriate rating. Due to geology, climate, vegetation, flow regimes, and other natural conditions, sometimes the zone of influence is naturally very narrow (less than one stream width). Examples of this are the deep, V-shaped valleys found in north-central Idaho. Do not try to adjust ratings for natural conditions (e.g., geology, climate, vegetation, flow-regime), as the DEQ classification system already considers these factors.

3.3.11.6 Pool Substrate Characteristics (for fish)

Firm sediment types (e.g., gravel, sand) and rooted aquatic plants support a wider variety of organisms than a pool substrate dominated by mud or bedrock and no plants. In addition, a stream that has a uniform substrate in its pools will support far fewer types of organisms than a stream that has a variety of substrate types (Barbour et al. 1999). Make a visual estimate of the substrate materials that make up the pool (Hayslip 1993) and assign a score of 0 to 20 (see Appendix F).

3.3.11.7 Pool Variability

A pool is a portion of the stream with reduced water velocity and water deeper than the surrounding areas. The bottom of a pool is often concave, forming a depression in the profile of the stream’s thalweg that retains water if there is no flow. The four basic types of pools are large-shallow, large-deep, small-shallow, and small-deep. A stream with many pool types will support a wide variety of aquatic species. According to Hayslip (1993), the greater the pool type diversity, the better the habitat. Conversely, streams with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community.

Determine the proportion of large and small pools and the proportion of shallow and deep pools. In general, if any pool dimension (i.e., length, width, oblique) is greater than half the cross-section on the stream, the pool is large. Assign a score of 0 to 20 based on the descriptions provided in Appendix F. Give a high score if the stream is dominated by an even mix of all four sizes of pools. Give a lower score if the stream is dominated by large-deep pools. Give an even lower score if the stream is dominated by shallow pools. Give the lowest score if the stream is dominated by small-shallow pools or has no pools. In general a 1m depth separates shallow and deep pools (Barbour et al. 1999).

3.3.11.8 Save Record

All fields on the “habitat” form are required. Once all fields are completed, click **Save Record** to save data and return to the switchboard. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking

information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

3.3.12 Comments

Record any valuable information that is not called for elsewhere in the field forms, such as observations concerning vegetation, geomorphology, impacts due to humans or natural events, riparian zone, fish, and amphibians. Also provide any needed explanations, such as information about collecting specimens (modification to protocol to collect samples) or factors affecting reliable data collection (high flow, low flow, etc.). These comments are transferred into the central database and will be available for viewing by all DEQ staff and the general public.

Indicate in the comments section if any amphibians were observed. An amphibian is defined by the following criteria:

- A cold-blooded, smooth-skinned vertebrate of the class Amphibia, such as a frog or salamander, that characteristically hatches as an aquatic larva with gills. The larva then transforms into an adult having air-breathing lungs (Horton 2001).
- An animal capable of living both on land and in water (Horton 2001).

Amphibians are in apparent decline (Corn 1994; Heyer et al. 1994; Reaser 2000) and may be important water quality indicators (Heyer et al. 1994). For these reasons, BURP keeps records of amphibians observed at monitoring sites. Any observations of amphibian deformities should be recorded in the “comments” form. Use DEQ’s laminated ID flip charts to assist with identification.

Vouchering amphibians is optional, although it is recommended that a few voucher specimens of each taxon from each study site be collected to help DEQ verify the amphibian distribution in Idaho. Amphibians can be euthanized in weak denatured alcohol solutions in hot water. If these methods/agents are not available, the amphibians can be euthanized in a 10% buffered formalin solution in an opaque plastic bottle. The specimens should be preserved in a 10% buffered formalin solution. If the specimen is large, make a small incision in the body wall (ventral side) to allow for proper internal preservation. Later (in the museum) the specimens will be transferred into 70% ethyl alcohol.

Amphibian voucher specimens are deposited at the Orma J. Smith Museum of Natural History at the College of Idaho in Caldwell. The information is shared with the Idaho Museum of Natural History at Idaho State University in Pocatello.

3.3.13 Fish Collection and Fish Data (Fish Col)

Fish contribute significantly to the ecology of the aquatic community. This biological assemblage is highly visible to the public and is an important economic resource in Idaho. Additionally, fish have relatively long life spans that can reflect long-term and current water quality conditions. Due to their mobility, fish also have extensive ranges and may be useful for evaluating regional and large-scale habitat differences (Simon and Lyons 1995).

Each BURP site should have accompanying fish data that are less than 5 years old. BURP coordinators should look for other agency, index-compliant data, particularly if there are endangered species present that are not permitted for "take." It is recommended that the site be electrofished because comprehensive data with all species (game and nongame) and length is often not available elsewhere. Fish collection information should be entered on the "fish col." and "fish data" forms.

3.3.13.1 Permits for Taking Fish

Before performing any electrofishing, DEQ must obtain all necessary permits. All federal permits are secured ahead of time by the State Office. A Scientific Research and Take Authorization must be obtained from the National Marine Fisheries Service in regions where steelhead and salmon occur. The permits are for researchers whose studies may capture, harass, or harm any Endangered Species Act-listed species of fish. DEQ submits one statewide application each year to the National Marine Fisheries Service as a Section 4(d) Scientific Research and Take Authorization for steelhead. DEQ prepares a comprehensive report to meet steelhead permit reporting requirements. DEQ also has a 5-year (2009–2014) Section 10 Scientific Research and Take Authorization for listed salmon species and for any boat electrofishing activities. DEQ reports annually on the Section 10 permit requirements as well. DEQ's Scientific Research and Take Authorization for bull trout is obtained through annual permitting and reporting with IDFG.

Each DEQ regional office is responsible for coordinating and obtaining a Scientific Collection Permit from the IDFG. Each office adheres to the stipulations and provisions of the permit, particularly concerning waters containing endangered species. Often, permits include a stipulation that DEQ must "notify the regional fishery manager with a complete list of dates and sample sites prior to field work." It is recognized this list may change. It is the responsibility of each DEQ regional office to update and provide IDFG with the most current information. Each regional office must report to IDFG as required by the permit stipulations and discuss the stream list with the appropriate IDFG representative to identify streams known or likely to contain endangered species. Additionally, any concerns, requirements, and/or restrictions (e.g., spawning fish) need to be identified by the IDFG representative, documented, and communicated to the appropriate DEQ field crew, who must heed these concerns.

Crew members need to completely read, understand, and adhere to the collection permit requirements. Usually the permit stipulates that a copy of the fish collection permit be kept with the crew in the field during electrofishing.

3.3.13.2 Electrofishing

To maximize personal safety and minimize fish injury, a person with electrofishing experience and formal training should oversee electrofishing operations. Effective but safe electrofishing requires an understanding of electricity in water, electrofishing safety, and electrofishing principles. All DEQ employees must follow DEQ electrofishing policy. Coordinators are responsible for making sure all crew members have read and understand the electrofishing safety information and signed the acknowledgement included in this manual as Appendix G before they do any electrofishing.

3.3.13.2.1 Electrofisher Preparation and Settings

Use standardized electrodes for electrofishing. The cathode should be the "rat-tail" type with three times the surface area of the anode. The anode should be round, shiny, and 28–30 cm in diameter. Remove all plating from the anode with an abrasive pad weekly or as needed.

Electrofisher units should use pulsed DC set to the lowest voltage, frequency, and duty cycle combination that elicits galvanotaxis response and minimizes tetanus. Table 6 displays initial and maximum recommended electrofisher settings.

Table 6. Recommended initial and maximum settings for electrofishers.

	Initial Settings	Maximum Settings
Voltage	100 V	1,100 V for conductivity < 100 µS/cm[a] 800 V for conductivity 100–300 µS/cm 400 V for conductivity > 300 µS/cm
Pulse width	500 microseconds	5 milliseconds
Duty cycle	0.7%	30%
Frequency	15 hertz	60 hertz

[a] microsiemens per centimeter

3.3.13.2.2 Electrofishing Method

Be sure the site surveyed for fish includes all habitat types present in the reach. Electrofish a minimum of 100 m of the stream reach after collecting macroinvertebrate and periphyton samples.

Follow the steps below for electrofishing and entering fish data on both the "fish col." and "fish data" forms:

- At a minimum, make one upstream pass without block nets. Proceed up the thalweg of the channel for streams whose wetted width is less than 5 m or in a zig-zag pattern in larger streams.
- Enter the following data on the "fish col." form (Figure 36):
  - Select electrofisher model.
  - Record effort (number of seconds), voltage, frequency, and duty cycle.
  - Measure and record the water temperature.
  - Measure and record the specific conductivity in microsiemens per centimeter.
- Once all "fish col." fields are completed, click **Save Record** to save data and return to the switchboard, where you can then enter the "fish data" form information. Exiting the form before all required information has been entered will cause a pop-up error message to appear stating which field is lacking information. By clicking **OK**, the user may see a second message requesting to close the database object. Click **No** to this second message to return to the form and add the needed information. *If the user does not return to the field form to enter missing data, all data for that form will be lost and will need to be re-entered.*

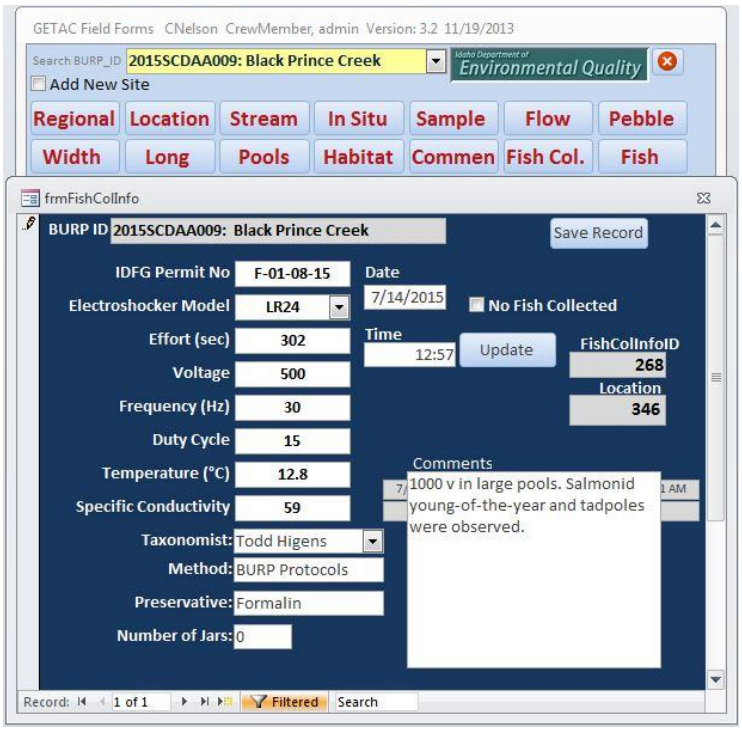


Figure 36. Fish collection form.

- Collect all fish. Ensure that all collected fish are maintained in cool, well-oxygenated water. Take care to avoid damage or injury to the fish. Identify all fish to the lowest taxonomic level possible (see Appendix H for DEQ fish taxon codes). Prepare equipment for measuring length and the recovery chamber prior to applying anesthesia (if used). Apply anesthesia (if desired) as recommended by Chandler et al. (1993).
- Group the fish by similar looking individuals or by species. Assign a grouping code for each type of fish that appears to be of the same species. If the field taxonomist is unsure of the species, group those that appear to be of the same species and give them the same alphabetical grouping code.
- On the "fish data" form, select the species and record the group ID and length for all fish collected. For those fish that are vouchered, enter the voucher tag number. If a fish (vouchered or not) exhibits signs of deformity, erosions, lesions, or tumors, select from the **DELT** drop-down. If the fish was killed in the process of electrofishing, check the box next to **Mortality** (Figure 37).
- On the "fish data" form, use the **Add** button to save the data entered for each record (specimen) and move to the next record. Clicking **Add** will increase the **Group/Species/Tally** box by 1 under the group/species corresponding to the fish just added. It is possible to double-click on the group/species to have it populate the next fish record. This feature reduces the amount of time spent searching through the species drop-down.

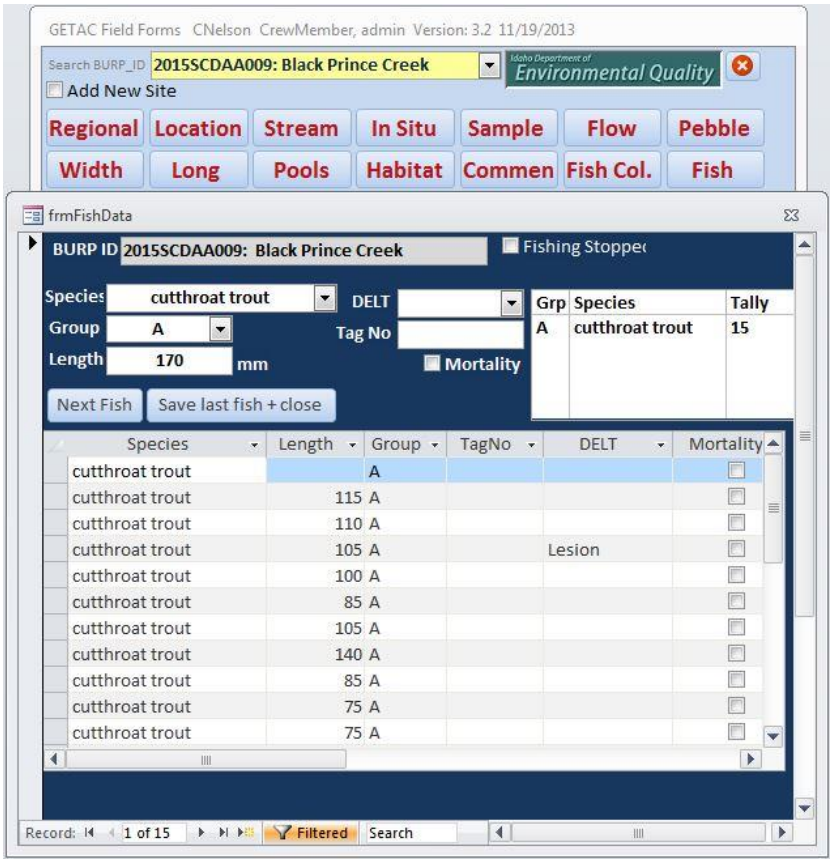


Figure 37. Fish data form.

3.3.13.3 Fish Vouchering

Vouchering of fish specimens is a QA procedure at DEQ and is a routine step in good biological science. It has been recommended to voucher specimens for additional taxonomic identification and eventual deposit in a museum (Lundberg and McDade 1990). The depository for DEQ fish (and macroinvertebrate) voucher specimens is the Orma J. Smith Museum of Natural History at the College of Idaho in Caldwell. Vouchered specimens can also be used for public education, staff training, and research and evidence in beneficial use attainability, beneficial use status, and environmental investigations.

3.3.13.3.1 Vouchering Policy

Voucher any fish that cannot be identified to the species level in the field and enough specimens of each species from each site to document the range of size and individual characteristics of each species at that site. One voucher of each group of similar looking fish from each site is usually enough.

Collect a complete QC voucher from 10% of the sites monitored. Voucher at least one representative from each taxon captured, including any that are unknown. For species that cannot be vouchered according to collection permit restrictions, photo “vouchers” should be taken. Include in the photograph any feature that is needed to positively identify the species.

Vouchering must comply with any applicable scientific collection regulations and restrictions, particularly those specified in permits. DEQ fish collection permits need to specify the Orma J. Smith Museum as the depository for the vouchered material. The museum also needs a photocopy of the collection permit to document legal possession of vouchered materials.

3.3.13.3.2 Vouchering Procedures

1. Before beginning, read the formalin health and safety information in Appendix E of this manual.
2. **Each** fish must be tagged using one Floy tag label per fish voucher. The most commonly used method to tag a fish is to use a wire through the mouth to attach the tag (Figure 38).

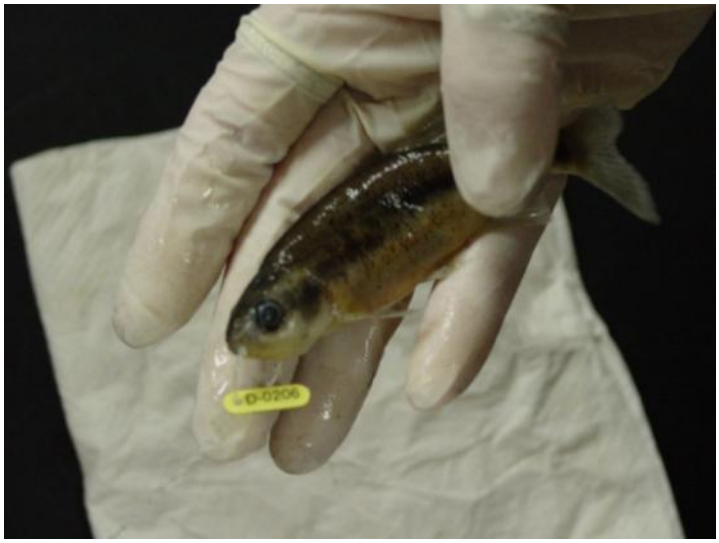


Figure 38. Fish with Floy tag attached through mouth and gills.

3. Place tagged live specimens in 10% buffered formalin solution as a fixing agent. Using live specimens allows the formalin solution to be ingested and dispersed into the interior organs and tissues of the fish. If a specimen is over 300 mm (1 foot) in total length, make a small incision in the abdomen and/or inject formalin into the large muscles. Be sure all the specimens are totally covered with formalin.
4. Label each sample jar according to the example in Figure 39. Each label must have at least the following information: (1) stream name (water body), (2) site ID, (3) date, (4) collector's name, (5) latitude/longitude, and (6) the jar count (e.g., 1 of 3, 2 of 3). When including paper labels with fish, use archival grade heavy paper that can withstand storage in formalin solution (such as Resistall Paper 36#). Use pencil. Place one label inside the jar and tape a second label to the outside of the jar.

DEQ Sample Label

☐ Macroinvertebrate ☐ Periphyton
☐ Fish ☐ Amphibian
☐ Water Chemistry ☐ Invasive Species

Waterbody: _____

Site ID: _____

Sample Station: _____

Lat: _____ Long: _____

Collector: _____

Date: _____ Jar _____ of _____

Other Information:

Figure 39. DEQ sample label.

5. Ideally, each site should have one jar for all vouchered fish. Each jar must have a label stating that it contains formalin. One way to do this is to put a "Mr. Yuk" sticker on the fish jars.
6. The fish specimens from any one crew must be kept separate from those of other crews and from other types of specimens. Do not mix fish, macroinvertebrate, or amphibian samples or different crews' fish samples together in one box. Each box of samples should be labeled with: (1) the regional (or state) office it is from, (2) the site IDs of the samples in the box, and (3) the box count and total number of boxes (i.e., box 1 of 5, 2 of 5, etc.).
7. Before submitting the specimens to the lab for analysis, fill out the "fish data" form relating tag numbers to DEQ fish specimen labels. Make an initial field identification of the specimens being vouchered.
8. When the monitoring season is finished, send all the samples (for one crew/region) to the laboratory in one shipment. Follow QA/QC instructions for lab submittal. Include records of fish vouchered with samples submitted to the lab. Do not mix samples from more than one region in any one shipment to the laboratory. Notify the lab before sending samples. If possible, call the lab before the end of the season with a reliable estimate of the number of samples they will receive. This allows the laboratory to order necessary supplies and schedule employees to complete the work.

3.3.14 Bacteria (*E. coli*) Check Sheet

E. coli (Escherichia coli) is a bacteria found in the normal intestinal flora of warm-blooded animals. Its presence in water indicates the water has been in contact with or been contaminated by fecal material. The Idaho water quality standards use *E. coli* as an indicator for bacteria and other pathogens. Although BURP currently analyzes for *E. coli*, the samples collected by this method could be analyzed for other bacteria as well. Numerical criteria for *E. coli* are included in the Idaho water quality standards for protecting primary and secondary contact recreation beneficial uses (IDAPA 58.01.02.250.01). The designated beneficial use is determined in the office before the field visit.

Each site is screened, using the process described below, to determine if the site potentially has sources of *E. coli*. If it does, a bacteria sample is collected from the site and submitted for laboratory analysis. If that sample contains *E. coli* at a level that exceeds a standard single sample threshold, four additional samples must be collected within 30 days to calculate a geometric mean for comparison to the water quality standards.

3.3.14.1 Bacteria Screening

At each BURP survey site, follow the screening process outlined below and complete the screening check sheet (Figure 40) to determine if bacteria sampling is required.

DEQ's screening process uses the following questions:

- Do upstream land uses have the potential for increasing bacteria concentration? Examples of such land uses are agriculture, grazing, urban development, wastewater treatment facilities, septic tanks, and cabins. If **yes**, apply secondary contact recreation threshold values for exceedances if primary contact recreation is not designated or observed.
- Are there other reasons that bacteria sampling should be done? For example, has the stream had bacteria problems in the past? Has the public filed complaints on the stream? Are there other reasons to expect a bacteria problem? If so, provide a description of these reasons. **For any of these reasons**, apply secondary contact recreation threshold values for exceedances if primary contact recreation doesn't apply.

If any of the above questions were answered yes, collect one grab sample for laboratory analysis, using the method given below. Threshold values are 406 organisms per 100 mL for primary contact recreation and 576 organisms per 100 mL for secondary contact recreation collected from a single sample (IDAPA 58.01.02.251.01). If an exceedance of the applicable threshold value occurs according to these criteria, follow up by collecting four additional samples 3–7 days apart within a 30-day period.

To determine if primary contact recreation applies, answer the following questions:

- Is primary contact recreation a designated beneficial use? If **yes**, apply primary contact recreation threshold values for exceedances. If **no**, apply secondary contact recreation threshold.
- Is primary contact recreation an existing beneficial use? For example, are swimming/bathing areas located within the reach? Is there evidence of swimming/bathing within the reach? Has swimming/bathing been observed in the reach? If **yes**, apply primary contact recreation threshold values for exceedances. If **no**, apply secondary contact recreation threshold.

Idaho Division of Environmental Quality
Bacteria Check Sheet

Stream Name:		Site ID:	
HUC #:		Collection Date:	

1	Is Primary Contact Recreation a Designated or Existing Use	Yes	No	If Yes collect 1 sample *****
				if No collect 1 sample *******
2	Are upstream land uses affecting recreation use **	Yes	No	if Yes collect 1 sample *******
3	Other reasons ***	Yes	No	if Yes collect 1 sample *******

explain other reasons

collect 1	
collect 5	

** include agriculture, grazing, recreation, urban, cabins, septic
*** on 303d list for bacteria, etc.
***** if e-coli exceeds 406/100ml, collect 5 samples over 30 days
******* if e-coli exceeds 576/100ml, collect 5 samples over 30 days

Sample Results

sample #	date	time	location	E-coli results
sample #1				
sample #2				
sample #3				
sample #4				
sample #5				
sample #6				
* if sample #1 exceed standards, collect remaining 4 samples			geometric mean	

other notes:

Figure 40. Sample of a bacteria check sheet.

3.3.14.2 Bacteria Sample Collection

For BURP monitoring, bacteria samples must be taken following standard methods (Clesceri et al. 1998). Follow these guidelines:

- Take bacteria samples in nonreactive borosilicate glass or plastic bottles that the laboratory has prepared with sodium thiosulfate ($Na_2S_2O_3$). Sodium thiosulfate dechlorinates and neutralizes any residual halogens and prevents continuation of bacterial action during sample transit. Sodium thiosulfate is usually intended for dechlorinating chlorinated wastewater effluents and drinking water. Sodium thiosulfate may not be necessary for surface waters (unchlorinated) but its use is recommended for standardization and will not negatively affect surface water samples. If you must prepare your own bottles, be sure they are cleaned and rinsed carefully, given a final rinse with deionized or distilled water, and sterilized.
- Use aseptic techniques to avoid sample contamination. Leave each sample bottle closed until it is to be filled. Follow these collection steps:
    1. Stand facing upstream in the thalweg at the sample collection location.

2. Remove the sample bottle cap or stopper as a unit; do not contaminate the inner surface of the stopper or cap and neck of the bottle. Do not rinse the bottle.
3. Invert the sample bottle and dip it to arm's length, not more than 80% of depth.
4. Revert the bottle while drawing upward; this approximates depth integration.
5. Pour out excess water to leave ample air space (at least 2.5 cm). The volume of the sample should be sufficient to carry out all tests required, preferably not less than 100 mL.
6. Recap the sample bottle immediately.
7. Place the sample in a cooler with ample ice to maintain a temperature of 4 °C.
8. Deliver the sample to the laboratory within the specified holding time, currently 24 hours.
9. Do not submit samples for analysis if they have exceeded the holding time specified by the laboratory. Currently the state laboratory closes at 4:30 p.m., so bacteria samples must be delivered by 4:00 p.m.

- Perform the following QA protocols for bacteria sampling:
  1. Collect 10% "blank" samples (i.e., after every 10 samples, collect one blank) by substituting steps 3 and 4 above with filling a sample bottle with deionized water.
  2. Collect 10% duplicate samples (i.e., after every 10 samples, collect one duplicate).
  3. Always complete proper labeling and field documentation to demonstrate compliance with sampling protocol and to reduce contamination of sample bottles.
- Make sure to record sample collection time, collector, and number of jars on the bacteria portion of the "sample" form (section 3.3.5.5).

4 Completing Follow-Up of BURP Field Activities

After the main field activities are finished, a few follow-up activities must be done when leaving the site and after returning to the office (Figure 41).

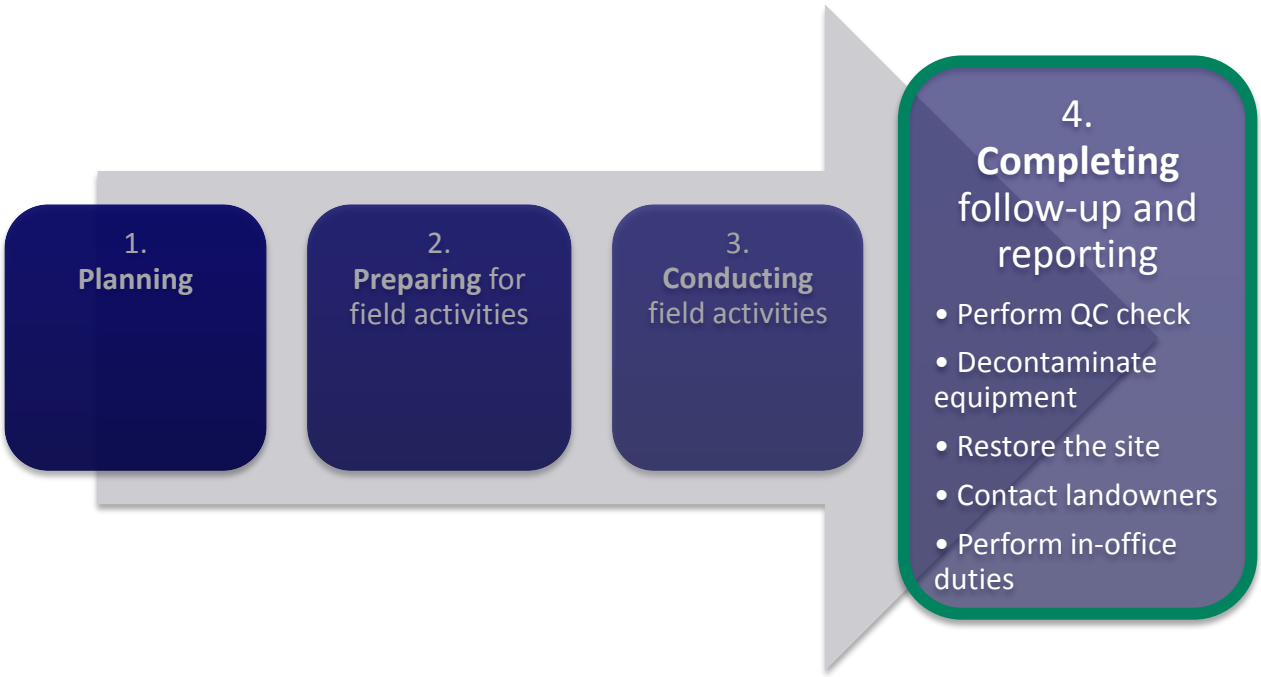


Figure 41. Steps in the follow-up phase.

4.1 When Leaving a Site

4.1.1 Perform Quality Control

The electronic field forms are programmed with a basic degree of quality control (QC). One feature of this QC is the required fields on each form for certain necessary data. If the user tries to exit a form without recording these required fields, the program will prompt the user to return to the field form to enter the missing data.

Another feature of the QC is the overall **SiteQC** button found on the switchboard. Prior to leaving the site or powering down the GETAC field computer, the crew should click the **SiteQC** button, which checks the forms for required data. If any data are missing, a datasheet will appear on the switchboard showing which fields are missing data. In addition, the forms with missing data will be underlined on the switchboard (Figure 42).

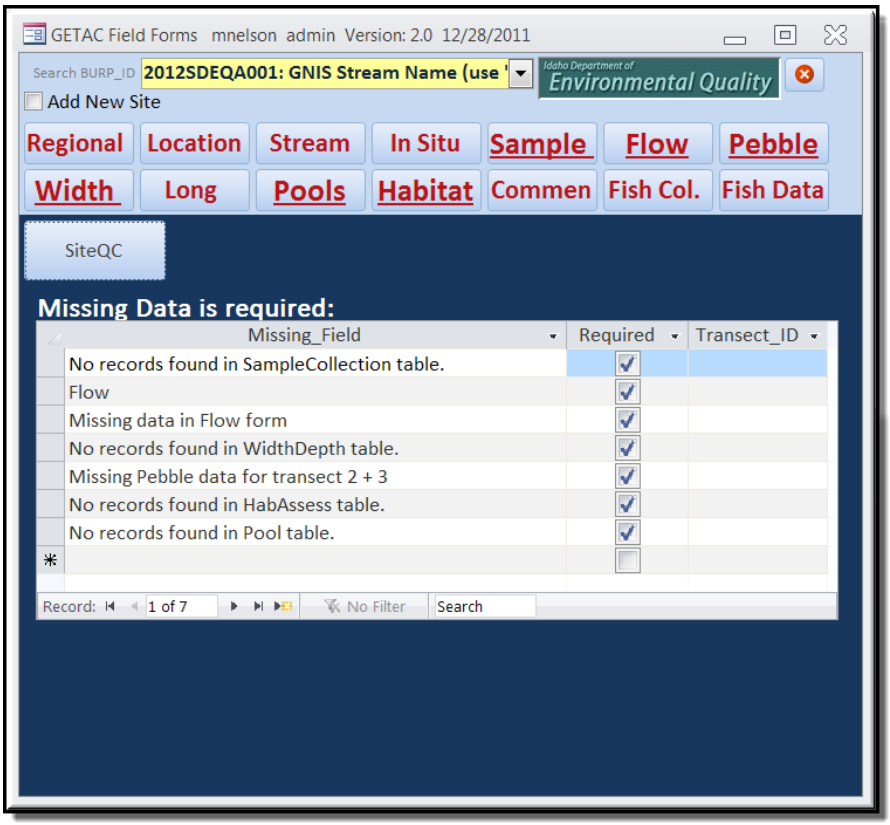


Figure 42. Site QC check. Notice the forms with missing data are underlined on the switchboard.

The **Site QC** button does not validate the "fish col." or "fish data" forms, as this information may not always be present. It is up to the crew and coordinator to do a final check on the fish information.

4.1.2 Decontaminate Equipment

DEQ does not want its monitoring activities to spread noxious weeds, aquatic diseases, or exotic flora and fauna. Take special care to perform decontamination steps as described below before moving from one area to another.

The following procedures were adapted from the New Zealand mudsnail control and management plan for Colorado (DOW 2005) and should be followed upon exiting *all* waters. Wading gear should be cleaned prior to leaving the site. If this is not possible, wading gear should be completely sealed inside a large plastic bag and cleaned before it is used in any other waters. BURP crews currently use two disinfectants: GS High Dilution Disinfectant 256 and Virkon Aquatic.

Gather the following equipment for GS High Dilution Disinfectant 256:

- 5 gallon bucket with lid containing GS High Dilution Disinfectant 256 solution (4–6 oz of solution per gallon of water—note that this solution will also kill whirling disease spores [*Myxobolus cerebralis*])5 gallon bucket with lid containing clean water
- Stiff-bristled brush
- Latex gloves

- Eye protection

Gather the following equipment for Virkon Aquatic:
3-5 gallon weed sprayer to carry in vehicle
Virkon Aquatic Formula
Eye Protection

Use the following protocol for cleaning and decontamination using GS High Dilution Disinfectant 256:

1. Before exiting the stream, use a stiff-bristled brush to remove mud and debris from boots.
2. Remove wading gear immediately after exiting the stream, and make sure infested gear does not come in contact with other equipment. If you use separate wading boots, remove the insoles from the boots. However, it is recommended you use waders with boots attached (versus stocking foot waders with separate boots) because snails can easily get trapped in laces and inside boots. Do not use waders with felt soles.
3. Wear latex gloves and eye protection when using GS High Dilution Disinfectant 256: This product is an industrial cleaner, and standard safety precautions should be followed. (See Appendix D for an SDS.)
4. Place waders, boots and insoles, and sampling equipment in the GS High Dilution Disinfectant 256 solution for a minimum of 10–15 minutes (solution may be reused several times). If using Virkon Aquatic spray equipment thoroughly and let sit for minimum of five minutes.
5. Remove from solution and inspect gear to make sure all snails and other debris have been removed.
6. Rinse by immersing and agitating in the bucket of clean water. Do not use stream water to rinse gear or you may reintroduce organisms and diseases.
7. Do not discard the GS High Dilution Disinfectant 256 solution or the rinse water in the field. Instead, cap the buckets, return to the office, and dispose of the liquid down a drain that is routed to a wastewater treatment plant.

Use the flowing protocol for cleaning and decontaminant using Virkon Aquatic:

Idaho Dept. of Fish & Game & US Fish & Wildlife Service
Eagle Fish Lab and Idaho Fish Health Center

Field Gear Disinfection

Waders, Boots, Equipment

1. Prepare appropriate disinfectant and put into a 3-5 gallon weed sprayer to carry in vehicle. *(Choose a disinfectant for species of concern.)*

Chlorine Bleach Formula: 10 -30 minute contact time. Use as dip and must rinse from equipment. Remember to neutralize with sodium thiosulfate	[target conc(ppm)] x [volume of water(gal)] x 0.00378/ % active ingredient = mL of bleach to add (assume 1 mL bleach weighs 1 g)
Quaternary Ammonium Compound Formula: Use at 400ppm 5-10 min. Use a spray on. No disposal if you make a dip.	# of gallons X 3785 = total of ml total ml/1,000,000mL X desired ppm = # ml needed X [concentration of active ingredient]
Virkon Aquatic Formula: 5-10 minutes Use as a no rinse spray on. 1:200 dilution (0.5% solution and 5000ppm) 1:100 dilution (1.0% solution and 10,000ppm)	add 0.65 ounces of powder per gallon of water add 1.3 oz or 37g of powder per gal of water

2. Remove visible organic debris by rinsing in water at site. *(Stream, Lake, or water pump is fine. This leaves critters that you may have picked up at their site of origin.)*

3. Spray equipment with sprayer when leaving site. *(Contact time is 5 minute minimum. This allows for disinfectant to work between sites)*

4. Clean hands with baby wipes or hand sanitizer. *(Aquatic virus, bacteria, and fungus can be transmitted via water on hands.)*

5. Repeat Steps 2- 4 as needed for each site visited.

6. On way back to office, use a high heat and pressure washer at car wash on large equipment to remove organic debris into sewer. *(You may cleanse and rinse here saving the need to do so at the office. This reduces possible transmission to office area.)*

7. Thoroughly disinfect upon returning to office.

a. **Remove any visible debris from items not rinsed at car wash.**
b. **Cleanse with soap and water** *(If you did not use cleanser at car wash).*
c. **Rinse all cleanser from equipment.**
(Cleansers combining with disinfectants are BAD!)
d. **Spray or dip equipment with disinfectant for 5 minutes.**
e. **Rinse with water.**
f. **Dry Completely.** *(Warm moist areas are preferable to microorganisms.)*

Caution:

****Disinfectants must not be poured into surface waters. The Label is the Law! Dispose of according to label.***

4.1.3 Leave the Site How You Found It

Make every effort to restore the site to the condition it was in when the crew arrived. Be sure to remove all markers, stakes, ribbons, equipment, and supplies. Leave all gates as you found them. If possible, avoid driving over soft terrain that can be damaged with vehicle tracks.

4.1.4 Contact the Landowner

Many private landowners and public lands caretakers appreciate being contacted by the BURP crews as they leave a site. If possible, contact the landowners or caretakers when leaving to express thanks and notify them of your departure. It is often helpful to convey any positive comments regarding their property or the stream. If they ask about indications of impairment, be honest but do not theorize or place blame for any degraded conditions you observed.

4.2 Back in the Office

Several activities must be done back in the office, some immediately and some within a few days:

- Submit samples to the lab.
- Handle data properly, filing notes and other information.
- Send thank-you notes to landowners and caretakers that you didn't contact in person when leaving their sites.
- QA/QC data and transfer to central database.

5 Quality Assurance and Quality Control

The data collected in the field is of little use unless its quality is ensured by QC practices. For DEQ to make maximum use of the BURP data, staff must follow BURP protocols in this field manual and QC practices in the current quality assurance project plan (QAPP).

Collecting reliable and accurate monitoring and measurement data is the goal of the QA program. DEQ's QA program enhances data accuracy, reliability, and consistency through (1) annual BURP coordinator workshops, (2) extensive BURP field crew training, (3) consistent crew supervision, (4) comprehensive field audits, and (5) various QA activities. Each of these is discussed below.

5.1 BURP Coordinator Workshops

Each year, BURP coordinators review protocols to learn new methods and exchange ideas on improving data collection efficiency and accuracy during several meetings and one workshop. The workshop is conducted before each field season and provides training materials and instruction methods, training on new methods, and examples of properly recorded measurements. If any protocols are changed, the BURP field manual is updated accordingly.

5.2 Crew Training

Because of the numerous variables measured and many samples taken, training the seasonal crews is essential for success of the BURP program. DEQ strives for statewide consistency in monitoring data and has chosen mandatory centralized training of the BURP field crews as the best way to accomplish this objective. All crew members receive comprehensive and consistent training about DEQ policies and BURP methods. This training includes new and returning crew members.

Crews are usually trained during the last 2 weeks in June, before the field season starts July 1. Currently, the training takes 4 full days. It includes a small amount of lecture in the office but is mainly done in the field. The crews learn all aspects of the methods presented in the BURP field manual. Most of the training consists of hands-on demonstrations, first by the DEQ instructors, then by the crew members to demonstrate their ability to perform each method. Other training methods include viewing instructional materials and lecture and discussion sessions. The crews are introduced to as many different types of streams, land uses, and ecoregions as possible during the training.

BURP crew members receive extensive training before beginning field work. They learn the correct procedures for taking samples and measurements and how to properly fill out the BURP field forms, an important part of accurate data entry and overall QA. In addition, they receive information about personal safety, QC, vehicle and equipment maintenance, and proper field etiquette.

5.3 Supervision of Crew Adherence to Standards

Each BURP crew is supervised throughout the monitoring season by a BURP coordinator who accompanies crews periodically throughout the monitoring season to ensure their continuing adherence to the BURP field manual and DEQ policy.

5.4 Field Audits

A field audit team consists of one or more members of the DEQ state office staff. The audit team observes crews performing measurements and collecting and preserving samples at a site. Each crew is audited within approximately 2 weeks of crew training. Each crew is audited at least once per season. The coordinators use the audit findings to ensure the crew’s performance is consistent and adheres to QA requirements. Crew’s that are found to not be following the standard protocols will have their data rejected during data handling and review steps. Follow up audits are then required for crews not following the protocols.

After the audit is completed, the audit team briefs the crew on site. The audit team prepares a written report of audit results immediately following the audits and distributes it to DEQ regional managers, coordinators, and other staff.

5.5 Quality Assurance

5.5.1 Sample Handling

BURP crews are trained to handle all samples as gently as possible and to take extra care with macroinvertebrate samples, as excessive shaking and jarring can destroy the samples. Crews are also trained on how to label samples correctly and on the importance of correct labeling.

5.5.2 Sample Vouchering

Voucher specimens should be archived for future reanalysis, identification, and other research (Bailey et al. 2001; New 1998). Voucher specimens should be stored in appropriate containers and preservatives. Voucher labels should include necessary information such as location, date, and collector's name and be printed on archival paper. Most BURP specimens are deposited in the Orma J. Smith Museum of Natural History at the College of Idaho in Caldwell. Amphibian voucher information is also shared with the Idaho Museum of Natural History at Idaho State University in Pocatello. DEQ will continue to support voucher specimens as resources allow.

5.5.3 Equipment Calibration

Calibrating the equipment means adjusting precisely for a particular function. To obtain the most accurate and precise information, the BURP coordinators are responsible for calibrating or standardizing each piece of monitoring equipment requiring calibration before each field season. Calibrating a piece of equipment tells how accurate its measurements are and ensures the integrity of the data.

Before the beginning of each monitoring year, the conductivity meter and flow meter are sent in for factory calibration and maintenance. The field crew inspects the lab-grade and field thermometers weekly and calibrates them monthly to confirm instrument integrity. The field crew also calibrates the conductivity meter monthly. The crew maintains a calibration log for each instrument.

5.5.4 Data Handling

Data handling by BURP crews and coordinators prior to submittal to the state office is considered part of the sampling process. One portion of QA for data handling has been outlined in section 4.1.1, which describes how the crew can ensure data is complete for a given site while still in the field. This section on data handling describes how data are validated for QC once the data is in the regional office.

5.5.4.1 Data Transfer and the Coordinator's Desktop Review Program

Data from the GETAC field computers should be transferred on a weekly basis to the regional coordinator's desktop computer using the Coordinator's Desktop Review program. When transferring the data from the GETAC field computer, the user should make a copy on a flash drive to transfer the database, renaming the copy as GETACFieldFormsMMDDYYYY.accdb, where MM is the 2-digit month, DD is the 2-digit day, and YYYY is the 4-digit year corresponding to the date when GETAC data is transferred. Each regional office should create a

folder on either a local or a shared drive that is regularly backed up where these files can be stored until the data has been transferred to the central database and validated.

The Coordinator's Desktop Review software program also allows the regional coordinator to review data prior to submitting it to the central database. This program contains the protocols for transferring data to the central database, which is the responsibility of the regional coordinator. Because this data becomes "live" once the regional coordinator performs the transfer, it is important to validate the data prior to transfer. The Coordinator's Desktop Review program retains the look and feel of the GETAC field forms, but with buttons for additional tasks. Data imported from the GETAC computers is housed in the Coordinator's Desktop Review program only temporarily; this is not a place to store final data.

5.5.4.1.1 Locate Data from GETAC

The **Locate Data from GETAC** button opens a form that requires the user to navigate to the database transferred from the GETAC field computer containing the data collected by the field crew (Figure 43). Select the file and click on **File is correct. Import it**. The program will remove any previous data stored in the Coordinator's Desktop Review and replace it with data from the GETAC field database. When the program has successfully imported the files, the text window will display the message "Import finished."

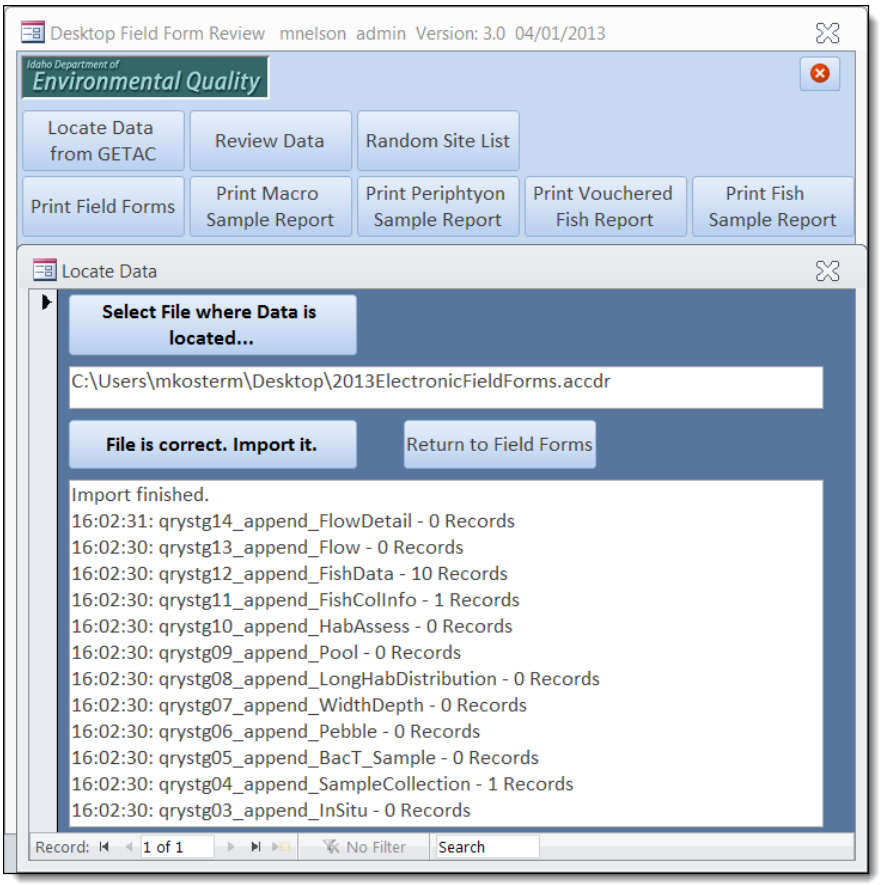


Figure 43. Locating data from GETAC field database using Coordinator's Desktop Review.

5.5.4.1.2 Review Data

The next step in the QC process is to review the imported data. Click on **Review Data** on the switchboard to bring up the "review data and transfer" form (Figure 44). On the top of this form, click on **QC Data Report** to initiate a preliminary review of the data and identify outstanding issues with the data. Some of the data issues that this preliminary review looks for include the following:

- HUC fields are 8 digits long
- Site Type and Stream Condition Factors correlate with each other
- All required fields have data present
- Pool numbers are consecutive (1 to 4)
- Any apostrophes used in text fields

If any issues are found, the program will generate a message in a QC report that the regional coordinator can view and determine what, if any, action is necessary to take prior to beginning the data transfer to the central database (Figure 45 and Figure 46).

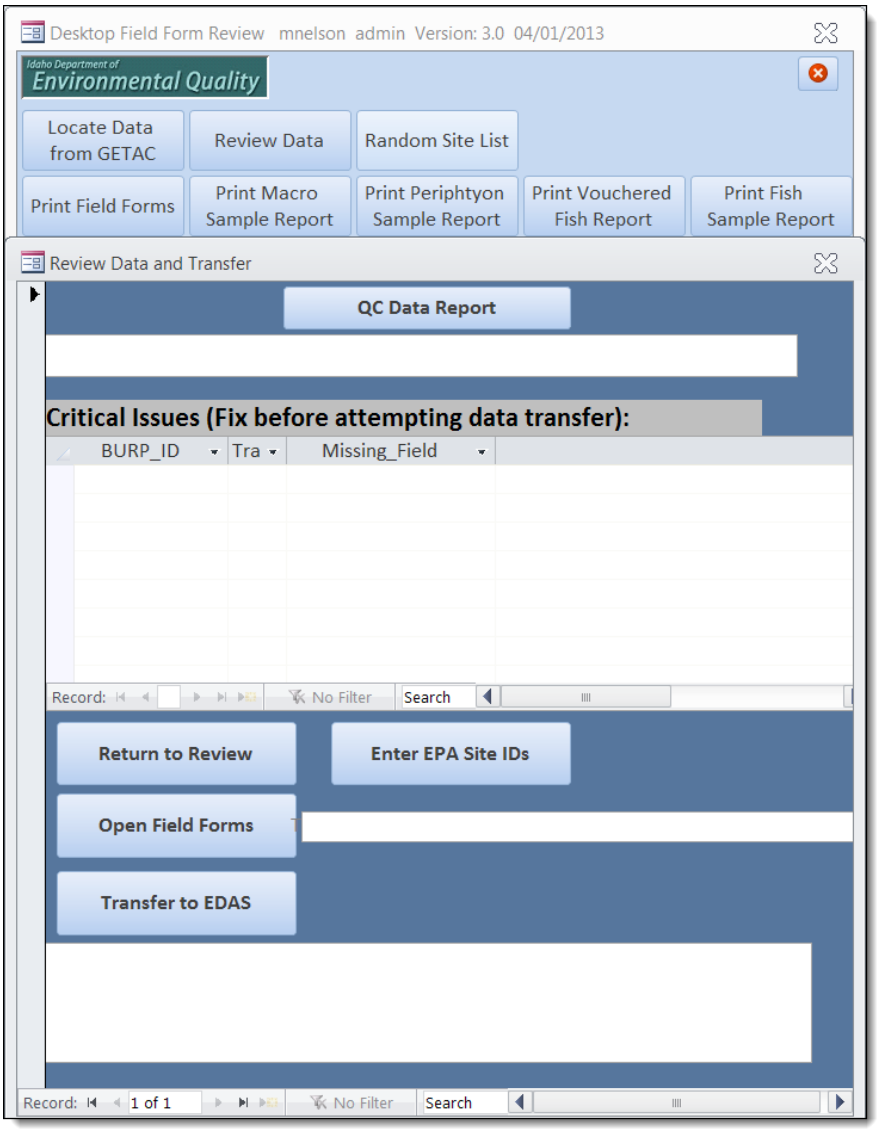


Figure 44. Review data and transfer form.

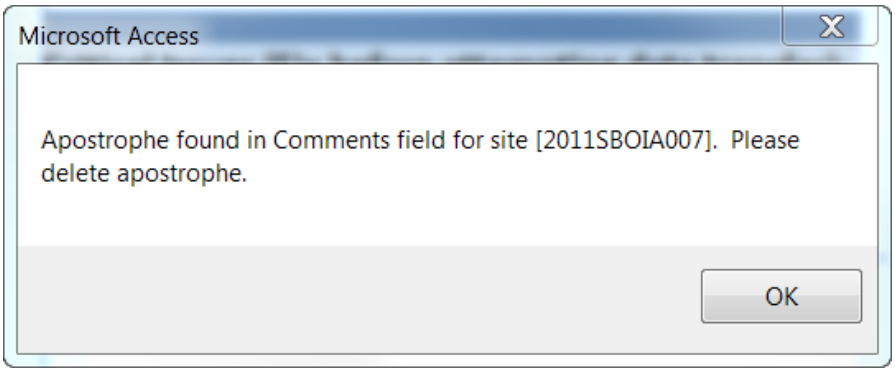


Figure 45. Error message showing site ID and field where an apostrophe was found.

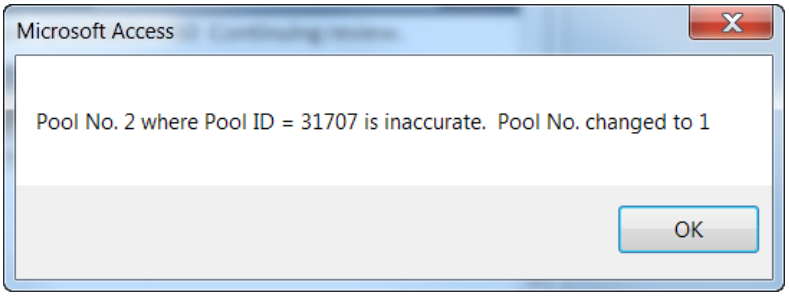


Figure 46. Error message showing a change in pool number.

Once the QC check is complete, the program will offer the option to view the full QC report. This report details all missing data, not just those fields that were required for data transfer to the central database. It will also identify issues regarding the probabilistic sampling sites, chiefly those sites where site type and stream condition factors do not correlate. The regional coordinator should review the full QC report prior to attempting data transfer. Critical issues (those where required fields are missing) are identified on the "review data and transfer" form once the QC check has completed (Figure 47). These critical issues must be resolved prior to attempting data transfer to the central database or they will result in transfer failure.

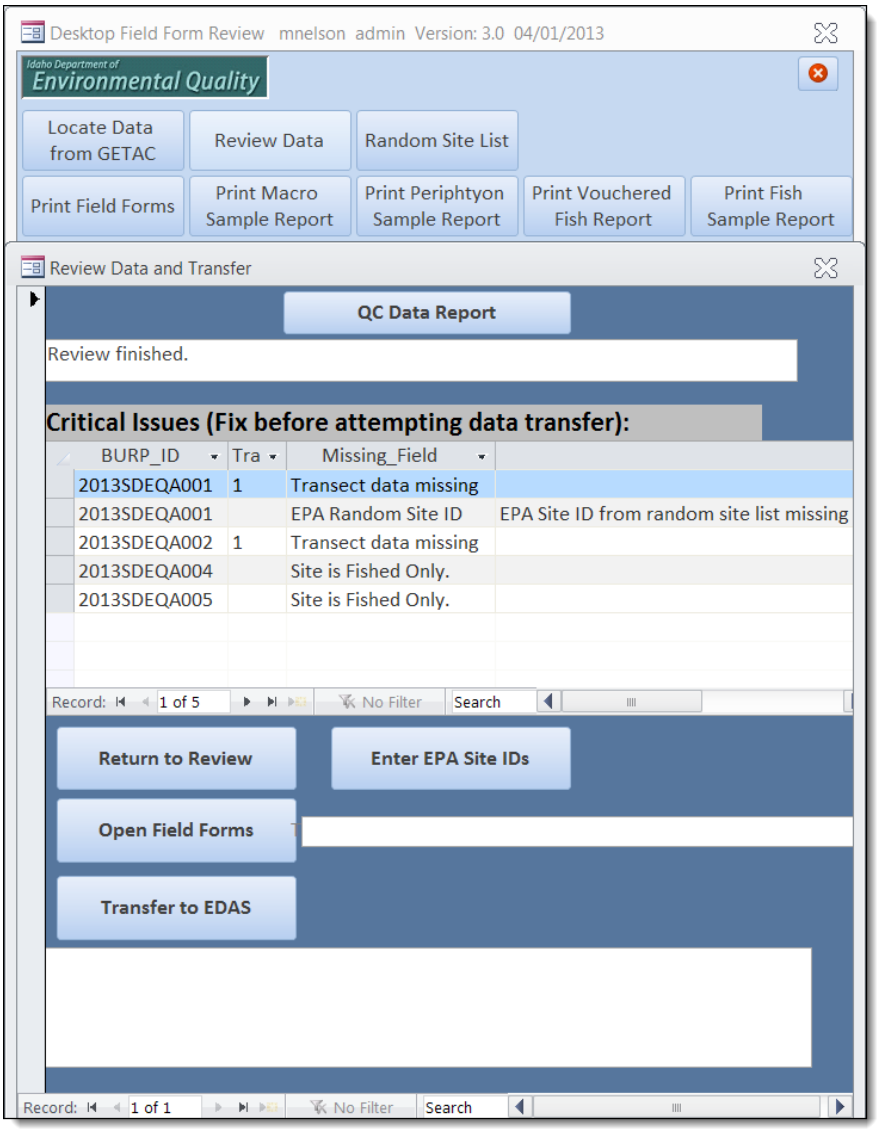


Figure 47. Review data and transfer form following QC check.

When the random site list is generated at EPA's Office of Research and Development (ORD) lab in Corvallis, it is sent to DEQ with its own unique set of site IDs. It is important for data analysis and interpretation that the site IDs on that list match the corresponding BURP site ID. The **Enter EPA Site IDs** button queries the data set and populates a table of BURP site IDs based on those sites that were identified in their site type field as random (Figure 47). BURP site IDs that do not have a corresponding EPA Site ID are then shown in the "random site list" form that appears after the user clicks **Enter EPA Site IDs**. The user can then enter the corresponding EPA site ID for the random BURP sites in the data set. This information is required for the transfer of sites to the central database and should be done before attempting data transfer.

The protocols written to transfer data to the central database will also update the GETAC database that was imported into the Coordinator's Desktop Review program. ***Therefore, it is imperative that the regional coordinator be satisfied with the accuracy of the data prior to transferring it to the central database.***

5.5.4.1.3 Transfer Data

Once all critical issues have been resolved and the regional coordinator is satisfied with the accuracy of the data, the data may be transferred to the central database by clicking **Transfer to EDAS**. The text box below the button will indicate the status of the data transfer. Please contact state office staff (Mary Anne Nelson) if you encounter errors during data transfer.

5.5.4.2 Central Database Quality Control Checks

Once data have been transferred to the central database, several QC checks will be done on the data on a monthly basis during the monitoring season, including verifying the following information:

1. Each BURP site transferred has the required location information such as latitude, longitude, site type, stream condition factor, etc.
2. All required data for sites marked "sampled" exist and are within the expected ranges
3. Fish collection information and fish data exist and are within expected ranges for all BURP sites where a fish sample was taken

In addition to the above mentioned QC checks, 10% of the sites uploaded each month during the monitoring season will be selected randomly for verification that data in the central database accurately and precisely reflect data collected and stored in the regional office.

5.6 Data Analysis and Interpretation

This field manual describes how to conduct a survey following the BURP protocol. This description includes BURP survey assumptions, methods, data handling, and required equipment. This document does not address data analysis and interpretation. That information is found in the *Water Body Assessment Guidance* (Grafe et al. 2002).

6 Safety

DEQ takes safety very seriously. Several policies ensure safety when performing monitoring activities, including mandatory training in cardiopulmonary resuscitation (CPR), first aid, hazardous substances, and electrofishing safety. DEQ also provides comprehensive training regarding employment and safety policies during regional orientation and centralized training.

6.1 CPR, First Aid, and Wilderness Training

All BURP crew members and DEQ staff who perform monitoring activities must be trained and certified in CPR and first aid to increase safety during all BURP field work, particularly during training and electrofishing. BURP coordinators will be responsible for educating crews on the identification of poisonous plants in Idaho such as poison oak, poison ivy, and sumac. Other topics that should be addressed are encounters with wildlife, heat exhaustion, and heat stroke.

6.2 Hazardous Situations and Substances

No BURP crew member is authorized to endanger his life or the lives of others with exposure to hazardous materials, laboratory waste, or drug paraphernalia. DEQ provides training to help identify potentially hazardous substances and situations that may be found at monitoring sites or during travel.

6.2.1 Hazardous Materials

Training prepares crew members to recognize hazardous materials if they are encountered in the field. Crew members are not trained or authorized to deal with hazardous materials. BURP coordinators, in consultation with hazmat coordinators, are encouraged to develop their own additional training programs specific to their regional areas.

Crew members are not authorized to collect or transport hazardous materials found in the field. However, they are authorized to determine the GPS coordinates of a site if it can be done without undue exposure and to report the site to the BURP coordinator, who will then report it to the regional office hazmat coordinator. Safety comes first in any situation.

BURP crews use a reduced concentration of formalin to preserve some samples in the field (currently fish, periphyton, and amphibians). Appendix E provides information on how to handle formalin safely.

6.2.2 Abandoned Mining Sites

BURP training includes awareness of safety issues surrounding abandoned mining sites. Crew members are not authorized to visit or enter abandoned mine sites (especially adits and tunnels) without notifying the BURP coordinator and the abandoned mine lands coordinator.

6.2.3 Laboratory Waste and Drug Paraphernalia

BURP training includes discussions of safety and health issues surrounding laboratory waste and drug paraphernalia that sometimes appear on public lands. Crew members are not authorized to collect or transport laboratory waste or drug paraphernalia without written authorization from the regional water quality manager. However, they are authorized to determine the GPS coordinates of a site if it can be done without exceeding the exposure level or otherwise risking the health and safety of crew members and others and to report them to the BURP coordinator, who will then immediately report them to the hazmat coordinator.

6.3 Electrofishing

DEQ has several policies to address electrofishing safety issues. DEQ’s electrofishing safety plan (Appendix G) addresses safety issues concerning training, equipment, and procedures. BURP coordinators, crew members, and other DEQ staff performing electrofishing activities must carefully review these policies and sign a form acknowledging they have received electrofishing orientation. DEQ also uses an electrofishing checklist to ensure equipment needs are met and safety issues are addressed (Appendix I).

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Glossary

See the *Glossary of Aquatic Habitat Inventory Terminology* (Armantrout 1998) for a more complete glossary of aquatic habitat inventory terminology.

alluvial—related to material deposited by running water

anode—the positive electrode

anthropogenic—resulting from the influence of human beings on nature

aquatic—pertaining to water; in this context, usually refers to plants or animals living in, growing in, or adapted to water

backwater pool—a pool caused by an eddy along the channel margin or by back-flooding upstream from an obstruction such as large woody debris, boulders, or root wads

bankfull depth—depth of water measured from the surface to the channel bottom when the water surface is even with the top of the streambank

bankfull height—measure of height from the water's surface to the level when water would be even with the top of the streambank

bank stability—the resistance of a bank to erosion

beneficial use—any of the various uses that may be made of water, including, but not limited to, water supply (agricultural, domestic, or industrial), recreation in or on the water, aquatic biota, wildlife habitat, and aesthetics

benthic—relating to the bottom or bed of a water body

canopy closure—the percentage of ground or water covered by shade from the outermost perimeter or natural spread of foliage from plants

cascade—a highly turbulent series of short falls and small scour basins, with very rapid water movement as it passes over a steep channel bottom with gradients exceeding 8%

cathode—the negative electrode

chute—a narrow, confined channel through which water flows rapidly and smoothly; chutes are a class of runs

conductivity—a measure of the ability of an aqueous solution to carry an electric current

criteria—either a narrative or numerical statement of water quality on which to base judgement of suitability for beneficial use

dammed pool—impoundment upstream of a complete or nearly complete channel blockage

density—mass per unit volume

designated use—a beneficial use listed for a water body or water bodies in a state's water quality regulations

discharge—commonly referred to as flow; expressed as volume of fluid per unit time (e.g. cubic feet per second) passing a particular point in a river or channel or from a pipe

eddy—a pool on the margin or off the main channel of a stream that is formed and maintained by strong currents

electrofishing—use of electricity to provide a sufficient electrical stimulus in fish to permit easy capture by netting

existing use—a beneficial use actually attained in a water body on or after November 28, 1975

Escherichia coli—often referred to simply as *E. coli*; found in the normal intestinal flora of warm-blooded animals. It is pathogenic and its presence in water indicates that the water has been in contact with or contaminated by fecal material.

floodplain—land beyond a stream channel that forms the perimeter for the maximum probability flood

fluvial—pertaining to or living in streams or rivers, or produced by the action of flowing water

formalin—a 37% by weight aqueous solution of formaldehyde with some methanol

glide—a portion of the stream with slow-moving, relatively shallow water. The water surface has little or no turbulence, and the stream bottom is flat or slightly convex in shape, lacking the scour associated with the pool.

grab sample—a single sample collected at a particular time and place

habitat—the place where a population lives, and its living and nonliving surroundings

high-gradient riffle—a collective term for rapids and cascades

hydrologic unit code (HUC)—a watershed numbering system developed by the US Geological Survey and usually associated with a 4th-order hydrologic unit, or subbasin

integrity—the extent to which all parts or elements of a system (e.g., aquatic ecosystem) are present and functioning

laminar flow—uniform streamflow with no mixing or turbulence

low-gradient riffle—shallow reaches with swiftly flowing turbulent water with some partially exposed substrate, usually cobble or gravel

macroinvertebrate—an invertebrate (without backbone) large enough to be seen without magnification and retained by a 0.5 mm screen

monitoring—checking or measuring water quality (chemical, physical, or biological) for a specific purpose, such as attainment of beneficial uses

nonpoint source—referring to pollution originating over a wide geographical area, not discharged from one specific location

organic—materials resulting from vegetative growth, decay, and accumulation in closed basins or on gentle slopes where the rate of accumulation exceeds that of decay

organism—any living thing composed of one or more cells

periphyton—a term for benthic algae, which is commonly used to refer to all of the microflora on substrata

plunge pool—a pool created by water passing over or through a complete or nearly complete channel obstruction and dropping steeply into the streambed below, scouring out a basin in the stream substrate where the flow radiates from the point of water entry

point source—any discernable, confined, or discrete conveyance of pollutant, such as a pipe, ditch, or conduit

pollution—any alteration in the character or quality of the environment due to human activity that makes it unfit or less suited for beneficial uses

pool—an aquatic habitat in a stream with a gradient less than 1% that is normally deeper and wider than aquatic habitats immediately above and below it

protocol—a collection of methods

quality assurance (QA)—a program organized and designed to provide accurate and precise results. Examples include selection of proper technical methods, evaluation of data, quality control, and training of personnel. The goal of QA is to ensure the data provided are of the quality needed and claimed.

quality control (QC)—routine application of specific actions providing information for the quality assurance program, such as standardization, calibration, and replication

rapids—a moderately steep stream area with supercritical flow between 15 and 50%, rapid and turbulent water movement, surface with intermittent whitewater with breaking waves, coarse substrate, exposed boulders at low flows, and a somewhat planar longitudinal profile

reach—a relatively homogeneous stretch of a stream having a repetitious sequence of physical characteristics and habitat types; any specified length of a stream

reconnaissance—an exploratory or preliminary survey of an area

representativeness—the measure of the degree to which data accurately and precisely represent a characteristic of a population or environmental condition

least impacted (reference) conditions—conditions that fully support applicable beneficial uses, with little impact from human activity and representing the highest level of support attainable

riparian zone—natural home for plants and animals occurring in a thin strip of land bordering a stream or river; dominant vegetation often consists of phreatophytes

riffle—a shallow reach with low subcritical flow in alluvial channels of finer particles that are unstable; characterized by small hydraulic jumps over rough bed material, causing small ripples, waves, and eddies, without breaking the surface tension

river—the larger of BURP's two size designations for flowing water

run—a portion of the stream with swiftly flowing, relatively deep water, which approximates uniform flow with no major flow obstructions and little or no surface turbulence

sample—a set of units or elements selected from a larger population, typically to be observed for making inferences regarding that population

sediment—fine fragmented materials from weathered rocks and organic material that are suspended in, transported by, and eventually deposited by water or air

sinuosity—the ratio of channel length between two points in a channel to the straight line distance between the same two points. Channels with sinuosities of 1.5 or more are called "meandering," while those close to 1.0 are called "straight."

stratification—the arrangement of water masses into distinct, horizontal layers that are separated by differences in density associated with water temperature and dissolved or suspended matter

stream—a natural water course containing flowing water, at least part of the year, together with dissolved and suspended materials that normally support communities of plants and animals within the channel and the riparian vegetation zone; the smaller of BURP's two size designations for flowing water

stream order—hierarchical ordering of streams based upon the degree of branching. By the Strahler (1957) method, a first-order stream is an unforked or unbranching stream. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, etc.

streambank—ground bordering a channel above the streambed and below the level of rooted vegetation that often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom

streambed—substrate plane, bounded by banks, of a stream bottom

stream channel—a long, narrow depression shaped by the concentrated flow of a stream and covered continuously or periodically by water. Also, bed and banks formed by fluvial processes where a natural stream of water runs continually or intermittently.

stream classification—systems used to group or identify streams possessing similar features using geomorphic structure, water source, associated biota, or other characteristics

streamflow—flow of water, generally with its suspended load, in a well-defined channel or water course

substrate—mineral and organic material forming the bottom of a waterway or water body

surface water—the collection of all natural bodies of water, including but not limited to streams, lakes, and wetlands, evident on the surface of the land

targeted survey—the use of best professional judgment to choose sampling locations

thalweg—a line joining the deepest points along successive cross-sections of a river channel

turbidity—the reduction of transparency in water due to the presence of suspended particles

turbulence—streamflows in which the velocity at a given point varies erratically in magnitude and direction and disrupts reaches with laminar flow

water body—a specific body of water or geographically delimited portion thereof

water quality—a term for the combined chemical, physical, and biological characteristics of water, which affect its suitability for beneficial use

wastewater—treated or untreated sewage, industrial waste, or agricultural waste and associated solids

watershed—region or area drained by surface and ground water flow in rivers, streams, or other surface channels; also, the divide between two catchment (drainage) areas

wetted width—the width of a water surface measured perpendicular to the direction of flow at a specific discharge

width:depth ratio (W/D)—an index of the cross section shape of a stream channel at bankfull level

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Appendix A. Sample Invitation Letter to an Aquatic Monitoring Coordination Meeting

To Whom It May Concern:

The Idaho Department of Environmental Quality invites you to attend the 2002 Interagency Monitoring Coordination Workshop. This once-a-year opportunity will allow you to network, exchange ideas, coordinate monitoring, and become aware of the aquatic activities and/or monitoring proposed for this year in your areas of interest. Topics will revolve around aquatic monitoring and restoration activities. Meeting attendees include representatives from private, local, state, and federal entities.

If you plan to attend, please be prepared to give a brief overview of your aquatic monitoring/restoration activities this year and information detailing specific monitoring activities and locations. If you do not plan to attend, please send information indicating the type of monitoring you will be doing this year, location of this monitoring, and a contact name. In addition, please review the attached mailing list and provide me with any other pertinent contact names. We wish to ensure this group is aware of all monitoring occurring within the basin. If you have any summaries from last year's efforts, please bring them as well.

Attached is a proposed agenda for the meeting and mailing list. It is flexible so we can add more presenters if necessary. This year's meeting will be held on (insert your date) at the DEQ Office, (insert your location). We will begin promptly at (insert the starting and ending times of the meeting). If you have any questions or suggestions, please contact me.

Sincerely,

(Name)

Beneficial Use Reconnaissance Program Coordinator

DEQ (Address)

Phone: (208) (Phone Number)

E-mail: (e-mail address)

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Appendix B. Informative Flyer About BURP Monitoring Activities

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Idaho is well-recognized for its scenic streams, rivers, and lakes and abundant water recreation opportunities that attract visitors from around the globe. To ensure that Idaho's water bodies remain clean and available for swimming, fishing, and domestic water supply, continuous monitoring and evaluation are needed.

The Idaho Department of Environmental Quality (DEQ) is responsible for providing consistent water body monitoring and assessment. Through the Beneficial Use Reconnaissance Program, or BURP, DEQ gathers reliable data on the biology, chemistry, and habitat conditions of Idaho's water bodies.

Read this brochure to learn how BURP helps maintain the quality of Idaho's streams, rivers, and lakes.

For More Information

Idaho Department of Environmental Quality

State Office
Water Quality Division
1410 N. Hilton
Boise, ID 83706
(208) 373-0487

Regional Offices

Boise
1445 N. Orchard
Boise, ID 83706
(208) 373-0550
toll-free: (888) 800-3480

Lewiston
1118 F Street
Lewiston, ID 83501
(208) 799-4370
toll-free: (877) 541-3304

Coeur d'Alene
2110 Ironwood Parkway
Coeur d'Alene, ID 83814
(208) 769-1422
toll-free: (877) 370-0017

Pocatello
444 Hospital Way #300
Pocatello, ID 83201
(208) 236-6160
toll-free: (888) 655-6160

Idaho Falls
900 N. Skyline, Suite B
Idaho Falls, ID 83402
(208) 528-2650
toll-free: (800) 232-4635

Twin Falls
1363 Fillmore Street
Twin Falls, ID 83301
(208) 736-2190
toll-free: (800) 270-1663

DEQ BURP Webpage: *www.deq.idaho.gov/burp*

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Water in Idaho

Idaho's Beneficial Use Reconnaissance Program

Working to maintain the quality of our streams, rivers, and lakes

Idaho Department of Environmental Quality
www.deq.idaho.gov

What is BURP?

The Beneficial Use Reconnaissance Program, known as BURP, is a cost-effective, efficient monitoring survey of Idaho's streams and lakes. The purpose of the program is to collect and measure key water quality parameters to aid DEQ in determining whether a water body is supporting its beneficial uses.

> ***A beneficial use is any of the various uses of water including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics.***

The federal Clean Water Act requires states to develop standards to protect water bodies based on their beneficial uses. For example, if a river is designated to support salmonid spawning, then standards are applied to ensure that the water quality is suitable for salmonid reproduction. In Idaho, beneficial use designations are required for aquatic life and recreation.

How BURP Data Are Collected

Each summer, DEQ technicians follow standardized procedures to:

- collect *algae* and *aquatic insects*
- conduct *fish* surveys and
- document *habitat* conditions from streams, rivers, and lakes.

BURP surveys are performed during the same low-flow time period each year—July 1 to September 15—so the information is comparable from one year to the next.

Why monitor aquatic life?

The BURP procedure calls for the collection and analysis of aquatic insects and fish as "biological indicators." Biological indicators are used because they are very sensitive to changes in water quality, so their presence, abundance, and health serve as indicators of the overall quality of a water body. Generally, unpolluted waters support a greater variety of aquatic insects and fish than polluted waters.

Where BURP Surveys Are Conducted

To ensure assessments can be applied to longer stream reaches or entire streams, monitoring sites must be representative. DEQ uses standard selection steps to identify potential sites.

BURP surveys are conducted on both public and private lands. DEQ's ability to enter private property is at the discretion of the property owner. If a private property is identified as a desirable monitoring location, DEQ always requests permission from the property owner before conducting any sampling. In addition, DEQ assures the landowner that monitoring will not damage the property or resources.

How DEQ Ensures Quality

Data gathered from BURP monitoring are the basis for many surface water quality decisions made by DEQ. The quality of data is ensured by providing centralized training for crews, using a standardized manual, following annual work plans, conducting annual field reviews, and following a quality assurance plan.

How BURP Data Are Used

The BURP data are evaluated to determine if the water body is supporting its designated beneficial uses.

If a water body is found to be not supporting beneficial uses, a water quality improvement plan, known as a total maximum daily load (TMDL), is developed. If a water body is found to be supporting beneficial uses, it may be monitored again in the future to ensure it continues to do so.

Appendix C. Field Equipment Checklist

MACROINVERTEBRATE SAMPLING EQUIPMENT	Yes	No
Hess and Surber samplers (500 µm mesh with 300 mL bucket)		
White pans		
Macro sample containers		
Preservative (95% ethanol)		
Spare nets for samplers		
Rebar stake		
Scrub brush		
Wash bottles for rinsing (water and alcohol)		
Field labels		
Field computer and field data forms		
Rubber gloves		
Pencils/indelible alcohol-proof markers		
PERIPHYTON SAMPLING EQUIPMENT	**Yes**	**No**
Periphyton sampler		
Periphyton brush		
Pipette/eye dropper		
10% buffered formalin solution and dropper		
Labels		
WOLMAN PEBBLE COUNT EQUIPMENT	**Yes**	**No**
Metric ruler (clear plastic) or other appropriate measuring device		
ELECTROFISHING EQUIPMENT	**Yes**	**No**
Collection permits or IDFG personnel		
Electrofisher		
Anode and cathode		
Dip nets		

Waders (nonbreathable, nonconductive material)		
Rubber gloves		
Specific conductivity meter		
Preservative: 10% buffered formalin solution		
Thermometer		
Small aquarium nets		
Anesthetic		
Buckets		
Specimen vouchering containers		
Fish measuring board		
Fish identification keys		
Fish voucher tags and labels		
Field data sheets		
First-aid kit		
Polarized sunglasses		
FLOW MEASUREMENT EQUIPMENT	**Yes**	**No**
Current velocity meter		
Top-set wading rod		
Measuring tape graduated in 0.1-ft units		
Rebar stakes		
Extra batteries for current meter		
BACTERIA SAMPLING EQUIPMENT	**Yes**	**No**
Bacteria check sheet		
Sterilized bacteria sample bottles		
Cooler with ice		
MISCELLANEOUS EQUIPMENT	**Yes**	**No**
First-aid kit		
Sunscreen		
Emergency equipment for vehicle		

GPS receiver		
Tool kit		
Clinometer		
Densiometer		
2-meter rod		
Tape measures		
Random number table		
Field notebook/clipboards/tatum		
Maps		
All forms and labels		
Camera and memory card		
Extra batteries		
Current BURP field manual and work plan		
Pens/pencils		
Duct tape		
Bug spray		
Flagging/ribbon		

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Appendix D. Safety Data Sheets (SDS)

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Univar USA Inc Safety Data Sheet

SDS No:	
Version No:	004 2014-04-17
Order No:	

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

UNIVAR USA INC.
ISSUE DATE:2011-10-16
Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: VANZOL A-1 200 AND 190 PROOF

DATE: 10/06/11
PAGE: 1 OF 8

SAFETY DATA SHEET

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System.
THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)
IMPORTANT: Read this SDS before handling & disposing of this product.
Pass this information on to employees, customers, & users of this product.

SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

PRODUCT IDENTITY: VANZOL A-1 200 AND 190 PROOF
SDS NUMBER: CDS1199
REVISION DATE: 10/06/2011 SUPERCEDES: 12/01/2008
COMPANY IDENTITY: Univar
COMPANY ADDRESS: 17425 NE Union Hill Road
COMPANY CITY: Redmond, WA 98052
COMPANY PHONE: 1-425-889-3400
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)
CANUTEC: 1-613-996-6666 (CANADA)

SECTION 2. HAZARDS IDENTIFICATION

DANGER!!

EXPOSURE PREVENTION: PREVENT DISPERSION OF MISTS OR DUST!
AVOID EXPOSURE OF ADOLESCENTS, CHILDREN!

RISK STATEMENTS:

R36/37/38	Irritating to eyes, respiratory system and skin.
R39/23/24/25	Toxic: Danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R11	Highly Flammable.
R20	Harmful by inhalation.
R41	Risk of serious damage to eyes.
R66	Repeated exposure may cause skin dryness or cracking.
R67	Vapors may cause drowsiness and dizziness.

SAFETY STATEMENTS:

S7/9	Keep container tightly closed and in a well-ventilated place.
S24/25	Avoid contact with skin and eyes.
S16	Keep away from sources of ignition. No smoking.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S29	Do not empty into drains.
S45	In case of accident, or if you feel unwell, seek medical advice immediately. (Show the label where possible).

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

MATERIAL	CAS#	EINECS#	WT %
Ethanol	64-17-5	200-578-6	75-85
Isopropanol	67-63-0	200-661-7	0-10
Methanol	67-56-1	200-659-6	0- 5
Water	7732-18-5	231-791-2	0- 5
Methyl Isobutyl Ketone	108-10-1	203-550-1	0- 5

Trace components: Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, reproductive toxins, respiratory tract mutagens, and sensitizers). None of the trace ingredients contribute significant additional hazards at the concentrations present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents, and Canadian Hazardous Materials Identification System Standard (CPR 4).

SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.

UNIVAR USA INC.
ISSUE DATE:2011-10-16
Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

SECTION 4. FIRST AID MEASURES

EYE CONTACT:
If this product enters the eyes, open eyes while under gently running water. Use sufficient force to open eyelids. "Roll" eyes to expose more surface. Minimum flushing is for 15 minutes. Seek immediate medical attention.

SKIN CONTACT:
If the product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove contaminated clothing, taking care not to contaminate eyes. If skin becomes irritated and irritation persists, medical attention may be necessary. Wash contaminated clothing before reuse, discard contaminated shoes.

INHALATION:
After high vapor exposure, remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR). Seek immediate medical attention.

SWALLOWING:
If swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, give two glasses of water to drink. DO NOT INDUCE VOMITING. Never induce vomiting or give liquids to someone who is unconscious, having convulsions, or unable to swallow. Seek immediate medical attention.

NOTES TO PHYSICIAN:
There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Any material aspirated during vomiting may cause lung injury. Therefore, emesis should not be induced mechanically or pharmacologically. If it is considered necessary to evacuate the stomach contents, this should be done by means least likely to cause aspiration (such as: Gastric lavage after endotracheal intubation).

SECTION 5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION PREVENTIVE MEASURES
NO open flames, NO sparks, & NO smoking. NO contact with oxidants.
Above flash point, use a closed system, ventilation,
explosion-proof electrical equipment, lighting.
Do NOT use compressed air for filling, discharging, or handling.

EXTINGUISHING MEDIA
Use dry powder, AFFF, alcohol-resistant foam, water in large amounts,
carbon dioxide.

SPECIAL FIRE FIGHTING PROCEDURES
Water spray may be ineffective on fire but can protect fire-fighters
& cool closed containers. Use fog nozzles if water is used.
Do not enter confined fire-space without full bunker gear.
(Helmet with face shield, bunker coats, gloves & rubber boots).
Use NIOSH approved positive-pressure self-contained breathing apparatus.

UNUSUAL EXPLOSION AND FIRE PROCEDURES
HIGHLY FLAMMABLE!! VAPORS CAN CAUSE FLASH FIRE
Isolate from oxidizers, heat, sparks, electric equipment & open flame.
Closed containers may explode if exposed to extreme heat.
Applying to hot surfaces requires special precautions.
Empty container very hazardous! Continue all label precautions!

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Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

COMPANY IDENTITY: Univar DATE: 10/06/11
PRODUCT IDENTITY: VANZOL A-1 200 AND 190 PROOF PAGE: 3 OF 8

SECTION 6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE AND ENVIRONMENTAL PRECAUTIONS:
Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel.

PERSONAL PROTECTIVE EQUIPMENT
The proper personal protective equipment for incidental releases (such as: 1 Liter of the product released in a well-ventilated area), use impermeable gloves (triple-gloves (rubber gloves and nitrile gloves, over latex gloves), goggles, face shield, and appropriate body protection. In the event of a large release, use impermeable gloves, specific for the material handled, chemically resistant suit and boots, and hard hat. Self-Contained Breathing Apparatus or respirator may be required where engineering controls are not adequate or conditions for potential exposure exist. When respirators are required, select NIOSH/MSHA approved based on actual or potential airborne concentrations in accordance with latest OSHA and/or ANSI recommendations.

ENVIRONMENTAL PRECAUTIONS:
Stop spill at source. Construct temporary dikes of dirt, sand, or any appropriate readily available material to prevent spreading of the material. Close or cap valves and/or block or plug hole in leaking container and transfer to another container. Keep from entering storm sewers and ditches which lead to waterways, and if necessary, call the local fire or police department for immediate emergency assistance.

CONTAINMENT AND CLEAN-UP MEASURES:
Absorb spilled liquid with polypads or other suitable absorbent materials. If necessary, neutralize using suitable buffering material, (acid with soda ash or base with phosphoric acid), and test area with litmus paper to confirm neutralization. Clean up with non-combustible absorbent (such as: sand, soil, and so on). Shovel up and place all spill residue in suitable containers. dispose of at an appropriate waste disposal facility according to current applicable laws and regulations and product characteristics at time of disposal (see Section 13 - Disposal Considerations).

SECTION 7. HANDLING AND STORAGE

HANDLING
Isolate from oxidizers, heat, sparks, electric equipment & open flame.
Use only with adequate ventilation. Avoid breathing of vapor or spray mist.
Avoid contact with skin & eyes.
Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse.
Avoid free fall of liquid. Ground containers when transferring. Do not flame cut, saw, drill, braze, or weld. Empty container very hazardous! Continue all label precautions!
To minimize static discharge when transferring, ensure electrical continuity by bonding and grounding all equipment. Use an inlet line diameter of at least 3.5 inches (8.9 centimeters) with a maximum flow rate of 1 meter/second.

STORAGE
Keep in fireproof surroundings. Keep separated from strong oxidants, food & feedstuffs. Keep cool. Do not store above 49 C/120 F.
Keep container tightly closed & upright when not in use to prevent leakage.

NONBULK: CONTAINERS:
Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Empty containers should be handled with care. Never store food, feed, or drinking water in containers which held this product.

BULK CONTAINERS:
All tanks and pipelines which contain this material must be labeled. Perform routine maintenance on tanks or pipelines which contain this product. Report all leaks immediately to the proper personnel.

UNIVAR USA INC.
ISSUE DATE:2011-10-16
Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: VANZOL A-1 200 AND 190 PROOF

DATE: 10/06/11
PAGE: 4 OF 8

SECTION 7. HANDLING AND STORAGE (CONTINUED)

TANK CAR SHIPMENTS:
Tank cars carrying this product should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Engineering Controls and Personal Protective Equipment.). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level, brakes must be set or wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tanks (for unloading) must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:
Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Collect all rinsates and dispose of according to applicable Federal, State, Provincial, or local procedures.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Ethanol	64-17-5	200-578-6	1000 ppm	1000 ppm A4
Isopropanol	67-63-0	200-661-7	400 ppm	200 ppm A4
Methanol	67-56-1	200-659-6	200 ppm S	200 ppm S
Water	7732-18-5	231-791-2	None Known	None Known
Methyl Isobutyl Ketone	108-10-1	203-550-1	100 ppm	20 ppm

MATERIAL	CAS#	EINECS#	CEILING	STEL(OSHA/ACGIH)	HAP
Isopropanol	67-63-0	200-661-7	None Known	400 ppm	No
Methanol	67-56-1	200-659-6	None Known	250 ppm	Yes
Methyl Isobutyl Ketone	108-10-1	203-550-1	None Known	75 ppm	Yes

Each component showing `Yes' under "HAP" is an EPA Hazardous Air Pollutant.

RESPIRATORY EXPOSURE CONTROLS
Maintain airborne contaminant concentrations below exposure limits given above. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, European Standard EN 149, or applicable State regulations. If adequate ventilation is not available or there is potential for airborne exposure above the exposure limits, a respirator may be worn up to the respirator exposure limitations, check with respirator equipment manufacturer's recommendations/limitations. For a higher level of protection, use positive pressure supplied air respiration protection or Self-Contained Breathing Apparatus or if oxygen levels are below 19.5% or are unknown.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS
Positive pressure, full-face piece Self-Contained Breathing Apparatus; or positive pressure, full-face piece Self-Contained Breathing Apparatus with an auxilliary positive pressure Self-Contained Breathing Apparatus.

VENTILATION
LOCAL EXHAUST: Necessary MECHANICAL (GENERAL): Necessary
SPECIAL: None OTHER: None
Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

EYE PROTECTION:
Splash goggles or safety glasses. Face-shields are recommended when the operation can generate splashes, sprays or mists.

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VERSION:004 2014-04-17

COMPANY IDENTITY: Univar
PRODUCT IDENTITY: VANZOL A-1 200 AND 190 PROOF

DATE: 10/06/11
PAGE: 5 OF 8

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION (CONTINUED)

HAND PROTECTION:
Wear appropriate impervious gloves for routine industrial use. Use impervious gloves for spill response, as stated in Section 6 of this SDS (Accidental Release Measures).
NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

BODY PROTECTION:
Use body protection appropriate for task. Cover-all, rubber aprons, or chemical protective clothing made from impervious materials are generally acceptable, depending on the task.

WORK & HYGIENIC PRACTICES:
Provide readily accessible eye wash stations & safety showers. Wash at end of each shift & before eating, smoking or using the toilet. Remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

SECTION 9. PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE:	Liquid, Water-White
ODOR:	Ketone
ODOR THRESHOLD:	Not Available
pH (Neutrality):	9.696
MELTING POINT/FREEZING POINT:	Not Available
BOILING RANGE (IBP,50%,Dry Point):	63 77 100 C / 147 171 212 F
FLASH POINT (TEST METHOD):	4 C / 40 F (TCC)
EVAPORATION RATE (n-BUTYL ACETATE=1):	1.3
FLAMMABILITY CLASSIFICATION:	Class I B
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	1.4 (Lowest Component)
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Available
VAPOR PRESSURE (mm of Hg)@20 C	45.1
VAPOR DENSITY (air=1):	1.5
GRAVITY @ 68/68 F / 20/20 C:	
SPECIFIC GRAVITY (Water=1):	0.798
POUNDS/GALLON:	6.647
WATER SOLUBILITY:	Complete
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	398 C / 750 F
DECOMPOSITION TEMPERATURE:	Not Available
VOC'S (>0.44 Lbs/Sq In) :	97.6 Vol% / 778.5 g/L / 6.4 Lbs/Gal
TOTAL VOC'S (TVOC)*:	98.0 Vol% / 778.5 g/L / 6.4 Lbs/Gal
NONEXEMPT VOC'S (CVOC)*:	98.0 Vol% / 778.5 g/L / 6.4 Lbs/Gal
HAZARDOUS AIR POLLUTANTS (HAPS):	5.7 Wt% / 45.5 g/L / .3 Lbs/Gal
NONEXEMPT VOC PARTIAL PRESSURE (mm of Hg @ 20 C)	44.0

* Using California South Coast Air Quality Management District (SCAQMD) Rule 443.1.

SECTION 10. STABILITY & REACTIVITY

STABILITY
Stable under normal conditions.

CONDITIONS TO AVOID
Isolate from oxidizers, heat, sparks, electric equipment & open flame.

MATERIALS TO AVOID
The substance can presumably form explosive peroxides, under the influence of light and air. Check for peroxide prior to distillation, eliminate if found.
Reacts violently with strong oxidants, strong reducing agents, causing fire & explosion hazard. Attacks

UNIVAR USA INC.
ISSUE DATE:2011-10-16
Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

SECTION 10. STABILITY & REACTIVITY (CONTINUED)

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon Monoxide, Carbon Dioxide from burning.

HAZARDOUS POLYMERIZATION
Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE HAZARDS

EYE & SKIN CONTACT:
Primary irritation to skin, defatting, dermatitis.
Primary irritation to eyes, redness, tearing, blurred vision.
Liquid can cause eye irritation. Wash thoroughly after handling.

INHALATION:
Anesthetic. Irritates respiratory tract. Acute overexposure can cause serious nervous system depression. Vapor harmful.
Breathing vapor can cause irritation.
Acute overexposure can cause harm to kidneys, blood, nerves, liver, lungs.
Repeated exposure over TLV can cause blindness.

SWALLOWING:
Can be fatal or cause blindness if swallowed. Cannot be made non-poisonous.
POISON ! Can cause irreversible nervous system damage & death.
Harmful or fatal if swallowed.
Swallowing can cause abdominal irritation, nausea, vomiting & diarrhea.

SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED

MEDICAL CONDITION AGGRAVATED BY EXPOSURE:
Skin and respiratory conditions can be aggravated by over-exposure to this product.

CHRONIC HAZARDS

CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:
This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%.
Absorption thru skin may be harmful. Studies with laboratory animals indicate this product can cause damage to fetus.
Depending on degree of exposure, periodic medical examination is indicated.

IRRITANCY OF PRODUCT: This product is irritating to contaminated tissue.

SENSITIZATION TO THE PRODUCT: No component of this product is known to be a sensitizer.

MUTAGENICITY: This product is not reported to produce mutagenic effects in humans.

EMBRYOTOXICITY: This product is not reported to produce embryotoxic effects in humans.

TERATOGENICITY: This product is not reported to produce teratogenic effects in humans.

REPRODUCTIVE TOXICITY: This product is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (such as: within the eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

UNIVAR USA INC.
ISSUE DATE:2011-10-16
Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

SECTION 11. TOXICOLOGICAL INFORMATION (CONTINUED)

MAMMALIAN TOXICITY INFORMATION

MATERIAL	CAS#	EINECS#	LOWEST KNOWN LETHAL DOSE DATA
Methanol	67-56-1	200-659-6	LOWEST KNOWN LD50 (ORAL) 1000.0 mg/kg(Man)
Isopropanol	67-63-0	200-661-7	LOWEST KNOWN LC50 (VAPORS) 1600 ppm (Rats)
Isopropanol	67-63-0	200-661-7	LOWEST KNOWN LD50 (SKIN) 16400.0 mg/kg (Rabbits)

SECTION 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

EFFECT OF MATERIAL ON PLANTS OR ANIMALS:
This product may be harmful or fatal to plant and animal life if released into the environment. Refer to Section 11 (Toxicological Information) for further data on the effects of this product's components on test animals.

EFFECT OF MATERIAL ON AQUATIC LIFE:
The most sensitive known aquatic group to any component of this product is:
Goldfish 250 ppm or mg/L (24 hour exposure).
Keep out of sewers and natural water supplies.

MOBILITY IN SOIL
This material is a mobile liquid.

DEGRADABILITY
This product is completely biodegradable.

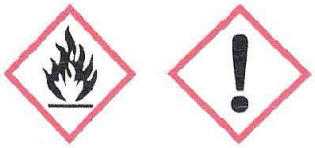
ACCUMULATION
This product does not accumulate or biomagnify in the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

Processing, use or contamination may change the waste management options. Recycle / dispose of observing national, regional, state, provincial and local health, safety & pollution laws. If in doubt, contact appropriate agencies.

SECTION 14. TRANSPORT INFORMATION

DOT SHIPPING NAME: UN1170, Ethanol solutions, 3, PG-II
DRUM LABEL: (FLAMMABLE LIQUID)
IATA / ICAO: UN1170, Ethanol solutions, 3, PG-II.
IMO / IMDG: UN1170, Ethanol solutions, 3, PG-II
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 127



SECTION 15. REGULATORY INFORMATION

EPA REGULATION:
SARA SECTION 311/312 HAZARDS: Acute Health, Fire

All components of this product are on the TSCA list.
SARA Title III Section 313 Supplier Notification
This product contains the indicated <*> toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning & Community Right-To-Know Act of 1986 & of 40 CFR 372. This information must be included in all MSDSs that are copied and distributed for this material.

SARA TITLE III INGREDIENTS	CAS#	EINECS#	WT%	(REG.SECTION)	RQ(LBS)
*Methanol	67-56-1	200-659-6	0- 5	(311,312,313,RCRA)	5000
*Methyl Isobutyl Ketone	108-10-1	203-550-1	0- 5	(311,312,313,RCRA)	5000

UNIVAR USA INC.
ISSUE DATE:2011-10-16
Annotation:

SDS NO:CDS1199
VERSION:004 2014-04-17

SECTION 15. REGULATORY INFORMATION (CONTINUED)

STATE REGULATIONS:
THIS PRODUCT MEETS REQUIREMENTS OF SOUTHERN
CALIFORNIA AQMD RULE 443.1 & SIMILAR REGULATIONS

CALIFORNIA PROPOSITION 65: This product contains no chemicals
known to the State of California to cause cancer & reproductive toxicity.

INTERNATIONAL REGULATIONS
The components of this product are listed on the chemical inventories of the
following countries:
Australia (AICS), Canada (DSL, NDSL), China (IECSC), Europe (EINECS, ELINCS),
Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC),
Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)
B2: Flammable Liquid.
D2B: Irritating to skin / eyes.

SECTION 16. OTHER INFORMATION

HAZARD RATINGS:
HEALTH (NFPA): 1, HEALTH (HMIS): 3, FLAMMABILITY: 3, REACTIVITY: 0
(Personal Protection Rating to be supplied by user based on use conditions.)
This information is intended solely for the use of individuals
trained in the NFPA & HMIS hazard rating systems.

EMPLOYEE TRAINING
See Section 2 for Risk & Safety Statements. Employees should be made aware
of all hazards of this material (as stated in this SDS) before handling it.

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this SDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

SDS for Formalin

Fisher Scientific

Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Creation Date 12-May-2011 **Revision Date** 24-Mar-2015 **Revision Number** 3

1. Identification

Product Name	**Formalin, Buffered, 10% (Phosphate Buffer/Certified)**
Cat No. :	**SF100-4; SF100-20; SF100-200**
Synonyms	None.
Recommended Use	Laboratory chemicals.
Uses advised against	No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 4
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 1
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 1
Target Organs - Respiratory system, Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Combustible liquid
Causes skin irritation
Causes serious eye damage
May cause an allergic skin reaction
Suspected of causing genetic defects

Page 1 / 9

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

May cause cancer
May cause respiratory irritation
May cause drowsiness or dizziness
Causes damage to organs
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves
Do not breathe dust/fume/gas/mist/vapors/spray
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep cool
Response
IF exposed: Call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
Fire
In case of fire: Use CO_2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

Other hazards
WARNING! This product contains a chemical known in the State of California to cause birth defects or other reproductive harm.
WARNING! This product contains a chemical known in the State of California to cause cancer.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Water	7732-18-5	91.9 - 92.9
Formaldehyde	50-00-0	4.0
Methyl alcohol	67-56-1	1.0 - 2.0
Sodium phosphate dibasic	7558-79-4	0.65
Phosphoric acid, monosodium salt, monohydrate	10049-21-5	0.4

4. First-aid measures

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

General Advice	Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms/effects	May cause allergic skin reaction. Breathing difficulties. . Causes eye burns. Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	81 °C / 177.8 °F
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Combustible material. Risk of ignition. Containers may explode when heated. Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	2	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Evacuate personnel to safe areas. Remove all sources of ignition. Take precautionary measures against static discharges. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Remove all sources of ignition. Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not breathe vapors or spray mist. Do not ingest. Keep

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

away from open flames, hot surfaces and sources of ignition.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Formaldehyde	Ceiling: 0.3 ppm	(Vacated) TWA: 3 ppm (Vacated) STEL: 10 ppm (Vacated) Ceiling: 5 ppm TWA: 0.75 ppm STEL: 2 ppm	IDLH: 20 ppm TWA: 0.016 ppm Ceiling: 0.1 ppm
Methyl alcohol	TWA: 200 ppm STEL: 250 ppm Skin	(Vacated) TWA: 200 ppm (Vacated) TWA: 260 mg/m^3 (Vacated) STEL: 250 ppm (Vacated) STEL: 325 mg/m^3 Skin TWA: 200 ppm TWA: 260 mg/m^3	IDLH: 6000 ppm TWA: 200 ppm TWA: 260 mg/m^3 STEL: 250 ppm STEL: 325 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Formaldehyde	Ceiling: 2 ppm Ceiling: 3 mg/m^3	Ceiling: 2 ppm Ceiling: 3 mg/m^3	STEL: 1.0 ppm CEV: 1.5 ppm
Methyl alcohol	TWA: 200 ppm TWA: 262 mg/m^3 STEL: 250 ppm STEL: 328 mg/m^3 Skin	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 250 ppm STEL: 310 mg/m^3	TWA: 200 ppm STEL: 250 ppm Skin

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear
Odor	pungent
Odor Threshold	No information available
pH	6.9 - 7.1
Melting Point/Range	0 °C / 32 °F
Boiling Point/Range	93.9 - 100 °C / 201 - 212 °F
Flash Point	81 °C / 177.8 °F
Evaporation Rate	> 1.0
Flammability (solid,gas)	Not applicable

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	1.0
Relative Density	1.10
Solubility	miscible
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Dermal LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Vapor LC50	Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Formaldehyde	500 mg/kg (Rat)	270 mg/kg (Rabbit)	0.578 mg/L (Rat) 4 h
Methyl alcohol	6200 mg/kg (Rat)	15800 mg/kg (Rabbit)	64000 ppm (Rat) 4 h 83.2 mg/L (Rat) 4 h
Sodium phosphate dibasic	17 g/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Severe eye irritant; Irritating to skin

Sensitization May cause sensitization by skin contact

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed
Formaldehyde	50-00-0	Group 1	Known	A2	X	A2
Methyl alcohol	67-56-1	Not listed	Not listed	Not listed	Not listed	Not listed
Sodium phosphate dibasic	7558-79-4	Not listed	Not listed	Not listed	Not listed	Not listed
Phosphoric acid, monosodium salt, monohydrate	10049-21-5	Not listed	Not listed	Not listed	Not listed	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

NTP: (National Toxicity Program)	*NTP: (National Toxicity Program)* *Known - Known Carcinogen* *Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen*
ACGIH: (American Conference of Governmental Industrial Hygienists)	*A1 - Known Human Carcinogen* *A2 - Suspected Human Carcinogen* *A3 - Animal Carcinogen* *ACGIH: (American Conference of Governmental Industrial Hygienists)*
Mexico - Occupational Exposure Limits - Carcinogens	*Mexico - Occupational Exposure Limits - Carcinogens* *A1 - Confirmed Human Carcinogen* *A2 - Suspected Human Carcinogen* *A3 - Confirmed Animal Carcinogen* *A4 - Not Classifiable as a Human Carcinogen* *A5 - Not Suspected as a Human Carcinogen*

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Formaldehyde	Not listed	Leuciscus idus: LC50 = 15 mg/L 96h	Not listed	EC50 = 20 mg/L 96h EC50 = 2 mg/L 48h
Methyl alcohol	Not listed	Pimephales promelas: LC50 > 10000 mg/L 96h	EC50 = 39000 mg/L 25 min EC50 = 40000 mg/L 15 min EC50 = 43000 mg/L 5 min	EC50 > 10000 mg/L 24h

Persistence and Degradability Miscible with water Persistence is unlikely based on information available.
Bioaccumulation/ Accumulation No information available.

Mobility . Will likely be mobile in the environment due to its water solubility.

Component	log Pow
Formaldehyde	-0.35
Methyl alcohol	-0.74

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Formaldehyde - 50-00-0	U122	-
Methyl alcohol - 67-56-1	U154	-

14. Transport information

DOT Not regulated
TDG Not regulated

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	X
Formaldehyde	X	X	-	200-001-8	-		X	X	X	X	X
Methyl alcohol	X	X	-	200-659-6	-		X	X	X	X	X
Sodium phosphate dibasic	X	X	-	231-448-7	-		X	X	X	X	X
Phosphoric acid, monosodium salt, monohydrate	-	-	-	-	-		X	-	X	X	-

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Formaldehyde	50-00-0	4.0	0.1
Methyl alcohol	67-56-1	1.0 - 2.0	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	Yes
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Formaldehyde	X	100 lb	-	-
Sodium phosphate dibasic	X	5000 lb	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Formaldehyde	X		-
Methyl alcohol	X		-

OSHA Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Formaldehyde	2 ppm STEL	TQ: 1000 lb

Formalin, Buffered, 10% (Phosphate Buffer/Certified) **Revision Date** 24-Mar-2015

	0.5 ppm Action Level 0.75 ppm TWA	

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Formaldehyde	100 lb	100 lb
Methyl alcohol	5000 lb	-
Sodium phosphate dibasic	5000 lb	-

California Proposition 65 This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Formaldehyde	50-00-0	Carcinogen	40 µg/day	Carcinogen
Methyl alcohol	67-56-1	Developmental	-	Developmental

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Water	-	-	X	-	-
Formaldehyde	X	X	X	X	X
Methyl alcohol	X	X	X	X	X
Sodium phosphate dibasic	X	X	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Formaldehyde	11250 lb STQ (solution)

Other International Regulations

Mexico - Grade Moderate risk, Grade 2

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class B3 Combustible liquid
D2A Very toxic materials
D2B Toxic materials

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 12-May-2011
Revision Date 24-Mar-2015
Print Date 24-Mar-2015
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard

replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

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End of SDS

SDS for Virkon Aquatic

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Virkon® Aquatic
MSDS Number	:	130000124312
Product Use	:	Disinfectant, Cleaning agent
Manufacturer	:	DuPont 1007 Market Street Wilmington, DE 19898
Product Information	:	1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency	:	1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Potential Health Effects

Skin	:	Irritating to skin.
Eyes	:	Risk of serious damage to eyes.
Inhalation	:	Causes respiratory tract irritation. Harmful if inhaled and may cause delayed lung injury.
Ingestion	:	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
Target Organ	:	Eyes
Primary Routes of Entry	:	Eye contact, Skin contact

Carcinogenicity

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

1 / 9

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Potassium peroxymonosulfate	10058-23-8	21.41 %
Sulfamic acid	5329-14-6	4 - 6 %
Sodium chloride	7647-14-5	1.5 %

SECTION 4. FIRST AID MEASURES

Skin contact : In case of contact, immediately flush skin with plenty of water. Take off contaminated clothing and shoes immediately. Wash contaminated clothing before re-use. Consult a physician if necessary.

Eye contact : Rinse immediately with plenty of water and seek medical advice.

Inhalation : Move to fresh air. Consult a physician if necessary.

Ingestion : Call a poison control center or doctor for treatment advice. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Do not give anything by mouth to an unconscious person.

SECTION 5. FIREFIGHTING MEASURES

Flammable Properties
Flash point : does not flash

Suitable extinguishing media : Water spray, Dry powder, Alcohol-resistant foam

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

Unsuitable extinguishing media	:	Carbon dioxide (CO2)
Firefighting Instructions	:	Wear self-contained breathing apparatus (SCBA). Wear suitable protective equipment. Evacuate personnel to safe areas. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	:	Wear suitable protective equipment. Wear respiratory protection.
Spill Cleanup	:	Sweep up and shovel into suitable containers for disposal. Avoid dust formation. After cleaning, flush away traces with water.
Accidental Release Measures	:	Prevent material from entering sewers, waterways, or low areas. Dispose of in accordance with local regulations.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel)	:	Avoid contact with skin, eyes and clothing. Do not get on clothing. Wash off with plenty of water. Wash clothing after use. Do not breathe dust. Avoid dust formation in confined areas. For personal protection see section 8. When using do not eat, drink or smoke.
Storage	:	Keep out of the reach of children. Keep away from food, drink and animal feedingstuffs. Keep containers tightly closed in a dry, cool and well-ventilated place. Store in original container. Keep away from: Combustible material Stable under recommended storage conditions.

3 / 9

VIRKON - Aquatic - Disinfectant Cleaning agent-SDS - 06-2016_Page_4

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls	:	Provide local exhaust ventilation when handling material in bulk. Ensure adequate ventilation.
Personal protective equipment		
Respiratory protection	:	Provide adequate ventilation. Wear NIOSH approved respiratory protection as appropriate.
Hand protection	:	Material: Impervious gloves
Eye protection	:	Wear coverall chemical splash goggles and face shield when the possibility exists for eye and face contact due to splashing or spraying of material.
Skin and body protection	:	Where there is potential for skin contact, have available and wear as appropriate, impervious gloves, apron, pants, jacket, hood and boots.

Exposure Guidelines
Exposure Limit Values

Sulfamic acid			
AEL *	(DUPONT)	0.5 mg/m3	8 & 12 hr. TWA
AEL *	(DUPONT)	1.5 mg/m3	15 minute TWA
Dipotassium peroxodisulphate			
TLV	(ACGIH)	0.1 mg/m3	TWA as persulfate

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

4 / 9

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

Form	:	powder
Color	:	colourless
Odor	:	none
pH	:	2.4 - 2.7
Specific gravity	:	1.07
Water solubility	:	65 g/l at 20 °C (68 °F)

SECTION 10. STABILITY AND REACTIVITY

Conditions to avoid	:	Protect from moisture.
Incompatibility	:	Strong bases combustibles, Acids, oxidizers, Brass, Copper, Halogenated compounds, Cyanides, Heavy metal salts
Hazardous decomposition products	:	Sulphur dioxide , Chlorine

SECTION 11. TOXICOLOGICAL INFORMATION

Virkon® Aquatic

Inhalation 4 h LC50	:	3.7 mg/l , rat
Dermal LD50	:	2,200 mg/kg , rabbit
Oral LD50	:	4,123 mg/kg , rat
Skin irritation	:	Moderate skin irritation
Eye irritation	:	Risk of serious damage to eyes.
Sensitisation	:	Animal test did not cause sensitization by skin contact., guinea pig

Potassium peroxymonosulfate

Repeated dose toxicity	:	Inhalation rat Target Organs: Eyes Pathologic changes, Eyes, corneal damage, Information given is based on data obtained from similar substances. Oral - gavage

5 / 9

rat

Reduced body weight gain, Gastrointestinal effects, Information given is based on data obtained from similar substances.

Mutagenicity : Genetic damage in cultured mammalian cells was observed in some laboratory tests but not in others.
Did not cause genetic damage in animals.
Did not cause genetic damage in cultured bacterial cells.
Information given is based on data obtained from similar substances.

Teratogenicity : Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity.
Information given is based on data obtained from similar substances.

Sodium chloride

Repeated dose toxicity : Oral
rat

Due to its physical properties, there is no potential for adverse effects.

Carcinogenicity : Animal testing did not show any carcinogenic effects.

Mutagenicity : Tests on bacterial or mammalian cell cultures did not show mutagenic effects.

Reproductive toxicity : Due to its physical properties, there is no potential for adverse effects.

Teratogenicity : Animal testing showed no developmental toxicity.

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity

Potassium peroxymonosulfate

96 h LC50 : Oncorhynchus mykiss (rainbow trout) 53 mg/l
Information given is based on data obtained from similar substances.

72 h EC50 : Pseudokirchneriella subcapitata (green algae) 0.97 mg/l
Information given is based on data obtained from similar substances.

48 h EC50	:	Daphnia magna (Water flea) 3.5 mg/l Information given is based on data obtained from similar substances.
Sulfamic acid		
96 h LC50	:	Pimephales promelas (fathead minnow) 14.2 mg/l
Sodium chloride		
96 h LC50	:	Lepomis macrochirus (Bluegill sunfish) 5,840 mg/l
96 h LC50	:	Carassius auratus (goldfish) 7,341 mg/l
96 h LC50	:	Pimephales promelas (fathead minnow) 10,610 mg/l
96 h IC50	:	Lemna minor (duckweed) 6,870 mg/l
48 h EC50	:	Daphnia magna (Water flea) 874 mg/l
7 d	:	NOEC Pimephales promelas (fathead minnow) 4,000 mg/l
33 d	:	NOEC Pimephales promelas (fathead minnow) 252 mg/l
21 d	:	NOEC Daphnia magna (Water flea) 314 mg/l
7 d	:	NOEC Ceriodaphnia Dubia (water flea) 354 mg/l

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal : In accordance with local and national regulations. Do not flush into surface water or sanitary sewer system. Do not contaminate water, food or feed by disposal.

SECTION 14. TRANSPORT INFORMATION

Not classified as dangerous in the meaning of transport regulations.

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

SECTION 15. REGULATORY INFORMATION

TSCA	:	On the inventory, or in compliance with the inventory
SARA 313 Regulated Chemical(s)	:	SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
CERCLA Reportable Quantity	:	7,192 lbs Based on the percentage composition of this chemical in the product.: Sodium dodecylbenzenesulfonate
California Prop. 65	:	Chemicals known to the State of California to cause cancer, birth defects or any other harm: none known
PA Right to Know Regulated Chemical(s)	:	Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Sodium dodecylbenzenesulfonate , Dipotassium peroxodisulphate , Sodium sulphate
NJ Right to Know Regulated Chemical(s)	:	Substances on the New Jersey Workplace Hazardous Substance List present at a concentration of 1% or more (0.1% for substances identified as carcinogens, mutagens or teratogens): Sodium dodecylbenzenesulfonate , Sulphamidic acid , Dipotassium peroxodisulphate , Potassium hydrogensulphate

SECTION 16. OTHER INFORMATION

		HMIS
Health	:	3
Flammability	:	0
Reactivity/Physical hazard	:	0
PPE	:	Personal Protection rating to be supplied by user depending on use conditions.

8 / 9

Material Safety Data Sheet

Virkon® Aquatic

Version 2.0

Revision Date 03/14/2013 Ref. 130000124312

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Contact person : MSDS Coordinator, DuPont Chemicals and Fluoroproducts, Wilmington, DE 19898, (800) 441-7515

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Significant change from previous version is denoted with a double bar.

9 / 9

SDS for GS High Dilution Disinfectant 256

Safety Data Sheet
Spartan Chemical Company, Inc.

Revision Date: 14-Aug-2015

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name:	**GS HIGH DILUTION DISINFECTANT 256**
Product Number:	3508 , 3516
Recommended Use:	Disinfectant
Uses Advised Against:	For Industrial and Institutional Use Only
Manufacturer/Supplier:	Spartan Chemical Company, Inc. 1110 Spartan Drive Maumee, Ohio 43537 USA 800-537-8990 (Business hours) www.spartanchemical.com

24 Hour Emergency Phone Numbers:

Medical Emergency/Information:	888-314-6171
Transportation/Spill/Leak:	CHEMTREC 800-424-9300

2. HAZARDS IDENTIFICATION

GHS Classification

Acute Toxicity - Oral:	Category 4
Acute Toxicity - Dermal:	Category 4
Skin Corrosion/Irritation:	Category 1 Sub-category B
Serious Eye Damage/Eye Irritation:	Category 1

GHS Label Elements

Signal Word: **Danger**

Symbols:

Hazard Statements:
Harmful if swallowed.
Harmful in contact with skin
Causes severe skin burns and serious eye damage.

Precautionary Statements:

Prevention:
Wash hands and any exposed skin thoroughly after handling.
Do not eat, drink or smoke when using this product
Wear protective gloves. Wear eye / face protection. Wear protective clothing.
Do not breathe mist, vapors or spray.

Response: **IMMEDIATELY CALL A POISON CENTER OR PHYSICIAN.**

-Eyes	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
-Skin	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Wash contaminated clothing before reuse.
-Inhalation:	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
-Ingestion:	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
-Specific Treatment:	See Safety Data Sheet Section 4: "FIRST AID MEASURES" for additional information.

Storage: Store locked up.
Disposal: Dispose of contents and container in accordance with local, state and federal regulations.

Hazards Not Otherwise Classified: Not Applicable

Other Information:
- Corrosive.
- Inhalation of vapors or mist may cause respiratory irritation.
- Keep out of reach of children.
- NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

0.53568% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Weight-%
water	7732-18-5	40-70
dialkyl dimethyl ammonium chloride	68424-95-3	10-30
alkyl dimethyl benzyl ammonium chloride	68424-85-1	5-10
ethanol	64-17-5	1-5
tetrasodium ethylenediaminetetraacetate	64-02-8	1-5
alcohol ethoxylate	68439-46-3	1-5

Specific chemical identity and/or exact percentage of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

-Eye Contact: Rinse cautiously with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IMMEDIATELY CALL A POISON CENTER OR PHYSICIAN.
-Skin Contact: Take off immediately all contaminated clothing and shoes. Rinse with water or shower for at least 15 minutes. IMMEDIATELY CALL A POISON CENTER OR PHYSICIAN. Wash contaminated clothing before reuse.
-Inhalation: Remove victim to fresh air and keep at rest in a position comfortable for breathing. IMMEDIATELY CALL A POISON CENTER OR PHYSICIAN.
-Ingestion: Rinse mouth. Do NOT induce vomiting. IMMEDIATELY CALL A POISON CENTER OR PHYSICIAN. Never give anything by mouth to an unconscious person.
Note to Physicians: NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media: Product does not support combustion, Use extinguishing agent suitable for type of surrounding fire
Specific Hazards Arising from the Chemical: Dried product is capable of burning. Combustion products are toxic.
Hazardous Combustion Products: May include Carbon monoxide Carbon dioxide and other toxic gases or vapors.

Protective Equipment and Precautions for Firefighters: Wear MSHA/NIOSH approved self-contained breathing apparatus (SCBA) and full protective gear. Cool fire-exposed containers with water spray.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with skin, eyes or clothing. Use personal protective equipment as required.
Environmental Precautions: Do not rinse spill onto the ground, into storm sewers or bodies of water.
Methods for Clean-Up: Prevent further leakage or spillage if safe to do so. Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

7. HANDLING AND STORAGE

Advice on Safe Handling: Handle in accordance with good industrial hygiene and safety practice. Wash thoroughly after handling.

Storage Conditions: Keep containers tightly closed in a dry, cool and well-ventilated place. Keep out of the reach of children. Keep from freezing.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits:

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH
ethanol 64-17-5	STEL: 1000 ppm	TWA: 1000 ppm TWA: 1900 mg/m³ (vacated) TWA: 1000 ppm (vacated) TWA: 1900 mg/m³	IDLH: 3300 ppm TWA: 1000 ppm TWA: 1900 mg/m³

Engineering Controls: Provide good general ventilation.
If work practices generate dust, fumes, gas, vapors or mists which expose workers to chemicals above the occupational exposure limits, local exhaust ventilation or other engineering controls should be considered.
Eye wash stations and shower facilities should be readily accessible in areas where the product is handled.

Personal Protective Equipment

Eye/Face Protection: Wear splash goggles.

Skin and Body Protection: Wear rubber or other chemical-resistant gloves.

Respiratory Protection: Not required with expected use.
If occupational exposure limits are exceeded or respiratory irritation occurs, use of a NIOSH/MSHA approved respirator suitable for the use-conditions and chemicals in Section 3 should be considered.

General Hygiene Considerations: Wash hands and any exposed skin thoroughly after handling.
See 29 CFR 1910.132-138 for further guidance.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance/Physical State:	Liquid
Color:	Clear
Odor:	Mild
pH:	6.5-7.5
Melting Point / Freezing Point:	No information available.
Boiling Point / Boiling Range:	100 °C / 212 °F
Flash Point:	> 100 °C / > 212 °F ASTM D56
Evaporation Rate:	1 (Butyl acetate = 1)
Flammability (solid, gas)	No information available.
Upper Flammability Limit:	No information available.
Lower Flammability Limit:	No information available.
Vapor Pressure:	No information available.
Vapor Density:	No information available.
Specific Gravity:	1.01
Solubility(ies):	Soluble in water
Partition Coefficient:	No information available.
Autoignition Temperature:	No information available.
Decomposition Temperature:	No information available.
Viscosity:	No information available.

10. STABILITY AND REACTIVITY

Reactivity: This material is considered to be non-reactive under normal conditions of use.

Chemical Stability: Stable under normal conditions.

Possibility of Hazardous Reactions: Not expected to occur with normal handling and storage.

Conditions to Avoid: Extremes of temperature and direct sunlight.
Incompatible Materials: Strong oxidizing agents. Strong acids.
Hazardous Decomposition Products: May include carbon monoxide, carbon dioxide (CO2) and other toxic gases or vapors.

11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Eyes, Skin, Ingestion, Inhalation.
Symptoms of Exposure:
-Eye Contact: Pain, redness, swelling of the conjunctiva and tissue damage. Eye contact may cause permanent damage.
-Skin Contact: Pain, redness, blistering and possible chemical burn.
-Inhalation: Nasal discomfort and coughing.
-Ingestion: Damage or chemical burns to mouth, throat and stomach. Pain, nausea, vomiting and diarrhea.

Immediate, Delayed, Chronic Effects
Product Information: Data not available or insufficient for classification.

Numerical Measures of Toxicity
The following acute toxicity estimates (ATE) are calculated based on the GHS document.

ATEmix (oral): 439 mg/kg
ATEmix (dermal): 1354 mg/kg
ATEmix (inhalation-dust/mist): 5.8 mg/l

Component Acute Toxicity Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
water 7732-18-5	> 90 mL/kg (Rat)	Not Available	Not Available
alkyl dimethyl benzyl ammonium chloride 68424-85-1	= 426 mg/kg (Rat)	Not Available	Not Available
ethanol 64-17-5	= 7060 mg/kg (Rat)	Not Available	= 124.7 mg/L (Rat) 4 h
tetrasodium ethylenediaminetetraacetate 64-02-8	= 10 g/kg (Rat)	Not Available	Not Available
alcohol ethoxylate 68439-46-3	= 1378 mg/kg (Rat)	> 2 g/kg (Rabbit)	Not Available

Carcinogenicity: No components present at 0.1% or greater are listed as to being carcinogens by ACGIH, IARC, NTP or OSHA.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Chemical Name	Algae/Aquatic Plants	Fish	Toxicity to Microorganisms	Crustacea
ethanol 64-17-5	Not Available	12.0 - 16.0: 96 h Oncorhynchus mykiss mL/L LC50 static 100: 96 h Pimephales promelas mg/L LC50 static 13400 - 15100: 96 h Pimephales promelas mg/L LC50 flow-through	Not Available	9268 - 14221: 48 h Daphnia magna mg/L LC50 10800: 24 h Daphnia magna mg/L EC50 2: 48 h Daphnia magna mg/L EC50 Static
tetrasodium ethylenediaminetetraacetate 64-02-8	1.01: 72 h Desmodesmus subspicatus mg/L EC50	41: 96 h Lepomis macrochirus mg/L LC50 static 59.8: 96 h Pimephales promelas mg/L LC50 static	Not Available	610: 24 h Daphnia magna mg/L EC50

Persistence and Degradability: No information available.
Bioaccumulation: No information available.

Other Adverse Effects: No information available.

13. DISPOSAL CONSIDERATIONS

Disposal of Wastes: Dispose of in accordance with federal, state and local regulations.
Contaminated Packaging: Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT: Not Regulated
Proper Shipping Name: Non-Hazardous Product
Special Provisions: Shipping descriptions may vary based on mode of transport, quantities, package size, and/or origin and destination. Check with a trained hazardous materials transportation expert for information specific to your situation.

IMDG: Not Regulated
Proper Shipping Name: Non-Hazardous Product

15. REGULATORY INFORMATION

TSCA Status: (Toxic Substance Control Act Section 8(b) Inventory)
All chemical substances in this product are included on or exempted from listing on the TSCA Inventory of Chemical Substances.

SARA 313
This product does not contain listed substances above the "de minimus" level

SARA 311/312 Hazard Categories

Acute Health Hazard:	Yes
Chronic Health Hazard:	No
Fire Hazard:	No
Sudden release of pressure hazard:	No
Reactive Hazard:	No

California Proposition 65
This product is not subject to warning requirements under California Proposition 65.

EPA Pesticide Registration Number: 1839-167-5741
EPA Statement:
This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:
EPA Pesticide Label:
Danger. Keep out of reach of children. Corrosive. Causes irreversible eye damage and skin burns. May be fatal if absorbed through the skin. Do not get in eyes, on skin or on clothing. Wear protective eyewear (goggles or face shield), clothing, and gloves when handling. Harmful if swallowed. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Remove contaminated clothing and wash before reuse.

16. OTHER INFORMATION

NFPA	**Health Hazards:** 3	**Flammability:** 0	**Instability:** 0	**Special:** N/A
HMIS	**Health Hazards:** 3	**Flammability:** 0	**Physical Hazards:** 0	

Revision Date: 14-Aug-2015
Reasons for Revision: Section 11

Disclaimer:
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End of Safety Data Sheet

Appendix E. Formalin Health and Safety

All field and laboratory activities will be performed in accordance with the Occupational Safety and Health Administration's requirements for a safe workplace. It is the responsibility of staff to establish and implement the appropriate health and safety procedures for the work being performed. All field staff are expected to review and understand the material safety data sheet and chemical fact sheet for chemicals of concern provided by field staff supervisors. Field staff are instructed to immediately report to their supervisor the development of any adverse signs or symptoms they suspect are attributable to chemical exposure.

The environmental samples scheduled to be collected during the Beneficial Use Reconnaissance Program will be obtained from surface water bodies located in natural settings. Samples to be collected include aquatic macroinvertebrates, fish specimens, periphyton, and occasionally amphibians. The sample stations and samples to be collected are not considered to be hazardous; however, sample preservation materials include formalin (formaldehyde), which requires prudent safety precautions by those collecting samples and those coming into contact with or disposing of samples.

Hazardous Materials (Formaldehyde)

Commercial grade formalin contains 37–55% formaldehyde. The use of formaldehyde and its derivatives is regulated under 29 CFR 1910.1048. Formaldehyde is a suspected human carcinogen. Formaldehyde is highly flammable and is incompatible with strong oxidizers, strong alkalis, acids, phenols, and urea.

For BURP sample preservation, we use a 10% formalin solution.

Formaldehyde Exposure Limits

There may be no safe level of exposure to a carcinogen, so all contact with formalin should be reduced to the lowest possible level. The odor threshold of 0.83 parts per million (ppm) for formaldehyde serves only as a warning of exposure. The permissible exposure limit (PEL) for formaldehyde is 0.75 ppm averaged over an 8-hour work shift. The short-term exposure limit (STEL) for airborne concentrations of formaldehyde is 2 ppm. The American Conference of Governmental Industrial Hygienists recommend airborne exposure limit to formaldehyde is not to exceed 0.3 ppm averaged over an 8-hour work period.

Respirators shall be used when (1) installing feasible engineering and work practice controls, (2) engineering and work practice controls are not feasible, and (3) engineering and work practice controls are not sufficient to reduce exposure to or below the PEL. Respirator use should be limited to an MSHA/NIOSH-approved supplied air respirator with a full face piece operated in the positive mode or with a full face piece, hood, or helmet operated in the continuous flow mode. An MSHA/NIOSH-approved selfcontained breathing apparatus with a full face piece operated in pressure demand or other positive mode is also recommended.

Formaldehyde exposure occurs through inhalation and absorption. Exposure irritates the eyes, nose, and throat and can cause skin and lung allergies. Higher levels can cause throat spasms and a build-up of fluid in the lungs—cause for a medical emergency. Contact can cause severe eye

and skin burns, leading to permanent damage. These may appear hours after exposure, even if no pain is felt.

Formaldehyde First Aid

If formaldehyde gets into the eyes, remove any contact lenses at once and irrigate immediately with deionized water, distilled water, or saline solution. If formaldehyde contacts exposed skin, flush with water promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration, if needed. When formaldehyde has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Formaldehyde Fire and Explosion Hazard

Mixtures of air and free formaldehyde gas are highly flammable. Formalin is a combustible liquid and presents a moderate fire and explosion hazard. Use a dry chemical, carbon dioxide, water spray, or “alcohol” form to extinguish formalin fires. Store formalin solutions in insulated, closed containers in a cool, dry, well-ventilated area separate from oxidizing agents and alkaline materials. Protect formalin containers from physical damage.

Formalin Spill Procedures

In case of a spill or leak, eliminate all sources of ignition, provide adequate ventilation, notify a supervisor, and evacuate all nonessential personnel. Neutralize spilled formalin with aqueous ammonia or mix with sodium sulfite. Wash residues with diluted ammonia to eliminate vapor. Prevent runoff from entering streams, surface waters, waterways, watersheds, and sewers.

Formalin Work Area Controls

Work area locations at stream sampling stations will be selected to ensure adequate ventilation when sample container lids are removed. Work area locations will be located downwind from field crew activities and will be isolated from field crew traffic. A single field crew member will be designated and authorized to secure the formaldehyde work area at sampling stations. This crew member will ensure proper handling of sample containers and fish specimens and will be responsible for establishing proper precautions for minimizing field crew exposure to formaldehyde at sampling stations.

Formalin Work Area Practices

Formalin (formaldehyde) is being used in this protocol for the purpose of asphyxiation and preservation of fish specimens, periphyton, and occasionally amphibians. Prelabeled and prepreserved plastic sample containers will be delivered to the field crew secured in large ice chests. Field crews will transport the containers in the coolers to the field sample stations. Fish specimens will be collected by hand and placed into the sample containers. Container lids will be removed immediately prior to, and closed immediately after, fish specimens and specimen labels are placed into the sample container. Specimens will be placed into the sample container; minimize the amount of time the sample jar is open to minimize vapors. The sample container will be placed into a large plastic bag and secured in an ice cooler until delivered to the laboratory for analysis.

Formalin Personal Protection

Field crew members within the designated formalin work area at sample stations will wear safety lenses and impervious nitrile, butyl rubber, or viton gloves to prevent excessive or prolonged skin contact. Contact lenses will not be worn within the designated formalin work area. No eating, drinking, or smoking will be allowed in the designated formalin work area.

Wash thoroughly after using formalin. Avoid transferring formalin from hands to mouth while eating, drinking, or smoking. Avoid direct contact with formalin. Remove contaminated clothing and launder before wearing. Contaminated work clothing should not be taken home. Contaminated work clothing should be laundered by individuals who have been informed of the hazards of exposure to formalin.

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Appendix F. Habitat Assessment Charts

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HABITAT ASSESSMENT

1. *Instream Cover (for fish):*

Less than 10% cobble, gravel or other stable fish cover. Lack of cover is obvious.	10-30% mix of cobble, gravel, or other stable fish cover. Cover availability is less than desirable.	30-50% mix of cobble, gravel, or other stable fish cover. Adequate cover.	Greater than 50% mix of cobble, gravel, woody debris, undercut banks, or other stable fish cover.
0 – 5	*6 – 10*	*11 – 15*	*16 – 20*

2. *Embeddedness (in riffles):*

Gravel, cobble and boulder particles are >75% surrounded by fine sediment, or bottom is sand, clay or bedrock.	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment (particles less than 6.35mm).
0 – 5	*6 – 10*	*11 – 15*	*16 – 20*

3. *Channel Shape:*

Inverse Trapezoidal	Rectangular	Trapezoidal

0 – 5	*6 – 10*	*11 – 15*

4. *Disruptive Pressures (on streambank, immediately adjacent to stream):*

Disruption of streambank vegetation is very high. Vegetation has been removed to less than 30% of the potential plant biomass.	Disruption obvious; some patches of bare soil or closely cropped vegetation present. 30-60% of potential plant biomass remains.	Disruption evident but not affecting community vigor. Vegetative use is moderate, 60-90% of the potential plant biomass remains.	Vegetative disruption minimal or not evident. Almost all potential plant biomass at present stage of development remains.
0 – 2	*3 – 5*	*6 – 8*	*9 – 10*

5. *Zone of Influence (width of riparian vegetative zone, least buffered side):*

Little or no riparian vegetation due to man induced activities (parking lots, clearcuts, lawns or crops planted to the edge of the stream).	Width of riparian vegetative zone (each side) is at least as wide as the stream. Human activities have caused a great deal of impact.	Width of riparian vegetative zone (on each side) is at least twice the width of the stream. Human activities have caused minimal impact.	Width of riparian vegetative zone (on each side) is at least 4 times the width of the stream. Human activities have caused no impact at all.
0 – 2	*3 – 5*	*6 – 8*	*9 – 10*

6. *Pool Substrate Characteristics (for fish):*
bedrock, boulder, cobble, pebble, gravel, sand, silt, logs, submerged vegetation

Uniform substrate, one type, ex. all bedrock or all sand, no vegetation	Combination of two	Combination of three	Diverse substrate, at least a combination of four
0 – 5	*6 – 10*	*11 – 15*	*16 – 20*

7. *Pool Variability:*

Majority of pools small and shallow, or pools absent.	Shallow pools much more prevalent than deep pools.	Majority of pools large and deep. Very few shallow pools.	Even mix of deep, shallow, large and small pools.
0 – 5	*6 – 10*	*11 – 15*	*16 – 20*

ROSGEN STREAM TYPE

Is it steep and riffle-dominated?
- YES: How steep?
  - VERY (>4%): **A**
  - QUITE (2-4%): **B**
- NO: Is it braided?
  - YES: **D**
  - NO:

NO:	*Entrenched*	*Wide floodplain*
Wide & Shallow	**F**	**C**
Narrow & Deep	**G**	**E**

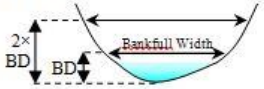
Further Information

Entrenchment Ratio		Description
	A	Steep, cascading, laterally contained step/pool streams, typically low stream order.
< 1.4 (entrenched)	**F**	Deeply entrenched channel with little or no visible flood plain. High bankfull width/depth ratio (>12).
	G	Narrow, deep bankfull channel (a gully). Low bankfull width/depth ratio (<12).
2.2 - 1.4	**B**	Moderately steep, moderately sinuous riffle-dominated channel, with infrequently spaced pools and stable banks.
> 2.2 (wide floodplain)	**C**	Meandering, riffle/pool channel with broad, well-defined floodplains and point bars. High bankfull width/depth ratio (>12) and moderate-high sinuosity.
	E	Tortuously meandering, with little deposition. Often found in flat-bottomed valleys and meadows. Very low bankfull width/depth ratio (<6).
N/A	**D**	Braided channel with very high bankfull width/depth ratio (>40). Bars and eroding banks. Three or more braids, caused by sediment.

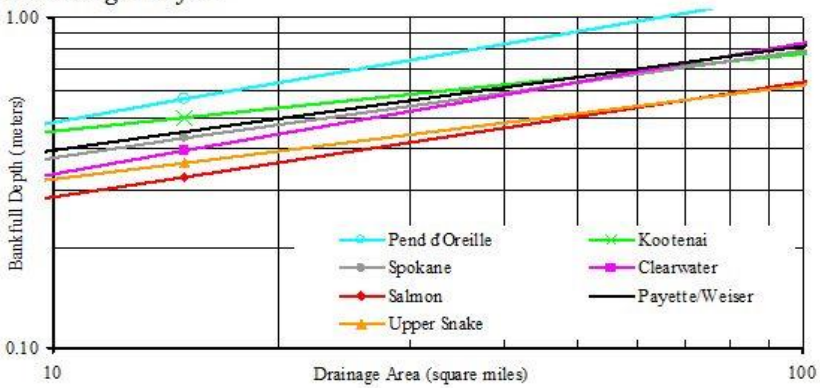
Calculating Entrenchment Ratio

Entrenchment ratio is a measure of how easily the stream can access its floodplain during high water. If the stream stays confined, it is said to be entrenched, and has a low *entrenchment ratio*.

$$\text{Entrenchment Ratio} = \frac{\text{Width at } 2 \times \text{Bankfull Depth}}{\text{Width at Bankfull Depth}}$$



Estimating Bankfull



Appendix G. Electrofishing Safety Orientation and Acknowledgement

Electrofishing Safety Policy and Plan

1. **Purpose**

   The purpose of this plan is to ensure human safety during electrofishing operations by establishing Idaho Department of Environmental Quality (DEQ) competency requirements for electrofishing operations. This plan also provides guidelines for a standard operating procedure and the safe operation of electrofishing equipment.

2. **Scope**

   The provisions of this plan apply to all DEQ activities using electricity (produced by gasoline-powered generator/alternators or batteries) to sample animals in aquatic habitats.

3. **Policy**

   DEQ recognizes that electrofishing is a hazardous activity for which skills and training are required. Therefore, all personnel serving as Beneficial Use Reconnaissance Program (BURP) coordinators must demonstrate knowledge of the principles and techniques of electrofishing. BURP coordinators will be considered knowledgeable of the principles and techniques of electrofishing upon satisfactory completion of the Principles and Techniques of Electrofishing course or equivalent training.

4. **Responsibilities**

   A. The DEQ health and safety coordinator is responsible for maintaining a current listing of all DEQ personnel who have attended electrofishing training.

   B. DEQ regional administrators are responsible for ensuring compliance with the provisions of this plan.

   C. BURP coordinators are responsible for the following:

      1) Providing electrofishing crews with the proper equipment and ensuring that such equipment is fully functional at the beginning of the field season

      2) Ensuring that the electrofishing crews have and utilize the proper safety equipment

      3) Ensuring that all crew members are first-aid and CPR certified

      4) Ensuring the availability of a well-equipped, water-tight first-aid kit

      5) Discussing potential hazardous conditions encountered during electrofishing operations with crew members

      6) Ensuring that all crew members are trained in proper electrofishing techniques

7) Designating an electrofishing team leader

D. Only individuals demonstrating knowledge of electrofishing techniques can serve as electrofishing team leaders. As the individuals in charge of electrofishing operations, the team leaders are responsible for the following:

1) Identifying hazardous field conditions associated with proposed electrofishing operations, determining measures to protect electrofishing team members, and appropriately briefing team members

2) Ensuring precautions are taken in the field to avoid harm to the public, domestic animals, or wildlife

3) Ensuring that all electrofishing operations cease and all crew members go ashore in the event of inclement weather

4) Ensuring that electrofishing operations include only those persons necessary to conduct a safe and efficient operation and those members being trained

5) Reviewing the electrofishing checklist and adding specialized items to the checklist that pertain to their regions or operation

6) Inspecting electrofishing equipment during the field season to ensure it is properly functioning and bringing necessary repairs to the attention of the regional BURP coordinator

E. All crew members must know who their leader is and recognize that leader's authority as final in operational decisions. Every crew member has the right to ask questions about any aspect of an electrofishing operation. A crew member has the right to decline participation in the operation if he/she feels unsafe working in the field conditions present. Crew members are responsible for reporting all potential work hazards, accidents, incidents, and job-related illnesses/injuries to their regional BURP coordinator.

5. Training and Education

A. BURP coordinators should attend the Principles and Techniques of Electrofishing course so they have knowledge of the following:

1) The basic principles of electricity and transmission of current in water

2) The basic concept and design guidelines for electrofishing equipment

3) Electrofishing equipment and the equipment's capabilities, limitations, and safety features

4) The safety precautions to employ while using electrofishing equipment

B. All members of the electrofishing crew must have a current certification in cardiopulmonary resuscitation (CPR) and first aid. All crew members will be briefed in the following areas:

1) Hazards involved in electrofishing

2) Safe operation of electrofishing equipment

3) Basic emergency procedures for drowning, unconsciousness, and electrical shock

4) Communication between electrofishing crew members while operating equipment

6. Standard Safety Equipment

A. All persons using portable electrofishers will wear protective gear that will insulate the wearer from electrical shock, preferably chest waders, but rubber hip boots would suffice. All footwear will be equipped with nonslip soles.

B. Appropriate gloves will be worn and inspected for punctures before each use. They will be replaced if damaged.

C. Polarized sunglasses will be worn when there is glare on the water.

7. Standard Operating Procedure

All persons must be aware of the hazards involved in using portable electrofishers in running waters, such as slippery surfaces, swift water currents, deep areas, and obstacles such as logs or similar objects.

A. A minimum of three people should be present to conduct electrofishing operations.

B. At all times during the electrofishing operation, the crew must communicate as to whether or not the unit is putting power into the water. If a crew member must reach into the water with his hands, it is his responsibility to inform the person operating the equipment so the operator can stop the operation. Communication between crew members is essential to a safe operation.

C. Netters will work beside or behind the individual with the electrofishing equipment to ensure the electrical field is well in front of both workers.

D. Crew members should only perform one job at a time. A person should not be carrying the bucket of fish and netting at the same time.

E. While walking in the stream, make sure that one foot is securely planted before stepping with the other foot. Do not cross one leg over the other, especially while walking in swift water.

F. The individual operating the electrofishing unit should not turn the power on until all crew members are in position and have stable footing.

G. Crew members will cease electrofishing operations during inclement weather; use discretion during rain.

H. All safety equipment will be utilized.

I. All operating manuals for electrofishing equipment must be available to the crew while in the field.

8. Portable Electrofisher Equipment Specifications and Operation

Only professionally produced electrofishing equipment should be used, and the equipment should not be altered in any way.

A. Electrodes

1) Electrode handles will be constructed of a nonconductive material and be long enough to avoid hand contact with the water.

2) The positive electrode (anode) used with portable electrofishers will be equipped with a magnetic switch that interrupts the electric current upon release.

B. Portable Electrical Power Source

1) Batteries used as an electrical power source for backpack shockers will be of the gel type that will not leak when tipped or overturned.

2) Backpacks will be equipped with a quick-release belt (hip) and shoulder straps.

C. Power Control

1) The operator will have a switch to the pulsator or power control unit in order for the electricity to be turned off quickly in an emergency.

2) All equipment purchased after October 1, 1985, must be equipped with a tilt switch that breaks the circuit if the operator falls.

Idaho Beneficial Use Reconnaissance Program
Acknowledgement of Electrofishing Training

I have received instruction and orientation about electrofishing from the Idaho Department of Environmental Quality. As a result, I understand and accept the following principles:

1. Electrofishing (EF) is an inherently hazardous activity in which safety is the primary concern. The electrical energy used in EF is sufficient to cause electrocution. During operations, it is critical to avoid contact with the electrodes and surrounding water. The EF field is most intense near the electrodes but can extend outward 10–20 feet.

2. A communication system must be known by all members of an EF crew. A minimum of three people are recommended for all EF operations. Crew members should only perform one job at a time (e.g., a person should not be carrying the bucket of fish and netting at the same time).

3. The individual operating the electrofishing unit should not turn the power on until all crew members are in position, have stable footing, and agree to begin.

4. An EF operation should proceed slowly and carefully; avoid fish-chasing and other sudden maneuvers. Operations should cease during inclement weather; use discretion during rain.

5. The main power switch must be turned off immediately if an emergency occurs.

6. Rubber knee boots are minimal foot protection, as are rubber gloves for the hands. Chest-waders with felt soles are recommended. Ear protection is recommended for those working near the generator. Crews will be provided with the necessary safety equipment in proper working condition.

7. All members of the EF crew must be certified for CPR and first aid. A first-aid kit must be accessible during an EF operation.

8. Stunned fish should be removed from the EF field as soon as possible and not subjected to continuous power by being held in the field. Avoid using the anode as a dip net—it is a poor electrofishing technique and potentially injurious to fish.

9. Measures should be taken to avoid harm to the public, domestic animals, and wildlife. The public cannot participate in electrofishing operations.

10. All EF crew members must know who their leader is and recognize his/her authority as final in operational decisions. However, every crew member has the right to ask questions about any aspect of an EF operation. A crew member has the right to decline participation in an EF operation, without fear of employer recrimination, if he/she feels unsafe in doing such work.

_____ _____

Signature of Employee Date

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Appendix H. DEQ Fish Taxon Codes

Scientific Name	Common Name	TAX_UID
Acipenser medirostris	green sturgeon	380
Acipenseridae sp.	sturgeon	161064
Acrocheilus alutaceus	chiselmouth	408
Agonopsis vulsa	northern spearnose poacher	507
Alosa pseudoharengus	alewife	701
Alosa sapidissima	American shad	702
Alosa sp.	shad	161701
Ambloplites rupestris	rock bass	755
Ameiurus catus	white catfish	815
Ameiurus melas	black bullhead	816
Ameiurus natalis	yellow bullhead	817
Ameiurus nebulosus	brown bullhead	818
Ameiurus sp.	bullhead	164034
Amia calva	bowfin	822
Anoplarchus purpurescens	high cockscomb	1172
Apeltes quadracus	fourspine stickleback	1308
Archoplites interruptus	Sacramento perch	1645
Campostoma anomalum	central stoneroller	3351
Carassius auratus	goldfish	3512
Catostomus ardens	Utah sucker	3751
Catostomus catostomus	longnose sucker	3753
Catostomus columbianus	bridgelip sucker	3755
Catostomus commersonii	white sucker	3757
Catostomus discobolus	bluehead sucker	3758
Catostomus macrocheilus	largescale sucker	3764
Catostomus occidentalis	Sacramento sucker	3766
Catostomus platyrhychus	mountain sucker	168474
Catostomus platyrhychus	mountain sucker	3767
Catostomus rimiculus	Klamath smallscale sucker	3769
Catostomus snyderi	Klamath largescale sucker	3771
Catostomus sp.	sucker	163893
Catostomus tahoensis	Tahoe sucker	3773
Catostomus warnerensis	Warner sucker	3774
Centrarchidae	sunfish	3803
Centrarchus macropterus	flier	3806
Chasmistes brevirostris	shortnose sucker	4457
Cichlasoma nigrofasciatum	convict cichlid	5051
cichlidae	cichlids	5058
Clarias batrachus	walking catfish	5172

Scientific Name	Common Name	TAX_UID
Clupeidae	herrings	5275
Cobitidae	loach (cobitidae)	5299
Coregonus clupeaformis	lake whitefish	5481
Coregonus hoyi	bloater	5491
Coregonus pidschian	humpback whitefish	5524
Coregonus sardinella	least cisco	5529
Coregonus sp.	whitefish	161932
Cottus aleuticus	coastrange sculpin	5802
Cottus asper	prickly sculpin	5803
Cottus bairdi	mottled sculpin	168469
Cottus bairdi	mottled sculpin	5806
Cottus beldingi	Paiute sculpin	5807
Cottus beldingi	Paiute sculpin	168475
Cottus cognatus	slimy sculpin	5809
Cottus confusus	shorthead sculpin	5810
Cottus extensus	Bear lake sculpin	5812
Cottus greenei	Shoshone sculpin	5816
Cottus gulosus	riffle sculpin	5817
Cottus klamathensis	marbled sculpin	5821
Cottus leiopomus	Wood river sculpin	5822
Cottus marginatus	margined sculpin	5823
Cottus perplexus	reticulate sculpin	5825
Cottus pitensis	pit sculpin	5826
Cottus princeps	Klamath Lake sculpin	5828
Cottus rhotheus	torrent sculpin	5830
Cottus sp.	sculpin	167229
Cottus tenuis	slender sculpin	5834
Couesius plumbeus	lake chub	5836
Couesius sp.	chub	163534
Ctenopharyngodon idella	grass carp	6013
Culaea inconstans	brook stickleback	6045
Cymatogaster aggregata	shiner perch	6115
Cyprinidae	minnows	6274
Cyprinodontidae	killifish	6294
Cyprinus carpio	common carp	6302
Deltistes luxatus	Lost River sucker	6536
Embiotocidae	surfperch	7114
Esox americanus	grass pickerel	7582
Esox lucius	northern pike	7586
Esox niger	chain pickerel	7588
Esox sp.	pike	162138
Etheostoma exile	Iowa darter	7648

Scientific Name	Common Name	TAX_UID
Etheostoma flabellare	fantail darter	7649
Etheostoma nigrum	johnny darter	7681
Etheostoma zonale	banded darter	7734
Fundulus diaphanus	banded killifish	8200
Fundulus notatus	blackstripe topminnow	8218
Gambusia affinis	western mosquitofish	8405
Gasterosteidae	stickleback	8446
Gasterosteus aculeatus	threespine stickleback	8450
Gila alvordensis	Alvord chub	8580
Gila atraria	Utah chub	8581
Gila bicolor	tui chub	8582
Gila boraxobius	Borax Lake chub	8587
Gila coerulea	blue chub	8588
Gila copei	leatherside chub	163549
Gila sp.	chub	163541
Glyptocephalus zachirus	rex sole	8781
Hesperoleucus symmetricus	California roach	9785
Hiodon alosoides	goldeye	9915
Hiodon sp.	mooneyes	161904
Hybognathus hankinsoni	brassy minnow	10261
Hypomesus olidus	pond smelt	10411
Hypomesus pretiosus	surf smelt	10412
Hypophthalmichthys molitrix	silver carp	10418
Hypophthalmichthys nobilis	bighead carp	10419
Icelinus filamentosus	threadfin sculpin	10515
Ichthyomyzon bdellium	Ohio lamprey	10553
Ichthyomyzon greeleyi	mountain brook lamprey	10557
Ichthyomyzon unicuspis	silver lamprey	10559
Ictaluridae	catfish	10571
Ictalurus furcatus	blue catfish	10575
Ictalurus punctatus	channel catfish	10582
Ictalurus sp.	catfish	163996
Lampetra appendix	American brook lamprey	11606
Lampetra ayresi	river lamprey	11607
Lampetra lethophaga	Pit-Klamath brook lamprey	11615
Lampetra minima	Miller Lake lamprey	11618
Lampetra richardsoni	western brook lamprey	11623
Lampetra sp.	lamprey	159700
Lepomis cyanellus	green sunfish	11864
Lepomis gibbosus	pumpkinseed	11865
Lepomis gulosus	warmouth	11866
Lepomis macrochirus	bluegill	11868

Scientific Name	Common Name	TAX_UID
Lepomis microlophus	redear sunfish	11871
Lepomis sp.	sunfish	168130
Leptocottus armatus	Pacific staghorn sculpin	11929
Lota lota	burbot	12345
Lota sp.	cod	164724
Lucania parva	rainwater killifish	12368
Margariscus margarita	pearl dace	12831
Meda fulgida	spikedace	12894
Menidia menidia	Atlantic silverside	13011
Microphis sp.	pipefish	166532
Micropterus dolomieu	smallmouth bass	13166
Micropterus salmoides	largemouth bass	13170
Micropterus sp.	bass	168158
Misgurnus anguillicaudatus	oriental weatherfish	13225
Misgurnus sp.	weatherfish	163977
Morone chrysops	white bass	13370
Morone saxatilis	striped bass	13374
Moronidae	temperate perches	13376
Moxostoma macrolepidotum	shorthead redhorse	13393
Moxostoma sp.	redhorse	163927
Mugil cephalus	striped mullet	13406
Mylocheilus caurinus	peamouth	13618
Myoxocephalus octodecemspinosus	longhorn sculpin	13631
Notropis hudsonius	spottail shiner	14399
Notropis oxyrhynchus	sharpnose shiner	14423
Notropis stramineus	sand shiner	14454
Noturus eleutherus	mountain madtom	14476
Noturus gyrinus	tadpole madtom	14484
Noturus miurus	brindled madtom	14489
Novumbra hubbsi	Olympic mudminnow	14536
Oncorhynchus aguabonita	golden trout	14705
Oncorhynchus clarki	cutthroat trout	168470
Oncorhynchus clarki	cutthroat trout	14708
Oncorhynchus clarki X O. mykiss	cutthroat trout (all stocks) x rainbow trout	168476
Oncorhynchus gilae	Gila trout	14719
Oncorhynchus gorbuscha	pink salmon	14722
Oncorhynchus keta	chum salmon	14724
Oncorhynchus kisutch	coho salmon	14725
Oncorhynchus mykiss	rainbow trout	14727
Oncorhynchus nerka	sockeye salmon	14736
Oncorhynchus sp.	Pacific salmon/trout	161974
Oncorhynchus tshawytscha	chinook salmon	14738

Scientific Name	Common Name	TAX_UID
Oregonichthys crameri	Oregon chub	14912
Oregonichthys kalawatseti	Umpqua chub	14913
Osmeridae	smelt	14943
Osmerus mordax	rainbow smelt	14950
Osmerus sp.	smelt	162038
Perca flavescens	yellow perch	15717
Perca sp.	perch	168468
Percidae	perch	15725
Percina caprodes	logperch	15735
Percopsis omiscomaycus	trout perch	15774
Percopsis sp.	trout-perch	164408
Percopsis transmontana	sand roller	15775
Petromyzon marinus	sea lamprey	15831
Pholis laeta	crescent gunnel	15908
Phoxinus erythrogaster	southern redbelly dace	15950
Pimephales notatus	bluntnose minnow	16065
Pimephales promelas	fathead minnow	16066
Platichthys stellatus	starry flounder	16124
Pleuronectidae	right-eye flounder	16391
Poecilia mexicana	shortfin molly	16431
Poecilia reticulata	guppy	16433
Poeciliidae	guppy	16438
Pomoxis annularis	white crappie	16907
Pomoxis nigromaculatus	black crappie	16908
Pomoxis sp.	crappie	168165
Prosopium abyssicola	Bear Lake whitefish	17175
Prosopium coulteri	pygmy whitefish	17176
Prosopium cylindraceum	round whitefish	17178
Prosopium gemmiferum	Bonneville cisco	168480
Prosopium sp.	whitefish	162007
Prosopium spilonotus	Bonneville whitefish	17180
Prosopium williamsoni	mountain whitefish	17181
Ptychocheilus oregonensis	northern squawfish	17730
Ptychocheilus sp.	squawfish	163522
Ptychocheilus umpquae	Umpqua squawfish	17731
Pungitius pungitius	ninespine stickleback	17735
Pylodictis olivaris	flathead catfish	17772
Rhinichthys cataractae	longnose dace	18055
Rhinichthys cobitis	loach minnow	18056
Rhinichthys evermanni	Umpqua dace	18058
Rhinichthys falcatus	leopard dace	18059
Rhinichthys osculus	speckled dace	18060

Scientific Name	Common Name	TAX_UID
Rhinichthys sp.	dace	163381
Rhinichthys umatilla	umatilla dace	18066
Richardsonius balteatus	redside shiner	18207
Richardsonius egregius	Lahontan redside	18208
Richardsonius sp.	shiner	163527
Salmo salar	Atlantic salmon	18407
Salmo sp.	Atlantic salmon/trout	161994
Salmo trutta	brown trout	18416
Salmonidae	trout	18420
Salvelinus alpinus	Arctic char	18430
Salvelinus confluentus	bull trout	18435
Salvelinus fontinalis	brook trout	18441
Salvelinus fontinalis X S. confluentus	brook trout x bull trout	168477
Salvelinus malma	Dolly Varden	18455
Salvelinus namaycush	lake trout	18458
Salvelinus sp.	char	161999
Semotilus atromaculatus	creek chub	19425
Sphoeroides maculatus	northern puffer	19821
Spirinchus thaleichthys	longfin smelt	19882
Stizostedion canadense	sauger	20194
Stizostedion vitreum	walleye	20196
Thaleichthys pacificus	eulachon	20880
Thymallus arcticus	Arctic grayling	20973
Thymallus sp.	grayling	162015
Tilapia aurea	blue tilapia	21021
Tilapia mossambica	Mozambique tilapia	21029
Tinca tinca	tench	21038
Umbra limi	central mudminnow	21421
Umbridae	mudminnows	21424
Unidentified	fish	168479
Xiphophorus helleri	green swordtail	21770
Xiphophorus sp.	platy	165919

Appendix I. Electrofishing Checklist

Backpack Electrofisher Safety Inspection

Date: _____ Stream: _____

Electrofishing Leader: _____

Crew Members: _____

Manual present? Yes ☐ No ☐

ELECTROFISHER

_____ 1. Controls and gauges operational

_____ 2. Adequate protection of wiring

_____ 3. Adequate connectors and interlocking

_____ 4. Audible tone generator working

_____ 5. "Kill switch" working

_____ 6. Mercury tilt switch working

_____ 7. Anode switch working

_____ 8. Wiring to anode in good condition

_____ 9. Anode in good condition, fastened securely

_____ 10. No screens or nets attached to anode

_____ 11. Cathode in good condition

_____ 12. Cathode clean, fastened securely

_____ 13. Backpack frame in good condition

_____ 14. Quick release buckle of backpack working

PERSONNEL/CREW MEMBERS

_____ 1. Each crew member briefed on unit operation

_____ 2. Recommended three or more crew members present, all CPR certified

_____ 3. Each crew member wearing rubber gloves

_____ 4. Each crew member wearing waders or rubber boots

_____ 5. Safety precautions covered

_____ 6. Local arrangements covered (landowner, Idaho Department of Fish and Game)

BATTERY (if applicable)

_____ 1. Fully charged, gel type cell

_____ 2. Terminals clean and tight

ANCILLARY EQUIPMENT

_____ 1. Nonconductive dip net handle

_____ 2. First-aid kit

_____ 3. Fish holding containers

_____ 4. Fish measuring board

_____ 5. Jars with formalin

_____ 6. Fish labels

_____ 7. Fish field forms

_____ 8. Formalin safety equipment