Methods for Assessing Wetland Functions

Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington

Part 2: Procedures for Collecting Data

Ecology Publication #99-116

Tom Hruby PhD[1]

Teri Granger[1]

Emily Teachout[1]

[1] Washington State Department of Ecology

Preferred Citation:

Hruby, T, T. Granger, and E.Teachout. 1999. Methods for Assessing Wetland Functions. Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington. Part 2: Procedures for Collecting Data. Washington State Department Ecology Publication #99-116, Olympia, Washington.

For additional information about the project contact:

Emily Teachout

Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

Telephone: (360) 407-6172

Email: etea461@ecy.wa.gov

Or visit our home page at www.wa.gov/ecology/sea/shorelan.html

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Acknowledgements

The many people who have made this project possible have been acknowledged in Part 1. We will, however, repeat our appreciation for work of the field teams who collected data used to calibrate the methods for western Washington lowlands. The team members made invaluable suggestions used to improve the procedures for collecting data. A hearty thanks go to field staff from the following agencies: Seattle and Portland offices of the Environmental Protection Agency and US Army Corps of Engineers, Washington State Department of Transportation, Washington State Department of Ecology, National Resources Conservation Service, US Fish and Wildlife Service, and Washington State Department of Fish and Wildlife.

For Part 2 we also thank the agencies and local governments that assisted our field effort by allowing the Field and Assessment Teams to access wetlands on publicly managed lands.

Overview of Part 2

This is the second of two parts of a document containing methods to assess selected types of wetlands in the Washington. The first part provides background information on the Washington State Wetland Function Assessment Project, the technical basis for method development, a brief description of how to apply the methods, a discussion on using the numeric results, as well as methods for four wetland subclasses. This part contains detailed descriptions of how to apply the methods in the field including procedures for collecting data and data sheets.

Chapter 1 provides background information on how the data are used, and the expertise and time needed to apply the methods and collect the data. It also introduces the data sheets (located in the appendices) used to record the data.

Chapter 2 recommends 11 steps for completing the assessments including gathering site-specific information such as maps and photography, dividing a wetland into AUs when appropriate, and collecting the data.

Chapter 3 consists of the detailed procedures for collecting each datum used for any of the four subclasses in the methods.

The appendices contain data sheets, profiles of the subclasses (also in Part 1), the summary sheet to record the numeric results and qualitative rating of opportunity, lists of common plants, and other useful tools.

Part 1. Introduction

1.1 How Data Are Used

Specific data are needed to calculate an index of performance for each function. Examples of data include the number of Cowardin vegetation classes and the constriction of the outlet of the area being assessed. An individual datum may be used directly to represent a variable, or it may be combined with other data to represent a variable. When several data are used to represent a variable, the data are often combined in an equation to calculate a value for a variable that is then scaled from 0 to 1.

1.2 Expertise and Training Needed to Collect the Data

Technical expertise in wetland science is needed to apply the methods and to collect and record the data accurately and consistently. The data are based on observations made at the site being assessed. A strong background in wetland science is, therefore, needed. At a minimum, the level of expertise needed to apply the methods should be similar to that needed to delineate wetlands.

> The methods are designed for use by technical specialists with a strong background in wetland science.

Training in the use of these methods is strongly recommended. After conducting testing of the methods, it was determined that training was important for accurate and appropriate application of the methods. At the time of printing, Ecology staff was providing 5-day training workshops in applying the methods. Whether the trainings continue through Ecology, or through another party, users are encouraged to seek training prior to application of the methods.

1.3 Time Needed to Collect Data

The time needed to collect data will vary depending on the complexity and size of assessment unit (AU), and how difficult it is to access and move within it. Larger sites with dense brush may involve more time and strenuous effort. In some cases you may not be able to access portions of the site. You may need to combine your direct observations at the site, interpretation of aerial photographs, and a combination of other resources to collect all the data required.

We estimate that it will take several hours to a day to collect data in most cases. Please note that identifying AUs within a complex wetland system may be more time consuming than collecting the data in some cases.

This estimate does not include the time required to delineate the wetland boundary if that is necessary for other reasons. Some of the data, however, can be collected while the boundary delineation is being performed.

1.4 Using the Data Sheets

Data collected are recorded on data sheets. Three data sheets have been developed because data needed to assess functions for each subclass are not always the same. One data sheet is used for depressional outflow and riverine impounding (Appendix II A), the second for depressional closed (Appendix II B), and the third for riverine flow-through (Appendix II C).

A total of 53 data, many broken into several items, are individually numbered on the data sheet. For example, D14 is Cowardin vegetation classes expressed as a % of the area of the unit being assessed. D14 is subdivided into:

D14.1 — evergreen forest
D14.2 — deciduous forest
D14.3 — evergreen scrub-shrub
D14.4 — deciduous scrub-shrub
D14.5 — emergent
D14.6 — aquatic bed

The datum number is used to link the datum to the calculations used in modeling the functions.

The same datum numbers are used for all three data sheets. If a datum is not used for models assessing that wetland subclass, the number is retained but left blank on the data sheet.

The data sheets are loosely organized by subject, such as landscape, water regime, vegetation, special habitat features, and physical structure. These subjects **do not** necessarily relate to types of functions. Don't assume, for example, that data in the water regime section are used for the water quantity functions.

The sheets should always be used in conjunction with the written procedures in this Part. The sheets contain selected notes as to how to collect data but <u>are not inclusive</u> of all that must be considered during data collection. For example, many data have to meet a minimum size requirement to be recorded.

Some data, such as the presence of different decomposition stages of snags, can be recorded as you walk around the AU. Other data, such as the % of the AU with different vegetation classes, must be recorded after your reconnaissance is complete and the photo maps have been finalized. photo maps are described later.

The data sheets that we provide in the appendices are up to nine pages long, partly because we provide ample space for notes and easier use. You may, however, want to use a computer

to scan the data sheets and compress them onto a smaller number of pages. In addition, Appendix II D provides a one-page sheet containing the pictorial diagrams and matrices for structures of aquatic bed plants, the presence of different decay classes of snags, and the size and decay classes of large woody debris.

You can arrange the data sheets to your liking as long as the content and numbering of each datum does not change.

A dichotomous key to help you determine the hydrogeomorphic classification is included as part of the data sheets.

Appendix II E contains a sheet that should be used to summarize the results of the assessment. The results include the indices of potential performance and habitat suitability, the performance or habitat suitability index expressed as acre or hectare points for each function, and a qualitative rating and description of opportunity. It also provides space for the rationale used to divide the wetland into AUs (if needed), and other notes such as the presence of endangered and threatened species.

All measurements of area and distance should be recorded on the data sheet in the metric system. If you plan to collect data using the "English" system please convert the information before recording it. Appendix II F provides a conversion table for the measurements of area and distance.

2. Recommended Steps for Completing an Assessment

Collecting the data may seem daunting. By following the steps described, however, the "task" can be broken down into several simpler tasks. The steps describe, in general, the materials needed prior to going to the field, how to classify the wetland being assessed, how to identify the area of wetland to assess (this is called the Assessment Unit or AU), how to collect the data, and how to calculate the results.

Step 1: Read and Understand the Methods and Procedures for Collecting Data

Before collecting data, it is important that you understand the methods and their models; including what the methods don't do, what the numeric results of the methods represent, and how the data are used. This information is provided in Part 1. It is also critical that you read and understand the profiles describing the characteristics of wetland subclasses (Appendix II G) and the procedures for collecting each datum provided in this Part.

Step 2: Gather Site Information and Equipment

A number of materials such as aerial photographs and maps are used to orient you to the site, create photo maps and sketches of the site, and collect the data. Below is a list of photographs, maps, and information that you will need. Some are required whereas others are helpful. The list of those that are helpful is not inclusive of everything you could use, but are offered as examples. You should gather and review the information prior to going to the site. A list of recommended equipment is also provided.

Required Materials

Aerial Photographs — At a minimum, aerial photographs at a scale of 1:12,000 are needed. It is best, however, to obtain the largest scale and the most recent photograph available. Color infrared is superior to black and white. It is good to have stereo pairs so you can observe the area being assessed through a stereoscope to view it in 3D.

Copies of the Aerials or Mylar Overlays — You will need to make various maps of the site to complete the data sheets. A sketch of the boundary of the AU, and other features, drawn on aerial photographs are used as photo maps. For example, to determine the % of the site occupied for evergreen forest, you should draw a polygon on a photograph to arrive at your visual estimate.

Photo Maps — To make photo maps use high-resolution copies of the aerial photograph or use acetate (mylar) to make maps that overlay the aerial photograph. In some cases, the photograph may need to be enlarged to be useable. Some photocopy businesses can produce good quality, high-resolution copies and enlargements. If a larger scale copy can't be made, you may use hand-drawn sketches of small sites. The sketches should have identifying landmarks that relate to features visible on the photograph.

Each Map Should Contain the Following:

Title Block — The AU identification number, classification, date data was collected, who collected the data, and the content of the map, for example, "areas covered by Cowardin vegetation classes."

North Arrow

Legend — A key to map conventions used.

Scale — This is especially important if the original was enlarged or reduced.

Tick Marks — If you are laying mylar over aerial photography to create maps, make marks on the mylar to line up the overlay with the photo. For example, trace photo numbers, roads, and streams, on each mylar photo map you create for that site.

Topographic Maps — The maps should cover the watershed of the area being assessed, usually a minimum of 1:24000. As with aerial photographs, the larger the scale the better. Topographic maps at a scale of 1:100,000 are needed for riverine sites with extensive watersheds.

Soil Surveys — Information provided in soil surveys and on soil maps are used to determine a specific datum on the data sheet. Soil information is also valuable to orient you to the site and to determine its approximate boundary.

Anadromous Fish Information — Maps displaying information concerning fish use and blockages can be used to help to determine opportunity for habitat suitability for anadromous fish. Direct observation of blockages should be made when possible. Maps are available through the Washington State Department of Fish and Wildlife (360-902-2543). Appendix H contains additional ordering information.

This information is used only if a qualitative assessment of opportunity is being made of use by anadromous fish.

Helpful Information

Maps of Surficial Geology

National Wetland Inventory (NWI) maps surveys (to determine the approximate boundary of the wetland from the office)

Watershed Reports

Flood Hazard Maps

"Lakes of Washington" (Walcott 1973) for lake depths and size

Stream Gauge Data

"Peat Resources of Washington" (Riggs 1954) for descriptions of wetlands with significant peat deposits

Local Wetland Inventory Maps

Local Land Use Maps

Other Local Government Maps

WDFW maps of Priority Habitats and Species (PHS)

Other Materials and Equipment Needed

The following table lists some additional materials and equipment that you will need for fieldwork. Many items on this list are the usual equipment used by wetland professionals who do field work. *This is not an all-inclusive list.*

REQUIRED	
Data sheets	Part 2 - Methods for Assessing Wetland Functions
Compass with pencil to map the 1 km circle around AU	Vial with sample color for tannins (see guidance for datum D36 - presence of tannins)
Shovel	Map wheel
pH paper (must be sensitive in water of low ionic strength in range of 4-6.)	"Land Locator" or something to estimate size and % cover
Something to measure height of flood marks from lowest point of outlet	Tape measure/DBH measure
Small ruler and/or caliper	Plastic bags for collecting plant specimens
OPTIONAL	
Colored pencils or acetate markers for mapping	Magnifier or portable stereoscope to view aerials in the field
Gazetteer/road maps	Binoculars
Field notebook	Field guides and plant keys

Step 3: Review Information and Make Preliminary Observations

Use the aerial photos and other maps and information to identify the approximate boundary and classification of the site being assessed. Soil maps, photo interpretation of aerial photos, and the NWI maps are especially helpful to determine approximate boundaries. Remember, however, that soil surveys and NWI maps are often inaccurate for various reasons. For example, some forested wetlands do not appear on NWI maps because of mapping difficulties associated with these wetlands. Many agricultural wetlands are also not mapped.

Aerial photographs and other information can also be used to help make a preliminary classification of the site. You can also note if there are areas within the boundary of the site that might need to be assessed as separate Assessment Units (AUs). Separate AUs should be identified when there are more than one class or subclass within the wetland, or when other criteria are met, as described in Steps 5 and 6.

Step 4: Visit the Wetland and Identify Its Approximate Boundary

Determine the location and approximate boundaries of the wetland on-site, confirming or revising the preliminary boundary you mapped in the office. This does not mean that a **precise** delineation of the wetland must be undertaken to complete data collection, unless this information is required as a part of your project.

The approximate wetland boundary and limit of the AU needs to be confirmed or revised and mapped in the field.

Field data needed to apply the methods can be collected while the boundary and AUs are being established. Great care, however, must be taken to **clearly** record in field notes and on photo maps where different features were observed and the extent of the various coverages so that data can be recorded accurately for each AU.

Steps 4-7 do not have to be completed sequentially. However, notes have to be carefully recorded and features mapped to fill out the data sheet accurately for each AU.

Step 5: Classify the AU(s)

One of the tasks to be completed at a site is to determine the classification of the wetland. Determining classification is critical in choosing the appropriate methods(s) and data sheet(s) to use. If there are multiple classes or subclasses are present within the wetland, each area should be assessed as a separate AU. For example, one continuous wetland may contain lacustrine fringe, depressional, and slope classes within its boundary. Each of these areas would be a different AU. The extent of each AU should be shown on a master photo map. You should also create an individual map of each AU to display wetland features and characteristics needed for the data sheets.

> Do not use riverine or depressional methods for any other wetland types. Defer to other methods currently used by the investigator, or recommended by the agency with jurisdiction over the project, to assess wetlands in classes or subclasses for which methods have not yet been developed for Washington.

Use the descriptions in the profiles (Appendix II D) and the dichotomous key attached to each data sheet (Appendices II A, B, and C) for information on classifying a unit into its appropriate hydrogeomorphic class and subclass.

Other Examples of Wetlands with Several Classes or Subclasses

Wetland contains deep, open water less than eight hectares in size — If the wetland contains deep water areas greater than 2 m (6.6 feet) deep but less than 8 ha (20 acres) in size, include this area as part of the depressional wetland.

> *Exception* — Where the deep open water is less than 8 ha but the vegetated areas that form a contiguous fringe are narrow, less than one quarter of the width of the open water, the area should be considered lacustrine.

Wetland contains a slope class — Another common example of multiple classes within one boundary is the presence of slope unit adjacent to a riverine flow-through unit.

> To be considered a slope unit, the area adjacent to the riverine flow-through portion should **not** be frequently flooded. The slope can be slight but the subsurface water flow should be unidirectional down the slope and roughly perpendicular to the contours of the slope.

Hard to Classify Wetlands

Some wetlands are not easily classified within one class or subclass. In these cases, consider how it functions in the landscape. Is it flooded frequently enough that the flooding has a

significant impact on the wetland ecosystem in terms of is structure (riverine)? OR, is the wetland in a depression, however slight, that collects water from the surrounding areas, and in many cases is also supported by groundwater (depressional)?

Frequent is defined as at least once every two years.

Frequent overbank flooding from a stream or river is an important characteristic distinguishing the riverine class. It is often not possible, however, to determine the frequency with which an area is inundated by a stream or river without detailed data on the local water regime and elevations. During reconnaissance at the site, use the field indicators in the following list to determine if the area is receiving frequent, overbank flooding and is therefore riverine.

Indicators of Frequent Flooding

- AU surface has scour marks
- There is evidence of recent sediment deposition (little vegetation growing through sediments)
- The vegetation is damaged or bent in the direction of the flood flow
- The soil, especially near the stream bank, may show alternating levels of different sediment size, or layers of sediment and organic matter
- The vegetation along the stream bank shows signs that it has been flooded to levels that are higher than the AU surface (color differences in bark, fine sediments trapped in the interstices of the bark, or debris trapped in branches)
- You have gauge data for the river or stream that can be used to calculate that the AU lies within the area that is flooded at least once every two years (two year return cycle)

NOTE: If the AU is in a river valley, but does not have a stream or river running through it or adjacent to it, you will have to judge from its position in the landscape, and the strength of the other indicators, whether it is frequently flooded.

After the classification(s) has been determined in the field, copy the appropriate sheet(s) from the appendices for recording data for each AU.

Step 6: Identify AUs Based on Other Factors

A wetland may be broken into multiple AUs under other circumstances. They are described below.

The guidance on identifying AUs is provided to improve consistency in dividing wetlands into AUs. It doesn't cover all of the innumerable situations you could encounter. There is, therefore, a certain amount of subjectivity involved with making judgements about AUs.
Most importantly, the logic and rationale for dividing a wetland into AUs must be adequately documented.
In all circumstance, the extent of AU(s) should be displayed on a master map showing the location of all units within the wetland being assessed. Individual photo maps should also be created for each AU.

Identifying AUs Using Differences In Water Regime

In some instances a wetland may be large with several constrictions, may be a long, linear feature contiguous with a river or stream, or may be bisected by a road or railroad. In these cases, you will have to determine what the AU(s) will be.

An important criterion that should be used to identify AUs is differences in water regime. Boundaries between units should be set at the point where the volume, flow, or velocity of the water changes rapidly, whether created by natural or human-made features (Figure 1, Part 2).

Examples of Different Water Regimes
1. Berms, dikes, cascades, rapids, falls and other features suggest that volume, flow, or velocity of water changes rapidly. The only exception is a series of beaver dams without intervening stream segments. Series of beaver dams should be assessed as one unit.
2. In the case of riverine flow through subclasses, points of significant inflow such as major tributaries.
3. The presence of drainage ditches that significantly reduce water detention in one area of a wetland.

Identifying AUs in Depressional Wetlands with Constrictions

Depressional wetlands may also contain constrictions where the wetland is narrow between two or more wetland areas. You will have to use your judgement as to when to assess the wetland as one or more AUs. The key consideration is direction of flow through the constriction. Does the water move easily back and forth through the narrows, or does it more unidirectionally down-gradient as elevation changes from one part to the other (see Figure 1). The more unidirectional the flow and the higher the velocity, the more justification exists for separating out two AUs.

Identifying AUs when Wetlands Are Associated with Streams or Rivers

Linear wetland areas contiguous with a stream or river may be broken into AUs at the point where the wetland becomes narrow for at least 80 m (200 feet). Narrow is defined as less than 20 m (50 feet) in width.

Figure 2 presents a diagram of how riverine flow-through wetlands might be separated into different AUs.

In cases when an AU contains a stream or river, you must also decide if the stream or river is a part of the AU. Use the following guidelines to make your decision:

Wetland on one side only — If the wetland area is contiguous to, but only on one side of, a river or stream, *don't* include the river in the AU.

Wetland on both sides of a wide stream or river — If there is a contiguous wetland area on both sides of a river where the bank-to-bank distance is greater than 15 m (50 feet) wide, consider *each side as separate units.*

Wetland on both sides of a narrow river or stream — If the river or stream has a bank-to-bank distance of less than 15 m (50 feet) wide and there is a contiguous wetland area on both sides extending for more than 200 feet, treat *both sides together as one unit*. *Include the stream or river in the unit if the vegetated portions combined are wider than the distance between banks.*

Narrow stream flowing through a depression — If a stream flows through a depressional wetland, include the stream as a part of the AU unless there are signs of frequent, overbank flooding. In this case, the area of frequent, overbank flooding would be considered riverine flow-through and the wetland should be assessed as two units.

Identifying AUs in Wetlands Forming a Patchwork on the Landscape

If the area proposed for assessment consists of a patchwork or mosaic of wetlands, the entire patchwork should be considered one AU when:

- Each patch is less than 0.4 ha (1 acre) and
- Each patch is less than 30 m (100 feet) apart, on the average, and
- The area of wetlands is more than 50% of the total area of both wetlands and uplands.

If an area meets the criteria for wetland mosaic, include the upland islands within the mosaic as part of the acreage calculations for the AU.

If these criteria are not met, each area should be considered as an individual AU (Figure 3, Part 2).

Identifying AUs when Wetlands Are Bisected by Human-Made Features

When a wetland is divided by a human-made feature, for example a road embankment, the wetland should not be divided into different AUs if the surface-water connection is level between the two parts of the wetland. Water should be able to flow between the areas and fish or other organisms move in both directions. For example, if there are wetlands on either end of a culvert under a road, and both sides of the culvert are partially or completely underwater, the wetland should be assessed as one. Make the down gradient area a separate AU if the culvert is above the water level of the receiving wetland (perched). However, don't separate the units based only on length of the culvert, even if the culvert is longer than 200 feet, unless there is a sharp gradient in water level and water flows only in one direction.

Cases when a Wetland Should Not be Divided into Seperate AUs

AUs and Land Uses

Differences in land uses within a wetland should not to be used to define AUs, unless they coincide with circumstances described above. For example, if half a wetland is a mature forest and the other half is a dominated by saplings because of recent clear-cutting, the entire area functions as, and should be assessed as, one unit (if the water regime is intact.) Whereas, if only the clear-cut area has been ditched and no longer retains surface water, it might be considered a separate AU.

The performance indices will be an average of the altered and unaltered portions for functions in which vegetation variables predominate in AUs with different land uses. Such

areas may provide different habitats, but as long as the water regimes are closely linked, many of the other functions may be interconnected. For example, an impact to wetland processes in a pastured area may have a significant impact on processes in the hydrologically contiguous, adjacent forested area.

AUs and Property or Project Boundaries

Property boundaries or a project footprint should also not be used to define an AU, unless some of the circumstances described above apply. For example, a project may be proposed that would fill two acres of a 10-acre wetland. The entire 10-acre wetland should be assessed as one unit to determine the performance or suitability index. The index is a score "per acre or hectare," as described in Part 1, Chapter 2. You would calculate the function being lost to fill by multiplying the index for each function by the two acres to be impacted.

AUs and Proposed Alterations

A wetland should not be divided into AUs by different proposed or actual alterations. As long as the AU is one subclass and has no hydrologic breaks, the entire wetland should be the AU even if only a small part is proposed for filling or alteration.

Assessing Sub-units of Larger AUs

Under some circumstances a wetland of one subclass may have no hydrologic breaks, but has areas that are dramatically different visually. An example is a wetland in which one part is a grazed pasture and the other is a complex mosaic of mature forest, sedge meadow, and shrub swamp. The investigator will have to judge whether differences in the levels of functions of one subunit are significantly different from the other, and that the overall index for the larger AU is not representative of the functions of each sub-unit.

It may be appropriate, in such cases, to assess the entire wetland as one unit (e.g. determine how it functions as a whole) and, in addition, assess each sub-unit separately. In the previous example, one of the sub-units would be the grazed pasture and the other the area containing the mosaic. As with other judgements, the rationale for dividing into sub-units must be documented. The investigator should also describe and compare the assessments of the whole AU and the sub-units.

Step 7: Collect Data in the Field

Data must be collected for each AU identified. Some data can be recorded directly on data sheets as you complete your reconnaissance of the wetland area to be assessed (the AU). You do not need to collect data in the order presented on the data sheet. However, estimates of % of the AU occupied by different characteristics, percent cover, number of plant species and assemblages, linear distances, etc. are best completed after your field data collection is complete and photo maps have been finalized. It is always advisable to complete maps and the data sheet at the site, if weather permits, so questions about the data can be confirmed. Some information, such as the area of the AU and that of its contributing basin should be determined after the field visit.

Guidance for each datum is provided in the following section titled "Procedures for Collecting Data."

As you conduct your reconnaissance, create photo maps to record the locations and extent of features, such as the area dominated by non-native vegetation, the locations where soil samples were taken and signs of seasonal inundation were noted.

We recommend you visit all parts of the AU to collect the required data. If areas are inaccessible, use vantage points in other parts of the AU, aerial photography, and your other information sources to complete the assessment. Note on the photo map and summary sheet in Appendix II E the areas that were inaccessible.(see Step 11).

Making Areal Estimates

Many data required on the data sheet are requested as % of AU occupied by a specific feature. These are areal estimates. Areal estimates are made using the mapped boundary of the feature as viewed from the air. Areal estimates are, therefore, best made from photo maps drawn on copies or an overlay of recent aerial photographs. If aerial photographs are not available, or are scaled too small to draw polygons, areal measurements can be derived from hand-drawn maps prepared at the site. Boundaries of different wetland characteristics can then be drawn on photo maps and the area or percent cover estimated.

The scale of the map, drawn from the original photography or enlargements, should be indicated on all maps.

If a percent area of the AU is requested on the data sheet, it should be recorded as a number between 0 and 100, not as a fraction or using the % symbol. The term "percent cover," however, means the percent of the ground surface covered by a specific vegetation type, as described below.

Areal Estimates vs. % Cover

Areal estimates are easily confused with % cover. Percent cover is usually estimated to describe the amount of ground covered by a particular species or vegetation class as viewed from above. Therefore, in a given area, several plants or vegetation classes can cover the same percentage of the ground if they overlay each other or occur in different strata. Percent cover is used, for example, when determining the "Cowardin" vegetation classes present in an AU. "Cowardin" vegetation classes are identified by the vegetation type that occupies the upper most stratum and covers at least 30% of the ground in that stratum as seen from above.

Estimates of % cover can also be done using the dot or grid method or visual estimates. Appendix II I provides a Vegetation Profile Board that can assist you with making visual estimates.

Identifying features that are of special importance to society, such as the presence of endangered and threatened species or locally rare plant communities is not a part of this assessment. Note all such features and record on the "Summary of Methods Results."

Step 8: Complete Data Sheet

After completing your field work, use your field notes and photo maps to record the data that you have not already noted on the data sheet during your reconnaissance. Also record the following information on the data sheet at the top of the data sheet. Make sure you include the dichotomous key used to help determine the AU's classification.

Wetland name

AU identification number

Date of field visit

Time spent in office

Time spent in field

Names of those collecting the data

Step 9: Calculate the Indices of Potential Performance and Habitat Suitability

Use the completed data sheets as the basis for calculating the indices of potential performance or habitat suitability for the functions. There are two ways in which the indices can be calculated. The first is to take the data recorded on your data sheet and input each datum into the Excel spreadsheet appropriate for the subclass that is on the diskette provided. Once all data are input, the spreadsheet will calculate the indices for the AU and show them at the top of the spreadsheet. More detailed information on using the spreadsheet is available on the diskette in the README.TXT file.

The second way to calculate the index is to use the tables presented in the methods in Part 1 under the headings of "Calculation of Potential Performance" or "Calculation of Habitat Suitability" for the appropriate subclass. These tables describe the variables used for each function and the specific data needed for the calculations. One of the columns lists the data numbers (from the data sheet) needed and how to calculate the scaled score for each variable. The equation used to calculate the index is also provided on the calculation page.

NOTE: We have tried to simplify the data collection process as much as possible. There was a choice between developing complex data collection procedures and simple calculations or *vice versa*. We chose to simplify the data collection since the complex calculations can be done by a spreadsheet.

NOTE: The calculations compute the numeric values for each variable using the data collected. Each datum may be used in several variables, and in different ways. When necessary, calculations add, subtract, and/or combine a datum with others to get what is needed for each variable. This simplifies the data collection because each datum has to be recorded once, and in one format.

Each datum may be used in several variables, and in different ways.

NOTE: The numeric equations in the spreadsheets may not be identical to the numeric equations described in the text. Both will, however, generate the same scaling for a variable. The equations in the text were developed so a user can calculate the index by hand. The equations in the spreadsheet may involve shortcuts that are possible because of the way the spreadsheet actually does its calculations.

The numeric equations in the spreadsheets may not be identical to the numeric equations described in the text.

Step 10: Calculate the Performance or Suitability Scores and Determine Opportunity

There may be times when it is necessary to calculate a performance score (e.g. assessing the impacts of fill). To calculate the performance and habitat suitability scores (acre or hectare points), multiply the index (which is "per acre or hectare") for each function by the area for the AU and, if appropriate, the impact area. The difference between the index and performance scores is described in Part 1, Chapter 2.

Also, make a judgement about the opportunity the AU has to perform the water quality, water quantity, general habitat, and anadromous fish functions. Refer to the guidance provided in the function models for the appropriate subclass method in Part 1. Rate the opportunity high, moderate, or low using your qualitative judgement and document your rationale.

Step 11: Complete Summary Sheet

All results (indices, performance scores, judgements of opportunity), should be recorded on a summary sheet. Appendix II E contains a sheet called "Summary of Method Results" that can be used for this purpose. It also provides space to record:

Rationale for dividing the wetland into multiple AUs

Description of areas that were not directly observed and an explanation as to why

Information of special note such as the presence of endangered or threatened species

General comments

In addition to the data sheet and summary sheet, all information used to make the assessment should be provided in any report documenting the results, including all data sheets, photo maps, sketches, and documentation of the rationale you used to make decisions concerning the AU or the data collected.

3. Procedures for Collecting Data

The following section describes the procedures for collecting each individual datum. All data needed for the four subclasses are numbered and described in order below. Not all data, however, are used in all four methods. Data not used in the assessment of a specific subclass are left blank on the data sheet.

D0: Assessment unit surrounded by dikes

Used only for depressional outflow subclass.

Determine if the AU is completely surrounded by dikes. If so, locate the surface water outlet and check whether the depth of water at the outlet can be changed manually. For example, if the outlet has a tide gate that can be closed for storm tides, or is a culvert with flap that can be controlled. If the AU is both surrounded by dikes and has a control structure that can be manipulated record a [1].

D1: Area of AU

Use a copy of your photo map to estimate the size, **in hectares (ha)**, of the AU being assessed. Estimates of area can be done using a graphic method using "squares," "dots" or "grids" method, a planimeter, or using geographic information system (GIS) software. Record the information to two significant digits (e.g. 1.2 ha, 120 ha, and 1,200 ha). **Unless you have considerable experience, visual estimation of acreage is unreliable.**

D2: Area of contributing basin

Estimate the area of the contributing basin (in hectares) using any of the methods described above. The contributing basin for a riverine AU will usually be the contributing area of the stream or river that is the source of the frequent overbank flooding, measured from the outlet of the AU. A smaller scale map (1:100,000 or 1:250,000) may be needed to outline the contributing basin in some cases. Record the information to two significant digits (e.g. 120 ha, 1200 ha, 120,000 ha).

Appendix II J provides guidance, using topographic maps, for outlining the boundaries of the basin contributing surface water flows to the AU (Roth et al. 1993.)

> **NOTE 1:** Some local governments have already mapped the contributing basins (watershed) of larger streams and rivers. Refer to these maps when possible.
>
> **NOTE 2:** The area of the AU should be included in the calculation of the area of the contributing basin. This is especially important in small basins where the AU may represent a relatively large part of the basin.

D3: Land uses within 1 km of the AU

Estimate the percentage of the area within a 1 km radius of the AU edge that is in each land use category listed below on the data sheet. This area may include upland or wetland areas outside the AU.

D3.1 Undeveloped forest — areas of managed and unmanaged forests not including clear-cut areas

D3.2 Agriculture — field or pasture used for grazing or cultivation of crops (a golf course counts as "agriculture")

D3.3 Clear-cut logging — areas where trees have been removed within 5 years of the time of the site visit. Saplings should be no more than 2 m high

D3.4 Urban/commercial — areas where over 50% of the area is in urban or commercial uses or developed in some way (not residential)

D3.5 High density residential — areas with apartments, town houses, and individual homes where there is more than one residence per 0.4 ha (1 acre)

D3.6 Low density residential — individual homes on parcels of 0.4 ha (1 acre) or more

D3.7 Undeveloped areas, shrubland (areas of shrubs and grassland not cut or grazed), **other wetlands, and open water outside the AU**

We suggest that you draw a 1km circle around the AU boundary on a copy of the photo map and outline the land uses. During the field reconnaissance, confirm that the land uses are approximately those identified from the aerial photos. Many areas in western Washington are rapidly being developed so an aerial photograph taken several years ago may no longer accurately portray the conditions around an AU.

USGS Land Use Designations by Color Schemes:

Undeveloped forest — green.

Agriculture — white areas without houses, or with houses with a density less than 1 / 4 ha (10 acres)

Clear-cut logging — white areas in hilly or mountainous terrain that are distant from any major roads or obvious signs of habitation

Urban/commercial — color blocks of large buildings surrounded by white

High density residential — gray or purple areas with street outlines

Low density residential — areas with individual houses marked as a small black square

Undeveloped grassland, shrubland, other wetlands, and open water — white or blue with the exception of forested wetlands

The USGS topographic maps may also be used as a guide to determine land uses. Different land uses are identifiable by different color and design schemes listed below on the USGS

maps. We recognize that using topographic maps to determine land uses is crude and that it is difficult to determine, for instance, the actual land uses taking place in the white areas. Use other sources of information where possible, such as land use maps developed by local governments.

Percentages can be estimated by using the "dot" method or a planimeter without actually calculating the area involved. The ratio of (#dots per land use/#dots in 1 km circle) x 100 = percent area.

D4: Channel within AU

Record a [1] on the data sheet if the AU contains a channel. Record a [0] if the AU does not have a channel.

A channel is defined as a distinct linear depression with identifiable bank edges that have been shaped by flowing water and have a definable outlet. Both banks have to be within the boundary of the AU to answer a "yes" for this datum. Man-made ditches are also categorized as channels. In this case the bank edges are not natural. Also grassy swales that intermittently carry slow-moving water, without distinct bank edges, can be considered a channel.

See guidance in Step 6 for when to include and exclude the stream or river from the AU.

The banks can be a few inches high. It is hard to identify channels if the wetland is flooded. They can be identified during periods of flooding by a linear break in the vegetation, or from aerial photos taken during the dry season.

D4.1 Try to determine if there is water flowing in the stream or channel for the entire year. You may assume that the flow is permanent if you observe flow during the summer months (July-September). You will have to use your judgement to answer this question during other times of the year. Check aerial photos (most of which are taken during the summer), refer to topographic maps, ask local residents, or judge the permanence of flow from the size, depth, and substrate of the channel. Establishing flow may be difficult in some cases such as riverine impounding AUs that have formed in old stream channels. The impounded open water in the AU may follow the old stream channel and may be present all year around. Such channels, however, usually do not have flowing water.

D4.2 ***This datum is used only for AUs that are classified as riverine flow-through.*** Note whether the channel or stream is contained within dikes. Answer a "1" to datum 4.2 if the average distance of the dike to the nearest channel/stream bank is less than 4 times the average distance between the channel banks. Estimate the average distance of the dike to the channel and the channel width only within the boundaries of the AU you have chosen (Figure 5).

D4.3 Note whether the channel or stream leaving the AU does so through a culvert with a diameter (or maximum cross-section) that is smaller than 60 cm (2 ft). Answer a "1" if such an outlet is present.

D5: Average width of stream or channel in AU

Used only for riverine flow-through subclass.

If there is no stream, ditch, or channel within the boundaries of the AU, or immediately adjacent to it, record [0] on the data form and go to the next datum. If there is, estimate the average width of the unvegetated parts of the channel in meters. The width should be estimated **using the entire unvegetated part of the channel,** not the width of the stream flow at the time of the site visit.

D6: Average width of AU perpendicular to permanent stream or river

Used only for riverine flow-through subclass.

Estimate the average width (in meters) of the AU along the axis that is perpendicular to the main direction of stream flow.

D7: Ratio of: length of channel within the AU – to length of the AU

Record this datum only if the AU contains a channel or stream that leaves it through a definable outlet (i.e. AU is not a closed depression on the landscape). If it is a closed depression record a [0]. Larger rivers or streams that are adjacent to the AU, but not within the assessment boundaries, are **not** to be used when estimating this ratio.

Using your photo map, estimate the distance of the channel or stream that passes through the AU from the point it enters the AU to the point it leaves the AU. Next, estimate the length of the AU along its longest axis. Record the answer as the ratio of the channel length to the AU length.

A map wheel is a convenient way to determine these distances.

$$D5 = \frac{\textit{channel length}}{\textit{AU length}}$$

If the AU contains multiple channels, use the one that, in your estimation, carries the highest volume of water on an annual basis.

NOTE 1: It is not necessary to estimate the actual distances in meters or feet since the value is a ratio. Any arbitrary units, such as those found on a map-wheel, can be used.

NOTE 2: Be sure to record the channel length as the numerator. A common mistake is to record the channel as the denominator and the length of the AU as the numerator.

NOTE 3: The channel in D5 is the same as the one in D4. If the channel is not continuous through the unit, for example the channel intersects a few areas of open water, the length of the channel would include the length of the open water as if the channel were continuous.

NOTE 4: If the AU curves into an L shape, estimate the length of AU along the "longest axis" by summing the length of both parts of the L.

D8: Areas of different types of inundation

D8.1: Percent of the AU that is annually ponded or inundated

The percent of the AU that is ponded or inundated (for at least 1 month) each year (in most years) is one of the more important characteristics used in the assessment. It is, however, one of the more difficult to determine during the dry season.

During the wet season, the area of ponding or inundation can be drawn directly on a "photo" map during the field reconnaissance, and the relative percent of the AU determined by using either the dot method or a planimeter. On the data form record the total percent of the AU that is seasonally inundated (including areas of permanent inundation) as a number between 0 and 100.

Inundation has to be present for at least one month to be considered for this datum.

During the dry season, however, the area of annual ponding or inundation will have to be estimated by using one or more of the following indicators.

- Water marks on trees or vegetation
- Drift lines of debris on the ground
- Water stained leaves (grayish or blackish in appearance)
- Scoured areas on the surface
- Areas where aquatic bed vegetation is present even though the ground may not be inundated
- Adventitious roots
- Level at which moss begins to grow on trees

To determine the area of annual ponding, walk in from the AU edge to the location where one or more of the indicators appear and mark the location on a "photo" map. Repeat this process at least four times at points that are about equidistant along the AU boundary (collect soil data at these four locations also).

Draw a line between the points that follow the approximate shape of the AU edge. When all four locations are connected on the "photo" map, you will have a polygon within the AU boundary that represents the approximate area of ponding. Record the % of the AU occupied by inundated areas on the data form.

D8.1 Used in Several Ways

In some models, permanent areas of inundation are subtracted to get a true area of seasonal inundation. In others, the total area of inundation is used. Therefore, to answer D8.1 correctly, account for all areas inundated for more than 1 month including permanently inundated areas.

NOTE 1: If you can't access all parts of the AU, choose four points as far apart as possible.

NOTE 2: If the AU contains upland islands within the area of seasonal inundation, their area will have to be subtracted from the total.

NOTE 3: It may be necessary to sample more than four locations around the AU edge if the AU is large (more than 4 hectares; 10 acres) or if the edge is highly irregular. As you walk through the AU you will have to judge whether the four sampling points provide an adequate mapping of the zone of inundation.

NOTE 4: Some AUs are completely inundated most years and the indicators may be found at the AU boundary. Carefully examine the AU boundary to check if indicators of inundation begin there.

NOTE 5: Some AUs may contain several areas of inundation that are not contiguous. Sketch them on the "photo" map, estimate the % of the AU that each occupies, and add these together for this datum.

D8.2: Percent of AU with permanent standing water

Record the percent of the AU that has permanently standing or flowing water. Areas with standing water in the zone of emergent, scrub/shrub, or forest vegetation are to be included in this datum. Also include areas that are categorized as "aquatic bed."

Permanent water means that surface water covers the land surface most of the time (more than 5yrs out of 10).

D8.3: Percent of AU with permanent open water

Record the percent of the AU that has permanent **open** water as a percent of the total AU. Areas with standing water in the zone of emergent, scrub/shrub, or forest vegetation are not to be categorized as "open water." Also, areas that are categorized as "aquatic bed" using the Cowardin classification are not to be counted within the area of "permanent open water."

For the purposes of this method, the area of permanent open water is similar to the areas of unconsolidated bottom (UB) and "rock bottom" (RB) classes that have the "permanent water" modifier in the Cowardin classification.

Draw the outline of the permanent **open water** on the "photo" map and estimate its extent as a percent of the total AU.

The area of permanent open water must cover at least 0.1 hectare (0.25 acre) of the AU to be included in the estimate, if the AU is equal to or greater than 1.0 hectare (2.5 acres) in size. For AUs that are smaller than 1.0 hectare, the threshold is 10% of the AU.

NOTE 1: Permanent open water may include "aquatic bed" areas if the aquatic bed is less than 0.1 hectares in size for AUs equal to or less than 1.0 hectare (2.5 acres) or 10% for AUs less than 1.0 hectare. If the aquatic bed covers a larger area it should be classified separately and recorded in D14.

NOTE 2: Discontinuous areas of permanent open water can be added together to estimate the total percent of the AU occupied by permanent open water.

NOTE 3: At certain times of year it may be difficult to determine if permanent open water (with or without aquatic beds) is present. During the winter this area will be more difficult to determine because the open water will include the area that is only seasonally open as well. A good indicator of permanent open water is the area without any emergent vegetation or the remains of aquatic bed vegetation. Also, most aerial photos are taken in summer months. Areas of open water visible on these photos can be considered permanent open water.

NOTE 4: If the AU contains a stream that does **not** have overhanging vegetation, the area covered by the stream can be counted as part of the open water component.

NOTE 5: Riverine flow-through wetlands are categorized as having permanent open water only if they have a permanent stream without an overhead canopy. The same size threshold is to be used.

An area is considered "unvegetated" if the total cover of plant material is less than 30%.

D8.4: Percent of the AU with unvegetated bars or mudflats

Some vegetated wetlands may contain small sand-bars or mudflats within their boundaries. Record unvegetated bars or mudflats as a percent of the total AU. **Bars and mudflats are counted only if they are above the surface of permanent water.** Areas permanently under water should be included in the previous datum. There are no size thresholds for this datum. The goal is to account for the entire AU within data D8 and D14.

NOTE: It will be difficult to determine if mudflats are present during the winter and spring when the AU is full of water. If possible use aerial photos taken during the summer to identify the presence of mudflats.

D8.5: Presence of unvegetated bars or mudflats

Record unvegetated bars or mudflats that are at least 100 m^2 in size. **Bars and mudflats are counted only if they are above the surface of permanent water.** In large AUs you may find that the bars and mudflats are less than 1% of the area and would be recorded as a zero in the previous datum, but may meet the size threshold for this datum.

D9: Types of inundation/saturation categories present in AU

For AUs equal to or greater than 1.0 ha (2.5 acres), an inundation/saturation category must occupy, at least, 0.1 ha (1/4 acre) of the total AU to be recorded. For AUs less than 1.0 ha, the threshold is 10% of the total area of the AU.

Identify the different types of inundation/saturation categories present in the AU using the descriptions below. The types listed below are loosely based the hydroperiods used in the National Wetland Inventory's classification system for wetland and deepwater habitat (Cowardin, et. al. 1979). Record a [1] on the data sheet for **all** the inundation that might apply. Remember that different parts of an AU may have different regimes.

The purpose is to **identify the wettest water regime within areas of the AU**. Thus, an area that is seasonally ponded, but only saturated to the surface during a field visit in the summer, would be categorized as "seasonally inundated," **not** "saturated" to the surface.

D9.1 Permanently Flooded or Inundated — Surface water covers the land surface throughout the year, in most years. This includes the Cowardin water regime modifiers of **Intermittently Exposed** (surface water is present throughout the growing season except in years of extreme drought) and **Semipermanently Flooded** (surface water persists throughout the growing season in most years).

NOTE: During high water in the winter and spring, it may be difficult to determine the area that would be permanently flooded during the summer dry period. One indicator of permanent water is an area of open water without vegetation inside the zone of seasonal flooding. Aerial photos taken during the summer may also show areas of permanent water.

D9.2 Seasonally Flooded or Inundated — Surface water is present for extended periods (1 month), especially early in the growing season, but is absent by the end of the season in most years. During the summer dry season it may be difficult to determine the area that is seasonally flooded. Use the indicators described in D6 to help you determine areas that are seasonally flooded or inundated.

D9.3 Occasionally Flooded or Inundated — Surface water is present for brief periods of less than one month during the growing season, but the water table usually lies below the soil surface for most of the season. Plants that grow in both uplands and wetlands are characteristic of the temporarily flooded regime.

D9.4 Saturated — The substrate is saturated to the surface for long enough to create a wetland, **but surface water is seldom present**. The latter criterion separates saturated areas from inundated areas. In this case, there will be no signs of inundation on plant stems or surface depressions.

D9.5 Permanently Flowing Stream — The AU contains a river, stream, channel, or ditch with water flowing in it throughout the year.

D9.6 Intermittently Flowing Stream — The AU contains a river, stream, channel, or ditch in which water flow is intermittent or seasonal.

> **NOTE:** The area recorded for D8.1 (area of annual ponding and inundation) would include the hydroperiods "Permanently Flooded or Inundated" and "Seasonally Flooded and Inundated."

D10: Usual (annual) height of flooding above the lowest point of outflow (estimating live-storage)

Locate the outlet of the AU and identify its lowest point, or the top of any permanent outflow present. Estimate the difference in elevation between this low point and the marks of annual inundation or ponding observed for D8.1. This will provide a estimate of the depth of live-storage during the seasonal high water. Try to find inundation marks as close to the outlet as possible so you can make visual estimates of the height from the outlet. Record the height above the lowest point of the outlet at which you noted marks of inundation. Record to the nearest 0.3 m (1 ft.)

> **NOTE 1:** If the outlet is a beaver dam or weir, treat the top of the dam or weir as the lowest point. If water is flowing over the dam then the water surface anywhere in the AU can be used to establish the low point.
>
> **NOTE 2:** If the AU has multiple outlets, try to find the one that has the lowest topographic elevation.
>
> **NOTE 3:** This datum does not apply to riverine flow-through wetlands since they do not hold back water longer than the flood event.
>
> **NOTE 4:** Sometimes the lowest point of the outlet is flooded or flowing. In these cases, measure from the bottom of the outlet to the height of marks of average annual flooding. A common mistake is to measure from the current water level in the outlet to the marks of flooding.
>
> **NOTE 5:** It can be difficult to extrapolate the height of flooding above the lowest point of the outlet in large AUs where the flood marks are distant from the outlet.

D11: Cross section of live-storage

Identify the diagram on the data sheet (D11.1 – D11.3) that best matches the cross section of the AU at its **widest point** in the area **that is seasonally inundated**. Record a [1] for the appropriate diagram. The questions to ask yourselves as you consider this questions are: 1) is the seasonally inundated area generally concave (picture 1); or 2) does it have a uniform slope to a central depression (picture 2); or 3) is it generally flat with most of the elevation change occurring at the edge (picture 3)? Do not try to judge the shape of the area below the surface of permanent water. Consider the surface of permanent water as the bottom of the diagram (i.e. the bottom of cross-sectional area that is seasonally inundated).

> **NOTE:** Use the diagram that represents the **dominant** cross section in the AU. Some AUs have multiple kinds and depths of cross sections.

D12: Water depths in AU

Identify all the water depth categories listed below that are present in the seasonally inundated and permanently inundated areas of the AU. In riverine flow-through wetlands this would only be the permanent or seasonal stream channel. A water depth category should be present for at least 1 month to be included. Water depths present during infrequent flooding events are not to be counted. You may have to use indicators to determine the water depth categories, depending on the time of year you make the visit. Use the information used for annual inundation (D8.1) and height of flooding (D10) to help you. Record a [1] on the data sheet for each category present.

D12.1 Water depth 1 - 20 cm (8 in.)

D12.2 Water depth 20 cm - 100 cm (8-40 in.)

D12.3 Water depth >1 m (40 in.)

For AUs equal to or greater than 1.0 hectare (2.5 acres), a water depth category must occupy, at least, 0.1 ha (1/4 acre) of the total AU for 1 month to be recorded. For AUs less than 1.0 ha, the threshold is 10% of the area of the AU.

NOTE: If an AU has deeper water (>1 m) and steep banks, you need to assess whether the extent of the shallower categories is large enough to qualify. For example, AUs in deep "kettle holes" may have steep banks and very narrow zones of the shallower waters that do not meet the size criteria.

D13: Constriction of outlet

Datum is used only for depressional outflow and riverine impounding subclasses.

Locate the outlet of the AU and identify its lowest point. Do a qualitative assessment of the amount of constriction of the outlet using one of the following three descriptors. Record a [1] on the data sheet for the one that best matches conditions in the AU. Record [0] for those that don't.

D13.1 Unconstricted or only slightly constricted — the outlet allows water to flow out of the AU across a wide distance.

The outlet does not provide much hindrance to flood waters flowing down gradient through the AU.

In general, the distance between the low point of the outlet and average height of inundation (D8) will be small (<30 cm/1ft).

Beaver dams are considered to be slightly constricted unless they are anchored to a steep bank on either side. In general, they do not hold back flood-waters because the water level is maintained at the crest of the dam.

D13.2 Moderately constricted — The outlet is small or narrow enough to cause flood water flowing through the AU to be held back. Categorize the outlet as moderately constricted if you cannot judge that it is either unconstricted or severely constricted.

D13.3 Severely constricted — These outlets are small or heavily incised, narrow channels anchored in steep slopes. In general, you will find marks of flooding or inundation a meter or more above the bottom of the outlet if the outlet is severely constricted. Another indicator of a severely constricted outlet is evidence of erosion of the down gradient side of the outlet. Small culverts (<50cm) can usually be categorized as severely constricted.

D13.4 No channelized outlet — Applicable only to the riverine impounding subclass. Surface water does not leave the wetland through any type of channel, swale, or culvert; rather it leaves the wetland by sheetflow over a berm, dike, or sheetflow through vegetated areas.

NOTE: If the AU has multiple outlets, judge the constriction as if all the outlets were combined into one large one.

D14: Percent of AU with different "Cowardin" vegetation classes

Vegetated "Cowardin" classes are distinguished on the basis of what constitutes the uppermost layer of vegetation (forest, shrub, etc.), and that provides more than 30% surface cover within the area of their distribution. Appendix II I is a Vegetation Profile Board that graphically represents different percentages of cover, to help your estimate of percent cover. Examples of how Cowardin classes are determined are provided below.

An area of trees with a 50% cover that has an understory of shrubs with a 60% cover would be classified as a forested zone.

An area with 20% cover of trees over a shrub layer with 60% cover would be classified as a "scrub-shrub" zone.

When trees or shrubs each cover less than 30%, but together cover 30% or more, the zone is classified as "scrub-shrub."

When trees and shrubs together cover less than 30% of an area, the zone is assigned to the dominant plant life-sheet below the scrub-shrub (e.g. emergent, aquatic bed, mosses and lichens) if these have greater than 30% cover

> For AUs equal to or greater than 1.0 hectare (2.5 acres), the class must cover at least 0.1 hectare (0.25 acre) of the AU to be recorded. For AUs that are smaller than 1.0 ha, the threshold for listing a class is 10% of the AU. Different areas of one class within an AU, however, should be added together to determine if the threshold is met.

Specific criteria for Cowardin vegetation classes

D14.1 – 14.2 Forest — A forested class is any area where woody vegetation over 6 m (20 ft.) tall (such as alder, cedar, hemlock, cottonwood, and some willow species, etc.) comprises at least 30% of the areal cover. **Trees need to be rooted in the AU** in order to be counted towards the estimates of cover. Some small wetlands may have canopy but the trees are not rooted within the AU. In this case the AU does not have a forested class.

> **D14.1 Evergreen and D14.2 Deciduous:** You are also asked to determine whether the dominant trees in the forest zone are deciduous or evergreen. Dominant is greater than 50% of the cover provided by plants of this vegetation class. Map the evergreen and deciduous areas separately and estimate the percent of the AU they occupy separately on the data sheet.
>
> **NOTE 1:** If the AU contains areas dominated by both evergreen and deciduous types, map and record them separately. Estimate the area that is dominated by evergreens as a percent of the total AU, as well as the area dominated by the deciduous.
>
> **NOTE 2:** If there is a forested portion that has an intermixing of deciduous and evergreen estimate the % cover of the deciduous and evergreen trees and divide the percent of the AU that is intermixed proportionally between the two categories. For example, 20 % of an AU has an intermixing of deciduous and evergreen. The deciduous trees cover 50% of the ground surface in this area and the evergreens have a cover of 50% of this area. On the data sheet, record 10% of the AU for deciduous and 10% for evergreen.

14.3 – 14.4 Scrub-shrub — A scrub-shrub class is any area where woody vegetation less than 6 m (20 ft. tall) (such as most willow species, Douglas' spiraea, red-osier dogwood, Labrador tea, salmonberry, etc.). To count as a class, scrub-shrub vegetation must provide at least 30% cover and be the upper most layer.

> **14.3 Evergreen and 14.4 Deciduous**: You are also asked to determine whether the dominant shrubs in the scrub-shrub zone are deciduous or evergreen. Map each shrub type separately and estimate area separately for the data sheet.

NOTE 1: If the AU contains areas dominated equally by both evergreen and deciduous types, map and record them separately. Estimate the area that is dominated by evergreens as a percent of the total AU, as well as the area dominated by the deciduous.

NOTE 2: If the scrub-shrub portion is an intermixing of deciduous and evergreen, use the guidance provided above for the forested class.

14.5 Emergent — An emergent class is any area covered by erect, herbaceous plants excluding mosses and lichens. To count as a class, emergent vegetation must provide at least 30% cover and be the upper most layer.

14.6 Aquatic Bed — An aquatic bed class is any areas of open water covered by plants that grow principally on or below the water surface for most of the growing season. Species are non-persistent and include submerged or floating- leaved rooted vascular plants, and submerged mosses. Aquatic bed vegetation does not always reach the surface and care must be taken to look into the water.

NOTE 1: Discontinuous areas of vegetation classes within the AU can be added together to estimate the percent of the AU occupied by that class.

NOTE 2: The calculation of the area covered by each vegetation class has to be based on the total AU, not only on the area that is vegetated.

D15: Check on area estimates

The data sheet asks you to sum D8.3, D8.4, and D14.1 through D14.6 to determine if your areal estimates add up to 100%. This datum is not used in the spreadsheets, but is included as a check of the data collection procedure.

Check to make sure that the cover of open water, unvegetated mudflats/bars, and vegetation classes = 100.

D16: Percent of forest or scrub/shrub areas with an herbaceous understory

Estimate the percent of the forested or scrub-shrub areas (D14) that have an understory of herbaceous plants**. The cover of herbaceous plants has to be greater than 20% to be included in the estimate of percent area.**

NOTE: Record only the % of the area within these two classes. **Do not try to extrapolate the % area of the entire AU.** The calculation pages in Part 1 include the necessary corrections in the equations for which this datum is used.

D17: Percent of AU with a canopy closure of woody vegetation

Identify the areas that are covered by the forested and scrub-shrub classes using the photo map of Cowardin classes developed above (D14). Within these areas, outline the areas where the forests and shrubs cover at least 75% of the ground (this is more restrictive than the 30% requirement for the Cowardin classes.) The shrub component must be at least 1m (3.3 feet) high. Estimate the % of the AU that has this denser canopy.

> **NOTE 1:** Some small AUs may have a canopy cover that is a result of trees rooted outside the AU. For this datum the canopy closure estimate **should** include the canopy provided by trees and shrubs rooted outside the AU.
>
> **NOTE 2:** Most people have difficulty in visually estimating % canopy closure in the field. An estimate from the aerial photo is usually more accurate.

D18: Percent length of stream with a 75% canopy closure

Used only for Riverine Flow-through subclass

If the AU does not have a stream within its boundaries, record a [0]. If the AU does have a stream, determine if any part of the stream within the AU has a canopy closure of overhanging trees or shrubs that occupy more than 75% of the width of the stream at that point. For this datum, record the length of the stream that has this canopy cover as a percent of the total length of the stream within the AU. For example, if the AU has 40 m of stream within its boundaries and 20 m of that length has a canopy cover of 75% which occupies 75% of the width of the stream, record 50 as the number in D16.

D19: The number of plant species present

As you walk in and around the AU, keep a list of the different number of plant species you find. It is best to keep two lists, one for native species and one for non-natives. You should try to identify plants to genus or species level if possible. If identification is not possible, your list can distinguish different plants by listing species 1, species 2, species 3 etc. Of the plants that you observed at the time of the site visit, the goal is to identify at least 80% to genus and species. Appendix L provides a list of common wetland plants in the Northwest.

We recognize that the number of species you observe will vary with the season. Therefore, if you see species that are dead but are recognizably different than the other species present, record them as “species 1” etc.

D19.1 The number of native species present
At the end of the field reconnaissance, record the number of **native** species you found in the AU in the row **D19.1** of the data sheet.

D19.2 The number of non-native species present
Record the number of non-native species in row **D19.2**. **Use only those listed in Appendix II M.**

NOTE 1: While identifying the non-native plant species present, also note the % of the AU in which non-native species are dominant or co-dominant (defined in D20). This information is used to answer D24.

NOTE 2: Species you can't identify to genus and species should be allocated to the native/non-native categories in the same proportions as those you could. For example, if you are able to identify 20 out of 24 species and 15 of those species are native, the 4 unidentified ones should be considered as 3 native and 1 non-native.

D20: The number of plant assemblages

While completing your field reconnaissance, identify and list the different plant assemblages present in the AU. Each area with a different dominant species (or a mix of co-dominant species) is considered to be a different plant assemblage. It may be helpful to systematically identify assemblages within each vegetation class in the AU.

Identifying assemblages may seem daunting. Remember, however, that the highest number of assemblages scaled is 12. If you have more than 12 there is no need to count the exact number.

The aerial photo may be useful to differentiate between areas with different dominant species. Difference in dominant species or co-dominants can be determined by changes in color (shading in B/W) or texture.

For AUs larger than 1.0 hectare (2.5 acres), the area covered by the assemblage must occupy at least 0.1 hectare (0.25 acre) of the AU. For AUs smaller than 1.0 hectare (2.5 acres) the threshold is 10% of the AU. Different areas of one assemblage within an AU, however, are added together to determine if the threshold is met.

Use the following criteria for identifying plant assemblages:

1. Areas where a single species is dominant — For a single species to be considered the dominant it must cover at least 50% of the surface of the ground. Use the aerial photo or your judgement in the field to determine if a species cover meets the 50% criterion.

2. Areas where several co-dominants are present — A different plant assemblage should be identified if there is no single dominant but several species are common that can be considered co-dominant. Co-dominance is defined as species that cover between 20-50 % of surface of the ground. Thus, assemblages defined by co-dominant species can have between 2 and 5 co-dominants.

3. Areas where no single species or group of co-dominants are present — A different plant assemblage is recognized if there are no species with cover greater than or equal to 20% of the surface of the ground, or if only one species has a cover >20% but no other species meet this criterion.

4. Areas where different species are dominant or co-dominant in the understory — A different plant assemblage should be counted if different species are dominant or co-dominant in the understory of forest or scrub-shrub vegetation. For example, an alder forest may have an understory of stinging nettle in one area and an understory of salmonberry in another. These two areas should be identified as two different plant assemblages.

> **NOTE 1:** Transition zones between plant assemblages may be considered as separate assemblages based on criterion #3 if they meet the minimum size threshold.
>
> **NOTE 2:** Aquatic bed species can be considered in your identification of assemblages.

D21: Number of vegetation strata present

As you observe the plant assemblages present (D20), identify the one with the most strata (vegetation layers) present and record the number of strata on the data sheet. To be counted, a stratum must cover at least 20% of the ground within the boundary of its plant assemblage, and be rooted in the AU.

A maximum of six strata can be present in any one assemblage. Do not include aquatic bed vegetation since that is addressed in D25. The strata being assessed are:

1. **Mosses and other ground cover**
2. **Herbaceous** — non-woody vegetation, usually less than 2m tall (*Typha spp.* and *Phragmites spp.* may exceed the height limit)
3. **Shrub** — Woody vegetation taller than 2m (6ft) consisting of shrubs, or young trees. The shrub stratum rarely exceeds 6 m (20 ft) in height.
4. **Sub-canopy —** Young or small trees growing under a canopy that range between 6-12 m (20-40ft).
5. **Canopy** — The highest vegetation stratum in an assemblage. It consists of large trees that may extend over the other four strata. It is usually higher than 12-15 m (40-50 ft).

NOTE: The term canopy is used in different ways. Sometimes it is used to represent the top layer of vegetation regardless of its height. We, however, follow the conventions commonly used in current ecological literature where the canopy is defined by the crowns of large trees. Since the datum we are collecting is the number of strata present, calling each one by a different name will reduce confusion.

6. **Vines** — Creeping or climbing vines that can range in size from <1 m high to several meters high. Common vines that can be found in wetlands include some honeysuckles (*Lonicera* spp), climbing nightshade (*Solanum dulcamara*), and blackberries (*Rubus* spp.).

D21.1 Stratum dominated by non-native blackberries

Record a [1] on the data sheet if the vine stratum is dominated or co-dominated by non-native blackberries (*Rubus discolor, Rubus laciniatus,* etc.). The only blackberry native to western Washington is *Rubus ursinus*.

D22: Presence/absence of mature trees

Use the photo map outlining the polygons of the different Cowardin vegetation classes in the AU. **If the AU has a "forested" class continue with the following assessment**, **if not record a [0] for row D22 on the data sheet.**

Determine if any of the tree species listed below are dominant, or co-dominant, within any plant assemblage identified in D20. Dominant and co-dominant are defined in D20. **If so, continue; if not record a [0] for row D22.**

This datum is determined by measuring the DBH (diameter at breast height) of the five largest trees of each of the dominant or co-dominant species present in the forested portion of the AU. If the diameter of **three** of the five largest individuals of any one dominant or co-dominant tree species exceeds the diameters given below, it is assumed that the AU contains a stand of mature trees. If so, record a [1] on line D20.

Tsuga heterophylla (western hemlock) >45 cm (18 in)
Thuja plicata (western red cedar) >45 cm (18 in)
Pseudotsuga menziesii (Douglas fir) >45 cm (18 in)
Picea sitchensis (Sitka spruce) >45 cm (18 in)
Populus balsamifera (black cottonwood) >45 cm (18 in)
Acer macrophyllum (big-leaf maple) >45 cm (18 in)
Alnus rubra (red alder) >30 cm (12in)
Fraxinus latifolia (Oregon ash) >30 cm (12 in)
Pinus contorta (lodgepole pine) >30 cm (12 in)
Salix lucida (Pacific willow) >30 cm (12 in)

To measure DBH, use a DBH tape or other forester's measuring device to determine the diameter at a height of approximately 1.5 m off the ground (4.8 ft). You can also use a tape

measure to determine the circumference at a height of approximately 1.5 m off the ground (4.8 ft) and divide by 3.14 to get the diameter.

> **NOTE 1:** Some small wetlands may have a forested class that consists of less than 5 trees. In this case, record a [0] for this datum.
>
> **NOTE 2:** To record a [1] on line D22, all you need is for one forest assemblage to have a minimum of three trees of the dominant or co-dominant species of the necessary size.
>
> **NOTE 3:** The DBH size thresholds for trees given are based on the judgement of the Assessment Teams and data collected in Puget Sound wetlands (Cooke Pers. Comm., 1998).

D23: Percent of the AU with a Sphagnum bog component

Estimate the percent of the AU within which sphagnum moss provides a minimum of 30% cover of the surface of the ground. The sphagnum moss can be growing under a stratum of shrubs or trees. For this assessment, the presence of 30% cover of sphagnum moss indicates the presence of a sphagnum bog.

D23.1 — 23.5 Percentage categories

Record a [1] on the data sheet for the appropriate category of areal percent.

D23.1 if the sphagnum bog component of the AU is **more than 75%** of the AU

D23.2 if the sphagnum bog component of the AU is **50% - 74%** of the AU

D23.3 if the sphagnum bog component is between **25 and 49%** of the AU

D23.4 if the sphagnum bog component is **1 - 24%** of the AU.

D23.5 if there is no sphagnum bog component in the AU.

D24: Percent of AU in which non-native plants are dominant or co-dominant

Identify if any non-native plants (see Appendix II M for list of species identified as non-native) are a dominant or co-dominant within parts of the AU. If so, map the areal extent of the area dominated by non-natives and estimate the percentage of the total AU this represents.

D24.1— 24.4 Percentage categories

Record a [1] on the appropriate data lines.

D24.1 if area of non-natives **>75%**

D24.2 if area is **50-75%**

D24.3 if area is **25-49%**

D24.4 if area is **1 - 25%**

D24.5 if AU has a **0%** area with non-native species as dominant or co-dominant

D25: Plant structures of aquatic bed vegetation

Locate the areas of open water in the AU or those with aquatic bed vegetation (mapped in D8.3 and/or D14.6). Check off which of the three types of plant structures are found among the different species of aquatic bed plants using the diagrams on the data sheet. Count the number of types present and record on data sheet. In no aquatic bed plants are present, record a [0].

NOTE: This datum is relevant only to aquatic bed vegetation that is **rooted**. Free-floating vegetation, such as *Lemna spp.*, is not counted.

The AU **does not** need to have an "aquatic bed" **class** (D14.6) to assess D25, and there is no size threshold for this datum.

D26: pH of water in AU

D26.1 pH of interstitial water

Use pH strips or a pH meter to determine the pH of water that seeps into the holes dug for assessment of soils (D47 and D48). Record the average of the pH's measured in all locations. If your soil pits do not have water seeping in from the sides, make a note of this on the data sheet, assume the pH is neutral, and record a 7.

NOTE 1: pH strips must be sensitive to water with low ionic strength, e.g. water in wetlands fed by rainwater and measure a range of 4-7.

NOTE 2: The pH should be measured immediately upon digging the hole since anoxic waters will quickly oxidize and change their pH.

NOTE 3: You may, however, need to leave the strip in the water for one minute, depending on the manufacturer.

D26.2 pH of standing or open water

If there is no standing or open water in the AU, record a [7] on the data sheet. If there is, measure the pH of the water just below the surface (no deeper than a hand's depth.) Use the same guidance described above.

D27: AU is within 8 km of a major brackish or salt water estuary

Determine if the AU is within 8km (5 miles) of a **major** brackish or salt-water estuary. Use a topographic map to determine D25. If so, record a [1] on the data; [0] if not.

For use in this assessment, major estuaries in western Washington are:

the mouths of the following rivers: Columbia, Nisqually, Puyallup, Duwamish, Snohomish, Stillaguamish, Skagit, and Nooksack

mouths of all rivers on the west side of Hood Canal

mouths of the rivers flowing into Willapa Bay and Grays Harbor.

The upstream boundary of the estuary, to be used for this assessment, is the upstream extent of salt-water incursion. If this information is not readily available, assume the salt-water incursion is approximately 1 km upstream on rivers on Hood Canal and 5 km (3 mi) from the river mouth in all others.

D28: AU is within 1.6 km of a large lake

Using your topographic map (1:24000 or larger scale), determine if the AU is within 1.6 km (1 mile) of a lake larger than 8 ha (20 acres). In this case, the AU **does not have to be connected by surface water**. If so, record a [1] on the data; [0] if not. The size of many lakes in Washington can be found in Lakes of Washington (Wolcott 1973).

D29: AU is within 5 km of a large field or pasture

Determine if the AU is within 5 km (3 mi) of a tilled field (in crop production) or pasture larger than 16 ha (40 acres). Large pastures or fields can be identified on a topographic map as "white" areas without houses or other structures indicated. However, it is important to confirm in the field that the white areas have recently (within the current calendar year) been tilled or grazed. The key factor for this datum is the presence of cultivated grasses, shorter than 15 cm (6 in.), and crops.

NOTE: Lawns and golf course do not count for this datum.

D30: Woody vegetation for browse by beaver

This datum assesses woody vegetation that is **favored** by beaver **(willow spp., aspen, cottonwood, and alder).** Identify areas in the AU **and** within 100m circumference of the AU that have a cover these species that is greater than 50% of the ground. For this datum, the 50% cover requirement can be provided by one or a combination of these three

To score, an AU must have at least 1.0 hectare (2.5 acres) of preferred woody vegetation in or within a 100 m (330 ft) circumference of the AU.

species. Estimate if the total area covered in and around the AU is at least 1.0 ha (2.5 acres). If so, record it as a [1] in the field data sheet. If the area is less, record a [0].

> **NOTE:** If there is an area where a preferred species is co-dominant (cover 20-49%) with a non-preferred species, divide the total area of that assemblage in half to determine if the 1 hectare threshold is met.

D31: Decomposition stages of snags and stumps

As you collect data, observe the snags and stumps present in the AU. Categorize each snag and stump with regard to how much it has decayed. Use the diagrams on the data sheet and the table of decomposition characteristics below to help discern decomposition categories. When you see a snag or stump of the minimum diameter or larger (see box) and appropriate amount of decay, circle it on the diagram. At the end of the field reconnaissance, record the number of diagrams circled in row D31 of the data sheet.

Snags and stumps can be counted only if their DBH is at least 10 cm (4 in.) or 10 cm at the base for decayed stumps, and they are rooted in the AU. There is no height threshold.

Log Characteristics	Log Decomposition Classes		
	Class 1	**Class 2**	**Class 3**
Bark	Intact	Intact	Trace
Twigs <3 cm (1.18 in)	Present	Absent	Absent
Texture	Intact	Intact to partly soft	Hard, large pieces
Color of Wood	Original color	Original color	Original color to faded
Portion of Log on Ground	Log elevated on support points	Log elevated on support points but sagging slightly	Log is sagging near ground

[Table adapted from Thomas (ed.) 1979]

> **NOTE:** Stumps that have not decayed are not counted (e.g. when recently cut).

D31.1 Snags larger than 30 cm.

Record a [1] if at least one of the snags above (D31) has a DBH greater than 30 cm (12").

D32: Overhanging vegetation

If the wetland **does not have a permanent open water category (D8.3) or a permanently flowing stream (D4.1) record a [0]** on line D 32 **and proceed to the next datum**.

Record if the banks along permanent open water or stream banks have **shrub** or **forest** vegetation that overhangs. Overhang means that vegetated branches extend over the water. See the box for the minimum requirements. If overhanging vegetation is present, record a [1] in row D32 on the data sheet.

NOTE 1: If you collect data during the winter, the branches of deciduous trees need to extend at least 1m from the edge. The overhanging vegetation must be alive, to provide shade when leaves are present. Break off twigs of the overhanging shrubs or trees to determine if the vegetation is alive.

The overhang has to extend at least 1 m (3 ft) from the edge and extend for at least 10 m (33 ft) along the open water or stream, and extend over the open water, **not** over a zone of emergent plants.

NOTE 2: In some AUs emergent vegetation may grow tall enough, and densely enough, to overhang permanent open water or flowing stream for the required 1m extension. If this is the case, record a [1] for this datum.

D33: Upland islands

Identify if the AU has upland areas within its boundaries. The areas must meet the criteria described in the box. Floating logs with upland vegetation growing on them can be categorized as islands if they meet the size criterion.

To record a [1] on the data sheet, "upland" islands must be larger than 10 m^2 (1000 ft^2) and they need to be surrounded by at least 30 m (100 ft) of open water deeper than 1 m (3 ft).

D34: Undercut banks

If the AU contains a stream, or is contiguous with a stream having defined banks, or is within the banks of a river, note whether any of the banks are undercut. Record a [1] on the data sheet if the area of undercutting extends for at least 2m (6.6 ft). Root masses that extend out over the water can count as undercut banks.

Area of undercutting must extends at least 2 m (6.6 ft) long.

D35: Egg laying structures for amphibians

Assess the interspersion between exposed water and thin-stemmed vegetation (or twigs and branches) in areas that are permanently or seasonally inundated. Use the dichotomous key in the data sheet. If characteristics in an AU do not match those described, use the rating that best represents the actual characteristics and record the appropriate score on the data sheet. In this case areas of aquatic bed vegetation can be treated as open water in judging interspersion.

For AUs larger than 1.0 ha (2.5 acres), the area of water and thin-stemmed vegetation must be at least 0.1 ha (0.25 acre). For AUs smaller than 1.0 ha (2.5 acres) the threshold is 10% of the AU.

NOTE: There are two stem-size thresholds for vegetation in this datum. The first question in the key asks if the AU has thin-stemmed vegetation that is between 1 – 8 mm. The other questions in the key ask if the vegetation is between 1-4 mm. Amphibians prefer smaller stem-sizes, but some species will use vegetation between 4-8 mm. The presence of the larger diameters in an AU will score less than the smaller ones.

D36: Tannins in surface water

Note if any areas of open or standing water have a brown, clear color. This color is an indicator of the presence of tannins in the water. If clear, brown water is present, determine if the area with tannins occur over a minimum of 10% of the total open and standing water in the AU. Record a [1] on line D36 of the data sheet if it does AND meets the color criteria described below.

The waters with high tannin content must extend over at least 10% of the areas of open and standing water.

To record a [1] on the data sheet the water should be the color often found in peat bogs. For those of you not familiar with the color of water in peat bogs, mix equal parts of water and a cola drink. The resulting colored water is a good approximation of water with a high tannin content. You may wish to take a sample of the diluted cola with you and an extra bottle of the same size for sampling for your site visit. Collect a sample of the water in the AU and compare it with your "cola standard." If the water in the AU is the same or darker, record a [1] for this datum.

> **NOTE:** The water has to be clear and brown. If the water is cloudy and brown it is probably carrying sediments and presence of tannins can't be determined.

D37: Steep banks of fine material

Check banks **within or immediately** adjacent to the AU for the following characteristics. A steep bank that can be used for denning must be 1) >30 degrees 2) at least 10 m long, 3) more than 0.6m (2 ft.) high (vertical), and 4) of fine material such as sand, silt, or clay. If these conditions are met, record the variable as present [1] on the data sheet.

A bank must be > 30 degrees steep, >10 m long, more than 0.6 m (2 ft) high, and consist of fine material.

NOTE: Some AUs may contain, or be bounded by, a dike of fine material (sand, silt, or clay), that can be used for denning. If the dikes meet the size criteria above they can be counted as a "steep bank."

D38: Interspersion between vegetated areas and open water

If the AU has a "permanent open water" class (D8.3 >0), identify the amount of interspersion between the areas with persistent vegetation (EM, SS, FO) and water in the AU using the diagrams in the data sheet as a guide. There are four categories of interspersion, numbered from 0-3. Identify the category that best matches the interspersion in the AU and record its number on the data sheet row D38.

D39: Interspersion between vegetation classes

Using the photo map of Cowardin vegetation classes (e.g. EM, SS, FO, AB) and the diagrams given in the data sheet, determine whether the interspersion between vegetation classes is high, moderate, low, or none. Record the scores as follows:

- High = 3
- Moderate = 2
- Low = 1
- None = 0

NOTE: AUs with only 2 vegetation classes can only score a moderate [2] or less, and AUs with 4 vegetation classes score a high [3] regardless of the interspersion. AUs with 3 classes can rate either a moderate or high depending on the amount of interspersion present. AUs with only one vegetation class score a 0.

D40: Structures in the AU that create eddies

Used only for riverine flow-through subclass.

Determine if the AU contains any of the following structural characteristics that would create eddies in flowing water. If you have difficulty determining if the structure is large enough, look for the presence of finer sediments just downstream of the structure.

A gravel or sand bar (may be vegetated or unvegetated)

Large logs (>50 cm diameter), or

Large rocks (>60 cm in diameter).

If any of these are present record the datum as present [1] on the data sheet.

D41: The characteristics of the edge between AU and uplands or adjacent wetlands

This datum assesses the structural complexity of the vegetation found at the edge between the AU and adjacent areas. It combines two different structural characteristics: 1) the sinuosity of the edge in the AU and 2) the presence of different vegetation levels along the edge.

Observe the different heights of vegetation, as reflected by Cowardin classes, on each side of the AU boundary. Vegetation classes include mosses, emergent (or herbaceous), shrub, and forest. Also observe the sinuosity of the AU boundary. Choose the verbal description that best fits those characteristics of the edge and record the appropriate score.

If the vegetation structure and sinuosity are not consistent around the entire edge, characterize the conditions that occur for at least 50% of the circumference. If conditions are not consistent for a minimum of 50% of the edge, choose one of the last two options in the list below.

> **NOTE 1:** Treat unvegetated dikes or roads at the edge of the AU as if they were the same vegetation class found within the AU (i.e. they do not provide any complexity to the edge habitat).
>
> **NOTE 2:** Tilled fields without vegetation should be considered as "emergent/herbaceous."
>
> **Choose the description that best fits the characteristics of the AU edge.**
>
> **0** = If there are **no differences** in vegetation classes on each side of the AU for more than 50% of the circumference, **record a [0] regardless of the sinuosity**. Examples: emergent (or herbaceous) to emergent (or herbaceous), shrub to shrub, forest to forest.
>
> **1** = If there is a **difference of one** vegetation class on each side of the AU and the edge is **straight** for more than 50% of the circumference, **record a [1].** Example:

emergent (or herbaceous) to shrub with a straight edge. A sinuous edge is defined as one where the actual distance along the edge is at least 2 times the straight line distance between two points.

2 = If there is a **difference of one** vegetation class on each side of the AU and the edge is **sinuous** for more than 50% of the circumference, **record [2**]. Examples: emergent (or herbaceous) to shrub with a sinuous edge.

2 = If there is a **difference of more than one** vegetation class on each side of the AU and the edge is **straight**, **record [2**]. Examples: emergent (or herbaceous) to forest with a shrub understory.

3 = If there is a **difference of more than one** vegetation class on each side of the AU and the edge is **sinuous**, **record [3**]. Example: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

2 = If **no single category above extends for more than 50%** of the circumference, and the edge is **straight**, **record [2].**

3 = If **no single category above extends for more than 50%** of the circumference, and the edge is **sinuous**, **record [3].**

D42: Characteristics of the buffer

Assess the characteristics of the existing buffer around the AU using the rating in the data sheet. If the characteristics of the buffer do not exactly match the description, use the category that most closely matches actual conditions.

The assessment focuses on the width of the relatively undisturbed areas and its relative length along the edge of the AU. The areas adjacent to the AU may be wetland, deep open water (lasustrine), or upland areas.

1. Determine if there are any relatively undisturbed areas of forest, shrub, grassland (not currently grazed or tilled), or open water. The area within 100m (330 ft.) should be observed to assess the characteristics of the buffer.

The three distances used in the categorization are as follows:

Relatively undisturbed areas extend at least 100 m (330ft) from the edge of the AU. The 100m are measured on the ground not from aerial photos. This is especially important if steep slopes surround the AU

Relatively undisturbed areas extend no more than 50 m (170 ft.) from the edge of the AU

Relatively undisturbed areas extend no more than 25 m (80 ft.) from the edge of the AU

Any heavily used paved or gravel roads, residential areas, lawns, or actively grazed pastures within a zone along the edge would disqualify the buffer from being “relatively undisturbed.”

Infrequently used gravel or paved roads, pipelines, or vegetated dikes, however, can be included in the "relatively undisturbed" areas.

1) **Determine the extent of these relatively undisturbed** areas around the AU as a percent of the total circumference. Cutoff points are 95%, 50%, and 25% of the circumference.

> **NOTE:** The criteria for categorizing the buffer are hierarchical. This means that you determine if the buffer meets the first criterion. If it does, it is a category 5. If it does not have a relatively undisturbed area of 100 m (330 ft) or more for more than 95% of its circumference, you determine if it matches the criterion for a category 4 buffer. If none of these criteria can be met, go the criteria for category 3, etc.

D43: Rating of corridors

Rate the current condition of corridors to and from the AU using the key on the data sheet. If the corridors do not exactly match the description, use the rating that most closely matches conditions found at the AU. Record the number of the rating category on the data sheet.

A riparian corridor, as used in this method, is defined as an area containing a stream or river that connects the AU to other wetlands or areas of open permanent or seasonal water. It is characterized by the presence of vegetation that tolerates moist conditions. An area can be categorized as riparian even though it does not meet the three criteria defining a regulated wetland. For the purposes of these methods, however, it must contain an intermittent, or permanent, stream or river.

> **NOTE:** The corridor must be "connected" to the AU. If the corridor is interrupted and no longer connects the AU to other habitat areas, answer no to D43.1 and 43.5. For example, the AU would not have a corridor if the immediate area were mowed, even though 50 feet away there is extensive forestland.

D44: Large woody debris on AU surface

As you collect the data, assess the number of different types of woody debris (LWD) present on the AU surface using the diagrams on the data sheet. These should be LWD **outside the area of permanent open water** identified in D8.3. When you see a piece of woody debris of the appropriate size and amount of decay, check off the appropriate box. At the end of the field visit, record the number of boxes checked for woody debris out of the areas of permanent water.

Logs on the surface must be at least 2 m (6.6 feet) long to count, with a minimum of 10 cm (4 in.) diameter at the widest part.

The size classes include:

10-20 cm (4-8 in.)

21-50 cm (8-20 in.)

>50 cm (>20 in.)

NOTE 1: Woody debris must be seen to be counted. Don't make assumptions about areas you are unable to access.

NOTE 2: If large woody debris is half out of and half in permanent open water, count it for both D44 and D45.

D45: Large woody debris in permanent open water

As you collect data, assess the number of different types of woody debris present **in** the **permanent open water** areas of the AU using the diagrams on the data sheet. (See instructions above.) The same size classes apply for D44 ad D45. At the end of the field visit, record the number of boxes checked for woody debris in permanent open water in row D45.

Logs in permanent open water must be at least 2 m (6.6 feet) long to count, with a minimum of 10 cm (4 in.) diameter at the widest part.

D46: Composition of AU surface

Note the type of non-living surfaces present on the ground, between stalks or stems of plants and in unvegetated, exposed areas. Record a [1] on the data sheet for every category present in the **areas that are not permanently inundated**. This datum does not apply to the substrate of permanently inundated areas. The categories are:

The minimum size threshold for any category to be counted is 10 m^2. Patches smaller than this should not be recorded.

D46.1 broad-leaved deciduous leaf litter

D46.2 other plant litter

D46.3 decomposed organic matter (plant source cannot be identified, including exposed muck soils)

D46.4 exposed cobbles

D46.5 exposed gravel

D46.6 exposed sand

D46.7 exposed silt

D46.8 exposed clay

NOTE 1: Areas covered by mosses or other bryophytes have no exposed surface visible, and therefore have no non-living surface layer exposed.

NOTE 2: Appendix II M provides some guidance on characteristics that can be used to identify differences between organic soils, sands, silts, and clays.

NOTE 3: Bare earth from animal tunnels does NOT count.

NOTE 4: D46.1, D46.2, D46.3 are commonly called the "duff" layer.

D47: Soils present in the A horizon.

Determine the extent of different soil types present in the top 10 -15 cm (3-4 in.) of the AU surface. The soil categories used in this assessment are peat, organic muck, mineral, and clay. Figure 11 (Appendix M) provides guidance on identifying soil types.

D47.1 peat

D47.2 organic muck

D47.3 mineral with clay fraction <30%

D47.4 mineral with clay fraction >30% (clay soils)

The data sheet categorizes areal extent into four categories. Record a [0-3] to indicate which category applies to the soil types present.

0 = **<1%** of the AU

1 = **1% - 49%** of the AU

2 = **50% - 95%** of the AU

3 = **>95%** of the AU

To start, refer to a soil survey map and identify if the AU contains any soil series identified as a peat or muck. Soil surveys often accurately identify organic soils. It is a good idea, however, to verify the presence of peat or muck, as well as mineral soil, when you conduct the reconnaissance of the AU.

Sample the soil at a minimum of four points in the AU. Sample points should be within the interior of the AU, not along the edge. If may be necessary to sample other areas also (see NOTE 1 and the box below.)

To sample the soil, dig a hole, or use a soil auger, and characterize the soil, 10-15 cm (3-4") below the level of the ground surface, into one of the four categories. Some guidance of field indicators for different soil types is given in Appendix II N.

Record 0-3 for the appropriate category of areal extent for each soil type present.

NOTE 1: If you are sampling in a seasonally inundated area, or in riverine AUs the interior, and want to combine the sampling with that needed for D48, you must increase the depth of the hole to 60 cm (24 in.)

To collect data for both D47 and D48, locate some of your soil sampling points in areas that are seasonally inundated for a depressional AU or in the interior of a riverine AU where the frequent flooding occurs.

NOTE 2: It may be necessary to sample more than four locations if the AU is large (i.e. more than 4 ha, 10 acres), highly irregular, or if significant changes in plant assemblages indicate changes in soil types. As you walk through the AU, you will have to judge whether four sampling points provide an adequate mapping of the soils.

NOTE 3: If the AU has large areas that are inundated at the time of your visit, you will need to judge what the soils might be in those areas. Areas of permanent inundation in depressional wetlands often have a peat or muck soil near the surface.

D48: Infiltration rate of soils

You will also need to rate the infiltration rate of the soils in the parts of **depressional** AUs that are **seasonally inundated,** and in the **interior of riverine** AUs. If your AU is depressional and does not have any areas of annual inundation (i.e. D8.1=0), record a [0] for all categories of infiltration rate.

Record the infiltration rate of the soils with greatest areal extent in the area that is seasonally inundated (depressional) or in the interior portion of AUs that are riverine.

Choose several locations in the areas specified above depending on the class of the AU. Dig a soil hole 60cm deep (2 ft) or use a soil auger to determine the type of soil present between the surface and 60 cm (24 in.). Determine which infiltration rate rating applies following the key in Appendix II M. Record a [1] on the data sheet for the appropriate rating.

D48.1 FAST If gravel, cobbles, or large rocks are >50% of a sandy soil, the infiltration rate is judged to be "fast."

D48.2 MODERATE If sand is the dominant constituent of the soil, the infiltration rate is judged to be "moderate."

D48.3 SLOW If clays, silts, or organic matter (fines) are more than 25-30% of the soil, the infiltration rate is considered to be "slow."

NOTE 1: The infiltration rate may be assessed in conjunction with the soil types. See previous guidance for D47.

NOTE 2: Record the **least** permeable layer if there are several layers of soil within the top 60cm.

D49: Substrate of permanently flowing stream or river

Record these data only if a permanently flowing stream or river is within the AU, NOT adjacent to it.

D49.1 & 49.2 Cobbles and Gravel

Determine if there are any areas of the stream or river where either gravel (D49.1) or cobbles (D49.2) can be seen within the streambed. Record a [1] on the appropriate line of the data sheet if there is at least 1m (3 ft.) of the stream bed (in direction of flow) that contain these substrates.

There must be at least 1 m (3 ft) of the stream bed (in direction of flow) with these substrates to count.

D49.3 Micro-depressions in stream channels or flow paths

Used only for riverine flow-through subclass.

This datum is applicable only to stream channels or flow paths in the riverine flow-through subclass. Note if channels in the AU have small depressions that form pools that are <1 m (3 feet) deep after a flood event. Record a [1] in Row D49.3 of the data sheet if such pools are present in stream channels or flow paths.

NOTE: 49.3 cannot be measured during a flood event when the AU is covered with water. When floodwaters have receded determine if there are any small pools within the main water channels extending through the AU. If the entire stream bed is dry look for the following indicators of the presence of pools:

- Depressions in the stream bed where finer sediment size than surrounding areas.
- Depressions in the stream bed where the surface may be caked and cracked or have a surface layer of dried algae.
- Depressions in the stream bed with emergent plants when the surrounding areas are devoid of plants.

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Figures

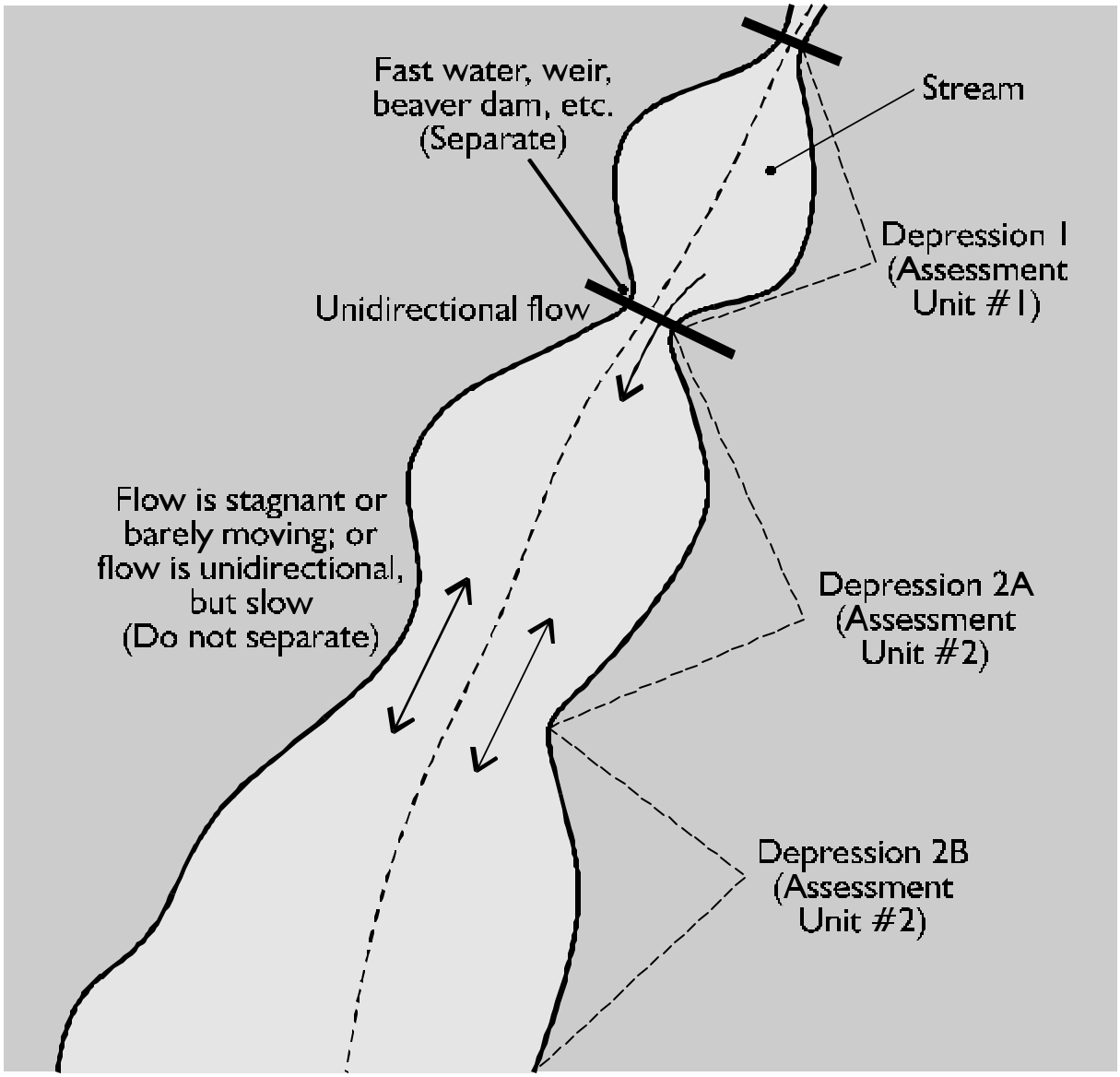


FIGURE 1: Determining Boundaries in Depressional Wetlands with Constrictions

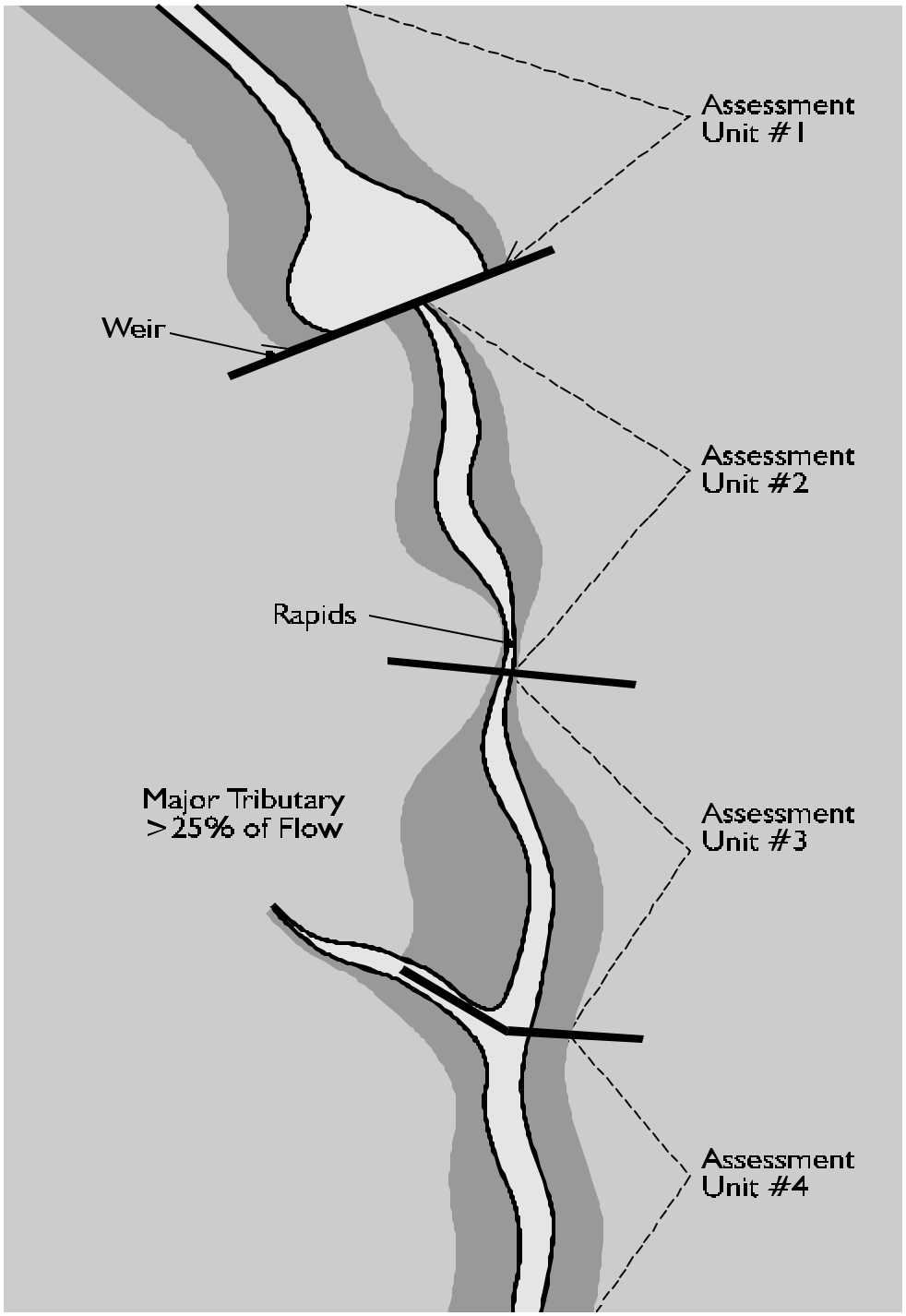


FIGURE 2: Determining Boundaries in Contiguous Wetlands Along a Stream Corridor or Floodplain

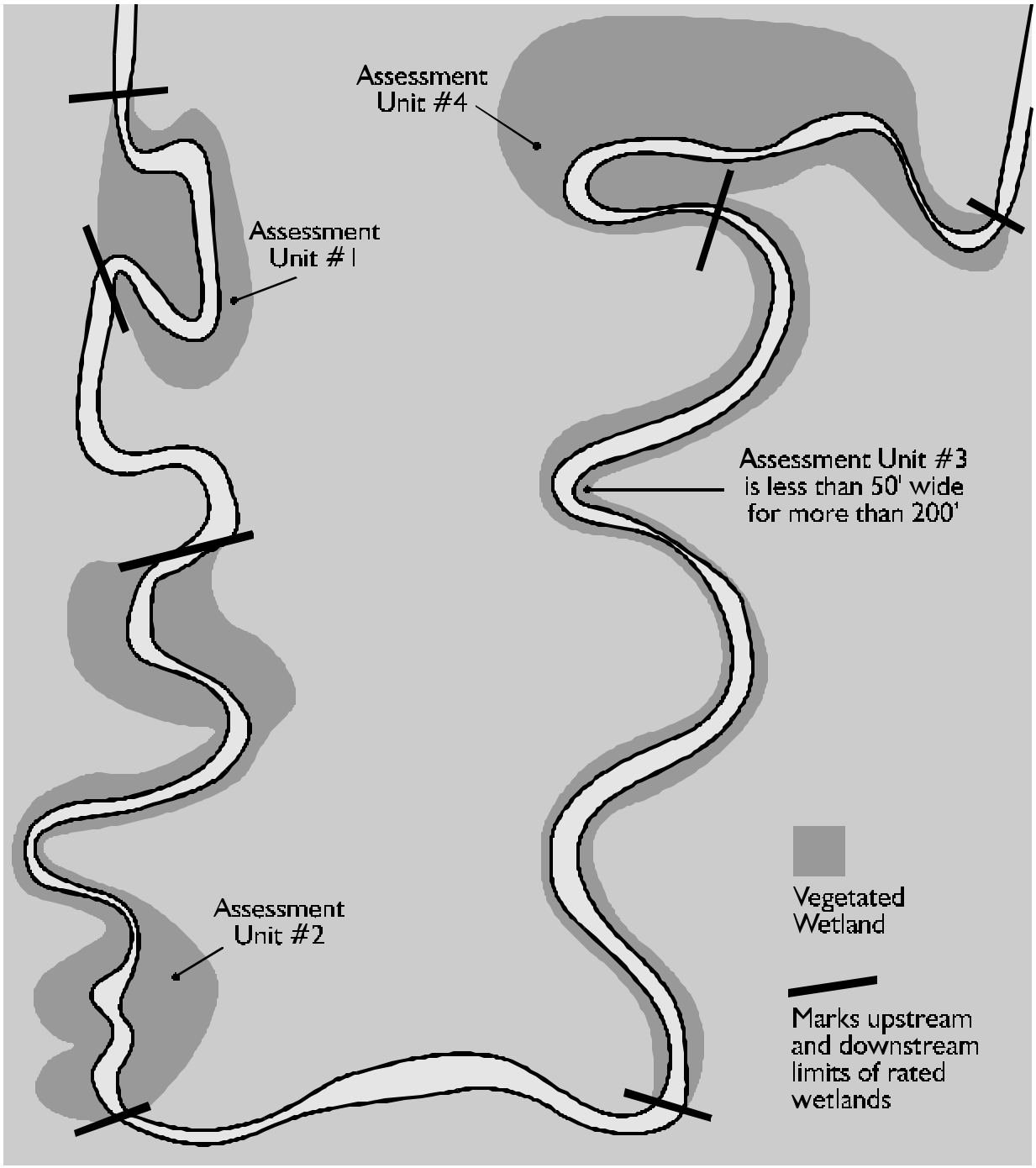
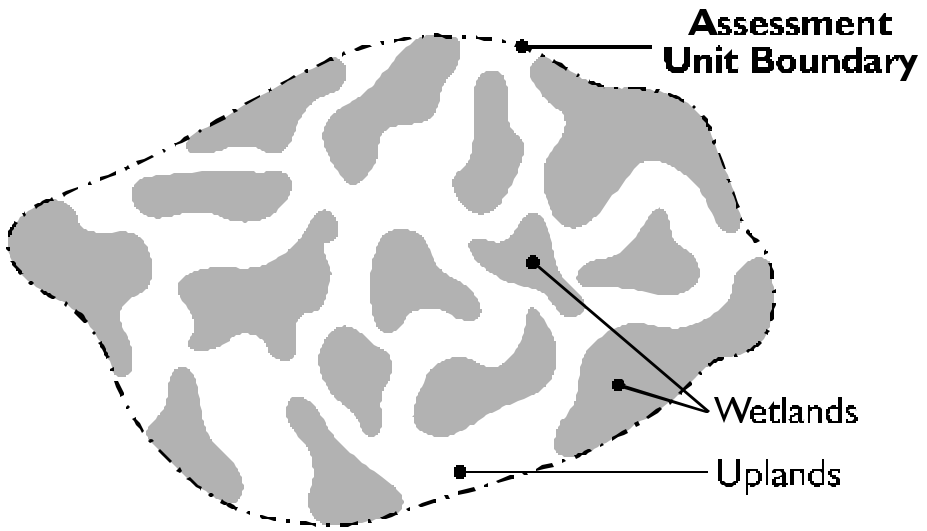
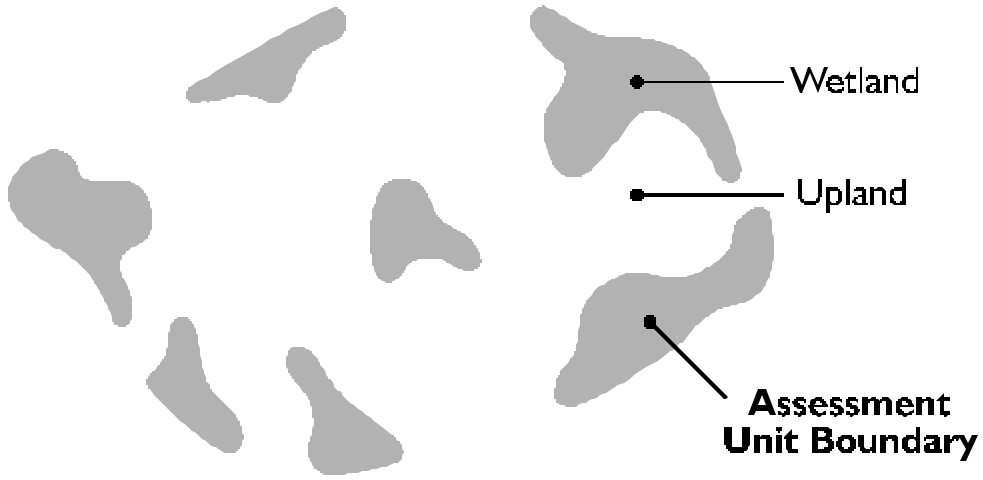


FIGURE 3: Determining Assessment Unit Boundaries in Linear Systems



Total wetland area >50%



Total wetland area <50%

FIGURE 4: Determining Boundaries When Wetland Areas are Patchy

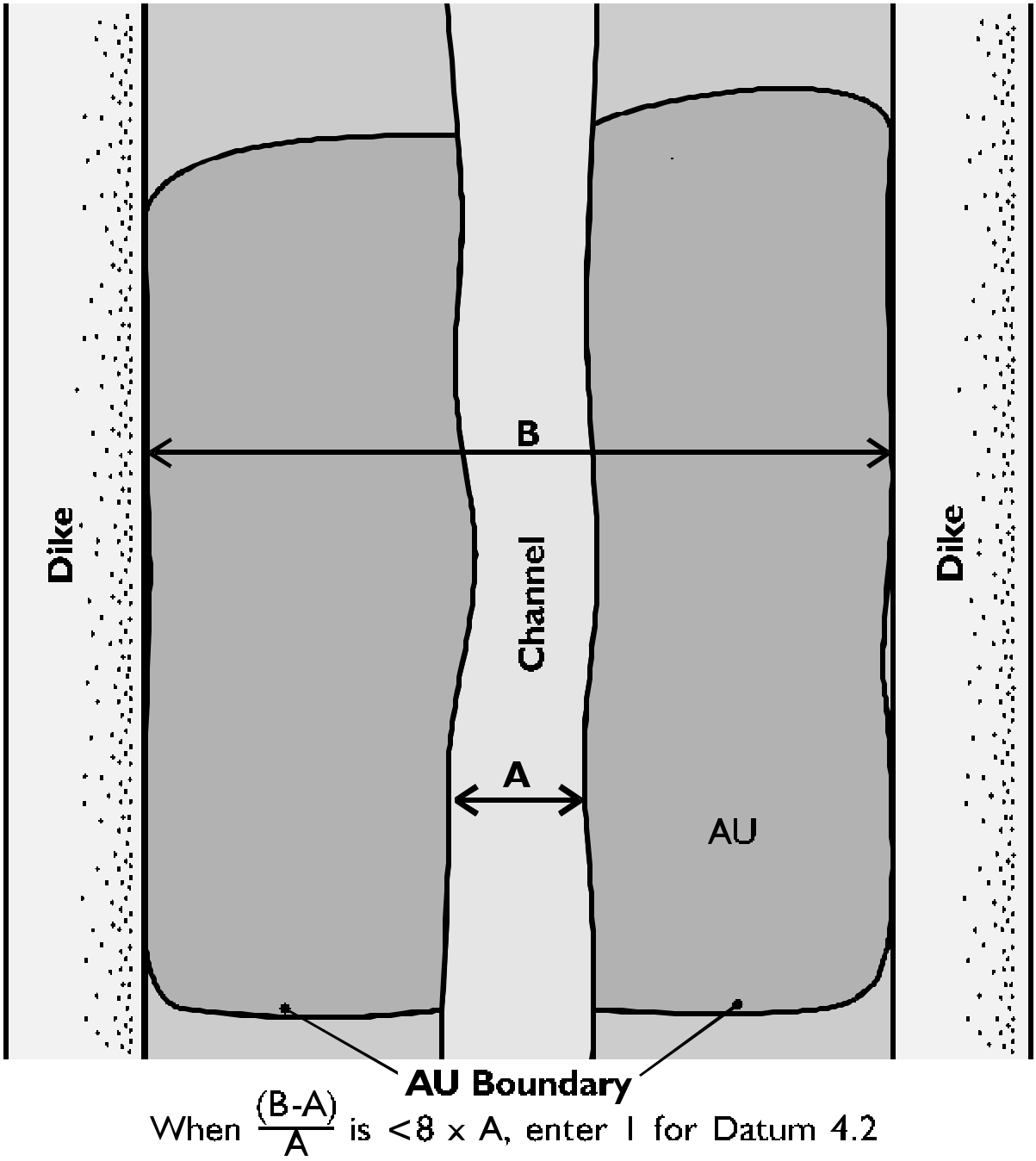
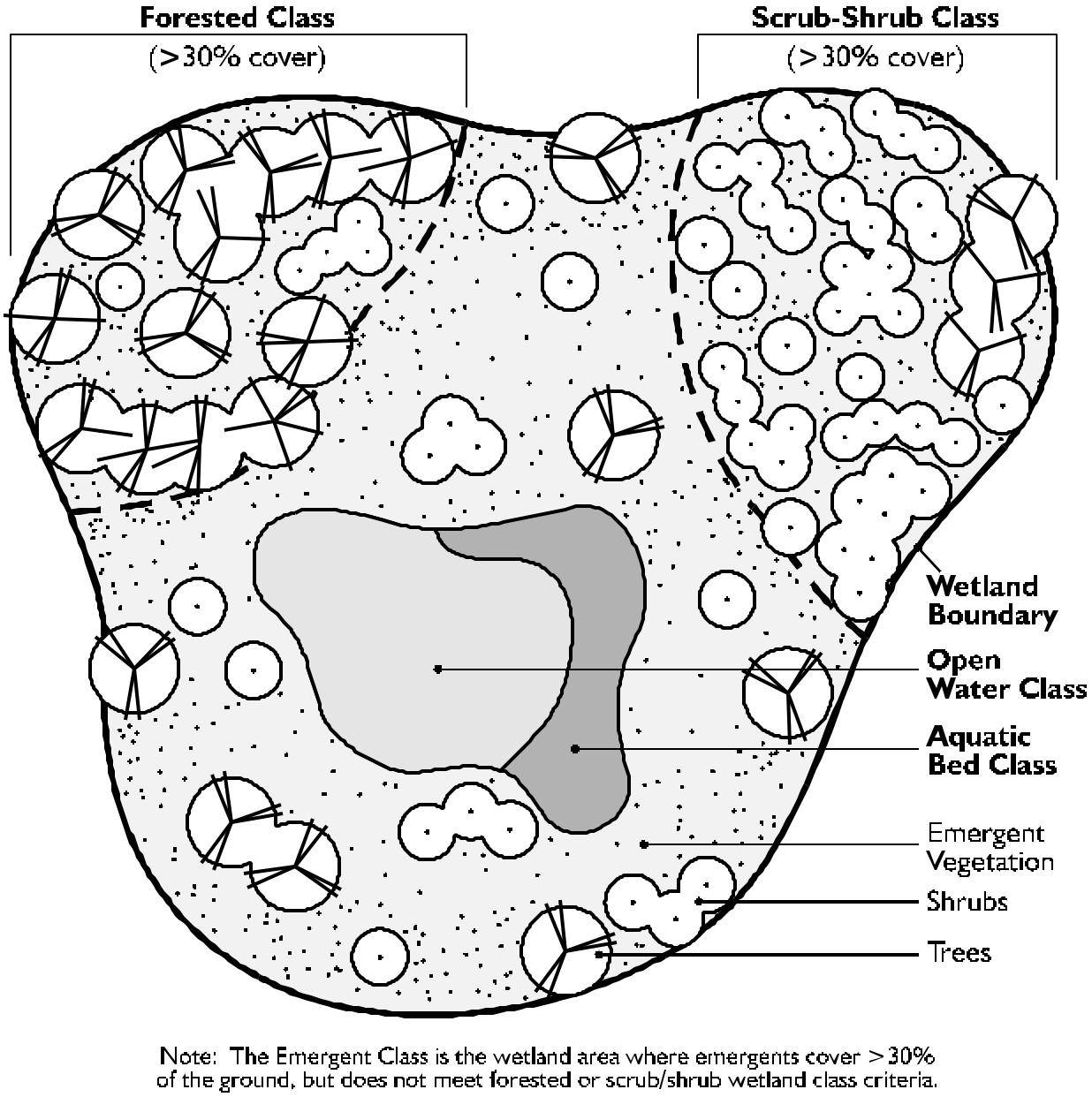


FIGURE 5: Determining Boundaries in AUs with Channels



Note: The Emergent Class is the wetland area where emergents cover >30% of the ground, but does not meet forested or scrub/shrub wetland class criteria.

FIGURE 6: Boundaries Between Vegetation Classes in a Wetland with a Mixture of Classes

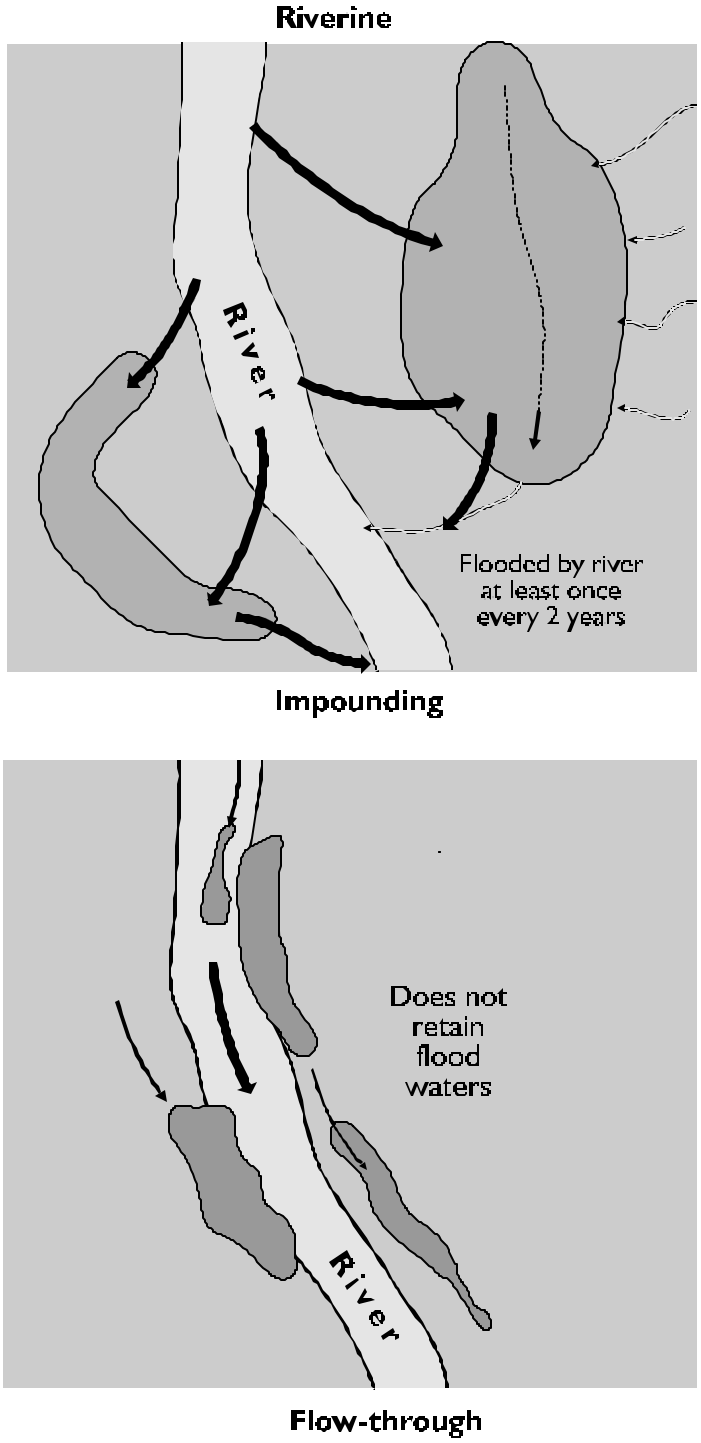


Figure 7: Hydrogeomorphic Classification for Wetlands in the Lowlands of Western Washington – Riverine

Depressional

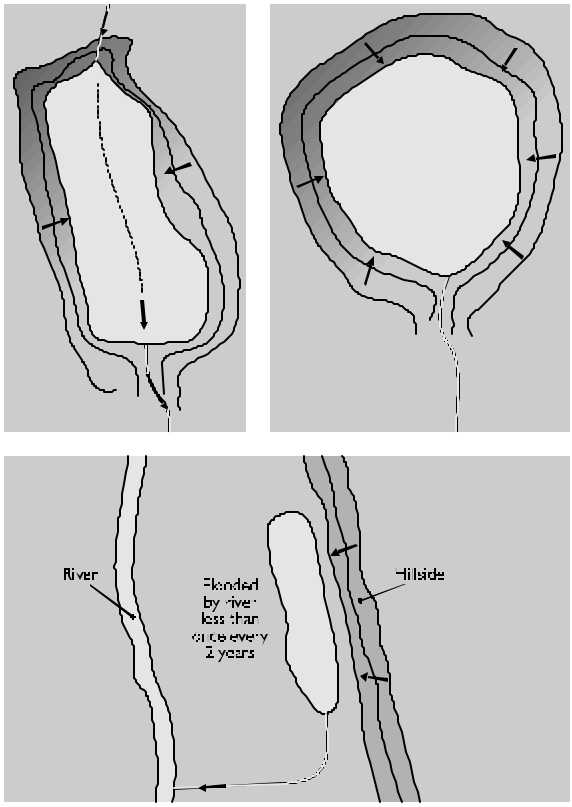


FIGURE 8: Hydrogeomorphic Classification for Wetlands in the Lowlands of Western Washington – Depressional

Appendix A: Data Sheets for Depressional Outflow and Riverine Impounding Wetlands and Classification Key

Wetland Name: _____ **AU ID#:** _____

Location: _____ **T/S/R:** _____

Data Collector: _____ **Date:** _____

Use this data sheet for:
DEPRESSIONAL OUTFLOW *or* ***RIVERINE IMPOUNDING*** *wetlands in the Lowlands of Western Washington*

- *Use in conjunction with the written guidance provided in Parts 1 and 2*
- *Record only numbers, yes/no answers are recorded as a [1] or [0]*

Estimate, Score/ or Rating			
			LANDSCAPE DATA
_____	1/0	**D0**	Do dikes surround the AU, and does it drain through a control structure that can be manipulated?
_____	ha	**D1**	Area of AU
_____	ha	**D2**	Area of contributing basin (upgradient watershed)
		D3	Land use (as % of total area) within 1 km of AU (include contiguous AUs of different class)
_____	%	*D3.1*	Undeveloped forest (if previously clear-cut, cut at least 5 years ago)
_____	%	*D3.2*	Agriculture (tilled fields and pastures; includes golf courses)
_____	%	*D3.3*	Clear-cut logging (<5 years since clearing)
_____	%	*D3.4*	Urban/commercial (any developed areas not identified as residential)
_____	%	*D3.5*	High density residential (>1 residence/acre)
_____	%	*D3.6*	Low density residential (<= 1 residence/acre)
_____	%	*D3.7*	Undeveloped areas, shrubland, other wetlands, and open water
			WATER REGIME
_____	0/1	**D4**	Channels, ditches, or streams in AU
_____	0/1	*D4.1*	Channels, ditches, or streams in AU have permanently flowing water *(you see water flowing)*
		D4.2	
_____	0/1	*D4.3*	The only surface outflow from the AU is through a culvert (<60 cm) or vertical siphon
		D5	
		D6	
		D7	
		D8	Inundation
_____	%	*D8.1*	Percent of AU that is ponded or inundated for >1 month
_____	%	*D8.2*	Percent of AU with permanent standing or moving water
_____	%	*D8.3*	Percent of AU with permanent open water *(without aquatic bed vegetation)*
_____	%	*D8.4*	Percent of AU with unvegetated bars or mudflats
_____	0/1	*D8.5*	Unvegetated bars or mudflats at least 100 square meters in size
		D9	Inundation regimes
_____	0/1	*D9.1*	Permanently flooded (include vegetated areas)
_____	0/1	*D9.2*	Seasonally flooded (>1 month)
_____	0/1	*D9.3*	Occasionally flooded (<= 1 month)
_____	0/1	*D9.4*	Saturated but seldom inundated
_____	0/1	*D9.5*	Permanently flowing stream
_____	0/1	*D9.6*	Intermittently flowing stream
_____	m	**D10**	Average height of annual flooding above lowest point of outlet or surface of permanent stream at outlet (round to 0.3 m)

By definition:
D8.1 >= D8.2 >= D8.3

Chose all that apply that meet size criteria: area >0.1 ha (1/4 acre) or > 10% of AU if AU smaller than 1 ha (2.5 acres)

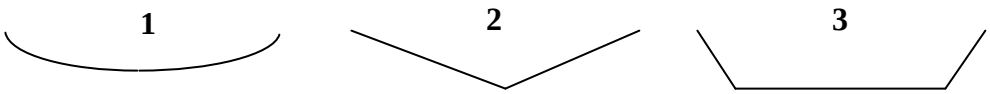
Wetland Name:	**AU ID#:**

D11 Cross section of AU in areas of seasonal inundation (record a 1 next to cross section that best fits)

_____ 0/1 *D11.1* Cross section 1

_____ 0/1 *D11.2* Cross section 2

_____ 0/1 *D11.3* Cross section 3



D12 Categories of water depths in AU, areas permanently or seasonally inundated/flooded

_____ 0/1 *D12.1* 1-20 cm (<8 in)

_____ 0/1 *D12.2* 20-100 cm (8-40 in)

_____ 0/1 *D12.3* >100 cm (>40 in)

Record a 1 for each category present if >0.1 ha (1/4 acre) or 10% of area

D13 Constriction of outlet

_____ 0/1 *D13.1* Unconstricted or only slightly constricted

_____ 0/1 *D13.2* Moderately constricted

_____ 0/1 *D13.3* Severely constricted

_____ 0/1 *D13.4* *Riverine Impounding only* – Completely constricted (no surface outlet)

If the AU has multiple outlets, judge the constriction as if all the outlets were combined into one large one.

VEGETATION

D14 Cowardin Classes (as % area of AU)

_____ % *D14.1* Forest - evergreen

_____ % *D14.2* Forest -deciduous

_____ % *D14.3* Scrub-shrub - evergreen

_____ % *D14.4* Scrub-shrub - deciduous

_____ % *D14.5* Emergent

_____ % *D14.6* Aquatic bed

- *Include forest only if trees are rooted in AU.*
- ***If forest is a mix of deciduous and evergreen estimate the relative % cover of each and divide percentage between the two categories.***
- ***If vegetation classes are patchy, add the patches together for each class to get a total.***
- *To count, a class must cover at least 0.1 ha or be more than 10% of the total area of the AU*

_____ 0/1 **D15** Does D8.3 + D8.4 + sum (D14.1 to D14.6) = 100? **If not, give reason.**

_____ % **D16** % area of herbaceous understory **in forest and shrub areas** (not % area in entire AU)

_____ % **D17** % area of AU with >75% closure of canopy *(SS, FO classes > 1 m high)*

D18

D19 Plant Richness

_____ # *D19.1* Record number of native plant species found in AU

_____ # *D19.2* Record number of non- native plant species found in AU

_____ # **D20** The # of plant assemblages in the AU with area >0.1 ha (1/4 acre) or >10% if AU <1 ha *(if more than 12 record a 12)*

_____ [1-6] **D21** Strata: The maximum # of strata present in any plant assemblage

_____ 0/1 *D21.1* Is vine stratum dominated by non-native blackberries?

A stratum must have 20% cover in assemblage

Wetland Name:	**AU ID#:**

0/1 **D22** Mature trees in AU

Average DBH of 3 out of 5 largest trees of a species has to exceed size threshold

Tsuga heterophylla (western hemlock) >45 cm (18")
Thuja plicata (western red cedar) >45 cm (18")
Pseudotsuga menziesii (Douglas fir) >45 cm (18")
Picea sitchensis (Sitka spruce) >45 cm (18")
Populus balsamifera (black cottonwood) >45 cm (18")
Acer macrophyllum (big-leaf maple) >45 cm (18")
Alnus rubra (red alder) >30 cm (12")
Fraxinus latifolia (Oregon ash) >30 cm (12")
Pinus contorta (lodgepole pine) >30 cm (12")
Salix lucida (Pacific willow) >30 cm (12")

D23 Sphagnum bogs

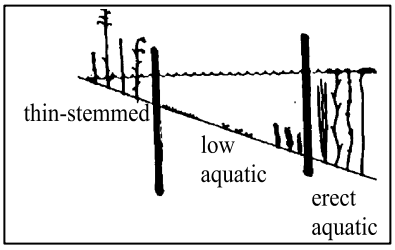
0/1 *D23.1* % area of Sphagnum bogs >75%
0/1 *D23.2* % area of Sphagnum bogs = 50-75%
0/1 *D23.3* % area of Sphagnum bogs = 25-49%
0/1 *D23.4* % area of Sphagnum bogs = 1-24%
0/1 *D23.5* % area of Sphagnum bogs = 0%

D24 Dominance by non-native plant species

0/1 *D24.1* % area of non-native species >75%
0/1 *D24.2* % area of non-native species = 50-75%
0/1 *D24.3* %area of non-native species = 25-49%
0/1 *D24.4* % area of non-native species = 1-24%
0/1 *D24.5* % area of non-natives = 0%

HABITAT CHARACTERISTICS

[0-3] **D25** Number of structure categories in aquatic bed vegetation
Applies only to aquatic bed species
DO NOT count persistent emergents



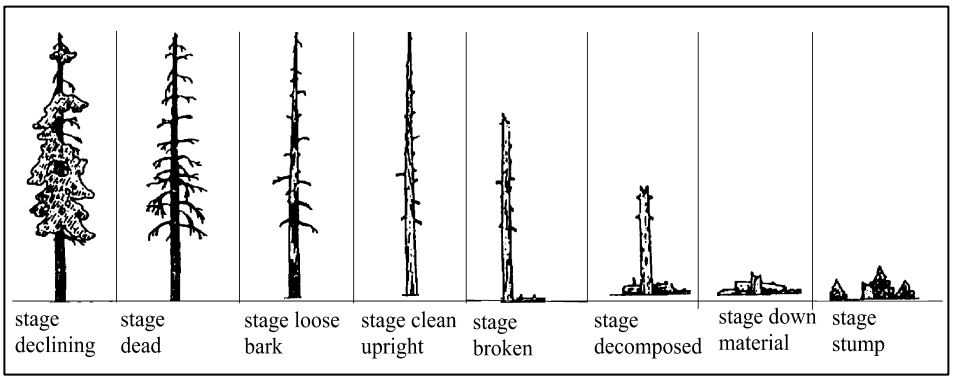
D26 pH

[4-9] *D26.1* pH of interstitial water *(measure immediately after digging hole in non-inundated areas)*
[4-9] *D26.2* pH of open or standing water (*record the lowest pH, if you cannot measure record a [7])*
0/1 **D27** Estuary: AU is within 8 km (5 mi) of a brackish or salt water estuary
0/1 **D28** Large lake: AU is within 1.6km (1 mi) of a lake >8 ha (20 acres)
0/1 **D29** Open field: AU is within 5 km (3 mi) of an open field (agriculture or pasture) >16 ha (40 acres)
0/1 **D30** Preferred woody vegetation: AU has >1 ha (2.5 acres) of preferred woody vegetation for beaver in and within 100 m of AU

Wetland Name:	**AU ID#:**

[0-8] **D31** Snags (record # of stages)

Circle the categories present; minimum DBH of snag =10 cm (4")



0/1 *D31.1* At least one of the snags above has a DBH greater than 30 cm (12").

0/1 **D32** Overhanging vegetation, extending out for 1 m, for at least 10 m (33 ft) over stream or open water.

0/1 **D33** Upland islands of at least 10 square meters (100 square ft.) within AU boundary

Islands need to be surrounded by at least 30 m (100 ft) of open water deeper than 1 m (3 ft)

0/1 **D34** Undercut banks present for at least 2 m (6.6 ft.)

[0-4] **D35** Key for rating egg-laying structures for amphibians

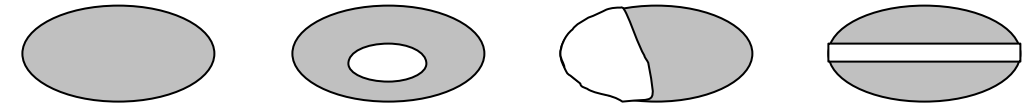
1. Does the AU have thin-stemmed vegetation or thin branches **(<8 mm)** in at least 1/4 acre (or 10% of AU) of permanent or seasonally inundated areas? *Thin-stemmed vegetation can include herbaceous species such as water parsley.*
   NO – Score = 0 YES go to 2
2. Does the AU have at least 0.2 ha (1/2 acre) of thin-stemmed emergent vegetation or woody branches, **1-4 mm** in diameter?
   NO go to 5 YES go to 3
3. Does the area with thin stems contain open water interspersed in a patchwork of a ratio that is approximately 1:1 [no more than a 40- 60% of the total area is open water)?
   NO go to 4 **YES - Score = 4**
4. Is the area of open water between 25% and 75% of the total area in the zone of thin stemmed vegetation?
   NO – Score = 2 **YES – Score = 3** STOP
5. Does the AU have >0.1 ha (1/4 acre) of thin-stemmed emergent vegetation or woody branches, **1-4 mm**?
   NO – Score = 1 YES go to 6
6. Does the area with thin stems contain open water interspersed in a patchwork of a ratio that is approximately 1:1 [no more than a 40- 60% of the total area is open water)?
   NO go to 7 **YES – Score = 3**
7. Is the area of open water between 25% and 75% of the total area in the zone of thin stemmed vegetation?
   NO – Score = 1 **YES – Score = 2**

Wetland Name:	**AU ID#:**

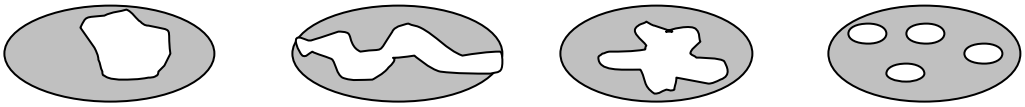
0/1 **D36** Tannins in surface waters >10% of water surface

0/1 **D37** Steep banks for denning (>30 degree slope, fine material, >10 m long, >0.6 m high) *(may be a dike)*

[0-3] **D38** Interspersion between erect vegetation and permanent open water (POW + AB) areas of AU



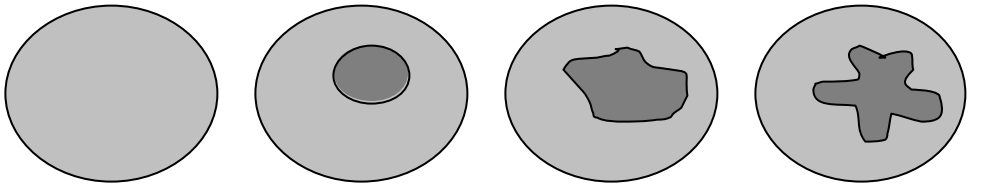
None [0] Low [1] Low [1] Low [1]



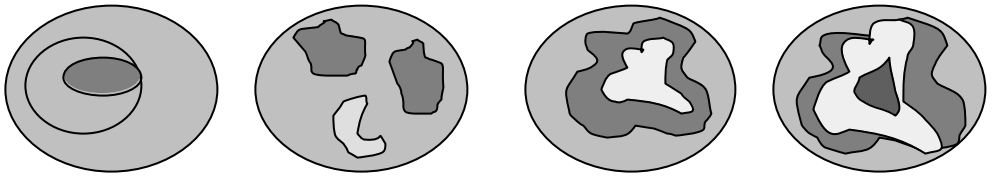
Moderate [2] Moderate [2] High [3] High [3]

[0-3] **D39** Interspersion between Cowardin vegetation classes

**AUs with only 2 classes can only score a moderate[2] or lower*
**AUs with 4 vegetation classes score a high [3]*
**AUs with 3 classes can score a moderate (2) or a high (3)*



None [0] Low [1] Low [1] Moderate [2]



Moderate [2] High [3] High [3] High [3]

Wetland Name:	**AU ID#:**

D40

[0-3] **D41** Edge of AU: The characteristics of the edge between AU and uplands or adjacent wetlands.

Choose the description that best fits the characteristics of the AU edge:

0 There are **no differences in level** of vegetation height as reflected by vegetation classes on each side of the AU for more than 50% of the circumference: record a [0] **regardless of the sinuosity**. Examples: emergent (or herbaceous) to emergent (or herbaceous), shrub to shrub, forest to forest.

1 There is a **difference of one level** in vegetation height as reflected by vegetation classes on each side of the AU and the **edge is straight** for more than 50% of the circumference: record a [1]. Example: emergent (or herbaceous) to shrub, shrub to forest

2 There is a **difference of one level** in vegetation height as reflected by vegetation classes on each side of the AU and the **edge is sinuous** for more than 50% of the circumference: record a [2]. Examples: emergent (or herbaceous) to shrub, shrub to forest.

2 There is a **difference of more than one level** of vegetation height as reflected by vegetation classes on each side of the AU and the **edge is straight: record a [2]**. Examples: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

3 There is a **difference of more than one level** of vegetation height as reflected by vegetation classes on each side of the AU and the **edge is sinuous: record a [3]**. Example: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

2 If **no single category** above extends for more than 50% of the circumference, and the **edge is straight: record a [2]**

3 If **no single category** above extends for more than 50% of the circumference, and the **edge is sinuous: record a [3]**

[0-5] **D42** Buffer of AU: Choose the description that best represents condition of AU buffer

> ** Open water or adjacent wetlands are considered part of the buffer*
> ** Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance"*

5 100 m (330 ft) of forest, scrub, relatively undisturbed grassland or open water >95% of circumference. Clear-cut >5 years old is OK. No developed areas within undisturbed part of buffer.

4 100 m (330 ft) of forest, scrub, relatively undisturbed grassland or open water >50% circumference OR 50 m (170 ft) of forest scrub, grassland or open water >95% circumference. No developed areas within undisturbed part of buffer.

3 100 m (330 ft) of forest, scrub, grassland or open water >25% circumference, OR 50 m (170 ft) of forest, scrub, grassland or open water >50% circumference.

2 No paved areas or buildings within 25m (80 ft) of wetland >95% circumference. Pasture or lawns are OK. OR no paved areas or buildings within 50m of wetland >50% circumference

0 Vegetated buffers are <2 m wide (6.6 ft) for more than 95% of the circumference

1 Does not meet any of the criteria above

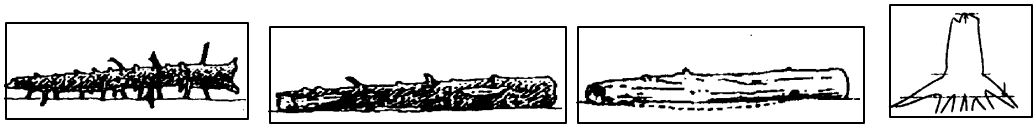
Wetland Name:	**AU ID#:**

_____ [0-3] **D43** Corridors of AU: Rate corridors using following key *(record rating of 0, 1, 2, or 3)*

1. Is the AU part of a riparian corridor *(see text for definitions)*
   NO go to 5 **YES go to 2**
2. Is the wetland part of riparian corridor > 50 m wide connecting 2 or more wetlands within 1 km with at least 30% shrub or forest cover in the corridor?
   NO go to 3 **YES = [3]**
3. Is the AU part of a riparian corridor 25-50 m wide connecting to other wetlands with at least 30% shrub or forest cover in the corridor?
   NO go to 4 **YES = [2]**
4. Is the AU part of a riparian corridor >5 m wide with relatively undisturbed veg. (grasslands, abandoned pasture are OK) that extends for more than 1 km?
   NO go to 5 **YES = [1]**
5. Is there a corridor >50 m wide with good (>30%) cover of forest or shrub (>2 m high) to natural upland area or open water that is >100 ha in size?
   NO go to 6 **YES = [3]**
6. Is there a 10-50 m wide forest or shrub corridor to a relatively undisturbed upland or open water that is >10 ha?
   NO go to 7 **YES = [2]**
7. Is there a corridor of relatively undisturbed vegetation (grassland, abandoned pasture) >50 m wide to an undisturbed upland or open water that is >10 ha?
   NO go to 8 **YES = [2]**
8. Is there any vegetated corridor 5-50 m wide between the AU and any relatively undisturbed area or open water that is >2.5 ha?
   NO = [0] **YES = [1]**

_____ [0-12] **D44** # of categories of large woody debris in AU **outside of perm. water**

Freshly cut stumps are not included



Diameter		**Log Class 1**	**Log Class 2**	**Log Class 3**	**Stump**
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

_____ [0-12] **D45** # of categories of large woody debris **in permanent water** of AU (may include aquatic bed areas)

Diameter		**Log Class 1**	**Log Class 2**	**Log Class 3**	**Stump**
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

Wetland Name:	**AU ID#:**

SOILS and SUBSTRATES

D46 Composition of AU surface

0/1	*D46.1*	Deciduous, broad-leaved, leaf litter
0/1	*D46.2*	Other plant litter
0/1	*D46.3*	Decomposed organic
0/1	*D46.4*	Exposed cobbles
0/1	*D46.5*	Exposed gravel
0/1	*D46.6*	Exposed sand
0/1	*D46.7*	Exposed silt
0/1	*D46.8*	Exposed clay

Record a 1 for each category present if its area is > 10 square meters. Note: bare earth from animal tunnels does NOT count.

D47 Soils present in top (15 cm) of A horizon (record [1] if 1-49% area of AU, [2] if 50-95%, [3] if >95%)

[0-3]	*D47.1*	Peat
[0-3]	*D47.2*	Organic Muck
[0-3]	*D47.3*	Mineral with clay fraction <30%
[0-3]	*D47.4*	Clay (clay fraction >30%)

Record the least permeable layer if there are several down to 60 cm.

D48 Infiltration rate of top 60 cm of soil in seasonally inundated areas

0/1	*D48.1*	Fast >50% gravel and cobble and the rest a sand, loamy sand, or sandy loam
0/1	*D48.2*	Moderate >50% sand and rest cobble, gravel, loamy sand, or sandy loam
0/1	*D48.3*	Slow - muck, peat, or loams (except sandy loam), silts, and clays

D49 Substrate of streams

0/1	*D49.1*	Substrate **of permanent stream** or river in AU has at least 1 square meter of gravel
0/1	*D49.2*	Substrate **of permanent stream** or river in AU has at least 1 square meter of cobbles
	D49.3	

Judgements of Opportunity (Ratings of High, Medium, Low)

Rating	*Functions*
	Removing Sediments
	Removing Nutrients
	Removing Toxic Metals and Organics
	Reducing Peak Flows
	Reducing Downstream Erosion
	Recharging Groundwater
	General Habitat
	Anadromous Fish Habitat

Western Washington Wetland Classification Key

Wetland Name: _____

AU ID #: _____ **Date:** _____

1) Water levels in AU usually controlled by tides
   No – go to 2 Yes – **Tidal Fringe**

2) Topography is flat and precipitation is only source (>90%) of water to the AU
   No – go to 3 Yes – **Flat**

3) AU is contiguous with >8 ha open water, and water is deeper than 2 m over 30% of open water area
   No – go to 4 Yes – **Lacustrine Fringe**

4) Open water is <8 ha and >2 m deep, but AU is a fringe narrower than ½ the radius of open water
   No – go to 5 Yes – **Lacustrine Fringe**

5) Water flow in AU is unidirectional on a slope, water is not impounded in the AU
   No – go to 6 Yes – **Slope**

6) AU is located in a topographic valley with stream or river in the middle
   No – go to 9 Yes – go to 7

7) Have data showing area flooded more than once every 2 yrs.; or indicators of flooding are present:
   - ❒ Scour marks common
   - ❒ Recent sediment deposition
   - ❒ Vegetation that is damaged or bent in one direction
   - ❒ Soils have alternating deposits
   - ❒ Vegetation along bank edge has flood marks

   No for all indicators – go to 9 Yes for any indicator – go to 8

8) Flood waters retained
   No – **Riverine Flow-through**
   Yes – **Riverine Impounding**
   - ❒ Depression in floodplain
   - ❒ Constricted outlet
   - ❒ Permanent water

9) Has surface water outflow – **Depressional Outflow**
   Has no surface outflow – **Depressional Closed**

Rationale for Choices:

Appendix B: Data Sheets for Depressional Closed Wetlands and Classification Key

Wetland Name: _____ **AU ID#:** _____

Location: _____ **T/S/R:** _____

Data Collector: _____ **Date:** _____

Use this data sheet for:
DEPRESSIONAL CLOSED *wetlands*
in the Lowlands of Western Washington

- *Use in conjunction with the written guidance provided in Parts 1 and 2*
- *Record only numbers, yes/no answers are recorded as a [1] or [0]*

Estimate, Score/ or Rating			
			LANDSCAPE DATA
_____	1/0	**D0**	Do dikes surround the AU, and does it drain through a control structure that can be manipulated?
_____	ha	**D1**	Area of AU
_____	ha	**D2**	Area of contributing basin (upgradient watershed)
		D3	Land use (as % of total area) within 1 km of AU (include contiguous AUs of different class)
_____	%	*D3.1*	Undeveloped forest (if previously clear-cut, cut at least 5 years ago)
_____	%	*D3.2*	Agriculture (tilled fields and pastures; includes golf courses)
_____	%	*D3.3*	Clear-cut logging (<5 years since clearing)
_____	%	*D3.4*	Urban/commercial (any developed areas not identified as residential)
_____	%	*D3.5*	High density residential (>1 residence/acre)
_____	%	*D3.6*	Low density residential (<= 1 residence/acre)
_____	%	*D3.7*	Undeveloped areas, shrubland, other wetlands, and open water
			WATER REGIME
		D4	
		D4.1	
		D4.2	
		D4.3	
		D5	
		D6	
		D7	
		D8	Inundation
_____	%	*D8.1*	Percent of AU that is ponded or inundated for >1 month
_____	%	*D8.2*	Percent of AU with permanent standing or moving water
_____	%	*D8.3*	Percent of AU with permanent open water *(without aquatic bed vegetation)*
_____	%	*D8.4*	Percent of AU with unvegetated bars or mudflats
_____	0/1	*D8.5*	Unvegetated bars or mudflats at least 100 square meters in size
		D9	Inundation regimes
_____	0/1	*D9.1*	Permanently flooded (include vegetated areas)
_____	0/1	*D9.2*	Seasonally flooded (>1 month)
_____	0/1	*D9.3*	Occasionally flooded (<= 1 month)
_____	0/1	*D9.4*	Saturated but seldom inundated
_____	0/1	*D9.5*	Permanently flowing stream
_____	0/1	*D9.6*	Intermittently flowing stream
	m	**D10**	

By definition:
D8.1 >= D8.2 >= D8.3

Chose all that apply that meet size criteria: area >0.1 ha (1/4 acre) or > 10% of AU if AU smaller than 1 ha (2.5 acres)

Wetland Name: **AU ID#:**

D11

0/1 *D11.1*

0/1 *D11.2*

0/1 *D11.3*

D12 Categories of water depths in AU, areas permanently or seasonally inundated/flooded

0/1 *D12.1* 1-20 cm (<8 in)

0/1 *D12.2* 20-100 cm (8-40 in)

0/1 *D12.3* >100 cm (>40 in)

Record a 1 for each category present if >0.1 ha (1/4 acre) or 10% of area

D13

D13.1

D13.2

D13.3

D13.4

VEGETATION

D14 Cowardin Classes (as % area of AU)

- *Include forest only if trees are rooted in AU.*
- ***If forest is a mix of deciduous and evergreen estimate the relative % cover of each and divide percentage between the two categories.***
- ***If vegetation classes are patchy, add the patches together for each class to get a total.***
- *To count, a class must cover at least 0.1 ha or be more than 10% of the total area of the AU*

% *D14.1* Forest - evergreen

% *D14.2* Forest -deciduous

% *D14.3* Scrub-shrub - evergreen

% *D14.4* Scrub-shrub - deciduous

% *D14.5* Emergent

% *D14.6* Aquatic bed

0/1 **D15** Does D8.3 + D8.4 + sum (D14.1 to D14.6) = 100? **If not, give reason.**

% **D16** % area of herbaceous understory **in forest and shrub areas** (not % area in entire AU)

% **D17** % area of AU with >75% closure of canopy *(SS, FO classes > 1 m high)*

D18

D19 Plant Richness

D19.1 Record number of native plant species found in AU

D19.2 Record number of non- native plant species found in AU

D20 The # of plant assemblages in the AU with area >0.1 ha (1/4 acre) or >10% if AU <1 ha *(if more than 12 record a 12)*

[1-6] **D21** Strata: The maximum # of strata present in any plant assemblage

0/1 *D21.1* Is vine stratum dominated by non-native blackberries?

A stratum must have 20% cover in assemblage

0/1 **D22** Mature trees in AU

Average DBH of 3 out of 5 largest trees of a species has to exceed size threshold

Tsuga heterophylla (western hemlock) >45 cm (18")

Thuja plicata (western red cedar) >45 cm (18")

Pseudotsuga menziesii (Douglas fir) >45 cm (18")

Picea sitchensis (Sitka spruce) >45 cm (18")

Populus balsamifera (black cottonwood) >45 cm (18")

Acer macrophyllum (big-leaf maple) >45 cm (18")

Alnus rubra (red alder) >30 cm (12")

Fraxinus latifolia (Oregon ash) >30 cm (12")

Pinus contorta (lodgepole pine) >30 cm (12")

Salix lucida (Pacific willow) >30 cm (12")

Wetland Name:	**AU ID#:**

D23 Sphagnum bogs

0/1 *D23.1* % area of Sphagnum bog >75%

0/1 *D23.2* % area of Sphagnum bog = 50-75%

0/1 *D23.3* % area of Sphagnum bog = 25-49%

0/1 *D23.4* % area of Sphagnum bog = 1-24%

0/1 *D23.5* % area of Sphagnum bog = 0%

D24 Dominance by non-native plant species

0/1 *D24.1* % area of non-native species >75%

0/1 *D24.2* % area of non-native species = 50-75%

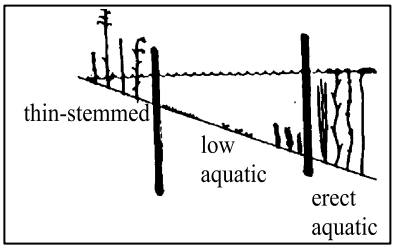
0/1 *D24.3* %area of non-native species = 25-49%

0/1 *D24.4* % area of non-native species = 1-24%

0/1 *D24.5* % area of non-natives = 0%

HABITAT CHARACTERISTICS

[0-3] **D25** Number of structure categories in aquatic bed vegetation
Applies only to aquatic bed species
DO NOT count persistent emergents



D26 pH

[4-9] *D26.1* pH of interstitial water *(measure immediately after digging hole in non-inundated areas)*

[4-9] *D26.2* pH of open or standing water (*record the lowest pH, if you cannot measure record a [7])*

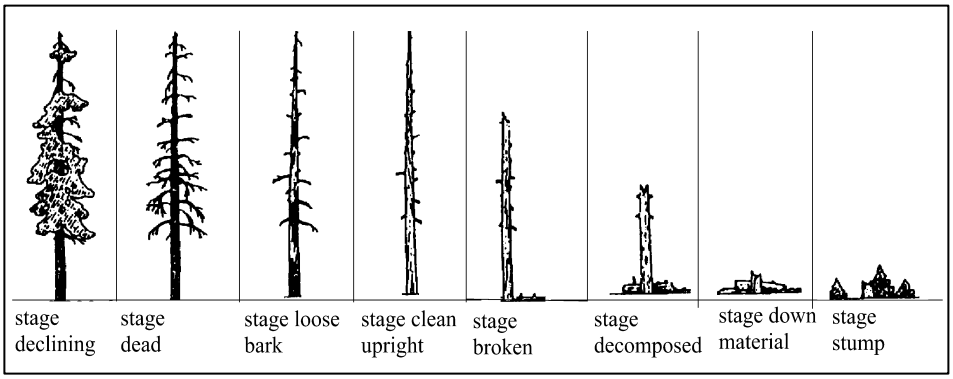
0/1 **D27** Estuary: AU is within 8 km (5 mi) of a brackish or salt water estuary

0/1 **D28** Large lake: AU is within 1.6km (1 mi) of a lake >8 ha (20 acres)

0/1 **D29** Open field: AU is within 5 km (3 mi) of an open field (agriculture or pasture) >16 ha (40 acres)

0/1 **D30** Preferred woody vegetation: AU has >1 ha (2.5 acres) of preferred woody vegetation for beaver in and within 100 m of AU

[0-8] **D31** Snags (record # of stages)
Circle the categories present; minimum DBH of snag =10 cm (4")



0/1 *D31.1* At least one of the snags above has a DBH greater than 30 cm (12").

Wetland Name:	**AU ID#:**

0/1 **D32** Overhanging vegetation, extending out for 1m, for at least 10 m (33 ft) over stream or open water.

0/1 **D33** Upland islands of at least 10 square meters (100 square ft.) within AU boundary

Islands need to be surrounded by at least 30 m (100 ft) of open water deeper than 1 m (3 ft)

D34

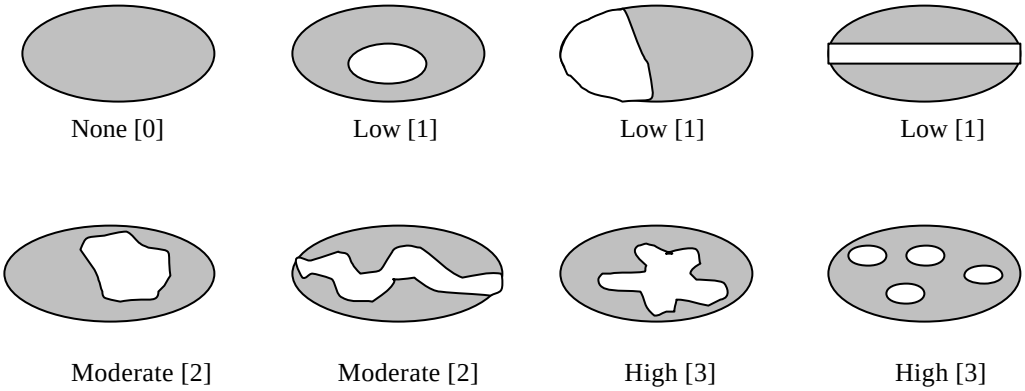
[0-4] **D35** Key for rating egg-laying structures for amphibians

1. Does the AU have thin-stemmed vegetation or thin branches **(<8 mm)** in at least 1/4 acre (or 10% of AU) of permanent or seasonally inundated areas? *Thin-stemmed vegetation can include herbaceous species such as water parsley.*
   NO – Score = 0 YES go to 2
2. Does the AU have at least 0.2 ha (1/2 acre) of thin-stemmed emergent vegetation or woody branches, **1-4 mm** in diameter?
   NO go to 5 YES go to 3
3. Does the area with thin stems contain open water interspersed in a patchwork of a ratio that is approximately 1:1 [no more than a 40- 60% of the total area is open water)?
   NO go to 4 **YES - Score = 4**
4. Is the area of open water between 25% and 75% of the total area in the zone of thin stemmed vegetation?
   NO – Score = 2 **YES – Score = 3** STOP
5. Does the AU have >0.1 ha (1/4 acre) of thin-stemmed emergent vegetation or woody branches, **1-4 mm**?
   NO – Score = 1 YES go to 6
6. Does the area with thin stems contain open water interspersed in a patchwork of a ratio that is approximately 1:1 [no more than a 40- 60% of the total area is open water)?
   NO go to 7 **YES – Score = 3**
7. Is the area of open water between 25% and 75% of the total area in the zone of thin stemmed vegetation?
   NO – Score = 1 **YES – Score = 2**

0/1 **D36** Tannins in surface waters >10% of water surface

0/1 **D37** Steep banks for denning (>30 degree slope, fine material, >10 m long, >0.6 m high) *(may be a dike)*

[0-3] **D38** Interspersion between erect vegetation and permanent open water (POW + AB) areas of AU



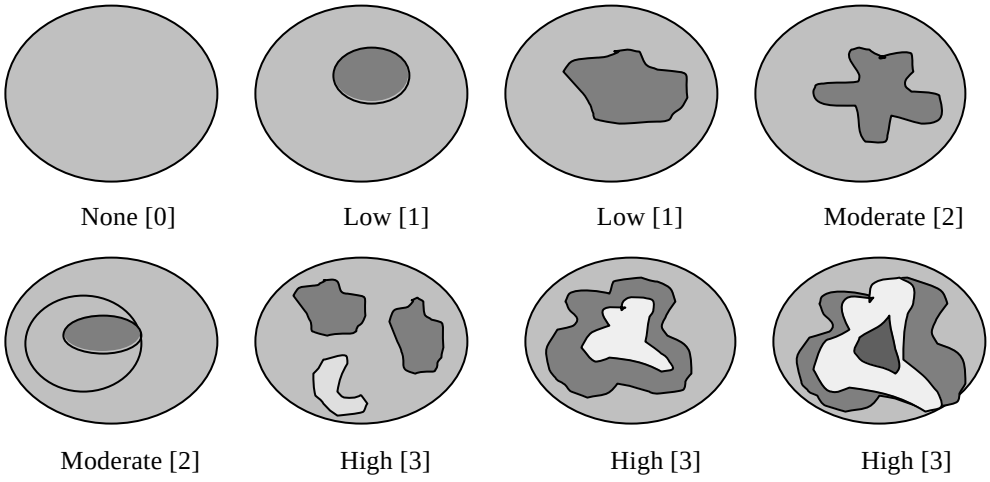
None [0] Low [1] Low [1] Low [1]

Moderate [2] Moderate [2] High [3] High [3]

Wetland Name:	**AU ID#:**

[0-3] **D39** Interspersion between Cowardin vegetation classes

**AUs with only 2 classes can only score a moderate [2] or lower*
**AUs with 4 vegetation classes score a high [3]*
**AUs with 3 classes can score a moderate (2) or a high (3)*



None [0] Low [1] Low [1] Moderate [2]

Moderate [2] High [3] High [3] High [3]

D40

[0-3] **D41** Edge of AU: The characteristics of the edge between AU and uplands or adjacent wetlands.

Choose the description that best fits the characteristics of the AU edge:

0 There are **no differences in level** of vegetation height as reflected by vegetation classes on each side of the AU for more than 50% of the circumference: record a [0] **regardless of the sinuosity**. Examples: emergent (or herbaceous) to emergent (or herbaceous), shrub to shrub, forest to forest.

1 There is a **difference of one level** in vegetation height as reflected by vegetation classes on each side of the AU and the **edge is straight** for more than 50% of the circumference: record a [1]. Example: emergent (or herbaceous) to shrub, shrub to forest

2 There is a **difference of one level** in vegetation height as reflected by vegetation classes on each side of the AU and the **edge is sinuous** for more than 50% of the circumference: record a [2]. Examples: emergent (or herbaceous) to shrub, shrub to forest.

2 There is a **difference of more than one level** of vegetation height as reflected by vegetation classes on each side of the AU and the **edge is straight: record a [2]**. Examples: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

3 There is a **difference of more than one level** of vegetation height as reflected by vegetation classes on each side of the AU and the **edge is sinuous: record a [3]**. Example: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

2 If **no single category** above extends for more than 50% of the circumference, and the **edge is straight: record a [2]**

3 If **no single category** above extends for more than 50% of the circumference, and the **edge is sinuous: record a [3]**

Wetland Name:	**AU ID#:**

[0-5] **D42** Buffer of AU: Choose the description that best represents condition of AU buffer

> ** Open water or adjacent wetlands are considered part of the buffer*
> ** Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance"*

5 100 m (330 ft) of forest, scrub, relatively undisturbed grassland or open water >95% of circumference. Clear-cut >5 years old is OK. No developed areas within undisturbed part of buffer.

4 100 m (330 ft) of forest, scrub, relatively undisturbed grassland or open water >50% circumference OR 50 m (170 ft) of forest scrub, grassland or open water >95% circumference. No developed areas within undisturbed part of buffer.

3 100 m (330 ft) of forest, scrub, grassland or open water >25% circumference, OR 50 m (170 ft) of forest, scrub, grassland or open water >50% circumference.

2 No paved areas or buildings within 25m (80 ft) of wetland >95% circumference. Pasture or lawns are OK. OR no paved areas or buildings within 50m of wetland >50% circumference

0 Vegetated buffers are <2 m wide (6.6 ft) for more than 95% of the circumference

1 Does not meet any of the criteria above

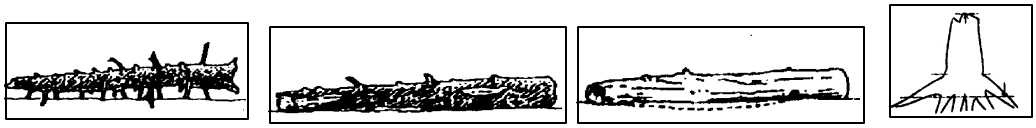
[0-3] **D43** Corridors of AU: Rate corridors using following key *(record rating of 0, 1, 2, or 3)*

1. Is the AU part of a riparian corridor *(see text for definitions)*
   NO go to 5 **YES go to 2**
2. Is the wetland part of riparian corridor >50 m wide connecting 2 or more wetlands within 1 km with at least 30% shrub or forest cover in the corridor?
   NO go to 3 **YES = [3]**
3. Is the AU part of a riparian corridor 25-50 m wide connecting to other wetlands with at least 30% shrub or forest cover in the corridor?
   NO go to 4 **YES = [2]**
4. Is the AU part of a riparian corridor >5 m wide with relatively undisturbed veg. (grasslands, abandoned pasture are OK) that extends for more than 1 km?
   NO go to 5 **YES = [1]**
5. Is there a corridor >50 m wide with good (>30%) cover of forest or shrub (>2 m high) to natural upland area or open water that is >100 ha in size?
   NO go to 6 **YES = [3]**
6. Is there a 10-50 m wide forest or shrub corridor to a relatively undisturbed upland or open water that is >10 ha?
   NO go to 7 **YES = [2]**
7. Is there a corridor of relatively undisturbed vegetation (grassland, abandoned pasture) >50 m wide to an undisturbed upland or open water that is >10 ha?
   NO go to 8 **YES = [2]**
8. Is there any vegetated corridor 5-50 m wide between the AU and any relatively undisturbed area or open water that is >2.5 ha?
   NO = [0] **YES = [1]**

Wetland Name:	**AU ID#:**

[0-12] **D44** # of categories of large woody debris in AU **outside of perm. water**

Freshly cut stumps are not included



Diameter		**Log Class 1**	**Log Class 2**	**Log Class 3**	**Stump**
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

[0-12] **D45** # of categories of large woody debris **in permanent water** of AU (may include aquatic bed areas)

Diameter		**Log Class 1**	**Log Class 2**	**Log Class 3**	**Stump**
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

SOILS and SUBSTRATES

D46 Composition of AU surface

0/1 *D46.1* Deciduous, broad-leaved, leaf litter

0/1 *D46.2* Other plant litter

0/1 *D46.3* Decomposed organic

0/1 *D46.4* Exposed cobbles

0/1 *D46.5* Exposed gravel

0/1 *D46.6* Exposed sand

0/1 *D46.7* Exposed silt

0/1 *D46.8* Exposed clay

Record a 1 for each category present if its area is > 10 square meters. Note: bare earth from animal tunnels does NOT count.

D47 Soils present in top (15 cm) of A horizon (record [1] if 1-49% area of AU, [2] if 50-95%, [3] if >95%)

[0-3] *D47.1* Peat

[0-3] *D47.2* Organic Muck

[0-3] *D47.3* Mineral with clay fraction <30%

[0-3] *D47.4* Clay (clay fraction >30%)

Record the least permeable layer if there are several down to 60 cm.

Wetland Name:	**AU ID#:**

		D48	Infiltration rate of top 60 cm of soil in seasonally inundated areas
	0/1	*D48.1*	Fast >50% gravel and cobble and the rest a sand, loamy sand, or sandy loam
	0/1	*D48.2*	Moderate >50% sand and rest cobble, gravel, loamy sand, or sandy loam
	0/1	*D48.3*	Slow - muck, peat, or loams (except sandy loam), silts, and clays
		D49	
		D49.1	
		D49.2	
		D49.3	

Judgements of Opportunity (Ratings of High, Medium, Low)

Rating	*Functions*
	Removing Sediments
	Removing Nutrients
	Removing Toxic Metals and Organics
	Reducing Peak Flows
	Reducing Downstream Erosion
	Recharging Groundwater
	General Habitat
	Anadromous Fish Habitat

Western Washington Wetland Classification Key

Wetland Name: _____

AU ID #: _____ **Date:** _____

1) Water levels in AU usually controlled by tides
   No – go to 2 Yes – **Tidal Fringe**

2) Topography is flat and precipitation is only source (>90%) of water to the AU
   No – go to 3 Yes – **Flat**

3) AU is contiguous with >8 ha open water, and water is deeper than 2 m over 30% of open water area
   No – go to 4 Yes – **Lacustrine Fringe**

4) Open water is <8 ha and >2 m deep, but AU is a fringe narrower than ½ the radius of open water
   No – go to 5 Yes – **Lacustrine Fringe**

5) Water flow in AU is unidirectional on a slope, water is not impounded in the AU
   No – go to 6 Yes – **Slope**

6) AU is located in a topographic valley with stream or river in the middle
   No – go to 9 Yes – go to 7

7) Have data showing area flooded more than once every 2 yrs.; or indicators of flooding are present:
   - ❒ Scour marks common
   - ❒ Recent sediment deposition
   - ❒ Vegetation that is damaged or bent in one direction
   - ❒ Soils have alternating deposits
   - ❒ Vegetation along bank edge has flood marks

   No for all indicators – go to 9 Yes for any indicator – go to 8

8) Flood waters retained
   No – **Riverine Flow-through**
   Yes – **Riverine Impounding**
   - ❒ Depression in floodplain
   - ❒ Constricted outlet
   - ❒ Permanent water

9) Has surface water outflow – **Depressional Outflow**
   Has no surface outflow – **Depressional Closed**

Rationale for Choices:

Appendix C: Data Sheets for Riverine Flow-through Wetlands and Classification Key

Wetland Name: _____ **AU ID#:** _____

Location: _____ **T/S/R:** _____

Data Collector: _____ **Date:** _____

Use this data sheet for:
RIVERINE FLOW-THROUGH *wetlands*
in the Lowlands of Western Washington

- *Use in conjunction with the written guidance provided in Parts 1 and 2*
- *Record only numbers, yes/no answers are recorded as a [1] or [0]*

Estimate, Score/ or Rating			
			LANDSCAPE DATA
_____	1/0	**D0**	
_____	ha	**D1**	Area of AU
_____	ha	**D2**	Area of contributing basin (upgradient watershed)
		D3	Land use (as % of total area) within 1 km of AU (include contiguous AUs of different class)
_____	%	*D3.1*	Undeveloped forest (if previously clear-cut, cut at least 5 years ago)
_____	%	*D3.2*	Agriculture (tilled fields and pastures; includes golf courses)
_____	%	*D3.3*	Clear-cut logging (<5 years since clearing)
_____	%	*D3.4*	Urban/commercial (any developed areas not identified as residential)
_____	%	*D3.5*	High density residential (>1 residence/acre)
_____	%	*D3.6*	Low density residential (<= 1 residence/acre)
_____	%	*D3.7*	Undeveloped areas, shrubland, other wetlands, and open water
			WATER REGIME
_____	0/1	**D4**	Channels, ditches, or streams in AU
_____	0/1	*D4.1*	Channels, ditches, or streams in AU have permanently flowing water *(you see water flowing)*
_____	0/1	*D4.2*	Channel or stream is contained by dikes
		D4.3	
_____		**D5**	Average width of stream in, or adjacent to, AU (bank to bank)
_____		**D6**	Average width of AU perpendicular to stream or river
_____		**D7**	Ratio of length of channel to length of AU
		D8	Inundation
	%	*D8.1*	
_____	%	*D8.2*	Percent of AU with permanent standing or moving water (has to be stream within AU)
_____	%	*D8.3*	Percent of AU with permanent open water in stream *(without aquatic bed vegetation)*
_____	%	*D8.4*	Percent of AU with unvegetated bars or mudflats
_____	0/1	*D8.5*	Unvegetated bars or mudflats at least 100 square meters in size
		D9	Inundation regimes
		D9.1	
		D9.2	
_____	0/1	*D9.3*	Occasionally flooded (<= 1 month)
_____	0/1	*D9.4*	Saturated but seldom inundated
_____	0/1	*D9.5*	Permanently flowing stream
_____	0/1	*D9.6*	Intermittently flowing stream
		D10	

Use channel with greatest volume or largest cross section

Chose all that apply that meet size criteria: area >0.1 ha (1/4 acre) or > 10% of AU if AU smaller than 1 ha (2.5 acres)

Wetland Name:	**AU ID#:**

D11

D11.1

D11.2

D11.3

D12 Categories of water depths in stream of AU (record only if D4 = 1)

Record a 1 for each category present if >0.1 ha (1/4 acre) or 10% of area

_____	0/1	*D12.1*	1-20 cm (<8 in)
_____	0/1	*D12.2*	20-100 cm (8-40 in)
_____	0/1	*D12.3*	>100 cm (>40 in)

D13 Constriction of outlet

D13.1

D13.2

D13.3

D13.4

VEGETATION

- *Include forest only if trees are rooted in AU.*
- ***If forest is a mix of deciduous and evergreen estimate the relative % cover of each and divide percentage between the two categories.***
- ***If vegetation classes are patchy, add the patches together for each class to get a total.***
- *To count, a class must cover at least 0.1 ha or be more than 10% of the total area of the AU*

D14 Cowardin Classes (as % area of AU)

_____	%	*D14.1*	Forest - evergreen
_____	%	*D14.2*	Forest -deciduous
_____	%	*D14.3*	Scrub-shrub - evergreen
_____	%	*D14.4*	Scrub-shrub - deciduous
_____	%	*D14.5*	Emergent
_____	%	*D14.6*	Aquatic bed
_____	0/1	**D15**	Does D8.3 + D8.4 + sum (D14.1 to D14.6) = 100? **If not, give reason.**
_____	%	**D16**	% area of herbaceous understory **in forest and shrub areas** (not % area in entire AU)
_____	%	**D17**	% area of AU with >75% closure of canopy *(SS, FO classes > 1 m high)*
_____		**D18**	% length of stream with a 75% canopy closure
		D19	Plant Richness
_____	#	*D19.1*	Record number of native plant species found in AU
_____	#	*D19.2*	Record number of non- native plant species found in AU
_____	#	**D20**	The # of plant assemblages in the AU with area >0.1 ha (1/4 acre) or >10% if AU <1 ha *(if more than 12 record a 12)*
_____	[1-6]	**D21**	Strata: The maximum # of strata present in any plant assemblage
_____	0/1	*D21.1*	Is vine stratum dominated by non-native blackberries?

A stratum must have 20% cover in assemblage

Wetland Name:	**AU ID#:**

0/1 **D22** Mature trees in AU

Average DBH of 3 out of 5 largest trees of a species has to exceed size

Tsuga heterophylla (western hemlock) >45 cm (18")
Thuja plicata (western red cedar) >45 cm (18")
Pseudotsuga menziesii (Douglas fir) >45 cm (18")
Picea sitchensis (Sitka spruce) >45 cm (18")
Populus balsamifera (black cottonwood) >45 cm (18")
Acer macrophyllum (big-leaf maple) >45 cm (18")
Alnus rubra (red alder) >30 cm (12")
Fraxinus latifolia (Oregon ash) >30 cm (12")
Pinus contorta (lodgepole pine) >30 cm (12")
Salix lucida (Pacific willow) >30 cm (12")

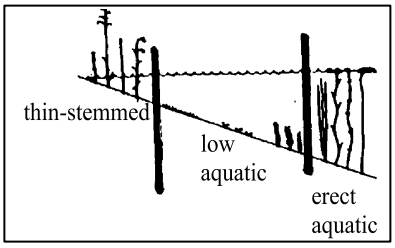
D23
D23.1
D23.2
D23.3
D23.4
D23.5

D24 Dominance by non-native plant species

0/1 *D24.1* % area of non-native species >75%
0/1 *D24.2* % area of non-native species = 50-75%
0/1 *D24.3* %area of non-native species = 25-49%
0/1 *D24.4* % area of non-native species = 1-24%
0/1 *D24.5* % area of non-natives = 0%

HABITAT CHARACTERISTICS

[0-3] **D25** Number of structure categories in aquatic bed vegetation
Applies only to aquatic bed species
DO NOT count persistent emergents



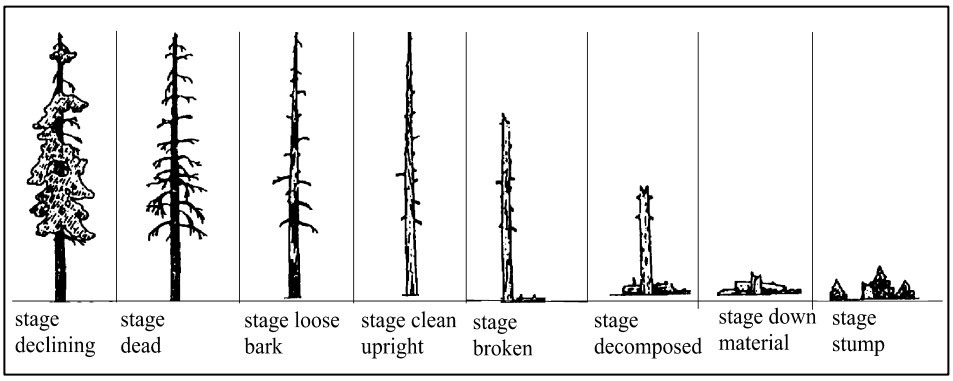
D26 pH

[4-9] *D26.1* pH of interstitial water *(measure immediately after digging hole in non-inundated areas)*
[4-9] *D26.2* pH of open or standing water (*record the lowest pH, if you cannot measure record a [7])*
0/1 **D27** Estuary: AU is within 8 km (5 mi) of a brackish or salt water estuary
0/1 **D28** Large lake: AU is within 1.6km (1 mi) of a lake >8 ha (20 acres)
0/1 **D29** Open field: AU is within 5 km (3 mi) of an open field (agriculture or pasture) >16 ha (40 acres)
0/1 **D30** Preferred woody vegetation: AU has >1 ha (2.5 acres) of preferred woody vegetation for beaver in and within 100 m of AU

Wetland Name:	**AU ID#:**

[0-8] **D31** Snags (record # of stages)

Circle the categories present; minimum DBH of snag =10 cm (4")



0/1 *D31.1* At least one of the snags above has a DBH greater than 30 cm (12").

0/1 **D32** Overhanging vegetation, extending out for 1m, for at least 10 m (33 ft) over stream or open water.

0/1 **D33** Upland islands of at least 10 square meters (100 square ft.) within AU boundary

Islands need to be surrounded by at least 30 m (100 ft) of open water deeper than 1 m (3 ft)

0/1 **D34** Undercut banks present for at least 2 m (6.6 ft.)

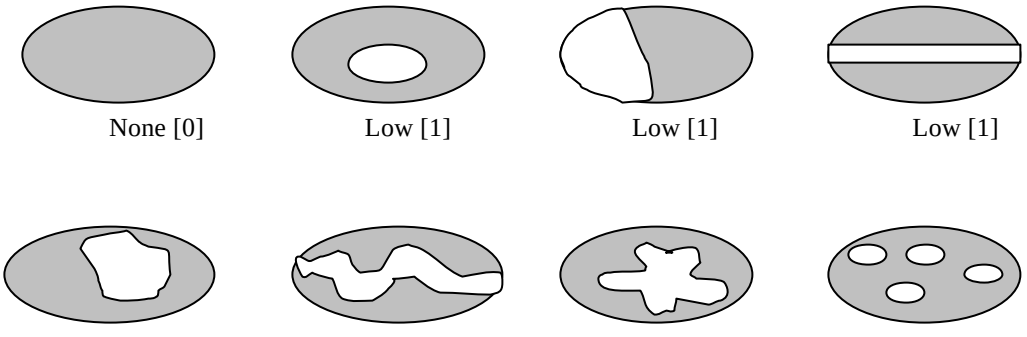
D35

Wetland Name:	**AU ID#:**

0/1 **D36** Tannins in surface waters >10% of water surface

0/1 **D37** Steep banks for denning (>30 degree slope, fine material, >10 m long, >0.6 m high) *(may be a dike)*

[0-3] **D38** Interspersion between erect vegetation and permanent open water (POW + AB) areas of AU

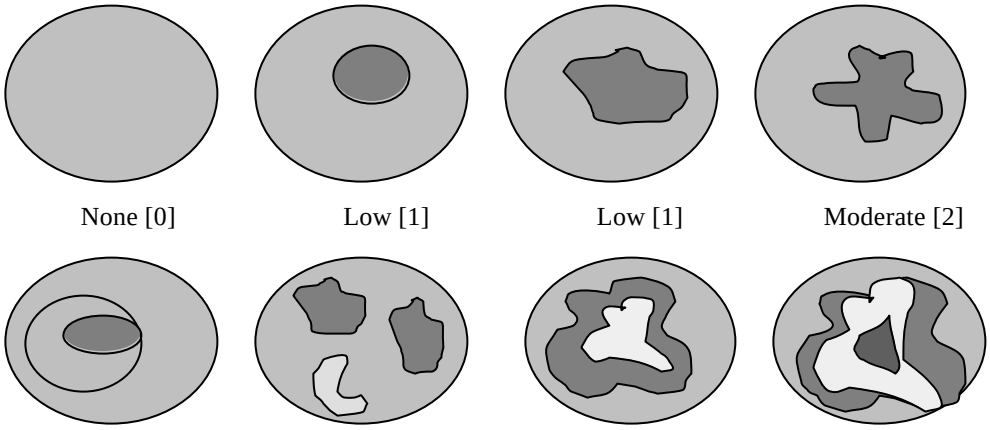


None [0] Low [1] Low [1] Low [1]

Moderate [2] Moderate [2] High [3] High [3]

[0-3] **D39** Interspersion between Cowardin vegetation classes

**AUs with only 2 classes can only score a moderate[2] or lower*
**AUs with 4 vegetation classes score a high [3]*
**AUs with 3 classes can score a moderate (2) or a high (3)*



None [0] Low [1] Low [1] Moderate [2]

Moderate [2] High [3] High [3] High [3]

Wetland Name:	**AU ID#:**

0/1 **D40** Structures in AU that create flow eddies (bars, large logs, large rocks)

[0-3] **D41** Edge of AU: The characteristics of the edge between AU and uplands or adjacent wetlands.

Choose the description that best fits the characteristics of the AU edge:

0 There are **no differences in level** of vegetation height as reflected by vegetation classes on each side of the AU for more than 50% of the circumference: record a [0] **regardless of the sinuosity**. Examples: emergent (or herbaceous) to emergent (or herbaceous), shrub to shrub, forest to forest.

1 There is a **difference of one level** in vegetation height as reflected by vegetation classes on each side of the AU and the **edge is straight** for more than 50% of the circumference: record a [1]. Example: emergent (or herbaceous) to shrub, shrub to forest

2 There is a **difference of one level** in vegetation height as reflected by vegetation classes on each side of the AU and the **edge is sinuous** for more than 50% of the circumference: record a [2]. Examples: emergent (or herbaceous) to shrub, shrub to forest.

2 There is a **difference of more than one level** of vegetation height as reflected by vegetation classes on each side of the AU and the **edge is straight: record a [2]**. Examples: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

3 There is a **difference of more than one level** of vegetation height as reflected by vegetation classes on each side of the AU and the **edge is sinuous: record a [3]**. Example: emergent (or herbaceous) to forest, bryophytes to scrub/shrub or forest.

2 If **no single category** above extends for more than 50% of the circumference, and the **edge is straight: record a [2]**

3 If **no single category** above extends for more than 50% of the circumference, and the **edge is sinuous: record a [3]**

[0-5] **D42** Buffer of AU: Choose the description that best represents condition of AU buffer

> ** Open water or adjacent wetlands are considered part of the buffer*
> ** Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance"*

5 100 m (330 ft) of forest, scrub, relatively undisturbed grassland or open water >95% of circumference. Clear-cut >5 years old is OK. No developed areas within undisturbed part of buffer.

4 100 m (330 ft) of forest, scrub, relatively undisturbed grassland or open water >50% circumference OR 50 m (170 ft) of forest scrub, grassland or open water >95% circumference. No developed areas within undisturbed part of buffer.

3 100 m (330 ft) of forest, scrub, grassland or open water >25% circumference, OR 50 m (170 ft) of forest, scrub, grassland or open water >50% circumference.

2 No paved areas or buildings within 25m (80 ft) of wetland >95% circumference. Pasture or lawns are OK. OR no paved areas or buildings within 50m of wetland >50% circumference

0 Vegetated buffers are <2 m wide (6.6 ft) for more than 95% of the circumference

1 Does not meet any of the criteria above

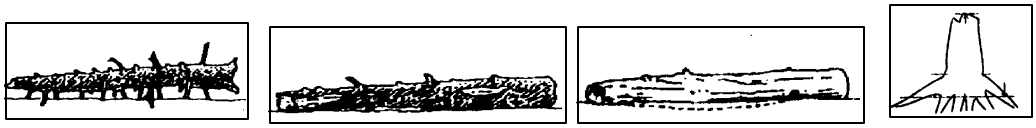
Wetland Name:	**AU ID#:**

[0-3] **D43** Corridors of AU: Rate corridors using following key *(record rating of 0, 1, 2, or 3)*

1. Is the AU part of a riparian corridor *(see text for definitions)*
   NO go to 5 **YES go to 2**
2. Is the wetland part of riparian corridor >50 m wide connecting 2 or more wetlands within 1 km with at least 30% shrub or forest cover in the corridor?
   NO go to 3 **YES = [3]**
3. Is the AU part of a riparian corridor 25-50 m wide connecting to other wetlands with at least 30% shrub or forest cover in the corridor?
   NO go to 4 **YES = [2]**
4. Is the AU part of a riparian corridor >5 m wide with relatively undisturbed veg. (grasslands, abandoned pasture are OK) that extends for more than 1 km?
   NO go to 5 **YES = [1]**
5. Is there a corridor >50 m wide with good (> 30%) cover of forest or shrub (> 2 m high) to natural upland area or open water that is > 100 ha in size?
   NO go to 6 **YES = [3]**
6. Is there a 10-50 m wide forest or shrub corridor to a relatively undisturbed upland or open water that is >10 ha?
   NO go to 7 **YES = [2]**
7. Is there a corridor of relatively undisturbed vegetation (grassland, abandoned pasture) >50 m wide to an undisturbed upland or open water that is >10 ha?
   NO go to 8 **YES = [2]**
8. Is there any vegetated corridor 5-50 m wide between the AU and any relatively undisturbed area or open water that is >2.5 ha?
   NO = [0] **YES = [1]**

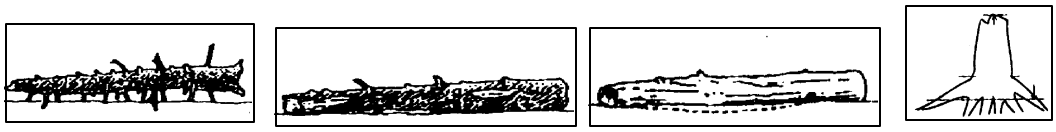
[0-12] **D44** # of categories of large woody debris in AU **outside of perm. water**

Freshly cut stumps are not included



Diameter		**Log Class 1**	**Log Class 2**	**Log Class 3**	**Stump**
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

[0-12] **D45** # of categories of large woody debris **in permanent water** of AU (may include aquatic bed areas)



Diameter		**Log Class 1**	**Log Class 2**	**Log Class 3**	**Stump**
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

Wetland Name:	**AU ID#:**

SOILS and SUBSTRATES

D46 Composition of AU surface

0/1	*D46.1*	Deciduous, broad-leaved, leaf litter
0/1	*D46.2*	Other plant litter
0/1	*D46.3*	Decomposed organic
0/1	*D46.4*	Exposed cobbles
0/1	*D46.5*	Exposed gravel
0/1	*D46.6*	Exposed sand
0/1	*D46.7*	Exposed silt
0/1	*D46.8*	Exposed clay

Record a 1 for each category present if its area is > 10 square meters. Note: bare earth from animal tunnels does NOT count.

D47 Soils present in top (15 cm) of A horizon (record [1] if 1-49% area of AU, [2] if 50-95%, [3] if >95%)

[0-3]	*D47.1*	Peat
[0-3]	*D47.2*	Organic Muck
[0-3]	*D47.3*	Mineral with clay fraction <30%
[0-3]	*D47.4*	Clay (clay fraction >30%)

Record the least permeable layer if there are several down to 60 cm.

D48 Infiltration rate of top 60 cm of soil in seasonally inundated areas

0/1	*D48.1*	Fast >50% gravel and cobble and the rest a sand, loamy sand, or sandy loam
0/1	*D48.2*	Moderate >50% sand and rest cobble, gravel, loamy sand, or sandy loam
0/1	*D48.3*	Slow - muck, peat, or loams (except sandy loam), silts, and clays

D49 Substrate of streams

0/1	*D49.1*	Substrate **of permanent stream** or river in AU has at least 1 square meter of gravel
0/1	*D49.2*	Substrate **of permanent stream** or river in AU has at least 1 square meter of cobbles
0/1	*D49.3*	Microdepressions in stream channel

Judgements of Opportunity (Ratings of High, Medium, Low)

Rating	*Functions*
	Removing Sediments
	Removing Nutrients
	Removing Toxic Metals and Organics
	Reducing Peak Flows
	Reducing Downstream Erosion
	Recharging Groundwater
	General Habitat
	Anadromous Fish Habitat

Western Washington Wetland Classification Key

Wetland Name: _____

AU ID #: _____ **Date:** _____

1) Water levels in AU usually controlled by tides
   No – go to 2 Yes – **Tidal Fringe**

2) Topography is flat and precipitation is only source (>90%) of water to the AU
   No – go to 3 Yes – **Flat**

3) AU is contiguous with >8 ha open water, and water is deeper than 2 m over 30% of open water area
   No – go to 4 Yes – **Lacustrine Fringe**

4) Open water is <8 ha and >2 m deep, but AU is a fringe narrower than ½ the radius of open water
   No – go to 5 Yes – **Lacustrine Fringe**

5) Water flow in AU is unidirectional on a slope, water is not impounded in the AU
   No – go to 6 Yes – **Slope**

6) AU is located in a topographic valley with stream or river in the middle
   No – go to 9 Yes – go to 7

7) Have data showing area flooded more than once every 2 yrs.; or indicators of flooding are present:
   - ❒ Scour marks common
   - ❒ Recent sediment deposition
   - ❒ Vegetation that is damaged or bent in one direction
   - ❒ Soils have alternating deposits
   - ❒ Vegetation along bank edge has flood marks

   No for all indicators – go to 9 Yes for any indicator – go to 8

8) Flood waters retained
   No – **Riverine Flow-through**
   Yes – **Riverine Impounding**
   - ❒ Depression in floodplain
   - ❒ Constricted outlet
   - ❒ Permanent water

9) Has surface water outflow – **Depressional Outflow**
   Has no surface outflow – **Depressional Closed**

Rationale for Choices:

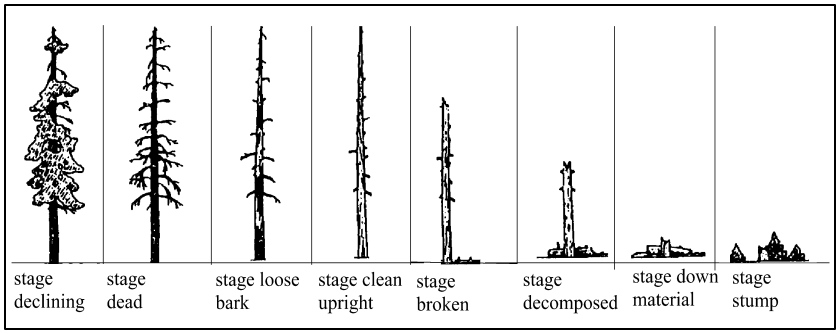
Appendix D: Single-Page Sheet for Snags, Large Woody Debris, and Aquatic Bed Vegetation

Single-Page Sheet for Snags, Large Woody Debris, and Aquatic Bed Vegetation

Wetland Name: _____

AU ID #: _____ **Date:** _____

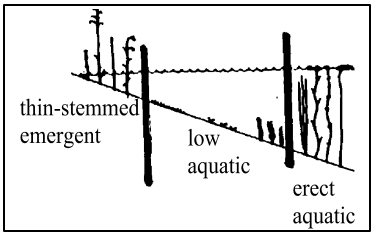
_____ [0-8] D31 Snags (record number of snags present)
Circle the categories present; min DBH of snag = 10 cm (4")



_____ [1-1] D44 Number of categories of large woody debris in AU **outside of perm. water**
Freshly cut stumps are not included

Diameter		Log Class 1	Log Class 2	Log Class 3	Stump
10-20cm	(4-8")				
21-50cm	(8-20")				
>50 cm	(>20")				

_____ [1-3] D25 Number of plant structure categories present in aquatic bed vegetation



Appendix E: Summary Table of Indices of Potential Performance and Descriptions of Potential Opportunity

Summary of Function Assessments

Wetland Name: _____ **AU ID#:** _____
Date: _____ **T/S/R:** _____
Investigator Name: _____ **Size of AU** _____

Wetland Classification:

Depressional Outflow ❒ Riverine Flow-through ❒ Riverine Impounding ❒

Function	Index	Description of Opportunity and Qualitative Rating (High, Moderate, Low)
Water Quality Functions		
Potential for Removing Sediment		
Potential for Removing Nutrients		
Potential for Removing Metals & Toxic Organics		
Water Quantity Functions		
Potential for Reducing Peak Flows		
Potential for Decreasing Downstream Erosion		
Potential for Recharging Groundwater		

Habitat Suitability (HS) Functions		
General Habitat HS(Fauna Only)		
HS for Invertebrates		
HS for Amphibians		
HS for Anadromous Fish		
HS for Resident Fish		
HS for Wetland-associated Birds		
HS for Wetland-associated Mammals		
Native Plant Richness		
Potential for Primary Production and Organic Export		

Rationale for dividing wetland into multiple assessment units:

Description of areas that were not directly observed and explanation as to why:

Information of special note in the AU (such as endangered/threatened species, local significance, etc.):

General comments:

Summary of Function Assessments

Wetland Name: _____ **AU ID#:** _____
Date: _____ **T/S/R:** _____
Investigator Name: _____ **Size of AU** _____

Wetland Classification:
Depressional Closed

Function	Index	Description of Opportunity and Qualitative Rating (High, Moderate, Low)
Water Quality Functions		
Potential for Removing Sediment	[10]	
Potential for Removing Nutrients		
Potential for Removing Metals & Toxic Organics		
Water Quantity Functions		
Potential for Reducing Peak Flows	[10]	
Potential for Decreasing Downstream Erosion	[10]	
Potential for Recharging Groundwater		

Habitat Suitability (HS) Functions		
General Habitat HS(Fauna Only)		
HS for Invertebrates		
HS for Amphibians		
HS for Wetland-associated Birds		
HS for Wetland-associated Mammals		
Native Plant Richness		
Potential for Primary Production and Organic Export		

Rationale for dividing wetland into multiple assessment units:

Description of areas that were not directly observed and explanation as to why:

Information of special note in the AU (such as endangered/threatened species, local significance, etc.):

General comments:

Appendix F: Conversions - Metric to Standard

Conversions: Metric to Standard

Length		
U.S. Customary Units	U.S. Equivalents	Metric Equivalents
Inch	0.083 foot	2.540 centimeters
Foot	1/3 yard, 12 in.	0.305 meter
Yard	3 feet, 36 in.	0.914 meter
Mile	1,760 yards, 5,280 feet	1.609 kilometers

Area		
U.S Customary Units	U.S. Equivalents	Metric Equivalents
Square inch	0.007 square foot	5.452 square centimeters
Square foot	144 square in.	929.030 square centimeters
Square yard	1,296 square in., 9 square feet	0.836 square meters
Acre	43,560 square feet, 4,840 sq. yards	4,047 square meters
Square mile	640 acres	2.590 square kilometers

Metric	
Unit	Approximate U.S. Equivalent
Hectare (10,000 m^2)	2.477 acres

Metric Conversions (Length)		
When You Know:	Multiply By:	To Find:
Millimeters	0.04	Inches
Centimeters	0.39	Inches
Meters	3.28	Feet
Kilometers	0.62	Miles
Inches	25.40	Millimeters
Inches	2.54	Centimeters
Feet	30.48	Centimeters
Miles	1.61	Kilometers

Metric Conversions (Area)		
When You Know:	Multiply By:	To Find:
Square centimeters	0.16	Square inches
Square meters	1.20	Square yards
Square kilometers	0.39	Square miles
Hectares (10,000 m^2)	2.47	Acres
Square inches	6.45	Square centimeters
Square feet	0.09	Square meters
Square yards	0.84	Square meters
Square miles	2.60	Square kilometers
Acres	0.40	Hectares

Appendix G: Profiles of Wetland Classes and Subclasses in the Lowlands of Western Washington

Profiles of Wetland Classes and Subclasses in the Lowlands of Western Washington

Class: Riverine

Riverine wetlands occur in floodplains and riparian corridors in association with stream or river channels. They lie in the active floodplain of a river, and have important hydrologic links to the water dynamics of the river or stream. The distinguishing characteristic of riverine wetlands in Washington is that they are frequently flooded by overbank flow from the stream or river. The flooding waters are a major environmental factor that structure the ecosystem in these wetlands. Wetlands that lie in floodplains but are not frequently flooded are not classified as riverine.

Surface and shallow subsurface water movement in most riverine wetlands is from the valley sides toward the stream channel, from the stream channel toward the adjacent floodplain and downstream during overbank events. Additional water sources may be groundwater discharge, overland flow from adjacent uplands and tributaries, and precipitation.

Water leaves riverine wetlands by surface flow returning to the river or stream channel after flooding or a rain event. The wetlands also may lose subsurface water by subsurface discharge to the channel called interflow (movement of water to shallow groundwater through infiltration), and evapotranspiration.

Many riverine wetlands are associated with rivers that are very dynamic. Their proximity to the river facilitates the rapid transfer of floodwaters in and out of the wetland, and the import and export of sediments. These wetlands are subject to frequent flood disturbances that may reset the "successional clock". The dominant vegetation in these wetlands may be representative of any of the seral stages possible; from early successional, emergent species, to late successional forest species.

Riverine wetlands are often replaced by depressional or slope wetlands near the headwaters of streams and rivers, where the channel (bed) and bank disappear, and overbank flooding grades into surface or groundwater inundation. In headwaters, the dominant source of water becomes surface runoff or groundwater seepage. For the purposes of classifying wetlands, wetlands that show evidence of frequent overbank flooding, even if from an intermittent stream, are considered riverine.

Riverine wetlands normally intergrade with tidal fringe wetlands near the mouths of rivers. The interface with tidal fringe occurs where the dominant hydrodynamics change to bi-directional tidal flows (Brinson et al 1995). This interface has been significantly modified in western Washington by diking. Many wetlands that were once freshwater tidal (a subclass of tidal fringe in Washington) are now either riverine or depressional (depending on the frequency of flooding).

Riverine wetlands normally extend perpendicular from the stream or river channel to the edge of the area that is frequently flooded (also known as active channel). Wetlands in large

floodplains that are found outside of frequently flooded areas, and that are in landscapes with great topographic relief and steep hydrostatic gradients, may function more like slope or depressional wetlands because the water regime is dominated by groundwater sources (see discussion in Brinson et al. 1995).

Field Characteristics for Riverine Wetlands in Washington State:

The operative characteristic of riverine wetlands in Washington is that of being "frequently flooded" by overbank flows. The Assessment Teams and SWTC, however, decided that this characteristic could only be determined from field indicators. The water regimes of wetlands in Washington have enough variability between dry and wet years that a frequency of flooding (e.g. flooded at least once every two years) could not be used. The following are some field indicators that are to be used to classify a wetland as riverine:

- Scour marks are common
- Recent sediment deposition
- Vegetation bent in one direction or damaged
- Soils with alternating deposits
- Flood marks on vegetation along the bank edge

Subclass: Riverine Flow-through

Riverine flow-through wetlands are those that do not retain surface water significantly longer than the duration of a flood event. Water tends to flow through the wetland rather than pond in the wetland. Usually the water does not remain in the wetland more than several days after the surrounding landscape is drained. Soil saturation, however, may be maintained by groundwater seepage from valley walls. Flow-through wetlands usually have evidence of active erosion and deposition and have a dynamic, fluctuating hydroperiod that closely matches that of the stream or river.

The wetlands in this subclass tend to be found in, or adjacent to, the active channel of a river or larger stream. They may be the vegetated bars in the active channel or they may form on recent alluvial deposits along the sides of the channel or within the channel.

Field characteristics of Riverine Flow-through Wetlands for Western Washington:

- Contains a less dense herbaceous understory, that commonly includes stinging nettle *(Urtica dioica)*
- Contains deciduous shrubs and trees (conifers are less likely)
- The soils are more coarse and have higher mineral content than those found in the impounding subclass
- The vegetation tends to be less diverse than in the impounding subclass

Subclass: Riverine Impounding

Riverine impounding wetlands are those that retain surface water significantly longer than the duration of a flood event. Riverine impounding wetlands tend to hold water for more than a week after a flood event. These wetlands are found within a topographic depression on the valley floor or in areas where natural or man-made barriers to downstream flow occur. The depressions may be filled with sediments or organic deposits. The critical characteristic, however, is that these wetlands retain floodwaters after an event longer than the surrounding landscape. Riverine impounding wetlands may have no outlet, or a constricted outlet, and have a hydroperiod that is less dynamic than that found in the adjacent stream, river, or "flow-through" wetland in the same valley.

Most riverine impounding wetlands are in the less dynamic parts of the floodplain; often on floodplain terraces or in old oxbows. Many may have peat accumulations that are isolated from the usual riverine processes, and they are subjected to long duration of saturation from surface or groundwater sources. Riverine processes will dominate only during the flooding event, though the groundwater levels may be controlled by water levels in the hyporheic zone through hydrostatic processes.

Some wetlands in the lowlands of western Washington fall into this subclass because dikes or roads have reduced their surface water connections. At one time, these wetlands did not retain floodwaters longer than the actual flooding event, but do so now because of a blockage.

Field characteristics of Riverine Impounding wetlands for western Washington:

- More herbaceous understory, commonly containing skunk cabbage *(Lysichiton americanum)*
- Aquatic vascular species are frequently present
- If there is a forested component, it may contain conifers
- Contains finer soils which may have a higher organic content
- Vegetation tends to be more diverse than in riverine flow-through wetlands

Class: Depressional

Depressional wetlands occur in topographic depressions that exhibit closed contour interval(s) on three sides and elevations that are lower than the surrounding landscape. The shape of depressional wetlands vary, but in all cases, the movement of surface water and shallow subsurface water from at least three directions in the surrounding landscape is toward the point of lowest elevation in the depression. Depressional wetlands may be isolated with no surface water inflow or outflow through a defined channel, or they may have permanent or intermittent, surface water inflow or outflow in defined channels, that connects them to other surface waters or other wetlands. Streams draining into a wetland may modify the topographic contours of the depression where they enter or exit the wetland. Depressional wetlands with channels or streams differ from riverine wetlands in that their ecosystem is not significantly modified by overbank flooding events from a stream or river.

Headwater wetlands would be classified as depressional or slope because overbank flooding is not a major ecological factor.

Depressional wetlands may lose water through intermittent or perennial drainage from an outlet, by evapotranspiration, and flow into the groundwater at times when they are not receiving discharge from groundwater.

The outflow and closed subclasses have very similar positions in the landscape that do not warrant separate geomorphic profiles. Differences between the subclasses are based on the functions they perform. The geomorphic characteristics of depressional wetlands in lowland western Washington are as follows:

1. Depressional wetlands in lowland western Washington are found in the following geomorphic settings; 1) former kettleholes left by receding glaciers, 2) depressions on top of clay lenses in glacial outwash, such as the area between Olympia and the Chehalis River, 3) headwaters of lowland streams, 4) alluvial terraces above the existing floodplains, 5) depressions in glacial till, and 6) in depressions in the flood plains of major rivers that have become isolated from frequent flood events.
2. Many depressional wetlands have well developed peat deposits because the outflow, if it exists, is above the base of the depression. Thus, organic matter will tend to collect.

Field characteristics for Depressional wetlands in western Washington :

Depressional wetlands in the lowlands of western Washington lie in topographic depressions where the slope on at least three sides above the wetland is greater than 1%, and that are not within the active floodplain of a stream or river. There may be a stream going through the wetland, but if so, it is not the major source of physical energy to the system.

The topographic depressions that characterize the position of this class in the landscape can be very small with only slight differences in elevation between the wetland and surrounding uplands. Some depressional wetlands are found on relatively flat surfaces, often in pastures. They are formed in depressions that exist in soils with low permeability such as glacial till.

Very small wetlands found in surface depressions with only 1-3 feet of topographic relief may be difficult to classify. If such wetlands form a mosaic on a landscape that is flat it may be more appropriate to classify them as a single wetland in the flats class if the only source of water to the wetland is precipitation. If the wetland receives a significant amount of its water from a surrounding contributing basin, however slight the topographic relief, it would be classified as a depressional wetland. A wetland classified as a flat, on the other hand, receives its water by direct precipitation only from the area within the wetland.

Subclass: ***Outflow***

Depressional outflow wetlands are those that have a surface water outflow to a stream or river. Inflow may be from surface water flowing down from the surrounding topographic relief, from an intermittent or permanent stream(s), or from groundwater.

Subclass: ***Closed***

Depressional closed wetlands are those that have no surface water outflow to channels, streams, or rivers. Depressional closed wetlands may have surface water inflow but no outflow through a defined channel.

CLASS: Slope

Slope wetlands occur on hill or valley slopes. Elevation gradients may range from steep hillsides to slight slopes. Principal water sources are usually groundwater seepage and precipitation. Slope wetlands may occur in nearly flat landscapes if groundwater discharge is a dominant source of water and there is flow in one direction. The movement of surface and shallow subsurface water is perpendicular to topographic contour lines. Slope wetlands are distinguished from the riverine wetland class by the lack of a defined topographic valley with observable features of bed and bank. Slope wetlands may develop channels but the channels serve only to convey water away from the slope wetland.

Field characteristics for Slope wetlands in western Washington:

Slope wetlands in Washington are found on hillsides or at the edge of hill where they grade into a river valley. They are identified by the fact that they are: 1) on a slope, even if very gradual), 2) lacking closed contours and cannot store surface water, and 3) without obvious surface water inflows such as streams or channels.

Note: Subclasses for this class of wetlands have not yet been identified.

CLASS: Lacustrine Fringe

Lacustrine fringe wetlands in western Washington occur at the margin of topographic depressions in which surface water is greater than 8 ha (20 acres) and greater than 2 meters deep (3 meters in eastern Washington). They are found along the edges of bodies of water such as lakes. The dominant surface water movement in lacustrine fringe wetlands has a bi-directional horizontal component due to winds or currents, but there may also be a corresponding vertical component resulting from seiches, wind, or seasonal water fluctuations.

Field characteristics for Lacustrine Fringe wetlands in western Washington:

Lacustrine fringe wetlands are those adjacent to bodies of freshwater that are at least two meters deep and more than 8 hectares (ha) is size (20 acres). In general, the deep water has to represent at least 30% of the area of open water. Some wetlands may be adjacent to rivers that are more than two meters deep but these would be classified as riverine because the flow tends to be in one direction and the wetland is subject to frequent overbank flooding.

Note: Subclasses for lacustrine fringe wetlands have not yet been identified.

CLASS: Tidal Fringe

Tidal fringe wetlands occur on continental margins where marine waters are greater than 2 meters deep. They are found along the coasts and in river mouths to the extent of tidal influence. The dominant source of water is from the ocean or river. The unifying characteristic of this class is the hydrodynamics. All tidal fringe wetlands have water flows dominated by tidal influences, and water depths controlled by tidal cycles.

Subclass: Tidal Saltwater Fringe

Tidal fringe wetlands in which the dominant water flows have salinity rates higher than 0.5 parts per thousand.

Subclass: Tidal Freshwater Fringe

Tidal fringe wetlands in which the dominant water flows are tidal but freshwater, with salinity rates below 0.5 parts per thousand.

CLASS: Flats

Flats wetlands occur in topographically flat areas that are hydrologically isolated from surrounding groundwater or surface water. The main source of water in these wetlands is precipitation. They receive virtually no groundwater discharge. This characteristic distinguishes them from depressional and slope wetlands.

Note: No subclasses are proposed for the flats class in western Washington.

References Cited:

Brinson, M.M., F.R. Hauer, L.C. Lee, W.L. Nutter, R.D. Rheinhardt, R.D. Smith, and D. Whigham. 1995. Guidebook for application of hydrogeomorphic assessments to riverine wetlands. DRAFT U.S. Army Engineer Waterways Experiment Station Wetlands Research Program Technical Report WRP DE-11.

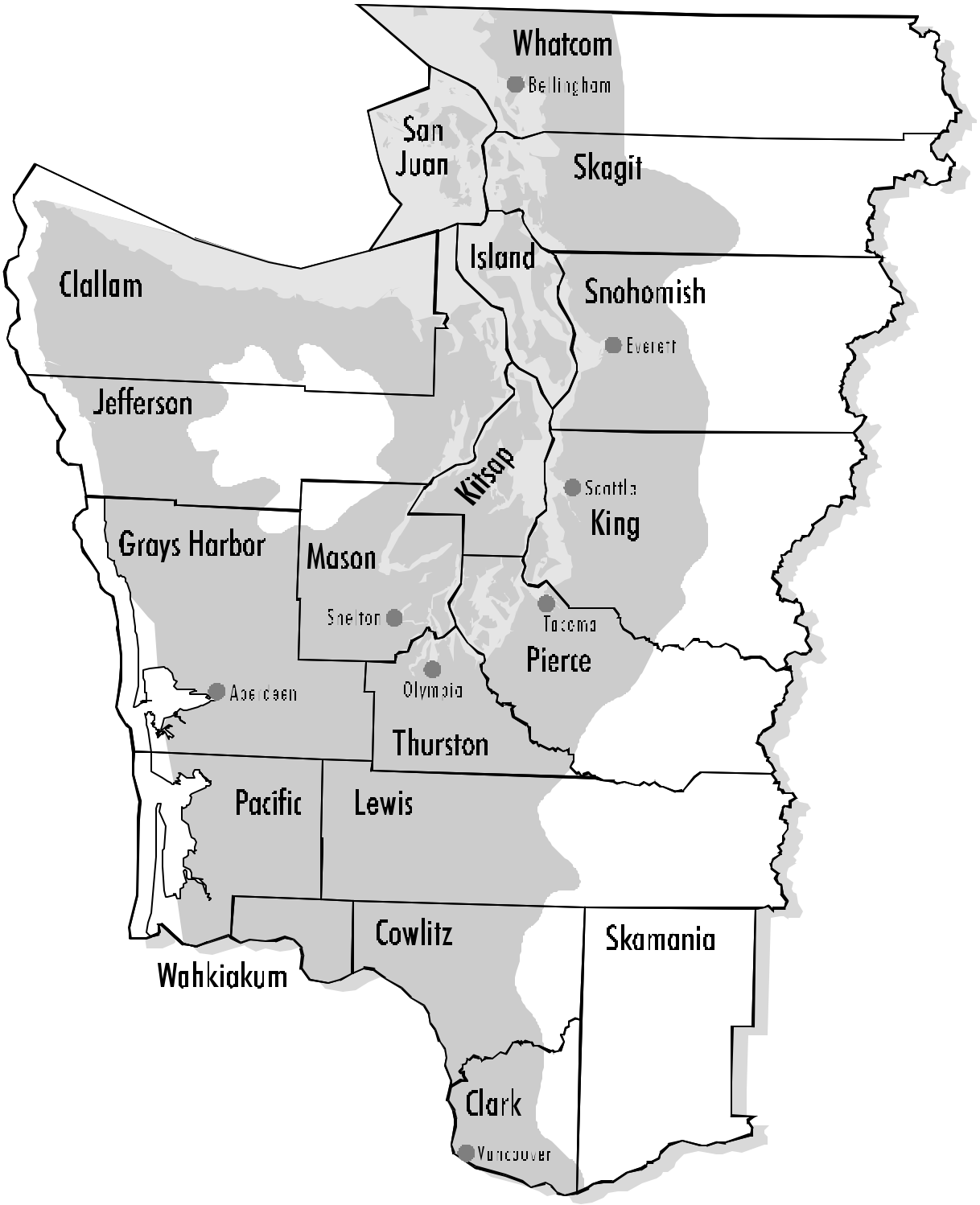


FIGURE 9: Lowlands of Western Washington – Hydrogeomorphic Region for Assessing Wetland Functions

Appendix H: Ordering Fish and Wildlife Data from the Washington Department of Fish and Wildlife

Ordering Fish and Wildlife Data from the Washington Department of Fish and Wildlife

The Washington Department of Fish and Wildlife maintains a database that contains location information on important fish and wildlife species that should be considered in land use decisions and activities.

WDFW provides standard products that answer the most common questions concerning the presence of important fish and wildlife species. This information, and order forms for hard copies, can be accessed on the WDFW web pages. The Internet address for the order form is – http://www.wa.gov/wdfw/hab/release.htm

Appendix I: Vegetation Profile Board for Estimating Percent of Surface Covered

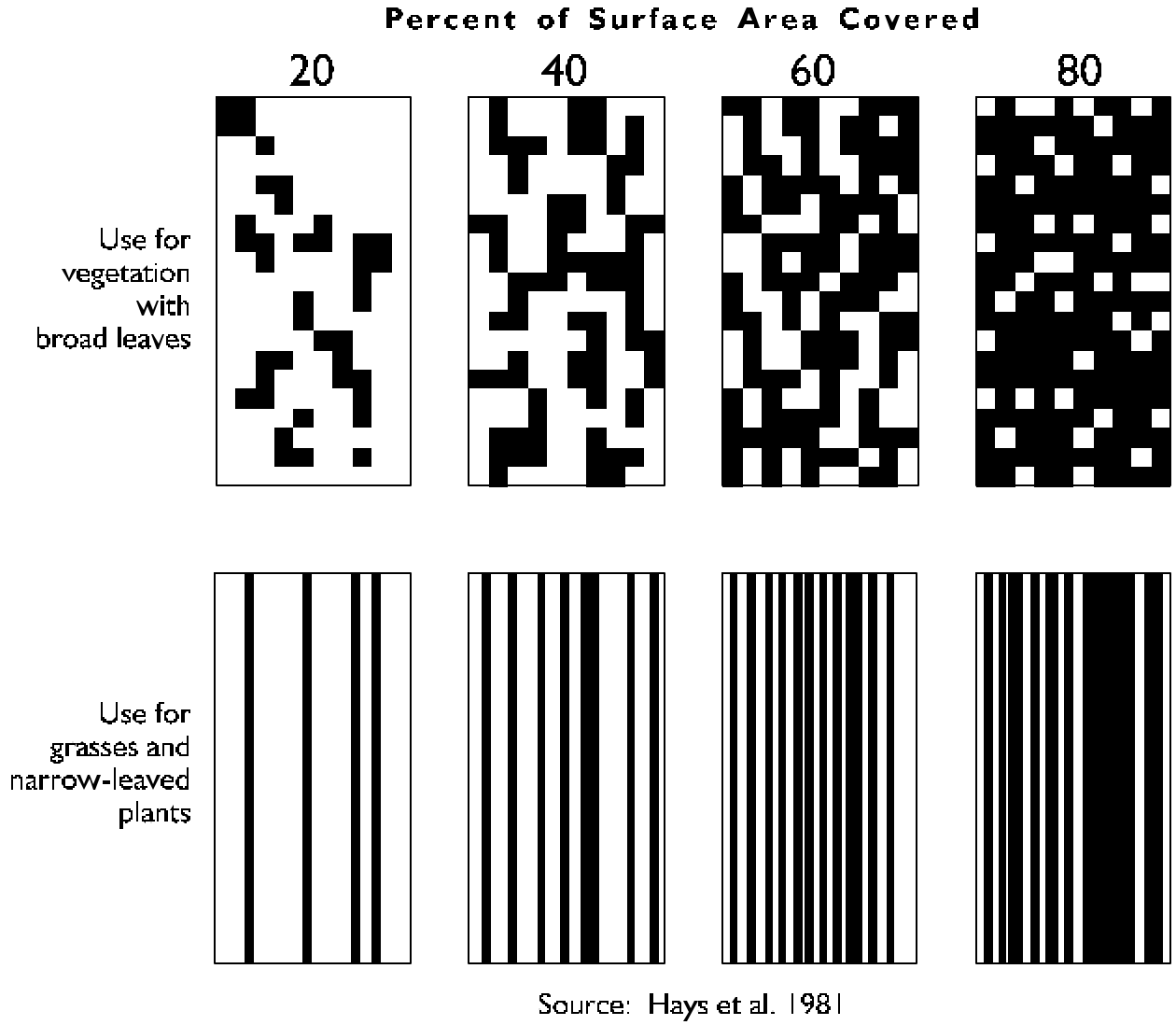


FIGURE 10: Vegetation Profile Board for Estimating Percent Surface Covered

Appendix J: Interpretation of Topographic Maps and Watershed Delineation

Interpretation of Topographic Maps and Watershed Delineation

This section is adapted from the Oregon Freshwater Wetland Assessment Methodology (OFWAM) (Roth et al 1996). For more information on the OFWAM contact:

Wetlands Program
Oregon Division of State Lands
775 Summer St. NE
Salem, OR 97310
(503) 378-3805

For watershed delineation you will need the following;

- Topographic map
- Ability to interpret topographic maps
- Planimeter or dot grid

The term "watershed" is used in many contexts and may have different meanings. For this reason the term "contributing basin" is used in the assessment methods to define a specific type of watershed. For the purpose of the Washington Function Assessment Methods, a contributing basin is defined as the geographic area that contributes surface water runoff to a watercourse or wetland. This is often also called its watershed. The method requires that an evaluator measure the watershed area of the wetland being assessed, unless this information is already available.

This appendix describes a method for delineating a watershed on a topographic map such as a U.S. Geological Survey quadrangle sheet. Once the watershed boundary is established, the area of the watershed can be estimated using the tools for measuring area described on p. 15.

How to interpret a topographic map

In order to successfully delineate a watershed boundary, the evaluator must visualize the landscape as represented by a topographic map. This is not difficult once the following basic concepts of the topographic map are understood.

Each contour line on a topographic map represents a ground elevation or vertical distance above a reference point such a sea level. A contour line is level with respect to the earth's surface just like the top of a building foundation. All points along any contour line are at the same elevation.

The difference in elevation between two adjacent contours is called the contour interval. This is typically given in the map legend. It represents the vertical distance you would need to climb or descend from one contour elevation to the next.

The horizontal distance between contours, on the other hand, is determined by the steepness of the landscape and can vary greatly on a given map. On relatively flat ground, two 20-foot contours can be far apart horizontally. On a steep cliff face, two 20-foot contours might be directly above and below each other. In each case the vertical distance between contour lines would still be 20 feet.

One of the easiest landscapes to visualize on a topographic map is an isolated hill. If this hill is more or less circular the map will show a series of more or less concentric circles (Figure J-1). Imagine that a surveyor actually marks these contour lines onto the ground. If two people start walking in opposite directions on the same contour line, beginning at point A, they will eventually meet face to face.

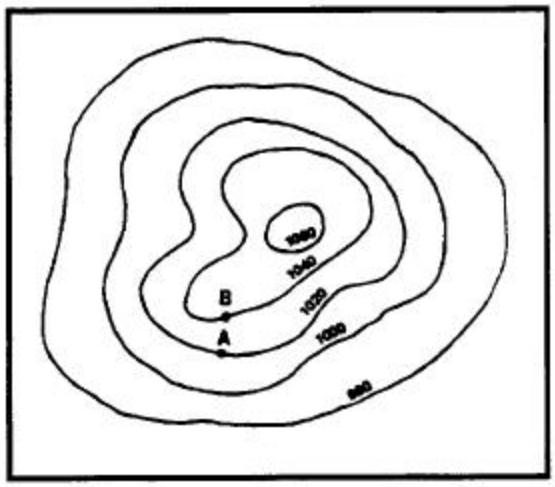


Figure J-1

If these same two people start out in opposite directions on different contours, beginning at points A and B respectively, they will pass each other somewhere on the hill and their vertical distance apart would remain 20 feet. Their horizontal distance apart could be great or small depending on the steepness of the hillside where they pass.

A rather more complicated situation is where two hills are connected by a saddle (Figure J-2). Here each hill is circled by contours, but at some point toward the base of the hills, contours begin to circle both hills.

How do the contours relate to water flow? A general rule is that water flow is perpendicular to contour lines. In the case of the isolated hill, water flows down on all sides of the hill. Water flows from the top of the saddle or ridge, down each side in the same way water flows down each side of a garden wall (see arrows on Figure J-2).

As the water continues downhill in flows into progressively larger watercourses and ultimately into the ocean. Any point on a watercourse can be used to define a watershed. That is, the entire drainage area of a major river like the Nisqually can be considered a watershed, but the drainage areas of each of its tributaries are also watersheds.

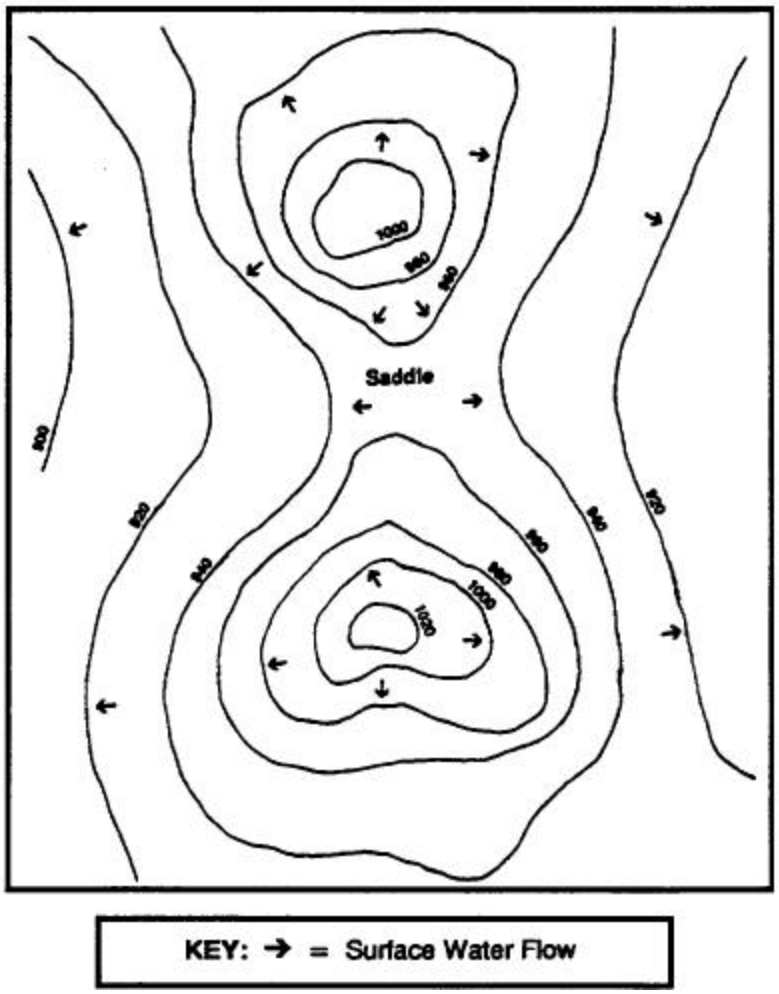


Figure E-2

Each tributary in turn has tributaries, and each one of these smaller tributaries has its own watershed. This process of subdivision can continue until very small, local watersheds are defined which might drain only a few acres.

Figure E-3 shows an idealized watershed of a small stream. Water always flows downhill perpendicular to contour lines. As one proceeds upstream, successively higher and higher contour lines first parallel then cross the stream. This is because the floor of a river valley rises as you go upstream. Like-wise, the valley slopes upward on each side of the stream. A

general rule is that topographic lines always point upstream. With that in mind, it is not difficult to make out drainage patterns and the direction of flow on the landscape even when there is no stream depicted on the map. In Figure E-3, for example, the direction of streamflow is from point A to point B.

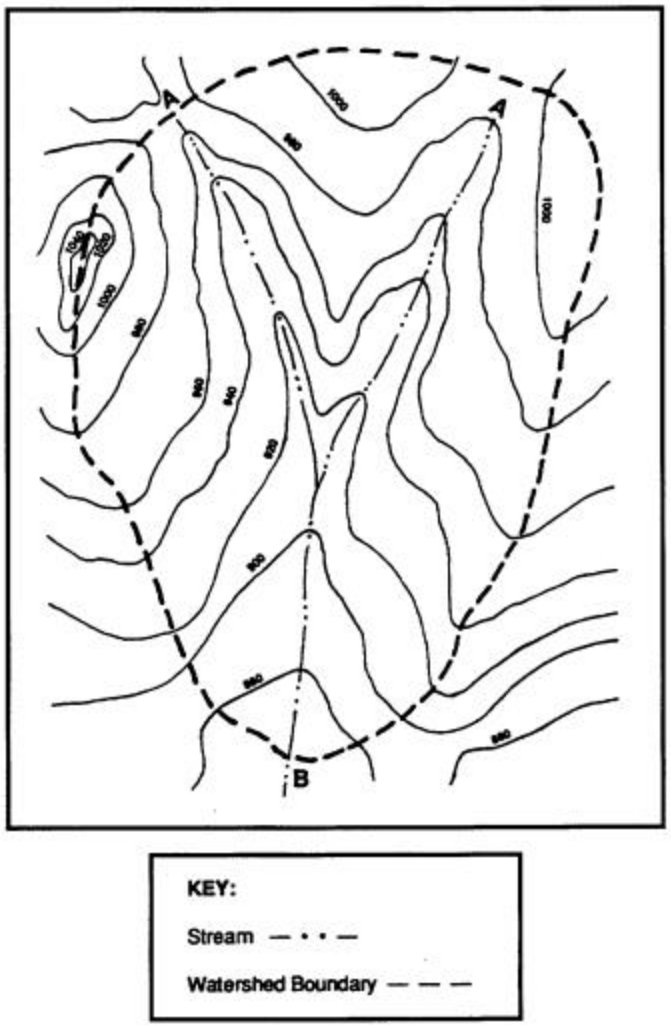


Figure E-3

Ultimately, you must reach the highest point upstream. This is the head of the watershed, beyond which the land slopes away into another watershed. At each point on the stream the land slopes up on each side to some high point then down into another watershed. If you were to join all these high points around the stream you would have the watershed boundary. (High points are generally hill tops, ridge lines, or saddles).

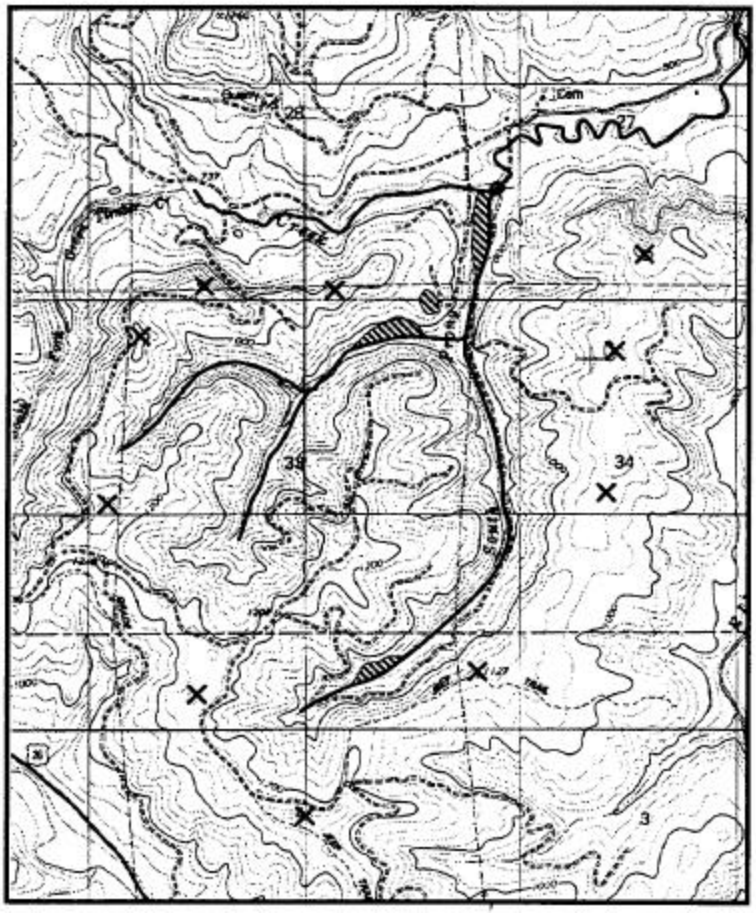


Figure E-4

How to delineate a watershed

The following procedure and example will help you locate and connect all the high points around a watershed on a topographic map shown in Figure J-4. Visualizing the landscape represented by the topographic map will make the process much easier than simply trying to follow the method by rote.

1. Draw a circle at the outlet of the wetland, or downstream point in question (the wetland is the hatched area shown in Figure J-4.)

2. Put small X's at the high points along one side of the watercourse, working your way upstream toward the headwaters of the watershed. If you have a closed depression without any inflowing streams, put the X's on the highest points closest to the wetland.

3. Starting at the circle that was made in step one, draw a line connecting the X's along each side of the watercourse. This line should always cross the contour lines at right angles (i.e. it should be perpendicular to each contour line it crosses).

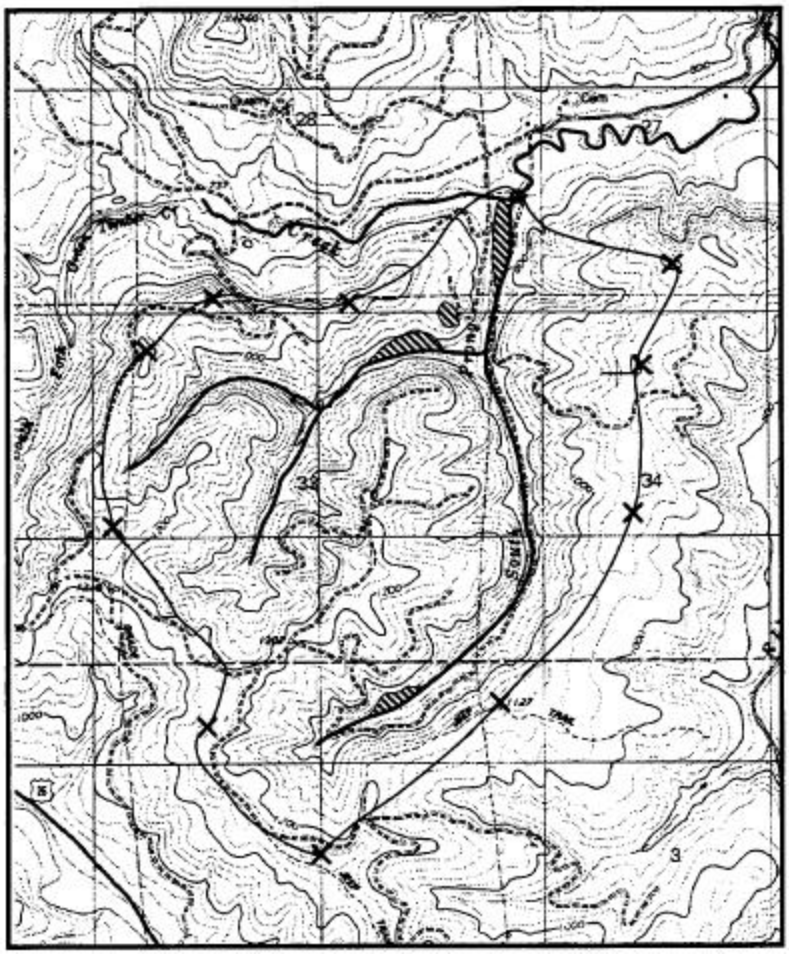


Figure E-5

4. Continue the line until it passes around the head of the watershed and down the opposite side of the watercourse. Eventually it will connect with the circle from which you started. At this point you have delineated the watershed of the wetland being assessed.

The delineation appears as a solid line around the wetland. Generally, surface water runoff from rain falling everywhere in this area flows into the wetland being assessed. This means that the wetland has the potential to modify and attenuate sediment and nutrient loads from this watershed as well as store runoff that might otherwise result in downstream flooding.

Appendix K: Common Wetland Plants

Common Wetland Plants

STATUS	SPECIES NAME	COMMON NAME	FAMILY
TREES			
FACU	*Acer macrophyllum*	Big-leaf maple	Aceraceae
FAC	*Alnus rubra*	Red alder	Betulaceae
OBL	*Betula glandulosa var. hallii*	Bog birch	Betulaceae
FAC*	*Betula papyrifera*	Paper birch	Betulaceae
FACW	*Fraxinus latifolia*	Oregon ash	Oleaceae
FAC	*Picea sitchensis*	Sitka spruce	Pinaceae
FAC	*Pinus contorta var. contorta*	Coast or shore pine	Pinaceae
-	*Pinus contorta var. latifolia*	Lodgepole pine	Pinaceae
FACU-	*Pinus monticola*	Western white pine	Pinaceae
FACU	*Pseudotsuga menziesii*	Douglas fir	Pinaceae
FAC+	*Populus tremuloides*	Quaking aspen	Salicaceae
FAC	*Populus balsamifera ssp. trichocarpa*	Black cottonwood	Salicaceae
FACU	*Prunus emarginata var. mollis*	Bitter cherry	Rosaceae
FAC-	*Rhamnus purshiana*	Cascara	Rhamnaceae
FACU	*Sorbus scopulina*	Mountain ash	Rosaceae
NI	*Taxus brevifolia*	Pacific yew	Taxaceae
FAC	*Thuja plicata*	Western red cedar	Cupressaceae
FACU	*Tsuga heterophylla*	Western hemlock	Pinaceae
-	*Quercus garryana*	Oregon white oak	Fagaceae
SHRUBS			
FAC-	*Acer circinatum*	Vine maple	Aceraceae
FACU	*Amelanchier alnifolia*	Western serviceberry	Rosaceae
OBL	*Andromeda polifolia*	Bog rosemary	Ericaceae
FAC	*Cornus sericea ssp.sericea = (C. stolonifera)*	Red osier dogwood	Cornaceae
FACU	*Corylus cornuta var. Californica*	Beaked hazelnut	Betulaceae
FAC	*Crataegus douglasii*	Black hawthorn	Rosaceae
-	*Cytisus scopairus*	Scot's broom	Leguminosae
FACU	*Gaultheria shallon*	Salal	Ericaceae
FACU	*Ilex aquifolia*	English holly	Aquifoliaceae
FACW+	*Kalmia microphylla var. occidentalis*	Bog laurel	Ericaceae
FAC+	*Lonicera involucrata*	Black twinberry	Caprifoliaceae
FACU	*Mahonia nervosa*	Oregon grape	Berberidaceae
FACW	*Malus fusca =(Pyrus fusca)*	Western crabapple	Rosaceae
FACU+	*Menziesia ferruginea*	Rusty menziesia	Ericaceae
OBL	*Myrica gale var. gale*	Sweetgale	Myricaceae
FACU	*Oemleria cerasiformis*	Indian plum	Rosaceae
FAC+	*Oplopanax horridus*	Devil's club	Araliaceae
FACW-	*Physocarpus capitatus*	Pacific ninebark	Rosaceae
FACW+	*Rhododendron neoglandulosum = Ledum glandulosum*	Smooth labrador tea	Ericaceae
OBL	*Rhododendron groenlandicum = Ledum g.*	Bog labrador tea	Ericaceae
FAC	*Ribes bracteosum*	Stink currant	Grossulariaceae
FAC	*Ribes divaricatum var. divaricatum*	Wax currant	Grossulariaceae
FAC+	*Ribes lacustre*	Swamp gooseberry	Grossulariaceae
-	*Ribes sanguineum var. sanguineum*	Redflowering currant	Grossulariaceae
FACW	*Rosa eglanteria*	Sweetbriar rose	Rosaceae
FACU	*Rosa gymnocarpa var. gymnocarpa*	Baldhip rose	Rosaceae
FAC	*Rosa nutkana*	Nootka rose	Rosaceae
FAC	*Rosa pisocarpa*	Peafruit rose	Rosaceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
FACU+	*Rubus laciniatus*	Evergreen blackberry	Rosaceae
FAC-	*Rubus parviflorus var. parviflorus*	Thimbleberry	Rosaceae
FACU	*Rubus procerus = R. discolor*	Himalaya blackberry	Rosaceae
FAC+	*Rubus spectabilis var. spectabilis*	Salmonberry	Rosaceae
FACU	*Rubus ursinus ssp. macropetalus*	Trailing blackberry	Rosaceae
FACW	*Salix alba var. calva*	White willow	Salicaceae
FACW	*Salix alba var. vitellina*	Golden willow	Salicaceae
OBL	*Salix exigua ssp melanopsis*	Sandbar willow	Salicaceae
OBL	*Salix fluviatilis*	Columbia River willow	Salicaceae
FACW+	*Salix geyeriana var. meleina*	Geyer willow	Salicaceae
FACW-	*Salix hookeriana*	Hooker's willow	Salicaceae
FACW+	*Salix lucida var. lasiandra= S. lasiandra*	Pacific willow	Salicaceae
FACW	*Salix piperi*	Piper's willow	Salicaceae
OBL	*Salix rigida var. macrogemma*	Heartleaf willow	Salicaceae
FAC	*Salix scouleriana*	Scouler's willow	Salicaceae
FACW	*Salix sessilifolia*	Soft-leaved willow	Salicaceae
FACW	*Salix sitchensis*	Sitka willow	Salicaceae
FACU	*Sambucus racemosa ssp. pubens*	Red elderberry	Caprifoliaceae
FACW	*Spiraea douglasii*	Douglas spiraea	Rosaceae
FACU	*Symphoricarpos albus var. laevigatus*	Common snowberry	Rosaceae
NI	*Vaccinium alaskaense*	Alaska blueberry	Ericaceae
OBL	*Vaccinium oxycoccus var. intermedium*	Wild cranberry	Ericaceae
-	*Vaccinium parvifolium*	Red huckleberry	Ericaceae
FACW+	*Vaccinium uliginosum*	Bog blueberry	Ericaceae
FAC+	*Vaccinium cespitosum*	Dwarf blueberry	Ericaceae
HERBS			
OBL	*Alisma plantago-aquatica var. Americana*	Broadleaf water-plantain	Alismataceae
FACW	*Angelica genuflexa*	Kneeling angelica	Apiaceae
FAC+	*Angelica lucida*	Seawatch angelica	Apiaceae
FACU	*Asarum caudatum*	Wild ginger	Aristolochiaceae
FACW	*Aster subspicatus var. subspicatus*	Douglas aster	Asteraceae
FACW	*Atriplex patula*	Fat-hen saltbrush	Chenopodiaceae
FACW+	*Bidens cernua*	Nodding beggarstick	Asteraceae
FAC	*Boykinia elata*	Slender boykinia	Sazifragaceae
FACW	*Boykinia major*	Greater mountain boykinia	Saxifragaceae
OBL	*Brasenia schreberi*	Wtershield	Cambombaceae
FACU	*Cakile edentula var. edentula*	American searocket	Chenopodiaceae
FACU	*Cakile maritima*	European searocket	Chenopodiaceae
OBL	*Callitriche heterophylla*	Different-lvd water-starwort	Callitrichaceae
OBL	*Caltha palustris spp. asarifolia*	Yellow marsh-marigold	Ranunculaceae
FACW-	*Camassia leichtlinii*	Leichtlin's camas	Liliaceae
FACW	*Camassia quamash*	Common camas	Liliaceae
OBL	*Ceratophyllum demersum*	Coontail	Ceratophyllaceae
FAC	*Chenopodium album*	Lamb's quarters	Chenopodiaceae
FACW	*Cicuta douglasii*	Western water-hemlock	Apiaceae
FACU+	*Cirsium arvense var. horridum*	Canada thistle	Asteraceae
FAC-	*Claytonia lanceolata*	Western springbeauty	Portulacaceae
FAC+	*Conium maculatum*	Poison-hemlock	Apiaceae
FAC	*Cornus canadensis*	Bunchberry	Cornaceae
FAC+	*Corydalis scouleri*	Scouler corydalis	Fumariaceae
FACW+	*Cotula coronopifolia*	Brassbuttons	Asteraceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
NI	*Cuscuta salina*	Salt-marsh dodder	Cuscutaceae
OBL	*Drosera rotundifolia var. rotundifolia*	Roundleaf sundew	Droseraceae
OBL	*Elodea canadensis*	Canada waterweed	Hydrocharitaceae
FACW-	*Epilobium ciliatum = E. watsonii*	Watson's willoweed	Onagraceae
FAC+	*Filagniella uliginosum = Gnaphalium u.*	Marsh cudweed	Asteraceae
FACU	*Galium aparine*	Cleavers	Rubiaceae
FACW	*Galium trifidum ssp. columbianum= G. cymosum*	Pacific bedstraw	Rubiaceae
FACW+	*Galium trifidum*	Small bedstraw	Rubiaceae
FACU	*Galium triflorum*	Fragrant bedstraw	Rubiaceae
OBL	*Gentiana sceptrum*	King gentian	Gentianaceae
FACW-	*Geum macrophyllum*	Largeleaf avens	Rosaceae
FACW+	*Glaux maritima ssp. obtusifolia*	Sea milwort	Primulaceae
FACW	*Grindelia integrifolia*	Puget sound gumweed	Asteraceae
FAC+	*Haplopappus uniflorus*	Plantain goldenweed	Asteraceae
OBL	*Hippuris vulgaris*	Common marestail	Halagroaceae
FACU	*Honkenya peploides*	Seabeach sandwort	Caryophyllaceae
OBL	*Hydrocotyle ranunculoides*	Mrsh-pennywort	Apiaceae
NI	*Hydrophyllum tenuipes*	Pacific waterleaf	Hydrophyllaceae
OBL	*Hypericum anagalloides*	Bog St. Johnsort	Hypericaceae
FAC	*Hypericum formosum*	Western St. Johnswort	Hypericaceae
FACU	*Hypochaeris radicata*	Hiry cat's-ear	Asteraceae
FACW	*Impatiens capensis*	Spotted touch-me-not	Balsaminaceae
FACW	*Impatiens noli-tangere*	Yellow touch-me-not	Balsaminaceae
OBL	*Iris pseudacorus*	Yellow iris	Iridaceae
OBL	*Jaumea carnosa*	Fleshy jaumea	Asteraceae
OBL	*Lemna minor*	Small duckweed	Lemnaceae
OBL	*Lilaeopsis occidentalis*	Western lilaeopsis	Apiaceae
FAC	*Lotus corniculatus*	Birdsfoot trefoil	Fabaceae
OBL	*Ludwigia palustris*	Water-purslane	Onagraceae
OBL	*Lycopus americanus*	American bugleweed	Lamiaceae
OBL	*Lycopus uniflorus*	Northern bugleweed	Lamiaceae
OBL	*Lysichitum americanum*	Skunkcabbage	Araceae
OBL	*Lythrum portula*	Loosestrife	Lythraceae
FACW+	*Lythrum salicaria*	Purple loosestrife	Lythraceae
FAC	*Maianthemum dilatatum*	Wild lily-of-the-valley	Liliaceae
FACW-	*Mentha arvensis*	Field mint	Lamiaceae
OBL	*Mentha spicata*	Spearmint	Lamiaceae
OBL	*Menyanthes trifoliata var. trifoliata*	Bogbean	Menyanthaceae
OBL	*Mimulus guttatus*	Common monkeyflower	Scrophulariaceae
OBL	*Myosotis laxa*	Small water forget-me-not	Boraginaceae
FACW	*Myosotis scorpioides*	Water forget-me-not	Boraginaceae
OBL	*Myriophyllum brasiliense = M. aquaticum*	Parrotfeather	Halagroaceae
OBL	*Myriophyllum spicatum*	Eurasian water-milfoil	Halagroaceae
NI	*Nephrophyllidium crista-galli*	Deer-cabbage	Menyanthaceae
OBL	*Nuphar luteum ssp. polysepalum*	Yellow pondlilly	Cambombaceae
OBL	*Nymphaea odorata var. odorata*	White water lily	Cambombaceae
OBL	*Oenanthe sarmentosa*	Water-parsley	Apiaceae
FACW+	*Orthocarpus castilleiodes*	Ambiguous-paintbrush	Scrophulariaceae
FAC-	*Parentucellia viscosa*	Yellow parentucellia	Scrophulacriaceae
FACW-	*Petasites frigidus var. palmatus*	Sweet coltsfoot	Asteraceae
FAC	*Plantago lanceolata var. lanceolata*	Rib plaintain	Plantaginaceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
FACU+	*Plantago major*	Broadleaf plantain	Plantaginaceae
FACW+	*Plantago maritima var. juncoides*	Seaside plantain	Plantaginaceae
OBL	*Polygonum amphibium var. stipulaceum*	Water ladysthumb	Polygonaceae
FACW-	*Polygonum aviculare*	Prostrate knotweed	Polygonaceae
FACU	*Polygonum cuspidatum*	Japanese knotweed	Polygonaceae
OBL	*Polygonum hydropiper*	Waterpepper	Polygonaceae
OBL	*Polygonum hydropiperoides var. hydropiperoides*	Mild waterpepper	Polygonaceae
FACW	*Polygonum lapathifolium*	Willow smartweed	Polygonaceae
FACW	*Polygonum persicaria var. persicaria*	Ladysthumb	Polygonaceae
OBL	*Polygonum punctatum*	Dotted smartweed	Polygonaceae
OBL	*Potamogeton natans*	Floatingleaf pondweed	Potamogetonaceae
OBL	*Potamogeton amplifolius*	Largeleaf pondweed	Potamogetonaceae
OBL	*Potentilla anserina ssp. pacifica*	Pacific silverweed	Rosaceae
OBL	*Potentilla palustris*	Marsh cinquefoil	Rosaceae
FACW-	*Ranunculus acris*	Tall buttercup	Ranunculaceae
OBL	*Ranunculus aquatilis*	White water buttercup	Ranunculaceae
FACW	*Ranunculus flammula*	Small creeping buttercup	Ranunculaceae
FACW	*Ranunculus repens var. repens*	Creeping buttercup	Ranunculaceae
OBL	*Ranunculus sceleratus*	Celery leaved buttercup	Ranunculaceae
FACW	*Rorippa calycina*	Persistent-sepal yellow-cress	Brassicaceae
OBL	*Rorippa curvisiliqua*	Western yellow-cress	Brassicaceae
OBL	*Nasturtium officinale = Rorippa nasturtium-aquaticum*	True water-cress	Brassicaceae
FACU+	*Rumex acetosella*	Sheep sorrel	Polygonaceae
FAC+	*Rumex crispus*	Curly dock	Polygonaceae
FACW+	*Rumex maritimus var. fueginus*	Golden dock	Polygonaceae
FAC	*Rumex obtusifolius*	Bitter dock	Polygonaceae
FACW+	*Rumex occidentalis var. labradoricus*	Western dock	Polygonaceae
OBL	*Ruppia maritima var. rostrata*	Widgeon grass	Potamogetonaceae
OBL	*Sagittaria latifolia var. latifolia*	Broadleaf arrowhead	Alismataceae
OBL	*Salicornia virginica*	Pickleweed	Chenopodiaceae
FACW+	*Sanguisorba officinalis*	Great burnet	Rosaceae
FACW+	*Scutellaria lateriflora var. lateriflora*	Mad-dog skullcap	Lamiaceae
FACW+	*Sisyrinchium californicum*	Golden-eyed grass	Iridaceae
OBL	*Sium suave*	Water-parsnip	Apiaceae
FAC+	*Solanum dulcamara*	Bittersweet nightshade	Solananceae
OBL	*Sparganium emersum*	Narrowleaf burreed	Sparganiaceae
OBL	*Sparganium eurycarpum*	Giant burreed	Sparganiaceae
OBL	*Spergularia canadensis var. occidentalis*	Candian sandspurry	Caryophyllaceae
OBL	*Spergularia macrotheca var. macrotheca*	Beach sandspurry	Caryophyllaceae
OBL	*Spergularia marina var. marina*	Saltmarch sandspurry	Caryophyllaceae
FACW	*Spiranthes romanzoffiana*	Hooded ladies-tresses	Orchidaceae
OBL	*Spirodela polyrhiza*	Large duckweed	Lemnaceae
FACW	*Stachys cooleyae*	Cooley hedgenettle	Lamiaceae
FAC	*Stellaria crispa*	Curly chickweed	Caryophyllaceae
OBL	*Stellaria humifusa*	Saltmarsh chickweed	Caryophyllaceae
FACW	*Stellaria longifolia*	Longleaf chickweed	Caryophyllaceae
FAC-	*Streptopus amplexifolius var. Americana*	Claspleaf chickweed	Liliaceae
facu-	*Streptopus roseus var. curvipes*	Rosy twisted-stalk	Liliaceae
FAC-	*Tiarella trifoliata*	three-leaf foamflower	Saxifragaceae
FAC	*Tolmiea menziesii*	Youth-on-age	Saxifragaceae
OBL	*Trientalis europaea ssp. arctica = T. arctica*	Arctic starflower	Primulaceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
FACU	*Trifolium pratense*	Red clover	Fabaceae
FAC	*Trifolium repens*	White clover	Fabaceae
FACW+	*Trifolium wormskjoldii*	Marsh clover	Fabaceae
OBL	*Triglochin maritimum*	Seaside arrowgrass	Juncaginaceae
OBL	*Typha angustifolia*	Narrowleaf cattail	Typhaceae
OBL	*Typha latifolia*	Common cattail	Typhaceae
FAC+	*Urtica dioica ssp. gracilis var. lyallii*	Stinging nettle	Urticaceae
OBL	*Utricularia minor*	Small bladderwort	Lentibulariaceae
OBL	*Utricularia vulgaris ssp. macrorhiza*	Common bladderwort	Lentibularlaceae
OBL	*Vallisneria americana*	American wild-celery	Hydrocharitaceae
OBL	*Veronica americana*	American brooklime	Scrophulariaceae
OBL	*Veronica anagallis-aquatilis*	Water veronica	Scrophulariaceae
OBL	*Veronica scutellata*	Marsh veronica	Scrophulariaceae
FACW+	*Viola glabella*	Stream violet	Violaceae
OBL	*Viola palustris var. palustris*	Marsh violet	Violaceae
NI	*Xerophyllum tenax*	Beargrass	Liliaceae
OBL	*Zostera marina var. marina*	Eelgrass	Zosteraceae
OBL	*Zostera japonica*	Dwarf eelgrass	Zosteraceae
RUSHES			
OBL	*Juncus acuminatus*	Tapertip rush	Juncaceae
OBL	*Juncus articulatus*	Jointed rush	Juncaceae
FACW+	*Juncus balticus*	Baltic rush	Juncaceae
FACW	*Juncus bufonius*	Toad rush	Juncaceae
FACW	*Juncus effusus*	Soft rush	Juncaceae
FACW	*Juncus ensifolius*	Daggerleaf rush	Juncaceae
FACW-	*Juncus falcatus var. sitchensis*	Sickleleaf rush	Juncaceae
FACW+	*Juncus gerardii var. gerardii*	Mud rush	Juncaceae
FACW	*Juncus lesueurii*	Salt rush	Juncaceae
OBL	*Juncus mertensianus*	Merten's rush	Juncaceae
FACW+	*Juncus oxymeris*	Pointed rush	Juncaceae
FACW	*Juncus nevadensis var.nevadensis*	Sierra rush	Juncaceae
FACW	*Juncus patens*	Rush	Juncaceae
FACW-	*Juncus tenuis var. tenuis*	Sleder rush	Juncaceae
OBL	*Juncus supiniformis*	Spreading rush	Juncaceae
FACW+	*Juncus uncialis*	Inch-high rush	Juncaceae
NI	*Luzula multiflora = L. campestris*	Field woodrush	Juncaceae
FAC-	*Luzula parviflora*	Small-flower woodrush	Juncaceae
-	*Juncus supinus*	Bulbous rush	Juncaceae
SEDGES			
FACW+	*Carex amplifolia*	Bigleaf sedge	Cyperaceae
OBL	*Carex aquatilis var. dives*	Water sedge	Cyperaceae
OBL	*Carex arcta*	Northern clustered sedge	Cyperaceae
FACW	*Carex athrostachya*	Slenderbeak sedge	Cyperaceae
FACW+	*Carex aurea*	Golden sedge	Cyperaceae
FACW+	*Carex canescens*	Gray sedge	Cyperaceae
FAC+	*Carex densa*	Dense sedge	Cyperaceae
OBL	*Carex comosa*	Bearded sedge	Cyperaceae
OBL	*Carex cusickii*	Cusick sedge	Cyperaceae
FACU	*Carex deweyana var. deweyana*	Dewey sedge	Cyperaceae
OBL	*Carex exsiccata = C. vesicaria var major*	Inflated sedge	Cyperaceae
FAC	*Carex hendersonii*	Henderson sedge	Cyperaceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
FACW-	*Carex interior*	Inland sedge	Cyperaceae
FACW	*Carex laeviculmus*	Smooth-stem sedge	Cyperaceae
OBL	*Carex lasiocarpa var. lasiocarpa*	Slender wetland sedge	Cyperaceae
FACW+	*Carex lenticularis var. lipocarpa*	Lenticular sedge	Cyperaceae
FACW	*Carex leporina*	Harefoot sedge	Cyperaceae
OBL	*Carex leptalea ssp. leptalea*	Bristle-stalked sedge	Cyperaceae
OBL	*Carex livida*	Livid sedge	Cyperaceae
OBL	*Carex lyngbyei*	Lyngby sedge	Cyperaceae
FAC-	*Carex macrocephala var. macrocephala*	Bighead sedge	Cyperaceae
NI	*Carex oederi*	Green sedge	Cyperaceae
OBL	*Carex obnupta*	Slough sedge	Cyperaceae
FAC	*Carex pachystachya*	Thick-head sedge	Cyperaceae
OBL	*Carex pauciflora*	Fewflowered sedge	Cyperaceae
OBL	*Carex pluriflora*	Several-flowered sedge	Cyperaceae
FACW	*Carex praticola*	Meadow sedge	Cyperaceae
FAC	*Carex pyrenaica*	Pyrenees sedge	Cyperaceae
OBL	*Carex utriculata = Carex rostrata var. utriculata*	Beaked sedge	Cyperaceae
OBL	*Carex aquatilis var. dives = C. sitchensis*	Water sedge	Cyperaceae
FACW+	*Carex stipata var. stipata*	Sawbeak sedge	Cyperaceae
FACU	*Carex tumulicola*	Foothill sedge	Cyperaceae
FACW	*Carex unilateralis*	One-sided sedge	Cyperaceae
OBL	*Carex exsiccata = C. vesicaria var. major*	Inflated sedge	Cyperaceae
OBL	*Carex vulpinoidea*	Fox sedge	Cyperaceae
FACW	*Cyperus strigosus*	Strawcolor flatsedge	Cyperaceae
OBL	*Dulichium arundinaceum*	Dulichium	Cyperaceae
OBL	*Eleocharis acicularis var. acicularis*	Needle spikerush	Cyperaceae
OBL	*Eleocharis ovata = E. obtusa var. ovata*	Ovoid spikerush	Cyperaceae
OBL	*Eleocharis palustris*	Creeping spikerush	Cyperaceae
OBL	*Eriophorum chamissonis*	Russet cottongrass	Cyperaceae
OBL	*Rhynchospora alba*	Beakrush	Cyperaceae
SCIRPUS GENUS			
OBL	*Scirpus acutus*	Hardstem bulrush	Cyperaceae
OBL	*Scirpus americanus*	Three-square bulrush	Cyperaceae
OBL	*Scirpus caespitosis*	Tufted sedge	Cyperaceae
OBL	*Scirpus atrocinctus = S.cyperinus v. brachypodus*	Woolly sedge	Cyperaceae
OBL	*Scirpus maritimus*	Seacoast bulrush	Cyperaceae
OBL	*Scirpus microcarpus*	Small-fruited bulrush	Cyperaceae
OBL	*Scirpus subterminalis*	Subterminate bulrush	Cyperaceae
OBL	*Scirpus tabernaemontanii= S. validus*	Softstem bulrush	Cyperaceae
OBL	*Scirpus triqueter*	Threesquare tule	Cyperaceae
GRASSES			
FAC	*Agrostis capillaris = (A. tenuis)*	Collonial bentgrass	Poaceae
FAC	*Agrostis gigantea = (A. alba var. alba)*	Redtop	Poaceae
FAC	*Agrostis oregonensis*	Oregon bentgrass	Poaceae
FAC	*Agrostis scabra*	Rough bentgrass	Poaceae
FAC	*Agrostis stolonifera = (A. alba var. major + var. palustris)*	Creeping bentgrass	Poaceae
FAC	*Agrostis stolonifera var. stolonifera*	Spreading bentgrass	Poaceae
FAC-	*Aira cayrophyllea*	Silver hairgrass	Poaceae
OBL	*Alopecurus aequalis var. aequalis*	Short-awn foxtail	Poaceae
OBL	*Alopecurus geniculatus var. geniculatus*	Water foxtail	Poaceae
FACW	*Alopecurus pratensis*	Meadow foxtail	Poaceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
FACU	*Ammophila arenaria*	European beachgrass	Poaceae
FACU	*Anthoxanthum odoratum*	Sweet vernalgrass	Poaceae
FACW+	*Phragmites australis = (P. communis)*	Common reed	Poaceae
OBL	*Beckmannia syzigache*	American sloughgrass	Poaceae
FACW+	*Calamagrostis canadensis*	Bluejoint reedgrass	Poaceae
FACW	*Calamagrostis nutkaensis*	Pacific reedgrass	Poaceae
FACU	*Dactylis glomerata*	Orchardgrass	Poaceae
FACW	*Deschampsia caespitosa*	Tufted hairgrass	Poaceae
FAC+	*Distichlis spicata*	Seashore saltgrass	Poaceae
FACW	*Echinochloa crusgalii*	Large barnyard grass	Poaceae
FACU	*Elymus mollis*	American dunegrass	Poaceae
FAC-	*Elytrigia repens = Agropyron repens*	Quackgrass	Poaceae
FAC-	*Festuca arundinacea*	Tall fescue	Poaceae
FACU+	*Festuca pratensis*	Meadow fescue	Poaceae
FAC+	*Festuca rubra*	Red fescue	Poaceae
OBL	*Glyceria borealis*	Northern mannagrass	Poaceae
FACW+	*Glyceria elata*	Tall mannagrass	Poaceae
OBL	*Glyceria grandis*	Reed mannagrass	Poaceae
FAC	*Holcus lanatus*	Common velvetgrass	Poaceae
FACU	*Holcus mollis*	Creeping velvetgrass	Poaceae
OBL	*Leersia oryzoides*	Rice cutgrass	Poaceae
FACU	*Lolium perenne var. aristatum = L. multiflorum*	Italian ryegrass	Poaceae
FACU	*Lolium perenne*	Perennial ryegrass	Poaceae
FACW	*Panicum occidentale*	Western panic grass	Poaceae
FACW	*Paspalum distichum*	Knotgrass	Poaceae
FACW	*Phalaris arundinacea*	Reed canarygrass	Poaceae
FAC-	*Phleum pratense var. pratense*	Common timothy	Poaceae
FAC	*Poa annua*	Annual bluegrass	Poaceae
FACU+	*Poa compressa*	Canada bluegrass	Poaceae
FAC	*Poa palustris*	Fowl bluegrass	Poaceae
FAC	*Poa pratensis*	Kentucky bluegrass	Poaceae
FACW	*Poa trivialis*	Rough bluegrass	Poaceae
OBL?	*Spartina anglica*	Spartina	Poaceae
OBL	*Spartina alterniflora*	Smooth cordgrass	Poaceae
NI	*Spartina californica*	California cordgrass	Poaceae
NI	*Spartina patens*	Saltmeadow cordgrass	Poaceae
OBL	*Torreyochloa pauciflora = Puccinellia pauciflora*	Weak alkaligrass	Poaceae
FACU	*Trisetum cernuum*	Nodding tristeum	Poaceae
FERNS/HORSETAILS			
FAC	*Adiantum aleuticum = A. pedatum*	Maidenhair fern	Adiantaceae
FAC	*Athyrium felixx-femina var. cyclosorum*	Lady fern	Dryopteridaceae
OBL	*Azolla filiculoides*	Pacific water-fern	Azollaceae
FAC+	*Blechnum spicant*	Deer fern	Blechnaceae
FACU	*Dryopteris expansa = D. austriaca*	Spreading wood-fern	Dryopteridaceae
FAC	*Equisetum arvense*	Field horsetail	Equisetaceae
OBL	*Equisetum fluviatile*	Water horsetail	Equisetaceae
FACW	*Equisetum hyemale var. affine*	Scouring-rush	Equisetaceae
FACW	*Equisetum pratense (palustre?)*	Shady horsetail	Equisetaceae
FACW	*Equisetum telmateia var. braunii*	Giant horsetail	Equisetaceae
FAC	*Gymnocarpium dryopteris var. disjunctum*	Oak fern	Dryopteridaceae
FACU	*Polystichum munitum*	Sword fern	Dryopteridaceae

STATUS	SPECIES NAME	COMMON NAME	FAMILY
FACU	*Polypodium glycyrrhiza*	Licorice fern	Polypodiaceae
FACU	*Pteridium aquilinum var. pubescens*	Bracken fern	Dennstaedtiaceae
MOSSES AND LIVERWORTS			
-	*Aulacomnium palustre*	Ribbed bog moss	-
-	*Calliergon cordifolium*	-	-
-	*Calliergonella cuspidata*	Spear moss	-
-	*Chiloscyphus polyanthos*	-	-
-	*Climacium dendroides*	Tree moss	-
-	*Dichelyma uncinatum*	-	-
-	*Fontinalis antipyretica*	Water moss	-
-	*Hookeria lucens*	Pale scale moss	-
-	*Leptodictyum riparium*	-	-
-	*Riccia fluitans*	-	-
-	*Ricciocarpos natans*	-	-
-	*Sphagnum girgensohnii*	-	-
-	*Sphagnum rubellum*	-	-

Appendix L: Common Non-native Plants Often Found in Western Washington's Wetlands

Common Non-native Plants Often Found in Western Washington's Wetlands

SPECIES NAME	*COMMON NAME*
Agropyron repens	Quackgrass
Alopecurus pratensis, A. aequalis	Meadow foxtail
Arcticum minus	Burdock
Bromus tectorum, B. rigidus, B. brizaeformis, B. secalinus, B. japonicus, B. mollis, B. commutatus, B. inermis, B. erectus	Bromes
Cenchrus longispinus	Sanbur
Centaurea solstitialis, C. repens, C. cyanus, C. maculosa, C. diffusa	Knapweeds
Cirsium vulgare, C. arvense	Thistles
Cynosurus cristasus, C. echinatus	Dogtail
Cytisus scoparius	Scot's broom
Dactylis glomerata	Orchardgrass
Dipsacus sylvestris	Teasel
Digitaria sanguinalis	Crabgrass
Echinochloa crusgalli	Barnyard grass
Euphorbia peplus, E. esula	Spurge
Festuca arundinacea, F. pratensis, F. rubra	Fescue
Holcus lanatus, H. mollis	Velvet grass
Hordeum jabatum	Foxtail barley
Hypericum perforatum	St. John's Wort
Iris pseudacorus	Yellow iris
Ilex aquifolium	English holly
Lolium perenne, L. multiflorum, L. temulentum	Ryegrass
Lotus corniculatus	Birdsfoot trefoil
Lythrum salicaria	Purple loosestrife
Matricaria matricarioides	Pineapple weed
Medicago sativa	Alfalfa
Melilotus alba, M. offiinalis	Sweet clover
Phalaris arundinacae	Reed canarygrass
Phleum pratense	Timothy
Phragmites australis	Common reed
Poa compressa, P. palustris, P. pratensis	Bluegrass
Polygonium aviculare, P. convolutus, P. cuspidatum, P. lapathifolium, P. persicaria, P. sachalineuse	Knotweeds
Ranunculus reprens	Creeping buttercup
Rubus procerus (discolor), R. lacinatus, R. vestitus, R. macrophyllus, R. leucodermis	Non-native blackberries
Salsola kali	Russian thistle
Setaria viridis	Green bristlegrass
Sisymbrium altissimum, S. loeselii, S. officinale	Tumblemustards
Tanacetum vulgare	Tansy
Trifolium dubium, T. pratense, T. repens, T. arvense, T. subterraneum, T. hybridium	Clovers
Misc. cultivated species	Wheat, corn, barley, rye, etc.

Appendix M: Rating Permeability of Soils

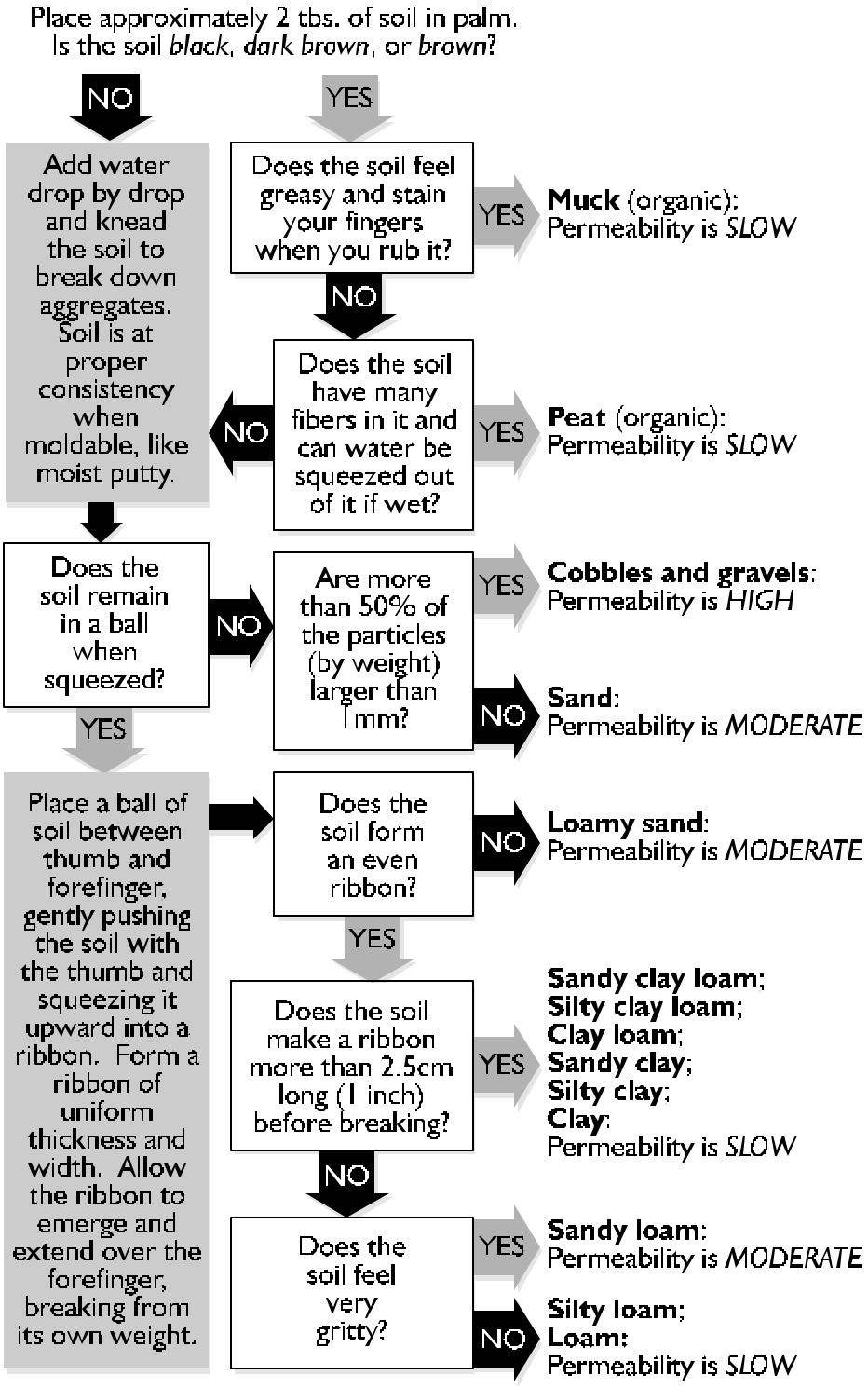


FIGURE 11: Rating Permeability of Soils

Appendix N: Summary of Data for which Photo Maps are Recommended

Summary of Data for which Photo Maps are Recommended

Datum	Description
D1	Area of AU
D2	Area of contributing basin
D3	Land uses within 1 km of the AU
D7	Ratio of channel length to length of AU
D8.1	Percent of AU that has annual ponding or inundation
D8.2	Percent of AU with permanent standing water
D8.3	Percent of AU with permanent open water
D14	Percent of AU with different “Cowardin” vegetation classes
D17	Percent of AU with a canopy closure of woody vegetation
D18	Percent length of stream with a 75% canopy closure
D22	Presence/absence of mature trees
D23	Percent of the AU with a sphagnum bog component
D24	Percent of AU in which non-native plants are dominant or co-dominant
D38	Interspersion between vegetated areas and open water
D39	Interspersion between vegetation classes
D42	Characteristics of the buffer

Appendix O: A Quick Reference to Data by Datum Number

A Quick Reference to Data by Datum Number

LANDSCAPE DATA	
D0	Is the AU part of a wetland surrounded by dikes that drains through a control structure?
D1	Area of AU
D2	Area of contributing basin (upgradient watershed)
Land use (as % of total area) within 1km of AU (include contiguous AUs of different class)	
D3.1	Undeveloped forest
D3.2	Agriculture (field and pasture)
D3.3	Clear-cut logging (<5 years since clearing)
D3.4	Urban/commercial
D3.5	High density residential (>1 residence/acre)
D3.6	Low density residential (<= 1 residence/acre)
D3.7	Undeveloped areas, shrubland, other wetlands, and open water
WATER REGIME	
D4	Channels or streams in AU with identifiable banks
D4.1	Channels or streams in AU with permanently flowing water (you see water flowing)
D4.2	Channel or stream contained by dikes
D4.3	The only surface outflow from the AU is through a culvert (<60 cm) or man-made water control structure
D5	Average width of stream in or adjacent to AU (bank to bank)
D6	Average width of AU perpendicular to stream or river
D7	Ratio of length of channel to length of AU
Inundation	
D8.1	Percent of AU that is ponded or inundated for >1 month
D8.2	Percent of AU with permanent standing or moving water
D8.3	Percent of AU with permanent open water (without aquatic bed vegetation)
D8.4	Percent of AU with unvegetated bars or mudflats
D8.5	Unvegetated bars or mudflats at least 100 square meters in size
D9	Inundation regimes with area >0.1 ha (1/4 acre) or > 10% of AU if AU is smaller than 1 ha (2.5 acres)
D9.1	Permanently flooded (include vegetated areas) (= 1 if D8.2 > 0)
D9.2	Seasonally flooded (>1 month) (= 1 if D8.1 >0)
D9.3	Occasionally flooded (<= 1 month)
D9.4	Saturated but seldom inundated
D9.5	Permanently flowing stream (if meets size criteria)
D9.6	Intermittently flowing stream (if meets size criteria)
D10	Average annual height of flooding above lowest point of outlet (round to 0.3 m)
D11	Cross section of AU in areas of seasonal inundation (record a 1 next to cross section that best fits)
D11.1	Cross section 1

D11.2	Cross section 2
D11.3	Cross section 3
Categories of water depths present in AU, areas permanently or seasonally inundated flooded	
D12.1	1 – 20 cm (<8 in)
D12.2	20 – 100 cm (8 – 40 in)
D12.3	>100 cm (>40 in)
Constriction of outlet	
D13.1	Unconstricted or only slightly constricted
D13.2	Moderately constricted
D13.3	Severely constricted
D13.4	No surface outlet (for riverine impounding only)
VEGETATION	
Cowardin Classes (as % area of AU)	
D14.1	Forest - evergreen
D14.2	Forest - deciduous
D14.3	Scrub-shrub - evergreen
D14.4	Scrub-shrub - deciduous
D14.5	Emergent
D14.6	Aquatic bed
D15	Does D8.3 + D8.4 + sum (D14.1 to D14.6) = 100?
D16	% area of herbaceous understory in forest and shrub areas
D17	% area of AU with >75% closure of canopy
D18	% length of stream with a 75% canopy closure
Plant Richness	
D19.1	Record number of native plant species found in AU
D19.2	Record number of non-native plant species found in AU
D20	The number of plant assemblages present in the AU
D21	The maximum number of strata present in any plant assemblage
D21.1	Is "vine" stratum dominated by non-native blackberries?
D22	Mature trees present in AU
Sphagnum bogs	
D23.1	Sphagnum bog component is >75% of area in AU
D23.2	Sphagnum bog component is 50% - 75% of area in AU
D23.3	Sphagnum bog component is 25% - 49% of area in AU
D23.4	Sphagnum bog component is 1 - 25% of area in AU
D23.5	No Sphagnum bog component in AU
Dominance by non-native plant species	
D24.1	% area of non-native species >75%
D24.2	% area of non-native species 50 - 75%
D24.3	% area of non-native species 25 - 49%
D24.4	% area of non-native species 1 - 24%
D24.5	No cover of non-natives in the AU
HABITAT CHARACTERISTICS	
D25	Number of structure categories in aquatic bed vegetation

pH	
D26.1	pH of interstitial water (measure immediately after digging hole in non-inundated areas)
D26.2	pH of open or standing water (record the lowest pH, if you cannot measure, record a [7])
D27	AU is within 8 km (5 mi) of a brackish or salt water estuary
D28	AU is within 1.6 km (1 mi) of a lake >8 ha (20 acres)
D29	AU is within 5 km (3 mi) of an open field (agriculture or pasture) >16 ha (40 acres)
D30	AU has more than 1 hectare (2.5 ac) of preferred woody vegetation for beaver in and within 100 m of AU
D31	Snags (# of stages present)
D31.1	At least one of the snags above has a DBH greater than 30 cm (12 in)
D32	Overhanging vegetation (1 m wide) for at least 10 m (33 ft) over stream or open water.
D33	AU has upland islands of at least 10 square meters
D34	Undercut banks present for at least 2 m (6.6 ft.)
D35	Key for rating egg-laying structures for amphibians
D36	Tannins present in surface waters >10% of water surface
D37	Steep banks suitable for denning
D38	Interspersion between erect vegetation and permanent (POW + AB) water areas of AU
D39	Interspersion between Cowardin vegetation classes
D40	Structures in AU that create flow eddies
D41	The characteristics of the edge between AU and uplands or adjacent wetlands.
D42	Rating of buffer
D43	Rating of corridors
D44	# of categories of large woody debris in AU outside of permanent water
D45	# of categories of large woody debris in permanent water of AU (may include aquatic bed areas)
SOILS and SUBSTRATES	
Composition of surface layer (above soil)	
D46.1	Deciduous leaf litter
D46.2	Other plant litter
D46.3	Decomposed organic
D46.4	Exposed cobbles
D46.5	Exposed gravel
D46.6	Exposed sand
D46.7	Exposed silt
D46.8	Exposed clay
Soil Types (record [1] if 1 - 49% area of AU, [2] if 50 - 95%, [3] if >95%)	
D47.1	Peat
D47.2	Muck
D47.3	Mineral with clay fraction <30%
D47.4	Clay (clay fraction >30%)
Infiltration rate of soils in seasonally inundated areas	

D48.1	Fast: >50% gravel and cobble and the rest a sand, loamy sand, or sandy loam
D48.2	Moderate: >50% sand and rest cobble, gravel, loamy sand, or sandy loam
D48.3	Slow: muck, peat, or loams (except sandy loam), silts, and clays
Substrate of streams	
D49.1	Substrate of permanent stream or river in AU has at least 1 square meter of gravel
D49.2	Substrate of permanent stream or river in AU has at least 1 square meter of cobbles
D49.3	Microdepressions in stream channel