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ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM-SURFACE WATERS:

WESTERN PILOT STUDY
FIELD OPERATIONS MANUAL FOR
WADEABLE STREAMS

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SECTION 2
OVERVIEW OF FIELD OPERATIONS

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This section presents a general overview of the activities a 4-person field team conducts during a typical one-day sampling visit to a stream site. General guidelines for recording data and using standardized field data forms and sample labels are also presented. Finally, safety and health considerations and guidelines related to field operations are provided.

2.1 DAILY OPERATIONAL SCENARIO

The field team is divided into two groups, termed the "Geomorphs" and the "Biomorphs", that reflect their initial responsibilities more than their expertise. The geomorphs are primarily responsible for conducting the intensive physical habitat characterization. The biomorphs are primarily responsible for collecting biological samples. Table 2-1 provides the estimated time required to conduct various field activities. Figure 2-1 presents one scenario of the general sequence of activities conducted at each stream reach. For some wide, shallow streams, the required reach length and/or the larger area requiring sampling effort may necessitate two days be allocated for completing all required activities.

Upon arrival at a stream site, the geomorphs are responsible for verifying and documenting the site location, determining the length of stream reach to be sampled, and establishing the required transects (Section 4). The biomorphs collect samples and field measurements for water chemistry (Section 5) and determine stream discharge (Section 6). The biomorphs also collect periphyton and benthos samples (Sections 8 and 11, respectively). The geomorphs conduct the intensive physical habitat characterization (Section 7).

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TABLE 2-1. ESTIMATED TIMES AND DIVISION OF LABOR FOR FIELD ACTIVITIES

Activity	Group	Est. Time Required
Site verification and establishing sampling reach and transects	Geomorphs (2 persons)	2 hr
Water chemistry sampling and stream discharge determination	Biomorphs (2 persons)	1 hr
Collecting and processing benthos and periphyton samples	Biomorphs (2 persons)	3 hr
Intensive physical habitat characterization, including legacy tree identification and presence of invasive plant taxa	Geomorphs (2 persons)	2 to 3 hr
Aquatic vertebrate sampling and processing	Geomorphs and Biomorphs (4 persons)	2 to 5 hr
Rapid habitat assessment Visual stream assessment	Biomorphs (2 persons)	0.5 hr
Sample tracking and packing	Geomorphs (2 persons)	1 hr
SUMMARY	28 to 32 person-hours	7 to 8 hrs per team[a]

[a] For wider wadeable streams (e.g., > 20 m, it may require more than 1 day to complete all required activities.

Both groups are involved with collecting aquatic vertebrates (Section 12) and preparing fish samples for analysis of toxic contaminants (Section 13). Finally, the biomorphs conduct a habitat characterization based on the Rapid Bioassessment Protocols (RBP; Plafkin et al., 1989; Barbour et al., 1999) and a visual stream assessment (Section 14), while the geomorphs prepare samples for transport and shipment (Section 3).

2.2 GUIDELINES FOR RECORDING DATA AND INFORMATION

During the one-day visit to a stream, a field team is required to obtain and record a substantial amount of data and other information for all of the various ecological indicators described in Section 1.3. In addition, all the associated information for each sample collected must be recorded on labels and field data forms to ensure accurate tracking and subsequent linkage of other data with the results of sample analyses.

The field data forms to be used for the Western Pilot Study are designed to be compatible with an optical scanner system to allow rapid conversion of the printed form into

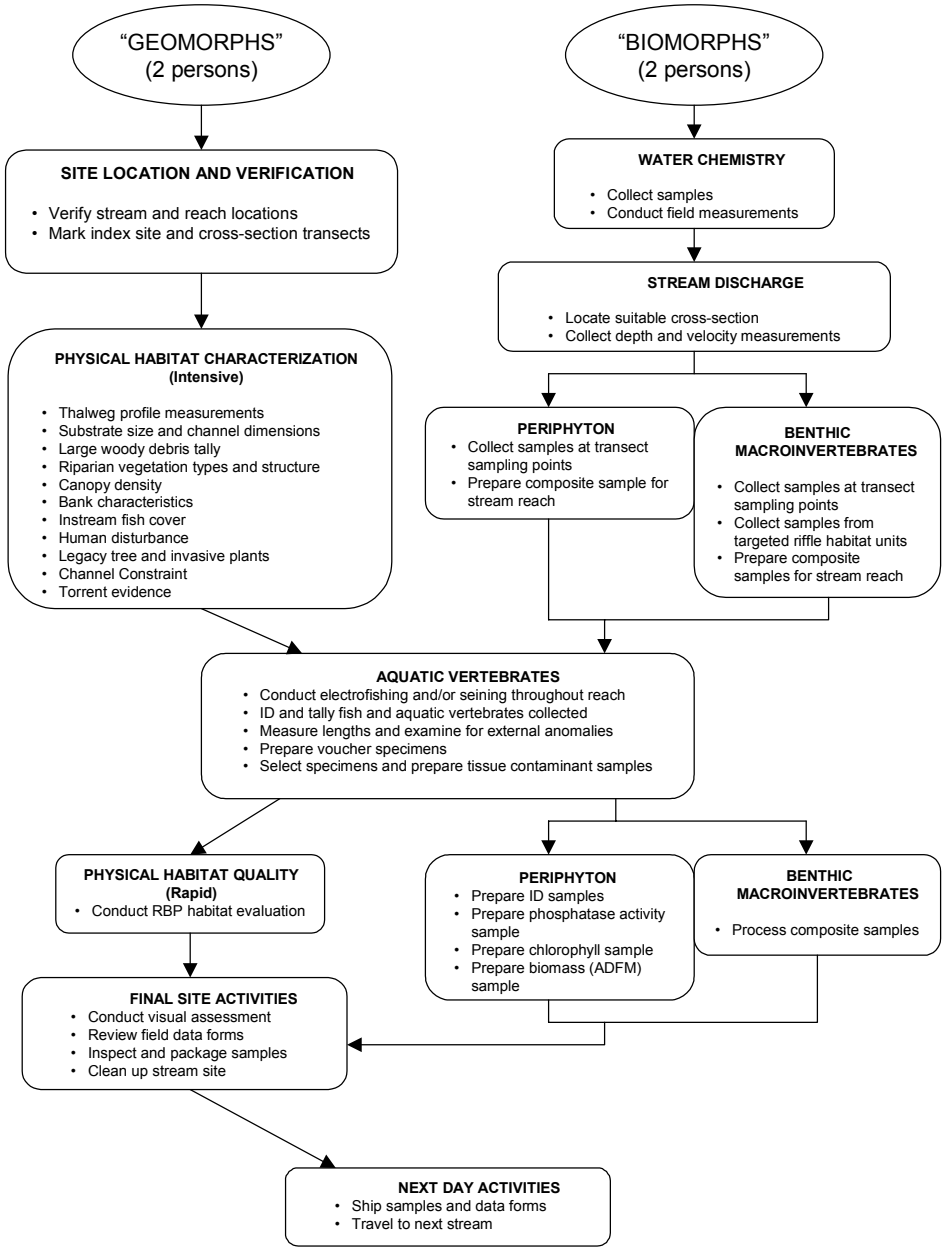


Figure 2-1. General sequence of stream sampling activities (modified from Chaloud and Peck, 1994).

one or more electronic files and reduce the need for manual data entry. While these forms should facilitate data recording by the field crew, it is imperative that field and sample information be recorded accurately, consistently, and legibly. Measurement data that cannot be accurately interpreted by others besides the field teams, and/or samples with incorrect or illegible information associated with them, are lost to the program. The cost of a sampling visit coupled with the short index period severely limits the ability to re-sample a stream because the initial information recorded was inaccurate or illegible. Some guidelines to assist field personnel with recording information are presented in Table 2-2. Examples of completed data forms and labels are presented in the sections describing field sampling and measurement procedures for different indicators, and a complete set of blank field data forms are included as Appendix C.

2.3 SAFETY AND HEALTH

Collection and analysis of samples (e.g., benthic invertebrates, fish, periphyton, sediment) can involve significant risks to personal safety and health (drowning, electrical shock, pathogens, etc.). While safety is often not considered an integral part of field sampling routines, personnel must be aware of unsafe working conditions, hazards connected with the operation of sampling gear, boats, and other risks (Berry et al., 1983). Personnel safety and health are of the highest priority for all investigative activities and must be emphasized in safety and health plans for field, laboratory, and materials handling operations. Preventive safety measures and emergency actions must be emphasized. Management should assign health and safety responsibilities and establish a program for training in safety, accident reporting, and medical and first aid treatment. Safety documents and standard operating procedures (SOPs) containing necessary and specific safety precautions should be available to all field personnel. Additional sources of information regarding field and laboratory safety related to biomonitoring studies include Berry et al. (1983), U.S. EPA (1986) and Ohio EPA (1990).

2.3.1 General Considerations

Important considerations related to field safety are presented in Table 2-3. It is the responsibility of the group safety officer or project leader to ensure that the necessary safety courses are taken by all field personnel and that all safety policies and procedures are followed. Sources of information regarding safety-related training include the American Red Cross (1989), the National Institute for Occupational Safety and Health (1981), U.S. Coast Guard (1987) and Ohio EPA (1990).

TABLE 2-2. GUIDELINES FOR RECORDING FIELD DATA AND OTHER INFORMATION

Field Measurements:

Data Recording:

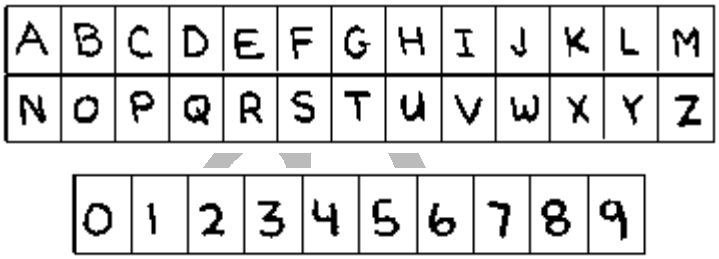
Record measurement values and/or observations on data forms preprinted on water-resistant paper.

Headers on the second pages of all forms link the data. Fill in all headers of all pages or data will be lost or linked to the wrong site record(this is a good one to review at the end of the day).

NEVER EVER mark on or around the cornerblocks or ID Box (the squares in the corners and the funky box with the number over it.) These markings are crucial to the scanning software and changing them in any way will affect performance.

Write legibly. Use a dark pencil lead that is at least a No. 2 for softness (HB), or use a dark pen. Your writing must be dark enough to be picked up by the scanner. Erase mistakes completely and write the correct value whenever you can. If you must line out an incorrect value, place the correct value nearby in the appropriate box so the data entry operator can easily find it.

Use all caps when filling in the name fields on the forms. Clearly distinguish letters from numbers (e.g., 0 versus O, 2 versus Z, 7 versus T or F, etc.). Do not put lines through 7's, 0's, or Z's. Do not use slashes. Below Here are examples of lettering that are readable by the scanning software:



It is not necessary to write in all caps in the long comments sections on the Stream Verification and Stream Assessment forms, but write legibly (because the data entry operators still need to read it to type it in.) Avoid marginal notes, etc. Be concise, but avoid using abbreviations and/or "shorthand" notations. If you run out of space, attach a sheet of paper with the additional information, rather than trying to squeeze everything into the space provided on the form.

When you need to circle a choice, make a medium-sized circle around your choice.

(Yes) No 1 (2) 3 4

(continued)

TABLE 2-2 (continued)

Record data and information so that all entries are obvious. Enter data completely in every field that you use. Follow the "comb" guidelines--print each number or letter in the individual space provided. Keep letters and numerals from overlapping. Record data to the number of decimal places provided on the forms. Illegible information is equivalent to no information.

If the measurement for a field is zero, enter zero. If left blank, it will be recorded as missing data. (There are parts of forms that are left blank when they are not being used. A typical example is page two of the field measurement form. Usually only one type of velocity and discharge information is taken and the unused areas of the form are left blank).

If the field calls for meters, write the answer in meters. Do not fill in a number and put (cm) for units. The same goes for adding decimal places (we just end up doing the rounding for you. If you have a negative reading for velocity on the Stream Discharge section, write the number and flag it as negative in the comments section.

	Dist. from Bank	Velocity	Depth	Flag
1	0	0	0	
2	10	0.1	0.6	F1
3	20	0.8	1.0	
4	30	1.3	1.3	

F1 Stream velocity negative

Record information on each line, even if it has to be recorded repeatedly on a series of lines (e.g., fish names or species codes, physical habitat characteristics). "Ditto" marks (") can be used if necessary and if they are clearly distinguishable from letters or numbers. DO NOT USE a straight vertical line to indicate repeated entries.

Data Qualifiers (Flags):

Use only defined flag codes from the list below and record on data form in appropriate field. If the information is important enough to write on the page, use an "Fn" flag and put it in the comment section. If you have been instructed to collect a piece of information for which there is no space on the form, choose a flag and comment section, and use them consistently.

FLAG	COMMENT
F1, F2, etc.	Miscellaneous comments assigned by Field crew (e.g. Fish dead)
K	Sample not collected; No measurement or observation made
U	Suspect sample, measurement or observation
Q	Unacceptable QC check associated with measurement
Z	Last station sampled before next transect

(continued)

TABLE 2-2 (continued)

If you cannot take a measurement, leave the measurement field blank and put the K flag in the Flag column.

	Dist. from Bank	Velocity	Depth	Flag
1	0	0	0	
2	10	0.1	0.6	F1
3	20	0.8	1.0	
4	30		1.3	K

F1 Stream velocity negative

Review of Data Forms:

Have someone who did not fill in the forms review them at the end of the day. Some information is duplicated. Sometimes, however, when one measurement is missing, as many as 100 other metrics based on that measurement are lost. Be thorough.

Example: Site_ID
Visit Date
Missing Data
Increment (on the back of the Thalweg form)

Returning the Forms

Return the originals
If you want a copy of the data, make a Xerox and keep it.
Try to keep the forms in their original order.
Do not staple the forms together.

Include a list of sites visited. Please include a list with Site ID and Visit Date for forms being returned.

Sample Labels and Tracking

Sample Labels:

Sample Labels– Use adhesive labels with preprinted ID numbers and a standard recording format for each type of sample.

Record information on labels using a fine-point indelible marker. Cover completed labels with clear tape.

(continued)

TABLE 2-2 (continued)

Sample Tracking Information:

Record sample ID number from the label and associated collection information on sample collection form. Use a dark pencil or pen.

Complete any sample tracking forms required. Include tracking forms with all sample shipments.

Sample Qualifiers (Flags):

Use only defined flag codes and record on sample collection form in appropriate field.

- K Sample not collected or lost before shipment; re-sampling not possible.
- U Suspect sample (e.g., possible contamination, does not meet minimum acceptability requirements, or collected using a nonstandard procedure)
- F*n* Miscellaneous flags (*n*=1, 2, etc.) assigned by a field team for a particular sample shipment.

Explain all flags in comments section on sample collection form.

Review of Labels and Collection Forms:

The field team compares information recorded on labels, sample collection forms, and tracking forms for accuracy before leaving a stream. Make sure Sample ID numbers match on all forms.

Persons using sampling devices should become familiar with the hazards involved and establish appropriate safety practices prior to using them. Individuals involved in electrofishing must be trained by a person experienced in this method or by attending a certified electrofishing training course. Reynolds (1983) and Ohio EPA (1990) provide additional information regarding electrofishing safety procedures and practices.

If boats are used to access sampling sites, personnel must consider and prepare for hazards associated with the operation of motor vehicles, boats, winches, tools, and other incidental equipment. Boat operators should be familiar with U.S. Coast Guard rules and regulations for safe boating contained in a pamphlet, "*Federal Requirements for Recreational Boats*, " available from a local U.S. Coast Guard Director or Auxiliary or State Boating Official (U.S. Coast Guard, 1987). All boats with motors must have fire extinguishers, boat horns, life jackets or flotation cushions, and flares or communication devices.

TABLE 2-3. GENERAL HEALTH AND SAFETY CONSIDERATIONS

Training:

- First aid
- Cardiopulmonary resuscitation (CPR)
- Vehicle safety (e.g., operation of 4-wheel drive vehicles)
- Boating and water safety (if boats are required to access sites)
- Field safety (e.g., weather conditions, personal safety, orienteering, reconnaissance of sites prior to sampling
- Equipment design, operation, and maintenance
- Electrofishing safety
- Handling of chemicals and other hazardous materials

Communications

- Check-in schedule
- Sampling itinerary (vehicle used and its description, time of departure, travel route, estimated time of return)
- Contacts for police, ambulance, fire departments, search and rescue personnel
- Emergency services available near each sampling site and base location

Personal Safety

- Field clothing and other protective gear
- Medical and personal information (allergies, personal health conditions)
- Personal contacts (family, telephone numbers, etc.)
- Physical exams and immunizations

A communications plan to address safety and emergency situations is essential. All field personnel need to be fully aware of all lines of communication. Field personnel should have a daily check-in procedure for safety. An emergency communications plan should include contacts for police, ambulance, fire departments, and search and rescue personnel.

Proper field clothing should be worn to prevent hypothermia, heat exhaustion, sunstroke, drowning, or other dangers. Field personnel should be able to swim. Chest waders made of rubberized or neoprene material and suitable footwear must always be worn with a belt to prevent them from filling with water in case of a fall. The use of a life jacket is advisable at dangerous wading stations if one is not a strong swimmer because of the possibility of sliding into deep water.

Many hazards lie out of sight in the bottoms of lakes, rivers and streams. Broken glass or sharp pieces of metal embedded in the substrate can cause serious injury if care is not exercised when walking or working with the hands in such environments. Infectious agents and toxic substances that can be absorbed through the skin or inhaled may also be present in the water or sediment. Personnel who may be exposed to water known or suspected to contain human or animal wastes that carry causative agents or pathogens must be immunized against tetanus, hepatitis, typhoid fever, and polio. Biological wastes can also be a threat in the form of viruses, bacteria, rickettsia, fungi, or parasites.

Prior to a sampling trip, personnel should determine that all necessary equipment is in safe working condition. Good housekeeping practice should be followed in the field. These practices protect staff from injury, prevent or reduce exposure to hazardous or toxic substances, and prevent damage to equipment and subsequent down time and/or loss of valid data.

2.3.2 Safety Equipment and Facilities

Appropriate safety apparel such as waders, lab coats, gloves, safety glasses, etc. must be available and used when necessary. Bright colored caps (e.g., orange) must be available and worn during field activities. First aid kits, fire extinguishers, and blankets must be readily available in the field. A properly installed and operating fume hood must be provided in the laboratory for use when working with carcinogenic chemicals (e.g., formaldehyde, formalin) that may produce dangerous fumes. Cellular telephones or portable radios should be provided to field teams working in remote areas for use in case of an emergency. Facilities and supplies must be available for cleaning of exposed body parts that may have been contaminated by pollutants in the water. Soap and an adequate supply of clean water or ethyl alcohol, or equivalent, should be suitable for this purpose.

2.3.3 Safety Guidelines for Field Operations

General safety guidelines for field operations are presented in Table 2-4. Personnel participating in field activities on a regular or infrequent basis should be in sound physical condition and have a physical exam annually or in accordance with Regional, State, or organizational requirements. All surface waters and sediments should be considered potential health hazards due to toxic substances or pathogens. Persons must become familiar with the health hazards associated with using chemical fixing and/or preserving agents. Formaldehyde (or formalin) is highly allergenic, toxic, and dangerous to human

TABLE 2-4. GENERAL SAFETY GUIDELINES FOR FIELD OPERATIONS

- Two persons (three to four persons for electrofishing) must be present during all sample collection activities, and no one should be left alone while in the field.
- Exposure to stream water and sediments should be minimized as much as possible. Use gloves if necessary, and clean exposed body parts as soon as possible after contact.
- All electrical equipment must bear the approval seal of Underwriters Laboratories and must be properly grounded to protect against electric shock.
- Use heavy gloves when hands are used to agitate the substrate during collection of benthic macroinvertebrate samples and when turning over rocks during hand picking.
- Use appropriate protective equipment (e.g., gloves, safety glasses) when handling and using hazardous chemicals
- Persons working in areas where poisonous snakes may be encountered must check with the local Drug and Poison Control Center for recommendations on what should be done in case of a bite from a poisonous snake.

  If local advice is not available and medical assistance is more than an hour away, carry a snake bite kit and be familiar with its use.
- Any person allergic to bee stings, other insect bites, or plants must take proper precautions and have any needed medications handy.
- Field personnel should also protect themselves against the bite of deer or wood ticks because of the potential risk of acquiring pathogens that cause Rocky Mountain spotted fever and Lyme disease.
- All field personnel should be familiar with the symptoms of hypothermia and know what to do in case symptoms occur. Hypothermia can kill a person at temperatures much above freezing (up to 10°C or 50°F) if he or she is exposed to wind or becomes wet.
- Handle and dispose of chemical wastes properly. Do not dispose any chemicals in the field.

health (carcinogenic) if utilized improperly. Chemical wastes can cause various hazards due to flammability, explosiveness, toxicity, causticity, or chemical reactivity. All chemical wastes must be discarded according to standardized health and hazards procedures (e.g., National Institute for Occupational Safety and Health [1981]; U.S. EPA [1986]).

During the course of field research activities, field teams may observe violations of environmental regulations, may discover improperly disposed hazardous materials, or may observe or be involved with an accidental spill or release of hazardous materials. In such

cases it is important that the proper actions be taken and that field personnel do not expose themselves to something harmful. The following guidelines should be applied:

- First and foremost during any environmental incident, it is extremely important to protect the health and safety of all personnel. Take any necessary steps to avoid injury or exposure to hazardous materials. If you have been trained to take action such as cleaning up a minor fuel spill during fueling of a boat do it. However, you should always error on the side of personal safety

- Field personnel should never disturb, or even worse, retrieve improperly disposed hazardous materials from the field and bring them back to a facility for "disposal". To do so may worsen the impact to the area of the incident, may incur personal liability, may incur liability for the team members and their respective organizations, may cause personal injury, or my cause unbudgeted expenditure of time and money for proper treatment and disposal of the material. However, it is important not to ignore environmental incidents. There is a requirement to notify the proper authorities of any incident of this type. The appropriate authorities may then take the necessary actions to properly respond to the incident.

- For most environmental incidents, the following emergency telephone numbers should be provided to all field teams: State or Tribal department of environmental quality or protection, U.S. Coast Guard, and the U.S. EPA regional office. In the event of a major environmental incident, the National Response Center may need to be notified at 1-800-424-8802.

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