Aquatic Inventories Project:

Methods for Stream Habitat Surveys

Conservation and Recovery Program
Oregon Department of Fish and Wildlife

2008

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INTRODUCTION

The Aquatic Inventories Project is designed to provide quantitative information on habitat condition for streams throughout Oregon. This information is used to provide basic information for biologists and land managers, to establish monitoring programs, and to direct or focus habitat restoration efforts.

Development of an Aquatic Inventories Project began within the Oregon Department of Fish and Wildlife (ODFW) in 1989 with sponsorship by the Restoration and Enhancement Program. Drafting of stream survey methods and implementation of field work began in 1990. The conceptual background for this work came from the experience of project staff and from interactions with Oregon State University, forest industry, and USFS PNW research scientists (Bisson et al. 1982, Grant 1986, Everest et al. 1987, Hankin and Reeves 1988, Moore and Gregory 1989, and Gregory et al. 1991). Significant contributions and review of these methods were provided by ODFW research staff, and from consultation with ODFW and United States Forest Service (USFS) biologists working on similar programs. Members of the Umpqua Basin Fisheries Restoration Initiative and the Oregon Forest Industry Council have provided additional review and consultation.

This methodology was designed to be compatible with other stream habitat inventories and classification systems (i.e., Rosgen 1985, Frissell et al. 1986, Cupp 1989, Ralph 1989, USFS Region 6 Level II Inventory 1992, and Hawkins et al. 1993). This compatibility is achieved by systematically identifying and quantifying valley and stream geomorphic features. The resulting matrix of measurements and spatial relationships can then be generalized into frequently occurring valley and channel types or translated into the nomenclature of a particular system. For example, information summarized at the reach level (valley width, channel type, slope, terrace height and width, sinuosity, width, depth, substrate, eroding banks, etc.) can be used to characterize the stream into one of the types described by Rosgen (1985) or to match the parameters collected in other quantitative (USFS) or historic (U.S. Bureau of Fisheries) surveys.

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The process of conducting a stream survey involves collection of general information from maps and other sources and the direct observation of stream characteristics in the field. This information is both collected and analyzed based on a hierarchical system of regions, basins, streams, reaches, and habitat units. Supervisors are responsible for collecting the general information on regions and basins and for directing the activities of the survey crews. Survey teams will collect field data based on stream, reach and channel unit characteristics. Region and basin data will primarily come from ODFW-EPA region and sub region classifications and from map analysis.

The following instructions and definitions provide the outline for these activities and a description of the tasks involved in conducting ODFW's stream habitat inventory.

Each field crew is comprised of two people with each member responsible for specific tasks. The "Estimator" will focus on the identification of channel unit characteristics. The "Numerator" will focus on the counts and relative distribution of several unit attributes and will verify the length and width estimates for a subset of units. The "Estimator" and "Numerator" share the responsibility for describing reach characteristics, riparian conditions, identifying habitat unit types, and for quantifying the amount of large woody debris. Crew members may switch responsibility for estimator or numerator when they start a new stream. They will not, however, switch estimator and numerator jobs on the same stream.

BASIN INFORMATION

Basin information is gathered prior to and during the course of the survey. Some of this information (primarily map work and regional classification) must be collected in the office. Most of this information is not the responsibility of the field crews. However, relevant comments by the survey crews should be included in their Field Books and on the Data Sheets. These summaries are used to group and classify streams and to provide general information for the final stream reports.

1. Basin name. Use the name of the large river commonly used to describe a region. For example, use McKenzie R for Lookout CR, not Willamette or Columbia.

2. Stream name. Use a standardized system of the name followed by descriptors of forks etc. Examples: Alsea R, Drift CR, Lobster CR, E FK. Spell out descriptive or non-standard types such as Branch, Slough, or Swale. Spell out compass direction only for larger streams and when the usage is common, such as North Umpqua. Use the same name format on all data sheets.

3. Stream order, drainage area, and drainage density of the study stream. Determined from blue line tributaries (perennial and intermittent) shown on U.S.G.S. 7.5 minute topographic maps.

4. Elevation (m) at the confluence with the receiving channel and at the end of the survey (this can be obtained from the GPS unit when there is adequate satellite coverage).

5. ODFW-EPA Regions and Sub regions, geology, and soils of the basin.

6. Stream Flow. Identify the location of USGS or other gauging stations. The location and stage height at any gauging station, marked bridge, or staff gauge will also be recorded during the survey.

7. General community structure and size composition of riparian vegetation. Identified by separate census or sample in each basin.

8. Description of fish species and stocks present, management concerns, and linkage to other databases or research projects.

9. Flow Regulation: Description of existing or proposed dams and diversions influencing the basin and segment.

10. General description of land use and ownership in the basin (e.g. managed timber, rural residential, agricultural, livestock grazing).

11. Contacts. Names, addresses, and phone numbers of key people to contact with respect to survey. Include ODFW district biologists, interested private individuals, landowners contacted for access, etc.

EQUIPMENT

1. Maps - 7.5 minute quad (1:24,000 scale) USGS topographic maps of the stream and basin. Road map coverage by county or fire district. Oregon Atlas and Gazetteer (Delorme Mapping).

2. Recording Materials - Waterproof field book, survey forms for each portion of the survey, waterproof paper, PDA, and pencils.

3. Clothes - Neoprene chest waders, wading shoes, and/or hip boots (non-slip soles of felt, studded “corkers”, outdoor carpet or similar material is advised), rainwear, snag and thorn-proof clothing appropriate for the weather.

4. Survey equipment - Two-meter-long staff (marked in meters and tenths), compass, 50 meter fiberglass measuring tape, day pack, polarized glasses, thermometers, clinometer, clipboard, vest, flagging, permanent markers, digital camera, GPS unit, and range finder.

5. Safety gear – first aid kit, poison oak pretreatment, head lamp, cb radio, and cellular phone

See equipment page in appendix for a more complete description of survey equipment.

MAP WORK

Do not go into the field without a topographic map! Data that cannot be linked to the maps are essentially useless. Use the maps to orient to the stream and to identify the location of reach changes, named tributaries, roads, and bridge crossings. Mark all reach changes and important features on the map. Write the channel unit number on the map at the place that corresponds to the location of named tributary junctions, bridges, and other landmarks. Clearly mark where you start and end the survey.

A good correspondence between landmarks on the map and the data collected is an essential part of our survey effort. Information from the surveys will be utilized and integrated with Geographic Information System (GIS) analysis. Well documented and accurate maps are required for this process. In addition to a well marked map, it is essential that the habitat survey follow the USGS named stream on the topo map, regardless of the amount of flow.

An example of field entries on a topographic map is in the appendix (Page 32).

If using a GPS unit, record the Easting and Northing UTM coordinates at the beginning of the survey, at all reach changes, at riparian transects, and at the end of all surveys. Also, make a note as to what coverage is obtained (2D or 3D). If 3D coverage is acquired, record the elevation in the notes. When reading the numbers from your GPS unit, the top number is the **Easting coordinate** and corresponds to small numbers along the top of your USGS quad map. The bottom number is the **Northing coordinate** and corresponds to similar numbers along the side of your USGS map. Your location should be where a vertical line from the Easting mark and a horizontal line from the Northing mark intersect. Mark your location on the topographic map if you acquire 3D coverage.

FIELD BOOK

This is a very important piece data collection feature and should have daily entries.

Maintain a succinct log of your activities in the field book. Each day, record the date and name of the stream where you worked. Enter the approximate distance covered and number of hours spent working on the stream. Keep track of your travel time separately.

Record relevant details about access to the stream, contact people from cooperating industry or agency groups, and people you contact to gain permission to survey. Record the names and phone numbers of people you may contact as you complete the survey.

Write a paragraph or so of general description for sections of each stream in the field book or on a separate stream report form. Pay particular attention to descriptions of the riparian zone, additional details concerning land use, or factors that influence the fish populations. This is the appropriate place to express your opinions. Other comments, sketches of complex features, suggestions, complaints, etc. are often useful.

PHOTOGRAPHS

A good photographic record of the stream survey provides additional information and documentation. Take pictures that typify reach changes, riparian zones, and other stream characteristics as described in the following sections of these instructions. Be sure that the date-back feature of the camera is functioning correctly and to turn off the flash. For each picture, record the channel unit number, date, time, and a description of the subject on the Photo Record and Unit sheets.

DATA SHEETS: REACH, UNIT-1, UNIT-2, WOOD, and RIPARIAN

REACH FORM

A reach is a length of stream defined by some functional characteristic. A reach may be simply the distance surveyed. More frequently, reaches are defined as: stream segments between named tributaries, changes in valley and channel form, major changes in vegetation type, or changes in land use or ownership.

Enter a new line on the reach data sheet at any significant change in any one of the reach variables (valley type, channel form, adjacent landform, valley width index, vegetation, or land use) *and/or* at the confluence with tributaries named on 7.5 minute topographic maps. When a new reach is identified by a named tributary, write the name in the Reach Note column. Also describe a new reach if an unnamed tributary contributes significant flow (approx. 15-20% of the total). Do not invent names for unnamed tributaries, instead identify them as Trib. 1, Trib. 2, etc. and record them on the data sheet and the map.

Changes in reach characteristics are used to verify survey location and to identify reach and stream segments within our basin classification system. Circle the variable that resulted in the new reach entry.

Flagging is used to mark specific points during a survey. Hang a strip of plastic flagging at the start, at each reach change, and at the end of the survey. Mark the flagging with the unit number, unit type, date, and "ODFW-AQ.-INV.". These flags will be used to locate specific reaches and units for fish sampling and to link units and locations for repeat habitat surveys. Randomly selected stream segments will be selected for repeat surveys during the field season. Results will be compared to check on variability between crews and for habitat changes at different stream flow.

The following sequence corresponds to the listing of variables on the data sheet:

1. **Date.**

2. **Reach.** The numbered sequence of reaches as they are encountered. Each reach is comprised of variable number of channel units.

3. **Unit Number.** Sequence number of the first unit recorded.

4. **Channel Form.** Determined by the morphology of the active channel, hill slopes, terraces, and flood plains. Identify the channel form and enter the appropriate two-letter code in this column.

Refer to Valley and Channel Classification in the appendix for definitions, allowable combinations, and examples.

First look at the ratio of the active channel width to the valley width to determine the **Valley Width Index** (see pg. 7, # 6). This ratio determines if you are in a broad or narrow valley floor type. If the VWI is 2.5 or less you have a narrow valley type and if the VWI is greater than 2.5 you have a broad valley type.

Next, look at the types of land forms adjacent to the stream channel to characterize and complete your classification.

The channel is constrained when adjacent landforms restrict the lateral movement of the channel. In constrained channels, stream flows associated with all but the largest flood events are confined to the existing channel configuration.

- Narrow Valley Floor Types (VWI ≤ 2.5)---Always constrained, defined by the characteristics of the constraining feature.

  CB **C**onstrained by **B**edrock (bedrock dominated gorge)
  CH **C**onstrained by **H**ill slope
  CF **C**onstrained by alluvial **F**an

- Broad Valley Floor Types (VWI > 2.5)---The valley is several times wider than the active channel. The channel, however, may be either unconstrained or constrained depending on the height and configuration of the adjacent landforms.

1. Unconstrained Channel (terrace height is less than the flood prone height* and the floodprone width* is > than 2.5X active channel width). Low terraces, overflow channels, and flood plains are adjacent to the active channel.

   US **U**nconstrained-predominantly **S**ingle channel.
   UA **U**nconstrained-**A**nastomosing (several complex, interconnecting channels)
   UB **U**nconstrained-**B**raided channel (numerous, small channels often flowing over alluvial deposits)

2. Constrained Channel (terrace height is greater than the flood prone height*). Adjacent landforms (terraces, hillslopes) are not part of the active flood plain.

   CT **C**onstraining **T**erraces. (terrace height > floodprone height and floodprone width < 2.5 X active channel width).
   CA **C**onstrained by **A**lternating terraces and hill slopes. Same rule for terrace height but the channel may meander across the valley floor. The stream channel is confined by contact with hill slopes and high terraces.
   CL **C**onstrained by **L**and use (road, dike, landfill)

* See page 20 for floodprone height and width definitions.

5. **Valley Form.** General description of the valley cross section with emphasis on the configuration of the valley floor. Divided into types with a narrow valley floor (valley floor width (VWI) ≤ 2.5 times stream active channel width (ACW) and types with a broad valley floor (VWI > 2.5 times ACW).

<u>Narrow Valley Floor (VWI < or = 2.5) – see page 33 for examples:</u>

SV **S**teep **V**-Shaped valley or bedrock gorge (side slopes $\geq 60^o$).
MV **M**oderate **V**-Shaped valley (side slopes > 30^o, <60^o).
OV **O**pen **V**-Shaped valley (side slopes $\leq 30^o$).

On rare occasions where you might encounter a different classification on each side of the stream, record only one on the reach sheet and make a note of the other in the note column .

<u>Broad Valley Floor (VWI > 2.5) – see page 33 for examples:</u>

CT **C**onstraining **T**erraces. Terraces typically high and close to the active channel. Terrace surface is unlikely to receive flood flows and lacks water dependent (hydrophilic) vegetation.
MT **M**ultiple **T**erraces. Surfaces with varying height and distance from the channel. High terraces may be present but they are a sufficient distance from the channel that they have little impact.
WF **W**ide-Active **F**lood plain. Significant portion of valley floor influenced by annual floods, and has water dependent vegetation (mesic meadow). Any terraces present do not impinge on the lateral movement and expansion of the channel.

Valley Form and Channel Form are related and can only occur in certain combinations. Possible combinations are shown on page 31, Table 1.

6. **Valley Width Index.** Ratio of the width of the active stream channel to the width of the valley floor. The Valley Width Index (VWI) is <u>estimated</u> for the reach by dividing the average *active channel width* into the average *valley floor width* (see diagram on page 20). The VWI is also entered on UNIT 1 sheet when the channel metric measurements are conducted (see pages 19 and 20).

Do not start a new reach for minor changes in valley width index. However, always start a new reach when the channel changes from VWI < 2.5 to VWI > 2.5; or VWI > 5.

When the valley width changes repeatedly within a short distance, select an average value for the VWI. For example, when the valley floor gradually widens from a hillslope constrained reach to a broad valley reach, make one reach change, <u>not</u> new reach designations every few channel units.

It is possible to have an unconstrained channel but a VWI of 1. This may occur in some meadow reaches and other *situations where the multiple channels and the floodplain spread across the entire valley floor.*

Observations of valley floor surfaces and characteristics can be done as part of the riparian vegetation survey. Getting out of the stream channel will help you to accurately estimate VWI, identify floodplain and terrace surfaces, and to classify reach types.

7. **Streamside Vegetation (Veg Class).** A two-letter code based on the composition of riparian zone vegetation. Generally, we consider the vegetation observed in the area within one active channel width of either side of the channel to represent the riparian zone. The first letter of the code identifies the plant community. The second part of the code will refer to the size of trees within identified dbh classes. <u>Do not</u> enter a size or age class for shrubs, brush, or grasses.

Example: riparian zone with 15-30 cm diameter alder = D15.

Separate entries are made for the dominant and subdominant plant communities as estimated from crown density. (Note: In some instances grass can be the dominant plant taxa).

Example: C30 (dominant) and G (subdominant) in ponderosa pine/grass communities.

Vegetation Type:

N	**N**o Vegetation (bare soil, rock)
B	Sage**B**rush (sagebrush, greasewood, rabbit brush, etc.)
G	Annual **G**rasses, herbs, and forbs.
P	**P**erennial grasses, sedges, rushes, and ferns
S	**S**hrubs (willow, salmonberry, some alder)
D	**D**eciduous Dominated (canopy more than 70% alder, cottonwood, big leaf maple, or other deciduous spp.)
M	**M**ixed conifer/deciduous (approx. a 50:50 distribution)
C	**C**oniferous Dominated (canopy more than 70% conifer)

Size Class. Use groupings for the estimated diameter at breast height (dbh) expressed in <u>centimeters</u> of the dominant trees. Estimate diameter of young conifers below the first whorl of branches. Enter the first number (in bold, below) of your choice, ex. C30.

1- 3	Seedlings and new plantings.
3-15	Young established trees or saplings.
15-30	Typical sizes for second growth stands. West side communities may have fully closed canopy at this stage.
30-50	Large trees in established stands.
50-90	Mature timber. Developing understory of trees and shrubs.
90+	Old growth. Very large trees, nearly always conifers. Plant community likely to include a combination of big trees, snags, down woody debris, and a multi-layered canopy.

These size classes correspond to dbh estimated in inches of: <1, 1-5, 6-11, 12-20, 21-35, and 36+ respectively.

8. **Land Use.** Determined from observations of terraces and hill slopes beyond the riparian zone. Code subdominant land use where appropriate. Separate entries for the dominant and subdominant land uses (i.e. PT (dominant) and HG (subdominant) = **P**artial cut **T**imber and **H**eavy **G**razing). If a code listed below does not adequately describe a land use, use the most appropriate and make a note. DO NOT make up new codes.

AG	**AG**ricultural crop or dairy land.
TH	**T**imber **H**arvest. Active timber management including tree felling, logging, etc. Not yet replanted.
YT	**Y**oung Forest **T**rees. Can range from recently planted harvest units to stands with trees up to 15 cm dbh.
ST	**S**econd growth **T**imber. Trees 15-30 cm dbh in generally dense, rapidly growing, uniform stands.
LT	**L**arge **T**imber (30-50 cm dbh)
MT	**M**ature **T**imber (50-90 cm dbh)
OG	**O**ld **G**rowth Forest. Many trees with 90+ cm dbh and plant community with old growth characteristics.
PT	**P**artial cut **T**imber. Selection cut or shelterwood cut with partial removal of large trees. Combination of stumps and standing timber. If only a few live trees or snags in the unit, describe in note column.
FF	**F**orest **F**ire. Evidence of recent charring and tree mortality.
BK	**B**ug **K**ill. Eastside forests with > 60% mortality from pests and diseases. Enter bug kill as a comment on the unit sheet when it is observed in small patches.
LG	**L**ight **G**razing Pressure. Grasses, forbs and shrubs present, banks not broken down, animal presence obvious only at limited points such as water crossings. Cow pies evident.
HG	**H**eavy **G**razing Pressure. Broken banks, well established cow paths. Primarily bare earth or early successional stages of grasses and forbs present.
EX	**EX**closure. Fenced area that excludes cattle from a portion of rangeland
GN	**G**ree**N** way. Designated Green Way areas, Parks (city, county, state).
UR	**UR**ban
RR	**R**ural **R**esidential
IN	**In**dustrial
DW	**D**omestic **W**ater supply watershed.
CR	**C**onservation area or wildlife **R**efuge.
GF	**G**ol**F** course.
MI	**MI**ning
WL	**W**et**L**and.
NU	**N**o **U**se identified.
WA	Designated **W**ilderness **A**rea

9. **Water Temperature.** Stream temperature recorded at each reach change or a minimum of once per page of data. Record the time as well. Note if the temperature is measured in ^{o}C or ^{o}F.

   At named tributaries, record the stream temperature of the tributary **and** in the mainstem stream upstream from the confluence of the tributary. Identify and record each temperature in the appropriate line of the Unit 1 Note column.

10. **Stream Flow.** Description of observed discharge condition. Best observed in riffles. If a gauging station is present, be sure to record the stage height.

DR	**DR**y
PD	**P**uddled. Series of isolated pools connected by surface trickle or subsurface flow.
LF	**L**ow **F**low. Surface water flowing across 50 to 75 percent of the active channel surface. Consider general indications of low flow conditions.
MF	**M**oderate **F**low. Surface water flowing across 75 to 90 percent of the active channel surface.
HF	**H**igh **F**low. Stream flowing completely across active channel surface but not at bankfull.
BF	**B**ankfull **F**low. Stream flowing at the upper level of the active channel bank.
FF	**F**lood **F**low. Stream flowing over banks onto low terraces or flood plain.

11. **Location.** Township, range, section and quarter at the start of the reach. Use the following example as the format: T10S-R5W-S22SE.

12. **Photo Number and Time.** Take a photograph that shows the stream <u>and</u> riparian zone at each reach change. Record the exposure number and the time shown on the camera on the reach sheet and the photo record sheet.

13. **Reach Note.** Additional space for comments, names of tributaries, land ownership, and reach start location. Abbreviate by ownership code or use names of forest, timber companies, ranches, etc. when known.

P	**P**rivate
M	**M**unicipal
C	**C**ounty
T	**T**ribal
GN	**G**ree**N**way
FW	Oregon Department of **F**ish and **W**ildlife
BL	**B**ureau of **L**and Management
SF	**S**tate **F**orest
NF	**N**ational **F**orest
US	**US** Fish and Wildlife Service
WA	**W**ilderness **A**rea

14. **Sketch.** Make a sketch of the channel and valley cross section for each reach in one of the boxes provided on the reach form. Identify the reach number in the box. Label and give approximate measurements and dimensions for important features.

15. **Record** GPS UTM coordinates. Note the coverage (2D or 3D) and the elevation.

UNIT-1 FORM

The “Estimator” member of the field crew completes this data sheet.

- Crews work upstream, identifying and characterizing the sequence of habitat units.

- **At tributary junctions:**

  Tributary channel junctions (confluence with a tributary) are identified and surveyed, regardless of flow. Note with comment code on the Unit 2 sheet; record the active channel width and temperature of the tributary in the note column. Refer to the topo map and indicate the trib referencing the unit number into which the tributary flows. At each channel junction, estimate the percent of total flow in each channel.

  Proceed up the named stream on the USGS topographic map regardless of flow. If neither channel is named, proceed up that with the greatest flow.

  Survey the portion of tributaries that flow across the active channel up to the bank full level. Tributary channel units will be numbered and sequenced from the point where the tributary enters the main channel. Be sure to use the proper channel type code. Survey and record a minimum of one unit for each tributary and additional units (if applicable) that would become part of the main channel at bankfull flow.

  A tributary differs from a spring seep because it will have a defined channel. Spring seeps are not surveyed, yet are noted in the notes column.

- **In braided channels:**

  Continue upstream, always taking the channel with the greatest flow, until reaching the unit where the stream again forms a single channel. Backtrack, and then survey the sequence of units in the secondary channel, then the sequence of units in the tertiary channel, etc.

  For particularly complex areas, make a simple sketch in the field book showing the sequence and locations of channel units (type and number).

1. **Reach.** The number of the reach; links unit data to reach data.

2. **Unit.** The sequential number describing the order of channel habitat units. A reach is comprised of many channel units.

3. **Unit Type.**

The concept of a channel habitat unit is the basic level of notation for our survey methodology. We subdivide the stream into two general classes of unit types: channel geomorphic units and special case units.

Channel geomorphic units are relatively homogeneous lengths of the stream that are classified by channel bed form, flow characteristics, and water surface slope. With some exceptions, channel geomorphic units are defined to be at least as long as the active channel is wide. Individual units are formed by the interaction of discharge and sediment load with the channel resistance (roughness characteristics such as bedrock, boulders, and large woody debris). Channel units are defined (in priority order) based on characteristics of (1) bedform, (2) gradient, and (3) substrate.

Special case units describe situations where, because of stream flow level or a road crossing, the usual channel geomorphic unit types do not occur. Special case units include dry or partly dry channels, and culverts.

GEOMORPHIC CHANNEL UNITS

Characteristic water surface slopes are given for each group of habitat unit types. However, channel bed form and flow characteristics are the primary determinant of unit classification. Use the unit's slope to help make determinations when the other characteristics are ambiguous.

POOLS (water surface slope always zero)

PP **P**lunge **P**ool: Formed by scour below a complete or nearly complete channel obstruction (logs, boulders, or bedrock). Substrate is highly variable. Frequently, but not always, shorter than the active channel width.

SP **S**traight scour **P**ool: Formed by mid-channel scour. Generally with a broad scour hole and symmetrical cross section.

LP **L**ateral scour **P**ool: Formed by flow impinging against one stream bank or partial obstruction (logs, root wad, or bedrock). Asymmetrical cross section. Includes corner pools in meandering lowland or valley bottom streams.

TP **T**rench **P**ool: Slow flow with U or V-shaped cross section typically flanked by bedrock walls. Often very long and narrow with at least half of the substrate comprised of bedrock.

DP **D**ammed **P**ool: Water impounded upstream of channel blockage (debris jams, rock landslides).

BP **B**eaver dam **P**ool: Dammed pool formed by beaver activity. In most cases this will be preceded by a SD (step over beaver dam).

SUBUNIT POOLS

Alcoves, backwaters, and isolated pools are types of habitat subunits; generally not as long as the full channel width. They are, however, generally easy to identify and are important habitat types. Subunit pools are formed by eddy scour flow near lateral obstructions. The water surface slope is always zero.

AL **AL**cove: Most protected type of subunit pool. Alcoves are laterally displaced from the general bounds of the active channel. Substrate is typically sand and organic matter. Formed during extreme flow events or by beaver activity; not scoured during typical high flows.

BW **B**ackwater **P**ool: Found along channel margins; created by eddies around obstructions such as boulders, root wads, or woody debris. Part of active channel at most flows; scoured at high flow. Substrate typically sand, gravel, and cobble.

IP **I**solated **P**ool: Pools formed outside the primary wetted channel, but within the active channel. Isolated pools are usually associated with gravel bars and may dry up or be dependent on inter-gravel flow during late summer. Substrate is highly variable. Isolated pool subunits do not include pools of ponded or perched water found in bedrock depressions.

GLIDES

GL **GL**ide: An area with generally uniform depth and flow without surface turbulence. Low gradient; 0-1 % slope. Glides may have some small scour areas but are distinguished from pools by their overall homogeneity and lack of structure. Generally deeper than riffles with few major flow obstructions and low habitat complexity. There is a general lack of consensus regarding the definition of glides (Hawkins et al. 1993).

RIFFLES

RI **RI**ffle: Fast, turbulent, shallow flow over submerged or partially submerged gravel and cobble substrates. Generally broad, uniform cross section. Low gradient; usually 0.5-2.0% slope, rarely up to 6%. Low gradient bedrock is considered a rapid (see Rapids below).

RP **R**iffle with **P**ockets: Same flow and gradient as Riffle but with numerous sub-unit sized pools or pocket water created by scour associated with small boulders, wood, or stream bed dunes and ridges. Sub-unit sized pools comprise 20% or more of the total unit area.

RAPIDS

RB **R**apid with protruding **B**oulders: Swift, turbulent flow including chutes and some hydraulic jumps swirling around boulders. Exposed substrate composed of individual boulders, boulder clusters, and partial bars. Moderate gradient; usually 2.0-4.0% slope, occasionally 7.0-8.0%.

RR **R**apid over Bed**R**ock: Swift, turbulent, "sheeting" flow over smooth bedrock. Sometimes called chutes. Little or no exposed substrate. Moderate to steep gradient; 2.0-30.0% slope. Low gradient bedrock, similar to a riffle, is considered “RR”.

CASCADES

CB **C**ascade over **B**oulders: Much of the exposed substrate composed of boulders organized into clusters, partial bars, or step-pool sequences. Fast, turbulent, flow; many hydraulic jumps, strong chutes, and eddies; 30-80% white water. High gradient; usually 3.5-10.0% slope, sometimes greater.

CR **C**ascade over Bed**R**ock: Same flow characteristics as Cascade over Boulders but structure is derived from sequence of bedrock steps. Slope 3.5% or greater.

STEPS

Steps are abrupt, discrete breaks in channel gradient. Steps are usually much shorter than the channel width. However, they are important, discrete breaks in channel gradient with gradients. Steps can separate sequential units of the same type. For example, small steps (<0.3m high) that separate pools may be important features in very low gradient reaches and should be recorded as individual habitat units. Low steps (<0.3m high) in moderate to high gradient reaches formed by gravel and small cobbles on the face of transverse bars can usually be included in the next fast water unit upstream.

Steps are classified by the type of structure forming the step.

SR **S**tep over Bed**R**ock (include hardpan and clay steps)
SB **S**tep over **B**oulders
SC **S**tep over face of **C**obble bar
SL **S**tep over **L**og(s), branches
SS **S**tep created by **S**tructure (culvert, weir, artificial dams)
SD **S**tep created by Beaver **D**am

⇨ Record the estimated height of the step in the note column and take a picture of any steps that are potential barriers to fish passage. (Note: always record a step height in the note column for the **SS** unit type regardless if a passage problem cannot be determined).

SPECIAL CASE UNIT TYPES

DU **D**ry **U**nit: Dry section of stream separating wetted channel units. Typical examples are riffles with subsurface flow or portions of side channels separated by large isolated pools. Record the length, active channel width (acw), and unit data. Count boulders w/in acw.

PD **P**u**D**dled: Nearly dry channel but with sequence of small isolated pools less than one channel width in length or width. Record all unit data. Record the average wetted width and modal depth. Note the acw and any deep pockets in the NOTE field.

DC **D**ry **C**hannel. Section of the main channel or side channel that is completely dry at time of survey. Record all unit data, use active channel width for width. Count boulders w/in acw. Depth = zero.

Note: For all three special case unit types, break out dry or puddled step unit types that are potential barriers to upstream migration as individual units. Record the height and type as it would appear if wetted (see STEP section above).

CC **C**ulvert **C**rossing. Stream flowing through a culvert. Record all data for metal bottom culverts. However, record the substrate of the surrounding fill material when estimating the composition of substrate material.

- ⇨ *Record the height from the culvert lip to the stream surface (drop), diameter, material, and shape of culvert in the note column. Take a picture of any culvert that is a potential fish barrier. If possible, have a depth staff or person in the photo to reference the step height.*

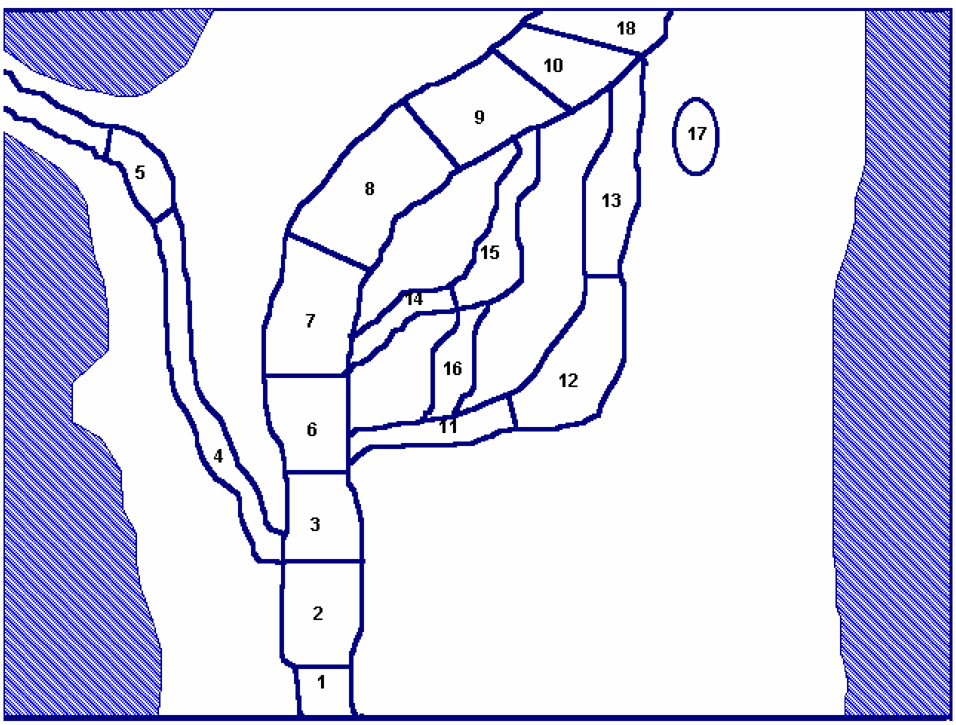
- ⇨ *All Culvert Crossing unit types should have a Step Structure unit type immediately preceding it unless there is <u>absolutely</u> no drop to the water below. If a drop exists, record a step height in the note column regardless of the height. Write “no drop” in the note column if a drop does not exist.*

4. **Channel Type.** Channel ordering code based on channel by size and location. Orders the sequence of single, multiple, and side channels.

00 No Multiple Channels (all flow in one channel)
01 Primary Channel (of multiple channel reach or in the unit where a tributary enters the channel)
02 Secondary Channel (of multiple channel reach)
03 Tertiary Channel (of multiple channel reach)
Continue pattern for 04, 05, 06 level channels.

10 Isolated Pools, Alcoves, or Backwater Pools.

11 Primary channel of valley floor tributary. If the tributary has a name, write it in the note column.
12 Secondary channel of valley floor tributary.



UNIT NUMBER	UNIT TYPE	CHANNEL TYPE	% FLOW
1	RI	00	100
2	LP	00	100
3	RB	01	90
4	RI	11	10
5	PP	11	10
6	RI	01	90
7	CB	01	80
8	RB	01	80
9	RI	01	90
10	LP	01	90
11	RI	02	10
12	LP	02	10
13	RB	02	10
14	RI	03	10
15	RP	03	10
16	RI	04	5
17	IP	10	0
18	CB	00	100

It is very important that the primary channel be identified with the proper code. This information is used in a critical step of the data analysis to calculate channel length and sinuosity.

The inventory considers the stream as the system of all channels that transport water down the drainage. The intention is to survey and quantify all aquatic habitats located within the valley floor. All active channels and unit types will be classified with a channel code and an estimate of the percent of total flow carried in each channel.

5. **Percent Flow.** Visual estimate of the relative amount of flow in the channel, in each channel where multiple channels occur, or the contribution to total flow from a tributary. Record 0% for alcove, backwater, and isolated pool unit types. For dry unit types don't try to estimate what the percentages would be if water were present – record 100% in the 00 or 01 channel unit(s) and 0% for the 02 channel unit(s).

   This is difficult to measure accurately. In the past, crews have tended to overestimate the contribution from tributaries. Don't be concerned about balancing your totals for flow to 100 percent. The information is used only to identify the relative contribution or distribution of flow. Record the active channel width (ACW) of the tributary in the note column as well.

6. **Unit Length.** Length of each unit in meters. The length is estimated every unit; it is estimated and verified every 10th unit.

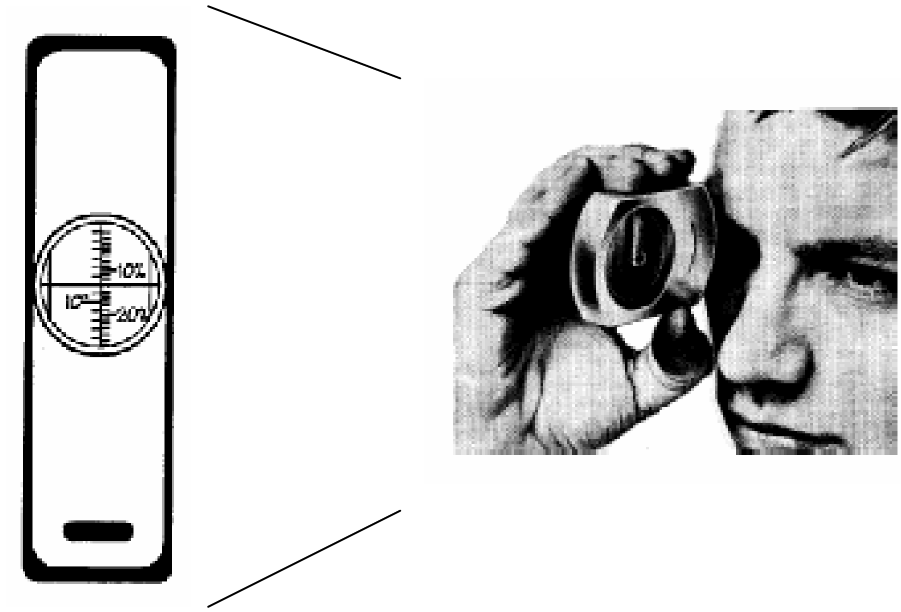
   To estimate the length of very long units, subdivide into lengths you are comfortable estimating and add them together. Do not pace the length of the unit. Except in very rare cases, no unit should be more than 100 to 150 meters long (with Oregon Plan surveys the maximum length of a unit will be 25m. for the 500 meter sites and 50m. for the 1000 meter sites).

   Long units can usually be divided at points where the stream changes direction. When long units turn corners of the stream, create a new unit before the upstream member of the crew disappears from view. Back-to-back units of the same type are acceptable when following this "line of sight" rule. Use gradient changes to identify breaks in unit lengths.

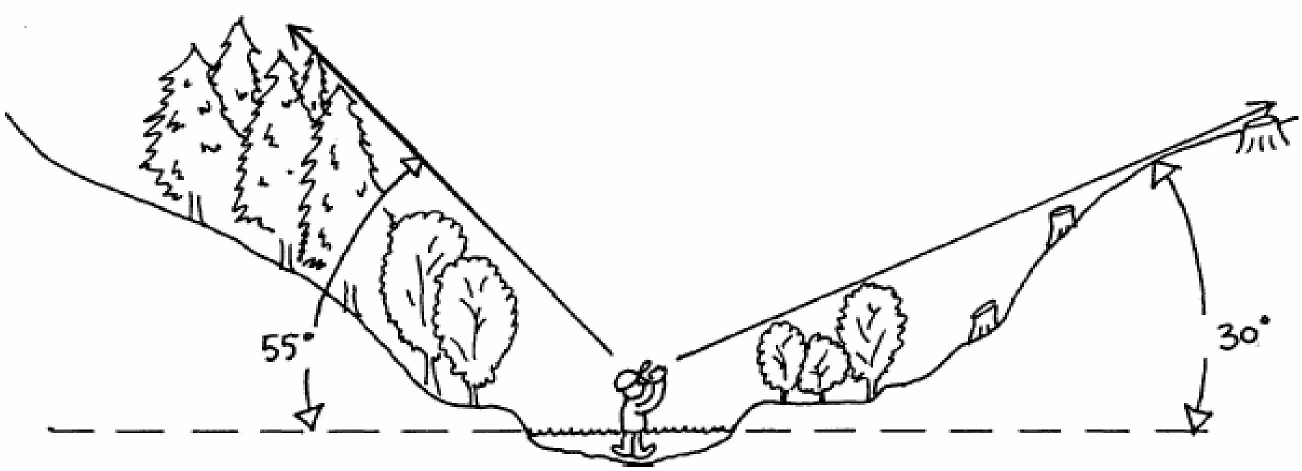
   ⇨ *Use equal effort to make good estimates on all units. Use the same technique on all units. Do not try to estimate more carefully on units you know will be verified.*

7. **Unit Width.** Width of wetted channel (estimated every unit; estimated and verified every 10th unit). Measure the average width of the entire unit. On multiple wetted channel units, such as steps over bedrock where there are several wetted slots carved into the rock, record the sum of the wetted widths.

Slope. Gradient of water surface in the unit. Expressed as the **percent** change in elevation over the length of the unit. Estimated with a clinometer using the scale on the right side in the viewfinder.



8. **Channel Shade.** (Shade Left and Shade Right on data sheet). Measured with the clinometer as the **degrees** (left side in the viewfinder) above horizontal to the top of riparian vegetation or land forms ($\leq 90^o$). Measured perpendicular to the channel unit on the left and right banks (see diagram below and on page 30). This variable requires integration of topographic shading and canopy closure.



10. **Active Channel Height.** Vertical distance from the average level streambed to the top of the active channel. Determined by averaging 3 cross-section measurements (taken at 25%, 50%, and 75% of the **A**ctive **C**hannel **W**idth) of the water depth of fast water units or at pool tail crest of pools and adding it to the distance from water surface to the top of the active channel. Measure the height at every 10th unit and at change in reach type.

11. **Active Channel Width.** Distance across channel at "bank full" flow. Bankfull flow is the level the stream flow attains every 1.5 years on average. The boundary of the active channel can be difficult to determine; use changes in vegetation, slope breaks, or high water marks as clues. Sum the width of all active channels in multichannel situations. Measure the active channel width every 10th unit when verifying estimates and at start of new reaches.

    The key indicator of bankfull stage (active channel) is the floodplain: a flat depositional surface adjacent to the channel and at the top of point bars.

12. **Floodprone Height.** The floodprone height is determined by doubling the active channel height. The floodprone height is the maximum depth in the channel during a flood event occurring approximately every 50 years. Record twice the active channel height as the floodprone height to the nearest 0.1 meter. Measure the floodprone height every 10th unit when verifying estimates and at start of new reaches.

13. **Floodprone Width.** Distance across the stream channel and/or unconstraining terraces at floodprone height. The floodprone width is the width of the valley floor inundated during a flood event occurring approximately every 50 years. Measure the floodprone width every 10th unit when verifying estimates and at start of new reaches.

    If the floodprone width is greater than 4 times the active channel width at that location, simply estimate the floodprone width. The ratio of floodprone width to active channel width is necessary to determine the reach type and entrenchment ratio.

14. **Terrace Height.** The height from the streambed to the top of the high terrace. A high terrace is defined as the first terrace you encounter above the floodprone height. Measure every 10th unit and at reach changes.

15. **Terrace Width.** This is the inter-terrace distance measured from the first high terrace lip, across the stream channel, to the corresponding terrace lip on other side of the stream (TW in diagram below) or to the hillslope if a matching terrace lip does not exist. Measure a terrace width and height if the following two conditions exist:

    1) The terrace height is greater than the floodprone height

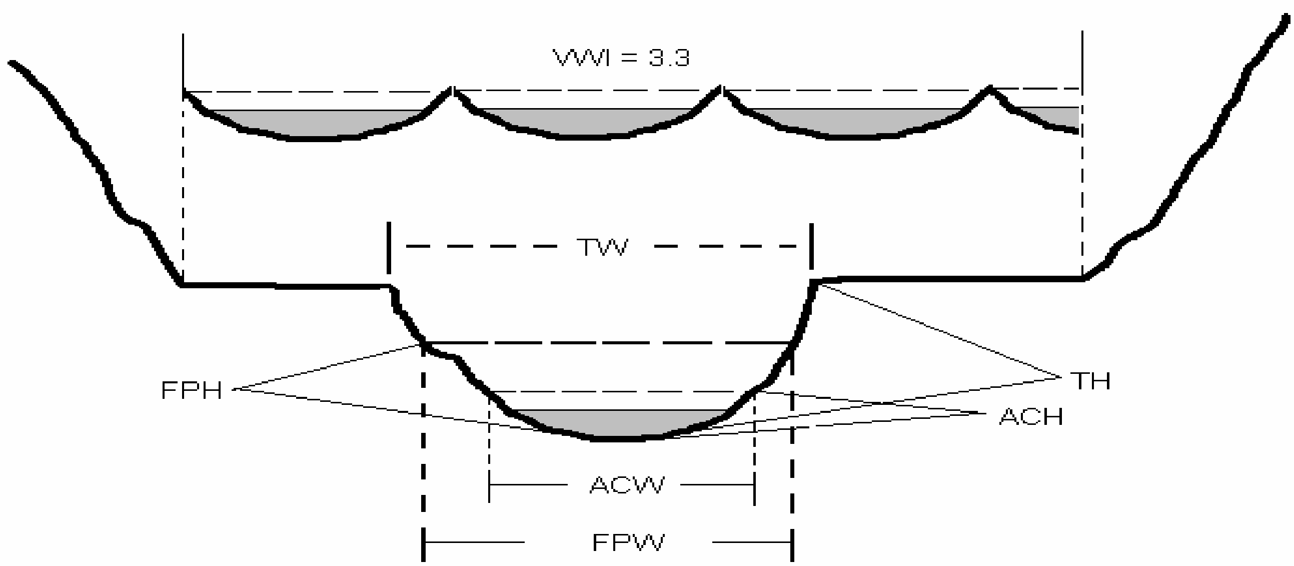
    AND

    2) The terrace width is less than 4 times the active channel width.

    In multichannel situations, sum the inter-terrace width of all channels. Measure at every 10th unit and at start of new reaches. Oregon Plan survey metric intervals differ slightly – see Appendix 1.

16. **VWI** Valley Width Index. Same method as on the reach sheet (page 7). Additional estimates improve accuracy of average value. Draw a cross section of the transect above the measurements on the data sheet (see example sheets in the appendix). Indicate the valley width and VWI estimate on the drawing.

Refer to diagrams below and in the appendix for illustrations of active channel, floodprone, and terrace measurements.



17. **Note.** Any pertinent additional information or items of interest (fish or wildlife observed, evidence of pollution or illegal dumping, description of channel structure, names of roads or tributaries, etc.).

UNIT-2 FORM

Information recorded by the "Numerator" member of each field crew.

1. **Unit Number.** Corresponds to number on "Estimator" sheet.

2. **Unit Type:** Corresponds to same type on "Estimator" sheet.

3. **Depth.** Maximum depth in pools, modal or typical depth in glides and fast water units. Measure to the nearest 0.05 meter as accurately as possible in pools. Probe the bottom with the depth staff to find the deepest point. Small differences in pool depth are significant.

4. **Depth at Pool Tail Crest:** Measure the maximum depth to the nearest 0.01 meter at the pool tail crest (PTC) for every pool habitat unit. For subunit pools (BW, AL, IP), a PTC does not need to be measured or recorded. The PTC location is where the water surface slope breaks into the downstream habitat unit. Measure the deepest point along the hydraulic control feature that forms the pools. For beaver ponds unit type (**BP**) that do not have water flowing over the top of the dam yet there is subsurface flow through the sticks and logs of the dam, record the PTC depth as 0.01 meter.

5. **Verified Length and Width.** The measured length and width of the habitat unit. Taken at every 10th unit and called "verified units" because the actual measurements are used to calibrate the estimates made on each unit. Where a particular unit type is rare, additional measurements may be necessary; simply write in the values over the shaded part of the data sheet.

6. **Substrate.** Percent distribution by streambed area of substrate material in six size classes: silt and fine organic matter, sand, gravel (pea to baseball; 2-64mm), cobble (baseball to bowling ball; 64-256mm), boulders, and bedrock. Estimate distribution relative to the total area of the habitat unit (wetted area). Round off each class to nearest 5 percent

   Do not worry about totaling your estimates to 100 percent; this will be done during analysis. Be sensitive to the difference between surface flocculants and other fine sediment. Fine sediment that <u>covers and embeds</u> gravel and cobble should be part of your estimate. A thin layer of low density fine material over bedrock or boulders should not be included. Hardpan clay or conglomerate substrate has bedrock characteristics and is therefore classified as bedrock when estimating percent composition. Estimate the distribution of the <u>surrounding</u> and/or <u>supporting</u> substrate to the best of your ability at SL (step over log) and CC (culvert crossing) units. For open bottom culverts, estimate the substrate as you would a normal habitat unit.

7. **Boulder Count.** Count of boulders greater than 0.5 m in average diameter. Within this size class, include only the boulders that have any portion protruding above the water surface and those at the margin of the wetted channel. In dry units and dry channels, estimate the boulder count within the active channel.

8. **Percent Actively Eroding Bank.** Estimate the percent of the lineal distance of both sides of the habitat unit that is actively eroding at the active channel margin. Active erosion is defined as actively, recently eroding, or collapsing banks and may have the following characteristics: exposed soils and inorganic material, evidence of tension cracks, active sloughing, or superficial vegetation that does not contribute to bank stability.

9. **Percent Undercut Bank.** An estimate of the percent of the perimeter of the habitat unit composed of undercut banks. Estimate at the margins of the wetted channel as an index of cover habitat.

   Look for areas that provide good hiding cover for fish. Typically, if the undercut portion extends along the bank for a meter or more, include it in your estimate. Include areas undercut beneath root wads.

10. **Comment Codes.** Comments identifying important features. Enter as many codes as appropriate. Separate items that apply to the left bank (looking upstream) from those for the right bank using a slash (/). *If a code does not exist for an observation, do not invent a code. Write a description in the note column if necessary.*

    AM **AM**phibian. Record species (if known) in NOTE field.
    BC **B**ridge **C**rossing. Record road name or number in note.
    BD **B**eaver **D**am. Helps to identify steps created by beavers.
    BK **B**ug **K**ill. Patches of insect or disease tree mortality.
    BV **B**ea**V**er Activity (beaver den, cut trees, etc.)
    CC **C**ulvert **C**rossing. Same as Bridge Crossing except the stream passes through a culvert. Record road name or number.
    CE **C**ulvert **E**ntry. Tributary entering through culvert. Record diameter, length, slope, and height of drop.
    CS **C**hannelized **S**treambanks. Rip-rap or other artificial bank stabilization and stream control.
    DJ **D**ebris **J**am. Accumulation of large woody debris that fills the majority of the stream channel and traps additional debris and sediment. These features tend to have potential to alter channel morphology.
    FC **F**ence **C**rossing.
    GS **G**auging **S**tation.
    HS Artificial **H**abitat **S**tructure. Describe type: gabion, log weir, cabled wood, interlocking log jams, etc. in note. If a habitat structure spans across several habitat units <u>record it only once</u>. Put the comment code in the unit that is most affected by the habitat structure.
    MI **MI**ning
    PA **P**otential **A**rtificial Barrier. Potential artificial or human created barrier to upstream or downstream migration of fish. Document height, take photos and notes.
    PN **P**otential **N**atural Barrier. Potential natural barrier to upstream or downstream migration of fish. Document height, take photos and notes.
    (Note: Barriers are relative to stream size and fish species encountering them. Consider these variables when using this comment code).

Comment Codes (continued)

RF **R**oad **F**ord. Road that crosses within the active channel of the stream (no bridge).

SD **S**creened **D**iversion (pump or canal). Give some indication of size or capacity.

SS **S**pring or **S**eep. Usually small amounts of flow (<5% of total flow) directly entering from hillslope. For large springs, estimate the contribution to flow. Springs do not have defined channels.

TJ **T**ributary **J**unction with named and unnamed tributaries. Use the **TJ** class only for tributaries with clearly developed channels. Survey even if the trib is dry. Locate and record unit number on the topo map. Indicate which side of the stream the trib is located. Record a temperature and the estimated Active Channel Width.

UD **U**nscreened **D**iversion (pump or canal). Give some indication of size or capacity.

WL **W**ild**L**ife use of stream or riparian zone (note species) This code refers to anything except fish species. Record fish observations only in the note column. Identify species if possible.

Mass Movement: Use a two-part code. The first letter identifies the type of mass movement failure. The second letter evaluates the apparent activity of the failure. (Example: AI = inactive debris avalanche.)

Type:

E **E**arthflow: general movement and encroachment of hill slope upon the channel. These can be identified by groups of unusually leaning trees on a hillslope

L **L**andslide: failure of locally adjacent hill slope. Usually steep, broad, often shaped like a half oval, with exposed soils.

A **A**valanche: failure of small, high gradient, tributary. Often appear “spoon shaped” looking upslope. Water may flow in these intermittent or ephemeral channels that contribute alluvial soils and debris.

Condition:

A **A**ctive: contributing material now.

I **I**nactive: evidence of contribution of material during previous winter or high flows.

S **S**tabilized: vegetated scars, no evidence of recent activity.

11. **Note.** Additional information that describes the habitat unit, comment code, riparian vegetation, fish species present, measurements of steps, culverts, barriers, etc.

WOOD FORM

Objective of this effort is to apply a standardized and consistent methodology to obtain quantitative estimates of wood volume and distribution within stream reaches. Information will be used to evaluate effects on fish habitat and channel structure and to make quantitative comparisons between streams.

- Minimum size requirement is 15 cm (0.15m) diameter **AND** 3 meter length. Length exception: root wads less than 3 m long; these are included and counted on the wood form in a specific column.

- Count all dead pieces that are within, partially within, or suspended over the active channel, regardless of height above channel. Do not count any live woody material.

- Collect data for all wood that meets the minimum size criteria and location requirements.

- **Measure** the entire length and diameter of all pieces; include the portion outside the active channel (do not estimate). If a log is partially buried, record the length for only that portion which is exposed.

- A LWD jam consists of 5 or more pieces which meet the size requirements and are in contact with each other in an accumulation. Indicate grouping of pieces in individual jams by drawing brackets around the appropriate rows in the note column and placing a "J" next to the bracket. If using PDA, then check the box. A jam on the wood sheet does not necessarily mean a DJ COMMENT is necessary.

- Write the letter "A" to indicate each artificially placed piece of wood. On the PDA, check the appropriate box to indicate the HS. Make sure an HS comment code is recorded in the COMMENT field on the unit sheet for each purposefully placed habitat structures.

- Make no entry for units where woody debris is absent.

1. **Unit Number.**

2. **Unit Type.**

3. **Diameter Class.** Estimate diameter of each piece at 2 meters above the base of the stem. Assign each piece or group of pieces to the closest size class (ex. 0.15, 0.30, 0.45). For pieces greater than 0.60 cm diameter, be as accurate as possible when determining diameter and length. Measure diameter in meters.

4. **Length Classes.** Count and tally the number of pieces within each length class. Root wad less than three meters long (frequently with a cut end) is a special case and has its own column, (RW<3). Wood >3m but <6m goes in the 3-6m column; wood >6m but <9m goes in the 6-9m column, etc.

5. **Wood Note.** Note the tree species if known and any other information or assessments of the source, influence, or character of the woody debris.

Record and tally *all countable pieces. Take a photograph of huge jams so they can be included in the final report. However, a photograph CANNOT be used as a substitute for the wood count.*

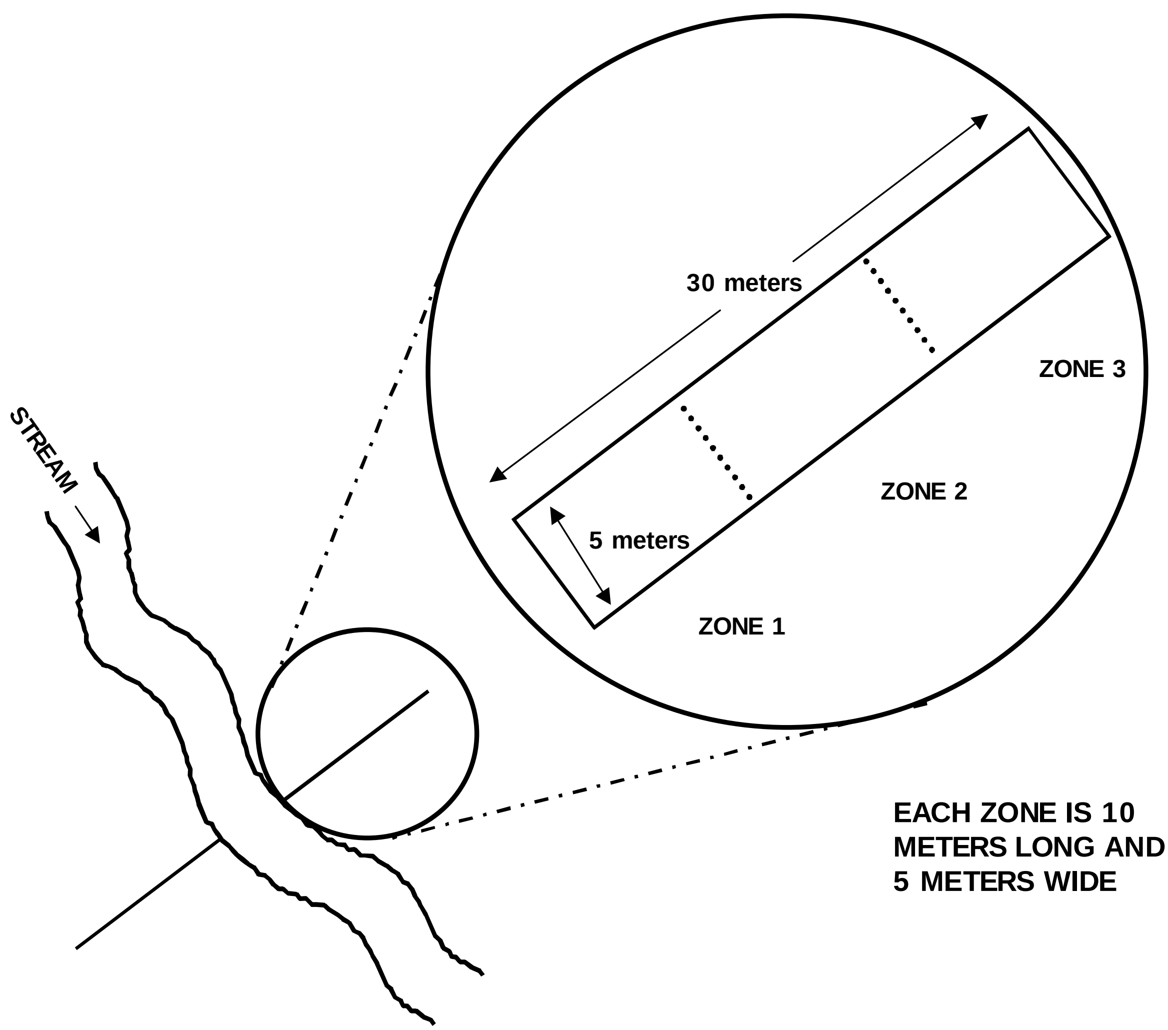
RIPARIAN FORM

Purpose: The riparian inventory is designed to provide additional quantitative information on the species composition, abundance, and size distribution of riparian zone vegetation.

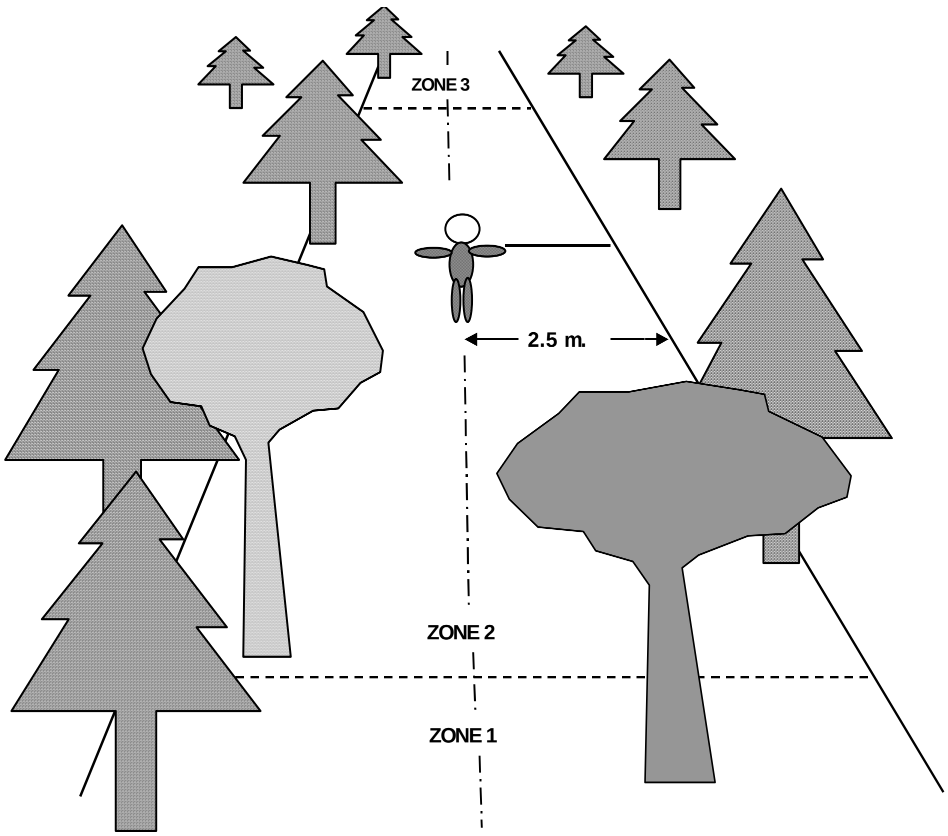
The riparian inventory will consist of a type of belt transect extending across the riparian zone perpendicular to the stream channel on each side.

Frequency: Transects will be conducted at least once every thirty units (once per unit page – except for Oregon Plan surveys – see Appendix 1) <u>and at the beginning of all reaches</u>. **Every** identified reach has to have at least one riparian transect. Begin the transect exactly where the new unit or new reach starts. Do not select starting point elsewhere in the unit because of ease of access or to get a "better" sample. Record a gps reading, indicate quality (2D, 3D). **Mark the location of each transect on the 7.5 minute topo map. Transects must occur at least every 1 kilometer.** Discuss transect spacing with your field supervisor if you are surveying a large stream.

Transects will begin at the margin of the active channel or where the initial band of riparian trees starts, whichever comes first. The transects will be perpendicular to the main axis of the stream and extend 30m as measured on the ground. The transects will be 5m wide and will be subdivided into three 10 meter long sections or zones (see the following diagrams).



One member of the survey crew will extend the tape measure out from the stream channel. The other crew member will follow and use the depth staff to determine if trees are within the area to be counted. Any tree that can be touched with the depth staff extended from either side of the body (practice the amount of reach you require to measure a 5m band) should be counted.



After the crews become very familiar with the method, particularly the dimensions of the sections and the size classes of trees they may visually estimate and count in difficult situations. There is no need, for example, to try and walk through 30m of blackberry bramble to measure the diameter of one or two alder trees. Likewise, it is not necessary to climb steep slopes to measure tree diameters.

Complete the following entries on the Riparian form:

1. **Unit Number.** The unit that begins where the transect is established.

2. **Side.** Left or right side of the channel, looking upstream.

3. **Zone.** Subdivision of the transect.

   1 0-10 meters
   2 10-20 meters
   3 20-30 meters

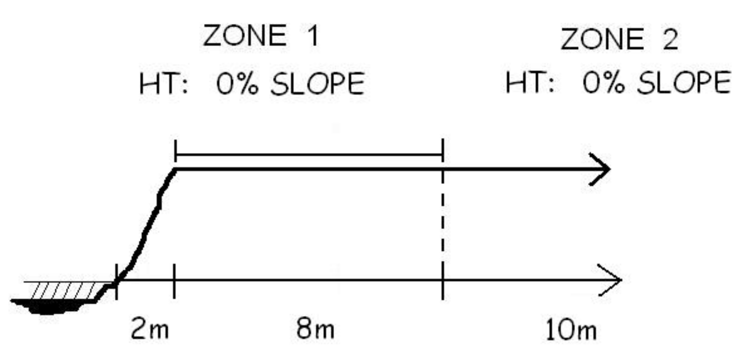
4. **Surface.** Geomorphic surfaces observed within the zone. If more than one surface is observed, record both on the data sheet in the space provided separated by a diagonal line and then circle the more dominant feature. Note length of each feature and explain any ambiguous observations in the note column.

FP	**F**lood**P**lain
LT	**L**ow **T**errace (height is < Flood Prone Height)
HT	**H**igh **T**errace (height is > Flood Prone Height).
HS	**H**ill**S**lope
SC	**S**econdary **C**hannel
TC	**T**ributary **C**hannel
IP	**I**solated **P**ool or unconnected valley wall channel.
WL	**W**et**L**and bog or marsh with no obvious channel.
RB	**R**oad **B**ed (indicate surface type in note column i.e. paved, rock)
RG	**R**ailroad **G**rade
RR	**R**ip **R**ap

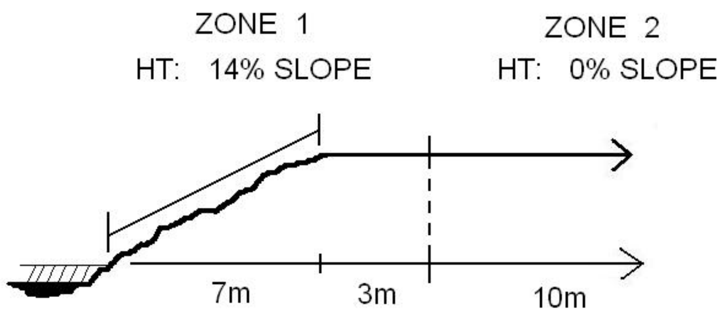
5. **Slope.** Measure the <u>**percent**</u> slope (NOT degrees) of the <u>dominant</u> surface in the zone.

NOTE: For terraces, a typical terrace slope measurement will be similar to example #1 below. However, for transitioning terraces (a measurable slope from the active channel margin to top of the level terrace <u>that is over 5 meters</u> in length **and** the following riparian zone(s) is/are terrace(s)), measure and record the slope of the transition <u>but</u> record the feature as a **H**igh **T**errace (<u>**NOT**</u> **H**ill**S**lope – a hillslope feature cannot precede a high terrace). Make a note in the RIPARIAN NOTE field that it is a transition feature and give approximate distances (see examples #2 and #3 below).

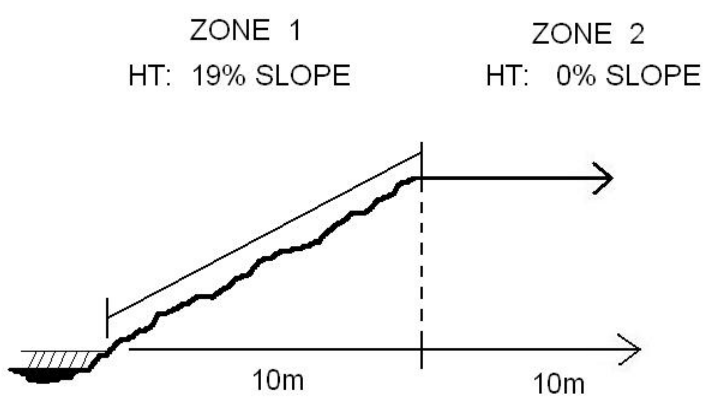
#1



#2



#3



6. **Canopy Closure.** The percent canopy closure estimated by looking up while standing in the middle of the zone. Include the influence of both conifer and hardwood species. Tall shrub cover (above your head) should be included as well. Estimate within broad categories (20% increments).

7. **Shrub Cover.** The percentage of ground cover provided by shrubs. Include blackberry, salmonberry, devils club, willow, sage, etc. Small trees (seedlings and samplings less than 8 feet high) should be included in shrub cover. Estimate within broad categories (20% increments).

8. **Grass and Forb Cover.** The percentage of ground cover provided by grasses, ferns, moss, herbs, sedges, rushes, etc. Estimate within broad categories (20% increments).

9. **Tree Group.** Conifer or hardwood.

10. **Count.** Tally of trees by diameter class. Measured in centimeters as: 3-15, 15-30, 30-50, 50-90, or 90+.

11. **Riparian Note.** Optional comments that describe tree species or the plant community, large woody debris, or characteristics of snags or old stumps. Note presence or absence of large down wood in riparian zone. Record the riparian photo number and time in this column as well.

12. **GPS.** Record the UTM coordinates of the riparian transect. Note the satellite coverage (2D or 3D) and elevation.

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ADDITIONAL LITERATURE

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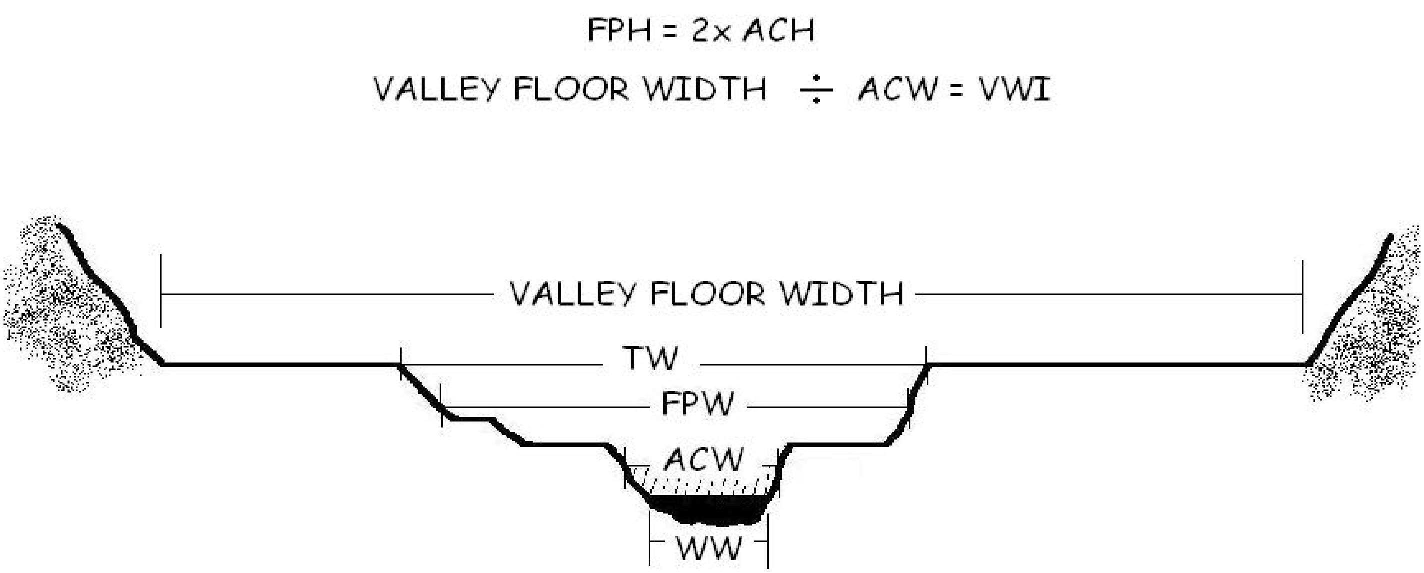
APPENDIX

WETTED, ACTIVE CHANNEL, FLOOD PRONE, TERRACE, AND VALLEY FLOOR WIDTHS



CHANNEL SHADE

Use of the clinometer to measure **degrees** of topographic and vegetative shading.

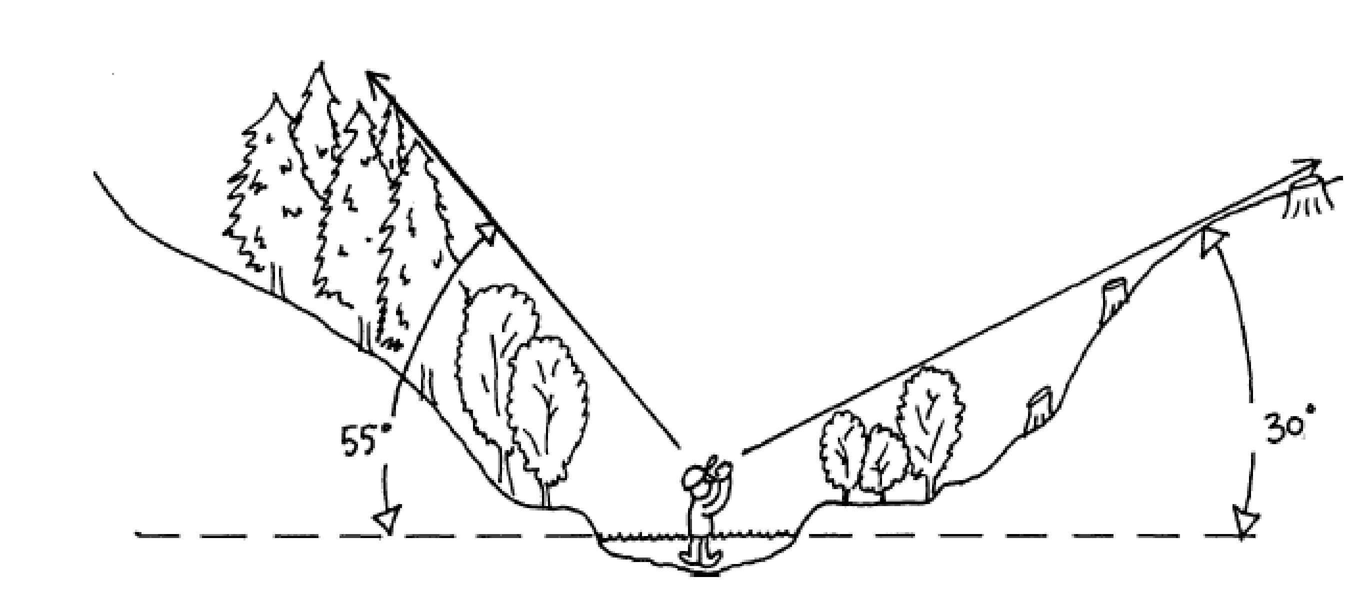


TABLE 1: POSSIBLE REACH – CHANNEL – VALLEY COMBINATIONS

CHANNEL FORM	VALLEY FORM					
	VWI < 2.5			**VWI > 2.5**		
CHANNEL	**NARROW VALLEY FLOOR**			**BROAD VALLEY FLOOR**		
CONSTRAINED:	STEEP V	MOD. V	OPEN V	HIGH TERRA	MULT. TERR	FLOODPLAIN
BEDROCK	CB - SV	CB - MV	CB - OV			
HILLSLOPE	CH - SV	CH - MV	CH - OV			
ALT. HILLSLOPE TERRACE				CA - CT	CA - MT	
HIGH TERRACE				CT - CT	CT - MT	
LAND USE				CL - CT	CL - MT	CL-WF
CHANNEL UNCONSTRAINED:						
SINGLE CHANNEL					US - MT	US - WF
ANASTOMOSING					UA - MT	UA - WF
BRAIDED CHANNEL					UB - MT	UB - WF

Check the valley form description against the Valley Width Index. If it does not match, is it because the reach was not described properly, or was the ACW determined incorrectly?

Does the terrace height work with the channel and valley form calls?
Remember that a high terrace is any terrace that is above the Flood Prone Height.

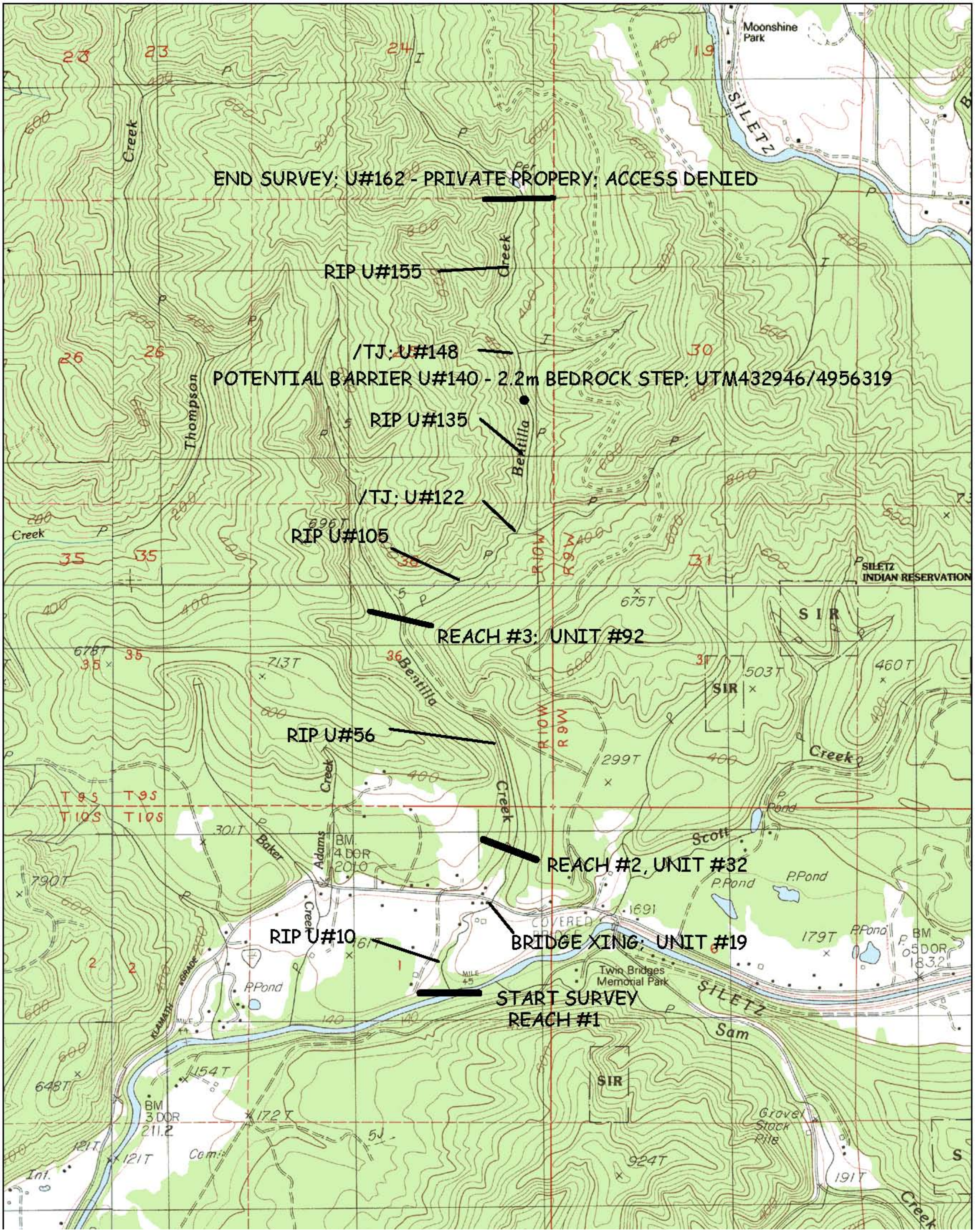
Streamside terraces are frequently present within narrow valley floors. However, remember that when VWI <2.5, it is a hillslope or bedrock constraining reach call, regardless of the terraces encountered.

In rare cases, notably flooded bogs, multiple channel wetlands, or flooded valley bottoms due to beaver activity, the VWI will equal 1 (ACW spans the width of the valley floor) but technically the channel is unconstrained (drain the beaver pond and the VWI will be greater than 2.5 - usually). Make a note and explain.

Use the boxes on the reach form to make diagrams of the reach cross section. Label your drawings so that ambiguous or exceptional reach types can be understood.

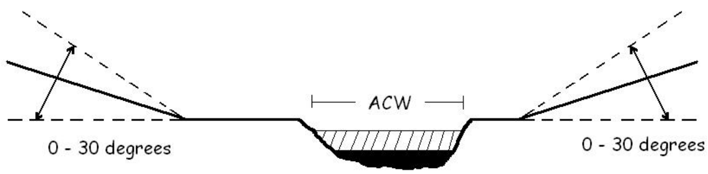
An unconstrained reach must meet at least these two criteria: 1) VWI has to be greater than 2.5 and 2) the Flood Prone Width has to be greater than 2.5 times the Active Channel Width.

EXAMPLE OF MAP DETAIL

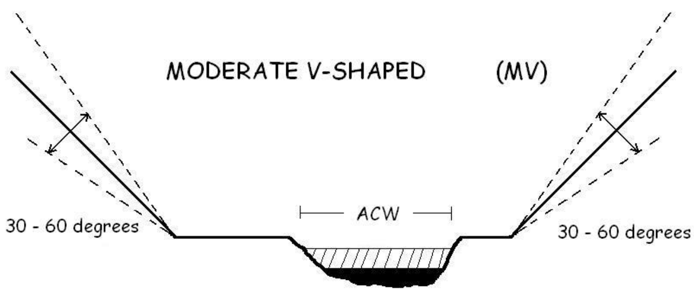


NARROW VALLEY FLOOR: VWI < 2.5

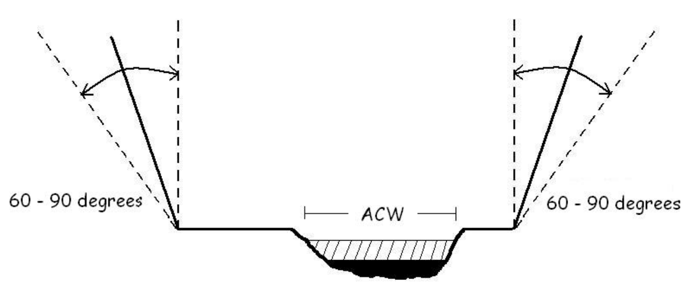
OPEN V-SHAPED (OV)



MODERATE V-SHAPED (MV)

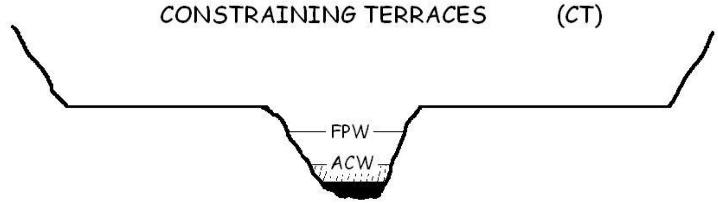


STEEP V-SHAPED (SV)

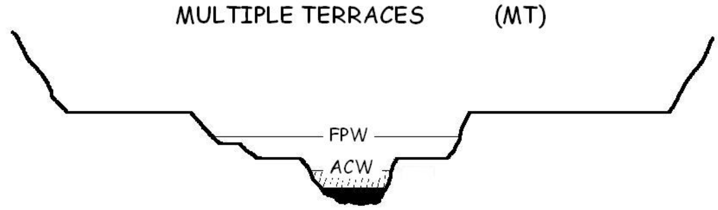


BROAD VALLEY FLOOR: VWI > 2.5

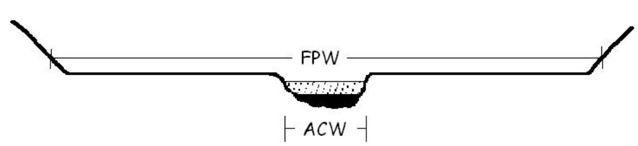
CONSTRAINING TERRACES (CT)



MULTIPLE TERRACES (MT)

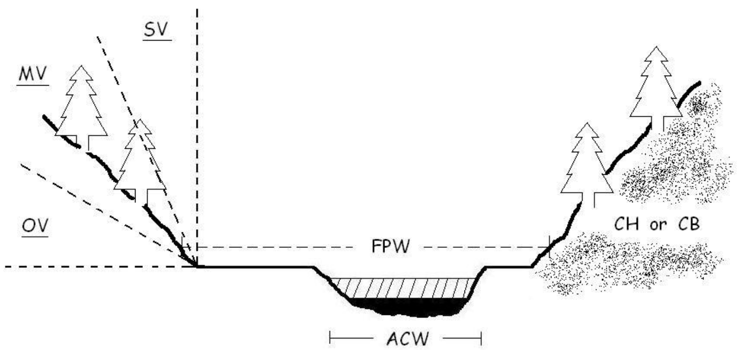


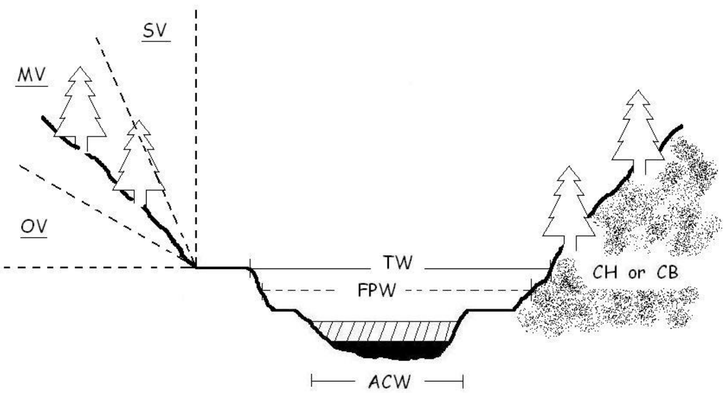
WIDE - ACTIVE FLOODPLAIN (WF)

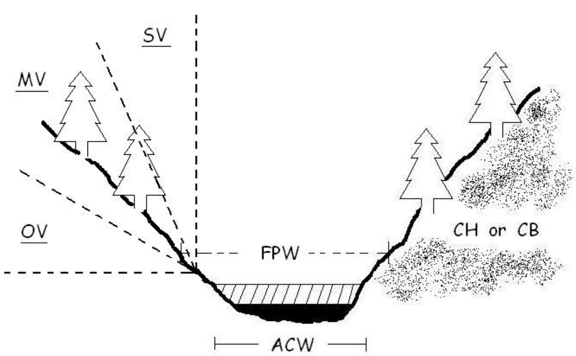


Examples of **constrained** channel morphology when:

<u>**VWI < 2.5**</u>



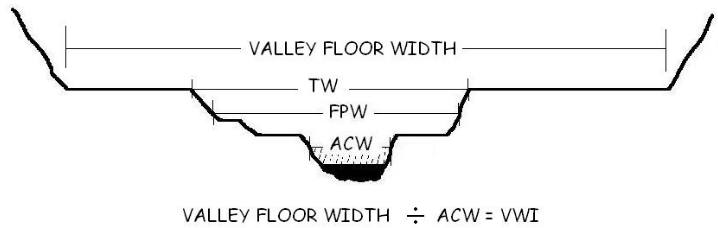




<u>**VWI > 2.5**</u>

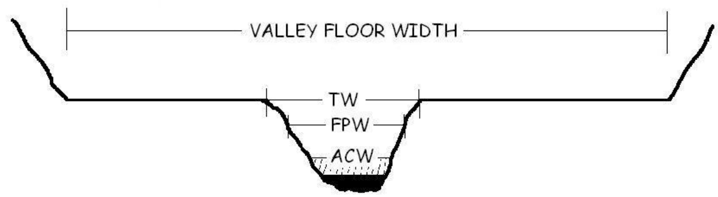
CONSTRAINED WITHIN TERRACES WITH MULTIPLE TERRACE FEATURES:

CT / MT



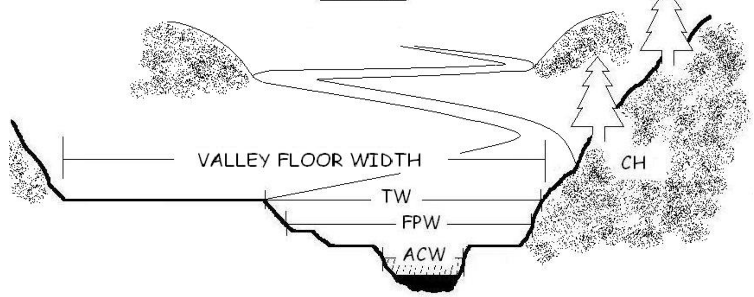
CONSTRAINED WITHIN TERRACES

CT / CT



ALTERNATINGLY CONSTRAINED BY HILLSLOPE AND TERRACES WITH MULTIPLE TERRACE FEATURES:

CA / MT



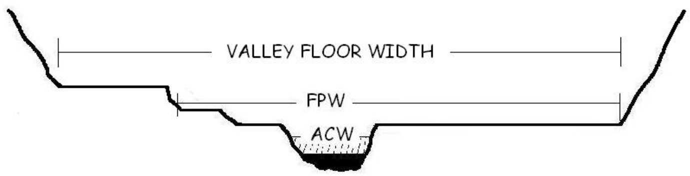
Examples of **unconstrained** channel morphology:

(a channel is unconstrained when FPW > 2.5x ACW. Note: It is not necessary to locate and measure a TW (terrace width) if the FPW > 4x ACW)

<u>**VWI > 2.5**</u>

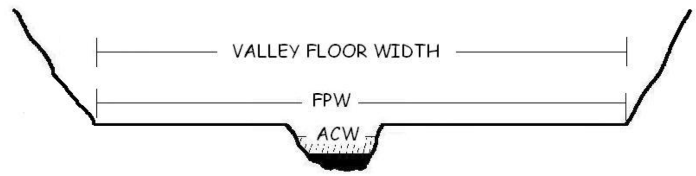
UNCONSTRAINED WITH MULTIPLE TERRACE FEATURES:

US / MT



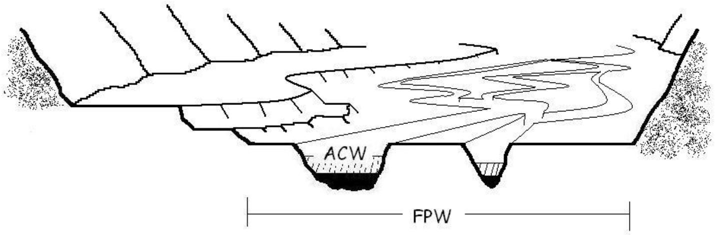
UNCONSTRAINED SINGLE CHANNEL WITHIN A WIDE-ACTIVE FLOODPLAIN

US / WF



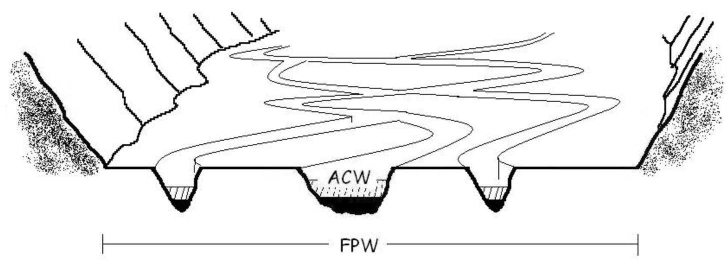
UNCONSTRAINED ANASTOMOSING CHANNEL WITH MULTIPLE TERRACE FEATURES:

UA / MT



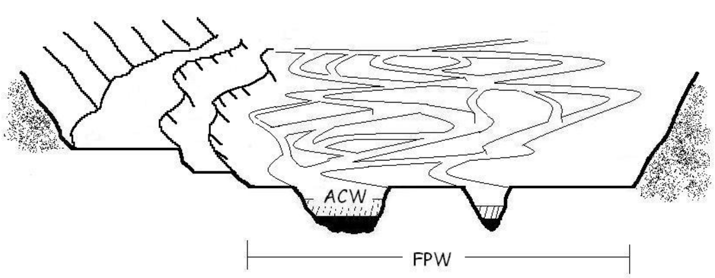
UNCONSTRAINED ANASTOMOSING CHANNEL WITHIN A WIDE-ACTIVE FLOODPLAIN:

UA / WF



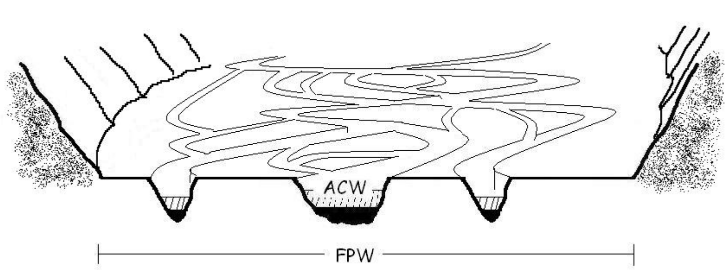
UNCONSTRAINED BRAIDED CHANNEL WITH MULTIPLE TERRACE FEATURES:

UB / MT



UNCONSTRAINED BRAIDED CHANNEL WITHIN A WIDE-ACTIVE FLOODPLAIN:

UB / WF



EQUIPMENT CHECK LIST

IN STORAGE BOX:

- ☐ ATLAS (Oregon Atlas and Gazetteer. DeLorme Mapping)
- ☐ AMPHIBIAN FIELD IDENTIFICATION GUIDE
- ☐ USGS TOPOGRAPHIC MAPS (must have for each stream)
- ☐ CAMERA (digital w date stamp)
- ☐ CLINOMETER (Sunto instruments- degree and % slope increments)
- ☐ CLIPBOARDS (fiberback and/or metal)
- ☐ COMPASS
- ☐ GPS unit
- ☐ DATA FORMS / FILE BOX / PDA (forms from ODFW)
- ☐ FIBERGLASS MEASURING TAPE (50m metric Kesson)
- ☐ FIELD BOOK ("Rite in the Rain" Line Rule or Level)
- ☐ FLAGGING TAPE (blue and white stripe)
- ☐ SURVEY METHODS AND INSTRUCTIONS
- ☐ THERMOMETER (Pocket Celcius scale)
- ☐ VESTS (optional Filson Cruiser Vest)
- ☐ STORAGE BOX (Rubbermade Action Packer)
- ☐ CB RADIO (recommended)
- ☐ LASER RANGE-FINDER (opptional)
- ☐ PENCILS, SHARPIE WATERPROOF MARKER
- ☐ FIRST AID KIT

OTHER:

- ☐ DEPTH STAFF (2m long marked every 10cm)
- ☐ HATS AND UNIFORM SHIRTS (ODFW personnel only)
- ☐ HIP BOOTS
- ☐ WADERS
- ☐ WADING SHOES
- ☐ RAINGEAR

All equipment must be checked in at the end of the field season. Your supervisor will replace hip boots, wading shoe felts, and other equipment that may become worn out during the summer. Keep your supervisor informed of your equipment needs.

EXAMPLES OF COMPLETED DATA FORMS AND BLANK DATA FORMS FOR COPYING

REACH

PAGE:________OF:________

STREAM:________________ CREW:________________

BASIN:________________ USGS 7.5' MAP NAMES:________________

DATE	REACH #	UNIT NUMBER	CHANL FORM	VALLEY FORM	VWI	VEG CLASS		LAND USE		WATER TEMP	STRM FLOW	LOCATION TWN-RNG-SEC-1/4	PHOTO # /TIME	REACH NOTE
						DOM.	SUB-DOM.	DOM.	SUB-DOM.					
													/	

UTM: ____________

UTM: ____________

UTM: ____________

UTM: ____________

UTM: ____________

UTM: ____________

REACH

PAGE: 1 OF: 1

STREAM: EXAMPLE CREEK

CREW: JANE DOE , JOHN DOE

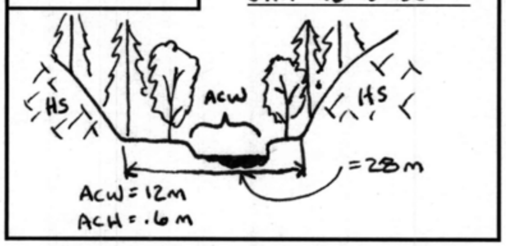
BASIN: NORTH SOMEWHERE RIVER

USGS 7.5' MAP NAMES: CEDAR BUTTE

DATE	REACH #	UNIT NUMBER	CHANL FORM	VALLEY FORM	VWI	VEG CLASS DOM.	VEG CLASS SUB-DOM.	LAND USE DOM.	LAND USE SUB-DOM.	WATER TEMP	STRM FLOW	LOCATION TWN-RNG-SEC-1/4	PHOTO # /TIME	REACH NOTE
7-2-03	1	1	CH	MV	2.3	M30	S	LT	YT	14°C	MF	T4S-R5W-20NW	10/09:12	BEGIN SURVEY @ CONF. W/MAPLE CK.
7-2-03	2	97	CT	CT	3.5	M30	—	LT	YT	14°C	MF	T4S-R5W-20SE	13/11:30	TRIB: ELK CK.
7-2-03	3	180	US	MT	5	D15	S	YT	—	15°C	MF	T4S-R5W-29NE	16/15:13	
7-3-03	4	257	CH	MV	1.5	D30	S	ST	YT	12°C	MF	T3S-R5W-1SE	18/08:14	
7-3-03	5	391	CH	MV	1.5	D30	S	ST	YT	14°C	MF	T3S-R5W-1SW	22/11:30	BLM BOUNDARY
7-3-03	6	440	CH	SV	1.0	C30	D3	ST	LT	14°C	MF	T3S-R5W-10NE	26/13:11	

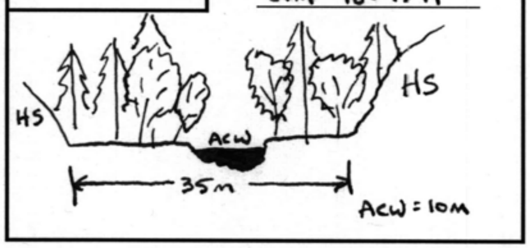
1

UTM: 10T 435640
UTM 4803030



2

UTM: 10T 435799
UTM 4804579



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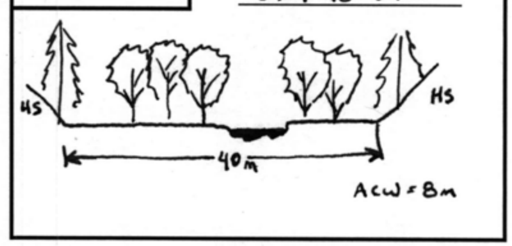
UTM 4805100



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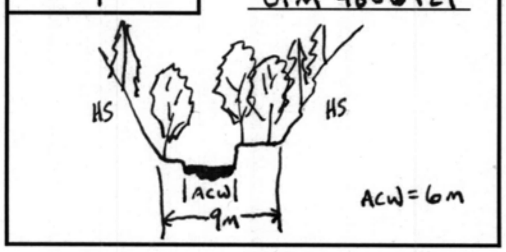
UTM 4806929



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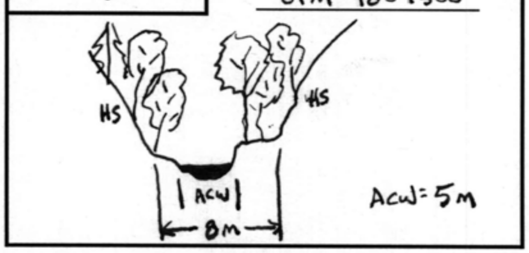
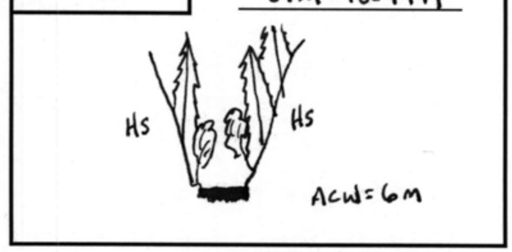


6

UTM: 10T 436503
UTM 4807999



UNIT-1

PAGE:________OF:________

STREAM:________________________ DATE:________________ ESTIMATOR:________________________

REACH	UNIT	UNIT	CHANL	%	UNIT	UNIT	SLOPE	SHADE (0-90)		ACTIVE CHANNEL		FLOOD PRONE		TERRACE			NOTE
#	#	TYPE	TYPE	FLOW	LENGTH	WIDTH	%	LEFT	RIGHT	HT.*	WIDTH	HT.	WIDTH	HT.**	WIDTH	VWI	

* MEASURE FROM THE STREAMBED TO THE TOP OF THE ACTIVE CHANNEL. TAKE THE MEASUREMENT AT POOL TAIL CREST ON POOL UNITS.

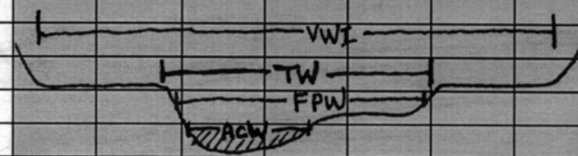
* * MEASURE FROM THE STREAMBED TO THE TOP OF THE TERRACE.

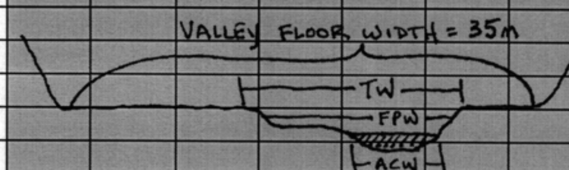
UNIT-1

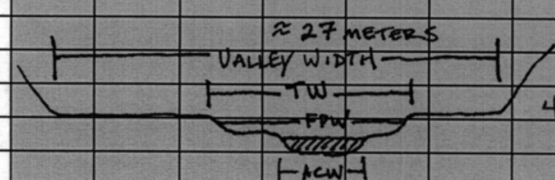
PAGE: 4 OF: 15

STREAM: EXAMPLE CREEK DATE: 7-2-99 ESTIMATOR: JANE DOE

REACH #	UNIT #	UNIT TYPE	CHANL TYPE	% FLOW	UNIT LENGTH	UNIT WIDTH	SLOPE %	SHADE (0-90) LEFT	SHADE (0-90) RIGHT	ACTIVE CHANNEL HT.*	ACTIVE CHANNEL WIDTH	FLOOD PRONE HT.	FLOOD PRONE WIDTH	TERRACE HT.**	TERRACE WIDTH	VWI	NOTE
1	91	RI	00	100	12	6	2	55	70							4	T=14°C @ 10:32
	92	RB	00	100	18	7	4	60	65								
	93	LP	00	100	10	7	0	75	85								
	94	RB	00	100	14	6	5	70	70	.50	10.0	1.0	18.0	1.8	23.0	3	
	95	LP	00	100	6	5	0	85	50								
1	96	RB	00	100	22	6	4.5	65	55								
2	97	LP	01	80	12	6	0	60	60								
	98	RI	11	20	9	2	3	90	85								TRIB TEMP = 11°C @
	99	LP	11	20	5	1.5	0	90	90								11:04, ACW = 4.5 m
	100	LP	00	100	10	7	0	85	80	.50	9.0	1.0	16.0	1.8	19.0	3.5	
	101	SP	00	100	12	8	0	70	70								
	102	RI	01	100	28	8	2.5	75	65								
	103	BW	10	0	5	1	0	85	80								COHO FRY (?15)
	104	LP	00	100	14	6	0	90	90								
	105	RI	00	100	30	7	2	90	85								
	106	LP	00	100	10	5	0	80	80								
	107	SC	00	100	1.5	7	8	80	85								
	108	LP	00	100	13	6	0	70	80								KINGFISHER
	109	RI	00	100	45	7	3	70	85								
	110	LP	00	100	10	7	0	70	70	.40	11.0	.80	18.0	1.5	22.0	3	
	111	RI	00	100	72	8	2	80	85								
	112	LP	01	75	11	6	0	85	85								
	113	RI	01	75	10	5	3.5	90	80								
	114	LP	01	75	8	5	0	85	85								
	115	SR	02	25	2	3	/	90	80								H=.90 m
	116	RI	02	25	25	2.5	1.5	80	80								
	117	PP	00	100	4	7	0	75	80							4	
	118	SS	00	100	.2	.5	/	80	80								H=1.8 m
	119	CC	00	100	17	.5	2.5	90	90								USFS ROAD # 2045
2	120	RB	00	100	39	6	4.5	80	75	.40	9.0	.80	15.0	1.5	18.0	3	PACIFIC GIANT SAL.







* MEASURE FROM THE STREAMBED TO THE TOP OF THE ACTIVE CHANNEL. TAKE THE MEASUREMENT AT POOL TAIL CREST ON POOL UNITS.

** MEASURE FROM THE STREAMBED TO THE TOP OF THE TERRACE.

UNIT-2

PAGE:________ OF:________

STREAM:______________________________________ DATE:____________________ NUMERATOR:____________________

UNIT #	UNIT TYPE	DEPTH*	DEPTH** PTC	VERIFIED LENGTH	VERIFIED WIDTH	S/O	PERCENT SUBSTRATE SND	GRVL	CBLE	BLDR	BDRCK	BLDR COUNT	% ACTIVE EROSION	% UNDER CUT	COMMENT CODES	NOTE
V																
V																
V																

* MAX DEPTH POOLS - MODAL DEPTH IN FAST WATER UNITS

** ONLY MEASURED @ POOLS (EXCEPT OFF-CHANNEL POOLS)

UNIT-2

PAGE: 4 OF: 15

STREAM: EXAMPLE CREEK DATE: 7-2-99 NUMERATOR: JOHN DOE

UNIT #	UNIT TYPE	DEPTH*	DEPTH** PTC	VERIFIED LENGTH	VERIFIED WIDTH	PERCENT SUBSTRATE S/O	SND	GRVL	CBLE	BLDR	BDRCK	BLDR COUNT	% ACTIVE EROSION	% UNDER CUT	COMMENT CODES	NOTE
91	RI	.20				5	10	45	40	0	0	0	0	0		
92	RB	.25				0	5	30	65	10	0	4	5	0		
93	LP	1.2	.15			10	10	40	20	0	0	0	10	25	BV	
94	RB	.20				0	0	35	65	10	0	6	0	0	BV	
95	LP	.90				5	15	60	15	5	0	0	0	5		
96	RB	.20				0	5	60	40	5	0	2	0	0		
97	LP	1.1	.20			10	15	50	25	0	0	0	10	5	/TJ	ELK CREEK
98	RI	.10				0	10	65	25	0	0	0	0	0		
99	LP	.60	.05			10	15	40	25	5	0	0	0	0	BV	
V 100	LP	.90	.20	13	5	5	10	50	30	0	0	0	0	5		
101	SP	1.2	.10			10	10	65	10	0	0	0	0	0		
102	RI	.25				0	5	65	30	0	0	0	0	0		
103	BW	.30				40	20	30	0	5	0	0	0	20		
104	LP	1.1	.25			10	10	50	35	0	0	0	0	0		
105	RI	.25				0	5	50	40	0	0	0	0	0	BC	HIGHWAY 588
106	LP	1.0	.20			5	10	40	20	0	0	1	15	0		
107	SC	.10				0	0	60	40	0	0	0	0	0		
108	LP	.90	.20			10	10	40	30	0	0	0	0	10	GS/	GAUGE = 1.25 FEET
109	RI	.25				5	5	45	40	0	5	0	0	0		
V 110	LP	1.1	.15	12	6	10	20	45	25	0	0	0	0	0		
111	RI	.30				0	10	50	40	0	0	0	0	0		
112	LP	.70	.25			15	10	35	20	0	0	0	10	0		
113	RI	.25				0	5	50	35	5	0	0	0	0		
114	LP	.85	.20			5	10	55	25	0	0	0	0	0		COHO
115	SR	.05				0	0	0	5	5	90	0	0	0		
116	RI	.15				0	5	60	30	5	0	0	5	0	SS/LS	
117	PP	.90	.20			5	15	50	20	5	0	0	0	0		
118	SS	.05				0	0	30	35	30	0	0	0	0		
119	CC	.05				0	0	30	35	30	0	0	0	0	CC	USFS ROAD # 2045
V 120	RB	.25		44	5	0	0	30	60	10	0	2	10	0		

* MAX DEPTH POOLS - MODAL DEPTH IN FAST WATER UNITS

** ONLY MEASURED @ POOLS (EXCEPT OFF-CHANNEL POOLS)

WOOD

PAGE:______ OF:______

STREAM:____________________ DATE:____________ NAME:__________________

UNIT	UNIT	DEBRIS			DBH	LENGTH CLASS (m)												WOOD NOTE
NUMBER	TYPE	CONFIG	TYPE	LOCAT	CLASS	RW <3	3	6	9	12	15	18	21	24	28	32	36+	

2008 Protocol: See methods for collection protocol.

WOOD

PAGE: 11 OF: 28

STREAM: EXAMPLE CREEK

DATE: 7/2/96 7/3/96

NAME: JOHN DOE

	UNIT NUMBER	UNIT TYPE	DEBRIS CONFIG	DEBRIS TYPE	DEBRIS LOCAT	DBH CLASS	RW <3	3	6	9	12	15	18	21	24	28	32	36+	WOOD NOTE
	233	LP				.80		I											
						.60			I										
						.25				I									
	236	RI				.30		I	II										
1/2	237	LP				.40			I										
						.60			I										
1/3	240	GL				.80			I										CEDAR
						.20		I											
	241	SP				.20			I										
	242	RI				.30		I											
						1.2	I												
	244	LP				.40			I										
						.70		I											
						.15		II											
						.15		II											
						.30			I										
	248	LP	J			.90				I									
						.20		II	I										
						.40		I											
						.80					I								
	252	LP				.30			I										
						.20		I											
						.60			I										
						.50		I											ALDER
						.30		I	I										
	255	SR				.40			I										
	256	RI				.30			I										
						.40			I										
						1.2		I											
						.30		I	I										

RIPARIAN

PAGE:_______ OF:________

STREAM:______________________________ DATE:_______________ NAME:______________________

UNIT NUMBER	SIDE	ZONE	SURFACE	SLOPE	CANOPY CLOSURE	SHRUB % COVER	GRASS/FORB % COVER	TREE	COUNT (DBH in CENTIMETERS) 3-15	15-30	30-50	50-90	90+	RIPARIAN NOTE
	LEFT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						
	RIGHT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						
	LEFT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						
	RIGHT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						

UNIT # _______	UNIT # _______

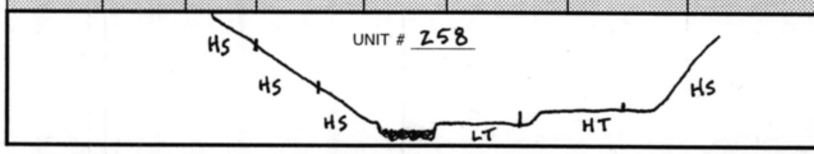
FOR EACH RIPARIAN TRANSECT, DRAW AND LABEL THE SURFACES (HT, LT, FP, HS, ETC) OF A CROSS SECTION IN THE BOX PROVIDED ABOVE. DRAWING AND LABELING VEGETATION IS NOT NECESSARY.

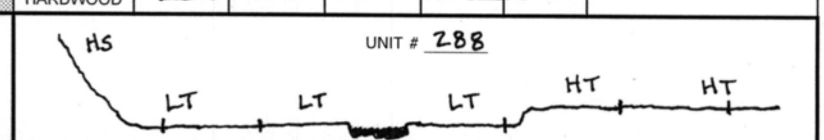
RIPARIAN

PAGE: 5 OF: 11

STREAM: EXAMPLE CREEK   DATE: 7-3-96   NAME: JANE DOE / JOHN DOE

UNIT NUMBER	SIDE	ZONE	SURFACE	SLOPE	CANOPY CLOSURE	SHRUB % COVER	GRASS/FORB % COVER	TREE	COUNT (DBH in CENTIMETERS) 3-15	15-30	30-50	50-90	90+	RIPARIAN NOTE
258	LEFT	1	HS	50	85	65	30	CONIFER		I				
								HARDWOOD	II	I				
		2	HS	60	90	70	30	CONIFER		I	I			
								HARDWOOD		I				
		3	HS	60	90	75	20	CONIFER		I	I			5% ROCK COVER
								HARDWOOD	—	—	—	—	—	
	RIGHT	1	LT	0	100	60	35	CONIFER	—	—	—	—	—	
								HARDWOOD	卌	I				
		2	HT	4	90	70	30	CONIFER			I			
								HARDWOOD	—	—	—	—	—	
		3	HS	45	90	80	20	CONIFER			I			
								HARDWOOD		I				
288	LEFT	1	LT	0	70	40	45	CONIFER	—	—	—	—	—	
								HARDWOOD	II	II	I			
		2	LT	3	65	60	40	CONIFER	—	—	—	—	—	
								HARDWOOD	I	I				
		3	HS	45	90	40	50	CONIFER			I			
								HARDWOOD		I				
	RIGHT	1	LT	0	25	80	20	CONIFER	—	—	—	—	—	
								HARDWOOD	卌 II		I			
		2	HT	0	70	70	30	CONIFER	—	—	—	—	—	
								HARDWOOD	II	I				
		3	HT	0	80	70	25	CONIFER		I				
								HARDWOOD	—	—	—	—	—	





FOR EACH RIPARIAN TRANSECT, DRAW AND LABEL THE SURFACES (HT, LT, FP, HS, ETC) OF A CROSS SECTION IN THE BOX PROVIDED ABOVE. DRAWING AND LABELING VEGETATION IS NOT NECESSARY.

PHOTO RECORD

PAGE:_______ OF:_______

STREAM:____________________ SURVEY TYPE: OR. PLAN ☐ BASIN ☐ MIXED ☐

BASIN OR GCG:____________________ FILM: DIGITAL ☐ SLIDE ☐ PRINTS ☐

SURVEY CREW:____________________ ROLL #:__________ MAILER #:______________

PHOTO # OR DIGITAL ID	UNIT #	DATE	TIME	STREAM / PHOTO DESCRIPTION
1 :				
2 :				
3 :				
4 :				
5 :				
6 :				
7 :				
8 :				
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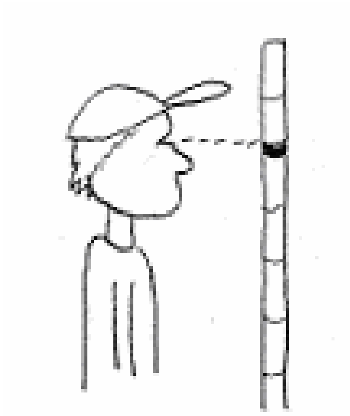
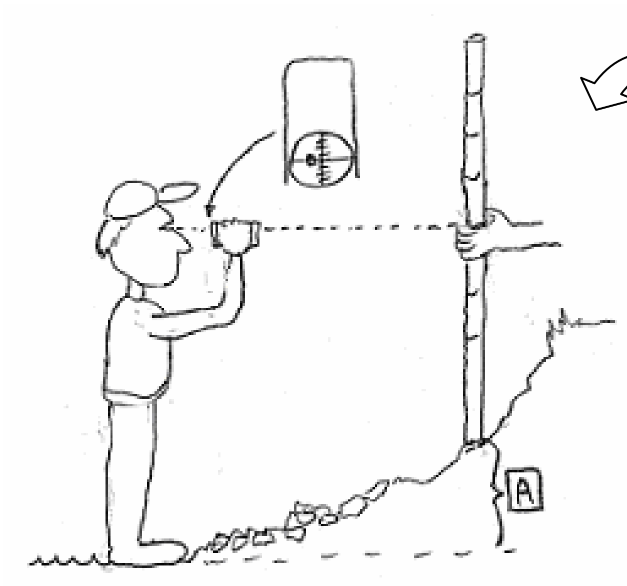
39 :				
40 :				

Guide to measuring channel metrics:



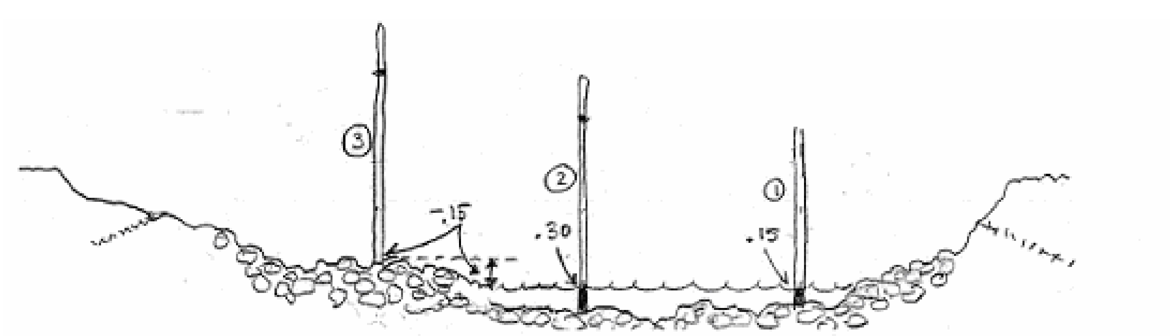
Step 1: Clinometer (CLINO) identifies his eye height on the depth staff.

Step 2: CLINO and survey partner (TAPE) discuss and agree on the active channel scour or margin on either side of the stream.



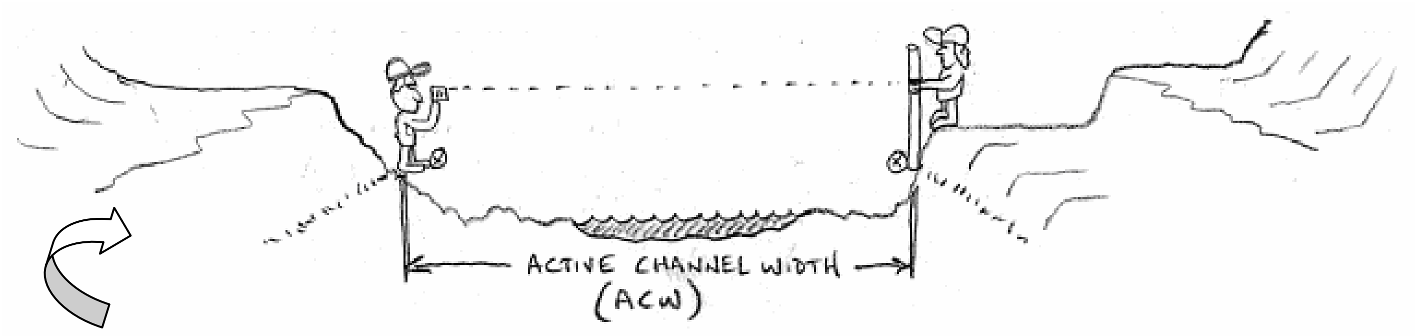
Step 3: TAPE places depth staff at top of the active channel. CLINO stands at the water surface. TAPE slides her hand down the depth staff until CLINO sees the hand come into view while keeping the clinometer on 0% slope.

Step 4: Subtract the height where CLINO saw the hand on the depth staff (Step 3) from the eye height established in Step 1. This is the height above the water surface (“A” in Step 3).

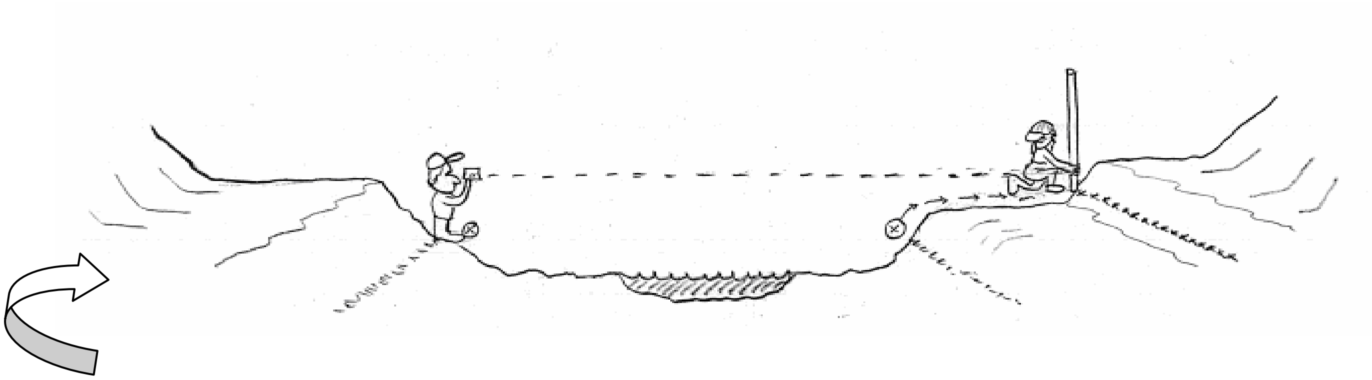


Step 5: CLINO takes the end of the tape measure and starts across the channel while TAPE stays at the active channel margin. CLINO takes 3 depth measurements at ¼, ½, and ¾ distance of the active channel width while crossing the channel (the measurements are usually the water depth but occasionally can be an exposed gravel bar above the water surface).

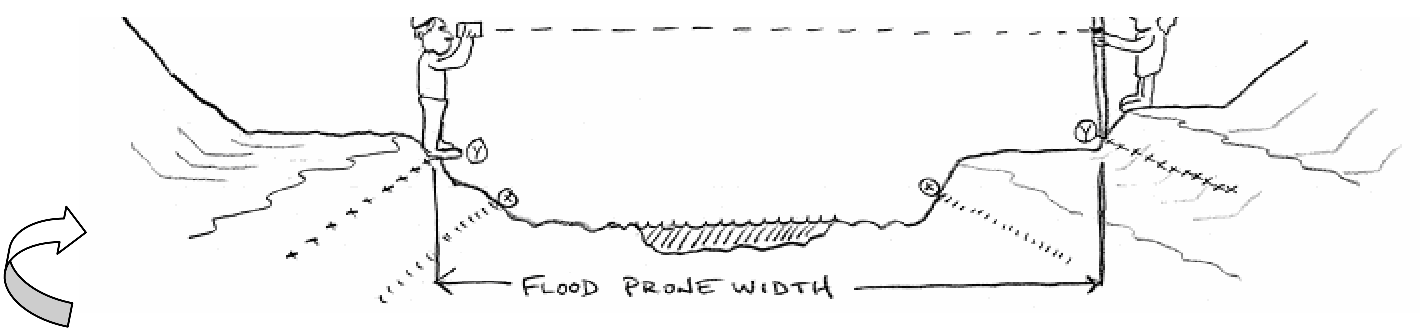
Step 6: Take the average of the three measurements. The example in Step 5 has the measurements 0.15, 0.30, and -0.15 (average = 0.10). Add this value to the measurement "A" obtained in Step 3. This sum is the **A**ctive **C**hannel **H**eight (ACH).



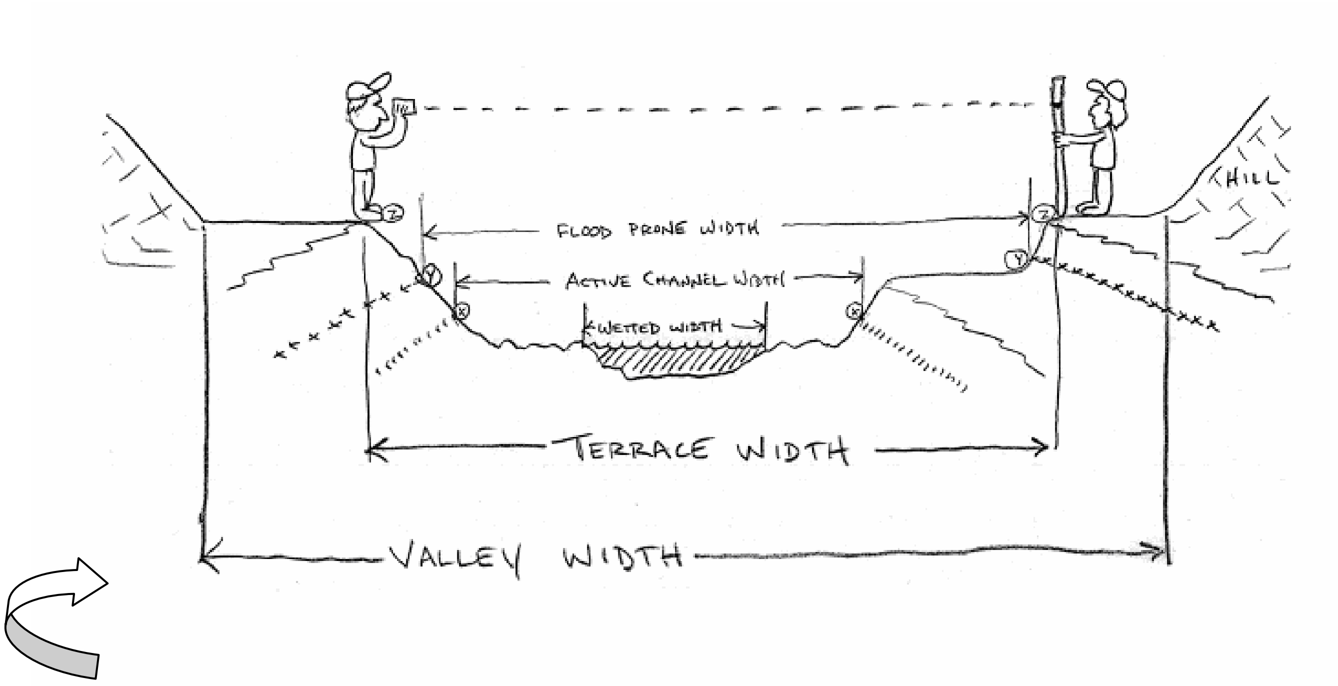
Step 7: TAPE repositions her hand at CLINO's eye height on the depth staff. On the other side of the stream, CLINO backs up the bank until his eye is level with TAPE's hand on the depth staff (using the clinometer at 0% slope). CLINO has now established the active channel margin on the other bank. The distance between CLINO and TAPE is the **A**ctive **C**hannel **W**idth (ACW) as **x** depicts above.



Step 8: TAPE subtracts the Active Channel Height value from CLINO's eye height on the depth staff. CLINO remains at the active channel margin with the clinometer at his eye on 0% slope. TAPE backs up the bank until her hand (at the new position) comes into CLINO's view. TAPE has now established the margin of the flood prone on her side of the stream.



Step 9: TAPE repositions her hand back to CLINO's eye height on the depth staff and does not move. CLINO backs up until his eye (clinometer on 0%) is looking at TAPE's hand. CLINO has now established the flood prone margin on his side of the stream. The measurement between CLINO and TAPE is the **F**lood **P**rone **W**idth (FPW) as depicted by **y** in the above illustration.



Step 10: If a high terrace (terrace feature above FPH) exists within 4 active channel widths then measure a terrace height (TH) and terrace width (TW). TAPE backs up until she is on the edge of the high terrace lip while CLINO stays at the flood prone margin on his side of the stream. TAPE slides her hand down the depth staff until CLINO (with clinometer on 0%) sees TAPE's hand in view. Subtract this height from CLINO's eye height on the depth staff. Add this difference to the Flood Prone Height value. This sum is the **T**errace **H**eight (TH).

TAPE repositions her hand back to CLINO's eye height on the depth staff and stays at the terrace lip while CLINO moves back until his eye (on 0%) is looking at his corresponding eye height on TAPE's depth staff. The distance between them is the **T**errace **W**idth (TW) as **z** depicts above.

The **V**alley **W**idth **I**ndex (VWI) is an estimate of how many Active Channel Widths can fit between the toe of the hillslope on one side of the valley to the toe of the slope on the other side of the valley. In the illustration above, if the Valley Width is 30 meters and the Active Channel Width is 15 meters, then the VWI is 2.0.

Oregon Plan Monitoring and Western Oregon Stream Restoration Program Surveys
Aquatic Inventories Project

Appendix 1- Methods for Random Habitat Surveys

Introduction:

An important objective of the Oregon Plan for Salmon and Watersheds is to determine current salmon habitat conditions and track trends in habitat over time. In order to accomplish this goal a long-term monitoring program coordinating stream habitat surveys, juvenile snorkeling inventories and spawning salmon surveys was developed. All field surveys encompass a point randomly selected using a GIS. The Western Oregon Stream Restoration Program works in conjunction with ODFW Habitat Biologists to asses the stream conditions prior to and post restoration placement. Sites are surveyed during different seasons and temporal periods. Methods for the habitat survey portion of the monitoring effort are similar to the basin surveys that have been conducted by the ODFW Aquatic Inventories Project since 1990. Due to the standard survey length of the monitoring sites, some measurements are taken at increased frequency while others are omitted. These survey modifications are specific to the monitoring surveys and do not apply to the comprehensive basin survey.

Site Set-up

It is crucial that the field surveys are set-up correctly. Some sites will be shared by all Oregon Plan monitoring programs during the same survey season and between years. **The following rules are necessary for successful site setup and are listed in order of importance.**

1) Surveys must encompass the point identified for the site.
2) Surveys must be 1000 meters in length (exception: habitat-only surveys are 500 m)
3) Habitat surveys may not cross a spawning survey ending or beginning sign. If a spawning survey sign is encountered before the point has been surveyed move the survey start up to the spawning survey sign. If a spawning survey sign is encountered after the point has been surveyed then move the start of the survey further down stream. Every effort should be made to not cross a spawning survey boundary while still attaining a length of 1000 meters.

Additional important guidelines:

- ✓ Include only one homogenous reach in survey (see reach section below)
- ✓ When possible start and end surveys at obvious recognizable points (e.g. sharp bends, tributaries, bridges, etc…).
- ✓ Coordinate with Juvenile Snorkel survey crews to survey common sites together. If it is not possible to coordinate with them, please share your complete and accurate start and end point descriptions with them.
- ✓ Clearly mark sites with flagging, take GPS readings at start and end points whenever this is possible, reference these locations on the map.
- ✓ If you have questions about the set-up of a site contact your field supervisor.

Site Marking

GPS coordinates will be taken at the start and end of the survey and each will be recorded on the reach sheet. Indicate the quality of the coverage. They will also be saved on the Garmin GPS unit with the Site Code and S for start or E for end. The GPS units will be downloaded at the end of the season to extract stored information.

GPS GCA codes:

N – North Coast	M – Mid Coast
U – Umpqua	C – Mid-south coast (based out of Charleston)
S – South Coast	

Example: the GPS unit coding for site Mid-Coast 345: start point M345S and end point M345E
Lower Columbia crews should simply enter the site id number with S or E at the end.
Example: Lower Columbia site 12345 should be: start point 12345S and end point 12345E

Yellow site tags and flagging will be placed at a noticeable location at the start and end point of the survey with an aluminum nail. Tags will be marked with stream name, site #, START or END, and the year. Location of the tags will be noted on the reach sheet (e.g. large conifer stump on right). Site tags and flagging should be placed on repeat surveys only when missing.

Photos

Photos will be taken at the start of the survey. Other photos may be taken of outstanding features of interest (such as significant barriers, debris flows, large log jams or riparian blow down). Record photo on the photo sheet and on the corresponding habitat unit on the PDA.

Reach Information

The goal of the habitat survey is to describe stream conditions that are representative of the point selected in the original sampling design. Therefore, it is best for only one reach to be documented in the field survey. There are instances in which the beginning or end of a survey may be moved in order to accommodate a reach break.
Example: On a 1km survey, if a reach break occurs 100 meters into a survey and the survey point has not been reached move the start of the survey to the beginning of the new reach. If the same condition occurs but the point is surveyed in the first 100 meters then move the survey below your initial survey point and restart the survey so that it ends at the reach break. If you modify the survey reach make sure that the new survey does not cross a spawning survey start or end sign.

While some modification may allow the maintenance of only one reach there are instances when a reach break occurs mid-survey. If a major reach change does occur during the survey, the reach will be recorded as a separate reach and the survey will continue for the full length. Only major changes in channel and valley constraint or major tributary junctions are a reason to call additional reaches.

Habitat Unit 1 form

The Metrics (Active Channel Width and Height, Flood Prone Width and Height, and Terrace Height and Width (when applicable)) will be measured 5 times per survey. Restoration sites exceeding 1000m will have more than 5 metric measurements. It is not necessary to break a unit at exactly these distances if it does not happen naturally. Instead, conduct these measurements at the beginning (or end) of the unit closest to the desired distance.

- For 1 km sites these will be taken at 0, 250, 500, 750 and 1000m
- For 0.5 km sites these will be taken at 0, 125, 250, 375 and 500m

If a Restoration site is longer than 1k, then continue measuring the metrics at the same interval until the survey end. All unit lengths and widths will be measured. Unit length will be measured up the center of the channel or following the thalwag in pools. The thalwag is defined as the portion of the stream carrying the most flow. In lateral pools this may be to the right or left of the center of the stream. Unit width will be measured at the point of average unit width. In highly variable or long units, multiple widths will be measured and averaged together. If unit lengths or widths are estimated they must be noted.

In order to ensure an adequate number of habitat units, maximum lengths are:

- The maximum length of fast-water units for 1 km sites is 50m(+5m).
- The maximum length of fast-water units for 0.5 km sites is 25m(+5m).
- There is no maximum length for slow water units (pools).

If a unit will naturally end within 5 m of the maximum unit length the unit may be extended to the natural end.
Example: In a 1 km survey, if a rapid that is 55 m long is followed by a lateral scour pool, there is no need to break the rapid unit into 2 units one 50 m in length and one 5 m in length. If the rapid unit is 60m in length, 2 units would need to be identified and recorded.

Riparian Survey

Riparian transects will be conducted at three (3) points along each survey. As with channel metrics, it is not necessary to break a unit at these measurements. Conduct the transect at the beginning of the unit closest to the desired distance.

- For 1 km sites these will be taken at approximately 250, 500, and 750m.
- For 0.5 km sites these will be taken at approximately 125, 250, and 375m.
-

If a Restoration site is longer than 1k, then continue conducting riparian transects at the same interval – every 250 meters - until the survey end.

Example of Oregon Plan and Restoration Reach form

GCG: 1-NC **SITE ID:** 771

ODFW RANDOM HABITAT SURVEY SITE FORM

GCG: 1-NC **SITE ID:** 771
SURVEY TYPE: s,r,h
STREAM: Summit Cr, S Fk
BASIN: Trask River
SUBBASIN: South Fork
START: Start at trib right

END: Survey 1000 meters

COMMENTS:

LENGTH:
INTERVAL: s48
QUAD: Dovre Pk

GPS Coordinates	UTM EASTING (10T)	UTM NORTHING (UTM)
START		
POINT	451884	5021575
UPSTREAM		

Date Completed: / / **Surveyors** ____

Township-Range-Section-1/4: T | R | S | 1/4

	Reach 1	Reach 2 Unit ___
Channel Form		
Valley Form		
VWI		
Temp (C)		
Flow		

	Reach 1	Reach 2 Unit ___
Veg Class Dominant		
Veg Class Sub-Dom		
Land Use Dominant		
Land Use Sub-Dom		

Reach Drawings

AMPHIBIANS OBSERVED: At Riparian Transect? (Y or N) ____ Within Survey? (Y or N) ____

LANDOWNERS

GCG	Site#	Name	Contact	Address	City	State	ZIP	Phone	OK Date	DATA REQUEST	Tax Lot #	Comments
1-NC	771	STATE									100	T3SR8W
1-NC	771	Green Diamond Resources	Mitch Parker/Dan Clay	PO Box 190	Tillamook	OR	97141	503-842-3180			6400	503-704-9195

SITE ACCESS DESCRIPTION

This is how the spawners got to their site. FROM TRASK, PARK ON TRASK RIVER RD. CONTINUE 2.0 MILES TO A FORK. GO RIGHT AND PROCEED 4.6 MILES TO A ROAD BRIDGE ON RIGHT. TURN RIGHT AND PROCEED 0.6 MILES TO A SHOULDER ON THE LEFT BEFORE THE ROAD BENDS RIGHT. SUMMIT CR. IS VISIBLE ACROSS S. FK. TRASK R. HIKE DOWN THE BANK, CROSS S. FK. TRASK R. AND ACCESS SUMMIT CR. WALK UPSTREAM 100M TO S. FK. SUMMIT CR. ON RIGHT.

Oregon Plan Monitoring Surveys
Aquatic Inventories Project

Appendix 2- Fish Inventory Protocols

Introduction

In 1998, the Oregon Plan for Salmon and Watersheds (OPSW) mandated that the Oregon Department of Fish and Wildlife (ODFW) establish annual surveys to monitor stream habitat and fish populations in Oregon coastal streams. At sites upstream of the known distribution of coho, fish are sampled with electrofishing gear to assess species composition and distribution. In 2006, an amphibian survey was added to the protocol. The amphibian survey is to be conducted at every site.

FISH SAMPLING:

The Effect of Pulsed Direct Current on Fish

Electroshocking surveys are conducted with Smith-Root backpack electrofishers that discharge direct pulsed current. When the button on the probe (anode) is pushed, an electrical circuit is completed through the water when the current flows from the negative cathode (rattail) through the water and then to the positively charged anode (probe). Fish that are on the periphery of a weak electrical current experience mild nerve excitation but still retain control of swimming ability and will escape from the field. Those under a strong electrical field experience a progressive series of reactions that culminate in immobilization. The polarized nature of body musculature often causes fish to curve toward and face the anode, but the initial orientation of fish in the electrical field results in varied directional responses. Spasmodic undulations of the musculature induced by the electrical field may also result in involuntarily swimming (electrotaxis) towards the anode probe. As fish move closer to the anode probe, they experience increased intensity of electrical current. Above a certain intensity, body muscles become cramped and fish are immobilized.

Fish close to the anode probe are quickly immobilized and may not exhibit electrotaxis. Larger fish are more easily immobilized than smaller fish because they present a greater amount of nerve tissue to the electrical field at a given distance from the anode probe. In addition to voltage the frequency and wavelength of pulsed direct current has different effects on muscles depending on fish size, species, water temperature and conductivity. Smaller fish generally require higher pulse frequencies to become immobilized. A minimum frequency exists below which fish will not be immobilized.

Fish recover the ability to swim quickly after electroshocking if the applied current is not too strong and the amount of time they are exposed to the electrical field is short. However, the fish may experience physiological stress for several days following shocking. Injury (damage to swim bladders, muscles, and skin; fractured vertebrae; and bleeding have been reported) or death can result if excessive current is applied.

The zone of potential fish injury is 0.5 m from the anode. Care should be taken in shallow waters, undercut banks, or where fish can be concentrated because in such areas the fish are more likely to come into close contact with the anode (NMFS, 2000).

Crew members should carefully observe the condition of sampled fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit should be adjusted. *Sampling should be terminated if injuries or abnormally long recovery times persist even after shocker settings have been reduced.*

Safety

The use of electrofishers can be dangerous. Some fatalities have occurred with older electrofishers that lacked tilt switches. Common sense will eliminate most of the potential for injury. Prevent exposure to the electrical field. Use nets with insulated metal handles. Wear standard weight waders or boots without leaks.

Rubber gloves are required to be worn while electrofishing. Replace ripped or overly worn gloves. Never place bare hands in the water unless it is completely understood that the electrical current is off and the probe is removed from the water.

Stunned fish frequently need to be extracted from crevices in the streambed. Before attempting to pick up a fish, have a well understood convention with the electrofisher operator, such as the netter saying "off" and having "off" repeated by the operator after the current is stopped and the probe lifted from the water. Resume electrofishing only after both parties give an "on" command. When reaching into crevices, use only one hand and keep the other arm well out of the water. This prevents passing an arc of current through your chest. Also, there is a chance of shock if you touch the probe in the “on” position at the same time you are touching the box on the backpack.

Technique

Electrofishing has the potential to harm or to cause direct mortality of fish. Electrofishing can also be hazardous to the survey crew if not performed correctly. Use the least amount of voltage and lowest frequency pulse that effectively immobilizes fish (see section below on Electrofishing Methods). This decreases stress and chance of injury to the fish. It also extends the amount of time on the battery charge. Increase voltage when target fish are small or when the conductivity of the water is low. Decrease the voltage and frequency if large fish are observed in the habitat unit. *Do not sample if adult salmon are observed in the unit.*

Sample at least 3 pools and 3 fastwater units totaling a minimum of 60 meters stream length. Record the fish collected in the first pool by species and size. Sample at least 15 meters of the fastwater unit immediately above the pool and record the fish captured. Walk upstream to the next pool and sample it and the fastwater unit above. Consecutive sampling is preferred. Continue sampling until 3 pool – fastwater sequences have been sampled. If a fish species or life history stage not observed in the first 4 units is captured in the 5^{th} or 6^{th} unit, sample another pool and fastwater unit. In small streams with low flow, you may have to walk a considerable distance to locate pools. In larger streams with long habitat units, you may need to subsample within unit types as well as sample a variety of unit types. If you detect a potential fish barrier in the habitat survey, electrofish above and below the barrier to determine if it impedes fish passage.

Release netted fish far enough downstream to be outside the electrical field. Carefully release fish back into the water; fish should not be exposed to air for more than a few seconds or latent mortality will likely occur.

If you are unable to identify the fish: write a description, take a close-up photo, or preserve a few individuals in ethanol for later identification. Write the date, stream name, sample site code, and name of the sampling crew members on the label in the jar or ziplock. Note on the data form that a collection was made at that site.

If fish were observed but not captured, indicate as much on the data sheet and approximate the length. If movement was seen but not body length nor size, do not guess these data. Write a note on the fish sheet decribing what was observed. It is easy to confuse movement of a salamander with that of a fish.

Survey Guidelines

(Information in this section taken from Rodgers 2001 unless otherwise cited)

Do not shock when water temperatures are above 18 C (65F) or expected to be above this temperature prior to completing the electrofishing. If water temperatures are appropriate in the morning, but you anticipate that they will increase later in the day, electrofish before you complete the habitat survey.

Measure the water conductivity and record it on the Fish Survey data form. High conductivity (over 2,000 microSiemens/cc) allows the electric current to spread throughout the water, decreasing the risk to fish health because most of the current flows through the water and not the fish. With higher conductivity readings use low voltages. Water conductivity may be higher in agricultural areas due to chemicals applied to fields and associated runoff. Conductivity of water also increases with increasing water temperature (Smith-Root 1998)

Smith Root electrofishers allow for adjustment of voltage, waveform, and frequency. Start with a setting of H-4 and 200 volts if in shallow pools; H-4 and 300 volts if sampling in deeper pools (>0.8m). Note that a pool for shocking may be smaller than pools identified in a standard habitat survey. If damage to fish (visible burn marks, extended spasms or long recovery periods) is occurring, decrease voltage to 100V. If fish continue to be injured, change settings to G-3 and 100V. If damage continues, try F-3 and 100V.

Increase voltage to 300V at H-4 if only small fish are being netted and larger fish are observed swimming away from the probe or fish are not stunned long enough to net. If either of these conditions continue, increase settings to I-4 and 200V. If this isn't catching fish, increase voltage to 300V and I-4. **Do NOT increase voltage beyond 300V.** Make sure to record shocker settings on the Fish Survey form.

The preferred method to prevent accidental mortality is to "attract" fish to the ring rather than actually "rolling" them. Keep the trigger on while "attracting" or "pulling" fish and netting them. Release trigger if you are rolling fish before you are able to net them.

The best way to get fish within an effective radius of the anode probe is to "surprise" them. Position the probe in a new area while it is turned off, turn it on only after it is in place. Sweeping a live probe about the stream merely introduces the weak border of the electrical field to new areas and fish will easily detect and escape the field. The stream should be covered systematically, moving the anode in a herringbone pattern through the water. Do not electrofish one area for an extended period. Continue shocking the habitat unit until the first pass is completed OR until at least one juvenile coho has been captured. Electrofishing of a stream must be terminated once a coho has been captured and positively identified.

Tips about the anode:

- *Do not use a net on the end of the ring.*
- *Wrapping the ring with cording may reduce damage to fish. Be sure to check the wrapped ring periodically for corrosion.*
- *Larger rings are better than smaller rings, they reduce the power gradient near the ring.*
- *Keep ring clean using a Scotch-brite pad suitable for Teflon. Do not use steel wool. Ring are fragile so be careful not to break them when cleaning.*

Tips about the cathode:

- *Add more area effected by electrical current by keeping the tail behind you in the same unit you are shocking. Be careful the cathode is not close to the anode and do not allow them to touch.*

Fish Survey Data Form
(most of the information in this section taken from "Methods from Stream Fish Inventories" 1998)

Header Information

Crew: Names of surveyors.

Stream name: Spell out the complete name of the stream being surveyed. Include the site identification number and monitoring area (MA) code.

USGS Map: Name of the USGS. 7.5 minute topographic quad.

Basin: Use the name of the large river commonly used to describe a region. For example, use McKenzie R as the basin name when sampling Lookout CR, not Willamette or Columbia.

Date: MM/DD/YY.

Notes: Additional information concerning sample site location (particularly relative to culverts or other potential barriers), type of ownership, and access roads or trails. Comments on the weather, cloud cover or precipitation, visibility and habitat condition can also be made.

UTM Start: Record the UTM coordinates at the beginning point of the fish survey.

UTM End: Record the UTM coordinates at the end point of the fish survey.

Map Code: Record the site's code including monitoring area and site id number (such as U1556 – for Umpqua site #1556). Be sure to mark all sites on topo maps and be as accurate as possible in marking sample sites on maps.

Active Channel Width: Distance <u>across channel</u> at "bank full" annual high flow estimated from change in vegetation, slope break, or high water mark. Sum the width of all active channels in multichannel situations.

Active Channel Height: Vertical distance from the stream bottom to the top of the active channel.

Stream Flow:
DR DRy
PD Puddled. Series of isolated pools connected by surface trickle or subsurface flow.
LF Low Flow. Surface water flowing across 50 to 75 percent of the active channel surface.
MF Moderate Flow. Surface water flowing across 75 to 90 percent of the active channel surface.

HF High Flow. Stream flowing completely across active channel surface but not at bankfull.
BF Bankfull Flow. Stream flowing at the upper level of the active channel bank.
FF Flood Flow. Stream flowing over banks onto low terraces or floodplain.

Water Temp: Degrees Centigrade or Fahrenheit; indicate scale used.

Gear/Method: Indicate method of sampling (i.e. snorkel, seining, or electrofishing). When electrofishing, indicate voltage setting of electroshocking unit.

Photo number and time: Take a photograph that shows the stream and riparian zone typical of the reach sampled. Record the exposure number and the time shown on the camera back. This can be the same photo used for the habitat survey.

Location: Township, range, and 1/4 section at the start of the fish survey site. Use following format: T10S R5W S22 SE. Draw a rough sketch of the stream as it appears in the topo map section in the upper right corner of the data form (see example).

Site Detail and Fish Species Information

Survey Number: The number of the unit sampled during habitat survey (if known). Not particularly important for Oregon Plan sites.

Sequence Number: The sequential number describing the order that channel units were sampled. Sample a minimum of 6 units and at least 60 meters.

Unit or Channel Type: Use the habitat types listed in the physical habitat survey methods.

Unit Length: Estimated length of each habitat unit or channel type sampled.

Depth: Maximum depth in pools, modal or typical depth in glides and other fast water habitat unit types.

Fish Code: Use the standard codes for the following species.
standard abbreviations:

BG	bluegill	LAM	lamprey
BLB	black bullhead	MSU	mountain sucker
BR	brown trout	OC	Oregon chub
BRB	brown bullhead	PK	pumpkinseed
BSU	bridgelip sucker	PM	peamouth
BT	brook trout	PS	pink salmon
BUT	bull trout	RB	rainbow trout
CC	channel catfish	RSS	redside shiner
CH	chinook salmon	RT	redband trout
CLM	chiselmouth	SB	smallmouth bass
CO	coho salmon	SS	sockeye salmon
CS	chum salmon	ST	steelhead
CSU	largescale sucker	SU	sucker
CT	cutthroat trout	WF	mountain whitefish
D	dace		

non-standard abbreviations:

AM	ammocoetes	PGS	Pacific giant salamander
AS	Atlantic salmon	RTS	reticulate sculpin
ATF	adult tailed frog	RO	roach
BD	black dace	RSN	rough skin newt
BTH	brook/bull hybrid	SH	shiner spp.
C	crappie	SKB	stickleback
CF	crayfish	SR	sandroller
COT	sculpin	SPD	speckled dace
CP	carp	NPM	northern pike minnonw/squawfish
CTH	cutthroat hybrid	SNF	sunfish
FRG	frog (species unknown)	SF	salmonid fry (age 0+)
JSU	Jenny lake sucker	SAL	salamander
LB	largemouth bass	TC	tui chub
LND	longnose dace	TF	trout fry (age 0+)
MF	western mosquitofish	TFT	tailed frog tadpole
MMS	Malheur mottled sculpin	UT	unknown trout
MS	mottled sculpin	US	unknown salmonid
X	no fish found	YP	yellow perch

For species not on the list, a code should be invented and an explanation of the code must be given in the note column and on every data form the invented code is used on.

Count: Tally of the number of fish grouped by species and size class.

Note: Indicate whether length was estimated (E) or measured (M) in comments column. Write measured lengths in all columns as needed. Also indicate pass number when separate passes are made within a single habitat unit (ie: E-1 for estimated 1st pass).

Electrofisher Troubleshooting

Malfunction of the electrofishing system may occur in the field and can be very frustrating. The following tips can help to resolve problems with the equipment.
Problem: Unit won't shock fish.

Possible Solutions:

1. Dirty anode ring. Clean ring with wire wheel or abrasive pad. DO NOT USE SANDPAPER!
2. Broken wire in anode pole. Try a different pole. See section on ANODE TESTING for testing anode poles.
3. Broken cathode (tail). Try a different cathode. See section on CATHODE TESTING for testing tails.
4. Battery weak or dead. Check voltmeter on front of unit with output activated. Replace battery if necessary.
5. Loose connection at battery terminals. Tighten connection if possible. If connection is broken or burned return for repair.
6. No output. Return unit for repair.
7. Unit is tilted at too steep an angle. Tip over switch is turning off unit. Make sure to stand upright when shocking.
8. Rattail is not in water. Both the probe and rattail must be in the water for a circuit to be completed.

Problem: Unit overloads.

Possible Solutions:

1. Output voltage set too high. Reduce output voltage setting.
2. Pulse width or frequency control set too high. Reduce setting.
3. Anode and cathode too close together. Increase distance between electrodes.
4. Metallic object in the water or stream bed near the shocker.

Problem: Relay clicks on and off when output activated.

Possible Solutions:

1. Broken wire in anode pole curl cord. Try a different pole.
2. Weak battery. Replace.
3. Bad connection at battery terminals. Tighten connection is possible. If connection is broken or burned return for repair.

Problem: On/Off circuit breaker trips when unit is turned on.

Possible Solution:

1. Battery connected backwards. Return unit for repair.

Anode Testing

1. Disconnect pole from shocker.
2. Connect red lead of ohmmeter to pin A in plug on end of curl cord.
3. Connect black lead of ohmmeter to anode ring or bottom of pole.
4. Set ohmmeter to read 200 ohms full scale.
5. The ohmmeter should read near zero ohms regardless of pole switch position if not the pole is bad. Shake the curl cord during this test. If the reading changes the pole is bad.
6. Connect the red lead of the ohmmeter to pin B in the pole connector.
7. Connect the black lead of the ohmmeter to pin C in the pole connector.
8. The ohmmeter should read infinite resistance until the pole switch is pressed. if not the pole is bad. Shake the curl cord during this test, if the reading changes the pole is bad.
9. Press the pole switch. The ohmmeter should read near zero ohms. If not the pole is bad. Shake the curl cord during this test, if the reading changes the pole is bad.
10. Test between each pin in the plug and the metal shell of the plug. The ohmmeter should read infinite resistance, if not the pole is bad.

Cathode Testing

1. Disconnect cathode from shocker.
2. Connect red lead of ohmmeter to pin A in plug on end of cathode.
3. Connect black lead of ohmmeter to bare cathode cable.
4. Set ohmmeter to read 200 ohms full scale.
5. The ohmmeter should read near zero ohms. If not the cathode is bad. Pull on the cable, if the reading changes the cathode is bad.
6. Connect the red lead of the ohmmeter to pin B in the cathode plug.
7. Connect the black lead of the ohmmeter to pin C in the cathode plug.

8. The ohmmeter should read near zero ohms, if not the cathode is bad.
9. Test between each pin in the plug and the metal shell of the plug. Ohmmeter should read infinite resistance, if not the cathode is bad.

Batteries

Our Smith-Root backpack electroshockers are powered by a 24 volt gel cell battery. Following some simple procedures can prolong a battery's service life. For instance:

1. Recharge batteries after every use.
2. Protect batteries both in use and in storage by periodically charging them during cold weather. Cold temperatures reduce the amount of cranking capacity a battery can offer so it is best if batteries are not left in the cold.

Always place batteries on a wood surface when in use or in storage. If left set directly on the ground, the battery will discharge.

References

Methods for Stream Fish Inventories. 1998. Oregon Department of Fish and Wildlife-Aquatic Inventories Project, Natural Production Section, Corvallis Oregon. Version 7.1, July1998.

NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. 2000. National Marine Fisheries Service, National Oceanic and Atmospheric Administration.

Rodgers, Jeff. 2002. Protocols for Conducting Juvenile Coho Salmon Surveys in Oregon Coastal Streams. Oregon Department of Fish and Wildlife, Corvallis Oregon.

Rodgers, Jeff. 2001. Personal Communication.

Smith-Root Backpack Electrofishers. 1998. Smith-Root, Inc. Vancouver, WA Rev. 03.

Oregon Plan Monitoring Surveys
Aquatic Inventories Project

Appendix 3- Amphibian Inventory Protocols

AMPHIBIAN SAMPLING:

Purpose:

The Aquatic Inventories Project began collecting amphibian information in 2006. The purpose of the amphibian survey is to establish a general baseline database about amphibian distribution throughout western Oregon. The observations will form the basis for evaluating the distribution of amphibian species over broad areas and for determining whether their populations are changing.

Crews should recognize that amphibians are fragile creatures, and over handling an individual can harm or kill it. Amphibian skin absorbs lotion, bug spray, perfume and cologne, and other chemicals. Care should be taken to not disturb habitat that is used by amphibians.

Survey Guidelines:

The following guide is meant to be a quick look at some of the Western Oregon species that may be encountered during stream habitat surveys. This is not a complete list of Oregon amphibians, and species that aren't described on the list below may be encountered while on a stream survey. A professional amphibian identification guide should be used in conjunction to this guide. Observations are to be recorded in the NOTE field of either the Estimator or Numerator data sheet (The reach sheet of the Oregon Plan and Restoration sites has a yes/no box to complete at the end of the survey. Additionally, PDA users should record observations in the NOTE field and check the box on the Reach form if applicable). Please, if possible, take a picture of the unknown species for later identification.

The information to be gathered includes:

- Species (use these abbreviations for the more common species):

PGS	Pacific giant salamander	NWS	Northwest salamander
ATF	adult tailed frog	LTS	long-toed salamander
RSN	rough skin newt	RLF	red-legged frog
FRG	frog (species unknown)	YLF	yellow-legged frog
TFT	tailed frog tadpole	BF	bull frog

- Substrate under the observed amphibian (log, moss, rock, mud, etc)
- Activity (breeding, calling, feeding, etc – if it can be determined)
- Photograph (if ID is questionable)
- Time of day (am or pm)

Salamanders:

Pacific Giant Salamander (*Dicamptodon tenebrosus*)

This is a very large, bulky salamander that is common throughout Western Oregon from the Cascades to the coast. It is the largest salamander in the region, and has a broad, thick head, a muscular body and limbs. Juveniles and Non-metamorphosed adults have very bushy gills, usually without visible stalks, and are dark brown in color. The head is usually wider than the body, and they have a laterally compressed tail which starts near the hind limbs. Juveniles and Non-metamorphosed adults can reach 14 inches in length. Metamorphosed adults of this species can also be found near streams, and are often black or gray with striking mottled brassy or coppery patterns that interconnect over the body. Metamorphosed adults can reach 7 ½ inches in length.

Pacific Giant Salamanders are quick and can deliver a very painful bite – handle with care.

Rough-Skinned Newt (*Taricha granulosa*)

Adults of this species are extremely common in Western Oregon ponds, streams, and forests from the Cascades through the coast range. Juveniles and adults have a pale yellow eye crossed with a dark bar. Adults are easily identified, as they are dark brown on the backs and sides, and orange to yellow on the underside. Their skin can often appear dry and rough, although the skin of individuals found in water will often appear smooth. This species does not have grooves on the sides of the body. Adults can reach nearly 8 inches in length.

Surveyors should take care when handling this species, as they are the most toxic of all Oregon's amphibians. It is highly recommended to wash your hands after handling this species.

Northwestern Salamander (*Ambystoma gracile*)

Juvenile and Non-metamorphosed adults are abundant in Western Oregon ponds and streams from the cascades through the coast range. Juveniles have gills which protrude from the head on long stalks, and have the appearance of ostrich feathers. Typically black to olive green in color. Metamorphosed adults are typically brown to black and have a fat, robust appearance. Key features include deep grooves along the body, and large glands at the back of the head. Adults can reach 7 ¼ inches in length.

Long-Toed Salamander (*Ambystoma macrodactylum*)

This species is typically found throughout the Willamette Valley, in the coast range North of the Rogue River, throughout the Cascades, and much of Eastern Oregon. They are widespread throughout the state, existing in many different types of habitats. During the course of aquatic habitat surveys, they will be most frequently encountered in shallow to deep ponds and marshy environments. Juveniles of this species develop rapidly, and should metamorphose early in the summer. Adults are black to dark gray, and often have a mottled dark mustard colored stripe down the back. The defining characteristic is the presence of a long fourth toe on each hind foot. Adults can reach 6 ¼ inches in length.

Torrent Salamanders (*Rhyacotriton spp.*)

A smaller species of salamander found throughout the Willamette Valley and along the coast in Oregon. This salamander is typically brown to honey colored with a orange to yellow underside. Adults are often seen with white and black flecks covering the body. This species has large eyes that are perched high on their head. Males of the species have an enlarged vent. Adults can be up to 4 inches in length.

Dunn's Salamander (*Plethodon dunni*)

A small salamander often identified because it actively runs to escape human contact and can be found throughout Western Oregon, often right along the sides of streams but rarely in the water. They have a long, thin body with short legs. They are dark brown in color with a yellow to green stripe down the back. This stripe does not extend all the way to the end of the tail, and is ragged on the sides. The speckles of the color of the stripe can typically be seen on the sides of these individuals. Length up to 6 inches.

Western Red-Backed Salamander (*Plethodon vehiculum*)

This is a small salamander that can be found on the edges of streams through most of the Western Oregon from Coos and Douglas Counties North. They have a long, thin body with short legs. They are dark brown in color with a yellow, green, or red stripe down the back. This stripe is very distinct with sharp edges and extends all the way to the end of the tail. Length up to just over 4 inches.

Frogs and Toads:

Tailed Frogs (*Ascaphus truei*)

This frog lives in cool, fast moving streams in the Cascades and Coast Range of Oregon. Tadpoles of this species have a mouth that allows it to cling to rocks in fast moving water. Tadpoles can be observed clinging to rocks in riffles and rapids. Adults are small with long legs, flat hind toes and a large head. Individuals are typically mottled tan or brown, with a tan triangle on the head between the eyes and the end of the snout. Their skin can often be grainy. Males have a short, wide tail. Adults can be up to 2 inches in length.

Western Toad (*Bufo boreas*)

This species can be found in ponds, marshes, and along the edges of streams throughout Oregon except within the Willamette Valley and the coast range, although they can be found along the coast. This toad is large and robust. Color can vary and ranges from cream to brown, and typically covered in darker blotches. There is almost always a light colored, thin stripe down the back. The skin is bumpy and often dry. Adults can be up to 5 inches in length.

Pacific Treefrog (*Hyla regilla*)

This frog is very common and abundant throughout Oregon. Adults are small. The key characteristic for this species is toe pads on the ends of the toes. This species is wildly variable in color, but will often be observed as green, gray, or tan with darker mottling on the sides and back. They have a dark stipe or mask which extends from the tip of the snout through the eye and to the shoulder. Adults are typically under 2 inches in length.

Cascades Frog (*Rana cascadae*)

This frog is limited to the Cascade range, and is typically found in and around streams, marshes and ponds above 2000 feet in elevation. They are typically honey to olive green colored, and have sharp edged black spots on their backs. They have two folds that extend from the eyes towards the tail, which are usually raised and lighter in color. The groin area is usually a solid color without mottling. Adults are typically around 3 inches in length.

Red-Legged Frog (*Rana aurora*)

This frog is common in streams, ponds, and marshes west of the Cascades. They are green to brown or reddish-brown and sometimes have black spots or mottling over their back. The undersides of the legs of these frogs are red, and this color can often continue over the belly. The groin at the hind leg is mottled with cream and black blotches. Adults range from 2 ¾ inches up to 4 inches in length.

Foothill Yellow-Legged Frog (*Rana boylii*)

This frog is found in and along streams and rivers along the west slope of the cascades from the Santiam basin south, and throughout south coast. These frogs prefer low gradient streams with bedrock or gravel substrates. They are typically olive, gray or brown in color and their skin appears rough. The undersides of the hind legs are often yellow, but sometimes cream colored. The throat usually has darker mottling. Adults can reach up to 3 inches in length.

American Bullfrog (*Rana catesbeiana*)

This is an introduced species that has found its way all over western Oregon. They are large light to dark olive green frogs with darker spots and blotches. They have large, golden colored eyes, and a ridge that extends behind the eye, over the eardrum, and down to the throat. Their eardrums are distinct and at least as large as their eyes, but can be larger in males. The undersides are cream colored with dark mottling.

NOTES: