DEPARTMENT OF ECOLOGY
State of Washington

Calculating Credits and Debits for Compensatory Mitigation in Wetlands of Western Washington

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Calculating Credits and Debits for Compensatory Mitigation in Wetlands of Western Washington

FINAL REPORT
March 2012

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SUMMARY

This document is one of a series of guidance documents developed by the Department of Ecology to improve wetland mitigation in the State of Washington. It describes a tool (called the Credit-Debit Method) for estimating whether a plan for compensatory mitigation will adequately replace the functions and values lost when a wetland is altered. The tool is designed to provide guidance for both regulators and applicants during two stages of the mitigation process: 1) estimating the functions and values lost when a wetland is altered, and 2) estimating the gain in functions and values that result from the mitigation. The Department of Ecology, however, does not require the use of this method. The adequacy of a mitigation project can also be determined by using any other method that addresses the "no-net-loss" policy.

The Credit-Debit Method is based on the Washington State Wetland Rating System for Western Washington (Ecology publication #04-06-025). It also incorporates some refinements in characterizing functions and values that have been developed since then, and that have been summarized in a previous article. [Hruby (2009). Developing rapid methods for analyzing upland riparian functions and values. Environmental Management 43:1219-1243.]

The ecological functions of wetlands that provide value to society fall into three major groups: 1) hydrologic 2) improving water quality, and 3) habitat and maintaining food webs. Functions are first scored based on: 1) the potential of the site to provide each of three functions, 2) the potential the landscape has to maintain each function at the site scale, and 3) the value each function may have for society. Each aspect of the function is then transformed to a qualitative rating of high, medium, or low.

The scores for each of the three functions at the wetland being altered (impact site) are used as the basis for calculating how much mitigation is needed. The gains in functions and values at a mitigation site are compared to the losses at the impact site to determine if the "no-net-loss" policy is being met.

First, the wetland being altered is rated for its functions and values and these ratings are transformed into a currency called "acre-points." The acre-points lost at the impact site are called the "debits." The gains in functions described in the mitigation plan are also calculated and these are called "credits." Appendix E has worksheets for doing both calculations. A mitigation project is usually deemed adequate when the "credit" score for the project is higher than the "debit" score for the impacted wetland. These calculations, however, are not intended to represent a quantitative measure of loss or gain in functions. Rather, the results provide qualitative ratings of the functions that are then transformed into numbers for the purpose of tracking changes.

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Appendices:

Acknowledgements

The Credit-Debit Method would not have been possible without the help of all those who have participated in developing Ecology's earlier wetland tools on which this one is based. These include the seven methods for assessing wetland functions, the two wetland rating systems, and the two volumes of guidance for managing wetlands. The Credit-Debit Method described in this document relies heavily on the data we collected and the experience we have gained over the last 15 years. All together, over 100 wetland scientists, regulators, and planners have participated in Ecology's efforts to provide usable tools to better manage our wetlands. We have published their names in Appendix A of each of the previous documents (Ecology publications #99-115, #00-06-47, #04-06-025, #04-06-015, #05-06-008). All these experts volunteered more than 6000 hours of their time to improve our knowledge and management of the wetlands in our State. In addition I would like to thank the 25 reviewers of the first draft and the operational draft of this method. Their comments and recommendations were an important part of process in developing this tool. Their comments and my responses to them will be available in a separate document. Finally, thanks to Yolanda Holder who made sure I crossed all my "t's" and dotted my "i's".

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CHAPTER 1

Introduction

1.1 Background

Wetlands are complex ecosystems that can improve water quality, provide natural flood control, provide important habitat, and stabilize shorelines. They often support a wide variety of plants and animals, including rare and endangered species, migratory birds, and the young of commercially valuable fishes (NRC 2001). In recent years, concern about the loss of wetlands in the United States and in Washington State has led to efforts to protect wetlands on both public and private lands. Compensatory mitigation is one of the ways used to protect the functions and values of wetlands that are lost as a result of changes in land use.

Definition of Compensatory Mitigation

For purposes of Section 10 and Section 404 of federal laws, compensatory mitigation is the restoration, creation, enhancement, or in exceptional circumstances, preservation of wetlands and/or other aquatic resources for the purpose of compensating for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.
http://www.nap.usace.army.mil/cenap-op/regulatory/definitions.html#Comp%20Mit

The basic policy used in compensating for impacts to wetlands is called the "No Net Loss" policy. "No net loss of wetland functions and values" is a Federal and State policy goal that emerged in 1989 and has been a mainstay of land use regulations since then (NRC 2001). To date, the no net loss policy has been interpreted to mean that wetlands should be conserved wherever possible, and that wetlands converted to other uses must be offset through compensatory mitigation to provide the same functions and values that have been lost. However, the National Academy of Sciences has concluded that mitigation projects have not met the policy goal despite some progress in the last 20 years (NRC 2001).

Many tools have been developed to understand the functions and values of wetlands. The methods range from detailed scientific analyses that may require many years to complete, to the judgments of individual resource experts done during one visit to the wetland. Managers of our wetland resources, however, are faced with a dilemma. Scientific rigor is often time consuming and costly. Tools are needed to provide information on the functions and values of wetlands in a time- and cost-effective way (Kusler 2004). One way to accomplish this is to rate wetland functions by their important attributes or characteristics based on the collective judgment of regional experts. Such methods are relatively rapid but still provide some scientific rigor (Hruby 1999).

The purpose of the Credit-Debit Method (method) is to provide a tool by which applicants and regulators can determine if actions taken to mitigate an impact to wetlands will adequately replace the functions and values lost. It is based on the Washington State Wetland Rating System for Western Washington (Ecology publication #04-06-025). The method also incorporates improvements in rating functions and values that have been developed for "rapid" methods since then and that have been summarized in Hruby (2009).

Chapter 2 provides an introduction to methods used in Washington State to characterize wetland functions and how they were calibrated. Chapter 3 describes the process used for estimating losses in functions that result from impacts to wetlands and the gains that can be achieved through compensatory mitigation. Chapters 4 and 5 are the "field guide" for collecting the data needed to calculate gains and losses in functions and values. Appendices A and E contain the worksheets for rating functions and values and then calculating the gains and losses in functions.

> The Credit-Debit Method is suitable only for freshwater vegetated wetlands as defined by state and federal delineation manuals. It should not be used for estuarine wetlands, streams, or upland riparian areas. Furthermore, the ratings of functions and values are valid only for entire wetland units as defined in Chapter 4. As of February 2012, no rapid methods have been calibrated for the wetlands in the State that can rate small sub-areas of wetlands in an accurate and repeatable manner.

1.2 The Credit-Debit Method in Relation to Other Wetland Guidance by Ecology

This document is one of a series of guidance documents developed by the Department of Ecology to improve wetland mitigation and protection in the State of Washington. The first document was the original wetland rating system published in 1991. Since then the department has been expanding and revising their guidance documents to incorporate the latest scientific information about wetlands and mitigation. For example, the current version of the wetland rating system for western Washington published in 2004 (Ecology publication #04-06-025) is the third revision of this guidance, and the 2006 joint agency guidance for developing mitigation plans (Ecology publication #06-06-011b) is an update of the 1994 joint agency publication on the same topic (Ecology publication #94-029).

The recommendations made in these documents from Ecology are not regulatory requirements. They do, however, provide useful information for protecting wetlands and doing mitigation. The Credit-Debit Method provides one tool for determining the adequacy of compensatory wetland mitigation. It does not set any new regulatory requirements. Many local regulations use area-based ratios to determine mitigation requirements, and this guidance does not change these regulatory requirements.

The Credit-Debit Method is Technical Guidance

The method for calculating mitigation requirements is not a regulation. It does not have any independent regulatory authority and it does not establish new regulatory requirements. Its use, however, may be requested by regulatory agencies or local jurisdictions.

Existing laws, regulations, and policies require that impacts to wetlands be mitigated to replace the functions, values, and area lost. Currently mitigation ratios are the most commonly used approaches to determine the adequacy of wetland compensatory mitigation. The Credit-Debit Method provides regulatory agencies, developers, and project proponents with another method to apply at the project level. If the method is implemented correctly, it should result in compliance with existing requirements for offsetting the losses of wetland functions and values.

The Credit-Debit Method is not the only method for providing an estimate of wetland functions that can be used in determining mitigation needs. As of February 2012, however, it is the only "rapid" method available in Washington that has undergone peer review and been calibrated to wetlands in the State. Studies done using other indicator-based methods all conclude that results are not accurate unless they are calibrated for the wetlands within a region. This has been found in Oregon, Pennsylvania, New Jersey, and the Appalachian region (Adamus and others 2010, Stander and Ehrenfeld 2009, Cole and others 2002, Rheinhard and others 1997, Cole and others 2008). The Credit-Debit Method was calibrated in 120 wetlands in western Washington and 91 wetlands in eastern Washington.

Using the Credit-Debit Method will change how the requirements for mitigation are calculated. Past guidance (Ecology publication #05-06-008) recommends that Wetland Category, the type of mitigation, the risk of failure, and the temporal loss of functions be used as factors in calculating the area of mitigation required. This is called the "mitigation ratio" and is summarized as the acres of mitigation required for each acre of wetland that is altered or lost. The mitigation ratio will probably remain one way to establish the adequacy of a mitigation project for some time to come because it is well known, has been accepted by both applicants and regulators, and has been incorporated into regulations.

The Credit-Debit Method substitutes a rating of three wetland functions and their values for the wetland category to provide a more accurate measure of wetland losses and gains. The method no longer uses area as the "currency" for estimating the adequacy of a mitigation project. It does use area as a factor, but it also includes a score for the rating of a function to define the "currency." This new currency is called "acre-points." The method still uses the type of mitigation, the risk of failure, and the temporal loss of functions as factors in the calculations. The values assigned to these latter factors, however, have been modified slightly from the previous Ecology guidance to reflect the latest scientific information (see discussion in Chapter 3).

This final draft of the Credit-Debit Method has undergone a two-step review process. The operational draft released in February 2011 included peer review and general public review as well as eight months of field testing. This final draft has undergone a year of field testing as well as further review by wetland scientists and wetland experts.

1.3 Process for Selecting a Mitigation Site

Selecting a mitigation site that compensates for the functions and values (now commonly called "ecosystem services") lost at the impact site is a complex process. First, you must identify the functions and values lost at the impact site, then you must try to find a site where those functions can be compensated, and finally you must determine if the mitigation will be feasible and sustainable. Figure 1 provides a graphical representation of the steps that should be taken in selecting an appropriate mitigation site. This method addresses only two of the questions in the process (the two boxes highlighted with a shadow in Figure 1). Figure 1 also includes the web links to other guidance documents published by the Department of Ecology that can help you address the other questions.

Figure 1: The technical questions that need to be addressed when developing wetland compensation projects. Other Department of Ecology guidance documents on the subjects are listed with links to their location on the Ecology web site.

Can impacts to wetlands and their buffers be avoided and minimized?
Guidance on avoidance and minimization
forthcoming

↓

What functions and values will be lost when you alter the wetland?
Credit Debit method – this document

↓

Do you need to replace the specific functions and values lost in the wetland that is altered?
OR,
Should your mitigation restore important functions and values identified in regional or watershed plans?
These questions need to be addressed in discussions with the regulatory agencies on a case by case basis

↓

Choose a possible site for mitigation, then ask: Will the site be sustainable and will mitigation actions improve ecological processes at a watershed scale?

Methods for analyzing landscape processes
http://www.ecy.wa.gov/biblio/1006014.html
http://www.ecy.wa.gov/biblio/0506027.html
Guide for Selecting Sites Using a Watershed Approach
http://www.ecy.wa.gov/biblio/0906032.html

↓

Does the mitigation site have constraints that might prevent you from improving the functions you need to replace?
Guide for Selecting Sites Using a Watershed Approach
http://www.ecy.wa.gov/biblio/0906032.html

↓

Can actions taken at the mitigation site increase functions and values enough to compensate for the functions and values lost?
Credit Debit Method – this document

↓

Develop a mitigation plan for the site

Guide for developing mitigation plans
http://www.ecy.wa.gov/biblio/0606011b.html

1.4 How the Method Works

The forms attached at the end of this document ask the user to collect information about the wetland to be altered and the mitigation site in a step-by-step process. These steps include:

1. Establish a wetland unit for rating impacts to functions (Chapter 4).
2. Classify the wetland unit using the Hydrogeomorphic (HGM) classification (Chapter 5).
3. Rate the functions and values being lost (Chapter 5, and Appendix A).
4. Estimate the amount of mitigation you will need (Debits Worksheet in Appendix E).
5. Choose a possible mitigation site and develop an outline of the actions you propose for creation, re-establishment, rehabilitation, enhancement, and/or preservation.
6. Rate the functions of the mitigation site in the future based on your draft plan (Chapter 5, Appendix A).
7. Estimate the gains in functions through mitigation (Credits Worksheet in Appendix E).
8. Determine if your mitigation will replace the functions and values lost (Summary in Appendix E).

We recommend careful reading of the guidance before filling out the forms. You need to be sure that the correct forms are being used. For this reason, it is important to understand the system used to classify wetlands (see Chapter 5).

Three functions of wetlands are characterized: hydrologic functions, improving water quality, and habitat. Each function is rated based on three aspects of the functions – the site potential, the landscape potential, and the value to society. The final score for a function can range from 3-9 and is based on assigning a score of 1, 2, or 3 to the ratings of high, medium, or low.

1.5 Time Involved

The time necessary to rate the functions of wetlands will vary from as little as fifteen minutes to several hours. Several of the questions on the Scoring Form are best answered by using aerial photographs, topographic maps, other documents, or a combination of these resources with field observations. Filling out the Scoring Form, however, does require a site visit to answer some of the questions that cannot be answered from aerial photographs. In some cases, it may also be necessary to visit the wetland more than once. Some of the questions cannot be answered if the ground is covered with snow or the surface water is frozen. If this is the case at the time a site is being characterized, it may be necessary to revisit the site later.

1.6 Experience Needed to Complete the Form

It is important that the person(s) using the Credit-Debit Method have experience and education in identifying natural features, indicators of wetland function, plants classes, and some ability to distinguish geomorphic differences in the landscape. We recommend that knowledgeable environmental consultants or wetland experts be used to analyze most sites, particularly the larger and more complex ones.

In addition, users of this method should be familiar with the Washington State Wetland Rating system for Western Washington, and have taken the training provided by the Department of Ecology on this method. Most of the data needed to fill out the Scoring Form (>90%) are also found on the form used in the Washington State Wetland Rating System.

Users of this method who have not taken the training on the wetland rating system or this Credit-Debit Method can expect that, **on the average**, their scores for the functions will be off by at least 1 point. This is based on data collected during the calibration of the wetland rating system and subsequent training sessions. Untrained users will underestimate, or over estimate, the amount of mitigation required by 15%. This is an average, and actual differences may be as high as 40%.

CHAPTER 2

Modeling Functions and Values in This Rapid Method

2.1 The Structure of the Method

Rapid methods for analyzing the environment often use data that are both qualitative and quantitative. The analyses may also involve numeric models that in themselves represent qualitative, multi-criteria, decision tools (Hruby 1999). As a result, generating a single score or index for a wetland function requires algorithms (rules that are similar to equations), for combining different characteristics that may not be mathematically compatible. Qualitative data and quantitative data both have to be transformed into ordinal numbers so they can be combined. In the method described here, wetland functions are first scored using ordinal numbers based on three separate aspects of a function (Site Potential, Landscape Potential, and Value). Each aspect is then rated as [H]igh, [M]edium, and [L]ow based on the sum of the ordinal numbers. The ratings are combined using a decision matrix that assigns final scores to each function (see first page of the field form in Appendix A).

The three aspects of functions used to rate it are: 1) the potential of the site to provide each of function, 2) the potential the landscape has to maintain the function at the site scale, and 3) the value each function may have for society at that location. Each aspect of a function is scored, but the score is transformed to a qualitative rating of high, medium, or low. The rating of each aspect is then given equal weight in the final score for that function.

The questions and scoring of the “site potential” used in this method are the same as the “Potential” used in the Washington State Wetland Rating System for Western Washington (Ecology publication #04-06-025). The “opportunity” score from the wetland rating system, however, is not used. Rather, the information once provided by the opportunity score is expanded into two categories. Functions are rated based on their “landscape potential” and the “values” instead of opportunity. These changes provide better information to meet the objectives of this method.

> The numeric models used to characterize functions in rapid methods do not model actual environmental processes but rather are multi-criteria decision models where each indicator represents a decision criterion to describe the level of function (Hruby 1999).

2.2 Wetland Functions and Their Indicators

The functions provided by wetlands derive from the interactions among different components of the ecosystem and the landscape. These interactions are called *environmental processes*. Processes are dynamic and can occur at all geographic scales. Thus the functions performed by a wetland can be influenced by events occurring within the wetland unit as well as in the watershed. For example, the river adjacent to a wetland may be deepened (downcut) as a result of increased runoff from up-gradient development. This changes the effectiveness of the wetland at storing overbank flood waters (a hydrologic function).

Any factor that changes how well, or how much, a function is performed by a wetland can be considered a "control" of that function. Another term often used in the scientific literature is *driver*. The drivers of functions in wetlands determine how well the functions are performed. An event that affects a driver is called a *disturbance* by ecologists (Dale and others. 2000). The type, intensity, and duration of disturbances can significantly change environmental processes (Dale and others 2000), and thereby wetland functions.

Climate, geology, and the topography are major processes in a watershed that control how water, sediment, and nutrients move. These processes, along with factors that occur within the boundary of a wetland, control the functions performed by the wetland. If human activities change these processes in a watershed then the functions in a wetland will also change (Sheldon and others 2005). Any rating of functions at a site, therefore, also requires information about the watershed in which it lies.

The ecological functions that provide value to society fall into three major groups: 1) hydrologic [e.g. flood storage], 2) improving water quality, and 3) habitat and maintaining food webs. Each of these can be sub-divided into separate functions. For example, hydrologic functions may include flood storage, velocity reduction, groundwater recharge, and de-synchronization of flood-flows (Hruby 2001). The Credit-Debit Method characterizes only the three major groups of functions to maintain consistency with the rating system on which it is based (Hruby 2004b).

In "rapid" methods such as this one, functions and values are analyzed by answering a series of questions that note the presence, or make simple measurements, of environmental indicators. Indicators are easily observable characteristics that are correlated with quantitative or qualitative observations of the performance of a function (Hruby 1999, NRC 2002). Most indicators represent relatively stable characteristics that describe the structure of the ecosystem or its physical or geologic properties (Brinson and others 1995). Indicators, unfortunately, cannot reflect actual rates at which functions are performed because rates can change in time. Our knowledge however, "is sufficiently well developed such that indicators can be used as shortcuts to judge whether functions are occurring at appropriate levels" (NRC 2002, p. 120).

2.3 The Values of Functions

The three basic functions rated in the Credit-Debit Method are all considered to be valuable and need to be replaced if lost. The wetland functions that are addressed in the tools developed by Ecology for Washington State are defined as the ecological processes that provide services/values to society (Hruby 2001). This is a subset of the possible functions wetlands perform. There are many ecological processes that are not usually considered of any significant value to society (e.g. providing habitat for Nematode worms or mosquitoes; taking up nitrogen from surface waters but then releasing back into the surface water when plants decompose).

Since all three functions are considered to be valuable, the approach used in the "value" sub-unit of the method is to rate the values relative to other wetlands in the landscape. The value part of the score is intended to highlight those wetlands where a function is more valuable to society because of factors in the surrounding landscape. For example, flood storage is more valuable in a watershed where flooding causes major damage than in a watershed without flooding. A wetland that is moderately effective at cleaning up pollutants is assigned a higher value if it is in a watershed that already does not meet water quality standards. In this case, the wetland removes pollutants that would otherwise further degrade water quality. A wetland that provides habitat for Threatened and Endangered Species (T/E species) is more valuable than one that provides habitat for other wetland dependent species since society has passed laws that give preference and added value to T/E species.

2.4 Calibrating the Indicators

An initial list of indicators identified from a review of the literature was used to develop protocols and data sheets for sampling reference sites. Indicators were divided into three types:

- Those present at the site itself (indicators of site potential).
- Those found in the surrounding landscape (indicators of landscape potential).
- Those that indicate the function performed is providing some value to society (indicators of value).

Data on each indicator were collected at a minimum of 20 sites for each Hydrogeomorphic Class of wetlands in western Washington. Sites were chosen to represent the widest possible range of environmental conditions found in the class. Data on some of the indicators could be collected from aerial color photographs, but all of this information was verified by at least one visit to each site.

The calibration process involved the following steps:

1. Deletion of indicators that could not be readily estimated from aerial photographs or during a brief field visit (< 3hrs). This represents a compromise between the science and the needs of the user. Some important indicators of function could not be used because they could not be measured within the time allocated, or could not

be collected with reproducible results by the majority of environmental scientists. For example, the organic or clay contents of wetland soils are an important indicator of chemical processes that improve water quality (Rosenblatt and others 2001, NRC 2002), but these cannot be readily measured in the field. The indicators of organic and clay soils therefore had to be simplified. Users are asked to determine if organic soils or clay soils are present in the unit based on the mapping done by the National Resource Conservation Service (NRCS). If it is not mapped, users are asked to perform one simple field test to determine if the soil meets the NRCS criteria. If the organic or clay content does not meet the percent needed to classify it as an organic soil or clay soil, the unit is considered not to have the indicator. In this case, the reproducibility of the data collection among different users was judged to be more important than achieving additional scientific rigor by scaling the amount of organic or clay material in the soil.

2. Reviewing the literature on wetland indicators, and determining what aspect of the indicators represent the high and low levels of functioning.

3. The data for each indicator collected at the reference sites are then sorted based on the values representing the highest level of function to the lowest in the reference wetlands. This ranking of data generates a distribution that is used to help determine where the breaks in the scoring should occur. The final decisions on scoring, however, were developed from graphical analyses of the distribution of scores of all sites. The goal was to ensure a relatively even distribution of ratings among the calibration sites. Although statistical methods are being developed for multi-criteria decision models (e.g. Ferguson and others 2007, Fuller and others 2008), these methods are not yet applicable to a categorization that incorporates values, special characteristics, as well as quantitative indicators.

4. Developing an independent, and qualitative, assessment of how well a wetland performs a function and then calibrating the scores of the indicators to get the best fit to the independent assessment. The calibration involved alternatively changing the scoring for each indicator and the scaling within an indicator to get the best fit to the independent assessment.

Further details on the approach used to calibrate the rapid assessment methods developed by Ecology can be found in Hruby and others (1999), Hruby (2001), and Hruby (2009).

CHAPTER 3

Estimating the Adequacy of Wetland Mitigation

Sites for mitigation in western Washington should be chosen using the latest guide from the Department of Ecology, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. As of February 2012, this is *Selecting Wetland Mitigation Sites Using a Watershed Approach* (Ecology publication #09-06-032 http://www.ecy.wa.gov/biblio/0906032.html).

The adequacy of a mitigation project is estimated by filling out worksheets that score the functions and values of the wetland being impacted (called debits) and then score the increase in functions that result from activities described in the mitigation plan (called credits). Appendix A has the worksheets for scoring the functions at both the impact and mitigation sites. Appendix E has worksheets for calculating the debits and credits for these functions. A project is usually deemed adequate when the "credit" scores for the three functions are higher than the "debit" scores for these same functions. The calculations, however, are not intended to represent an exact measure of loss or gain in functions. Even though the method uses numbers, it depends on qualitative ratings of the level of functions that were developed through a formal decision making process described in Hruby (1999, 2001).

The worksheets in this method are intended to establish a clear, understandable, and consistent method for determining if a mitigation project will replace the functions and values lost when a wetland is altered. **However, nothing in this method should be interpreted as a promise or guarantee that a project which satisfies the guidelines given herein will be assured of approval.** Also, the method does not change any requirements given in the 404(b)(1) Guidelines or other applicable regulations regarding avoidance, sequencing, minimization, etc. Such requirements need to be addressed independently of this method.

> **NOTE**: The Credit-Debit Method should not be used in developing design criteria for a mitigation plan because it does not provide enough detail. For guidance on developing mitigation plans please see Ecology's guide on this subject: (Ecology publication # 06-06-011b, http://www.ecy.wa.gov/biblio/0606011b.html).

The Credit-Debit Method is **not** appropriate for:

- Projects planning to use a wetland mitigation bank, unless the method is specified in the mitigation banking instrument for the bank.
- Wetlands that meet any of the criteria listed in the "Special Characteristics" section of the rating systems for western Washington. Mitigation for wetlands with Special Characteristics needs to be addressed on a case-by-case basis.
- Addressing impacts to societal values (e.g., historic, cultural, aesthetic) that may need to be mitigated in addition to the environmental functions.

3. 1 Information Needed When Using the Method

You will need the following information to determine if the compensatory mitigation you are planning is adequate to replace the functions and values lost at the impact site.

1. Mitigation Plan

You will need a draft mitigation plan that provides enough detail to properly fill out the worksheets and estimate the mitigation credits available. The plan should be prepared according to the guidance developed by Ecology, the US Army Corps of Engineers (Corps), and US Environmental Protection Agency (EPA) for Washington State (Ecology publication #06-06-011b, http://www.ecy.wa.gov/biblio/0606011b.html).

2. Score for Loss of Functions at Impact site

You will need to score the functions of the wetland being altered before the impacts are sustained using the Scoring Form described in Chapter 5. **The scoring has to be based on a "wetland unit" as defined in Chapter 4**. The method is not scientifically valid if you score only the area that will sustain the impacts (impact area). You will however calculate the amount of mitigation needed based only on the area of the wetland being altered.

3. Score for the Gain in Functions Resulting from Mitigation

You will need to score the functions of the site proposed for the mitigation using the same method. Use the information in the draft mitigation plan to estimate what the indicators of function would be when all the goals for the mitigation site have been achieved. If the proposed mitigation site is already a wetland (e.g. you are doing re-habilitation or enhancement) you will need to score the functions for the existing conditions as well. In the latter case, the scoring again has to be based on a "wetland unit" as defined in Chapter 4.

Two calculations are needed; one to quantify the amount of impact sustained, and one to quantify the amount of mitigation proposed. These are called the Debits and Credits. The "currency" for the transaction is a number called an "acre-point." It represents a score for a rating of wetland function assigned to one acre. The size of the impact or proposed mitigation is multiplied by the score for a function to determine how many acre-points are needed. For example, a wetland may score 7 points for habitat functions on the Scoring

Form. If the footprint of the impact is 0.5 acres, the amount of mitigation required is 3.5 acre-points of the habitat function.

Debits: Debits are the amount of mitigation, in acre-points, needed to replace the functions lost at the impact site. The debits are based on the existing condition of the wetland before the impact. For example, if a wetland is to be impacted by filling, then the debits shall be calculated based on the existing, unfilled, condition.

You will be calculating three separate values for debits: one for each of the three functions (improving water quality, hydrologic function, and habitat functions).

Credits: The increase in functions, measured in acre-points, that results from the activities at the mitigation site. The credits are calculated based on the conditions in the wetland expected at the time when all structural and hydrologic elements proposed in the plan have reached maturity. If different types of mitigation are proposed for different areas of a site, then each such area will need a separate calculation of credits (see Section 3.3). For example, the creation of an emergent marsh in one area and the enhancement of a forest community in another will require separate calculations. The credits are then totaled to calculate the overall credits generated by the mitigation plan. In addition, if mitigation is proposed for different sites, then a worksheet should be prepared for each site and the credits for each function added together to determine if the mitigation is adequate.

You will be calculating three separate values for credits: one for each of the three functions (improving water quality, hydrologic functions, and habitat functions).

A mitigation plan is deemed adequate for replacing the functions lost when the credits that will be generated through the mitigation are at least as large as the debits resulting from the impact **for each of the three functions individually.** Thus,

Credits - improving water quality ≥ Debits - improving water quality

Credits - hydrologic function ≥ Debits - hydrologic function

Credits - habitat function ≥ Debits - habitat function

NOTE: It is not always necessary to replace all three functions at one site. In some cases, especially in urbanizing areas, a mitigation plan that replaces hydrologic and water quality functions nearby and the habitat functions in another hydrologic unit might be more sustainable.

NOTE: It may be possible to negotiate an exchange of functions where excess credits for one function are used to balance a lack of credits for another function. This may be appropriate in areas where a watershed plan or watershed analysis has indicated there is a higher need for restoring one function over another, or where other data exist showing one function is more important than another.

4. Maps and aerial photographs

Some of the information required to rate the functions can be obtained from aerial photographs. We suggest you print out aerial photos of both the impact and mitigation sites for mapping the information required in the Scoring Form.

The amount of mitigation required (debits) and the amount of mitigation achieved (credits) depends on the types of plants at both the impacted site and the mitigation site. It is important therefore to map the Cowardin plant classes within the wetland being impacted and at the mitigation site. Use the procedures for mapping Cowardin classes that are described in Section 5.2.

You will also need to map separately the areas that will be created or re-established from those that will be rehabilitated or enhanced. Credits will be calculated separately for each type of mitigation.

3.2 Calculating Losses in Functions and Values (Debit Worksheet)

Use the Wetland Scoring Form in Appendix A to determine the scores for each function in the wetland being altered or filled. **The scores need to be determined for the entire wetland unit.** Chapter 4 describes how to establish a wetland unit. The procedures for collecting the data needed to fill out the Scoring Form are described in Chapter 5. Finally, transfer the ratings and scores from the first page of the scoring sheet to the Debit Worksheet.

Temporal Loss Factors

Scientific studies have shown that it will take decades if not centuries to fully replace the functions lost at an impact site even if the mitigation is started concurrently with the impacts (reviewed in Sheldon and others 2005). If functions are replaced only to the level present at the impact site there will be a net loss of functions for the project (Figure 2).

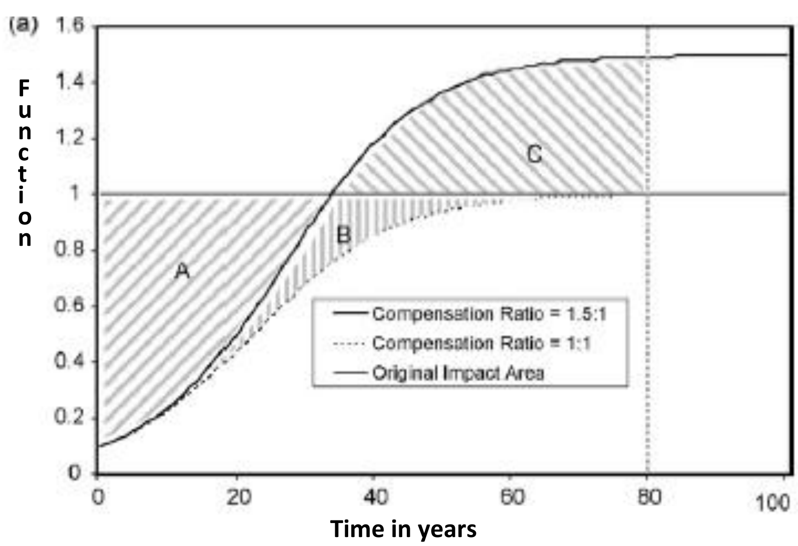


Figure 2 (from Bendor 2009): A hypothetical graph showing temporal loss of functions for two mitigation scenarios. If functions are replaced only on a one for one basis there is a net loss of functions (area A+B on the graph). A "no net loss" of functions is achieved only when Area A on the graph is equal to or smaller than Area C on the graph.

Regulators often require compensation for such temporal losses in functions by increasing the size of the mitigation needed (Bendor 2009). This is known as the "mitigation ratio," which is currently defined as the ratio of the area of mitigation required to the area of wetland impacted (Figure 2).

Previous Department of Ecology guidance (Granger and others 2005) recommends a ratio of 1.5:1 to account for the temporal losses in functions to emergent and shrub wetlands. The ratio is 2.2:1 for forested wetlands. These ratios are based on area only, not functions. There have been suggestions that such ratios are too low (Bendor 2009), but the ones recommended by Ecology were used as the starting point in developing the temporal loss factors (ratios) in this method.

The temporal loss of functions is included in the calculations of Debits since it represents an impact on the wetland resource and is not related to the type of mitigation being proposed. The temporal loss factors in the worksheet are further refined by the plant community being altered. Forests, especially evergreen forests, take longer to mature and so the functions they support will take longer to become established. As a result, the temporal loss factor is larger for evergreen forests than for deciduous forests, and the loss factor is higher for forests than for emergent or shrub communities.

If a mitigation project is done in advance of an impact we can assume the overall temporal losses will be reduced. Some of the functions, such as the hydrologic ones, can be established fairly early in the evolution of a mitigation site. Thus, the temporal loss factor is set at 1.25:1 for advance mitigation rather than 1.5:1.

On the other hand, if a mitigation project is delayed, and impacts are incurred before a mitigation project is installed, there is an increase in the temporal losses. Thus, the temporal loss factor is increased for projects that are delayed. To avoid a higher temporal loss factor, the physical alterations at the mitigation site have to be completed within one year of the impacts. The plantings, however, may be delayed by up to two years, if needed to optimize conditions for success. Construction that is not completed in this time frame has a higher temporal loss factor. A dynamic modeling of temporal losses in functions has indicated that delays of more than 10 years will always result in a net loss and cannot be corrected by increasing the ratios - even to 100:1 or higher (Bendor 2009).

> **NOTE:** The ratings, scoring and calculations are valid for only five years because wetlands and their functions will change with time. If delays in the construction of the site are more than 5 years the mitigation plan will probably have to be re-negotiated and the calculation re-done. This time limit was chosen to be consistent with time that the U.S. Army Corps of Engineer considers delineations to be valid.

> **NOTE:** In general it may take decades or more for mitigation sites to develop to the point where they fully perform ecological functions. The hydrologic functions of depressional wetlands, however, can sometimes be created or restored to the proposed levels as soon as the project is constructed. In this wetland class, the function depends mostly on the amount of storage in the unit and the characteristics of its outlet. These are characteristics of a depressional wetland that can be established at the time of

construction. It may be possible to negotiate a lower temporal loss factor for the hydrologic functions on a case-by-case basis. In this case you will need to demonstrate how the hydrologic functions will be restored at the time of construction. Factors that need to be discussed include, but are not limited to:

1. The predicted water levels in the depressional wetland relative to the outlet elevations.
2. Detailed contours (elevations) of the proposed mitigation site.
3. Evidence that excavations will not pierce aquitards that could drain the wetland.

A reduction in the temporal loss factor for the hydrologic functions, however, is generally not appropriate for riverine, lake-fringe, or slope wetlands. The hydrologic functions in these HGM classes partially depend on the structure of the plant community, and this can take several years to develop.

Temporary Impacts

Some impacts to wetlands can be considered temporary. An activity in a wetland may impact the functions for a time, but the functions can be re-established on site. Examples include laying pipelines or power lines through wetlands. The Army Corps of Engineers, the U.S. Environmental Protection Agency, and Ecology divide temporary impacts into two categories: those that can be considered short-term and those that are long-term. The definitions below are based on those from the interagency guide *Wetland Mitigation in Washington State: Part 1: Agency Policies and Guidance* (Ecology publication #06-06-011a).

Short-term temporary impacts last for a limited time. In general, an impact is considered short-term if the functions return to pre-impact levels within one year or one growing season of the impact. For example, cutting emergent vegetation without damaging the soil structure is a short-term impact. The emergent vegetation that is cut will usually return within one growing season if the disturbance is not severe. Cutting shrub species that are fast growing, such as willow, may also be considered as short-term temporary impacts. The cutting of forests that take decades to grow, however, is not considered short-term. Compensatory mitigation is often not required for short-term temporary impacts.

Long-term temporary impacts last for more than one year but the loss of functions will eventually be restored over time. Long-term temporary impacts or alterations also carry a risk of permanent loss if the ecosystem is changed. Examples include soils that are compacted by equipment, deep excavation, or pipeline trenches that alter the water regime. Clearing a forested wetland for a temporary access road changes the plant community and degrades functions, such as song bird habitat provided by the tree canopy. It will take many years for a forest to grow back and re-establish the previous level of function.

Long-term temporary impacts should be rated and scored as if they were permanent impacts with the mitigation occurring within the footprint of the impact. The mitigation is then considered as re-establishment in an area where wetland functions were absent for a time. If all the functions at the site are re-established to their previous levels, the mitigation site would have the same scores as the site before the impacts. The only additional mitigation needed would be to compensate for the temporal loss of functions and for the potential risk the re-establishment would fail. Risk is part of the credit calculations in the next section.

NOTE: Some sites used for new pipelines or power lines can never be fully "restored" to their previous condition because the vegetation may need to be cut or mowed on a regular basis to provide access for service. In this case, the future condition of the re-established site can only be scored based on its "mowed" or "cut" condition. Score the indicators on the form based on a description of the conditions at the site when it is mowed or cut.

NOTE: Some long-term temporary impacts may change the water regime to the extent that the Hydrogeomorphic class of the wetland will change. For example, a pipeline through a slope wetland may create a raised berm that impounds water and changes the wetland to a depressional one. In this case, the future condition of the site should be scored and rated based on what the HGM class will be in the future.

NOTE: Some long-term temporary impacts to highly degraded wetlands may be successfully mitigated within the original footprint of the impact. All the temporal losses of functions and risks of failure could be addressed by improving the functions of the impact site beyond what they were before the impact.

3.3 Calculating Gains in Functions and Values Proposed Through Mitigation (Credit Worksheet)

The increases in wetland functions and values that result from mitigation activities are calculated the same way as the Debits. If a project establishes a wetland from an upland (also known as creation), or re-establishes a wetland, then it is assumed that the mitigation site had no wetland functions to start. You calculate credits assuming all functions score [0] in the beginning. If the mitigation includes an existing wetland (rehabilitation or enhancement), the credits will be based on the difference between the current scores for the wetland unit and the future scores. This is often called the "Lift" in functions. The four types of mitigation activities are defined in the box below.

Definitions of Mitigation Activities

Establishment (Creation). The manipulation of the physical, chemical, or biological characteristics present to develop a wetland on an upland or deepwater site, where a wetland did not previously exist. Establishment results in a gain in wetland acreage and function. (**NOTE**: The U.S. Army Corps of Engineers' Regulatory Guidance Letter 02-02 uses the term "establishment" rather than the previously accepted term "creation." Federal agencies, as well as the Department of Ecology, have started using the term "establishment.")

Re-establishment. The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former wetland. Activities could include removing fill material, plugging ditches or breaking drain tiles.
Re-establishment results in a gain in wetland acres and functions.

Enhancement. The manipulation of the physical, chemical, or biological characteristics of a wetland site to heighten, intensify or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for specified purposes such as water quality improvement, flood water retention or wildlife habitat. Activities typically consist of planting vegetation, controlling non-native or invasive species, modifying site elevations or the proportion of open water to influence hydroperiods, or some combination of these. Enhancement results in a change in some wetland functions and can lead to a decline in other wetland functions, but does not result in a gain in wetland acres.

Rehabilitation. The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions and processes of a degraded wetland. Activities could involve breaching a dike to reconnect wetlands to a floodplain, restoring tidal influence to a wetland, or breaking drain tiles and plugging drainage ditches. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

Use the Scoring Form in Appendix A to determine the scores for each of the three functions before the mitigation project is started, and for the time when the site has matured. Use the information in the draft mitigation plan to estimate what the indicators of function would be when the site has met its goals for water regime, physical structure, plant communities and soils.

Risk Factors

All studies of compensatory mitigation reviewed by Ecology (Sheldon and others 2005) and the National Academy of Sciences (NRC 2002) indicated that many mitigation projects have not been successful at replacing the functions lost through impacts. The studies prior to 2005 showed that about one-half of the mitigation projects involving re-establishment and re-habilitation failed. The failure rate was even worse for enhancement (reviewed in Sheldon and others 2005). As a result, the risk of a failure became a factor in the calculation of how much mitigation is needed. Generally, the risk of failure was compensated by increasing the area of mitigation required (the mitigation ratio) (NRC 2002).

Based on these early studies of the success of mitigation, the Department of Ecology recommended a ratio of 2:1 (based on acreage) to account for the chance that half of the projects would fail (Granger and others 2005). For example, two acres of mitigation were required for every acre of impacts to wetlands to account for the risk of failure. In the Credit-Debit Method we reduce the credits available through mitigation by a "risk factor" rather than asking for an increase in area. This requires a different approach to the calculations. The risk of failure is addressed by multiplying the credits by a number less than one. For example, the original mitigation ratio of 2:1 would be equivalent to a risk factor of 0.5. The credits available through mitigation would be multiplied by 0.5. This means that the increase in functions at the mitigation site has to be twice that of the functions lost to account for risk. Instead of saying that the area of mitigation has to be twice the area of the impacts, we are saying that the increase in functions has to be twice the level of functions lost at the impact site.

Recent data, however, suggests that mitigation has improved, and the risk of failure is less than 50% for replacing functions, and especially for replacing wetland area (Balcombe 2003 – 11 out of 11 mitigation sites successfully replaced habitat functions; Kettlewell and others 2008 - 22% loss of area in 22 sites but some differences in structure and functions; Reiss and others 2009 - 17% rate of complete failure to replace functions in 29 sites; Gutrich and others 2009 - no percentages, but conclusion was that most sites were "relatively successful"). Based on these results, the factor to account for the risk of failure has been reduced in the calculations of how much mitigation is required. Instead of requiring a 2:1 ratio in functions (functions increased through mitigation/functions lost), the ratio has been decreased to 1.5:1.

The calculations used in the Credit-Debit Method start with the gain in functions in a project assuming there is no risk of failure. This basic credit score is then reduced by the "risk factor" to reflect different levels of risk. This requires that the previous mathematical approach be reversed. Rather than calculating mitigation needs by multiplying the “impact” by a factor larger than one, we calculate the adequacy of the mitigation by multiplying the “mitigation” by a factor smaller than one (see example in box below). This approach was necessary because the method is now based on functions rather than area. A mitigation site may provide different levels of increased functions as well as different levels of risk. The approach to the calculations used here makes it easier to determine up front if a mitigation project will replace the functions lost.

Example of how ratios were used to establish risk factors

Example:

- Impact = 10 acre-points to hydrologic functions (2 acres of impact to a wetland with a score of [5] for the hydrologic function)
- If we assume a 75% success rate, the basic mitigation ratio to account for risk of failure is 1.5 to 1. This means mitigation has to provide 10 x 1.5 = 15 acre-points of hydrologic functions to compensate for the 10 acre-points of impacts.

The calculations of risk in this method use the credits provided by the mitigation site rather than the debits incurred at the impact site. The risk needs be on the credit side of the equation because it is the mitigation that is risky, not the impact. If impacts are not multiplied by a risk factor, the credits need to be multiplied by 0.67 to balance the equation. Assume that the mitigation site provides 15 acre-points of hydrologic functions. We calculate: 15 x 0.67 = 10 acre-points. Thus, mitigation adequately replaces hydrologic functions since 10 acre-points were needed.

As a starting point, the basic credits achieved through mitigation are reduced by a risk factor of 0.67 (representing a ratio of 1.5:1) instead of 0.5 (representing a ratio of 2:1).

The risk factor can be further reduced in certain cases. Specifically:

- “If a mitigation project is completed in “advance” and meets the criteria in Ecology’s guide for selecting mitigation sites using a watershed approach (Ecology publication #09-06-032) the risk factor is [1.0]. We assume there is little risk of failure and the gains in functions are not discounted. “Advance” mitigation is currently defined in guidance as “At least two years has passed since plantings were completed or one year since “as-built” plans were submitted to regulatory agencies” before impacts are incurred.

- If a mitigation project is completed in advance, but does not meet the criteria in the guide for selecting mitigation sites, the risk ratio is increased to 1:2 to 1. This means the risk factor in the calculation is 0.83

- Concurrent mitigation in which the sites meet criteria in Charts 1 and 3 and the appropriate charts in Charts 4-11 of the Site Selection Guide (Ecology publication #09-06-032) are considered to have a lower risk of failure than the “average” project. We assume that sites identified in watershed plans will be more successful because larger scale environmental processes are taken into account. Furthermore, a watershed plan usually includes analyses of the potential success of different sites chosen for restoration. Such sites are given a risk factor of [0.9]. This is equal to a risk ratio of 1.11:1 instead of 1.5:1. There is still a risk of failure, but it is considered to be less than that of projects whose sites have not undergone a larger scale analysis. *To qualify for this risk factor you will need to submit the answers to the questions in Chart 3 of the guide and fill out the worksheets in Appendix B of the site selection guide.*

- In the absence of a formal watershed plan, you may wish to do your own analysis of the watershed using principles outlined in Chart 2 of the Site Selection Guide (Ecology publication #09-06-032). If this analysis is presented in the mitigation plan and the site also meets the appropriate criteria in Charts 4 – 11 in the guide, the risk factor is [0.80]. This is equal to a risk ratio of 1.25:1 instead of 1.5:1. *To qualify for this risk factor you will need to submit the answers to the questions in Chart 3 of the guide and fill out the worksheets in Appendix B of the Site Selection Guide.*

The experience with mitigation, however, has also shown that certain types of projects have a higher risk of failure when the watershed and landscape processes have not been analyzed. Thus, the risk factor is increased for certain types of projects when no watershed analyses have been done. Specifically:

- Establishing a wetland dominated by herbaceous plants is usually less successful than one dominated by shrubs and trees. The problem lies with the difficulty in controlling aggressive herbaceous plants such as reed canarygrass (Hovick and Reinartz 2007, Wilcox and others 2007). Projects whose goal is to develop an herbaceous plant community are assigned a higher risk than the average. The risk factor is "increased" to 0.5 for sites where no landscape or watershed analyses have been done. This is equal to a risk ratio of 2:1 instead of the basic 1.5:1.

- Creating a wetland from upland often has a higher risk of failure because it is more difficult to create a water regime appropriate for a wetland than to restore one (Hunt 1996). Creation projects that do not provide data to show the water regime is adequate for maintaining a wetland are assigned a "higher" risk factor [0.5 instead of 0.67]. To avoid the higher risk factor proponents of creation need to provide (at a minimum) the following analyses:
    - Proof that excavations will not break through confining layers that keep water near the surface.
    - There is enough water to account for evapotranspiration of the plant community but not too much to flood the entire area.
    - They have the water rights necessary for the water losses through evapotranspiration and infiltration (if surface water is the source).

Preservation

Preservation is a tool used for mitigation even though it does not replace the actual functions or area lost. Preservation is important at a societal level because there is currently no way to continue economic growth or population growth without some type of environmental impacts. Preservation is one way to limit the impact of continued growth on the environment (Semlitsch 2008). Preservation is given mitigation credits based on a number of different factors that include the type of wetland or upland being protected, proximity to the site being altered, and the degree of threat present at the site.

For a wetland, you will need to rate its functions using the Scoring Form in Appendix A and determine its Category using the Washington State Wetland Rating System. In addition, the credits for preserving a Category II wetland can be increased if there are disturbances to the wetland that can be removed or reduced.

Criteria used to determine the credits that can be achieved through preservation of uplands are:

- Its value as habitat based on criteria used by the Department of Fish and Wildlife and the Department of Natural Resources-Natural Heritage Program.
- Location relative to the "impact" site.
- Degree of threat from human activities.

> The hydrologic and water quality functions that uplands provide are not directly comparable to those provided by wetlands, and we do not have methods for rating them. Habitat for wildlife and plants are the only functions that are marginally comparable. **As a result, credits from the preservation of uplands can only be used to compensate for impacts to the habitat functions.** Upland areas are assigned a "habitat" score for the purpose of calculating the credits available through preservation.

The Department of Ecology does not have specific guidance on ratios for preservation. As a result, the scaling factors used to calculate credits are derived from the conclusions of the multi-agency team (WSPI) assembled by the Washington State Department of Transportation (WSDOT 1999). Although it is not possible to correlate the ratios in the WSDOT report directly to those used in this method, the low range of possible ratios falls within the range reported in Table 1, of the report (WSDOT 1999). The factors for preservation are scaled so the basic ratio (assuming area is the only criterion) is approximately 4:1 for the preservation of the highest quality wetland under direct threat.

Rather than ratios, the calculations again use scaling factors that are less than one. This maintains consistency with the other credit calculations.

In addition, the best ratios for preservation apply only if the mitigation project includes the creation or re-establishment of wetland area that is equal to the area lost. If wetland area is not replaced acre for acre, the scaling factors are reduced by ½. This represents an increase in the ratio by a factor of 2. This increase represents a policy decision to compensate for the net loss of wetland area that results when an equal area of wetland is not created or re-established. Thus, one would have to preserve approximately 4 acres of the highest scoring wetland (Category I under direct threat) to replace 1 acre of impacts to a Category III wetland if an equal area is created or re-established, and 8 acres of wetland preservation if the wetland area is not adequately replaced.

Certain wetlands and uplands may not be suitable for preservation. Less suitable sites are given low scaling factors that are equal to very high ratios which can exceed 100:1 by area. Some sites might even score a negative "credit" indicating they are completely unsuitable for preservation.

CHAPTER 4

Identifying Wetland Boundaries for Rating

To begin, determine the location and approximate boundaries of all wetlands at the site you are investigating. A surveyed delineation of the wetland, however, is not necessary to complete data collection, unless this information is required for another part of your project. The boundary, however, will need to be verified in the field. Boundaries that are not verified by a field survey may cause problems in the scoring of the indicators. This is especially true in forested wetlands where the boundaries are difficult to determine from aerial photographs.

It is also highly recommended that you obtain aerial photos of the site. The field form identifies the information that needs to be included on aerial photos or maps and submitted with the form.

The entire wetland unit has to be scored. Usually it is the entire delineated wetland that is scored. Small areas within a wetland unit (such as the footprint of an impact) cannot be rated separately. The method is not sensitive enough, or complex enough, to allow division of a wetland unit into smaller units based on level of disturbance, property lines, or plant communities. DO NOT SCORE ONLY THE PART BEING ALTERED OR MITIGATED.

Furthermore, you do not subdivide a wetland unit into different hydrogeomorphic classes if more than one is present. A wetland unit with several wetland classes within its boundary is treated as one class. The second page of the classification key in Appendix A provides guidance on how to classify wetlands having several HGM classes within its boundary.

There are, however, ecological criteria that can be used to separate very large wetlands into smaller units for scoring. These criteria are described below.

If you do not have access to the entire unit you should do the best you can to answer the questions from aerial photos, using binoculars, or any other additional information. Note your lack of access on the data form and record which questions are based on incomplete data.

The rating of an entire wetland unit rather than just the part of it being mitigated or impacted is a trade-off made between scientific rigor and the need for a "rapid" method. None of the rapid methods developed by Ecology (the rating systems and function assessment methods) are rigorous enough to adequately assess the functions of only a small area within a wetland unit. We did numerous tests of this question, and both methods gave us invalid results when applied to small areas within a wetland. More detailed data are needed to adequately assess functions in only a part of a wetland unit. This would require monitoring and measuring the actual processes taking place in different parts of a wetland rather than characterizing the structural indicators present, and will certainly require monthly sampling for at least one year.

4.1 Identifying Boundaries of Large Contiguous Wetlands in Valleys (Depressional and Riverine)

Wetlands can often form large contiguous areas that extend over hundreds of acres. This is especially true in river valleys where there is some surface water connection between all areas of the floodplain. In these situations the initial task is to identify the wetland "unit" that will be rated. A large contiguous area of wetland can be divided into smaller units using the criteria described below.

The guiding principles for separating a wetland in a valley into different units are the changes in the water regime or a lack of wetland plants. Boundaries between different units should be set at the point where the volume, flow, or velocity of the water changes abruptly. These changes in water regime can be either natural or human-made (anthropogenic). The following sections describe some common situations that might occur. The criteria for separating wetlands into different units are based on the observations made during the calibration of the rating systems and the methods for assessing wetland functions. They reflect the collective judgment of the teams of wetland experts that developed and calibrated the methods.

Examples of Changes in Water Regime

- Berms, dikes, cascades, rapids, falls, and culverts.
- Features that change flow, volume, or velocity of water over short distances.
- The presence of drainage ditches that significantly reduce water detention in one area of a wetland.

Wetlands in a Series of Depressions in a Valley

Wetlands that form ponded depressions in river corridors may contain constrictions where the wetland narrows between two or more depressions. The key consideration is the direction of flow through the constriction. If the water moves back and forth freely it is **not** a separate unit. If the flow between depressions is unidirectional, down-gradient, and has a change in elevation from one part to the other, then a separate unit should be created. The justification for separating wetlands increases as the flow between two areas becomes more unidirectional and has a higher velocity. Constrictions can be natural or man-made (e.g. culverts) (Figure 3). Generally, if the high water mark in the lower wetland is 6 inches or more lower than the high water mark in the upper wetland, then the two should be considered as separate units for rating.

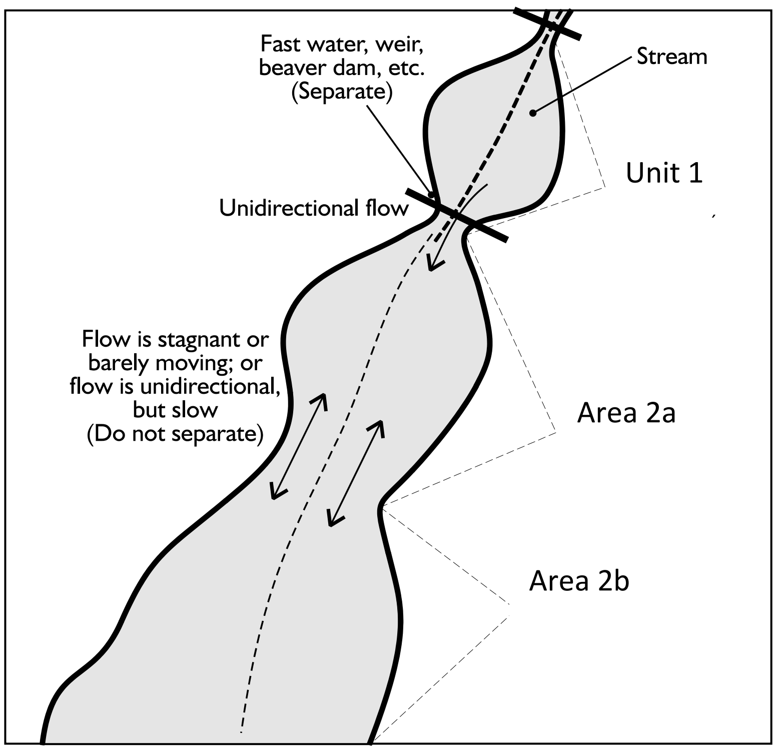


Figure 3: Determining depressional wetland units along a stream corridor with constrictions. Areas 2a and 2b should be rated as one unit.

Wetlands along the banks of streams or rivers

In western Washington, linear wetlands contiguous with a stream or river may be broken into units using criteria based on either hydrologic factors or the distribution plants. Figure 4 presents a diagram of how wetland units might be separated along a stream corridor based on change in the water regime. Three changes in water regime are illustrated: 1) a weir or dam, 2) a series of rapids, and 3) a tributary coming into the main stream that increases the flow significantly (generally > 25%).

NOTE: Unit 1 in Figure 4 should be classified as a depressional wetland. Units 2, 3, and 4 would probably be riverine or slope, depending on the area of overbank flooding.

Figure 5 illustrates how units can be separated based on the distribution of plants. Units can be separated when: 1) plants disappear and are replaced with unvegetated bars or banks for at least 50 ft along the stream, and 2) the wetland plant community is less than 30 ft wide along the shore for at least 100 feet.

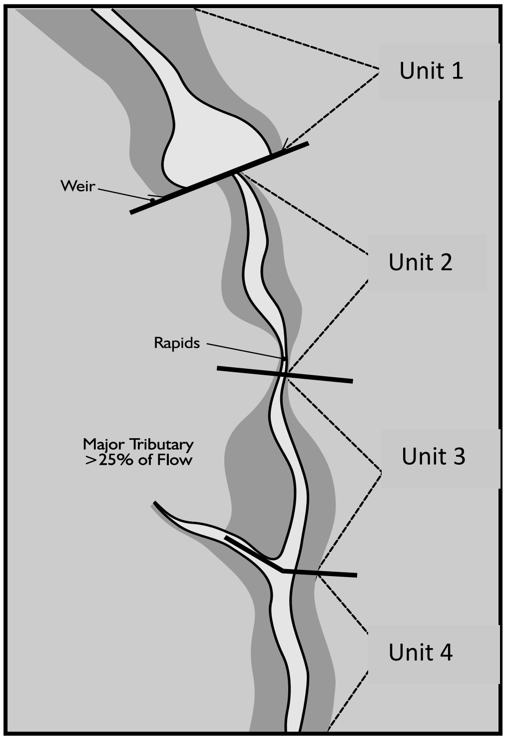


Figure 4: Determining wetland units in a riverine system based on changes in water regime.

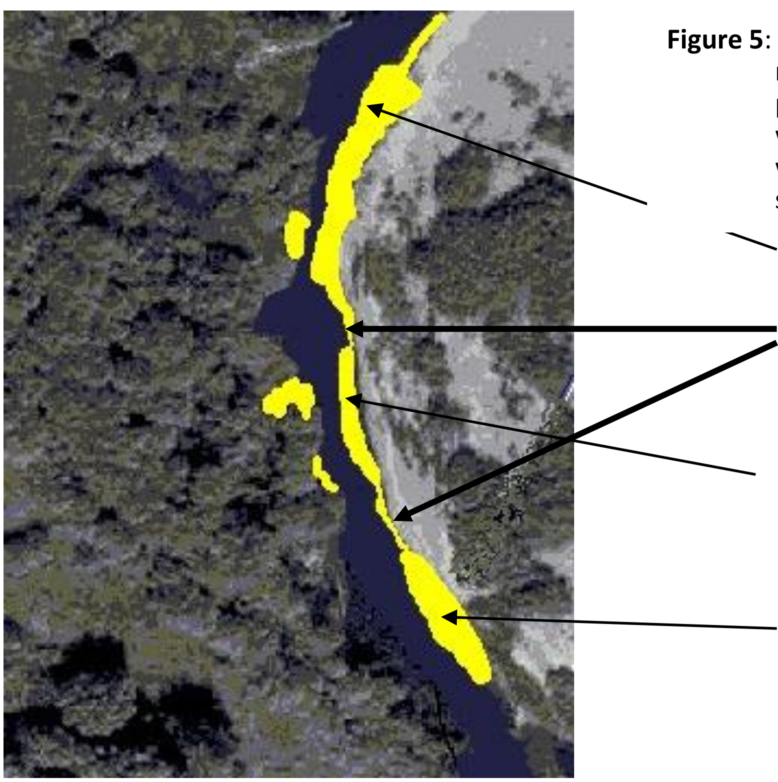


Figure 5: Determining wetland units in a riverine setting based on reduced plant cover. In this case the river is wider than 50ft. and the vegetated wetlands on either side are rated separately.

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

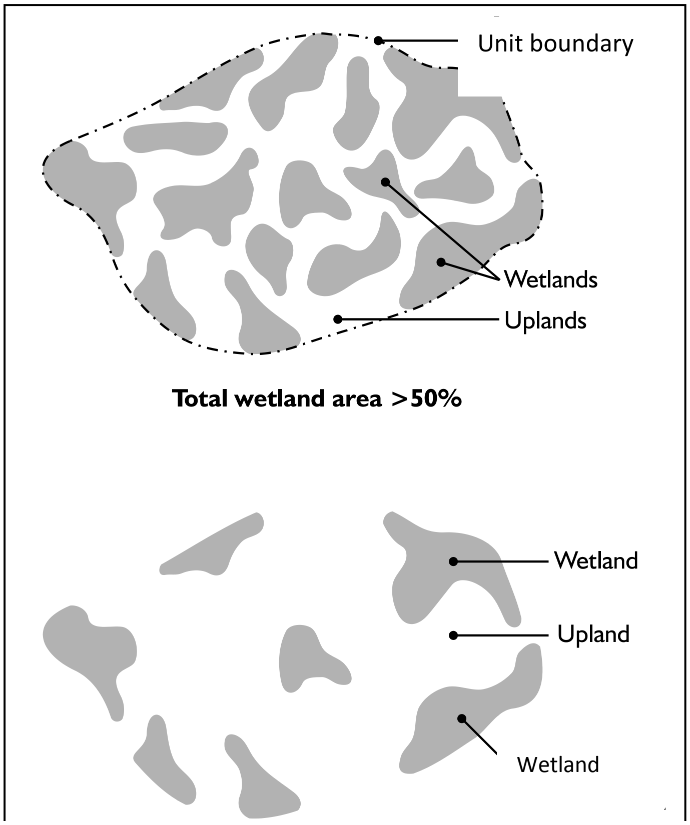
- Wetland on one side only — If the wetland area is contiguous to, but only on one side of, a river or stream, **do not** include the river as a characteristic of the wetland unit for rating.
- Wetland on both sides of a wide stream or river — If the river or stream has an unvegetated channel that is more than 50 ft (15 m) wide, and there are contiguous wetland areas on both sides, treat **each side as a separate unit** for rating. **Do not** include the river as a characteristic of the wetland unit for rating.
- Wetland on both sides of a narrow river or stream — If the river or stream has an unvegetated channel less than 50 ft (15 m) wide, and there are contiguous vegetated wetlands on both sides, treat **both sides together** as one unit, and **include** the river as a characteristic of the wetland.

4.2 Identifying Wetlands in a Patchwork on the Landscape (Mosaic)

If the wetland area being scored contains a mosaic of wetlands and uplands, the entire mosaic **should be considered one unit** when:

- Each patch of wetland is less than 1 acre (0.4 hectares), AND
- Each patch is less than 100 ft (30 m) away from the nearest wetland, AND
- The total area delineated as vegetated wetland is more than 50% of the total area of wetlands and uplands, open water, and river bars around which you can draw a polygon (see Figure 6), AND
- There are at least three patches of wetland that meet the size and distance thresholds.

If these criteria are not met, each wetland area should be considered as a separate unit for this method (see Figure 6).



Total wetland area < 50% of polygon – each wetland is a separate unit

Figure 6: Determining unit boundaries when wetlands are in small patches. Each wetland polygon should be scored separately when the total area is less than 50% wetland.

4.3 Identifying Unit Boundaries Along the Shores of Lakes or Reservoirs (Lake-fringe Wetlands Only)

Lakes or reservoirs will often have a fringe of wetland plants along their shores. Different areas of this vegetated fringe can be separated into different units if there are gaps where the width of plants narrows or they disappear completely. Use the following criteria for separating units along a lakeshore.

Only the vegetated areas along the lake shore are considered part of the wetland unit for rating. Open water within areas of plants are considered to be part of the wetland, but open water that separates patches of plants along a shore is not considered to be part of the wetland (Figure 7).

If only some parts of the lakeshore are vegetated with wetland plants, separate the vegetated parts into different units at the points where the wetland plants thin out to less than a foot in width for at least 33ft (10m) (Figure 8).

> **NOTE**: If the open water is less than 20 acres, the entire area (open water and any other vegetated areas) is considered as <u>one</u> wetland unit, and is a depressional or riverine wetland.

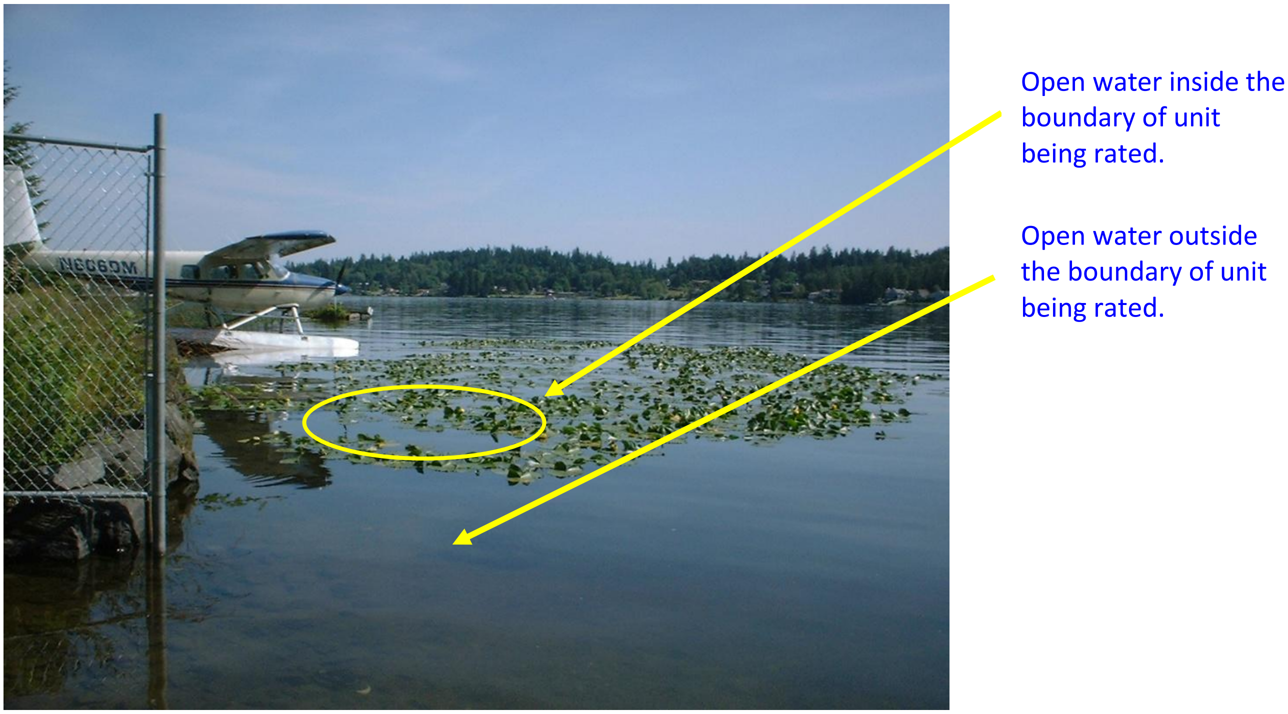


Figure 7: Lake-fringe wetland showing open water that is included within the wetland boundary

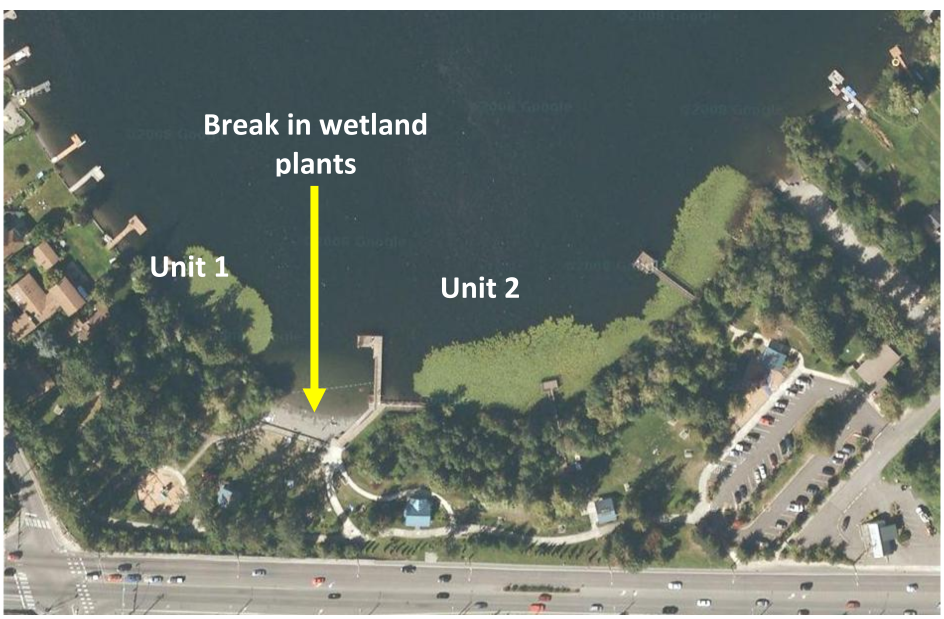


Figure 8: Absence of wetland plants along the shore of a lake that separates the wetlands into two units for rating.

Another common situation found in western Washington is a lake-fringe wetland that is contiguous with a large wetland that extends far from the edge of the lake (Figure 9).

These wetlands are usually classified as depressional or riverine. The entire unit of riverine and lake-fringe wetlands should be rated as one unit.

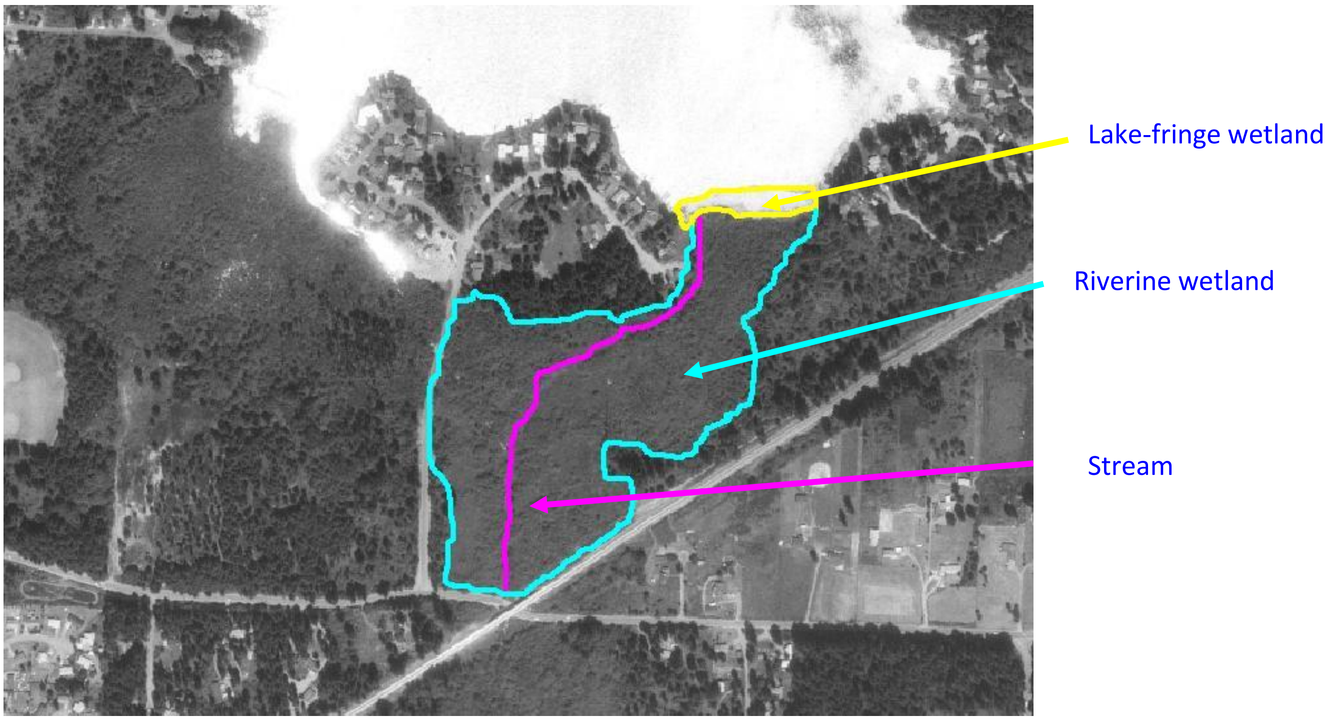


Figure 9: Aerial photograph of a lake-fringe wetland connected to a riverine wetland without any topographic or hydrologic breaks between them. Both types of wetlands are rated as one using the questions for Riverine wetlands.

Sometimes a strip of open water is found between the wetland plants further from shore and those closer to shore. In this situation, the open water is considered a part of one unit that encompasses both the rooted submerged plants offshore and the shore-side plants. The absence of plants in the area of open water may only be temporary, or the submerged plants are present but not visible because they do not grow to the surface. The plants may also be absent due to wave action or physical removal.

4.4 Wetlands Bisected by Human-Made Features

When a depressional wetland is divided by a human-made feature, such as a road embankment, the wetland should <u>not</u> be divided into different units if there is a <u>level</u> surface-water connection between the two parts of the wetland. Water should be able to flow equally well between the two areas. For example, if there is a wetland on either side or a road with a culvert connecting the two, and both sides of the culvert are partially or completely underwater for most of the year, the wetland should be treated as one unit. Make the down gradient wetland a separate unit, however, if the bottom of the culvert is above the high water marks in the receiving wetland, or the high water marks on either side differ by more than 6 inches in elevation.

4.5 Cases When a Wetland Should Not be Divided

Differences in land use within a wetland should not be used to define units unless they coincide with the circumstances described above. Many functions that wetlands perform are independent of the land use in the wetland. For example, a depressional wetland has approximately the same amount of live storage whether the surface is a shrub community or a pasture.

Furthermore, the rating system used in this method is not robust enough to capture slight differences in habitat functions within different portions of the same wetland unit. Attempts were made during the calibration of the wetland rating system to score different portions of a wetland unit based on differences in land use, but the results did not provide an accurate representation of the system. This compromise is necessary in order to make the tool rapid and easy to use. For example, if half a wetland has been recently cleared for farming and the other half left intact, the entire area functions as, and should be categorized as, one unit. Figure 10 shows a wetland that is a lawn along one side and a shrub community on the other side. In this case, the entire wetland should be rated as one unit.

Figure 10: A wetland with two land uses and separated by a fence. The entire wetland should be treated as one unit.

4.6 Very Small Wetlands

Users often question the effectiveness of using rapid methods in wetlands that are ¼ acre or less. One tree or shrub may be all that is needed in a small wetland to score points on the Scoring Form for certain questions. The data collected during the calibration of the rating systems, however, indicate that wetlands smaller than a ¼ acre can be rated accurately. The smallest wetlands rated during the calibration were about 1/10 acre in size (see Figure 11 for an example of a small wetland that is about 1/10 acre in size), and all were judged by the field teams to be adequately characterized.

Figure 11: A slope wetland near Padilla Bay that is approximately 1/10 acre in size.

At present, the accuracy of the scoring has not been tested for wetlands smaller than 1/10 acre, but the method may be applicable to even smaller wetlands because the scoring of most functions is not dependent on the size or the number of characteristics in the wetland. The scoring for the "water quality" functions is independent of size because the functions are rated on the potential per unit area. For example, the ability of a square yard of organic soil in a wetland to remove nitrogen is not dependent on the size of the wetland. A square yard of soil in a wetland of 1/10 acre can be just as effective at performing a function as a square yard in a large wetland.

The same is true for the hydrologic functions. A small wetland that stores 3 ft of water during a flooding event is more effective, on a per acre basis, than a large wetland that stores only 1 ft. The larger wetland may store a larger volume overall, but it is the volume per unit area that needs to be characterized. Impacts to wetlands are usually calculated by area. For example, an impact to 1/10 acre of a wetland that stores 3 ft of water needs to be mitigated by replacing a similar amount of storage (i.e. 3 ft over 1/10 acre). It makes no difference if the size of the wetland impacted is ¼ acre, 10 acres, or 100 acres.

The field testing, however, indicated that the method will not work well for scoring habitat functions in wetlands smaller than 1/10 acre (4000 ft^2). For example, one large tree may cover 400 square feet of a 4000 square foot wetland and this would give it a "forested" class. It is not expected however that the tree will provide functions to the same level as a forested class in a larger wetland. On the other hand, wetlands that are larger than 1/10 acre are adequately characterized. This is based on the consensus of the different teams (function assessment and rating) that went out into the field.

Also, very small wetlands may not provide good habitat for some of the larger wildlife species such as otter or beaver, but they are known to provide critical habitat for many smaller species. For example, amphibians were found using and breeding in wetlands as small as 270 ft^2 in the Palouse region of northern Idaho (Monello and Wright 1999).

Thus, very small wetlands may be less important for large wildlife but more important for smaller wildlife. Since the methods were judged to be accurate for wetlands as small as a 1/10 of an acre, the review team and the Department of Ecology staff decided not to develop additional questions for very small wetlands less than 1/10 acre in size. Very small wetlands can be rated with the understanding that the results are not as robust as in larger wetlands.

CHAPTER 5

Detailed Guidance for the Scoring Form

This chapter provides detailed guidance for answering the questions on the scoring form. The questions are listed in the order they appear on the form. Results from each section should be summarized on the first page of the form. More than three fourths of the questions are the same, or similar, to those used in the Washington State Wetland Rating System for Western Washington (Ecology publication #04-06-025). Questions that are identical to those in the rating system are noted on the scoring form in Appendix A.

A correctly filled out wetland rating form requires six maps for depressional wetlands, seven for riverine, six for lake-fringe and four for slope wetlands. These are also required to correctly fill out the forms for the Credit-Debit Method. In addition, the method requires one additional map to answer three new questions. This map does not have to be digitized or put into a CAD system. Downloading an aerial photo, drawing a 1 km circle around the wetland unit and estimating the area of different land uses using a gridded overlay takes less than 15 minutes for an experienced user. **Do not estimate percent area visually without a graphic aid such as gridded overlay.** Visual estimates of area can be off by 30-40% and this will change the results.

Users of this method who have not taken any training can expect that, **on the average**, their scores for the functions will be off by at least 1 point. This means that the scores calculated for credits or debits will be either 1 acre-point higher or 1 acre-point lower for every acre of impact or mitigation (average error is+/-15%). Our initial analysis suggests that errors of 2 acre-points will occur in 1/3 of the cases for untrained users. These statistics are based on the data collected during the development of the wetland rating system.

5.1 Classifying the Wetland

Scientists have come to understand that wetlands can perform functions in different ways. The way wetlands function depends to a large degree on hydrologic and geomorphic conditions (Brinson 1993). As a result, we group wetlands into categories based on the geomorphic and hydrologic characteristics that control many functions. This classification system is called the Hydrogeomorphic (HGM) Classification.

The Credit-Debit Method described here uses only the highest grouping in the HGM classification (i.e., wetland class). The more detailed methods for assessing wetland functions developed for eastern and western Washington (Hruby and others 1999, Hruby and others 2000) refine this classification and subdivide some of the classes further. This method, however, does not require such a level of detail.

A classification key is provided with the Scoring Form to help you identify whether the wetland is tidal-fringe, flats, lake-fringe, slope, riverine, or depressional. The key contains eight questions that need to be answered sequentially. Each question is described below in more detail than found on the key.

Question 1: Tidal Fringe Wetlands

Tidal fringe wetlands 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 in the adjacent ocean.

> This method does not score the functions and values of estuarine wetlands, but it can be used to score freshwater tidal fringe wetlands.

Tidal fringe wetlands, in which the water has a salinity higher than 0.5 parts per thousand, are classified as "Estuarine" and not scored. Tidal fringe wetlands in which the waters are tidal but freshwater (salinities below 0.5 parts per thousand), are scored using the forms for riverine freshwater wetlands.

There are numerous tidal fringe wetlands in the estuaries and tidal sloughs in the Puget Sound region as well as in Willapa Bay and Grays Harbor. The difficulty is in identifying the boundary between fresh and brackish waters. In the absence of local information (e.g., the salt wedge in the Snohomish River extends upstream to the Route 2 bridge), users will have to rely on plants to identify the boundaries between fresh and salt water. Appendix B lists common wetland plants that are tolerant of salt (from Hutchinson 1991). If the dominant plants in the community are those listed as "Tolerant" or "Very Tolerant," it can be assumed that the waters in the slough or river at that point are saline.

Figure 12 shows Edison Slough which has a fringe of *Triglochin* sp. and *Carex lyngbyei* along the edge of the mudflat. On this basis the wetland was classified as "estuarine." If you have the situation presented in Figure 12; a fringe of freshwater plants that is above an area of salt-tolerant plants, you should consider the entire unit as estuarine. See question 8 on the classification key in the field form.

Figure 12: An estuarine slough at low tide with salt tolerant plants along the edges.

Question 2: Flats Wetlands

"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 directly on the wetland itself. They receive virtually no groundwater discharge or surface runoff from the surrounding landscape. This characteristic distinguishes them from depressional and slope wetlands. In western Washington flats wetlands are very rare. They occur in areas raised above the surrounding landscape and underlain by glacial till. It is highly unlikely that you can find a flats wetland in areas where the rate of evapotranspiration is greater than rainfall, such as eastern Washington.

Wetlands that should be classified as flats may be hard to distinguish from flat depressional wetlands that are fed by groundwater. This need not be a concern however, because both depressional and flats wetlands use the same questions in the scoring form.

Question 3: Lake-fringe Wetlands

Lake-fringe wetlands are separated from other wetlands based on the area and depth of open water adjacent to them. If the area of open water next to a vegetated wetland is larger than 20 acres (8 hectares), and more than 6.6 feet deep (2m) over 30% of the open water areas, the wetland is considered to be "lake-fringe." The criterion here is 20 acres of open water without any aquatic plants. The Shoreline Management Act requires 20 acres within Ordinary High Water Mark (OHWM). Thus a 20 acre shallow pond that is completely vegetated would be a lake under the Act but a depressional wetland for the purpose of this method.

Figure 13: Lake-fringe wetland with an area of aquatic bed plants and a narrow band of wetland shrubs along the shore.

The definition of lakes is based on limnological characteristics and not the criteria used in the Shoreline Management Act. Lakes have different environmental processes than small ponds (e.g., stratification, spring turnover, etc.). In general. these processes occur in western Washington only in systems that have at least 20 acres of open water that is deeper than 2 meters. Figure 13 shows a lake-fringe wetland in Snohomish County with aquatic bed plants and a fringe of wetland shrubs.

Wetlands found along the shores of large reservoirs such as those found behind the dams along the major rivers are also considered to be lake-fringe. Although the area was once a river valley, the wetlands along the shores of the reservoirs function more like lake-fringe wetlands rather than riverine wetlands. The technical teams developing the wetland rating systems (Hruby 2004 a, b) decided to include wetlands along the shores of reservoirs as lake-fringe if they meet the thresholds for open water and depth.

Question 4: Slope Wetlands

Slope wetlands occur on hill or valley slopes where groundwater "daylights" and begins running along the surface, or immediately below the surface. Water in these wetlands flows only in one direction (down the slope) and the gradient is steep enough that the water is not impounded. The "downhill" side of the wetland is always the point of lowest elevation in the wetland. Figure 14 shows a slope wetland that formed where the slope of the hillside changed and caused groundwater to come to the surface.

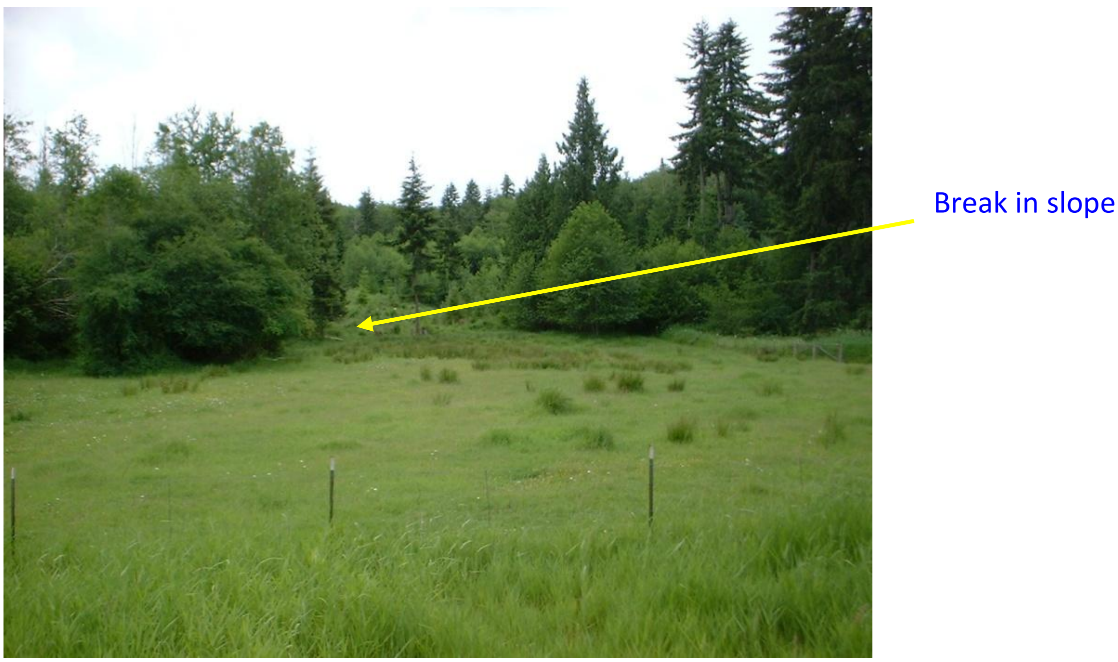


Figure 14: Slope wetland in Lewis County identified by the presence of wetland plants (*Carex* sp. *Juncus* sp.) and hydric soils. Wetland occurs where there is a major break in the slope of the hillside.

Slope wetlands with surface flows can be distinguished from riverine wetlands by the lack of a defined stream bed with banks. Slope wetlands may develop small rivulets along the surface, but they serve only to convey water away from the wetland. There is no surface flow coming into the wetland through channels. Also, slope wetlands do not impound water except in very small depressions that may form on the surface. These are only a few inches in diameter and a few inches deep.

Question 5: Riverine Wetlands

Riverine wetlands occur in valleys associated with stream or river channels. They lie in the active floodplain, and have important hydrologic links to the flows in the river or stream. Their proximity to the river facilitates the rapid transfer of floodwaters in and out of the wetland, and the import and export of sediments. The distinguishing characteristic of riverine wetlands in western Washington is that they are flooded by overbank flow from the river at least once every two years. Riverine wetlands, however, may also receive significant amounts of water from other sources such as groundwater and slope discharges.

Wetlands that lie in floodplains but are not frequently flooded are **not** classified as riverine. Also, wetlands behind dikes are usually disconnected from the active floodplain and are no longer regularly flooded. In cases where wetlands in the floodplains are not frequently flooded they should be classified as depressional or slope.

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. However, for the purposes of classification, wetlands that show evidence of frequent overbank flooding, even if from an intermittent stream, are considered riverine even if they receive water from surface flows or groundwater.

Riverine wetlands normally merge with tidal fringe wetlands near the mouths of rivers. The interface occurs where tidal fluctuations become the dominant hydrologic driver (Brinson and others 1995). This interface has been significantly modified in western Washington by diking. Many wetlands that were once freshwater tidal are now either riverine or depressional (depending on the frequency of flooding).

The operative characteristic of riverine wetlands in Washington is that of being “frequently flooded” by overbank flows (Figure 15).

Figure 15: A riverine wetland being inundated by flood waters from North Creek. The creek is in the background. This flooding occurs at least once a year.

In western Washington the technical committees developing assessment methods decided that the frequency of overbank flooding needed to call a wetland riverine is at least once in two years (2 yr. "return" frequency). This characteristic, however, cannot be easily measured in the field and needs to be established from field indicators. The following are some field indicators that can be used to classify a wetland as riverine:

- Scour marks are common in the wetland.
- Recent sediment deposits.
- Plants are bent in one direction or damaged.
- Soils with layered deposits of sediment.
- Flood marks on plants along the edge of the bank at different levels.

Wetlands that are created in a stream channel by impounded water from an obstruction such as a beaver dam, weir, or debris dam are considered to be depressional rather than riverine. The major hydrologic factor that maintains and provides the structures in these systems is the ongoing flow that is impounded. The overbank flooding is not as important a factor. A wetland would be considered riverine, however, if the dam or weir impounds water for only a short time, such as a single storm. The impounded water must be present for at least two months every year to be considered depressional.

Question 6: Depressional Wetlands

Depressional wetlands occur in topographic depressions where the elevation of the surface within the wetland is lower than in the surrounding landscape. The shapes of depressional wetlands vary, but in all cases, the movement of surface water and shallow subsurface water is toward the lowest point in the depression. The depression may have an outlet, but the lowest point in the wetland is somewhere within the boundary, not at the outlet.

Depressional wetlands can sometimes be hard to identify because the depression in which they are found are not very evident. By working through the key it may not be necessary to look at topographic maps, or try to identify that the lowest point of the wetland is in the middle. If a wetland has surface ponding, even if only for a short time, and is not lake-fringe, or riverine, it can be classified as depressional (Figure 16).

Figure 16: A depressional wetland. Note the surface ponding in the low point of the wetland where the cattails are found.

Question 7: Flat Areas Maintained by High Groundwater

Many wetlands have developed on the outwash plains left by the glaciers. These are maintained by high levels of groundwater in the region and do not easily fit into either the depressional, riverine, or flats class. These wetlands are fairly flat, are often ditched, and do not seem to have an identifiable natural outlet (Figure 17). If they pond water it is usually only because groundwater levels are high in the entire region and the water has nowhere to drain. These wetlands are classified as "depressional" for the purpose of scoring them.

Figure 17: Wetland maintained by high levels of groundwater. It is not in an easily identified topographic depression and has slope wetlands along its upper edge.

Question 8: Wetland Is Hard to Classify

Sometimes it is hard to determine if the wetland unit you are scoring meets the criteria for a specific wetland class. You may find characteristics of several different hydrogeomorphic classes within one wetland boundary. For example, seeps at the base of a slope often grade into a riverine wetland, or a small stream within a depressional wetland has a zone of flooding along its sides that would be classified as riverine.

If you have a wetland with the characteristics of several HGM classes present within its boundaries use Table 1 to identify the appropriate class to use for scoring. Use this table only if the area encompassed by the "recommended" class is at least 10% of the total area of wetland being rated. For example, if a slope wetland grades into a riverine wetland and the area of the riverine wetland is ¼ of the total wetland unit you are rating, use the questions for riverine wetlands. However, if the area that would be classified as riverine is less than 10% (e.g., ½ acre of a 10 acre unit is frequently flooded) use the questions for the slope wetlands. The same applies for other combinations of classes. A unit in which the depressional area is only 5% of the entire unit that is otherwise a slope wetland should be rated as a slope wetland. If, however, the area classified as depressional is 15% of the area of the unit it should be rated as depressional.

Table 1: Classification of wetlands with multiple hydrogeomorphic classes for the purpose of rating their functions.

HGM classes found within one wetland unit	HGM Class to use if area of this class > 10% total area of unit
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine	Depressional
Depressional + Lake-fringe	Depressional
Riverine + Lake-fringe	Riverine
Salt Water Tidal fringe and any other class of wetland	Treat as ESTUARINE and do not score. Categorize the wetland based on the Special Characteristics section.

If you are still unable to determine which of the above criteria apply to your wetland, or you have more than two HGM classes within a wetland boundary, classify the wetland as depressional. Hydrologically complex wetlands found in western Washington during the calibration of the methods have always had features of depressional wetlands, and thus, could be classified as depressional.

Once you have classified the wetland, you will need to answer only the questions that pertain to the HGM class of the wetland being rated. The first letter of the question on the Scoring Form identifies the wetland class for which the question is intended:

D = Depressional or flats

R = Riverine or Freshwater Tidal Fringe

L = Lake-fringe

S = Slope

The guidance in the following sections is divided according to the HGM class of the wetland being rated. Each question on the Scoring Form is addressed in turn.

NOTE: The questions for scoring habitat functions are labeled [H] and apply to all HGM classes of wetlands.

5.2 Classifying the Plant Communities

There are several questions on the data sheet that ask you to classify the plant communities found within the wetland unit. This should not be confused with classifying the wetland unit as described earlier. The Credit-Debit Method uses several different classification schemes for plant communities; only one of which is the commonly used "Cowardin" classification. The Cowardin classification is the most complex one and is described in more detail below. You will need to carefully read the description of each question to insure that you use the classification scheme appropriate for that question. **Use caution in filling out the Scoring Form because the thresholds for scoring differ among the questions as well as the way plants are classified.**

The Cowardin Classification

"Cowardin" plant classes are distinguished by the uppermost layer of plants (forest, shrub, etc.) that provides more than 30% surface cover within part or all of a wetland. This area is often called a Cowardin "polygon" when mapping the distribution of plants. If the total cover of plants is less than 30% the area does not have a plant class. Areas with less than 30% plant cover should be categorized as open water or sand/mud flats. If the plants are deciduous and you are rating the wetland during periods when leaves have fallen, try to reconstruct what the cover would be when the plants are fully leafed out. A deciduous forest of big-leaf maple would still be considered a forest using the Cowardin classification even in winter when there are no leaves present and the cover may be less than 30%.

This method uses only four of the major Cowardin plant classes to map the plant communities in a wetland. These are:

1. **Forested class:** An area (polygon) in the wetland unit where the canopy of woody plants over 20 ft. (6 m) tall (such as cottonwood, aspen, cedar, etc.) covers at least 30% of the ground. Trees need to be partially rooted in the wetland in order to be counted towards the estimates of cover (unless the unit is a mosaic of small wetlands as described in Section 4.2). Some small wetlands may have a canopy over the unit but the trees are not rooted within the wetland. In this case the wetland does not have a forested class.
2. **Scrub/shrub class**: An area (polygon) in the wetland unit where woody plants less than 20 ft. (6 m) tall are the top layer of plants. To count, the shrub plants must provide at least 30% cover and be the uppermost layer. Examples of common shrubs in western Washington wetlands include the native rose, young alder, young cottonwoods, hardhack (*Spiraea)*, willows, and red-osier dogwood.
3. **Emergent class:** An area (polygon) in the wetland unit covered by erect, rooted herbaceous plants excluding mosses and lichens. These plants have stalks that will support the plant vertically in the absence of surface water during the growing season. These plants are present for most of the growing season in most years. To count, the emergent plants must provide at least 30% cover of the ground and be the uppermost layer. Cattails and bulrushes are good examples of plants in the "emergent" plant category.

Herbaceous plants are defined as seed-producing species that do not develop persistent woody tissue (stems and branches). Most species die back at the end of the growing season.

4. **Aquatic bed class:** An area (polygon) in the wetland unit where rooted aquatic plants, such as lily pads, pondweed, etc., cover more than 30% of the surface of the standing water. These plants grow principally on or below the surface of the water for most of the growing season in most years. This is in contrast to the emergent plants described above that have stems and leaves that extend above the water most of the time. Aquatic bed plants are found only in areas where there is seasonal or permanent ponding or inundation. *Lemna sp.* (duckweed) is not considered an aquatic bed species because it is not rooted. Aquatic bed plants do not always reach the surface and care must be taken to look into the water.

NOTE: Sometimes it is difficult to determine if a plant found in the water is "aquatic bed" or "emergent." A simple criterion to separate emergent and aquatic bed plants most of the time is--If the stalk will support the plant vertically in the absence of water, it is emergent. If, however, the stalk is not strong enough to support the plant when water is removed, it is aquatic bed.

NOTE: The definition of emergent plants used by Cowardin is different than the one used in delineation for determining the boundaries between "vegetated wetlands" and "vegetated shallows."

Examples of how different areas might be classified are given below.

- An area (polygon) of trees within the wetland unit having a 50% cover of trees and with an understory of shrubs that have a 60% cover would be classified as a "forest." The trees are the highest layer of plants and meet the minimum requirement of 30% cover.
- An area with 20% cover of trees overlying a shrub layer with 60% cover would be classified as a "shrub." The trees do not meet the requirement for minimum cover.
- An area where trees or shrubs each cover less than 30%, but together have a cover greater than 30% is classified as "shrub."
- When trees and shrubs together cover less than 30% of an area, the polygon is classified based on the next highest plant class that has a 30% cover. This would e either "emergent" or "aquatic bed."

Each polygon with a wetland unit can only have one Cowardin class. For this reason, it is useful to map the Cowardin classes on an aerial photo. This will avoid the common mistake of counting emergent plants under a canopy of trees or shrubs as a separate class.

5.3 Water Quality and Hydrologic Functions of Wetlands in the Depressional or Flats Class (*Questions starting with 'D' on the Scoring Form)*

D 1.0 Does the Site have the Potential to Improve Water Quality?

D 1.1 Characteristics of surface water outflows from the wetland: (This indicator is used for both the water quality and the hydrologic functions.)

Rationale for indicator: Pollutants that are in the form of particulates (e.g., sediment, or phosphorus that is bound to sediment) will be retained in a wetland with no outlet. Wetlands with no outlet are scored the highest for this indicator. An outlet that flows only seasonally is usually better at trapping particulates than one that is flowing all the time because there is no chance for a downstream release of particulates for most of the year (a review of the scientific literature on the "trapping" potential of wetlands is found in Adamus et. al. 1991).

As you walk around the edge of the depressional unit note carefully if there are any indications that surface water leaves the wetland and flows further down-gradient. The question is relatively easy to answer if you find a channel.

Figure 18: A small depressional wetland with no outlet.

You are asked to characterize the surface outlet in one of four ways, and these are:

Unit has no surface water outlet - You find no evidence that water leaves the wetland on the surface. The wetland lies in a depression in which the water never goes above the edge (Figure 18).

Unit has an intermittently flowing, or highly constricted, outlet. Intermittently flowing means that there is no outflow from the unit at some times during the year. The water levels in the unit fall below the elevation of the outlet. Highly constricted outlets, on the other hand **are permanently flowing** but are small relative to the flow. Marks of flooding or inundation have to be three feet or more above the bottom of the outlet (live storage is ≥ 3 ft) for the outlet to be considered constricted. Note: A depressional wetland with occasional outflow resulting from stormwater runoff from an adjacent developed area is considered to have intermittent flow.

Unit has an unconstricted or slightly constricted outlet with permanent flow that allows water to flow out of the wetland without backing up. The outlet does not provide much hindrance to flood waters flowing through the wetland. In general, the distance between the low point of the outlet and average height of inundation will be less than three feet. Beaver dams are considered to be unconstricted unless there are indicators that water is backed up at least 3 ft above the top of the dam.

Unit is flat and has no obvious outlet or the outlet is a ditch. The bottom of the ditch usually has a lower elevation than the rest of the unit. This characteristic is commonly found in the wetlands described on p. 43. Answer this question as "YES" if you find no outlet and there are no indicators that the unit ponds more than 6-10 inches of water. Usually, these wetlands have no indicators that they pond. These types of wetlands are often drained by man-made ditches. If the ditch is not permanently flowing score the unit as intermittently flowing.

NOTE: If you cannot find an outlet but know the wetland is not completely closed, score it as intermittently flowing.

D 1.2 The soil two inches below the surface is a true clay, or true organic soil.

Rationale for indicator: Clay soils and organic soils are good indicators that a wetland can remove a wide range of pollutants from surface water. The uptake of dissolved phosphorus and toxic compounds through adsorption to soil particles is highest when soils are high in clay or organic content (Mitsch and Gosselink 1993). We only consider the type of soil near the surface because this is where the soil actually has contact with the surface waters carrying the pollutants. This is where most of the chemical and biological reactions occur.

If the unit is found within an area that is mapped as an organic or clay soil by the NRCS on their county soil maps consider the unit to have clay or organic soils. If it is not mapped as an organic or clay soil, you will need to take at least one sample at the site and determine its composition.

To look at the soil: dig a small hole within the wetland boundary and pick a sample from the area that is about 2-3 inches below the duff layer. Usually it is best to sample the soil toward the middle of the wetland rather than at the edge. Do not sample the soil under areas of permanent ponding. Avoid picking up any of the duff or recent plant material that lies on the surface. Determine if the soil is organic or clay. If you are unfamiliar with the methods for doing this, a key for clay soils is provided in Appendix C.

> **NOTE**: The presence of organic or clay soils anywhere within the wetland unit counts. There is no scaling for this question based on the size of the patch of soil. This simplification is necessary because it is not possible to develop a reproducible map of different soils in a wetland unit within the time frame for doing a rating.

See the NRCS web page on soils for more descriptions on how to identify soils.

http://soils.usda.gov/technical/manual/contents/chapter3.html (as of Feb. 2012)

D 1.3 Characteristics and distribution of persistent plants (emergent, shrub, and/or forest classes).

> **Rationale for indicator:** Plants enhance sedimentation by acting like a filter, and cause sediment particles to drop to the wetland surface (review in Adamus and others 1991). Plants in wetlands can take on different forms and structures. The intent of this question is to characterize how much of the wetland is covered with plants that persist throughout the year and provide a vertical structure to trap or filter out pollutants. It is assumed, however, that the effectiveness at trapping sediments and pollutants is severely reduced if the plants are grazed.

Use the Cowardin classification of plants for this question. You are looking for the areas that would be classified as "Emergent", "Scrub/shrub," or "Forested" (see Section 5.2). These are all "persistent" types of plants; those species that normally remain standing at least until the beginning of the next growing season (Cowardin and others 1979). Emergent plants do not have to be alive at the time of the site visit to qualify as persistent. The dead stalks of emergent species will provide a vertical structure to trap pollutants as well as live stalks.

You are asked to characterize the plants in terms of how much area within the wetland unit is covered by persistent, ungrazed plants. There are three size thresholds used to score this characteristic – more than 1/10 of the wetland unit is covered in persistent plants; more than 1/2 of the wetland unit is covered; or more than 95% of the wetland unit is covered. These thresholds can usually be estimated visually in small wetlands. Large wetlands, however, may require you to draw the area of persistent plants on a map or aerial photo before you can feel confident that your estimates are accurate. **NOTE: this question applies only to persistent plants that are not grazed or mowed** (or if grazed or mowed, the plants are taller than 6 inches).

An easy way to estimate the amount of persistent plants is to map the areas that are open water, covered with aquatic bed plants, mudflats or rock on an aerial photograph. Also include areas that are grazed because much of the vertical structure of wetland plants is removed when plants are grazed. The remaining area is then by default the area of persistent plants. Figure 19 shows a depressional wetland in which persistent plants cover between 50% and 95% of the area of the wetland. The remainder is open water.

NOTE 1: To meet the "class" requirement for Cowardin, a polygon of plants within the wetland unit needs at least 30% cover of the specified plants type (forest, shrub, etc.). However, to count the Cowardin polygon as a "plants structure" in the rating system the “Cowardin” polygon itself has to represent at least 10% of the wetland unit in units that are smaller than 2.5 acres, or at least 1/4 acre in units that are larger. A plant class does not have to cover 30% of the entire wetland unit to be counted, just 10% or ¼ acre.

NOTE 2: If the unit has just been mowed or grazed, but you suspect this occurs infrequently, you will need to determine if the plants in the wetland are 6 inches or less at the time when the wetland is receiving surface waters that transport sediment and pollutants. If the grazing occurs in summer (because the area is too wet for cows in the winter) but the plants have time to grow again before the flood season, then the unit is ungrazed because the plants will meet the height threshold at the time of flooding. If however, the grazing pressure is intense enough that the grass does not have time to recover during the flood season then it should be considered "grazed”. The same question can be asked of seasonal mowing or haying.

Figure 19:
A depressional wetland in which persistent, ungrazed, plants cover is between 50% and 95% of the area of the wetland.

D 1.4 Characteristics of seasonal ponding or inundation.

> **Rationale for indicator**: The area of the wetland that is seasonally ponded is an important characteristic in understanding how well it will remove different forms of nitrogen that cause eutrophication. The highest levels of nitrogen transformation occur in areas of a wetland that undergo a cyclic change between oxic (oxygen present) and anoxic (oxygen absent) conditions. The oxic regime is needed so certain types of bacteria can change nitrogen that is in the form of ammonium ion (NH_4^+) to nitrate, and the anoxic regime is needed for denitrification (changing nitrate to nitrogen gas) (Mitsch and Gosselink 1993). The area that is seasonally ponded is used as an indicator of the area in the wetland that undergoes this seasonal cycling. The soils are oxygenated when dry but become anoxic during the time they are flooded.

To answer this question you will need to estimate how much of the wetland is seasonally ponded with water. Areas that are seasonally ponded must be inundated for at least 2 consecutive months, but then dry out for part of the year.

One way to estimate this area is to make a rough sketch of the boundary of the wetland unit, and on this diagram draw the outside edge of the area you believe has surface water during the wet season. If the wetland also has permanent surface water you will have to draw this and subtract it when making your estimate (see Figure 20).

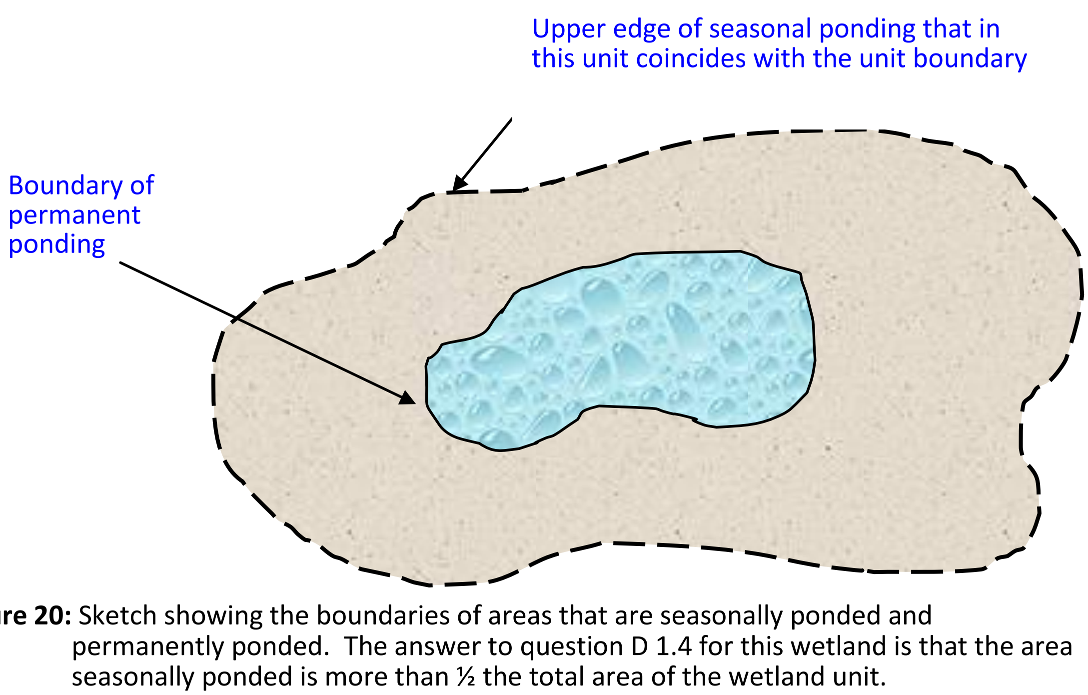


Figure 20: Sketch showing the boundaries of areas that are seasonally ponded and permanently ponded. The answer to question D 1.4 for this wetland is that the area seasonally ponded is more than ½ the total area of the wetland unit.

During the dry season, the boundary of areas ponded for several months (*seasonal ponding*) will have to be estimated by using indicators such as:

- Marks on trees and shrubs of water/sediment/debris (Figure 21). The boundary of seasonal ponding can be estimated by extrapolating a horizontal line from this mark to the edge of the wetland.
- Water stained plants lying on wetland surface (grayish or blackish appearance of leaves on the surface).
- Dried algae left on the stems of emergent plants and shrubs and on the wetland surface (Figures 22 and 23).

Figure21: Water mark on tree showing vertical extent of seasonal ponding

Figure 22: Small depressional wetland covered with algae. The edge of the algae marks the area that is seasonally ponded.

Figure23: Algae left hanging on plants as wetland dried out. The top of the algae marks the vertical extent of seasonal ponding. The boundary of seasonal ponding can be estimated by extrapolating a horizontal line from this mark to the edge of the wetland.

NOTE: Avoid making visual estimates of area covered by seasonal ponding when standing at the wetland edge. These estimates can be very inaccurate. Drawing the boundary on an aerial photograph and then using a graphic tool such as a grid to calculate area is a more accurate way to estimate area. A Global Positioning System (GPS) that has been corrected for positional inaccuracies can also be used to locate the boundaries and estimate area.

D 2.0 Does the Landscape Have the Potential to Support the Water Quality Function of the Site?

Wetlands can remove many pollutants coming into them. It is the removal of this excess pollution that is considered to be a valuable function for society. The landscape surrounding the wetland will to some degree determine how well a wetland improves water quality. If the wetland receives a heavy load of pollutants from the surrounding areas it will function to its maximum capacity. However, if, there are no pollutants coming in, the wetland cannot remove them, even if it has the necessary physical and chemical characteristics. Thus, the "landscape potential" for the function is related to the amount of pollutants that come into the wetland from the surrounding areas. Qualitatively, the level of pollutants can be correlated with the level of disturbance, development, and intensity of agriculture in the landscape. For example, relatively undisturbed watersheds will carry much lower sediment and nutrient loads than those that have been impacted by development, agriculture, or logging practices (Hartmann and others 1996, Reinelt and Horner 1995).

D 2.1 Does the wetland unit receive stormwater discharges?

> **Rationale for indicator**: Stormwater coming from residential or developed areas is often discharged into wetlands. Untreated stormwater is a source of many different pollutants (reviewed in Sheldon and others 2005). Furthermore, stormwater ponds do not remove all pollutants leaving them, even those constructed recently (Mallin and others 2002). Thus, any stormwater discharge into a wetland increases the pollutants coming into it.

Answer "YES" to the question if you see any pipes coming into the wetland from the surrounding land. These are usually stormwater discharges. Also, look on the aerial photograph of the wetland and its surroundings for stormwater ponds. If you see any ponds, determine if their discharges can get into the wetland.

D 2.2 Is more than 10% of the area within 150 ft of the wetland unit in agricultural, pasture, residential, commercial, or urban?

> **Rationale for indicator**: Farming, grazing, residential areas, commercial land uses, and urban areas in general are major sources of pollutants (reviewed in Sheldon and others 2005). The review also found that a well vegetated buffer of 150 ft will only remove 60-80% of some pollutants from surface runoff into a wetland. Thus, pollutants from such land uses will probably reach the wetland unit if they are within 150 ft of the wetland.

Use your aerial photo and draw a line around the unit that is 150 ft from the edge of the unit you have mapped for rating. Answer "YES" to this question if you find the listed uses within 150 ft of the wetland and they cover more than 10% of the "donut" polygon around the unit. Use a graphic aid, such as an acetate overlay with a grid or dots, to estimate area. Visual estimates are not accurate enough and may result in significant errors.

D 2.3 Are there septic systems within 250 ft of the wetland unit?

> **Rationale for indicator**: Septic systems can pollute groundwater because nitrogen is not removed underground. Plumes of nitrogen from septic systems can be traced at least 250 ft in the groundwater (Aravena and others 1993).

Use the aerial photograph of the unit to determine if there are any residences within 250 ft of the unit. Septic systems are still in common use in many areas of western Washington that are outside of city boundaries. If your unit is within a city limit you will need to check with the local planning office to determine if the area has sewers serving the houses or if they are still on septic systems. If you are outside city limits in areas with lots of 1/2 acre or larger you can assume the houses are on septic systems.

D 2.4 Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1 – D 2.3?

Rationale for indicator: The three sources of pollutants listed in questions D 2.1-D 2.3 may not be the only sources coming into the wetland unit from the surrounding landscape.

Answer "YES" to the question if you can identify any source of pollutants in the groundwater or surface water coming into the wetland caused by human activities. Identify the source of the pollution on the Scoring Form. Wetlands can receive polluted waters even if they have well vegetated and large buffers. For example, a stream that drains areas where pollutants are released far from the unit can pass through the wetland. Also, silt fences often do not prevent all the sediment from reaching the wetland during construction. Other sources of pollutants may be pesticide spraying on golf courses, particulates in exhausts from airplanes or motor vehicles and pesticides used in mosquito control.

D 3.0 Is the Water Quality Improvement Provided by the Site Valuable to Society?

D 3.1 Does the unit discharge directly to a stream, river, or lake that is on the 303(d) list?

Rationale for indicator: The term "303(d) list" is short for the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit to the Environmental Protection Agency (EPA) every two years. In Washington, we identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards. Wetlands that discharge directly to these polluted waters are judged to be more valuable than those that discharge to unpolluted bodies of water because their role at cleaning up the pollution is critical for reducing further degradation of water quality.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards http://www.ecy.wa.gov/programs/wq/303d/2008/index.html. Determine from the aerial photo if the wetland unit you are rating is within at least 1 mile of any aquatic resource listed as Category 2, 4, or 5 waters and has a surface water channel, ditch, or other discharge to it.

D 3.2 Is the unit in a basin or sub-basin where water quality is an issue in some aquatic resource? There is an aquatic resource in the basin that is on the 303(d) list.

Rationale for indicator: Wetlands can mitigate the impacts of pollution even if they do not discharge directly to a polluted body of water. Wetlands can remove nitrogen from groundwater as well as surface water. They can also trap airborne pollutants. Thus, wetlands can provide an ecosystem service and value to our society in any basin and sub-basin that has pollution problems. The removal of pollutants by wetlands is judged to be more valuable in basins where other aquatic resources are already polluted or have problems with eutrophication. Any further degradation of these resources by destroying the wetland could result in irreparable damage to the ecosystem.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards http://www.ecy.wa.gov/programs/wq/303d/2008/index.html. Determine from the aerial photo if the wetland unit you are rating is in the contributing basin of any aquatic resource listed as Category 2, 4, or 5 waters. To find the boundaries of contributing basins in the area consult with the planning department of the local jurisdiction. If this information is not available, use the guidance for mapping contributing basin described in question D 4.3 on p. 61.

D 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality?

Rationale for indicator: Not all pollution and water quality problems are identified by Ecology's water quality monitoring program. Local and watershed planning efforts sometimes identify wetlands that are important in maintaining existing water quality. These wetlands provide a value to society at the local level that needs to be replaced if they are impacted.

To answer this question you will need to seek information from the planning department of the local jurisdiction where the site is located. Information on regional or local plans can often be found on the web site of the city or county in which the site is found. Useful "search" phrases include: "watershed plan," "water quality," or "wetland protection." If the basin in which the wetland is found has a TMDL plan (also called a Water Clean Up Plan) developed for it, then you should answer "YES" for this question. It is assumed that all wetlands are valuable in a basin where water quality is poor enough to require a TMDL. The Department of Ecology's web site lists all the bodies of water that have TMDL's: http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html .

D 4.0 Does the Site Have the Potential to Reduce Flooding and Stream Erosion?

D 4.1 Characteristics of surface water outflows from the wetland:

Rationale for indicator: Wetlands with no outflow are more likely to reduce flooding than those with outlets, and those with a constricted outlet will more likely reduce flooding than those with an unconstricted outlet (review in Adamus and others 1991). In wetlands with no outflow, all waters coming in are permanently stored and do not enter any streams or rivers. Constricted outlets will hold back flood waters and release them slowly to reduce flooding downstream. Wetlands with intermittent flow also provide a higher level of protection than those with unconstricted permanently flowing discharges because they can hold back flash floods that can occur during storms.

See the description for question D 1.1. This question is answered the same way as question D 1.1. The difference between D 1.1 and D 4.1, however, is in the scores assigned each type of outflow. Differences in scores are based on the difference in importance of the outflow characteristics to the two functions.

D 4.2 Depth of storage during wet periods (estimating "live storage"):

Rationale for indicator: The amount of water a depressional wetland stores is an important indicator of how well it functions to reduce flooding and erosion. Retention time of flood waters is increased as the volume of storage is increased for any given inflow (Fennessey and others 1994). It is too difficult to estimate the actual amount of water stored for a rapid method such as this one, and we use an estimate of the maximum depth of the "live storage" as a surrogate. This is only an approximation because depressional wetlands may have slightly different shapes and thus the volume of water they can store is not exactly correlated to the maximum depth of storage.

Live storage is a measure of the volume of storage available during major rainfall events that cause flooding in western Washington. This indicator recognizes that some wetlands, particularly those with groundwater connections, have water present all year around, or have some storage below the elevation of the outlet that does not contribute to reductions in peak flows (so called "dead storage"). In most depressional wetlands in western Washington the depressions have filled to the edge of the outlet by the time the peak flooding occurs in late winter and early spring (Hruby and others 1999).

Locate the outlet of the unit and identify its lowest point (Figures 24, 25). In wetlands without outlets: 1) identify the deepest "hole" if the wetland is dry (Figure 26), or 2) the level of the areas that are permanently flooded. Estimate the difference in elevation between these low points and the marks of seasonal ponding (use information from D 1.4). This will provide an estimate of the depth of live-storage during the seasonal high water. Try to find water marks as close to the outlet as possible so you can estimate the height from the outlet. Figures 24 and 25 show water marks directly on the culverts. Estimate the difference in elevation between the lowest point of the outlet and the level at which you noted marks of inundation. There are four thresholds of concern: 1) more than 3 ft of storage, 2) between 2-3 ft of storage, 3) between 6 inches and 2 ft of storage, and 4) less than 6 inches of storage. These thresholds can usually be estimated without needing to use special equipment.

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 wetland can be used to establish the low point. Beaver dams generally have less than 6 inches of live storage because they allow water to flow out over a wide area. Four inches of live storage was the highest measured in the 11 beaver dams that were visited during the calibration of the method.

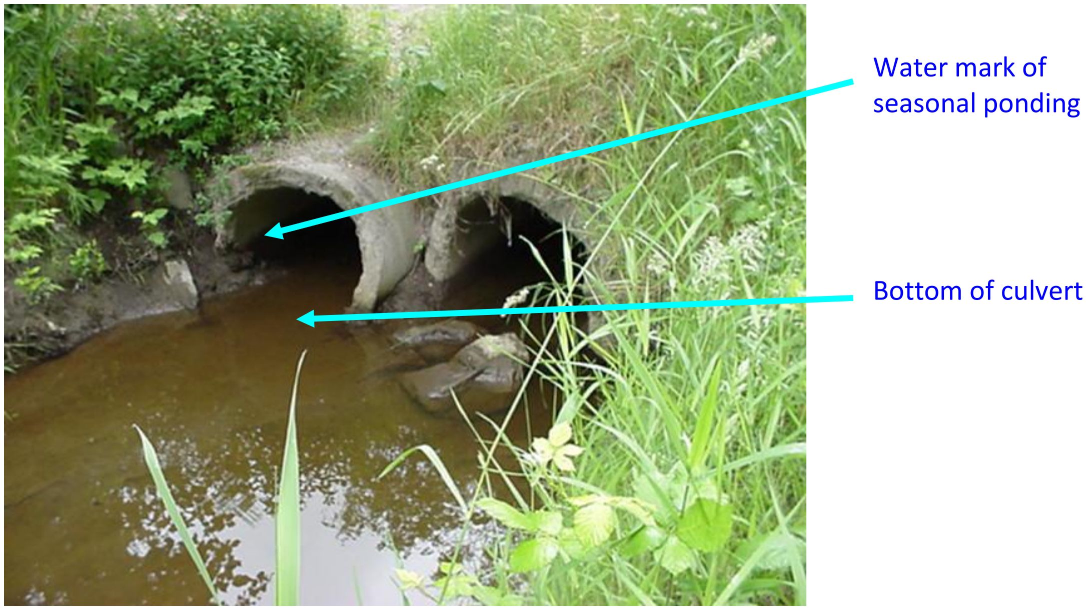
NOTE 2: If the wetland has multiple outlets, try to find the one that has the lowest topographic elevation.

NOTE 3: Sometimes the lowest point of the outlet is flooded or flowing. In these cases, measure from the bottom of the outlet to the mark of the seasonal flooding. A common mistake is to measure from the current water level in the outlet to the marks of flooding.

NOTE 4: It can be difficult to extrapolate the height of flooding above the lowest point of the outlet in large wetlands where the flood marks are distant from the outlet.

Figure24: A box culvert that is the outlet of a depressional wetland. The live-storage is measured as the distance between the bottom of the culvert and the water marks on the side. The distance here is approximately 15 inches.

Figure25: A round culvert with water still present. Live storage is measured from the bottom of the culvert, not the present water level. The depth of storage is approximately 7 inches.



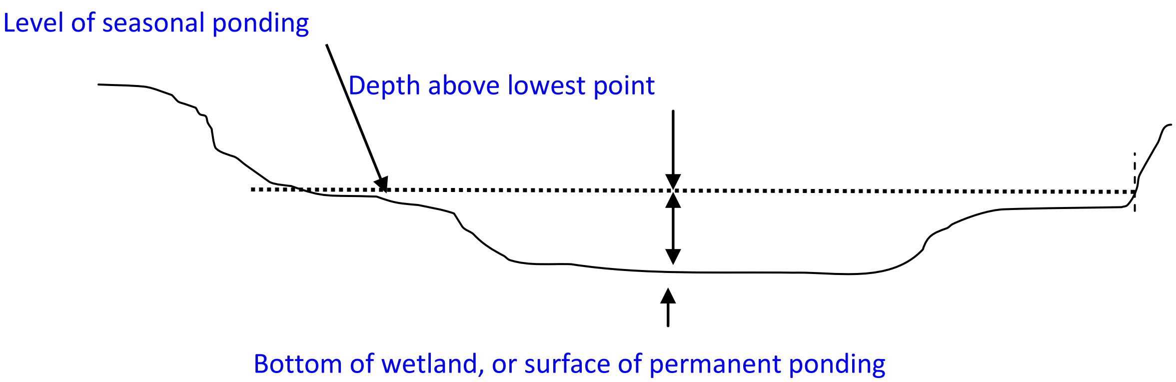


Figure26: Measuring maximum depth of seasonal ponding in a wetland without an outlet.

Headwater wetlands: This question also asks if the wetland being categorized is a "headwater" wetland. Depressional wetlands found in the headwaters of streams often do not store surface water to any great depth. They can, however, be important in reducing peak flows because they slow down and "desynchronize" the initial peak flows from a storm (Brassard and others 2000). Their importance in hydrologic functions is often under-rated (statement of Michael L. Davis, Deputy Assistant of the Army, before the committee on Environment and Public Works, Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety, United State Senate, June 26, 1997). The depth of seasonal storage in headwater wetlands was judged to be an inadequate representation of the importance of these wetlands in the hydrologic functions. For this reason, headwater wetlands are scored 5 points, out of 7 possible, regardless of the depth of seasonal storage.

To identify if the unit is a "headwater" wetland, use the information collected in question D 1.1. If the unit has a permanent or seasonal outflow through a defined channel but NO inflow from a permanent or seasonal channel, it is a headwater wetland for the purposes of this categorization. **NOTE:** One exception to this criterion is wetlands whose water regime is dominated by groundwater coming from water storage facilities. Depressional wetlands at the base of irrigation reservoirs, dams or the edge of irrigation canals are not headwater wetlands, even if they have surface water that flows out of them without an inflow.

D 4.3 Contribution of the wetland to storage in the watershed:

> **Rationale for indicator**: The potential of a wetland to reduce peak flows from its contributing basin is a function of its retention time (volume coming into a unit during a storm event/the amount of storage present). The area of the contributing basin is used to estimate the relative amount of water entering it, while the area of the wetland is used to estimate the amount of storage present. Large contributing basins are expected to have larger volumes for any given storm event than smaller basins. Thus a small wetland with a large contributing basin is not expected to reduce peak flows as much as a large wetland with a small contributing basin.

This question asks you first to estimate the geographic area that is found upstream of the wetland that contributes surface water to the wetland unit you are rating. This is called the contributing basin of the unit. You will then need to estimate the area of the unit and calculate the ratio of the two. You do not need to estimate these areas exactly because the scoring is based on thresholds for the ratio. If the contributing basin is less than 10 times the size of the wetland itself, the wetland will score the most points. On the other hand, if the area of the contributing basin is more than 100 times the area of the wetland the score is [0], and you will not need to make any further estimates.

> **NOTE:** You can use whatever means available to estimate the area of the upstream basin contributing surface water to a wetland. A topographic map works well if the landscape is not too confusing. If you have GIS with basin boundaries you will have to be careful to include only the areas upgradient of the wetland unit. If you are unfamiliar with the methods for mapping contributing basins, the procedure is described in a fact sheet by the NRCS "How to Read a Topographic Map and Delineate a Watershed" http://www.nh.nrcs.usda.gov/technical/Publications/Topowatershed.pdf .

D 5.0 Does the Landscape Have the Potential to Support the Hydrologic Functions of the Site?

Human changes in land use tend to de-stabilize the flows of water in a watershed. Generally, human activities reduce infiltration and increase the run-off during storm events and thus increase flooding problems (review in Sheldon and others 2005). A wetland located in areas where run-off has increased can provide more flood protection than one located in an undeveloped area. Thus, the "landscape potential" for the function is related to the increased amounts of water coming into the wetland from human sources.

Qualitatively, the increase is modeled as the number of different new sources of water coming into the unit.

D 5.1 Does the unit receive any stormwater discharges?

Rationale for indicator: A depressional wetland that receives stormwater directly has a higher potential for providing hydrologic functions. It will receive more water during a rain event than under normal (no stormwater discharges) conditions.

Answer "YES" to the question if you see any pipes coming into the wetland from the surrounding uplands. These are usually stormwater discharges. Also, look on the aerial photograph of the wetland and look for stormwater ponds within 300 ft of the unit. If you see any ponds, determine if their discharges can get into the wetland.

D 5.2 Is more than 10% of the area within 150 ft of wetland unit in agricultural, pasture, residential, commercial, or urban?

Rationale for indicator: Water can also flow into the depression directly from surrounding land uses that prevent some or all water from infiltrating. For example, a lawn can reduce infiltration by as much as 65% relative to a forest (Kelling and Peterson 1975).

Use your aerial photo and draw a line that is 150 ft from the edge of the unit you have mapped for rating. Answer "YES" to this question if you find the listed uses within 150 ft of the wetland and they cover more than 10% of the "donut" polygon around the unit.

D 5.3 Is more than 25% of the contributing basin of the wetland unit covered with intensive human land uses (residential at >1 residence/acre, urban, commercial, agriculture, etc.)?

Rationale for indicator: Human changes in land use tend to de-stabilize the flows of water in a watershed. Generally, human activities reduce infiltration and increase the run-off during storm events and thus increase flooding problems (review in Sheldon and others 2005). Research in the Puget Sound area by the University of Washington has found that there are significant increases in water flows when intensive land uses represent more than 25 – 35% of the contributing basin (Azous and Horner 1997).

Use the map of the contributing basin you developed for question D 4.3 and estimate the area within the basin that has intensive land uses that de-stabilize surface flows.

D 6.0 Are the Hydrologic Functions Provided by the Site Valuable to Society?

D 6.1 Is the unit in a landscape that has flooding problems?

> **Rationale for indicator**: The value of wetlands in reducing the impacts of flooding and erosion is based on the presence of human or natural resources that can be damaged by these disturbances. In general, the value of a wetland in reducing flood damage is judged to decrease with the distance downstream because the amount of water stored by the wetland relative to the overall flows decreases.

You will need to do some fact finding if you do not know whether floods have caused damage downstream of the unit. Your best sources of information on flooding problems are the emergency planning office in your local government, the local FEMA (Federal Emergency Management Agency), or the USGS for groundwater issues.

Choose the descriptions that best match conditions within the wetland unit being rated. Choose the description that generates the highest score on the Scoring Form.

- The site has been identified as important for flood storage or flood conveyance in a regional flood control plan.
- The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., salmon redds).
- Flooding occurs in sub-basin that is immediately down-gradient of unit.
- Surface flooding problems are in a sub-basin further down-gradient.
- Flooding from groundwater is an issue in the sub-basin where the unit is found. For example, certain areas of Pierce and Thurston counties have problems with flooding and damage from groundwater. See USGS information for Puget Sound at: http://wa.water.usgs.gov/projects/pugethazards/urbanhaz/PDF/fs111_00.pdf
- The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood.

NOTE 1: Many depressional wetlands with no surface water outflow can protect natural or human resources from flooding. They are performing the hydrologic functions at the highest levels possible. No surface water leaves the wetland to cause flooding or erosion. The water either infiltrates to groundwater or it evaporates. To answer the "value" question for a wetland with no outflow, try to picture the wetland as "filled" with a parking lot. Where would the surface water it normally stores flow? If it would flow into a swale, channel, or stream, there is a possibility that the flow would increase flooding or erosion.

NOTE 2: (a landscape constraint on function): When a depressional wetland is situated upslope of a road where water movement through the road is limited by ineffective culverts, the roadway typically acts as a levee, de-coupling upslope wetlands from downstream flooding. The roadway, rather than the wetland, delays storm flows, and acts like a flood-control dam. This indicates that the hydrologic connection between the floodway and the upslope area is impaired. If, however, the water impounded on the upslope side of the road recedes at the same rate as a flooding event, you can assume the connections through the road are not constrained. In this case, the storage provided by the wetland on the upslope side is important, and the wetland unit should be scored accordingly.

NOTE 3: (a landscape constraint on function): Depressional wetlands situated at the base of a hillside typically receive significant water inputs from groundwater. Generally, you can conclude that wetlands that receive less than 10% of their water from surface flows do not provide much protection from flooding because they are not connected to the major patterns of surface flows. If the only water inputs are from a spring or seep emerging from a hillslope, then the wetland unit likely does not provide much value in reducing flooding. If, however, there are indicators that the wetland receives surface runoff from further up the slope (e.g., small gullies, washes, etc.) as well as groundwater, then the wetland may be valuable if there are flooding problems further downstream. A wetland can be considered to have more than a 90% groundwater influence if there is no seasonal or permanent surface water inflow and a very small contributing basin. Depressional wetlands in western Washington, however, rarely, if ever get most of their water from groundwater. For example, assume an average rainfall of 48" in western Washington and an average rate of evapotranspiration of 18"/year for a forest. Thus, a minimum of 30"/year of water comes into the unit from rain alone within its boundary. To exceed the 90% threshold the unit would need to receive the equivalent of 300 inches of groundwater/unit area. A 1 acre wetland would need a minimum of 25 acre feet of groundwater flowing through the system to meet the volume threshold for being dominated by groundwater, even if the only source of surface water is rain within its boundaries.

NOTE 4: (a landscape constraint on function): A depressional wetland that receives only return flow from irrigation is not in a landscape position to perform the hydrologic functions. Since the inflow is controlled, there is little chance that the water coming into the wetland will cause downstream flooding or erosion.

5.4 Water Quality and Hydrologic Functions in Riverine and Freshwater-Tidal Wetlands *(Questions Starting with 'R')*

R 1.0 Does the Site have the Potential to Improve Water Quality?

R 1.1 Total area of surface depressions within the wetland that can trap sediments and associated pollutants during a flooding event:

> **Rationale for indicator**: Depressions in riverine wetlands will tend to accumulate sediment and the pollutants associated with sediment (phosphorus and some toxics) because they reduce water velocities (Fennessey and others 1994) when the river floods. Wetlands where a larger part of the total area has depressions are relatively better at removing pollutants associated with sediments than those that have no such depressions.

For this question, you will need to estimate the fraction of the wetland that is covered by depressions. Make a simple sketch of the unit boundary, and on this superimpose the areas where depressions are found. From this you can make a rough estimate of the area that has depressions. Determine if this area is more than ¾ or more than ½ of the total area of the wetland unit. Standing or open water present in the wetland when the river is not flooding are good indicators of depressions. Figure 27 shows a riverine wetland with depressions filled with water.

> **NOTE:** Generally you should count only depressions that hold water for more than a week after a flood recedes. If a depression is not flooded at the time of your site visit, look for the deposition of fine or mucky sediments in the bottom of the depression. Sediments in the depression usually have a finer texture than those in the immediate area indicate the water was present in the depression for longer periods of time.

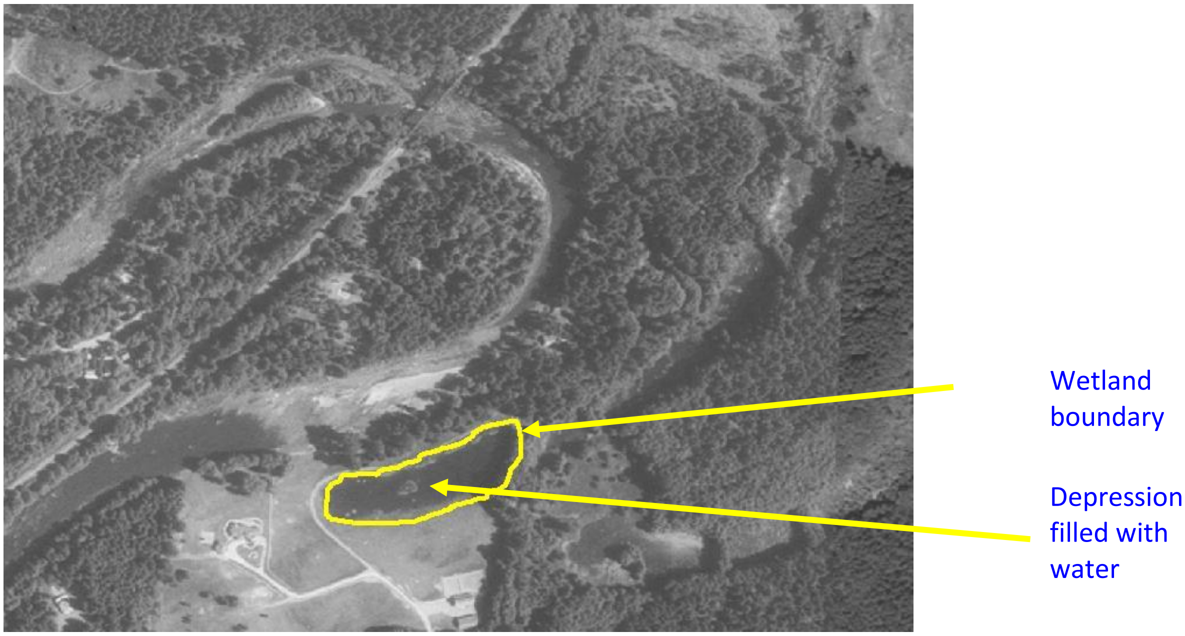


Figure 27: A riverine wetland in an old oxbow of the Nisqually River with one big depression that is filled with water and covers more than ¾ of the wetland.

R 1.2 Characteristics of the plants in the wetland:

> **Rationale for indicator**: Plants in a riverine wetland will improve water quality by acting as a filter to trap sediments and associated pollutants. The plants also slow the velocity of water which results in the deposition of sediments. Persistent, multi-stemmed plants enhance sedimentation by offering frictional resistance to water flow (review in Adamus and others 1991). Shrubs and trees are considered to be better at resisting water velocities than emergent plants during flooding and are scored higher. Aquatic bed species or grazed, herbaceous (non-woody) plants are not judged to provide much resistance to water flows and are not counted as "filters."

For this question you will need to group the plants found within the wetland into three categories: 1) forest or shrub, 2) ungrazed or unmowed emergent plants (> 6 inches high), and 3) neither forest, shrub, or ungrazed emergent plants.

NOTE: This question about plant cover is NOT based on the Cowardin classification. The polygons you draw of emergent and shrub plants must have a 90% cover of the ground when you look down from a person's height (5ft).

NOTE: You will need to judge if the plants in the unit are 6" high or more at the time when the river floods and is actually transporting sediment. If grazing or mowing occurs in summer but the plants have time to grow again before the time when the riverine wetland gets flooded, then the system is ungrazed. If, however, the grazing pressure is intense enough that the grass does not have time to recover during the flood season then it should be considered grazed.

There are two size thresholds used to score this characteristic: 1) more than 2/3 of the wetland area is covered (>66% cover) in either emergent, forest, or shrubby plants, and 2) more than 1/3 is covered. These thresholds can usually be estimated visually in small wetlands. Large wetlands, however, may require you to draw the area of plant types on a map or aerial photo before you can feel confident that your estimates are accurate.

R 2.0 Does the Landscape Have the Potential to Support the Water Quality Function of the Site?

Wetlands will remove many pollutants coming into them, and it is the removal of this excess pollution that is considered to be a valuable function for society. The landscape surrounding the wetland will to some degree determine how well a wetland improves water quality. If the wetland receives a heavy load of pollutants from the surrounding areas it will function to its maximum capacity. If, however, there are no pollutants coming in, the wetland cannot remove them, even if it has the necessary physical and chemical characteristics. Thus, the "landscape potential" for the function is related to the amount of pollutants that come into the wetland from the surrounding areas. Qualitatively, the level of pollutants can be correlated with the level of disturbance, development, and intensity of agriculture in the landscape. For example, relatively undisturbed watersheds will carry much lower sediment and nutrient loads than those that have been impacted by development, agriculture, or logging practices (Hartmann and others 1996, and Reinelt and Horner 1995).

R 2.1 Is the unit within an incorporated city or within its Urban Growth Area (UGA)?

R 2.2 Does the contributing basin to the unit include a UGA or incorporated area?

Rationale for indicators: Urban and suburban areas are a major source of pollutants to streams (review in Sheldon and others 2005). The presence of development adjacent and upstream of the wetland is a good indicator that there are pollutants in the surface waters reaching the riverine unit from the stream.

To begin, trace the stream or river to its source and determine if there are any urban areas or suburban areas adjacent to the stream that floods the unit. Answer "YES" to this question if there are any incorporated cities and towns or their Urban Growth Areas upstream of the unit or if the unit is within an urban area or UGA. Maps of UGA and urban areas can be found at http://www.ecy.wa.gov/programs/air/aginfo/ugamaps.htm.

If there are no developed areas adjacent to the stream you will need to identify the contributing basin to the stream that floods the wetland unit you are rating. This can be done using topographic maps or through web sites such as the USGS http://water.usgs.gov/wsc/map_index.html. Answer "YES" to this question if there are any incorporated cities and towns or UGAs within the contributing basin.

R 2.2 Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years?

> **Rationale for indicator**: Tilled fields are a source of nutrients, pesticides, and sediment. Pastures are a source of nutrients and pathogenic bacteria, and clearcut areas are a source of sediment (reviews in Sheldon and others 2005). The presence of these conditions upstream of the wetland unit are a good indicator that there are pollutants in the river waters reaching the unit.

Define the boundaries of the contributing basin to the stream that floods the wetland unit as in question R 2.1. Answer "YES" to this question if at least 10% of the total area of the upstream contributing basin has at least one or a combination of pasture, tilled fields or clearcut logging. Land uses can be determined from aerial photographs of the area or by downloading land use maps from the USGS http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/Land_Cover_Products.

R 2.3 Is more than 10% of the area within 150 ft of wetland unit in agriculture, pasture, golf courses, residential, commercial, or urban land uses?

> **Rationale for indicator**: Farming, grazing, golf courses, residential areas, commercial land uses, and urban areas, in general, are major sources of pollutants (reviewed in Sheldon and others 2005). The review also found that a well vegetated buffer of 150 ft will only remove 60-80% of some pollutants from surface runoff into a wetland. Thus, pollutants from such land uses will probably reach the wetland unit if they are within 150 ft of the wetland.

Use your aerial photo and draw a line around the unit that is 150 ft from the edge of the unit you have mapped for rating. Answer "YES" to this question if you find the listed uses within 150 ft of the wetland and they cover more than 10% of the "donut" polygon around the unit.

R 3.0 Is the Water Quality Improvement Provided by the Site Valuable to Society?

R 3.1 Is the unit along a stream or river that is on the 303(d) list or on a tributary that drains to a stream on the 303(d) list?

> **Rationale for indicator**: The term, "303(d) list," is short for the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit to the Environmental Protection Agency (EPA) every two years. In Washington, we identify all waters where required pollution controls are not sufficient to attain or maintain water quality standards. The sites are ranked from 1-5 based on the uses of the water and severity of the pollution problem. Wetlands that discharge directly to these polluted waters are judged to be more valuable than those that discharge to unpolluted bodies of water because their role at cleaning up the pollution is critical for reducing further degradation of water quality.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards http://www.ecy.wa.gov/programs/wq/303d/2008/index.html. Determine from the aerial photo if the wetland unit you are rating is flooded by a stream or river listed as Category 2, 4, or 5 waters or is on a tributary to it.

R 3.2 Does the drainage in which the unit is found have TMDL limits for nutrients, toxics, or pathogens? *(see Rationale for definition of TMDL)*

> **Rationale for indicator**: Total Maximum Daily Loads (TMDLs or Water Cleanup Plans) describe the type, amount and sources of water pollution in a particular water body. They analyze how much the pollution needs to be reduced or eliminated to meet water quality standards, and then provide targets and strategies to control the pollution. Wetlands that discharge directly to these polluted waters are judged to be more valuable because they function at a landscape scale to mitigate discharges of pollutants. TMDL's are based on models that estimate the natural decay and absorption of pollutants under current conditions. Wetlands are an important part of that "natural" decay and their destruction would require a recalibration of the models, and force polluters to further reduce their discharges.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that have TMDL's: http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html. Determine if the wetland unit you are rating is flooded by a stream or river in a drainage for which TMDL's have been developed.

R 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality?

> **Rationale for indicator**: Not all pollution and water quality problems are identified by Ecology's water quality monitoring program. Local and watershed planning efforts sometimes identify wetlands that are important in maintaining existing water quality. These wetlands provide a value to society that needs to be replaced if they are impacted.

To answer this question you will need to seek information from the planning department of the local jurisdiction where the site is located. Information on regional or local plans can often be found on the web site of the city or county in which the site is found. Useful "search" phrases include: "watershed plan," "water quality," or "wetland protection." If the drainage in which the wetland is found has a TMDL plan developed for it, then answer "YES" for this question. It is assumed that all wetlands are valuable in a basin where water quality is poor enough to require a TMDL. The Department of Ecology's web site lists all the bodies of water that have TMDL's (see above)

R 4.0 Does the Site Have the Potential to Reduce Flooding and Stream Erosion?

R 4.1 Characteristics of the "overbank" flood storage the wetland provides, based on the ratio of the channel width to the distance of the wetland perpendicular to the flow:

Rationale for indicator: The ratio of the width of the channel to the width of the wetland perpendicular to the flow is an indicator of the relative volume of storage available within the wetland. The width of the stream between banks is an indicator of the relative flows at that point in the watershed. Wider streams will have higher volumes of water than narrower streams. More storage is therefore needed in larger systems to lessen the impact of peak flows. The distance of the wetland perpendicular to the stream is used as an indicator of the amount of short-term storage available during a flood event. A wetland that is wide relative to the width of the stream is assumed to provide more storage during a flood event than a narrow one. The ratio of the two values provides an estimate that makes it possible to rank wetlands relative to each other in terms of their overall potential for storage.

You will need to estimate the average distance of the wetland perpendicular to the direction of the flow, and the width of the stream or river channel (distance between the top of the banks of the stream). Calculate this ratio by taking the width of the wetland and dividing by the width of the stream. There are five thresholds for scoring: a ratio more than 20, a ratio between 10 – 20, a ratio between 5 – <10 , a ratio between 1 - <5, and a ratio < 1.

Riverine wetlands are found in different positions in the floodplain and it may sometimes be difficult to estimate this indicator. The following bullets describe some common types of riverine wetland and how to estimate this indicator.

- If the vegetated wetland lies within the banks of the stream or river, the ratio is estimated as the average width of the "delineated" wetland/average distance between banks. Figure 28 shows a wetland where plants fill only a small part of the distance between the banks. In this case the ratio is < 1.

- If the wetland lies outside the existing banks of the river, you may need to estimate the distances using a map or aerial photograph. Riverine wetlands in old oxbows may be some distance away from the river banks. Instead of trying to estimate a width for the wetland and the distance between banks in feet or yards, it may be easier to estimate the ratio directly. Ask yourself if the average width of the wetland is more or less than the distance between banks. If it is more, is it more than five times as wide? If not, the ratio is between 1- <5. If it is more than five times greater, is it more than 10 times, etc. Figure 29 shows a riverine wetland in an old oxbow where the ratio was judged to be between 1- <5.

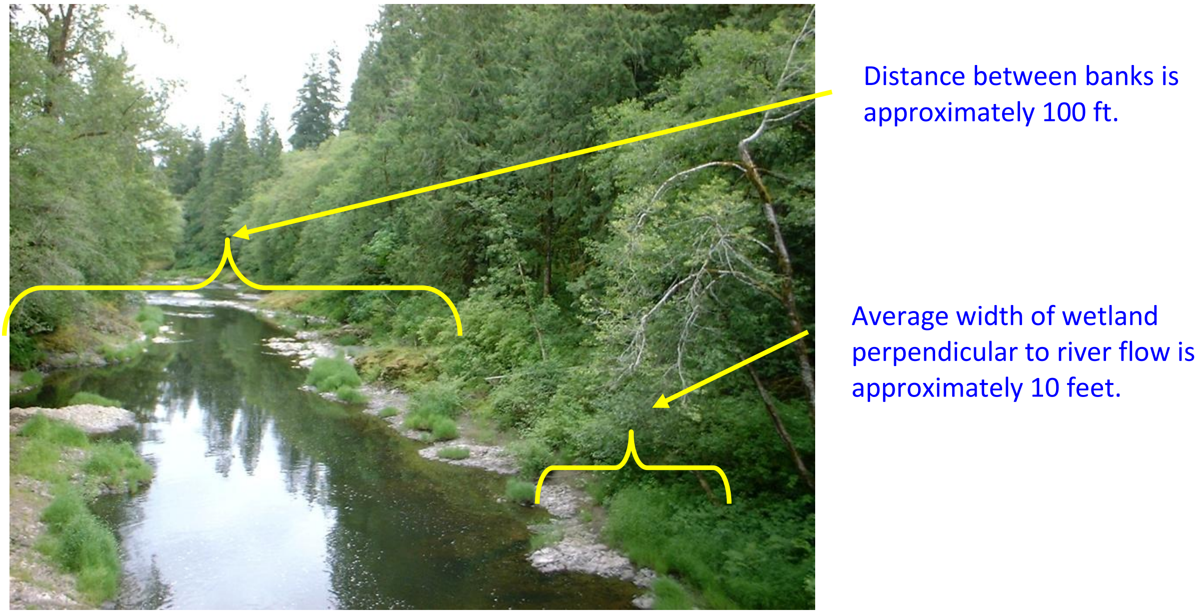


Figure 28: A riverine wetland where the width of the wetland is less than the distance between the banks (ratio ≤ 1).

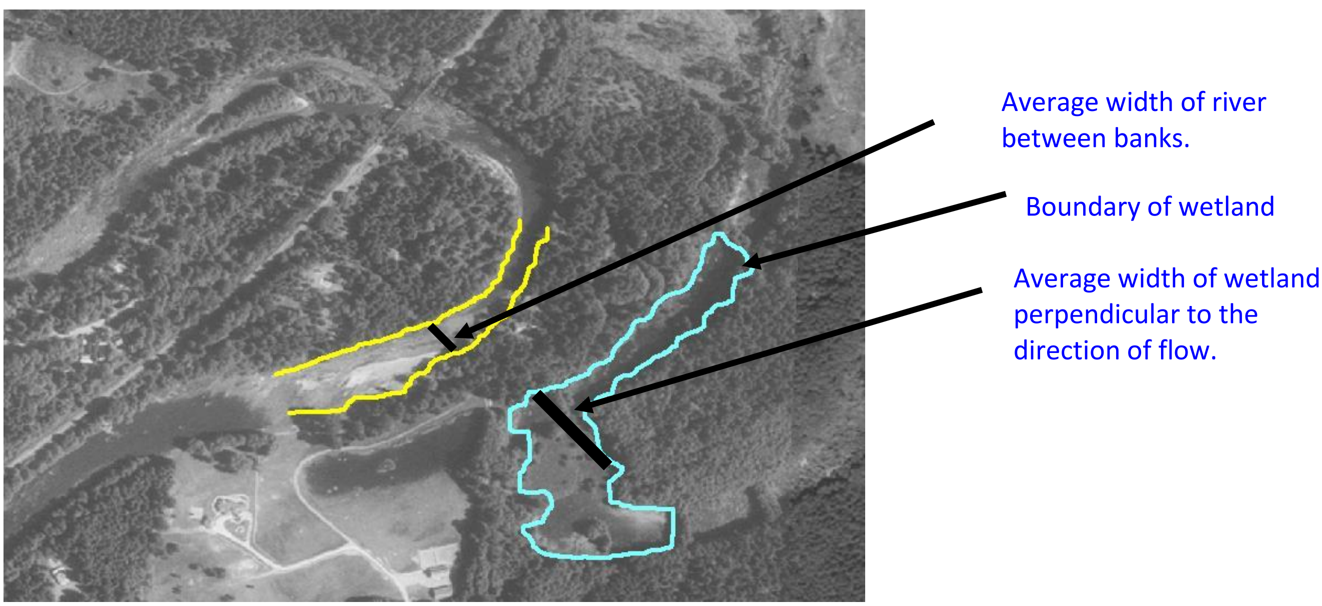


Figure 29: A riverine wetland in an old oxbow of the Nisqually River where the average width of the wetland is between 1-5 times the width of the river channel.

- If you are including the river or stream as part of the wetland, then the width of the stream is also included in the estimate of the width of the wetland.

- Braided channels: If the wetland is associated with only one braid you should use the cumulative width of all channels to calculate the average width of the channel.

R 4.2 Characteristics of plants that slow down water velocities during floods:

> **Rationale for indicator**: Riverine wetlands play an important role during floods because the plants act to slow water velocities and thereby erosive flows. This reduction in velocity also spreads out the time of peak flows, thereby reducing the maximum flows. The potential for reducing flows will be greatest where the density of wetland plants and other obstructions is greatest and where the obstructions are rigid enough to resist water velocities during floods (Adamus and others 1991). The indicator used combines both characteristics for the scoring. Shrubs and trees are considered to be better at resisting water velocities than emergent plants. Aquatic bed species are judged not to provide much resistance and are not counted. Wetlands with a dense cover of trees and shrubs are scored higher than those with only a cover of emergent species.

For this question you will need to group the plants found within the wetland into two categories: 1) emergent, and 2) forest and scrub/shrub.

There are four size thresholds used to score this characteristic: 1) forest or shrub > 1/3 the area of the wetland, 2) emergent plants > 2/3 area, 3) forest or shrub > 1/10 area, 4) emergent plants > 1/3 area. Figure 30 shows an aerial photograph of a riverine wetland that has dense shrub plants over most of its area.

NOTE: This plant cover is NOT based on the Cowardin classification. The polygons you draw of emergent and shrub plants must have a 90% cover of the ground when you look down from a person's height (5ft).

NOTE: If the wetland is covered with downed trees, you can treat large woody debris as "forest or shrub."

Figure 30: A riverine wetland in Bothell that has shrub plants over more than 1/3 of its area in many patches. Other important characteristics are: 1) the stream is part of the wetland because it is smaller than 50 ft. and there are wetland plants on both sides, 2) the average ratio of width of wetland to width of stream is greater than 20.

R 5.0 Does the Landscape Have the Potential to Support the Hydrologic Functions of the Site?

R 5.1 Is the stream or river adjacent to the unit downcut?

Rationale for indicator: Streams in developed areas are often downcut because of the increased flows from impermeable surfaces (review in Sheldon and others 2005). As a result the streams can become disconnected from the surrounding floodplain and floodwaters go overbank less frequently. A riverine wetland that is directly adjacent to a downcut stream will not provide the same level of flood attenuation as one that is adjacent to a stream with no downcutting.

To answer this question you will need to **view the section of the stream that provides the overbank flows to the wetland unit.** Generally, downcutting becomes visible when its watershed contains more than 10% impervious surface (Donaldson and Hefner 2005). Figures 31, 32, 33 and 34 show a progression of different levels of downcutting that result from development. For the purposes of this rating, Figures 33 and 34 show streams for which the answer to R 5.1 would be “YES”. Figures 31 and 32 are streams for which the answer would be “NO” because the floodplain is still somewhat connected to the stream. Figures 31-34 are from Donaldson and Hefner 2005.

Figure 31: Stream in a watershed with less than 5 percent impervious cover, showing no downcutting.

Figure 32: A stream in a watershed with 8-10% impervious cover. Streambed is still relatively stable, but signs of stream erosion are more apparent. Not much downcutting is evident.

Figure 33: A stream in a watershed with approximately 20% impervious cover showing downcutting. You would answer "YES" to question R 5.1 for this stream.

Figure 34: This stream has a surrounding area of approximately 30%impervious cover. The manhole in the middle of the picture was originally in the floodplain and is an indicator of the degree to which the channel has been downcut.

R 5.2 Does the upgradient watershed include an UGA or incorporated area?

Rationale for indicator: Urban and suburban areas are a major source of impervious surface. These areas increase both intensity of peak flows and the amount of water flowing during a storm event (review in Sheldon and others 2005). The presence of development upstream of the wetland is a good indicator that the landscape is increasing the flood flows to the wetland unit and thereby increases its level of functioning.

To begin, trace the stream or river to its source and determine if there are any urban areas or suburban areas adjacent to the stream. Answer "YES" to this question if there are any incorporated cities and towns or their Urban Growth Areas upstream of the unit. Maps of UGA and urban areas can be found at http://www.ecy.wa.gov/programs/air/aginfo/ugamaps.htm and http://www.commerce.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&ItemID=7518&MId=944&wversion=Staging

If there are no developed areas adjacent to the stream you will need to identify the contributing basin to the stream that floods the wetland unit you are rating. This can be done using topographic maps or through web sites such as the USGS http://water.usgs.gov/wsc/map_index.html. Answer "YES" to this question if there are any incorporated cities and towns or UGAs within the contributing basin.

R 5.3 Is the upgradient stream or river controlled by dams?

Rationale for indicator: Dams will buffer the flood waters that a wetland receives by holding much of the waters back upstream of the unit. This can reduce the flood storage and attenuation that the wetland itself performs. The landscape potential for a wetland performing hydrologic functions is therefore reduced when dams are present upstream.

To answer this question you will have to trace on a map or aerial photo the stream or river adjacent to the unit you are rating. You answer "YES" to this question if there is a dam within 10 miles upstream of the unit. Look only for dams on the main channel. Dams on tributaries to the main stream do not count.

R 6.0 Are the Hydrologic Functions Provided by the Site Valuable to Society?

R 6.1 Distance to the nearest areas downstream that have flooding problems?

Rationale for indicator: The value of wetlands in reducing the impacts of flooding and erosion is based on the presence of human or natural resources that can be damaged by these processes. The indicator used characterizes whether the wetland's position in the landscape protects down-gradient resources from flooding. In general, the value of a wetland in reducing flood damage is judged to decrease with the distance downstream to flood-prone areas because the amount of water stored by the wetland relative to the overall flows decreases.

If you do not know if floods have caused damage in the sub-basin further downstream you will need to do some research. Your best sources of information on flooding problems are the emergency planning office in your local government and the local FEMA (Federal Emergency Management Agency). You may also find useful information using search engines on the web. Search for "watershed name" + flooding (or flood problems, flood history).

Determine if flooding occurs that damages resources in:

- The sub-basin that is immediately down-gradient of the unit.
- A sub-basin further down-gradient.

R 6.2 Has the site has been identified as important for flood storage or flood conveyance in a regional flood control plan?

Rationale for indicator: The values of flood storage and flood conveyance provided by wetlands are often recognized in regional flood control plans, and specific sites are mentioned in these plans.

To answer this question contact the jurisdiction in which the site is found to determine if any regional flood control plans exist. A search of web sites will probably also list flood control plans for the watershed in question. If plans exist, try to determine if the site has been identified as important or valuable. To answer "YES" to this question, the flood control district needs to have developed a flood control plan or flood hazard mitigation plan that identifies the site as one that needs to be preserved or enhanced to improve flood protection.

5.5 Water Quality and Hydrologic Functions in Lake-Fringe Wetlands *(Questions Starting with "L")*

L 1.0 Does the Site have the Potential to Improve Water Quality?

NOTE: Lake-fringe wetlands have a maximum score of only 12 points for the water quality functions instead of 16. The technical review team developing the Washington State Wetland Rating systems concluded that lake-fringe wetlands do not improve water quality to the same extent as riverine or depressional wetlands because any pollutants taken up in plant material will be more easily released into the water column and dispersed when the plants die off.

L 1.1 Average width of plants along the lakeshore:

Rationale for indicator: The intent of this question is to characterize the width of the zone of plants that provide a vertical structure to filter out pollutants or absorb them. Wetlands in which the average width of plants is large are more likely to retain sediment and toxic compounds than where plants are narrow (Adamus and others 1991). Even aquatic bed species that die back every year are considered to play a role in improving water quality. These plants take up nutrients in the spring and summer that would otherwise be available to stimulate algal blooms in the lake. In addition, aquatic bed species change the chemistry of the lake bottom to facilitate the binding of phosphorus (Moore and others 1994).

It is often difficult to map the outside edge of a wetland when it is along the shores of a lake where open water can extend out for large distances. For this reason the question is phrased in terms of width of plants perpendicular to the shore rather than the area of plants. There are three thresholds for scoring the average width of plants:

1) 33 ft or more (10 m)

2) 16 ft - < 33 ft (5–10 m)

3) 6 ft - <16 ft. (2 – 5 m)

For large wetlands along the shores of a lake it may be necessary to sketch the plants and average the width by segment, and then calculate an overall average. Figure 35 gives an example of such a sketch. Figure 36 shows an actual lake-fringe wetland where the average width of plants is greater than 33 ft.

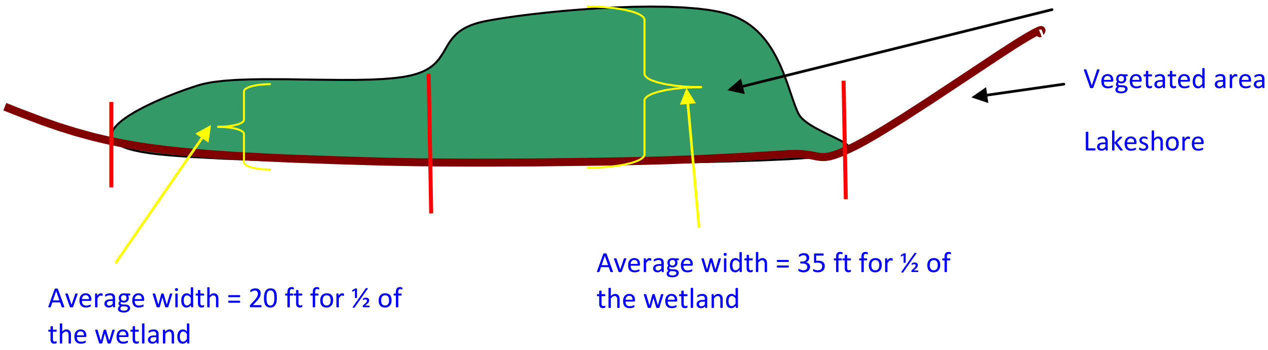


Figure 35: Estimating width of plants along the shores of a lake. The average width of plants for the entire area is: (20 ft x 0.5) + (35 ft x 0.5) = 27.5 ft.

Figure 36: A lake-fringe wetland where the plants are wider than 33 ft. The plants along the shores of this lake consist of a zone of shrubs and a zone of aquatic bed and emergent species.

L 1.2 Characteristics of the plants in the wetland:

Rationale for indicator: The intent of this question is to characterize how much of the wetland is covered with plants that are more effective at improving water quality in a lake environment. Herbaceous emergent species have, in general, been found to sequester metals and remove oils and other organics better than other plant species (Hammer 1989, and Horner 1992).

For this question you will need to group the plants found within the wetland into three categories: 1) herbaceous, 2) aquatic bed, and 3) any other plants. For this question, the herbaceous plants can be either the dominant plant form (in this case it would be called emergent class) or as an understory in a shrub or forest community. **These again are not the Cowardin classes for plants.**

There are several size thresholds used to score this characteristic – more than 90%, more than 2/3, or more than 1/3, of the vegetated area is covered in herbaceous plants or other types. These thresholds can usually be estimated visually in small wetlands. Large wetlands, however, may require you to draw the area of plant types on a map or aerial photo before you can feel confident that your estimates are accurate.

> **NOTE**: In lake-fringe wetlands the area of the wetland used as the basis for determining thresholds is only the area that is vegetated. Do not include open water beyond the outer edge of the unit in determining the area of the wetland covered by a specific type of plants.

L 2.0 Does the Landscape Have the Potential to Support the Water Quality Function of the Site?

L 2.1 Is the lake used by power boats?

Rationale for indicator: The presence of power boats on a lake will increase the pollutants entering a lake fringe wetland. Toxic chemicals, oils, cleaners, and paint scrapings from boat maintenance can make their way into the water (review in Asplund 2000). In addition, older two stroke engines still found on many recreational boats and jet skis were purposely designed to discharge gasoline and oil into the water. The landscape potential of a wetland along a lake-shore to improve water quality is higher if the lake itself is directly receiving pollutants from power boats.

To answer this question you will need to know if the lake has any restrictions on use by power boats. The local planning department or parks department should have this information. The answer to this question is "NO" if there is a complete ban on gasoline or diesel motors on the lake. Many lakes are limited to small outboards of less than 5 or 10 hp, but these are still sources of pollutants. Other lakes are limited to electric motors only. In this latter case, the answer would also be "NO".

The answer to this question should be "YES" unless you can provide evidence that the bans on power boats are present.

L 2.2 Is more than 10% of the area within 150 ft of the wetland unit (on the shore side) agricultural, pasture, residential, commercial, or urban?

> **Rationale for indicator**: Farming, grazing, residential areas, commercial land uses, and urban areas in general are major sources of pollutants (reviewed in Sheldon and others 2005). The review also found that a well vegetated buffer of 150 ft will only remove 60-80% of some pollutants from surface runoff into a wetland. Thus, pollutants from such land uses will probably reach the wetland unit along the lake if they are within 150 ft of it.

Use your aerial photo and draw a line around the unit that is 150 ft from the upland edge of the unit. The line should be 150 ft upslope of the unit boundary. Answer "YES" to this question if you find the listed uses within 150 ft of the wetland and they cover more than 10% of the polygon.

L 2.3 Does the lake have problems with algal blooms or excessive plant growth such as milfoil?

> **Rationale for indicator**: Algal blooms and blooms of larger plants such as milfoil are an indication of excessive nutrients in the lake water (Schindler and Fee 1974, Smith and others 1999). The increased levels of nutrients in the lake increase the amount of nutrients that the wetland plants absorb (Venterink and others 2002) and thus also increase the level of function within the wetland unit.

To answer this question you will need to visit the lake in the summer, or examine aerial photographs taken in the summer, to determine if there is excessive plant growth (Figures 37, 38). If you are rating the unit in the winter, you will need to inquire locally (residents, board of health officials, or parks departments) to determine if blooms occur in the summer.

Figure 37: Algal blooms in a lake in the Puget Sound area.

Figure 38: A lake infested with milfoil indicating the presence of excess nutrients (photo courtesy of NHDEP).

L 3.0 Is the Water Quality Improvement Irovided by the Site Valuable to Society?

L 3.1 Is the lake on the 303(d) list of degraded aquatic resources?

Rationale for indicator: In Washington we identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards. The sites are ranked from 1-5 based on the uses of the water and severity of the pollution problem. Wetlands along the shores of lakes on the 303(d) list are judged to be more valuable because their role at cleaning up the pollution is critical for reducing further degradation of water quality.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards http://www.ecy.wa.gov/programs/wq/303d/2008/index.html. Determine if the wetland unit is along the shores of a lake on the 303(d) list.

L 3.2 Is the lake is in a sub-basin where another aquatic resource is on the 303(d) list?

Rationale for indicator: Lake-fringe wetlands can mitigate the impacts of pollution even if they are not located directly on a polluted body of water. At a watershed scale, lake-fringe wetlands can remove pollutants that might otherwise cause problems further downstream. They can also trap airborne pollutants. Thus, wetlands can provide an ecosystem service and value to our society in any basin and sub-basin that has pollution problems. The removal of pollutants by wetlands is judged to be more valuable in basins where other aquatic resources are already polluted. The 303(d) list is used as an indicator of pollution problems in a basin.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards (see above).. Determine if the wetland unit is in a basin or sub-basin where any body of water is on the 303(d) list.

L 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality?

Rationale for indicator: Not all pollution and water quality problems are identified by Ecology's water quality monitoring program. Local and watershed planning efforts sometimes identify wetlands that are important in maintaining existing water quality. These wetlands provide a value to society that needs to be replaced if they are impacted.

To answer this question you will need to seek information from the planning department of the local jurisdiction where the site is located. Information on regional or local plans can often be found on the web site of the city or county in which the site is found. Useful "search" phrases include: "watershed plan," "water quality," or "wetland protection." If the basin in which the wetland is found has a TMDL plan (also called a Water Clean Up Plan) developed for it, then you answer "YES" for this question. It is assumed that all wetlands are valuable in a basin where water quality is poor enough to require a TMDL. The Department of Ecology's web site lists all the bodies of water that have TMDL's: http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html .

L 4.0 Does the Site Have the Potential to Reduce Shoreline Erosion?

Lake-fringe wetlands have a maximum score of only 6 points for the hydrologic functions instead of 16. The technical review team developing the wetland rating system (Hruby 2004b) concluded that lake-fringe wetlands do not provide hydrologic functions to the same extent as riverine or depressional wetlands. The function of reducing shoreline erosion at the local scale was not judged to be as important as reducing peak flows and reducing erosion at the watershed scale, and should not be scored as highly. Lake-fringe wetlands, however, do reduce erosion by dissipating wave energy before it reaches the shore.

L. 4.1 Average width and characteristics of plants along the lakeshore (do not include aquatic bed species):

Rationale for indicator: The intent of this question is to characterize how much of the wetland is covered with plants that provide a physical barrier to waves and protect the shore from erosion. This protection consists of both shoreline anchoring and the dissipation of erosive forces (Adamus and others 1991). Wetlands that have extensive, persistent (especially woody) plants provide protection from waves and currents associated with large storms that would otherwise penetrate deep into the shoreline (Adamus and others 1991). Emergent plants provide some protection but not as much as the stiffer shrubs and trees.

This characteristic is similar to that used in L 1.1 and L 1.2, but the grouping of plants types and thresholds for scoring are different. If you are familiar with the Cowardin classification of plants you are looking for the areas that would be classified as "Scrub/shrub," "Forested," or "Emergent." **This indicator is based on the Cowardin plant classes.**

It is difficult to map the outside edge of a wetland when it is along the shores of a lake where open water can extend out for large distances. For this reason the question is phrased in terms of the width and type of plants found only within the area of shrubs, trees, and emergents. There are two thresholds for measuring the average width of plants [33 ft (10m) and 6 ft (2m)], and two thresholds based on distance along the shore [¾ and ¼ of the distance along the shore]. For large wetlands along the shores of a lake it may be necessary to sketch the plants types and average the width by type. Figure 39 gives an example of such a sketch.

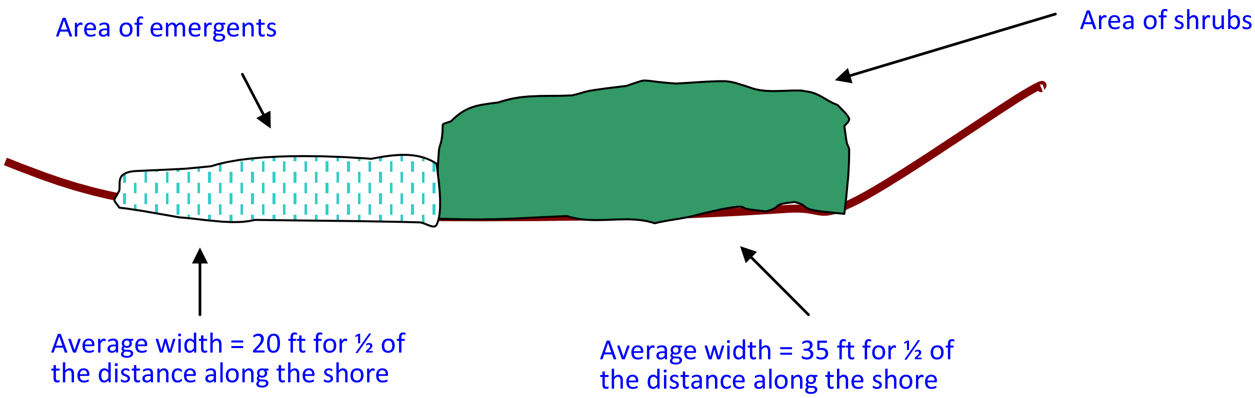


Figure 39: Estimating width of plants types along the shores of a lake. The average width of shrubs is 35 ft for ½ the distance along the shore and the width of emergents is 20 ft for ½ of the distance. This wetland would score 4 points because more than 1/4 distance consists of shrubs wider than 33ft.

L 5.0 Does the Landscape Have the Potential to Support the Hydrologic Functions of the Site?

L 5.1 Is the lake used by power boats with more than 10 hp?

Rationale for indicator: Boat wakes can be a major source of shoreline erosion (Maynord and others 2008, review in Asplund 2000). Lakes with boat traffic will have larger waves than lakes without. Wetlands along the shores of the latter will provide a higher level of function by reducing the impact of the larger waves.

To answer this question you will need to know if the lake has any restrictions on power boats. The local planning department or parks department should have this information. The answer to this question is "NO" if there is a complete ban on gasoline or diesel motors on the lake. Many lakes are limited to small outboards of less than 5 hp or 10 hp. Other lakes are limited to electric motors only. In both cases the answer would also be "NO" because the speed of these smaller boats is limited and correspondingly their wakes will be smaller.

The answer to this question should be "YES" unless you can provide evidence that the bans on power boats are present.

L 5.2 Is the fetch on the lake side of the unit at least 1 mile in distance?

> **Rationale for indicator:** The size of wind generated waves on lakes depends on the fetch. The fetch is the uninterrupted distance over which the wind blows without a significant change in direction. Lakes with larger fetches will have larger waves. Wetlands along the shores of lakes with longer fetches will provide a higher level of function by reducing the impact of the larger waves. The threshold of 1 mile was chosen because in many lakes such a fetch will generate a wave of approximately 1ft in a 20 mph wind.
> http://woodshole.er.usgs.gov/staffpages/csherwood/sedx_equations/RunSPMWave.html

Use a topographic map or scaled aerial photograph to measure the farthest distance to another shore or obstruction. This is the maximum fetch over which a wind can blow. Answer "YES" to this question if the distance is one mile or more.

L 6.0 Are the Hydrologic FunctionsPprovided by the Site Valuable to Society?

L 6.1 Are there resources, both human and natural, along the shore that can be impacted by erosion?

> **Rationale for indicator**: Lake-fringe wetlands provide value by protecting a shoreline from erosion if there is some resource that could be damaged by this erosion. For example, houses are often built along a shoreline, and these can be damaged by shoreline erosion, especially if the house is on a bluff. Buildings, however, are not the only resource that can be impacted. A mature forest along the shores of a lake is an important natural resource that provides important habitat. Shoreline erosion, especially man-made erosion from boat wakes, may topple trees into the lake and reduce the overall area of this resource.

Users of this method must make a qualitative judgment on the value of the lake-fringe wetland in protecting resources from shoreline erosion. Generally, a lake-fringe wetland does have value if:

- There are human structures or old growth/mature forests within 25 ft of OHWM of the shore in the unit.
- There are nature trails or other paths and recreational activities within 25 ft of OHWM.

The Scoring Form has space to note observations of resources along the shore that do not meet the criteria above. If you observe or know of other resources, note this on the form and score it.

5.6 Water Quality and Hydrologic Functions in Slope Wetlands *(Questions Starting with "S")*

S 1.0 Does the Site Have the Potential to Improve Water Quality?

Slope wetlands have a maximum score of only 12 points for the water quality functions instead of 16. The technical review teams that developed the Washington State Wetland Rating System concluded that slope wetlands do not improve water quality to the same extent as riverine or depressional wetlands because slope wetlands will tend to release surface water fairly quickly. They are usually less effective at trapping sediment and all the pollutants associated with sediment because of their topography and the way water moves through them.

S 1.1 Characteristics of the average slope of the wetland:

> **Rationale for indicator**: Water velocity decreases with decreasing slope. This increases the retention time of surface water in the wetland and the potential for retaining sediments and associated toxic pollutants. The potential for sediment deposition and the retention of toxics by burial increases as the slope decreases (review in Adamus and others 1991).

For this question you will need to estimate the average slope of the wetland unit. Slope is measured either in degrees or as a percent (%). In this method, we use the latter measurement, (%), which is calculated as the ratio of the vertical change between two points and the horizontal distance between the same two points [vertical drop in feet (or meters) / horizontal distance in feet (or meters)]. For example, a 1 ft drop in elevation between two points that are 100 ft. apart is a 1% slope, and a 2 foot drop in the same distance is a 2% slope.

For large wetlands the slope can be estimated from USGS topographic maps of the area. The change in contour lines can be used to calculate the vertical drop between the top and bottom edges of the wetland unit. The horizontal distance can be estimated using the appropriate scale (printed at the bottom of the map). Local jurisdictions sometimes have assessor's maps that are contoured at 2 ft intervals. These can be very useful in estimating the slope.

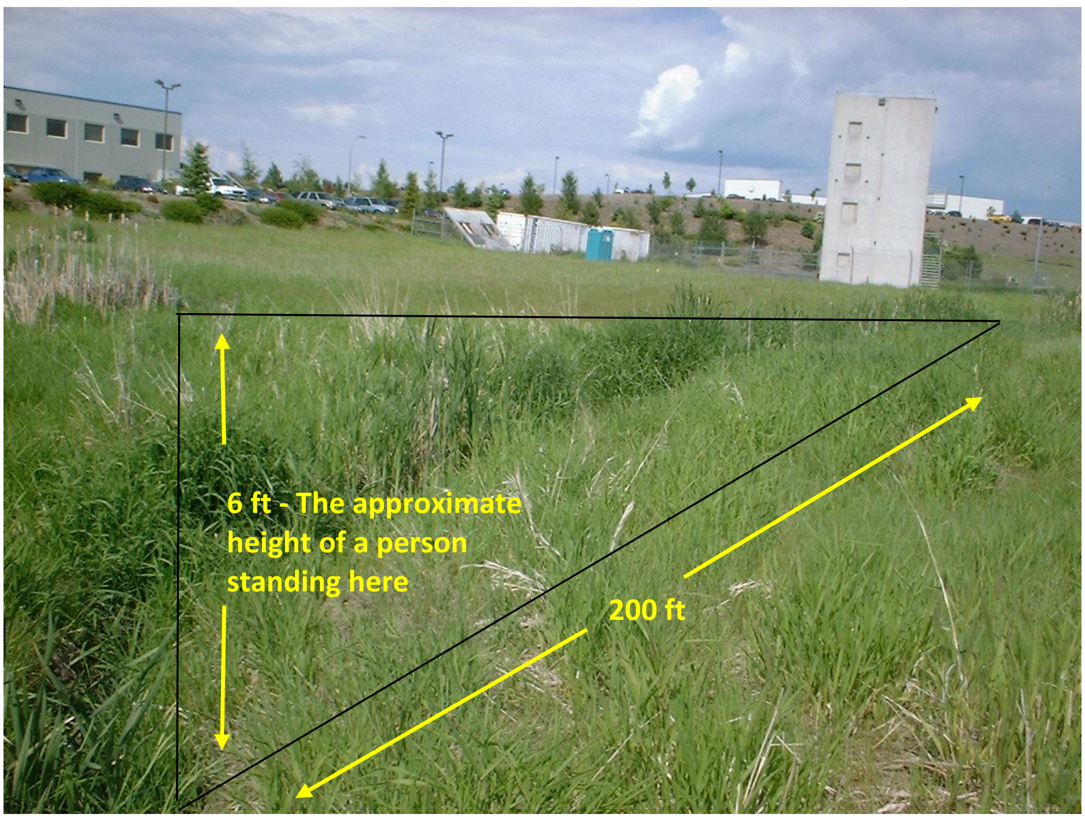
For small wetlands it will be necessary to estimate the vertical drop visually and the horizontal distance by pacing or using a tape measure. Visual estimates of the vertical drop are more accurate if you can find a point of reference near the bottom edge of the wetland. Stand at the upper edge of the wetland and visualize a horizontal line to a tree, telephone pole, or another person at the lower edge of the slope wetland. The point at which the" horizontal line intersects the object at the lower edge can be used to estimate the vertical drop between the upper and lower edges of the wetland (see Figure 40).

NOTE: If you are standing at the upper edge of the wetland looking for a visual marker at the lower edge, do not forget to subtract your height from the total.

NOTE: If the slope of a wetland changes the best way to estimate the average is to calculate the slope between the upper most unit boundary and the lowest point on the boundary. This will average out all the variations unless the unit has a much higher slope for a short distance at either end.

NOTE: If the slope wetland has a ditch along its bottom side DO NOT use the bottom of the ditch for calculating the slope. Use the elevation of the top of the ditch for calculating the slope.

Figure 40: Estimating the slope of a small slope wetland. The top of a six foot person is about level with the upper edge of the wetland. The average slope is approximately 6/200 = 0.03 or 3%.



S 1.2 The soil 2 inches below the surface is a true clay or true organic soil.

> **Rationale for indicator**: Clay soils and organic soils are both good indicators that a wetland can remove a wide range of pollutants from surface water. The uptake of dissolved phosphorus and toxic compounds through adsorption to soil particles is highest when soils are high in clay or organic content (Mitsch and Gosselink 1993).

If the unit is found within an area that is mapped as an organic or clay soils by the NRCS in their county soil maps, you do not need to do any further investigations. Consider the unit to have clay or organic soils. If it is not mapped as an organic or clay soil you will need to take at least one sample at the site.

To look at the soil: dig a small hole within the unit boundary and pick a sample from the area that is about 2 inches below the duff layer. Usually it is best to sample the soil toward the middle of the wetland rather than at the edge. Avoid picking up any of the duff or recent plant material that lies on the surface. Determine if the soil is organic or clay. If you are not familiar with procedures for identifying organic or clay soils, a key is provided in Appendix C.

> **NOTE**: The presence of organic or clay soils anywhere within the wetland unit counts. There is no scaling for this question based on the size of the patch of soil. This simplification is necessary because it is not possible to develop a reproducible map of different soils in a wetland unit within the time frame for doing the field work.

See the NRCS web page for more descriptions on how to identify organic soils: ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/keys/2010_Keys_to_Soil_Taxonomy.pdf

S 1.3 Characteristics of the plants that trap sediments and pollutants:

> **Rationale for indicator**: The intent of this question is to characterize how much of the wetland is covered with plants that are more effective at improving water quality in a slope environment. Herbaceous species have, in general, been found to sequester metals and remove oils and other organics better than other plant species (Hammer 1989, and Horner 1992). Furthermore, dense herbaceous plants present the greatest resistance to the surface flow often found on slope wetlands. Water in this environment tends to flow very close to the surface and be shallow (not more than a few inches). Trees and shrubs tend to be widely spaced relative to herbaceous plants and don't provide as much resistance to this type of surface flow.

For this question you will need to group the plants found within the wetland into only two groups: 1) dense, ungrazed, herbaceous plants, and 2) all other types (Figure 41). **NOTE**: **The Cowardin plants types are NOT used for this question.** For this question the herbaceous plants includes the areas of emergent plants as classified by Cowardin and the herbaceous understory in a shrub or forest. To qualify for "dense", the herbaceous plants must cover at least ¾ (75%) of the ground (as opposed to the 30% requirement in the Cowardin plant classes).

> **NOTE**: The best information on reducing surface flows in a slope is provided by the basal cross-section of the plants. However, this is not easy to measure. The best indicator we were able to find is an estimate of the cover from a person's height. Generally, if less than 25% of the ground is visible at 5-6ft., then there will be a fairly high stem density and basal cross section to trap sediments and reduce flows. In Question S 1.3 we differentiate between herbaceous and non-herbaceous plants while in S 4.1 it is between rigid, dense, plants and other types.

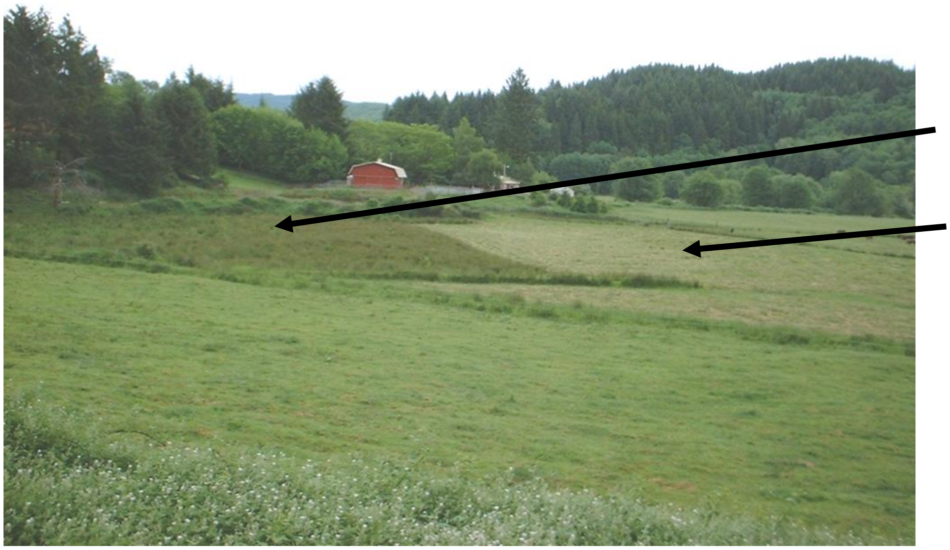


Figure 41: A slope wetland where dense unmowed, plants are between 1/4 and 1/2 the area of the wetland.

S 2.0 Does the Landscape Have the Potential to Support the Water Quality Function of the Site?

S 2.1 Is >10% of the buffer area within 150 ft upslope of wetland unit in agricultural, pasture, residential, commercial, or urban?

Rationale for indicator: Farming, grazing, residential areas, commercial land uses, and urban areas in general are major sources of pollutants (reviewed in Sheldon and others 2005). The review also found that a well vegetated buffer of 150 ft will only remove 60-80% of some pollutants from surface runoff into a wetland. Thus, pollutants from such land uses will probably reach the wetland unit if they are within 150 ft of the unit and upslope of it.

Use your aerial photo and draw a line around the unit that is 150 ft from the edge of the unit. The line should be 150 ft upslope of the unit boundary. Answer "YES" to this question if you find the listed uses within 150 ft of the wetland and they cover more than 10% of the polygon upslope of the unit.

S 3.0 Is the Water Quality Improvement Provided by the Site Valuable to Society?

S 3.1 Does the unit discharge directly to a stream, river, or lake that is on the 303(d) list?

Rationale for indicator: Wetlands that discharge directly to these polluted waters are judged to be more valuable than those that discharge to unpolluted bodies of water because their role at cleaning up the pollution is critical for reducing further degradation of water quality.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards http://www.ecy.wa.gov/programs/wq/303d/2008/index.html. Determine from the aerial photo if the wetland unit you are rating is within at least 1 mile of any aquatic resource listed as Category 2, 4, or 5 waters and has a surface water channel, ditch or other discharge to it.

S 3.2 Is the unit in a basin or sub-basin where another aquatic resource is on the 303(d) list?

Rationale for indicator: Wetlands can mitigate the impacts of pollution even if they do not discharge directly to a polluted body of water. Wetlands can remove nitrogen from groundwater as well as surface water. They can also trap airborne pollutants. Thus, wetlands can provide an ecosystem service and value to our society in any basin and sub-basin that has pollution problems. The removal of pollutants by wetlands is judged to be more valuable in basins where other aquatic resources are already polluted. Any further degradation of these resources could result in irreparable damage to the ecosystem.

To answer this question you will need to access the Department of Ecology's web site that lists all the bodies of water that do not meet water quality standards (see above). Determine from the aerial photo if the wetland unit you are rating is in the hydrologic basin or sub-basin of any aquatic resource listed as Category 2, 4, or 5 waters. To find the boundaries of hydrologic units in the area consult with the planning department of the local jurisdiction or use the map of hydrologic units developed by USGS. http://water.usgs.gov/GIS/huc.html

S 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality?

Rationale for indicator: Not all pollution and water quality problems are identified by Ecology's water quality monitoring program. Local and watershed planning efforts sometimes identify wetlands that are important in maintaining existing water quality. These wetlands provide a value to society that needs to be replaced if they are impacted.

To answer this question you will need to seek information from the planning department of the local jurisdiction where the site is located. Information on regional or local plans can often be found on the web site of the city or county in which the site is found. Useful "search" phrases include: "watershed plan," "water quality," or "wetland protection." If the basin in which the wetland is found has a TMDL plan (also called a Water Clean Up Plan) developed for it, then answer "YES" for this question. It is assumed that all wetlands are valuable in a basin where water quality is poor enough to require a TMDL. The Department of Ecology's web site lists all the bodies of water that have TMDL's: http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html .

S 4.0 Does the Site Have the Potential to Reduce Flooding and Stream Erosion?

Slope wetlands have a maximum score of only 8 points for the hydrologic functions instead of 16. The technical review teams that developed the Washington State Wetland Rating Systems concluded that slope wetlands may provide some velocity reduction but do not provide flood storage. Thus, they should be scored less than wetlands that can perform both aspects of the function.

S 4.1 Characteristics of plants that reduce the velocity of surface flows.

Rationale for indicator: The intent of this question is to characterize how much of the wetland is covered with plants that provide a physical barrier to sheetflow coming down the slope. Plants on slopes will reduce peak flows and the velocity of water during a storm event (U.S. Geologic Service, http://ga.water.usgs.gov/edu/urbaneffects.html, accessed July 31, 2003). The importance of plants on slopes in reducing flows has been well documented in studies of logging (Lewis and others 2001) though not specifically for slope wetlands. The assumption is that plants in slope wetlands play the same role as plants in forested areas in reducing peak flows.

For this question you will need to estimate the area of two categories of plants found within the wetland: 1) dense, uncut, rigid plants, and 2) all other plants. This indicator of plants is **not** related to any of the Cowardin classes. **Dense** means that individual plants are spaced closely enough that the soil is barely, if at all, (> 75% cover of plants) visible when looking at it from the height of an average person. **Uncut,** means that the height of the plants has not been significantly reduced by grazing or mowing. "Significantly reduced" means that the height is less than 6 inches. **Rigid** is defined as having stems thick enough (usually > 1/8 in.) to remain erect during surface flows.

There is only one threshold used to score this characteristic: dense, ungrazed, rigid plants for more than 90% of the area of wetland (Figure 42), The wetland in Figure 41 was mowed over much of its area, except where the *Juncus sp.* was growing. The mowed plants were less than 6 inches high, so the only plants that were included for this indicator were the *Juncus*.

NOTE: This is a simpler version of the questions in the wetland rating system. Only one answer resulted in a [M]oderate rating of 6 or more points. As a result the other questions were dropped since all resulted in a [L]ow rating.

NOTE: This description is not species specific because a species may be rigid in one environment and not rigid in another. For example, reed canarygrass (*P. arundinaceae*) can grow very thick and rigid stems in areas with high nutrients. In other situations, however, it can be very thin (e.g., shady environment) and would easily be bent to the ground by runoff.

Figure 42: A slope wetland with dense, rigid, ungrazed plants (reed canarygrass and *Juncus* sp., shrubs and trees) over more than 90% of its area. The direction of the slope is from the left of the photograph to the right.

S 5.0 Does the Landscape Have the Potential to Support the Hydrologic Functions of the Site?

S 5.1 Is more than 10% of the buffer area within 150 ft upslope of wetland unit in agricultual, pasture, residential, commercial, or urban land use?

Rationale for indicator: Human land uses tend to de-stabilize the flows of water in a watershed. Generally, human activities reduce infiltration and increase the run-off during storm events (review in Sheldon and others 2005). For example, a lawn can reduce infiltration by as much as 65% (Kelling and Peterson 1975). Thus, a slope unit located in areas where run-off has increased can provide more velocity reduction of surface flows than one located in an undeveloped area.

Use your aerial photo and draw a line around the unit that is 150 ft from the edge of the unit. The line should be 150 ft upslope of the unit boundary. Answer "YES" to this question if you find the listed land uses within 150 ft of the wetland and they cover more than 10% of the polygon.

S 6.0 Are the Hydrologic Functions Provided by the Site Valuable to Society?

S 6.1 Distance to the nearest areas downstream that have flooding problems.

Rationale for indicator: The value of wetlands in reducing the impacts of flooding and erosion is based on the presence of human or natural resources that can be damaged by these processes. The indicator used characterizes whether the wetland's position in the landscape protects down-gradient resources from flooding. In general, the value of a wetland in reducing flood damage is judged to decrease with the distance downstream because the amount of water flowing through the unit relative to the overall flows decreases.

If you do not know if floods have caused damage in the sub-basin further downstream you will need to do some research. Your best sources of information on flooding problems are the emergency planning office in your local government and the local FEMA (Federal Emergency Management Agency).

Choose the description that best matches conditions around the wetland unit being rated.

The wetland reduces velocities that would otherwise impact down-gradient areas where flooding has damaged human or natural resources (e.g., salmon redds):

- In the sub-basin that is immediately down-gradient of unit.
- In a sub-basin further down-gradient.

S 6.2 Has the site has been identified as important for flood storage or flood conveyance in a regional flood control plan?

Rationale for indicator: The values of flood storage and flood conveyance provided by wetlands are often recognized in regional flood control plans, and specific sites are mentioned in these plans.

To answer this question contact the jurisdiction in which the site is found to determine if any regional flood control plans exist. If so, try to determine if the site has been identified as important or valuable.

5.7 Habitat Functions (*Questions starting with "H" for all HGM classes)*

A rapid method such as this one relies on indicators of function that are fixed and present throughout most of the year (see Chapter 2). As a result it is not possible to actually monitor the species that use a wetland, nor determine their abundance. The one aspect of habitat that we can determine is a relative number for habitat niches present. The questions below describe indicators that represent different habitat niches. The basic assumption is that wetlands with more niches can provide higher level of the habitat function than one with fewer. The rating for this function is based on the potential number of species for which a site can provide habitat.

H 1.0 Does the Site Have the Potential to Provide Habitat?

H 1.1 Structure of plant community:

Rationale for indicator: More habitat niches are provided within a wetland as the number of plant communities increases. The increased structural complexity provided by different plants optimizes potential breeding areas, escape, cover, and food production for the greatest number of species (Hruby and others 1999). This increased species richness arising from the increased structural diversity also supports a greater number of terrestrial species in the overall wetland food web (Hruby and others 1999). The Cowardin plants classes are used as indicators of different types of structure in the plant community. In addition, the presence of vertical structure in forested communities is considered a characteristic that increases habitat complexity and niches.

For this question you will need to map the "Cowardin" classes of plants in the wetland and whether the forested class has different strata present under the canopy. The plant community is divided into the following habitat types:

- Aquatic bed
- Emergent
- Scrub/shrub (areas where shrubs have >30% cover)
- Forested (areas where trees have >30% cover)
- Multiple strata within the forest class. Do the areas mapped as a Cowardin forested class have at least three out of the five strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover)?

NOTE 1: Each plant class has to cover more than ¼ acre, or if the wetland is smaller than 2.5 acres, the threshold is 10% of the area of the wetland. "Cowardin" plant classes are distinguished on the basis of the uppermost layer of plants (forest, shrub, etc.) that provides more than 30% surface cover within the area of its distribution (see Section 5.2).

NOTE 2: Aquatic bed plants do not always reach the surface and care must be taken to look beneath the water's surface. Because waterfowl can graze certain species of aquatic bed early in the growing season, you may incorrectly conclude that aquatic bed plants are not present if the field visit is made during this time period**. Therefore, examine the pond bottom in areas of open water for evidence of aquatic bed species that have senesced.** If a wetland is being rated very late in the growing season, when either the standing water is gone or very limited in extent, examine mudflats and adjacent vegetated areas for the presence of dried aquatic bed species.

NOTE 3: If a plant class is distributed in several patches, the patches can be added together to meet the size threshold. However, the patches have to be large enough so that no more than 10 are needed to meet the size threshold. For example, if 15 patches of shrubs are needed to meet the size threshold then the unit does NOT have a scrub/shrub class.

NOTE 4: Count how many strata (i.e., canopy, sub-canopy, shrubs, herbaceous, moss/groundcover) are present in forested areas of the wetland. If three or more of the five strata are present, record this on the field form.

NOTE 5: Each stratum (canopy, sub-canopy, shrub, herbaceous, or groundcover) has to cover at least 20% of the ground within the polygon identified as "forest" when looking at it from above. If the field visit is during the winter you will have to estimate cover based on your expectation of what the plants would cover when in full leaf.

H 1.2 Hydroperiods

Rationale for indicator: Many aquatic species have their life cycles keyed to different water regimes (e.g., permanent, seasonal, or saturated conditions). A number of different water regimes in a wetland will, therefore, support more species than a wetland with fewer water regimes. For example, some species are tolerant of permanent pools, while others can live in pools that are temporary (Wiggins and others 1980).

For this question you will need to identify areas in the wetland with different water regimes. You are looking for areas with different patterns of flooding or saturation. For example, does part of the wetland have surface ponding only for a very short time (we call this occasionally flooded) or are there areas that have surface water all year (permanently flooded). The purpose is to identify the wettest water regime within different areas of the wetland unit. Thus, an area that is seasonally flooded, but only saturated during the field visit in the summer, would still be categorized as "seasonally flooded." **To count, the water regime has to cover more than 10% of the wetland or ¼ acre.** This includes streams and rivers. Often there is a small stream in a depressional wetland or along the side of a riverine one but it **cannot** be counted because the total area between the banks of the stream that is in the unit or adjacent to it does not meet the size threshold.

The six water regimes that you need to identify are:

Permanently Flooded or Inundated — Surface water covers the land surface throughout the year, 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 plants inside the zone of seasonal inundation. Aerial photos taken during the summer may also show areas of permanent water.

Seasonally Flooded or Inundated — Surface water is present for extended periods (for more than 2 consecutive months during a year), 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 inundated. Use the indicators described in D1.4 to help you determine areas that are seasonally flooded or inundated.

Occasionally Flooded or Inundated — Surface water is present for brief periods of less than two months 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 this water regime (facultative).

Saturated — The soil is saturated near 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.

Permanently Flowing Stream — The wetland unit contains a river, stream, channel, or ditch with water flowing in it throughout the year within its boundaries or along one edge (most often in a riverine situation).

Intermittently Flowing Stream — The wetland unit contains a river, stream, channel, or ditch in which water flow is intermittent or seasonal within its boundaries or along one edge.

Figure 20 shows a hypothetical wetland with two water regimes – permanently flooded and seasonally flooded. Figure 43 shows a photograph of a slope wetland, also with two water regimes - some areas are **occasionally flooded** from sheet flow during storms and the rest is **saturated** from subsurface flows. Figure 44 shows a depressional wetland with three water regimes.

> **NOTE 1**: Wetlands that are classified as **Lake-fringe or Freshwater Tidal Fringe are scored 2 points for this question**. The water regimes in these two types of wetlands do not fit the descriptions above or are too difficult to determine in the field.
>
> **NOTE 2:** An area (polygon) within a wetland unit being rated can only have one hydroperiod. Different areas within a unit, however, may have different hydroperiods.

NOTE 3: You should map the hydroperiods as they would appear at the wettest time of the year.

NOTE 4: A drawing such as Figure 20 should be made on a copy of the aerial photograph or map outlining the different hydroperiods. Such a drawing will reduce common errors (e.g., failure to confirm the size threshold or counting the same area as having two hydroperiods).

NOTE 5: Depressional wetlands often have their water regimes in concentric rings. In addition to permanently ponded and seasonally ponded, a wetland could have an additional ring that is occasionally ponded and then even just saturated. To count, however, each of these hydroperiods needs to meet the size threshold. Slope wetlands often have only a saturated hydroperiod and if they get surface runoff then they have "occasional" surface inundation as well. Thus, for depressional, riverine, or lake fringe wetlands that are joined to slope wetlands you need to record the hydroperiods of the area classified as slope as well as those with another classification.

NOTE 6: Many streams in wetlands however cannot be counted because the area of the stream where the water flows does not meet the size threshold.

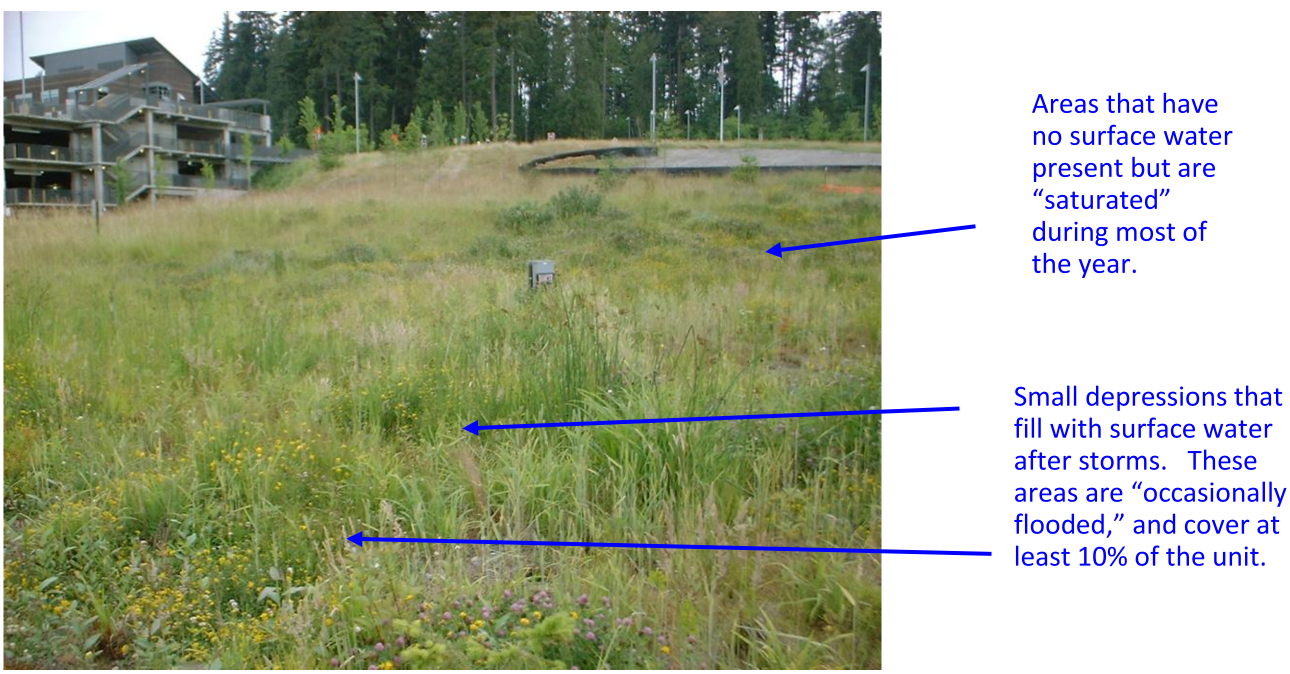


Figure 43: Slope wetland with two water regimes.

Figure 44: A large depressional wetland with three water regimes: permanently flooded, seasonally flooded, and occasionally flooded. The areas that are seasonally and occasionally flooded are found around the outer edge of the wetland.

H 1.3 Richness of Plant Species:

Rationale for indicator: The number of plant species present in a wetland reflects the potential number of niches available for invertebrates, birds, and mammals. The total number of animal species in a wetland is expected to increase as the number of plant species increases (Hruby and others 1999). For example, the number of invertebrate species is directly linked to the number of plant species (Knops and others 1999). This indicator includes both native and non-native plant species (with the exceptions noted below) because both provide habitat for invertebrate and vertebrate species. The four aggressive species excluded from the count tend to form large mono-cultures that exclude other species and reduce the structural richness of the habitat.

As you walk through the wetland unit keep a list of the patches of different plant species you find. You should count both wetland and upland plants. However, you include only species that form patches that cover at least 10 square feet within the unit. Different patches of the same species can be combined to meet the size threshold. This threshold was established to reduce the variability among users with different levels of expertise in identifying plants.

You should try to identify plants, but keying them out is not necessary. All you need to track is the total number, so you can identify species as Species 1, Species 2, etc. In order to capture the full range of plant species present during the year, record any species that are "dead" and recognizably different from other species present. There are 3 thresholds to keep in mind: 20 or more species, 5-19, and less than 5 species. If you count more than 19 species you do not need to continue identifying plants.

For this question the following species are **NOT TO BE INCLUDED** in the total: Eurasian water-milfoil (*Myriophyllum spicatum*), reed canarygrass (*Phalaris arundinaceae*), Purple Loosestrife (*Lythrum salicaria*), and Canadian thistle (*Circium arvense*). These species were judged to reduce the number of niches present in a wetland by the team of wetland scientists who developed this indicator.

H 1.4 Interspersion of Habitats:

Rationale for indicator: In general, interspersion among different physical structures (e.g., open water) and classes of plants (e.g., aquatic bed, emergent plants, shrubs) increases the suitability for different guilds of wildlife by increasing the number of ecological niches (Hruby and others 1999). For example, a higher diversity of plant forms is likely to support a higher diversity of macro-invertebrates (Chapman 1966, Dvorak and Best 1982, Lodge 1985).

In question H.1.1 you determined how many different Cowardin plant classes are present in the unit being rated. This question uses this information and also asks you to identify if there are any areas of open water in the unit (open means without plants on or above the water surface during the spring, summer, or fall). You are asked to rate the "interspersion" between these structural characteristics of the wetland. The diagrams on the field form show what is meant by ratings of High, Medium, Low, or None. Each polygon with a different shading represents a different plant class or open water.

To answer this question first consider if the interspersion falls into the two "default" ratings. If the wetland has only one class of plants present (question H 1.1) and no open water, it will always be rated as NONE (see Figure 45). If the wetland has four plant classes (from question H 1.1), or three plant classes and open water it will always be rated as HIGH. Figure 44 is a depressional wetland with open water, emergent, aquatic bed, shrub, and forest classes. Thus, it automatically rates a HIGH. The only time you will have to make a decision is when the wetland has two or three types of structure that provide habitat.

Additional notes for determining the interspersion are:

- Lake-fringe wetlands will always have <u>at least</u> two categories of structure (open water and one class of plants).
- A wetland with a meandering, unvegetated, stream (seasonal or permanent) should be rated MODERATE if it has only one plant class, or HIGH if it has two or more.
- Several isolated patches of one structural category (e.g., patches of open water) should be considered the same as one "patch" with many lobes.

In scoring units with two types of structure the difference between LOW and MODERATE interspersion is the amount of edge habitat between the structures. Units with convoluted edges are scored moderate. Those with relatively straight edges are scored LOW. For units with three types of structure the same criterion is used to differentiate between a MODERATE and HIGH scoring.

Figure 45: A depressional wetland with only one class of plants and no open water. The interspersion is rated as NONE.

H 1.5 Special Habitat Features:

Rationale for indicator: There are certain habitat features in a wetland that provide refuge and resources for many different species. The presence of these features increases the potential that the wetland will provide a wide range of habitats (Hruby and others 1999). These special features include:

1) Large downed woody debris in the wetland that provides major niches for decomposers (i.e., bacteria and fungi) and invertebrates,

2) Snags that provide perches and cavities for birds and other animals,

3) Undercut banks that provide protection for fish and amphibians,

4) Stable, steep banks of fine material that might be used by aquatic mammals for denning,

5) Thin-stemmed plants that provide structure on which amphibians can lay their eggs, and

6) A plant community that does not have aggressive (invasive) species. This indicates the wetland unit is relatively undisturbed.

Record the presence of any the following special habitat features within the wetland on the Scoring Form:

- Large woody debris within the wetland that is more than 4 inches in diameter at the base and more than 6 ft long (Figure 46).

- Snags present in the wetland that are more than 4 inches in diameter at breast height (Figure 46). **The snag has to have been "rooted" in the wetland to count**. Fence posts or other vertical posts that meet the size threshold can be counted.
- Steep banks of fine material for denning, or evidence of use of the wetland by beaver or muskrat. Banks need to be at least 33 ft long, 2 ft high within or immediately adjacent to the wetland and have the following characteristics: at least a 30 degrees slope, with at least a 3 ft depth of fine soil such as sand, silt, or clay. OR, Evidence the area has been recently used by beaver, such as downed trees and shrubs with teeth marks, and where the wood has not turned gray yet (Figure 47). Evidence of grazing or activity by muskrat does not count because it may be the result of Nutria, an invasive aquatic mammal. It is very difficult to differentiate between these two species in the field.
- At least ¼ acre of thin-stemmed persistent plants or woody branches that are in areas that are permanently or seasonally inundated. These plants provide egg-laying structures for amphibians. A ¼ acre of such plants provide optimal conditions for egg-laying (K. Richter, personal communications), and a unit will score a point only if this criterion is met. This does not mean that a wetland does not provide amphibian habitat in the absence of this; just that wetland provides better habitat if these conditions are present.
- The cover of invasive plants is less than 25% within EACH stratum present in the unit. The five possible strata are canopy, sub-canopy, shrub, herbaceous/emergent, and ground-cover. For example, a forested wetland with a 100% canopy of native species but with an understory of reed canarygrass that covered 70% of the ground would not qualify for this characteristic. The species that are considered "invasive" for answering this question are as follows:

  Circium arvense (Canadian thistle)
  Rubus laciniatus (evergreen blackberry)
  Rubus discolor (Himalayan blackberry)
  Polygonum cuspidatum (Japanese knotweed)
  Polygonum sachalinense (giant knotweed)
  Polygonum cuspidatum x sachalinense (hybrid of Japanese and giant knotweeds)
  Lysimachia vulgaris (garden loosestrife)
  Lythrum salicaria (purple loosestrife)
  Myriophyllum spicatum (Eurasian milfoil)
  Phalaris arundinaceae (reed canarygrass)
  Phragmites australis (common reed)
  Tamarix spp.(either Tamarix ramosissima and/or T. parviflora, salt cedar).

  Only the species on this list count as invasive. This is the list on which the experts developing and reviewing the rating system could agree. Other species may be considered invasive by one of more botanists but we could not achieve consensus to include any others on the list.

Check off each habitat feature on the data form. Add the total number of checks and record that as a score in the right-hand column.

Figure 46:
Large woody debris and snags in wetland

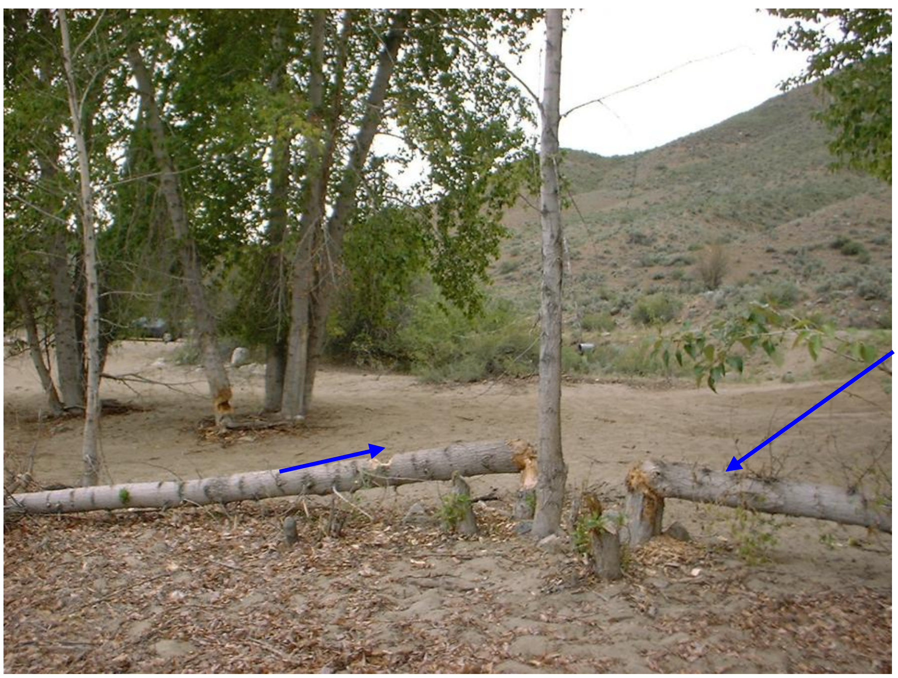


Figure 47:
Evidence of beaver activity. Note the conical shape of the cut.

H 2.0 Does the Landscape Have the Potential to Support the Habitat Functions of the Site?

Habitat loss and fragmentation are a major source of losses in biodiversity (Fahrig 2003). Thus, wetlands in areas that have not been subject to fragmentation and habitat loss are in a better landscape position to provide habitat for a wide range of species that require both uplands and wetlands to survive. Questions H 2.1 and H 2.2 describe two indicators for characterizing the availability of good habitat around a wetland.

Land uses that are often called "high intensity" such as dense residential areas, manufacturing areas, and commercial all have negative impacts on habitat because of noise, light, toxic runoff, and other disturbances (reviewed in Sheldon and others 2005). Wetlands that are located in such areas are therefore less suited as habitat for many species. Question H 2.3 attempts to characterize these impacts by reducing the overall landscape potential of a site if these high intensity land uses are present.

All three questions ask you to map three types of land uses in a 1 km circle around the wetland unit being scored. These are "high intensity" land uses, "moderate and low intensity" land uses, and "relatively undisturbed." Do this by:

1. Drawing a polygon around the unit that extends 1 km from the edge. Use an aerial photograph or a map of land uses if available.
2. Drawing smaller polygons within this 1 km circle around the areas that are relatively undisturbed, have moderate intensity land uses and have high intensity land uses.

Terms are defined in the following box and in Table 2. If you find a land use that is not listed you will have to decide how to categorize it (high intensity, moderate intensity, relatively undisturbed). In this case you should document your rationale on the data form or attached to the figures you submit.

"***Relatively undisturbed***" is a general term used to describe areas that are almost completely free of human impacts and activities. This includes uplands, other wetlands, lakes and other bodies of water. It means that the area is free of regular disturbances such as:

- Tilling and cropping
- Residential and urban development
- Grazing
- Paved roads or frequently used gravel roads
- Mowing
- Pets

NOTE 1: Areas dominated by invasive species are not considered disturbed unless you also have other evidence that disturbances are still present. The invasive species could be a result of some past disturbance that is no longer present.

NOTE 2: Logged areas that have been undisturbed for at least 5 years can qualify as "relatively undisturbed." This includes hybrid poplar plantations that are more than 5 years old.

NOTE 3: Areas that are regularly accessible to dogs, either from residential areas or from people walking their dog should be treated as disturbed. Dogs and other pets cause stress among the animals using a wetland.

NOTE 4: A rarely used path or gravel road can be considered "relatively undisturbed" if it is used less than once or twice a week. Daily usage of a road or area is considered "disturbed."

NOTE 5: Lakes, ponds and other bodies of open water can be considered relatively undisturbed if they are not regularly used for boating or for other water related activities. Daily usage of the lake by boats would be considered "disturbed." A lake can be considered undisturbed if it is used only once or twice a week.

Table 2: Land uses that can be classified as high and moderate/low intensity based on their impacts to wetland habitat.

Level of Impact	Types of Land Use Based on Common Zoning Designations
High Intensity	• Commercial • Urban • Industrial • Institutional • Retail sales • Residential (more than 1 unit/acre) • High-intensity agriculture (dairies, nurseries, greenhouses, growing and harvesting crops requiring annual tilling and raising and maintaining animals, etc.) • High-intensity recreation (golf courses, ball fields, etc.)
Moderate and Low Intensity	• Residential (1 unit/acre or less) • Parks • Moderate-intensity agriculture (orchards, hay fields, pastures.) • Trails • Forestry • Utility corridors

H .2.1 What is the area of accessible habitat?

Rationale for indicator: It is difficult to separate the effects of habitat loss from the fragmentation of habitat (Fahrig 2003). Thus, Eigenbrod and others (2008) have developed an indicator, called "accessible habitat," that integrates these two concepts into one measurable indicator. Accessible habitat is defined as the amount of habitat that can be reached from the wetland without crossing a human land use (e.g., roads, fields, and development). Some lower intensity human land uses such as parks do not completely isolate a habitat. As a result, low and moderate intensity land uses are totally discounted as accessible habitat. The total area of low and moderate intensity land uses adjacent to the unit is divided by two and then added to the area of undisturbed habitat. This addresses the issue that some lower intensity land uses do still provide habitat, but not to the same level as undisturbed areas.

To calculate the accessible habitat around the wetland unit you are scoring follow these steps.

1. Highlight all polygons of "relatively undisturbed" land uses on your map that are contiguous with the unit boundary.
2. Estimate the area of all such polygons as a percent of the total area within the larger 1 km polygon unit. You do not need to measure actual acreages, just the percent of

the total areas within the larger polygon (Figure 48). Include this number on the Scoring Form.

3. Highlight all polygons of "moderate or low intensity" land uses that are contiguous with the unit boundary or the relatively undisturbed areas mapped in #1 above.
4. Estimate the area of the polygons categorized as "moderate or low intensity" as a percent of the total area within the larger 1 km polygon unit. Divide this result by 2 and add it to the percent accessible, undisturbed, habitat calculated in steps #1 and #2 above.

Use the sum as the area of Accessible Habitat to answer question H 2.1.

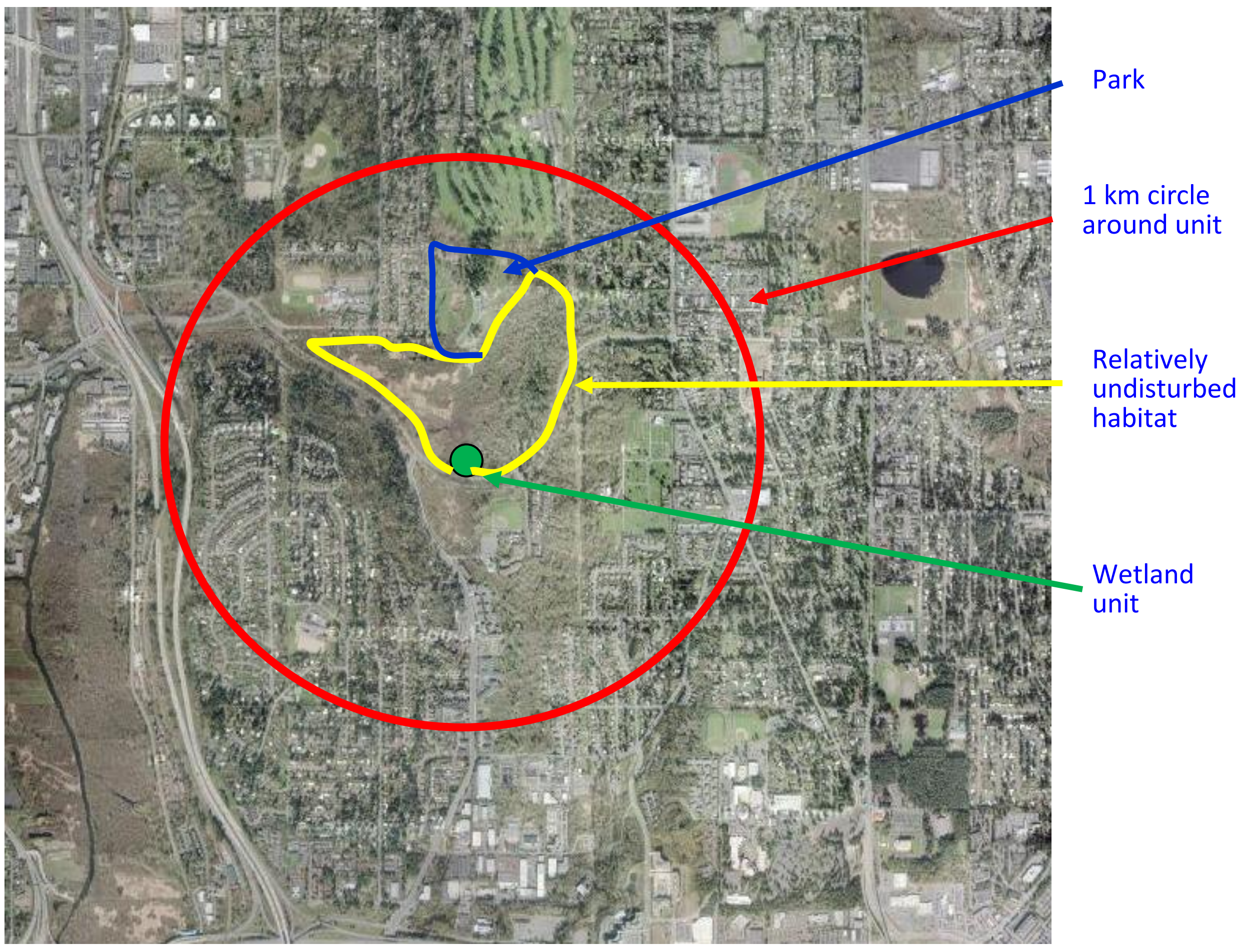


Figure 48: A 1 km circle around a wetland unit showing the Accessible Habitat. Accessible Habitat is 10 – 25 % of the total area of the 1 km polygon.

H 2.2 Total undisturbed habitat in 1 km circle around unit

Rationale for indicator: The focus of this indicator is more toward the fragmentation of the surrounding landscape. Flying species such as birds are not dependent on undisturbed corridors to move from habitat patch to habitat patch but more on the total area of habitat available (Rodewald and Bakermans 2006). This indicator characterizes the overall habitat available surrounding the wetland unit.

Use the diagram of land uses within 1 km of the unit to answer this question as well, but analyze using the following criteria:

1. Select only the polygons identified as relatively undisturbed even if they are separated from the unit by some human disturbance.
2. Calculate the total area of undisturbed habitat in the 1 km circle. If it is more than 50% of the total record that on the Scoring Form.
3. If the area is between 10% and 50% count the number of distinct patches in the circle and score this using the criteria on the Scoring Form.

H 2.3 Land use intensity in 1 km circle

Rationale for indicator: Land uses that are often called "high intensity" such as dense residential areas, manufacturing areas, and commercial all have negative impacts on habitat because of noise, light and other disturbances (reviewed in Sheldon and others 2005). Wetlands that are located in such areas are therefore less suited as habitat for many species.

Use the diagram of land uses within 1 km of the unit to answer this question as well, but analyze using the following criterion.

1. Identify all polygons of high intensity land uses.
2. Calculate the total area of in the 1 km circle. If it is more than 50% of the total record that on the Scoring Form and subtract two points from the total.

H 3.0 Is the Habitat Provided by the Site Valuable to Society?

People do not value all species equally. Some are valued for their "charismatic" characteristics, some because they are in danger of extinction, some for their commercial, aesthetic, or moral values (Perry 2010). The value of the habitat a wetland provides for society is therefore linked to the presence of these more valued species. However, as individuals we often place different values on wildlife. For example, some may value a beaver more than frogs while others disagree.

Question H 3.1 attempts to characterize the values of different species of wildlife at a broad level by highlighting wetlands that provide habitat for species that are formally recognized by jurisdictions, the state, and federal agencies as having some importance and that are protected by laws and regulations. In this case, we are relying on the agencies and jurisdictions (as representatives of society as a whole) to identify the valuable species and habitats. The Department of Ecology does not have the resources, or the mandate, to develop a different list of "valuable" species.

H 3.1 Does the site provides habitat for species valued in laws, regulations, or policies?

Rationale for indicator: There are lists of species that are identified through federal and state Endangered Species Acts or are the focus of management and conservation by the Washington State Department of Fish and Wildlife through their priority species and habitat program (http://wdfw.wa.gov/hab/phspage.htm). These species are judged to have a higher value to society than others. Wetland units that provide habitat for these species are thus considered to have a higher habitat value.

Wetlands are assigned a high value for habitat if the unit:

- Provides habitat for Threatened or Endangered species on either a state or federal list. This includes both plants and animals. For the latest information on T/E species you will have to access the National Marine Fisheries Service and the WA Dept. of Fish and Wildlife (WDFW) links below or contact the local WDFW biologist. These links are active as of March 2012.
  http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Maps/
  http://wdfw.wa.gov/conservation/endangered/
  For information on plants contact the Natural Heritage Program:
  http://www1.dnr.wa.gov/nhp/refdesk/plants.html
  NOTE: Be aware that wetlands with streams running through them in the Puget Sound area and on the Columbia River will probably be providing habitat for Endangered Salmonids.

- Is a "priority area" for an individual WDFW priority species. The WDFW maintains maps of important habitat areas for species on their priority species list. These maps should be used to identify if the unit falls within one of their mapped "priority areas." Information on how to obtain these maps and how to access them is available on the WDFW web sites. http://wdfw.wa.gov/hab/phspage.htm

- Contains a High-Quality Plant Community or Wetland Ecosystem as determined by the Department of Natural Resources.
  http://www1.dnr.wa.gov/nhp/refdesk/lists/communitiesxco/countyindex.html

- Has at least three different WDFW priority habitats within 100 m of the unit. This means the unit scores 4 points on question H 2.3 of the Wetland Rating System for Western Washington (Ecology publication #04-06-025 page 16 of the field form). Use Appendix D to identify priority habitats within 100 m if the unit has not been categorized using the wetland rating system. The latest definitions for priority habitats will be found on the WDFW web page:
  http://wdfw.wa.gov/publications/00165/wdfw00165.pdf)

NOTE: Wetlands are specifically excluded from the list of priority habitats because all wetlands are a priority habitat.

- Has been categorized as an important habitat site in a local or regional comprehensive plan, Shoreline Master Plan, or a watershed plan. The Department of Ecology does not maintain a database of important habitat areas identified in local plans. You will need to contact the planning department of the jurisdiction in which your wetland unit is found to determine if it has been identified as an area that provides valuable habitat.

Wetlands are assigned a moderate value for habitat if the unit scores 1-3 points on question H 2.3 of the Wetland Rating System for Western Washington (Ecology publication #04-06-025, Appendix D has question H 2.3 from the rating system).

Wetlands are assigned a low value for habitat if they do not meet any of the criteria above.

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Appendix A. Scoring Form for the Credit and Debit Method

Wetland name or number _____

SCORING FORM

Scoring functions to calculate mitigation credits and debits in Western Washington

Name of wetland (if known): ____________________________ Date of site visit: ____

Scored by________________________
SEC: __ TWNSHP: ___ RNGE: ___ Estimated size:_____ Aerial photo included? _______

These scores are for:
_________Wetland being altered
_________Mitigation site before mitigation takes place
_________Mitigation site after goals and objectives are met

SUMMARY OF SCORING

FUNCTION	**Improving Water Quality**	**Hydrologic**	**Habitat**
Rating of Site Potential			
Rating of Landscape Potential			
Rating of Value			
Score Based on Ratings (see table below)			

	Wetland HGM Class Used for Rating	
	Depressional	
	Riverine	
	Lake-fringe	
	Slope	
	Flats	
	Freshwater Tidal	
	Check if unit has multiple HGM classes present	

Scores
(*Order of ratings is not important*)
9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

NOTE: Form is not complete without the figures requested.
Put only the highest score for a question in each box of the form, even if more than one indicator applies to the unit. Do NOT add the scores within a question.

HGM Classification of Wetlands in Western Washington

For questions 1-7 the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e., except during floods)?

NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

YES – Freshwater Tidal Fringe NO – Saltwater Tidal Fringe (Estuarine)

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and not scored. This method cannot be used for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

NO – go to 3 **YES** – The wetland class is **Flats**

*If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?

___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface) at least 20 acres (8 ha) in size;

___At least 30% of the open water area is deeper than 6.6 ft (2 m)?

NO – go to 4 **YES** – The wetland class is **Lake-fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?

____The wetland is on a slope (*slope can be very gradual*),

____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.

____The water leaves the wetland **without being impounded**?

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

NO - go to 5 **YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

____The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

NO - go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 **YES** – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes Within the Wetland Unit Being Rated	HGM Class to Use in Rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake-fringe	Depressional
Riverine + Lake-fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as Depressional for the rating.

Wetland name or number _____

Depressional and Flats Wetlands **WATER QUALITY FUNCTIONS** - Indicators that the site functions to improve water quality. Questions D 1.1 – D 1.4 are from the Wetland Rating System (Hruby 2004b).	
D 1.0 Does the wetland unit have the potential to improve water quality?	
D 1.1 Characteristics of surface water flows out of the wetland: *Provide photo or drawing* Unit is a depression with no surface water leaving it (no outlet) points =3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet (*permanently flowing*) points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 (If ditch is not permanently flowing treat unit as "intermittently flowing")	Figure __
D 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES: points = 4 NO: points = 0	
D 1.3 Characteristics of persistent plants (emergent, shrub, and/or forest Cowardin class *Provide map of Cowardin plant classes* Wetland has persistent, ungrazed, plants ≥ 95% of area points = 5 Wetland has persistent, ungrazed, plants ≥ 1/2 of area points = 3 Wetland has persistent, ungrazed plants ≥ 1/10 of area points = 1 Wetland has persistent, ungrazed plants <1/10 of area points = 0	Figure __
D 1.4 Characteristics of seasonal ponding or inundation. *Provide map of hydroperiods* This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs. Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	Figure __
Total for D 1 Add the points in the boxes above	

Rating of Site Potential: If score is 12 – 16 = H
6 - 11 = M
0 - 5 = L

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

D 2.0 Does the landscape have the potential to support the water quality function at the site?	
D 2.1 Does the Wetland unit receive stormwater discharges? Yes = 1 No = 0	
D 2.2 Is more than 10% of the area within 150 ft of wetland unit in agricultural, pasture, residential, commercial, or urban? Yes = 1 No = 0	
D 2.3 Are there septic systems within 250 ft of the wetland unit? Yes = 1 No = 0	
D 2.4 Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1 – D 2.3? Source______________ Yes = 1 No = 0	
Total for D 2 Add the points in the boxes above	

Rating of Landscape Potential: If score is 3 or 4 = H
1 or 2 = M
0 = L

Record the rating on the first page

D 3.0 Is the water quality improvement provided by the site valuable to society?	
D 3.1 Does the unit discharge directly to a stream, river, or lake that is on the 303d list? Yes = 1 No = 0	
D 3.2 Is the unit in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	
D 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality? (*answer YES if there is a TMDL for the basin in which unit is found*) Yes = 2 No = 0	
Total for D 3 Add the points in the boxes above	

Rating of Value: If score is 2-4 = H
1 = M
0 = L

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

<u>Depressional and Flats Wetlands</u> **HYDROLOGIC FUNCTIONS** - Indicators that the site functions to reduce flooding and stream degradation. Questions D 4.1 – D 4.3 are from Wetland Rating System (Hruby 2004b).	
D 4. 0 Does the wetland unit have the <u>potential</u> to reduce flooding and erosion?	
D 4.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 Unit has an unconstricted, or slightly constricted, surface outlet and is permanently flowing) points = 0 (If ditch is not permanently flowing treat unit as "intermittently flowing")	
D 4.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	
D 4.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	
Total for D 4 Add the points in the boxes above	
Rating of Site Potential: If score is 12 – 16 = H **6 - 11 = M** **0 - 5 = L**	

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

Wetland name or number _____

D 5.0 Does the landscape have the potential to support hydrologic functions at the site?	
D 5.1 Does the unit receive any stormwater discharges? Yes = 1 No = 0	
D5.2 Is >10% of the land use within 150 ft of the wetland unit agriculture, pasture, residential, urban, or commercial? Yes = 1 No = 0	
D 5.3 Is more than 25% of the contributing basin of the wetland unit covered with intensive human land uses (residential at >1 residence/1 acre, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	
Total for D 5 Add the points in the boxes above	

Rating of Landscape Potential: If score is 3 = H
1,2 = M
0 = L

Record the rating on the first page

D 6.0 Are the hydrologic functions provided by the site valuable to society?	
D 6.1 The unit is in a landscape that has flooding problems. Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met. ☐ The site has been identified as important for flood storage or flood conveyance in a regional flood control plan. points = 2 ☐ The wetland captures surface water that would otherwise flow downgradient into areas where flooding has damaged human or natural resources (e.g., salmon redds), AND ○ Damage occurs in sub-basin that is immediately down-gradient of unit. points = 2 ○ Damage occurs in a sub-basin further down-gradient. points = 1 ☐ Flooding from groundwater is an issue in the sub-basin. points = 1 ☐ The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* ______________________ points = 0 ☐ There are no problems with flooding downstream of the unit. points = 0	

Rating of Value: If score is 2 = H
1 = M
0 = L

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

Wetland name or number _____

Riverine and Freshwater Tidal Fringe Wetlands **WATER QUALITY FUNCTIONS** - Indicators that site functions to improve water quality Questions R 1.1 – R 1.2 are from the Wetland Rating System (Hruby 2004b).	
R 1. Does the wetland unit have the potential to improve water quality?	
R 1.1 Area of surface depressions within the riverine wetland that can trap sediments during a flooding event: *If depressions > ½ of area of unit draw polygons on aerial photo or map* Depressions cover >3/4 area of wetland points = 8 Depressions cover > 1/2 area of wetland points = 4 Depressions present but cover < 1/2 area of wetland points = 2 No depressions present points = 0	Figure __
R 1.2 Characteristics of the plants in the unit (areas with >90% cover at person height): *Include photo or map showing polygons of different plants types* Trees or shrubs > 2/3 area of the unit points = 8 Trees or shrubs > 1/3 area of the unit points = 6 Herbaceous plants (> 6" high) > 2/3 area of unit points = 6 Herbaceous plants (> 6" high) > 1/3 area of unit points = 3 Trees, shrubs, and ungrazed herbaceous < 1/3 area of unit points = 0	Figure __
Total for R 1 Add the points in the boxes above	

Rating of Site Potential: If score is 12 – 16 = H
6 - 11 = M
0 - 5 = L

Record the rating on the first page

R 2.0 Does the landscape have the potential to support the water quality function at the site?	
R 2.1 Is the unit within an incorporated city or within its UGA? Yes = 2 No = 0	
R. 2.2 Does the contributing basin include a UGA or incorporated area? Yes = 1 No = 0	
R 2.3 Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years? Yes = 1 No = 0	
R 2.4 Is more than 10% of the area within 150 ft of the wetland unit in agricultural, pasture, golf courses, residential, commercial, or urban? Yes = 1 No = 0	
Total for R 2 Add the points in the boxes above	

Rating of Landscape Potential: If score is 3 - 5 = H
1 or 2 = M
0 = L

Record the rating on the first page

R 3.0 Is the water quality improvement provided by the site valuable to society?	
R 3.1 Is the unit along a stream or river that is on the 303(d) list or on a tributary that drains to one? Yes = 1 No = 0	
R 3.2 Does the river or stream have TMDL limits for nutrients, toxics, or pathogens? Yes = 1 No = 0	
R 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality? (*answer YES if there is a TMDL for the drainage in which unit is found*) Yes = 2 No = 0	
Total for R 3 Add the points in the boxes above	
Rating of Value: If score is 2 - 4 = H **1 = M** **0 = L**	

Record the rating on the first page

Riverine and Freshwater Tidal Fringe Wetlands **HYDROLOGIC FUNCTIONS** - Indicators that site functions to reduce flooding and stream erosion Questions R 4.1 and R 4.2 are from Wetland Rating System (Hruby 2004b).	
R 4.0 Does the wetland unit have the potential to reduce flooding and erosion?	
R 4.1 Characteristics of the overbank storage the unit provides: *Provide aerial photo showing average widths* Estimate the average width of the wetland unit perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of unit)/(average width of stream between banks). If the ratio is more than 20 points = 9 If the ratio is between 10 – 20 points = 6 If the ratio is between 5 - <10 points = 4 If the ratio is between 1 - <5 points = 2 If the ratio is < 1 points = 1	Figure __
R 4.2 Characteristics of plants that slow down water velocities during floods: *Treat large woody debris as "forest or shrub". Choose the points appropriate for the best description* (polygons need to have >90% cover at person height NOT Cowardin classes): *Provide photo or map showing polygons of different plants types* Forest or shrub for >1/3 area OR herbaceous plants > 2/3 area points = 7 Forest or shrub for > 1/10 area OR herbaceous plants > 1/3 area points = 4 Plants do not meet above criteria points = 0	Figure __
Total for R 4 Add the points in the boxes above	
Rating of Site Potential: If score is 12 – 16 = H **6 - 11 = M** **0 - 5 = L**	

R 5.0 Does the landscape have the potential to support the hydrologic functions at the site?	
R5.1 Is the stream/river adjacent to the unit downcut? Yes = 0 No = 1	
R 5.2 Does the contributing basin include a UGA or incorporated area? Yes = 1 No = 0	
R 5.3 Is the upgradient stream or river controlled by dams? Yes = 0 No = 1	
Total for R 5 Add the points in the boxes above	

Rating of Landscape Potential: If score is 3 = H
1 or 2 = M
0 = L

Record the rating on the first page

R 6.0 Are the hydrologic functions provided by the site valuable to society?	
R 6.1 Distance to the nearest areas downstream that have flooding problems? *Choose the description that best fits the site.* The sub-basin immediately down-gradient of site has surface flooding problems that results in $$ loss or loss of natural resources. points = 2 Surface flooding problems are in a sub-basin further down-gradient. points = 1 No flooding problems anywhere downstream. points = 0	
R 6.2 Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	
Total for R 6 Add the points in the boxes above	

Rating of Value: If score is 2 – 4 = H
1 = M
0 = L

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

Lake-fringe Wetlands **WATER QUALITY FUNCTIONS** - Indicators that the site functions to improve water quality. Questions L 1.1 – L 1.2 are from the Wetland Rating System (Hruby 2004b).	
L 1.0 Does the wetland unit have the potential to improve water quality?	
L 1.1 Average width of plants along the lakeshore *(use polygons of Cowardin classes)*: *Provide map of Cowardin classes with widths marked* Plants are more than 33 ft (10m) wide points = 6 Plants are more than 16 ft (5m) wide and <33ft points = 3 Plants are more than 6 ft (2m) wide and <16 ft points = 1 Plants are less than 6 ft wide points = 0	Figure __
L 1.2 Characteristics of the plants in the wetland: choose the appropriate description that results in the highest points, and do not include any open water in your estimate of coverage. The herbaceous plants can be either the dominant form or as an understory in a shrub or forest community. These are not Cowardin classes. Area of cover is total cover in the unit, but it can be in patches. *Herbaceous does not include aquatic bed.* *Provide map with polygons of different plants types* Cover of herbaceous plants are >90% of the vegetated area points = 6 Cover of herbaceous plants are >2/3 of the vegetated area points = 4 Cover of herbaceous plants are >1/3 of the vegetated area points = 3 Other plants that are not aquatic bed > 2/3 unit points = 3 Other plants that are not aquatic bed in > 1/3 vegetated area points = 1 Aquatic bed plants and open water cover > 2/3 of the unit points = 0	Figure __
Total for L 1 Add the points in the boxes above	
Rating of Site Potential: If score is 8 - 12 = H **4 – 7 = M** **0 - 3 = L** *Record the rating on the first page*	

L 2. Does the landscape have the potential to support the water quality function at the site?	
L 2.1 Is the lake used by power boats? Yes = 1 No = 0	
L 2.2 Is more than 10% of the area within 150 ft of wetland unit (on the shore side) agricultural, pasture, residential, commercial, or urban? Yes = 1 No = 0	
L 2.3 Does the lake have problems with algal blooms or excessive plants such as milfoil? Yes = 1 No = 0	
Total for L 2 Add the points in the boxes above	
Rating of Landscape Potential: If score is 2 or 3 = H **1 = M** **0 = L** *Record the rating on the first page*	

L 3.0 Is the water quality improvement provided by the site valuable to society?	
L 3.1 Is the unit on a lake that is on the 303(d) list? Yes = 1 No = 0	
L 3.2 Is the lake in a sub-basin where water quality is an issue? (at least one aquatic resource in the basin is on the 303(d) list) Yes = 1 No = 0	
L 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality? Yes = 2 No = 0	
Total for D 3 Add the points in the boxes above	

Rating of Value: If score is **2 - 4 = H**
1 = M
0 = L

Record the rating on the first page

<u>Lake-fringe Wetlands</u> **HYDROLOGIC FUNCTIONS** - Indicators that the wetland unit functions to reduce shoreline erosion Question L 4.1 is from Wetland Rating System (Hruby 2004b).	
L 4.0 Does the wetland unit have the <u>potential</u> to reduce shoreline erosion?	
L 4.1 Distance along shore and average width of Cowardin classes along the lakeshore (**do not** include aquatic bed): *(choose the highest scoring description that matches conditions in the wetland)* *Include aerial photo or map with Cowardin plant classes* > ¾ of distance is shrubs or forest at least 33 ft (10m) wide points = 6 > ¾ of distance is shrubs or forest at least 6 ft (2 m) wide points = 4 > ¼ distance is shrubs or forest at least 33 ft (10m) wide points = 4 Plants are at least 6 ft (2m) wide (any type except aquatic bed) points = 2 Plants are less than 6 ft (2m) wide (any type except aquatic bed) points = 0	Figure__

Rating of Site Potential: If score is **6 = M**
0 - 5 = L

Record the rating on the first page

Wetland name or number ______

L 5.0 Does the landscape have the potential to support hydrologic functions at the site?	
L 5.1 Is the lake used by power boats with more than 10 hp? Yes = 1 No = 0	
L 5.2 Is the fetch on the lake side of the unit at least 1 mile in distance? Yes = 1 No = 0	
Total for L 5 Add the points in the boxes above	

Rating of Landscape Potential: If score is 2 = H
1 = M
0 = L

Record the rating on the first page

L 6.0 Are the hydrologic functions provided by the site valuable to society?	
L 6.1 If more than one resource is present, choose the one with the highest score. There are human structures or old growth/mature forests within 25 ft of OHWM of the shore in the unit. points = 2 There are nature trails or other paths and recreational activities within 25 ft of OHWM. points = 1 Other resources that could be impacted by erosion. points = 1 There are no resources that can be impacted by erosion along the shores of the unit. points = 0	

Rating of Value: If score is 2 = H
1 = M
0 = L

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

Slope Wetlands **WATER QUALITY FUNCTIONS** - Indicators that the site functions to improve water quality Questions S 1.1 – S 1.3 are from Wetland Rating System (Hruby 2004b).	
S 1. Does the wetland unit have the potential to improve water quality?	
S 1.1 Characteristics of average slope of unit: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft horizontal distance*) Slope is1% or less points = 3 Slope is 1% - 2% points = 2 Slope is 2% - 5% points = 1 Slope is greater than 5% points = 0	
S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES = 3 points NO = 0 points	
S 1.3 Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense plants means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 inches.* *Provide photo or map showing polygons of different plants types* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	Figure__
Total for S 1 Add the points in the boxes above	

Rating of Site Potential: If score is 12 = H
6 - 11 = M
0 - 5 = L
Record the rating on the first page

S 2. 0 Does the landscape have the potential to support the water quality function at the site?	
S 2.1 IS >10% of the buffer area within 150 ft upslope of wetland unit in agricultural, pasture, residential, commercial, or urban? Yes = 1 No = 0	

Rating of Landscape Potential: If score is 1 = M
0 = L
Record the rating on the first page

S 3.0 Is the water quality improvement provided by the site valuable to society?	
S 3.1 Does the unit discharge directly to a stream, river, or lake that is on the 303(d) list? Yes = 1 No = 0	
S 3.2 Is the unit in a sub-basin where water quality is an issue? (at least one aquatic resource in the basin is on the 303(d) list) Yes = 1 No = 0	
S 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality? Yes = 2 No = 0	
Total for D 3 Add the points in the boxes above	
Rating of Value: If score is 2 - 4 = H **1 = M** **0 = L**	

Record the rating on the first page

<u>Slope Wetlands</u> **HYDROLOGIC FUNCTIONS** - Indicators that the site functions to reduce flooding and stream erosion Questions S 4.1 – S 4.2 are from Wetland Rating System (Hruby 2004b).	
S 4.0 Does the wetland unit have the <u>potential</u> to reduce flooding and stream erosion?	
S 4.1 Characteristics of plants that reduce the velocity of surface flows during storms. Choose the points appropriate for the description that best fit conditions in the wetland. *(Stems of plants should be thick enough (usually > 1/8 in), or dense enough, to remain erect during surface flows)* Dense, uncut, **rigid** plants covers > 90% of the area of the wetland. YES = 1 All other conditions = 0	
Rating of Site Potential: If score is 1 = M **0 = L**	

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

S 5.0 Does the landscape have the potential to support the hydrologic functions at the site?	
S 5.1 Is more than 25% of the buffer area within 150 ft upslope of wetland unit in agricultural, pasture, residential, commercial, or urban ? Yes = 1 No = 0	

Rating of Landscape Potential: If score is 1 = M
0 = L

Record the rating on the first page

S 6.0 Are the hydrologic functions provided by the site valuable to society?	
S 6.1 Distance to the nearest areas downstream that have flooding problems? Immediate sub-basin down-gradient of site has surface flooding problems that results in $$ loss or loss of natural resources points = 2 Surface flooding problems are in a sub-basin further down-gradient points = 1 No flooding problems anywhere downstream points = 0	
S 6.2 Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	
Total for R 6 Add the points in the boxes above	

Rating of Value: If score is 2 - 4 = H
1 = M
0 = L

Record the rating on the first page

NOTES and FIELD OBSERVATIONS:

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat. Questions H 1.1 – H 1.5 are from Wetland Rating System (Hruby 2004b).	
H 1. Does the wetland unit have the potential to provide habitat for many species?	
H 1.1 Structure of plant community – *indicators are Cowardin classes and layers in forest* Check the Cowardin plant classes in unit – *Polygons for each class must total ¼ acre, or more than 10% of the unit if it is smaller than 2.5 acres*. *Provide map of Cowardin plant classes* ___Aquatic bed ___Emergent plants ___Scrub/shrub (areas where shrubs have > 30% cover) ___Forested (areas where trees have > 30% cover) If the unit has a forested class check if: ___The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon Add the number of structures checked. If you have: 4 structures or more points = 4 3 structures points = 2 2 structures points = 1 1 structure points = 0	Figure__
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count (*see text for descriptions of hydroperiods*). *Provide map of polygons with different hydroperiods* ___Permanently flooded or inundated 4 or more types present points = 3 ___Seasonally flooded or inundated 3 types present points = 2 ___Occasionally flooded or inundated 2 types present points = 1 ___Saturated only 1 type present points = 0 ___Permanently flowing stream or river in, or adjacent to, the wetland ___Seasonally flowing stream in, or adjacent to, the wetland **___Lake-fringe wetland = 2 points** **___Freshwater tidal wetland = 2 points**	Figure__
H 1.3. Richness of Plant Species Count the number of plant species in the wetland unit that cover at least 10 ft^2. *Different patches of the same species can be combined to meet the size threshold and you do not have to name the species.* Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle If you counted: > 19 species points = 2 *List species below if you want to:* 5 - 19 species points = 1 < 5 species points = 0	

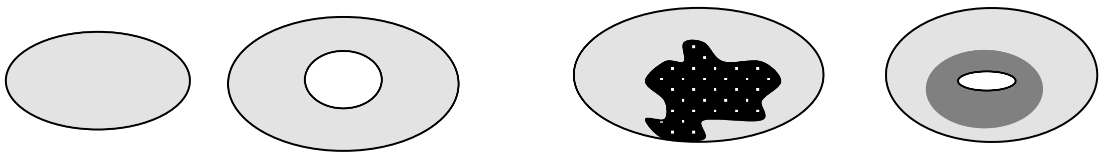
Wetland name or number _____

H 1.4. Interspersion of habitats

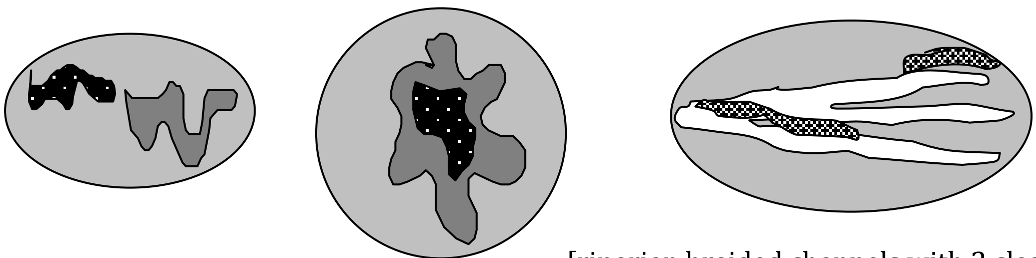
Decide from the diagrams below whether interspersion between Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.

Provide map of Cowardin plant classes (same as H1.1)

Figure__



None = 0 points Low = 1 point Moderate = 2 points



[riparian braided channels with 2 classes]

High = 3 points

NOTE: If you have four or more classes or three plants classes and open water the rating is always "high."

H 1.5. Special Habitat Features:

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

___Large, downed, woody debris within the unit (>4 inches diameter and 6 ft long).

___Standing snags (diameter at the bottom > 4 inches) within the unit

___Undercut banks are present for at least 6.6 ft (2m) **and/or** overhanging plants extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

___Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)*

___At least ¼ acre of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated.*(structures for egg-laying by amphibians)*

___Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)

H 1. TOTAL Score - potential for providing habitat

Add the scores from H 1.1, H 1.2, H 1.3, H 1.4, and H 1.5

Rating of Site Potential: If score is

15 - 18 = H

7 – 14 = M

0 – 6 = L

Record the rating on the first page

H 2.0 Does the landscape have the potential to support habitat at the site?	
H 2.1 Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat **+** [(% moderate and low intensity land uses)/2] **=** ______ *Provide map of land use within 1 km of unit edge* If total accessible habitat is: > 1/3 (33.3%) of 1 km circle *(~100 hectares or 250 acres)* points = 3 20 - 33% of 1 km circle points = 2 10 - 19% of 1 km circle points = 1 <10% of 1 km circle points = 0	Figure__
H 2.2 Undisturbed habitat in 1 km circle around unit. If: Undisturbed habitat > 50% of circle points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches points = 2 Undisturbed habitat 10 - 50% and > 3 patches points = 1 Undisturbed habitat < 10% of circle points = 0	
H 2.3 Land use intensity in 1 km circle. If: > 50% of circle is high intensity land use points = (- 2) Does not meet criterion above points = 0	
Total for H 2 Add the points in the boxes above	

Rating of Landscape Potential: If score is 4- 6 = H
1-3 = M
< 1 = L

Record the rating on the first page

H 3.0 Is the Habitat provided by the site valuable to society?	
H3.1Does the site provides habitat for species valued in laws, regulations or policies? *(choose only the highest score)* Site meets ANY of the following criteria: points = 2 — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is a “priority area” for an individual WDFW species — It is a Natural Heritage Site as determined by the Department of Natural Resources — It scores 4 on question H2.3 of the wetland rating system — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site scores 1-3 on question H2.3 of the wetland rating system points = 1 Site does not meet any of the criteria above points = 0	

Rating of Value: If score is 2 = H
1 = M
0 = L

Record the rating on the first page

Appendix B. Salt tolerant plants

Salt sensitivity rating of the estuarine wetlands and associated uplands flora of the Pacific Northwest (*=estimated) from Hutchinson (1991).

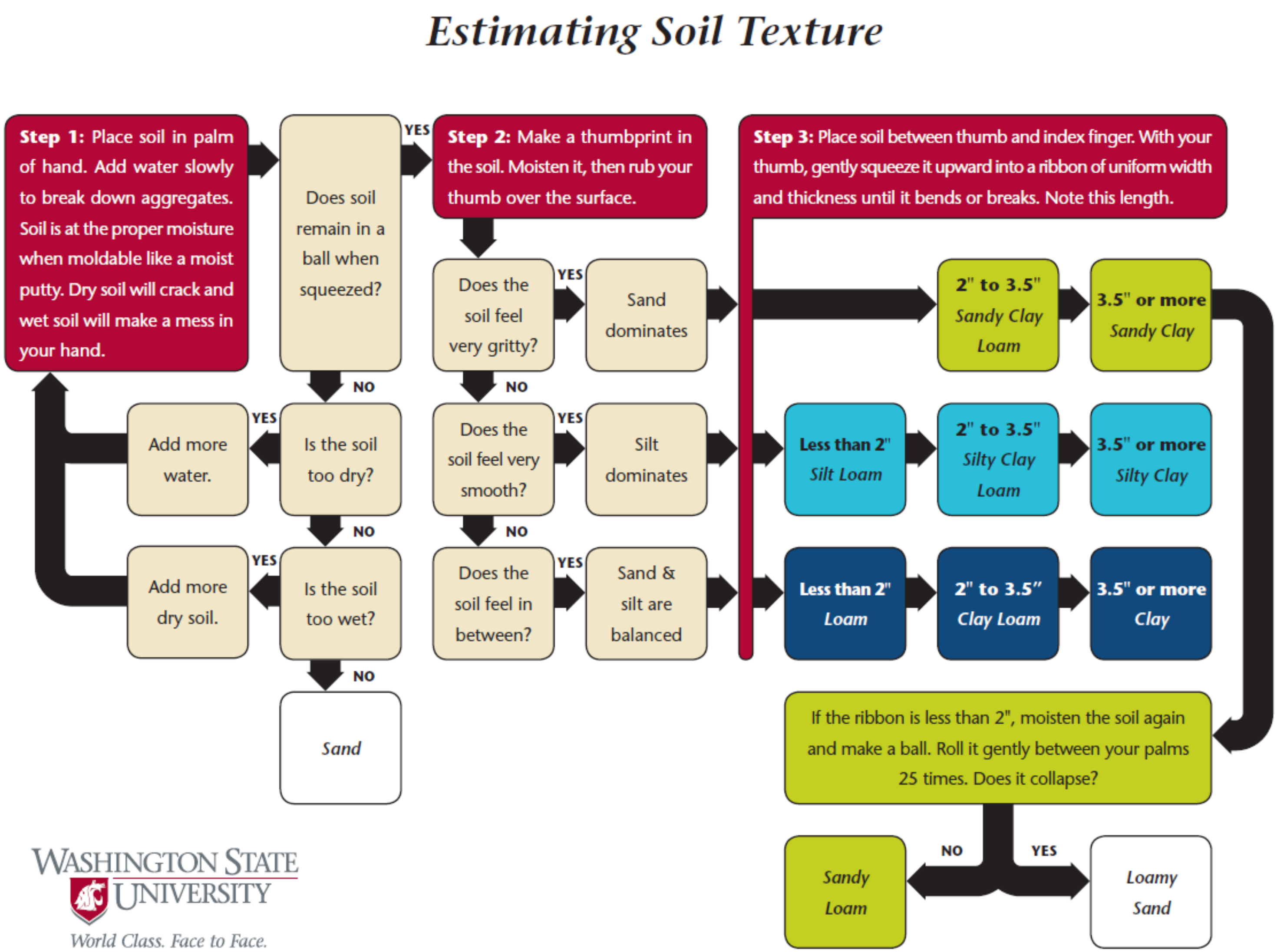
Tolerant

- *Orthocarpus castillejoides
- *Typha angustifolia
- Carex lyngbyei
- Deschampsia caespitosa
- Glaux maritima
- Hordeum jubatum
- Juncus gerardii
- Liliaeopsis occidentalis
- Scripus maritimus
- Stellaria humifusa

Very Tolerant

- Grindelia integrifolia
- Suaeda maritima
- Triglochin concinnum
- Triglochin maritimum
- Atriplex patula
- Cotula coronopifolia
- Distichlis spicata
- Jaumea carnosa
- Juncus balticus
- Plantago maritima
- Salicornia europea
- Salicornia viginica
- Spergularia canadensis
- Spergularia marina

Appendix C. Estimating Soil Texture



Appendix D: Question H 2.3 of the Wetland Rating System

H 2.3 Near or adjacent to other priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp.
http://wdfw.wa.gov/publications/00165/wdfw00165.pdf)

Count how many of the following priority habitats are within 330 ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.4 ha (1 acre).

____**Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report p. 152*).

____**Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

____**Old-growth/Mature forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age. (Mature forests) Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

____**Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

____**Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

____**Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 51 cm (20 in) in western Washington and are > 2 m (6.5 ft) in height. Priority logs are > 30 cm (12 in) in diameter at the largest end, and > 6 m (20 ft) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Scoring for H 2.3:

- If wetland has 3 or more priority habitats = 4 points
- If wetland has 2 priority habitats = 3 points
- If wetland has 1 priority habitat = 1 point
- No habitats = 0 points

Appendix E: Worksheets for Estimating the Adequacy of Wetland Mitigation

"DEBIT" WORKSHEET

Wetland unit to be altered: ______________________________________ Date __________

Use the following tables to calculate the Debits for the impact site. Use a separate worksheet for each wetland unit being altered. In addition, you will need to calculate the debits separately for forested areas and for emergent/shrub areas. Use the map of Cowardin plant types from question H 1.1 on the Scoring Form to determine the boundaries between forested areas and non-forested areas.

FUNCTION ***From Scoring Form***	**Improving Water Quality**	**Hydrologic**	**Habitat**
Rating of Site Potential			
Rating of Landscape Potential			
Rating of Value			
Score for Wetland			

CALCULATIONS **emergent or shrub areas**	**Improving Water Quality**	**Hydrologic**	**Habitat**
Score for wetland unit (see above)			
Impact - Acres of **non-forested** areas *(same for all functions)*			
Basic mitigation requirement (BMR) = *Score for function x acres impacted*			
Temporal loss factor (TLF) (See table below)			
Mitigation required DEBITS = BMR x TLF			
CALCULATIONS **forested areas**	**Improving Water Quality**	**Hydrologic**	**Habitat**
Score for wetland unit (see above)			
Impact - Acres of **forest** *(Create a separate column for each type of forest)* Deciduous (D), Evergreen (E), Cat. 1 deciduous (>50%cover) (CD) Cat. 1 evergreen (>50% cover)(CE)	D E CD CE	D E CD CE	D E CD CE
Basic mitigation requirement (BMR) = *Score x acres impacted*			
Temporal loss factor (TLF) (See table below)			
Mitigation required DEBITS = BMR x TLF			
TOTAL for forested areas (D+E+CD+CE)			

Temporal Loss Factors:

Timing of Mitigation	Temporal Loss Factor
Advance – At least two years has passed since plantings were completed or one year since "as-built" plans were submitted to regulatory agencies	1.25
Concurrent – Physical alterations at mitigation site are completed within a year of the impacts, but planting may be delayed by up to 2 years if needed to optimize conditions for success.	
For impacts to an emergent or shrub community	1.5
For impacts to a deciduous forested wetland community	2.0
For impacts to an evergreen forested wetland community	2.5
For impacts to a deciduous Category I forested wetland community	3
For impacts to an evergreen Category I forested wetland community	3.5
Delayed - Construction is not completed within one year of impact, but is completed (including plantings if required) within 5 growing seasons of impact.	
For impacts to an emergent or shrub community	3
For impacts to a deciduous forested wetland community	4
For impacts to an evergreen forested wetland community	5
For impacts to a deciduous Category I forested wetland community	6
For impacts to an evergreen Category I forested wetland community	7

NOTE: The ratings, scoring and calculations are valid for only five years because wetlands and their functions will change with time. If delays in the construction of the site are more than 5 years, the mitigation plan will probably have to be re-negotiated and the calculation re-done. This time limit was chosen to be consistent with the validity of wetland delineations as established by the U.S. Army Corps of Engineers.

TOTALS

	Improving Water Quality	Hydrologic	Habitat
DEBITS - Emergent or shrub areas	Acre-points	Acre-points	Acre-points
DEBITS - Forested areas	Acre-points	Acre-points	Acre-points
TOTAL	Acre-points	Acre-points	Acre-points

“CREDIT” WORKSHEET

Mitigation Site: _______________ Wetland Unit: ______________________ Date __________

To calculate the CREDITS fill out the following worksheets using the data from the Scoring Form. Also,

- Use additional worksheets if more than one wetland unit is being used for mitigation.
- Use the map of Cowardin plant types from question H 1.1 on the Scoring Form to determine the boundaries of areas dominated by emergent plants (if needed for the calculations).
- Map out and estimate the areas in the wetland unit that will be created or re-established and the areas that will be rehabilitated or enhanced. The credits from creation/re-establishment and rehabilitation/enhancement are calculated separately before being combined at the end.

Additional notes:

Note 1: B = 0 for all three functions in mitigation sites that are not currently wetlands (creation or re-establishment).

Note 2: If you are increasing the size of an existing wetland the credits are calculated by rating the functions for the entire future wetland (original wetland + area created or re-established). However, you only get credits based on the area (footprint) of the area created or re-established.

Note 3: For enhancement and rehabilitation you cannot score only the parts of a wetland where mitigation takes place. You need to score the entire unit as defined in Chapter 4. This is done for both “before” and “after” conditions. The score for the unit after mitigation [A] will be the same for either enhancement or rehabilitation. This method is based on calculating the “lift” in functions without considering whether the mitigation is called enhancement or rehabilitation.

Note 4: Scoring the landscape potential of a mitigation site to calculate credits after the mitigation takes place depends on how its rating changes. Specifically:

4.1 **If the score for the landscape potential decreases as a result of the mitigation activity** then the score for the current conditions can be used for calculating credits. For example, the rating of landscape potential might decrease for a large mitigation project that removes sources of pollutants in the buffer. In this case the scores for the site might decrease even though positive actions are being taken.

4.2 **If the score for the landscape potential decreases as a result of the development or proposed impacts** then the score for the "future" condition should be used to calculate credits. For example, on-site mitigation should be getting a lower rating for the landscape potential if development to which it is linked breaks corridors or reduces the area of undisturbed habitat. These reduce the effectiveness of the mitigation site as habitat.

4.3 **If the score for the landscape potential increases as a result of the mitigation actions** then the score for the "future" condition can be used in calculating credits. For example, new corridors or habitat connections that are made as a result of the project should be given credit. Also, riverine wetlands that are reconnected to their floodplain should get credit (e.g., question R 5.1).

4.4 **If the score for the landscape potential increases as a result of the development or proposed impacts** then the score for landscape potential for the current conditions has to be used in calculating credits. A development could provide a source of pollutants or excess water to the mitigation site that would increase its level of flood storage and removal of pollutants. We do not want to give mitigation credits to increases in functioning of a wetland that are a result of the impacts associated with the project.

Use the following worksheet to calculate credits. Totals are in acre-points for comparison with the debits worksheet. Separate the mitigation site into different areas (polygons on a map) by the type of mitigation proposed (creation, re-establishment [C/R], and rehabilitation/enhancement [R/E]) and by the plant community proposed for that polygon. These areas have different risk factors.

Scores for unit before any mitigation takes place

B = 0 for Creation and Re-establishment

FUNCTION ***From Scoring Form - Unit ID_________***	**Improving Water Quality**	**Hydrologic**	**Habitat**
Rating of Site Potential			
Rating of Landscape Potential			
Rating of Value			
Score for mitigation site [B]efore	**B =**	**B =**	**B =**

Scores for unit based on the expected wetland ecosystem when all the vegetation has reached maturity and the water regime has stabilized

FUNCTION ***From Scoring Form - Unit ID_________***	**Improving Water Quality**	**Hydrologic**	**Habitat**
Rating of Site Potential			
Rating of Landscape Potential			
Rating of Value			
Score for mitigation site [A]fter	**A =**	**A =**	**A =**

Calculations for Credits **Unit ID____________**	**Improving Water Quality**		**Hydrologic Function**		**Habitat Function**	
Increase in Score at mitigation site (**A – B**) **=** [f/s] – forest/shrub/aquatic bed [e] – emergent	C/R f/s e	R/E f/s e	C/R f/s e	R/E f/s e	C/R f/s e	R/E f/s e
Acres of mitigation (*should be same for the 3 functions for each type of mitigation*)						
Basic mitigation credit (BMC) = Increase in Score x acres of mitigation						
Risk factor (RF) (see table below)						
Mitigation credits available for each area CREDITS = BMC x RF						
TOTAL CREDITS AVAILABLE Add the credits from the different types of mitigation						

Risk Factors:

Type of Mitigation	**Risk Factor**
Advance mitigation The site meets **criteria in Charts 1 and 3** of the site selection guidance [i.e., identified in a local plan and is sustainable] **AND** meets the **criteria in Charts 4-11** for the appropriate functions. (Ecology publication #09-06-032) ***Advance** means that at least two years has passed since plantings were completed or one year since "as-built" plans were submitted to regulatory agencies.*	1.0
Advance mitigation without meeting criteria in Ecology publication #09-06-032	0.83
Concurrent Mitigation Mitigation site meets **criteria in Charts 1 and 3** of the site selection guidance [i.e., identified in a local plan and is sustainable] **AND** meets the **criteria in Charts 4-11** for the appropriate functions. (All worksheets for Chart 3 and in Appendix D of Ecology publication #09-06-032 are submitted) *Risk factor applies to all types of mitigation.*	0.9
Mitigation site chosen meets the **criteria in Charts 2 and 3** of the site selection guidance [i.e., identified as a site with potential and that is sustainable] ; **AND** meets **criteria in Charts 4-11** for the appropriate functions. (All worksheets for Chart 3 and in Appendix D of Ecology publication #09-06-032 are submitted) *Risk factor applies to all types of mitigation.*	0.80
Site does not meet criteria in site selection guide, or guide was not used.	
Re-establishment, rehabilitation, or enhancement of an aquatic bed, shrub, or forest community	0.67
Re-establishment, rehabilitation, or enhancement of an emergent community	0.5
Creation of an aquatic bed, shrub, or forest community with data showing there is adequate water to maintain wetland conditions 5 years out of every 10.	0.67
Creation of an emergent community with data showing there is adequate water to maintain wetland conditions 5 years out of every 10.	0.5
Creation of an aquatic bed, shrub, or forest community without adequate hydrologic data.	0.5
Creation of an emergent community without adequate hydrologic data.	0.4

Calculating credits achieved through preservation

The credits available from preservation are calculated by scoring the importance and location of the site being proposed for preservation.

- If you are preserving wetlands use the first table below. The wetland will have to be scored for its functions using the Scoring Sheet in Appendix A.
- If you are preserving uplands use the second table.

To come up with ratios for preservation that are similar to those currently in use we modify the "Basic Score" by "Scaling Factors" that reflect the importance of the site and the potential threats to the site. The descriptions of the criteria used for determining the scaling factors are given after the tables. The tables show two scaling factors for each criterion. Use the first scaling factor if the mitigation plan you are proposing also meets the "no net loss of area" policy. This means you are creating or re-establishing an area of wetland that is equivalent to the area lost. Use the second scaling factor if wetland area is not fully replaced (i.e., the mitigation consists of only mostly rehabilitation, enhancement and/or preservation).

Preservation of Existing Wetlands

Calculating Credits When Preserving Wetlands	Improving Water Quality	Hydrologic Functions	Habitat Functions
Scores of wetland being preserved (*from Scoring Sheet*)			
Acres of preservation			
Basic Score = Score x acres of wetland preserved			
Scaling Factors see tables below Wetland Category			
Location			
Threat			
Sum of scaling factors			
CREDITS AVAILABLE (Basic Score) *x* (sum of scaling factors) =	Acre-points	Acre-points	Acre-points

Preservation of Uplands

The hydrologic and water quality functions that uplands provide are not directly comparable to those provided by wetlands, and we do not have methods for rating them. Habitat for wildlife and plants are the only functions that are marginally comparable. **As a result, credits from the preservation of uplands can only be used to compensate for impacts to the habitat functions.** Different types of upland habitat are assigned an equivalent "wetland habitat" score for the purpose of calculating the credits. The scoring for uplands is as follows:

Type of Upland Habitat	Habitat Score to be applied in calculation
Upland is Identified as important habitat for preservation in a watershed plan	9
Upland is a "Priority area" for priority species as defined by WDFW OR upland is listed as Natural Heritage site by the Department of Natural Resources	8
Upland is a priority habitat as defined by WDFW (other than wetlands) (see Appendix D for list)	7
Other relatively undisturbed uplands (see definition of relatively undisturbed on page 106)	5

Calculating Credits When Preserving Uplands	Habitat Score
Habitat Score for type of upland from table above	
Acres of preservation	
Basic Score = Score x acres of preservation	
Scaling Factors see tables below Connections	
Location	
Threat	
Sum of scaling factors	
HABITAT CREDITS AVAILABLE Basic Score *x* sum of scaling factors =	Acre-points

Criteria and Their Scaling Factors

Each criterion has two scaling factors. The first is to be used if the mitigation plan includes the creation or re-establishment of an area of wetland that is equivalent to the area lost. The second is to be used if wetland area is not replaced and the mitigation consists of only rehabilitation or enhancement and preservation.

Factor if area is replaced = Creation or re-establishment replaces, at a minimum, the area of wetland lost.

Factor if area is not replaced = Enhancement, rehabilitation, or preservation provides the bulk of the mitigation. The wetland area lost is not completely replaced by the proposed mitigation.

Areas may be separated for calculations if they represent different types of preservation.

Criterion - Wetland Category (*applies only if preserving wetlands*) – the category of the wetland from the Washington State Wetland Rating System. Some Category II wetlands have ongoing disturbances such as grazing ditches, or drain tiles. The scaling factor for Category II wetlands can be increased if the mitigation plan includes the removal of these disturbances.

	Category 1 wetland	**Category 2 wetland**	**Category 2 wetland with removal of disturbances**	**Category III or IV wetland**
Scaling Factor if area is replaced	0.1	0.05	0.08	0
Scaling Factor if area is not replaced	0.05	0.025	0.04	0

Criterion - Habitat Connections for Uplands *(applies only if preserving uplands)* - The connection of the preservation site relative to other relatively undisturbed habitat areas (see definition for relatively undisturbed on page 105).

	Site connected to at least 250 acres of undisturbed habitat	**Site connected to ≥ 25 acres of undisturbed habitat**	**Site provides a habitat corridor**	**No corridors**
Scaling Factor if area is replaced	0.1	0.05	0.025	0
Scaling Factor if area is not replaced	0.05	0.025	0.013	0

Definitions:

Site connected to an undisturbed habitat at least 250 acres in size– Use a map or aerial photograph to determine if site being preserved is part of, or connected to, a relatively undisturbed upland, wetland, or estuary, at least 250 acres in size. Relatively undisturbed means the area is not subject to regular disturbances from human activities (see p. 105). If site is connected by a corridor, the corridor must be relatively undisturbed and at least 100 ft wide.

Site part of an undisturbed habitat of at least 25 acres - Use same criteria as above, but the size of undisturbed habitat only has to be 25 acres instead of 250.

Site provides a habitat corridor – The preservation site is a relatively undisturbed vegetated habitat corridor at least 50' wide between two existing patches of relatively undisturbed habitat at least 10 acres in size, or a relatively undisturbed riparian corridor that is at least ¼ mile in length and at least 50 ft wide.

Criterion – Location *(Use for both upland and wetland preservation)* - characterizes the position of the preservation site relative to the impact site*.*

Location of mitigation site relative to impact site	Same hydrologic unit*	Adjacent hydrologic unit*	Site chosen with no analysis of hydrologic units (negative scaling factor)
Scaling Factor if area is replaced	0.05	0.025	-0.02
Scaling Factor if area is not replaced	0.025	0.013	-0.04

*See site selection guide (Ecology publication #09-06-032) for defining hydrologic units used in watershed analyses.

Definitions:

Same hydrologic unit – The preservation site is in the same hydrologic unit as the impact site as defined in the site selection guide (Ecology publication #09-06-032). The scale of the hydrologic unit chosen should be compatible with those used in any available local planning efforts.

Adjacent hydrologic unit - The site is in a hydrologic unit that is contiguous with the one where the impacts will occur. (see above for defining hydrologic units)

Site chosen with no analysis of hydrologic units – the location of the preservation site was chosen without any analysis of the hydrologic units in the watershed.

Criterion - Degree of Threat *(Use for both upland and wetland preservation)* – Characterizes the level of imminent risk of loss or damage to the preservation site.

Threat	High	Moderate	Low
Scaling Factor if area is replaced	0.1	.05	0
Scaling Factor if area is <u>not</u> replaced	0.05	0.025	0

Definitions:

Threat High – There is a demonstrable threat to the site based on documented evidence of proposed destructive land use. The threat has to be documented. Also any areas within the boundaries of an incorporated city or town are under a High Threat.

Threat Moderate – There is threat to the site based on local and regional land use trends that are generally not the consequence of actions under the control of the land owner. Any areas within an urban growth boundary can be considered as having a moderate threat.

Threat Low – There is little evidence of an imminent risk to the preservation site.

Summary of Credits and Debits

This summary provides space for three separate impact sites and three mitigation areas. If more areas are planned, another sheet will be needed.

DEBITS (all numbers are acre-points)	**Improving Water Quality**	**Hydrologic Function**	**Habitat Function**
	Site #1 Site #2 Site #3	Site #1 Site #2 Site #3	Site #1 Site #2 Site #3
TOTAL (in acre-points)			
CREDITS (all numbers are acre-points)	**Improving Water Quality**	**Hydrologic Function**	**Habitat Function**
Creation/re-establishment	Site #1 Site #2 Site #3	Site #1 Site #2 Site #3	Site #1 Site #2 Site #3
Rehabilitation			
Enhancement			
Wetland Preservation			
Upland Preservation			
TOTAL Credits available (In acre-points)			
BALANCE Credits - Debits			