Wetlands in Washington State

Volume 2: Guidance for Protecting and Managing Wetlands

Final

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Washington Department of FISH and WILDLIFE

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Volume 2: Guidance for Protecting and Managing Wetlands

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Chapter 1
Introduction to Volume 2

1.1 Overview of Volumes 1 and 2

This document is the second in a two-volume series addressing wetlands in Washington and their protection and management. The first volume, *Freshwater Wetlands in Washington State - Volume 1: A Synthesis of the Science* (Sheldon et al. 2005), is a synthesis of the most current science and was released in draft form to the public in the fall of 2003. The comments from reviewers of the draft were used to revise the document and create the final version. All of the comments received on Volume 1 and the author's responses to them, as well as a 10-page summary of the significant comments, are posted on the project's web page: http://www.ecy.wa.gov/programs/sea/bas_wetlands.

Volume 1 synthesized the literature regarding:

- Freshwater wetlands in Washington and how they function
- The effects of human activities on Washington's freshwater wetlands and their functions
- The tools used to protect and manage freshwater wetlands and their functions and values

The key conclusions from Volume 1 are summarized in Chapter 3 in this document.

Volume 2 contains guidance primarily for local governments on protecting and managing wetlands and their functions based on the synthesis of the science in Volume 1. Although the primary audience is local governments, the information contained in this document should be useful to anyone who has an interest in the protection and management of wetlands in the state.

The key themes or messages in Volume 2 are as follows:

- By relying on a site-by-site approach to managing wetlands, we are failing to effectively protect them
- To effectively protect wetlands and their functions, we must understand and manage their interaction with the environmental factors that control wetland functions
- To understand and manage these environmental factors and wetland functions, information generated through landscape analysis is needed

- Landscape analysis should be one step in a four-step framework that should be used in developing a diversified program to protect and manage wetlands and their functions; the four-step framework should include analyzing the landscape, prescribing solutions, taking actions, and monitoring results and applying adaptive management

- Protection and management measures developed and implemented in steps two and three of the four-step framework (prescribing solutions and taking action) should incorporate a full range of components including:

  – Policies and plans such as landscape-based plans (such as Green Infrastructure), comprehensive plans, subarea plans, etc.

  – Regulations such as critical areas ordinances, clearing and grading ordinances, etc.

  – Non-regulatory activities such as incentives that encourage conservation, restoration, and preservation through voluntary efforts

1.2 Purpose and Goals of Volume 2

Both Volumes 1 and 2 were written to assist local governments in complying with requirements in the Growth Management Act (GMA) to include the best available science when adopting development regulations to designate and protect critical areas, including wetlands. The GMA requires that local governments protect wetland functions and values, and evaluate and include relevant scientific information when determining what policies, plans, and regulations are needed. (See Chapter 2 for a discussion of the relevant mandates in the Growth Management Act.)

This is a challenging task and one that some cities and counties are poorly equipped to undertake. Many local governments have asked the state departments of Ecology and Fish and Wildlife to assist them by synthesizing the science (Volume 1) and providing general guidance as well as specific recommendations for protecting wetlands based on the science (Volume 2). (See Section 1.4 on how Volume 2 was developed.)

The guidance presented in Volume 2 is advisory only. Local governments are not required to use this guidance. The guidance in and of itself is not "best available science." Rather, it represents the recommendations of the departments of Ecology and Fish and Wildlife as to how a local government could include the best available science in policies, plans, and regulations to protect wetlands.

Volume 2 was also written to address the fact that wetlands continue to be lost and degraded through human activities in spite of the adoption of "no net loss" policies at local, state, and federal levels and an increased knowledge of the complex processes that drive wetland functions. The results of the scientific research synthesized in Volume 1 are clear: We have not stopped the continued degradation of our wetlands and their functions (Sheldon et al. 2005).

As concluded in Volume 1, wetland losses often result from a combination of impacts from human activities that occur both within and outside individual wetlands. Changes from human activities result in cumulative impacts across the landscape. Currently, however, the majority of decisions about managing wetlands in Washington State fail to consider environmental factors that control wetland functions or the consequences of human actions that occur at a landscape scale; they are made on a case-by-case basis related to specific projects.

The departments' goals for Volume 2, therefore, are to help local governments:

- Include current scientific information in their decisions about the protection and management of wetlands to meet the requirements of the GMA
- Incorporate a diversified, landscape-based approach to better protect wetlands and their functions and values and to manage cumulative effects

Where possible, the authors of Volume 2 provide several options for protecting and managing wetlands using landscape analysis, processes for planning, regulatory options, as well as non-regulatory approaches. For example, three alternatives for buffer widths are presented, one being a matrix using factors such as wetland rating, intensity of the proposed, adjacent land use, wetland functions, and other characteristics. Such approaches allow more flexibility.

In the future, it is hoped that:

- The protection and management of wetlands will be integrated with the management of all environmental resources across the landscape
- Impacts to wetland functions and values from decisions about land uses will be understood at the appropriate geographic scales
- Local jurisdictions will plan for future development in a proactive manner, so impacts to the environmental factors that control functions are minimized before they occur
- When tradeoffs between conflicting values are made, the decision will be made with a full understanding of the "true value" lost or gained

1.2.1 Implementing a More Comprehensive Approach

This volume presents a four-step framework that integrates scientific information about the landscape (landscape analysis), planning approaches, and regulatory and non-regulatory actions at the different geographic scales at which natural resources should be managed. It represents the ideal situation where a local government has adequate resources and commitment to undertake this process. The available scientific information makes clear that the most effective way to protect wetland functions and values is to use a comprehensive, landscape-based approach. Addressing only some of the recommendations in this volume, therefore, increases the risk that wetland functions and values will not be adequately protected. (See Chapter 10 for additional discussion of characterizing the risk of proposed solutions for protecting and managing wetlands.)

The departments of Ecology and Fish and Wildlife understand that not all local governments are currently in a position to implement the diversified, comprehensive program described in Volume 2. The entire process is presented so users can understand what information or tasks they are missing and to help understand the tradeoffs being made and the risks taken.

The authors of Volume 2 also recognize that many jurisdictions will face a challenge in updating their development regulations to meet the state GMA deadlines, even without incorporating a landscape perspective at this time. In addition, transforming our approach to managing wetlands from a site-specific focus to a view of the broader landscape is a change of practice for local governments. It will most likely occur incrementally as local governments collect and analyze landscape data and incorporate that information into their various policies, plans, and regulatory and non-regulatory activities. Local governments, therefore, should at a minimum adopt strong wetland regulations until they can incorporate landscape-based plans, policies, and non-regulatory elements.

Working with local governments on developing and using landscape analysis

This document provides ideas on how to analyze the landscape as well as references for the various analyses that are available (see Chapter 5 and Appendix 5-B). One method for landscape analysis that is described is a method currently being developed by Ecology. It provides suggestions on how to analyze landscape information (such as geology, soils, and water flow) for use in planning, developing protection measures, and identifying wetlands for restoration and preservation.

Ecology's method for landscape analysis is being improved as it is applied in different jurisdictions. In addition, the methods are currently lacking an analysis of wildlife habitat and corridors. This gap will be addressed in the near future as the departments of Fish and Wildlife and Ecology work together to better include wildlife factors in the analysis.

Ecology invites local governments to work with the agency to conduct landscape analyses and use the information to develop more effective approaches to protecting and managing the landscape and its wetlands. In this way, local governments can play an important role in further developing this approach to landscape analysis.

1.3 Scope of Volume 2

1.3.1 Non-GMA Protection of Wetlands is Not Addressed in Volume 2

The regulations and management programs implemented by federal, state, and tribal governments are not discussed in Volume 2. For example, the Clean Water Act administered by the U.S. Army Corps of Engineers is not discussed. These laws are only mentioned in relation to direct mandates to local governments. For example, the definition of wetlands used by local governments is mandated in state statute (see Chapter 8).

There is, however, a brief discussion of the Shoreline Management Act (SMA). In Chapter 4, the SMA is mentioned in relation to the four-step framework recommended in this volume for local wetland protection programs. The SMA guidelines include requirements for the inventory and analysis of "ecosystem-wide processes" (landscape processes). These requirements are consistent with the recommendations in Volume 2 for incorporating landscape analysis into local planning and protection efforts. The reader is referred to the following web site more information on the SMA guidelines (http://www.ecy.wa.gov/programs/sea/SMA/index.html).

1.3.2 Vegetated Tidal Wetlands are Addressed in Volume 2

The recommendations made in this document are not strictly limited to freshwater wetlands. Vegetated tidal wetlands (a subset of all tidal wetlands including vegetated wetlands in estuaries and coastal lagoons) are addressed specifically in the revised wetland rating system for western Washington (Hruby 2004b) because they were included in past versions of the rating system, even though the scientific information about them was not summarized in Volume 1. The scientific information on which recommendations for tidal wetlands were based is summarized in Appendices 8-E and F.

1.3.3 How Values are Addressed in Volume 2

As discussed in Volume 1, wetland functions are the things that wetlands "do." Society, however, does not necessarily attach "value" to all wetland functions. Value is usually associated with goods and services that society recognizes. For example, trapping sediments is a wetland function that improves water quality, and this is often valued by society. Not all of the environmental factors that control wetland functions or the functions themselves, however, are recognized or valued.

Sometimes what is valued is not what a wetland does but some other aspect of the wetland ecosystem that is considered important socially. For example, "recreation" is valued by society and is often called a function even though it is not something a wetland "does." Other aspects of the wetland ecosystem that are valued and have been called functions include “education” and “aesthetic quality.” These values are sometimes referred to as *social functions* to separate them from functions based on environmental factors.

The social functions cannot be assessed or rated using the same methods used to assess functions based on environmental factors. Valuing social functions requires methods based on economic, sociologic, and psychological tools, rather than on ecology and other environmental sciences. Therefore the literature on social functions was not synthesized in Volume 1.

The values of a community are an important consideration when developing the plans and polices of local governments. Values in this context are opinions held by communities in regard to what is important to them. For example, a community (urban or rural) might value one wetland function more than another. Water quality improvement might be more valued than flood control in an area with water quality problems if that community is not in an area prone to flooding. In addition, a community might value certain amenities in their neighborhoods or rural areas above others. For example, a neighborhood might value keeping the maximum amount of vegetated area through clustered development as opposed to scattered development that results in fragmented islands of vegetation. The need to identify and consider these values is discussed in Chapters 6 and 7. The landscape analysis discussed in Chapter 5 provides important information needed when making decisions about a community’s values as well as what communities, and their wetlands, will be like in the future.

1.4 Developing Volume 2

Production of this document and Volume 1 was funded through a grant from the U.S. Environmental Protection Agency. Attendees of two focus groups provided early direction for the volumes. Meetings of focus groups were held in Olympia and Moses Lake in early 2002 to solicit ideas for the scope and objectives of the project. This information was used to guide the development of both volumes. These focus groups were attended by over 60 individuals, primarily representatives from local governments and consulting firms.

Both volumes were developed by a team (called the Core Team). Membership of the Core Team changed somewhat with the initiation of Volume 2. The Core team for Volume 2 consisted of staff from the departments of Ecology, Fish and Wildlife, and Community, Trade and Economic Development; Sheldon & Associates; and 2N Publications (the contract editor for the draft). A list of the members of the Core Team for Volume 2 is provided in Appendix 1-A. Several members of the Core Team wrote the various sections, chapters, and appendices of Volume 2.

The Core Team developed the guidance in conjunction with a team of local government staff: a Local Government Wetlands Advisory Team (LGWAT). The LGWAT members are also listed in Appendix 1-A. The LGWAT convened in December 2003 to provide ongoing input and guidance during the development of this volume. The team met several times to review and respond to draft concepts and materials developed by the Core Team. Additionally, meetings were held with representatives from the business and environmental communities to solicit their ideas and comments on concepts and early draft documents (see Appendix 1-B).

The draft of Volume 2 was distributed for review during a four-week period to solicit comments. It was provided to all those who requested a hard copy, or a CD, or who downloaded it from the project's web page. Prior to the completion of the draft, a newsletter was sent to the project's mailing list of over 1,200 recipients, informing them of the review period. They were requested to inform Ecology if they wanted to review the draft and in what form they wanted to receive it. The Core Team requested that reviewers critique the general guidance as well as specific recommendations or additions. Comments regarding organization and ease of reading were also welcomed.

Seven reviewers provided comments (see Appendix 1-B) which were reviewed by the authors and were compiled in a separate document along with the author's responses to the comments. All four documents (responses to comments on the draft of Volume 1, the final version of Volume 1, responses to comments on the draft of Volume 2, and the final version of Volume 2) are posted on the project's web page and can be obtained as a CD or paper copy (http://www.ecy.wa.gov/programs/sea/bas_wetlands).

1.5 How Volume 2 is Organized

Volume 2 is organized into 12 chapters plus references, a glossary, and appendices. The first three chapters in this document explain the purpose, legal basis, and basic scientific foundation for the recommendations that follow. Chapter 4 outlines a suggested framework (divided in to four steps) which local governments can use to develop a diversified program to protect and manage wetlands. The remaining chapters, Chapters 5-12, describe the four steps and the primary components of a wetland protection program. The chapters include discussions of analyzing the landscape, landscape-based plans, comprehensive plans, regulatory and non-regulatory tools, characterizing the risk of wetland protection, implementing components of a protection program, and monitoring and adaptive management. Methods for analyzing landscapes and wetlands, recommended language for an ordinance, and various supporting information are provided in the appendices.

1.6 How to Use Volume 2

Local governments are encouraged to read and understand the entire document before determining how they want to protect wetland functions and values. This document is not intended to be a scientific treatise and, in general, references to specific scientific literature are limited. While Chapter 3 provides an overview of the scientific basis for the recommendations in this document, the more detailed, peer-reviewed and referenced information on wetland science is contained in Volume 1. We highly recommend reading Volume 1 as well, especially key points and conclusions.

As noted above, many of the recommendations in this document cannot be tied to a specific scientific article and cannot be cited as such (or the list of citations would be extremely long and cumbersome). Citations are provided only when a specific recommendation was also made within the scientific literature. Additional literature sources are cited in Chapters 6, 7, 9 and elsewhere in various parts of Volume 2. Many of these are more oriented towards policy and are not strictly scientific in nature. They were not, therefore, included in the synthesis of the science in Volume 1. Lastly, references are provided in various appendices. These are not necessarily included in the list of cited references but are at the end of the individual appendix in which they are mentioned.

In Volume 2, measurements are given in English Customary instead of metrics, whereas in Volume 1 both metric and standard are provided. For example, buffer widths are listed in feet only, not feet and meters. This was chosen because most local governments use English Customary measurements in their plans and regulations.

As mentioned previously, the guidance provided in Volume 2 is advisory only. The Growth Management Act does not require that local governments adopt the protection measures recommended in this document. Local governments are free to use or adapt the four-step framework and the options and recommendations presented here or develop entirely different approaches to protecting wetlands to fit their particular circumstances.

1.7 Using Science to Protect and Manage Wetlands

We recognize that it is challenging for local governments to include the best available science in developing or updating measures to protect and manage wetlands. In the following sections we discuss several topics relevant to this challenge. The topics include ecological principles to use when considering options for protecting and managing wetlands, some reasons why including the science can be challenging, and understanding the risks of the decisions made.

"To be effective, the nation's wetlands protection and management programs must anticipate rather than react. They should focus on future, not the present or the past; on effectively protecting the remaining resources and actively restoring or creating additional wetlands. They should anticipate needs and problems on the basis of rigorous analyses of regional resources, trends, stresses, and values. They should consider the whole, not just the individual parts."

The Conservation Foundation, *Protecting America's Wetlands: An Action Agenda. The Final Report of the National Wetlands Policy Forum* (1988).

1.7.1 Ecological Principles to Consider

The Ecological Society of America has taken a lead in compiling and explaining scientific principles on managing natural resources, such as wetlands (Dale et al. 2000). The ecologist's goal is to ensure that future decisions include the best scientific information available. The principles illustrate the need to take a more holistic, landscape approach to managing our natural resources. The principles and their implications in environmental decision making are briefly summarized in Table 1-1.

Table 1-1. Ecological principles and their implications in making decisions about land use (adapted from Dale et al. 2000 to focus on wetlands rather than land use in general).

Ecological Principle	Implication for Managing Land Use in and Around Wetlands
The type, intensity, and duration of disturbances are the major factors shaping populations and the ecosystem as a whole. Disturbances can occur at many different spatial and temporal scales.	Changes in land use that cause new disturbances are likely to cause changes in animal and plant populations and the functions of a wetland. We need to manage disturbances at the scale at which they occur. For example, the eutrophication of a wetland may be a result of disturbances throughout its watershed and this problem cannot be managed only within the wetland itself. Also, it is not possible to target a specific "end point" when creating or restoring wetlands because changes are continuous.
Ecological processes operate at many time scales, and ecosystems change through time.	The current state of a wetland is in part a consequence of historical conditions. Therefore, historical information may be needed to understand how a wetland will respond to disturbance. Managing wetlands to protect their valuable functions requires us to consider how ecological processes change through time both with and without the influence of human activities.
Some species have key, broad-scale effects on the ecosystem (keystone species).	The removal of keystone species can radically change the functions in a wetland and spread well beyond the boundaries of the wetland. Because the effects of keystone species are complicated and not fully understood, we cannot predict the effects on the ecosystem of changes in their numbers or distribution. For example, removing beavers from a river system has significant impacts on the biological diversity and flooding patterns of the entire watershed.
Local conditions strongly affect environmental functions at a site.	The position of a wetland in the landscape defines the functions it performs. Wetlands in a specific landscape position may perform only certain functions and at specific rates. We need to understand these local conditions when creating, restoring or enhancing wetlands so we do not "plan" for functions that the landscape will not support. For example, wetlands on slopes do not pond water. Creating a ponded wetland on a slope is not compatible with the position in the landscape, and maintaining this wetland will require constant management of the dikes and the outflow structure.
The size, shape, and location of different types of uplands around a wetland influence its functions.	An understanding of the surrounding landscape is needed to understand the implications of decisions made about an individual wetland.

The Ecological Society of America has also proposed guidelines for managers to use in considering the ecological impacts of their decisions about land use (including wetlands) (Dale et al. 2000). These guidelines, listed below, can be considered a checklist of factors to consider when making decisions about protecting or managing wetlands:

- Examine the impacts of local decisions in a regional (or landscape) context
- Plan for long-term change and unexpected events
- Preserve rare landscape elements, critical habitats, and associated species
- Avoid land uses that deplete natural resources over a broad area
- Retain large contiguous or connected areas that contain critical habitats
- Minimize the introduction and spread of non-native species
- Avoid or compensate for the effects of development on ecological processes
- Implement land use and land management practices that are compatible with the natural potential of the area

1.7.2 Interpreting the Science

Decisions by hearings boards and the courts have made clear that the requirement to "include the best available science in developing policies and development regulations to protect the functions and values of critical areas" is a substantive requirement, not merely a procedural one. (A review of hearings board and court cases that summarizes the key findings related to best available science, prepared by staff from the Department of Community, Trade and Economic Development and the state Attorney General's office, is presented in Chapter 2.)

However, incorporating scientific information in policies, plans, and regulations is challenging. The science of projecting how future land uses influence aquatic resources, such as wetlands, is still in its infancy (Nilsson et al. 2003). Planners using the scientific information available should not expect to be able to employ detailed methods that provide quantitative assessments of impacts from future development. Using existing data and tools, the ecological forecasts are largely qualitative in nature and essentially based on expert knowledge and correlations (Nilsson et al. 2003). Thus, the results of applying scientific principles are presented in terms of a "high," "moderate," or "low" risk to natural resources rather than a quantitative estimate of impacts (e.g., the number of amphibian species will be reduced by 50% if the county permits the filling of 10% of the remaining wetlands).

In fact, one of the greatest difficulties in applying scientific information in land-use planning and management is that the "science" doesn't provide specific answers for each circumstance that arises. The scientific information available rarely supplies us with exact or precise solutions for local circumstances. For example, some experiments that could be used to estimate the loss of amphibian species may not be applicable outside the immediate geographic area where the experiments were performed.

Furthermore, the scientists who reviewed the literature for Volume 1 found few studies that actually documented the effectiveness of specific protection measures (see Chapters 5 and 6 in Volume 1). Rather, most studies discuss the impacts of human activities on wetlands in general. The results are presented as correlations. For example, a decline in amphibian species in the Stockholm Sweden area has been correlated with the amount of developed land in the immediate vicinity of wetlands (Lofvenhaft 2002). This type of study does not demonstrate a true cause-and-effect relationship. There is no experimental proof that the decline is caused by the change in land use. Many impacts of human activities are not well understood and can only be hypothesized based on correlations.

As a result, recommendations based on scientific information are, to a large degree, based on hypotheses that extrapolate and synthesize all the information collected. Many of the recommendations in this document represent the collective interpretations by the authors (as reviewed by the Department of Fish and Wildlife) of the findings of the scientific literature synthesized in Volume 1 and how it pertains specifically to Washington or specific geographic regions within the state.

For example, the recommendation that a 200-foot buffer will adequately protect the wildlife habitat functions of high-functioning wetlands in eastern Washington is not based on one specific scientific study. Rather, it represents a synthesis of many studies (see Chapter 5 in Volume 1). These studies show that different species need different widths of buffers that range from 100 feet to more than 600 feet. Furthermore, very few studies have focused specifically on the needs of wildlife in wetlands of eastern Washington. Therefore, to provide general guidance, the authors were forced to make an informed decision on the size of buffer needed to protect wildlife in the wetlands of eastern Washington. In the absence of information about the species actually using a wetland, it was judged that a 200-foot buffer would adequately protect wildlife in wetlands that provide good habitat and are well connected in the landscape with a moderate risk that the protection standard will result in some degradation or loss of function. A local jurisdiction that wants to take a low-risk approach would increase the buffer widths above what is recommended in this volume.

1.8 Science and Risk Management

One of the major recommendations made in Volume 2 is that local jurisdictions should understand the risk to the wetland resource resulting from their decisions. The uncertainties of translating the science to specific protection measures, described above, is one of the reasons that local governments need to assess the risks. Using buffers again as an example, one might ask: *How wide a buffer is enough to protect wetland functions?* The science does not say that a 100-foot buffer will protect a certain kind of wetland, whereas a 95-foot buffer will not. Instead, scientific information on buffers clearly states that buffers are important, that they perform many functions that are critical to maintaining wetland functions, and that a wide range of buffer widths provides a variety of benefits depending on a number of factors.

Therefore, answering the critical question *How wide a buffer is enough?* is largely an exercise in assessing the science and deciding how much risk is acceptable. A regulation that sets a 300-foot buffer around every wetland significantly reduces the risk to those wetlands from human activities in the immediate vicinity of the wetland. That regulation can be characterized as relatively "low risk." On the other hand, a jurisdiction that decides they will provide a 50-foot buffer for all wetlands would have to characterize their action as "high risk" because a 50-foot buffer will not protect many wetland functions.

In this document, risk is addressed by tailoring the degree of protection to several factors that the scientific literature says are important. Continuing to use buffers as an example, one option presented in Volume 2 provides different buffer widths depending on the type of wetland and the functions it performs, as well as the type and intensity of adjacent land use. The widths recommended in this volume were selected from the middle of the range of buffers suggested in the literature: This, therefore, represents a moderate risk approach to determining buffer widths.

"Characterizing the risk" of decisions is also an important tool for improving approaches to wetland protection. Scientific data on the effectiveness of measures for protection can be collected and used to monitor the success of wetland management. This information then provides an objective basis on which to revise management approaches. (Risk characterization is discussed in detail in Chapter 10, and Chapter 12 provides information on monitoring and adaptive management.)

Many local governments will be inclined to rely largely on a regulatory approach to protect wetlands, and will tend to skip over the guidance on using a landscape approach as well as recommendations regarding landscape-based plans and non-regulatory tools. However, we believe the key message from the scientific literature is that reliance upon a strictly regulatory, permitting approach will fail to adequately protect wetland functions and values. Decision-makers should, therefore, consider the entire context of wetland protection and management when choosing the protections afforded to wetlands — from reducing impacts to wetlands through planning and zoning based on landscape analysis to using non-regulatory approaches such as stewardship incentives and restoration programs.

Chapter 2

The Growth Management Act and Protection of Critical Areas

2.1 Introduction

This chapter provides background on the Washington State Growth Management Act (GMA) and its directives to local governments to protect critical areas such as wetlands. It also clarifies issues regarding the protection of critical areas and incorporation of best available science into critical areas regulations.

As defined in Chapter 36.70A.030(5) Revised Code of Washington (RCW), "critical areas" include: wetlands; areas with a critical recharging effect on aquifers used for potable water; fish and wildlife habitat conservation areas; frequently flooded areas; and geologically hazardous areas.

2.2 An Overview of the GMA

In 1990, the Washington State Legislature passed the GMA (RCW 36.70A) to guide local jurisdictions in their decisions regarding land use. The GMA dictates that counties and cities with certain characteristics must plan for future growth (RCW 36.70A.040). The GMA (RCW 36.70A.020 and RCW 90.58.020) identifies 14 goals that are to be used by local governments to "guide" the development of comprehensive plans and development regulations, including critical areas ordinances, to meet its intent and requirements. The goals consist of a range of actions, including concentrating urban development to reduce sprawl, providing a range of affordable housing, ensuring that transportation infrastructure is coordinated between jurisdictions, and assuring property rights.

In addition, the GMA includes goals that address maintaining the extraction of natural resources, such as timber and mining, and agricultural land uses while avoiding incompatible uses; providing for open space and recreation, including conserving fish and wildlife habitats; and protecting the environment and the quality of life in the state. Cities and counties have responded to these mandates by developing or updating their comprehensive plans and development regulations.

The GMA requires jurisdictions to develop regulations that implement their comprehensive plan provisions (RCW 36.70A.040). Comprehensive plans and development regulations, including critical areas regulations, are subject to continuing review and evaluation by the county or city that adopted them. In 2002, the Legislature amended the GMA to require counties and cities to take legislative action to review and, if needed, revise their comprehensive land-use plans and regulations on a seven-year cycle to ensure the plans and regulations comply with the requirements of GMA (RCW 36.70A.130). (The review cycle had previously been five years.)

The GMA also requires local jurisdictions to include the best available science in the development of policies and development regulations used to both designate and protect the functions and values of critical areas (RCW 36.70A.172). The Legislature considered the requirement for best available science an important step toward regulatory reform and timely permitting of projects.

The GMA contains a variety of provisions that are directly related to landscape-based planning and developing regulations based on science. For example, there is a requirement to identify open space corridors within and between urban growth areas (RCW 36.70A.160). In addition, the GMA states that the corridors are to provide lands that are "… useful for recreation, wildlife habitat, trails, and connection of critical areas as defined in RCW 36.70A.030." This provision relates to one of the key findings of the synthesis of the science in Chapter 3 of Volume 1, which identifies habitat fragmentation (elimination of habitat links between wetlands) as one of the significant, adverse effects of urbanization on biodiversity. Other examples include provisions under the land use element (RCW 36.70A.070(1)) which requires the "protection of the quality and quantity of groundwater used for public water supplies" and, where applicable, the review of "drainage, flooding, and storm water run-off in the area and nearby jurisdictions and provide for guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state, including Puget Sound, or waters entering Puget Sound."

In passing the GMA, the Legislature also required that local governments coordinate their comprehensive plans with jurisdictions that share either common borders or regional issues, to be consistent across political boundaries. Variations in zoning regulations, density of housing, for example, as well as the infrastructure built for transportation, water service, sewage, and other necessary public utilities, had been resulting in inconsistent and incompatible uses and expectations across jurisdictional boundaries.

2.3 A Review of Hearings Board Cases and Court Cases

The following sections present a review of court cases and Growth Management Hearings Board cases prepared by Alan Copsey, Washington State Attorney General's Office, and Chris Parsons, Washington State Department of Community, Trade and Economic Development. The text in these sections is from a memorandum (dated April 2004) to state agencies developed by Chris Parsons, summarizing Alan Copsey's information about GMA and critical areas protection. Minor edits have been made to the formatting of this text, such as the addition of subheadings, and to punctuation to make it consistent with the format of other chapters in this volume.

2.3.1 Designating Critical Areas and Adopting Regulations to Protect Them

The GMA recognizes that the first formal step required in implementing the GMA is the designation and protection of critical areas. This is important for two reasons: 1) to exclude critical areas from urban growth designations and impacts, and 2) to prevent irreversible environmental harm while comprehensive plans and implementing development regulations are prepared.

All three Growth Management Hearings Boards in Washington State (Central Puget Sound, Eastern Washington, and Western Washington) have recognized and given effect to the required priority of critical areas designation and protection.[1] The phrase *given effect to* implies a legal review and decision conferring status. In an oft-quoted passage, the Central Board explained:

> *It is significant that the Act required cities and counties to identify and conserve resource lands and to identify and protect critical areas before the date that IUGAs had to be adopted. This sequence illustrates a fundamental axiom of growth management: "the land speaks first." Only after a county's agricultural, forestry and mineral resource lands have been identified and actions taken to conserve them, and its critical areas, including aquifers, are identified and protected, is it then possible and appropriate to determine where, on the remaining land, urban growth should be directed pursuant to RCW 36.70A.110.*[2]

RCW 36.70A.170(1) requires that all critical areas in all counties and cities must be designated where appropriate. The GMA permits no exemptions, exclusions, or limitations on applicability that would result in some critical areas not being designated. The requirement to designate may be met by designating or mapping known critical areas at the time the critical areas ordinance is adopted or by adopting a process to designate or map critical areas as information becomes available.

RCW 36.70A.060(2) requires all counties and cities in Washington to adopt development regulations to protect designated critical areas.[3] The Western Board has described RCW 36.70A.060(2) as imposing a *duty* on local governments to adopt development

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[1] *See Bremerton v. Kitsap Cy.*, CPSGMHB No. 95-3-0039c (Final Decision & Order, Oct. 6, 1995); *Association to Protect Anderson Creek v. City of Bremerton*, CPSGMHB No. 95-3-0053 (Final Decision & Order, Dec. 26, 1995); *City of Port Townsend v. Jefferson Cy.*, WWGMHB No. 94-2-0006 (Final Decision & Order, Aug. 10, 1994); *C.U.S.T.E.R. Ass'n v. Whatcom Cy.*, WWGMHB No. 96-2-0008 (Final Decision & Order, Sept. 12, 1996); *Knapp v. Spokane Cy.*, EWGMHB No. 97-1-0015c (Final Decision & Order, Dec. 24, 1997).

[2] *Bremerton v. Kitsap Cy.*, CPSGMHB No. 95-3-0039c (Final Decision & Order, Oct. 6, 1995).

[3] RCW 36.70A.060(2).

regulations that protect critical areas; inherent in that duty is the requirement that the regulation contain appropriate and specific criteria and standards to ensure protection.[4]

All designated critical areas must be protected but not all critical areas must be protected in the same manner or to the same degree.[5] To "protect" critical areas means to maintain their values and functions, this requires no net loss of critical areas values and functions.[6] The required standard of protection should be to prevent adverse impacts or, at the very minimum, to mitigate adverse impacts.[7]

While local governments have discretion to adopt critical areas regulations that may result in local impacts upon some critical areas, or even the loss of some critical areas, there must be no net loss of the structure, value, and functions of the natural systems constituting the protected critical areas.[8] A county or city must provide a detailed and reasoned justification for any designated critical area not protected.[9] All such decisions and justifications must be based on a substantive consideration of the best available science.[10]

Development in critical areas is not absolutely prohibited under the GMA, so long as the structure, functions, and values of the critical areas are protected.[11]

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[4] *See Whatcom Envtl. Coun. v. Whatcom Cy.*, WWGMHB No. 95-2-0071 (Final Decision & Order, Dec. 20, 1995); *Willapa Grays Harbor Oyster Growers Ass'n v. Pacific Cy.*, WWGMHB No. 99-2-0019 (Final Decision & Order, Oct. 28, 1999).

[5] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995); *Easy v. Spokane Cy.*, EWGMHB No. 96-1-0016 (Final Decision & Order, Apr. 10, 1997); *Confederated Tribes & Bands of the Yakama Indian Nation v. Yakima Cy.*, EWGMHB No. 94-1-0021 (Final Decision & Order, Mar. 10, 1995); *Save Our Butte Save Our Basin Soc'y v. Chelan Cy.*, EWGMHB No. 94-1-0015 (Final Decision & Order, Aug. 8, 1994); *Clark Cy. Natural Res. Coun. v. Clark Cy.*, WWGMHB No. 92-2-0001 (Final Order, Nov. 10, 1992).

[6] RCW 36.70A.172(1); WAC 365-195-825(2)(b); *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995).

[7] *Save Our Butte Save Our Basin Soc'y*, EWGMHB No. 94-1-0015 (Compliance Hearing Order, Apr. 8, 1999, and Final Decision & Order, Aug. 8, 1994); *English v. Bd. of Cy. Comm'rs of Columbia Cy.*, EWGMHB No. 93-1-0002 (Final Decision & Order, Nov. 12, 1993).

[8] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995). These decisions address wetlands and fish and wildlife habitat conservation areas, but their rationale applies also to frequently flooded areas and critical aquifer recharge areas insofar as they are protected for their ecological or hydrological function and value.

[9] *Friends of Skagit Cy. v. Skagit Cy.*, WWGMHB No. 96-2-0025 (Final Decision & Order, Jan. 3, 1997); *Whatcom Envtl. Coun. v. Whatcom Cy.*, WWGMHB No. 95-2-0071 (Final Decision & Order, Dec. 20, 1995).

[10] RCW 36.70A.172(1); *Honesty in Envtl. Analysis. & Legislation (HEAL) v. Cent. Puget Sound Growth Mgmt. Hrgs. Bd.*, 96 Wn. App. 522 (1999).

[11] *Knapp v. Spokane Cy.*, EWGMHB No. 97-1-0015 (Final Decision & Order, Dec. 24, 1997); *Association to Protect Anderson Creek v. Kitsap Cy.*, CPSGMHB No. 95-3-0053 (Final Decision & Order, Dec. 26,

The GMA does not categorically exempt pre-existing land uses from the requirement to protect critical areas. A city or county may need to regulate pre-existing uses in order to fulfill its statutory duty to "protect critical areas" under RCW 36.70A.060(2).[12] Any exemptions for pre-existing use must be limited and carefully crafted.[13]

Some critical areas, such as wetlands and fish and wildlife habitat conservation areas, may transcend the boundaries of individual parcels and jurisdictions, so that it is necessary to address the protection of their structure, function, and values on a larger scale (such as a watershed).[14]

2.3.2 Relationship of Critical Areas Regulations to Other Land Uses

Critical areas regulations are to overlay all other land uses, including designated natural resource lands and designated urban growth areas, and are to preclude land uses and developments that are incompatible with the protection of critical areas.[15] This overlay requirement makes sense in the overall scheme of the GMA, under which all lands are designated in one of three categories:

- Urban land (i.e., within a designated urban growth area)
- Natural resource land (i.e., designated as agricultural, forest, or mineral resource land)

1995); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995).

[12] *Protect the Peninsula's Future v. Clallam Cy.*, WWGMHB No. 00-2-0008 (Final Decision & Order, Dec. 19, 2000).

[13] *Id.*; *Friends of Skagit Cy. v. Skagit Cy.*, WWGMHB No. 96-2-0025 (Final Decision & Order, Jan. 3, 1997).

[14] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997).

[15] WAC 365-190-020. Critical areas overlaying designated urban growth areas, *see Advocates for Responsible Dev. v. City of Shelton*, CPSGMHB 98-2-0005 (Final Decision & Order, Aug. 10, 1998); *Litowitz v. City of Federal Way*, CPSGMHB No. 96-3-0005 (Final Decision & Order, July 22, 1996); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995); *Association of Rural Residents v. Kitsap Cy.*, CPSGMHB No. 93-3-0010 (Final Decision & Order, June 3, 1994).Critical areas overlaying designated natural resource lands, *see Protect the Peninsula's Future v. Clallam Cy.*, WWGMHB Nos. 00-2-0008/ 01-2-0020 (Compliance Order/Final Decision & Order, Oct. 26, 2001); *Mitchell v. Skagit Cy.*, WWGMHB No. 01-2-0004 (Final Decision & Order, Aug. 6, 2001); *Saddle Mtn. Minerals v. City of Richland*, EWGMHB No. 99-1-0005 (Order Finding Partial Compliance, Apr. 18, 2001); *Friends of Skagit Cy. v. Skagit Cy./Skagit Audubon Soc'y v. Skagit Cy.*, WWGMHB Nos. 96-2-0025/ 00-2-0033c (Compliance Hearing/Final Decision & Order, Aug. 9, 2000); *Saddle Mtn. Minerals v. Grant Cy.*, EWGMHB No. 99-1-0015 (Final Decision & Order, May 24, 2000); *Island Cy. Citizens' Growth Mgmt. Coalition*, WWGMHB No. 98-2-0023 (Final Decision & Order, June 2, 1999); *Friends of Skagit Cy. v. Skagit Cy.*, WWGMHB No. 96-2-0025 (Final Decision & Order, Jan. 3, 1997). Critical areas overlaying rural lands, *see City of Anacortes v. Skagit Cy.*, WWGMHB No. 00-2-0049c (Final Decision & Order, Feb. 6, 2001).

- Rural land (which may include limited areas of more intense rural development and a variety of land uses)

These three designations have been called the "fundamental building blocks of land-use planning under the GMA;"[16] other land-use designations and restrictions overlay these three primary designations. As long as critical areas are protected, "other, non-critical portions of land can be developed as appropriate under the applicable land-use designation and zoning requirements."[17]

2.3.3 Including Best Available Science in Critical Areas Regulations

RCW 36.70A.172(1) requires all local governments to include the best available science when adopting development regulations to designate and protect critical areas. In addition, they "shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries." This language actually imposes three inter-related requirements:

- The requirement to include the best available science when designating and protecting critical areas
- The requirement to give special consideration to the preservation or enhancement of anadromous fisheries
- The requirement to adopt development regulations that protect the functions and values of critical areas

There are two reported appellate court decisions interpreting RCW 36.70A.172, focused primarily on what it means to *include* the best available science.[18] In the HEAL case, the Court did not attempt to explain what constitutes best available science, although it suggested in passing that the Board could not displace a local government's judgment as to which science in the record is the "best."[19] On the other hand, the Court strongly stated that a local government "cannot ignore the best available science in favor of the science it prefers simply because the latter supports the decision it wants to make."[20] This language suggests the Board in fact may review whether a local government has

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[16] *See Forster Woods' Homeowners Ass'n v. King Cy.*, CPSGMHB No. 01-3-0008 (Final Decision & Order, Nov. 6, 2001)

[17] *See Association to Protect Anderson Creek v. City of Bremerton*, CPSGMHB No. 95-3-0053 (Final Decision & Order, Dec. 26, 1995); *Knapp v. Spokane Cy.*, EWGMHB No. 97-1-0015c (Final Decision & Order, Dec. 24, 1997).

[18] *Honesty in Envtl. Analysis & Legislation (HEAL) v. Cent. Puget Sound Growth Mgmt. Hrgs. Bd.*, 96 Wn. App. 522 (1999). *Whidbey Environmental Action Network [WEAN] v. Island County*, ___ Wn. App. ___, 93 P.3d 885, 893 (2004)

[19] *Id.*, 96 Wn. App. at 530.

[20] *Id.*, 96 Wn. App. at 534.

identified and relied on the best available science and remand to the local government to achieve compliance with RCW 36.70A.172(1).

In the WEAN case (see footnote 18 on the previous page), the Central Board concluded that some of the stream buffers in Island County that were adopted to protect fish and wildlife habitat conservation areas were not supported by the scientific information in the record before the County. The Court of Appeals affirmed, rejecting the County's argument that the Board must defer to the local government's discretionary balancing of the best available science with other factors. The Court explained that RCW 36.70A.172(1) requires the best available science to be included in the record and considered substantively in the development of critical areas policies and regulations.[21] The Court briefly reviewed the science in the record and held that the Board's disapproval of the stream buffers was supported by sufficient evidence.

If a local government chooses to depart from best available science, then it is recommended that the jurisdiction follow the criteria provided in Chapter 365-195-915 WAC for demonstrating that the best available science has been "included" in the development of critical areas policies and regulations. The local government's record supporting adoption of those policies and regulations should include the following:

- The specific policies and regulations adopted to protect the functions and values of critical areas
- Copies of (or references to) the best available science used in the decision making
- The nonscientific information used as a basis for departing from science-based recommendations
- The rationale supporting the local government's reliance on the identified nonscientific information
- Actions taken to address potential risks to the functions and values of the critical areas the policies and regulations are intended to protect

Implicit in the rule is the presumption that the Growth Management Hearings Boards and the courts review both the local government's assessment of what constitutes the best available science and the substantive relationship between the best available science and the adopted critical areas regulations. Local governments must substantively consider the best available science when adopting development regulations to designate or protect critical areas. The adopted regulations must protect the functions and values of the critical areas. If the local government determines this protection can be assured using an approach different from that derived from the best available science, the local government must demonstrate on the record how the alternative approach will protect the functions and values of the critical areas.

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[21] 76 Wn.2d at 1222-23, citing *Honesty in Environmental Analysis & Legislation (HEAL) v. Central Puget Sound Growth Management Hearings Board*, 96 Wn. App. 522, 532, 979 P.2d 864 (1999).

2.3.4 Protecting the Functions and Values of Critical Areas

Local governments must adopt development regulations that protect the functions and values of critical areas. This reference to functions and values has been interpreted to mean the functions and values of the resources of which a given critical area is a part. Accordingly, while a local government is not prohibited from allowing localized impacts on some critical areas, or even the loss of some critical areas, it may not allow a net loss of the functions and values of the resources including the impacted or lost critical areas. Moreover, any loss or adverse impact should be allowed only for good cause and evaluated using the best available science.

The Central Board has explained that RCW 36.70A.172(1), read together with RCW 36.70A.060 and RCW 36.70A.020(8), requires local governments to protect critical areas, maintain and enhance anadromous fisheries, and conserve fish and wildlife habitat.[22] RCW 36.70A.172(1) thus conveys a legislative intent to protect the functions and values of critical areas, recognizing that wetlands and fish and wildlife habitat conservation areas, in particular, are interrelated ecosystems important to the preservation and enhancement of anadromous fisheries:

> *[T]he Act's requirement to protect critical areas, particularly wetlands and fish and wildlife habitat conservation areas, means that the values and functions of such ecosystems must be maintained. While local governments have the discretion to adopt development regulations that may result in localized impacts upon, or even the loss of, some critical areas, such flexibility must be wielded sparingly and carefully for good cause, and in no case result in a net loss of the value and functions of such ecosystems within a watershed or other functional catchment area.*[23]

[22] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Order on Motions, Oct. 6, 1996).

[23] *Id.*

Chapter 3
Key Conclusions from Volume 1

3.1 Introduction

This chapter briefly summarizes the information and conclusions presented in Volume 1 of this two-volume document. The first section highlights the major conclusions from the scientific literature that relate to protecting and managing wetlands. The subsequent sections summarize the findings of Chapters 2 through 7 of Volume 1.

Please note that this is intended to be a brief overview of Volume 1. More detailed lists of key points and discussions of conclusions are provided at the end of major sections in each chapter of Volume 1.

3.2 Major Conclusions About Our Current Efforts to Protect Wetlands

In spite of wetland regulatory programs at federal, state, and local levels, the data show that impacts to wetlands continue. The existing scientific information points to the fact that we have not achieved the federal and the state of Washington goal of "no net loss of wetland functions or area." From 1986 to 1997, the estimated annual loss of wetlands nationwide continued to be about 58,500 acres per year. On a positive note, this was about a quarter of the rate of previous losses (National Research Council 2001). Such losses of wetlands have also been documented for the Pacific Northwest (see Chapter 7 in Volume 1).

The review of the information on how we manage wetlands points to several reasons why losses continue. These include:

- Case-by-case permitting under current regulations does not meet the goal of "no net loss" (National Research Council 2001). The majority of decisions concerning wetlands in Washington State and the nation are based on case-by-case actions related to specific projects, without any opportunity to consider the broader landscape, the environmental factors that control wetland functions, or consequences. This pattern is a result of the current structure of programs at local, state, and federal regulatory agencies. The results of the research on case-by-case permitting processes are clear: There are consistent wetland losses regionally and statewide. These impacts are often the result of cumulative and synergistic impacts across the landscape.

- The functions performed by wetlands can be affected by actions taken in other parts of the watershed (see Chapter 2 in Volume 1).

- Decisions made without an understanding of how a wetland is affected by and can affect its watershed often result in actions that do not adequately protect functions of wetlands. Since the case-by-case approach has not worked to ensure that there is “no net loss” of wetland area and functions for over 20 years, it can be assumed that wetlands and their functions will be adequately protected to meet this goal only if protection and management occur at a larger geographic scale. The National Research Council (2001) concludes that “a watershed approach would improve permit decision-making.”

3.3 Wetlands in Washington and How They Function (Chapter 2 of Volume 1)

3.3.1 Types of Wetland Functions and How They Are Controlled

Chapter 2 of Volume 1 discusses the functions of wetlands, which are things that wetlands “do.” Wetland functions are generally grouped into three broad categories:

- Biogeochemical functions, which are related to trapping and transforming chemicals and include functions that improve water quality in the watershed
- Hydrologic functions, which are related to maintaining the water regime in a watershed and include such functions as reducing flooding
- Food web and habitat functions

The functions that wetlands perform are controlled by environmental factors that occur in the broader landscape as well as within the wetland. The primary factors that control wetland functions are climate, geomorphology, the source of water, and the movement of water. These factors affect wetland functions directly or through a series of secondary factors including nutrients, salts, toxic contaminants, soils, temperature, and the connections between different ecosystems.

The most important environmental factors that control wetland functions at an individual site may occur outside the boundary of the wetland. For example, riverine wetlands are affected to a great degree by processes operating at the scale of the entire watershed of the river. In contrast, depressional wetlands often are subject to processes that occur primarily within the basin that contributes surface or groundwater to the wetland. Thus, the environmental factors that control the structure and functions of a wetland occur at both the landscape scale (in the watershed where the wetland is located and beyond) as well as at the site scale (within and near the wetland).

Information about the factors that control functions at the landscape scale is still evolving. Ongoing research is continually strengthening our understanding of these factors.

An understanding of wetland functions for the purposes of protecting and managing them will require knowledge of how the major controls of functions change or are affected by humans at different geographic scales. We need to understand how climate, topography, and the movement of water, nutrients, sediment, etc. are affected by human activities in the larger landscape as well as within and in the immediate vicinity of the wetland. Environmental disturbances caused by human activities and their affects on the functions of wetlands are summarized in Sections 3.3 and 3.4 below.

3.3.2 Classification of Wetlands in Washington as a Key to Understanding Their Functions

The diverse areas of Washington State support many kinds of wetlands that vary in functions. For example, vernal pools on the scablands differ greatly from the floodplain marshes along the Snoqualmie River, and wetlands that formed in the potholes created by glaciers have different functions from those found along the shores of salt lakes in the Grand Coulee.

Scientists have divided wetlands in Washington into different groups based on their functions (see Table 3-1). The environmental factors of geomorphology, the source of water, and the movement of water are the basic characteristics used to divide wetlands into these groups.

Table 3-1. Subclasses and families of wetlands in different regions of Washington State. (Hruby et al. 1999, 2000)

Class	Subclasses and Families by Region			
	Lowlands of Western WA	**Lowlands of Eastern WA**	**Columbia Basin**	**Montane (East and West)**
Riverine	Impounding Flow-through	ND	ND	ND
Depressional	Outflow Closed	ND	Alkali Freshwater Long-duration Short-duration	ND
Slope	ND	ND	ND	ND
Flats	ND	Probably does not occur in the region.	Probably does not occur in the region.	ND
Lacustrine (lake) Fringe	ND	ND	ND	ND
Tidal Fringe	Salt Water Fresh Water	Does not occur in the region.	Does not occur in the region.	Does not occur in the region.
ND = Subclasses in the region have not yet been defined.				

3.4 Environmental Disturbances Caused by Human Activities and Uses of the Land (Chapter 3 of Volume 1)

Chapter 3 of Volume 1 discusses the major types of environmental disturbances created by human activities and uses of the land and water. These disturbances change the environmental factors that in turn control wetland functions. Chapter 3 of Volume 1 addresses the disturbances created by four major types of land uses in Washington State: agriculture, urbanization, forest practices, and mining.

Several types of disturbances have been documented to change the factors that control wetland functions. These disturbances include:

- Changing the physical structure within a wetland (e.g., filling, removing vegetation, tilling soils, compacting soils)
- Changing the amount and velocity of water (either increasing or decreasing)
- Changing the fluctuation of water levels (volume, frequency, amplitude, direction of flow)
- Changing the amount of sediment (increasing or decreasing the amount)
- Increasing the amount of nutrients
- Increasing the amount of toxic contaminants
- Changing the temperature
- Changing the acidity (acidification)
- Increasing the concentration of salt (salinization)
- Fragmentation (decreasing area of habitat and its spatial configuration)
- Other disturbances that are not as well documented including, alteration of soils, construction of roads, noise, recreational access, invasion of exotic species, and access by domestic pets

As with performance of functions, a general conclusion that can be made from the scientific literature is that disturbances can also occur at several geographic scales. Much of the early research focused on disturbances at a single site or wetland. More recent research has documented the significance of disturbances that occur at the much larger scale of the landscape.

The effects of different human land uses on the flow and fluctuations of water are well documented. Changes in land uses and vegetation communities alter the patterns of surface and shallow groundwater movement across a landscape. Flows of water can be reduced or increased by different land uses, as can the volume, frequency, and amplitude of water levels downgradient of the disturbance. Removal of vegetation and/or compaction of native soils through agricultural practices, creation of lawns or grazed pastures, or creation of impervious surfaces through urbanization all have the same relative consequence: increased volumes of water and rates of flow after a given storm event. As with urbanization, agriculture can influence the water regime of wetlands, leading to loss of wetlands in some areas and creation or maintenance of wetlands in other areas where wetlands did not originally exist, such as areas influenced by irrigation.

Human activities also increase sediment and other pollutants in runoff. Pollutants often adhere to sediment particles that enter wetlands. In agricultural areas, pesticides and fertilizers can contribute to contamination of surface waters. In urban areas, stormwater runoff frequently contains sediment, organic matter, phosphorus, metals, and other pollutants. Mining increases the acidity of surface waters as well as adding toxic heavy metals. Logging increases sediments and can also change the amount of water and its fluctuations.

Fragmentation of habitats is also of increasing concern in the literature. As connections between wetlands and other habitats are broken and more wetlands across the landscape are converted to other uses, the remaining habitat becomes more isolated. This potentially puts wildlife populations at risk.

A key finding is that different land uses may cause the same change in the controls of wetland functions. For example, changing the input of sediment can affect wetland functions (as discussed in Section 3.4 below). Urban land uses, agricultural practices, and forest practices have all been shown to increase sediments in a watershed. From the wetland's "point of view," the source of the sediment is irrelevant—the impact of excess sediments on wetland functions is similar, regardless of the source of the sediments.

The disturbances created by some types of land use are summarized in Table 3-2. The table is organized by the type of land use and the scale at which the disturbance occurs. This table represents a synthesis of the severity of impacts as compiled by the authors of Volume 1 based on the information in the literature.

Table 3-2. Summary of types of environmental disturbances created by some types of land use.

Disturbance	Scale of Disturbance	Agriculture	Urbanization	Mining
Changing the physical structure within wetlands (filling, vegetation removal, tilling of soils, compaction of soils)	Site scale	xx	xx	h
Changing the amounts of water	Landscape scale Site scale	xx xx	xx xx	? h
Changing fluctuations of water levels (frequency, amplitude, direction of flows)	Landscape scale Site scale	xx xx	xx xx	? h
Changing the amounts of sediment	Landscape scale Site scale	xx xx	xx xx	h h
Increasing the amount of nutrients	Landscape scale Site scale	xx xx	xx xx	nm nm
Increasing the amount of toxic contaminants	Landscape scale Site scale	xx xx	xx xx	x xx
Changing the acidity	Landscape scale Site scale	nm nm	nm nm	x xx
Increasing the concentrations of salt	Landscape scale Site scale	x x	nm nm	nm nm
Fragmentation	Landscape scale	xx	xx	h
Other disturbances	Site scale	xx	xx	h

Key to symbols used in table:

(xx) land use creates a major disturbance of environmental factors that affects large areas in the state

(x) land use creates a disturbance

(nm) studies on impacts of this land use do not mention this disturbance

(h) literature is lacking but disturbances can be hypothesized based on authors' experiences

(?) information lacking

3.5 Negative Impacts of Human Disturbances on the Functions of Wetlands (Chapter 4 of Volume 1)

As described above, Chapter 3 of Volume 1 discusses how human land uses cause disturbances in the environmental factors that control wetland functions. Chapter 4 takes the discussion a step further by explaining how a change in these environmental factors can actually result in a change in wetland functions.

The literature findings are displayed in a summary format in Table 3-3. This table summarizes the effects on wetland functions of each type of human disturbance listed in Table 3-2 (e.g., change in physical structure, change in the amount of water, change in the amount of sediment, etc.).

By combining the information in Tables 3-2 and 3-3, it is possible to associate changes in functions of wetlands with general types of human land use, as shown in Table 3-4.

For example, Table 3-2 shows that urbanization creates significant disturbances that change the amount of water, fluctuations of water levels, input of sediments, nutrients, and contaminants to wetlands. Table 3-3 shows that disturbances to water flows, fluctuations of water levels, and input of sediments, nutrients, and contaminants have a significant impact on the wetland functions of providing habitat for plants, invertebrates and reptiles/amphibians. Table 3-4 synthesizes the information from the previous two tables to show that urbanization impacts the habitat for plants, invertebrates, reptiles, and amphibians in wetlands. These tables, therefore, summarize how human land uses create various disturbances in the environment, and those disturbances in turn affect the factors that control wetland functions, ultimately leading to changes in those functions.

Table 3-3. Synthesis of the information reported in the literature on the negative impacts of different human disturbances on wetland functions.

Disturbance Type	Functions							
	Hydrologic	Water Quality	Plants	Habitat for Invertebrates	Habitat for Amphibians and Reptiles	Habitat for Fish	Habitat for Birds	Habitat for Mammals
Changing the physical structure within a wetland	+	+	++	++	+	+	++	+
Changing the amount of water	+	+	++	++	++	+	+	?
Changing fluctuations of water levels	?	?	++	+	++	+	?	?
Changing amounts of sediment	+	?	++	++	?	?	?	?
Increasing amounts of nutrients	+	+	++	++	++	+	+	+
Increasing amounts of toxic contaminants	?	+	++	++	++	++	++	?
Changing acidity	0	+	+	++	++	+	+	+
Increasing concentrations of salt	0	?	++	++	?	?	+	?
Fragmentation	0	?	?	?	++	?	++	+
Other disturbances	?	?	++	+	++	++	++	++

Note: A disturbance can decrease or increase a function depending on the intensity of the disturbance (e.g., small amounts of nutrients can increase invertebrate richness and abundance, but too much will cause eutrophication and a negative impact).

Key to symbols used in table:

++ Major negative impacts on specific functions have been documented

\+ Some data suggest impacts, or impacts could be hypothesized

0 Data indicate that impacts are minimal

? Information is lacking and/or may vary by species

Table 3-4. Synthesis of the negative impacts of some land uses on wetland functions.

Land Use	Functions							
	Hydrologic	Water Quality Improvement	Plants	Habitat for Invertebrates	Habitat for Reptiles and Amphibians	Habitat for Fish	Habitat for Birds	Habitat for Mammals
Agriculture	+	+	++	++	++	++	++	+?
Urbanization	+	+	++	++	++	++	++	+?
Mining	?	?	+	++	++	+	+	+?

Key to symbols used in table:

++ Major negative impacts on specific functions have been documented
+ Some data suggest impacts or impacts could be hypothesized
? Information is lacking
+? Some impacts have been documented but more information is needed

3.6 The Science and Effectiveness of Wetland Management Tools (Chapter 5 of Volume 1)

3.6.1 How Wetlands Are Defined

Wetlands are defined using well established language that is generally consistent between federal and Washington State laws. In some jurisdictions, all lands that meet the definition of wetland are regulated. However, it is not unusual for a jurisdiction to differentiate within its regulations between *wetlands* (i.e., biological wetlands) and *regulated wetlands* (i.e., wetlands that they intend to regulate). The definition of what constitutes a regulated wetland may vary from jurisdiction to jurisdiction.

Delineation of wetland boundaries is conducted according to either the federal or state delineation manual. These manuals are consistent and, when applied correctly, will result in the same wetland boundary. In the State of Washington, however, local jurisdictions are required by state law to use the state manual (RCW 36.70A.175, Chapter 173.22.080 WAC).

As discussed in Chapter 5 of Volume 1, certain wetland types are sometimes excluded from regulation. These can include small wetlands, isolated wetlands, and wetlands that are designated as Prior Converted Croplands. The scientific literature makes clear that small wetlands and isolated wetlands provide important functions and does not provide any rationale for excluding these wetlands from regulation. Little scientific information is available on Prior Converted Croplands that are wetlands, but there is no evidence to suggest that they are unimportant in providing wetland functions.

Wetland rating systems are a useful tool for grouping wetlands based on their needs for protection. In Washington, a wetland rating system for both eastern and western Washington (Hruby 2004a, 2004b) has been developed, which places wetlands in categories based on their rarity, sensitivity, our inability to replace them, and their functions. Many local governments in Washington have modified these state rating systems for use in their own jurisdictions.

3.6.2 Wetland Buffers

Wetland buffers are one management tool for protecting wetland functions. The findings in the literature on buffers and their effectiveness are related to the type of wetland function, what activities are being buffered, and the characteristics of the wetland and the buffer itself.

The literature confirms that for improving water quality (e.g., sediment removal and nutrient uptake) there is a non-linear relationship between the width of the buffer and increased effectiveness in water quality improvement. Sediment removal and nutrient uptake are provided at the greatest rates within the immediate outer portions of a buffer (nearest the source of sediment/nutrient), with increasingly larger widths of buffers required to obtain measurable increases in those functions beyond this initial removal. Additionally, the long-term effectiveness of buffers in providing this function is not well documented in the literature and represents a need for future research.

To protect wildlife that depends on wetlands, the literature has documented the need for significantly larger buffers than those that are adequate to provide sediment removal and nutrient uptake. Research confirms that many wildlife species depend upon wetlands for only portions of their life cycles and they require upland habitats adjacent to the wetland to meet all their life needs. Some species use upland habitats that are far removed from the wetland. The literature documents that, without access to appropriate upland habitat and the opportunity to move safely between habitats across a landscape, it is not possible to maintain viable populations of many species.

In the long term, human actions can reduce the effectiveness of buffers through removal of buffer vegetation, soil compaction, sediment loading, and dumping of garbage.

Authors who synthesized the literature on the effectiveness of buffer widths suggest buffers between 25 and 75 feet for wetlands with minimal wildlife habitat functions and adjacent low-intensity land uses; 50 to 150 feet for wetlands with moderate habitat functions or adjacent high-intensity land uses; and 150 to 300 feet for wetlands with high habitat functions. Effective buffer widths for protecting water quality ranged from 25 to 50 feet for 60% removal of pollutants, to 150 to 200 feet for 80% removal of pollutants.

3.7 The Science and Effectiveness of Wetland Mitigation (Chapter 6 of Volume 1)

As discussed in Chapter 6 of Volume 1, according to the rules implementing the Washington State Environmental Policy Act (Chapter 197.11 WAC), mitigation involves the following steps that are performed sequentially (WAC 197.11.768):

1. *Avoiding the impact altogether by not taking a certain action or parts of an action;*

2. *Minimizing impacts by limiting the degree or magnitude of the action and its implementation by using appropriate technology or by taking affirmative steps to avoid or reduce impacts;*

3. *Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;*

4. *Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;*

5. *Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or*

6. *Monitoring the impact and taking appropriate corrective measures.*

The term *compensatory mitigation* refers to the compensation stage of the mitigation sequence (number 5 in the list of steps above). For wetlands, it typically involves producing new wetland area, functions, or both as compensation for wetland area, function, or both that have been or will be lost due to a permitted activity. Compensatory wetland mitigation generally entails performing one or more of the following types of compensation:

- **Restoring** wetland conditions (and functions) to an area
- **Creating** new wetland area and functions
- **Enhancing** functions at an existing wetland
- **Preserving** an existing high-quality wetland to protect it from future development

Chapter 6 of Volume 1 synthesizes the literature on compensatory mitigation from the last 15 years. The majority of projects that provide compensatory mitigation described in the literature have been neither fully successful nor complete failures. One challenge in synthesizing this information was the range of meanings for and the implications of the very terms success and failure.

3.7.1 Compliance of Projects with Permit Requirements (Volume 1 Section 6.4)

While most of the mitigation projects documented in the literature were implemented, compliance of the projects with permit requirements was generally low. This was a result of inadequate acreage of wetland, failure to achieve performance standards, and a lack of monitoring and maintenance. The few studies that examined the effect of regulatory follow-up suggested that it had a positive influence on the level of compliance and success for compensatory wetland mitigation projects.

3.7.2 Ecological Effectiveness of Different Types of Compensation (Volume 1 Section 6.5)

There is a general lack of information about the relative ecological effectiveness of the various types of compensation (e.g., restoration, creation, enhancement, etc.). Creation is generally the most frequently used type of compensation, but studies of its effectiveness produced mixed results.

Enhancement of wetlands is also frequently used, but few studies have examined its effectiveness. Limited studies from Washington indicated a low level of success among enhanced wetlands, primarily due to a minimal gain in functions in the timeframe between construction of the mitigation project and the evaluation of gain in functions. It may simply take longer for a gain in functions to appear (15 to 20 years rather than 5 to 10 years).

Restoring wetlands was noted as a high priority in the literature, but this type of compensation is not frequently used. This could be because restoration is often not an option on a project-by-project basis when costs and local regulations defer to on-site mitigation options. Restoration appears to be a more frequent choice in non-regulatory situations.

Preservation and the use of a mixture of compensation types appear to be used occasionally based on the literature review, and studies provided limited information on the effectiveness of these types of compensation. Two studies from Washington indicated that mixed compensation projects had a higher level of compliance than creation or enhancement, and all mixed projects were moderately successful.

3.7.3 Replacement Ratios (Volume 1 Section 6.6)

Replacement ratios are a tool used to account for the risk of mitigation failure and the temporal loss of functions. Required replacement ratios vary from one jurisdiction to another, based on the type of compensation proposed and project-specific circumstances.

The review of the literature indicated that the wetland functions and acreage achieved by using replacement ratios were less than what was required. In some cases the result was less than 1:1 replacement of acreage and a net loss of wetland acreage and function on the landscape.

3.7.4 Functions and Characteristics of Mitigation Wetlands (Volume 1 Section 6.8)

The functions performed and the structural characteristics that developed in created and restored wetlands usually differed from those in reference wetlands discussed in the literature. The one exception was the group of functions that improve water quality; these appeared to be performed in a similar capacity in mitigation wetlands as in reference wetlands. (Studies reviewed for Volume 1 did not compare the functions provided by wetlands that had been developed as compensation against the functions provided by the wetlands that were lost. Instead, reference wetlands were used as the basis for comparison with mitigation wetlands.)

For the most part, reference wetlands were found to provide habitat for a greater diversity or abundance of wildlife than created or restored wetlands. Birds were an exception since half of the studies found no difference between created/restored sites and reference wetlands, particularly for ducks.

Created and restored wetlands were also found to exhibit different vegetation characteristics and plant communities than reference wetlands. The effect of wetland age on the vegetation of created and restored wetlands was noted in various studies.

3.7.5 Types of Wetlands Produced through Compensation Projects (Volume 1 Section 6.9)

The review of the literature indicates that compensatory mitigation is producing more acreage of open water wetlands than has been lost. The ability of compensatory mitigation projects to produce wetlands of other Cowardin classes (e.g., emergent, scrub-shrub, forested) varies.

Compensatory mitigation is also producing wetlands with significantly different hydrogeomorphic (HGM) classes than were present in the reference wetlands near that location. (The HGM classification is based on the position of the wetland in the landscape, the wetland's water source, and the flow and fluctuation of the water once in the wetland.) This has resulted in mitigation wetlands that have more inundation for a longer period than in reference wetlands, as well as HGM classes of wetlands that are atypical for the landscapes in which they are being created.

Some unique types of wetlands, such as bogs, fens, and mature forested wetlands, may not be reproducible, especially not within current regulatory timeframes. Other wetland types, such as vernal pools, may be reproducible given the right conditions.

3.7.6 Suggestions for Improving Compensatory Mitigation (Volume 1 Section 6.10)

The literature provides numerous suggestions on virtually every aspect of the compensatory mitigation process. Key suggestions include:

- Improving regulatory guidance on a variety of topics, such as measurable, meaningful, and enforceable performance standards for compensatory mitigation
- Finding better sites that provide increased benefits due to their location within a watershed
- Monitoring compensatory mitigation wetlands more effectively
- Maintaining compensatory mitigation sites
- Increasing the regulatory follow-up of compensation projects

The review of the literature indicates that improvements have been made in compensatory mitigation over the past two decades, particularly in terms of what is required. Based on the research reviewed, the overall success and permit compliance have not noticeably improved. Most studies indicate that created and restored wetlands do not provide the same characteristics or level of functions as reference wetlands (water quality functions may be the exception). Though older created and restored wetlands generally exhibit characteristics of the vegetation that lead to improved habitat for wildlife, the soils and the hydroperiods may remain so modified that they will not replicate reference systems in the foreseeable future. Since the effectiveness of compensatory mitigation remains highly variable, it is important to understand the cumulative effects of the continuing loss of wetland acreage and functions (summarized in the next section).

3.8 Cumulative Impacts to Wetlands and the Need for a New Approach (Chapter 7 of Volume 1)

The literature reviewed for Volume 1 indicates that project-by-project decisions cannot, by their very site-specific nature, adequately address the complexities of wetland systems as they function in a landscape context. The majority of wetland management decisions in Washington State are related to individual projects, without an opportunity to consider the environmental factors that control functions or cumulative impacts.

As discussed in Chapter 7 of Volume 1, the causes of cumulative impacts are not limited to the policies or regulations of a single agency but can also result from multiple agencies making land-use decisions in isolation. Also, cumulative effects are difficult to assess because of the large spatial and temporal scales involved, the wide variety of processes and interactions, and the lag times that often separate a land use activity from resulting effects.

While the literature did not focus on the reasons for the lack of landscape-scale wetland management in Washington, some impediments can be assumed:

- The costs of analysis, inventories, assessments, and rankings
- The costs of implementing a landscape-scale program relative to existing project-driven programs that are often funded by applicant fees
- Inconsistent mandates driving the agendas and priorities of regulatory agencies
- Lack of examples of successful tools for interagency collaboration and implementation
- Lack of awareness and understanding of the ecological consequences of existing regulatory programs by the public and the staff of implementing agencies
- Lack of support for local jurisdictions to tackle the process of identifying and prioritizing aquatic resources for long-term protection and/or potential alteration

The literature recommends a broader approach for the management and restoration of aquatic resources including wetlands. Researchers recognize the need for an analysis of the broader landscape and the environmental factors that control functions and cumulative effects (i.e., the historic, ongoing, and future impacts on an ecosystem).

For this reason, the guidance provided in Volume 2 stresses the importance of starting with an understanding of the landscape as well as wetland functions at the site scale. This understanding of the landscape can then be incorporated into more effective planning, regulatory, and non-regulatory tools.

Chapter 4

Framework for Protecting and Managing Wetlands Using Best Available Science

4.1 Introduction

This chapter outlines a four-step framework for developing and implementing approaches to wetland protection and management by local governments. This chapter introduces the four steps of this framework and the feedback loop called "adaptive management." Following chapters describe each step in more detail. Examples and additional information are provided in the appendices.

The framework is an adaptation of one developed for the *Statewide Strategy to Recover Salmon* (Washington State Joint Natural Resources Cabinet 1999). The framework incorporates the findings of the synthesis of the science from Volume 1, such as using landscape analysis to guide the decision-making process when developing plans, policies, codes, ordinances, and non-regulatory approaches to protecting and managing wetlands. One goal of the framework, as presented here, is to help local governments integrate all of their activities relating to wetlands so they can work together. The integration of analyses, planning, regulations, and non-regulatory activities by a local government can be considered its "wetland protection program."

The review of the literature in Chapter 2 of Volume 1 emphasizes that wetlands are an integral part of the landscape. Therefore, to protect and manage wetlands and reduce cumulative impacts, local governments need to understand how changes in land use that result from human activities at a landscape scale can affect wetlands at the smaller, site scale. Once such an understanding is developed, it is possible to plan for, and minimize, the impacts of human activities at all geographic scales, and thereby effectively protect wetlands and their functions.

Analyzing the landscape that influences wetlands is a relatively new idea. Planners and managers of natural resources face a challenge in incorporating landscape information into the planning and protection process. Three common questions posed by planners and managers are:

- What are landscape processes and what do we know about them and their interaction with wetlands?
- What tools can be used to most effectively incorporate a landscape perspective into wetland management?
- How do we organize planning and protection activities to incorporate information about the landscape as well as protecting individual wetlands?

The first question is answered in Chapter 5, which describes what is meant by a landscape analysis. The last two questions are answered in the guidance provided in subsequent chapters and appendices in this document. Collectively, the framework for a program to protect wetlands described below can help minimize cumulative impacts.

Key terms used in this document to describe processes and functions

Landscape processes - Environmental factors that occur at larger geographic scales, such as basins, sub-basins, and watersheds. Processes are dynamic and usually represent the movement of a basic environmental characteristic, such as water, sediment, nutrients and chemicals, energy, or animals and plants. The interaction of landscape processes with the physical environment creates specific geographic locations where groundwater is recharged, flood waters are stored, stream water is oxygenated, and pollutants are removed, and wetlands are created.

Wetland functions - The physical, biological, chemical, and geologic interactions among different components of the environment that occur within a wetland. There are many valuable functions that wetlands perform but these can be grouped into three categories: functions that improve water quality, functions that change the water regime in a watershed such as flood storage, and functions that provide habitat for plants and animals.

4.2 Four-Step Framework for Protecting and Managing Wetlands

The framework for protecting and managing wetlands is designed to provide a number of opportunities to incorporate landscape information into decision-making at the planning stages as well as into decisions regarding individual wetlands. The four steps of the framework include:

1. Analyzing landscape processes that influence wetland resources (called “landscape analysis”), as well as processes that occur at the scale of the site itself

2. Prescribing solutions for protecting and managing wetlands based on information from Step 1 (such as developing policies, plans, codes, ordinances, and non-regulatory approaches, etc.)

3. Taking actions to implement the solutions (such as applying regulations at individual wetlands, restoring wetlands, and providing non-regulatory incentives)

4. Monitoring the results of the actions taken and the effectiveness of the solutions (such as tracking acreage and functions of wetlands lost and gained and determining whether plans and programs are being implemented); this information will help determine if cumulative impacts are occurring

The four-step framework should be iterative and ongoing. If the data collected through monitoring in the fourth step indicates that wetlands are not being adequately protected and cumulative impacts are occurring, the management actions need to be revised accordingly. Evaluation of the monitoring data initiates a feedback loop called adaptive management.

Figure 4-1 conceptually illustrates the four-step framework that can be used by local governments to develop and implement effective approaches to protecting wetlands and other critical areas. The first two steps—analyzing the landscape and its wetlands and prescribing solutions—can be considered long-term planning, and the second two—taking actions and monitoring results—as implementation. As mentioned previously, an additional component is the feedback loop, called adaptive management. This is the process of assessing what has or has not been effective and making modifications based on these insights.

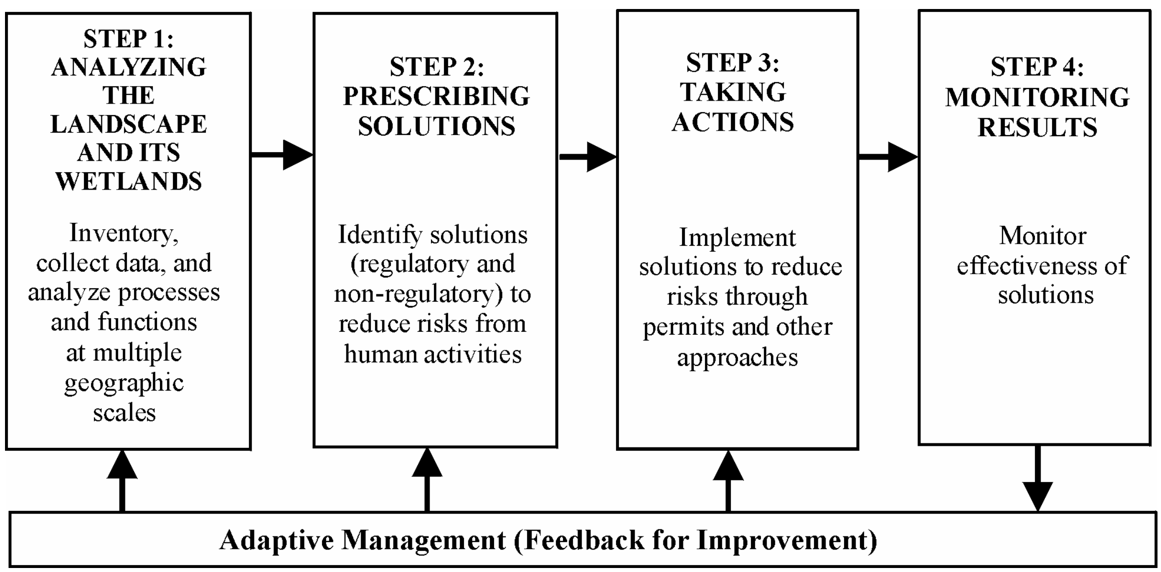


Figure 4-1. A suggested framework for local governments to use in protecting and managing wetlands. These four steps serve as the framework for discussions in this volume and are reproduced at the beginning of each chapter.

4.2.1 Incorporating Different Geographic Scales in the Four-Step Framework

The synthesis of the science presented in Volume 1, and the ecological principles listed in Chapter 1 of this volume, indicate the need for analyzing, planning, and managing at a landscape scale as well as at the scale of individual sites. Therefore, the words used to describe different scales must be clarified to provide a "common language."

Local governments can protect and manage wetlands at different geographic scales. Three geographic scales are discussed in this document. These are the *contributing landscape*, the *management area*, and the *site*, described in the box below. Figure 4-2 provides an example of these three geographic scales.

Geographic scales discussed in this document

The ***contributing landscape*** is the geographic area within which the landscape processes that influence the functions or structure of wetlands located in a *management area* (defined below) occur. A contributing landscape may span jurisdictional boundaries and even span several watersheds (see Figure 4-2). Given that the contributing landscape may cross jurisdictional boundaries, efforts to protect the wetlands need to be coordinated and integrated with programs of other local governments. Because most ecosystems are linked across the landscape, it is important that measures to protect wetlands are coordinated with measures for protecting other resources including riparian areas, floodplains, estuaries, shorelines, and fish and wildlife habitat.

The ***management area*** is the geographic area for which plans and regulations are being developed by a local government. The management area is usually a subset of the contributing landscape because it may be based on political boundaries (e.g., a jurisdiction such as a city), or it may be defined geographically to include a specific Water Resource Inventory Area (WRIA), basin, or sub-basin in a county.

The ***site*** is the area encompassed within the boundary of a single wetland. It, too, may span private property lines or jurisdictional boundaries.

In Figure 4-3, each of the four steps of the framework described earlier is divided into a series of actions that would be undertaken at each of these three geographic scales.

Steps 1 through 4 of the framework are described in detail following the figures.

Figure 4-2. An example of contributing landscape, management area, and site scales.

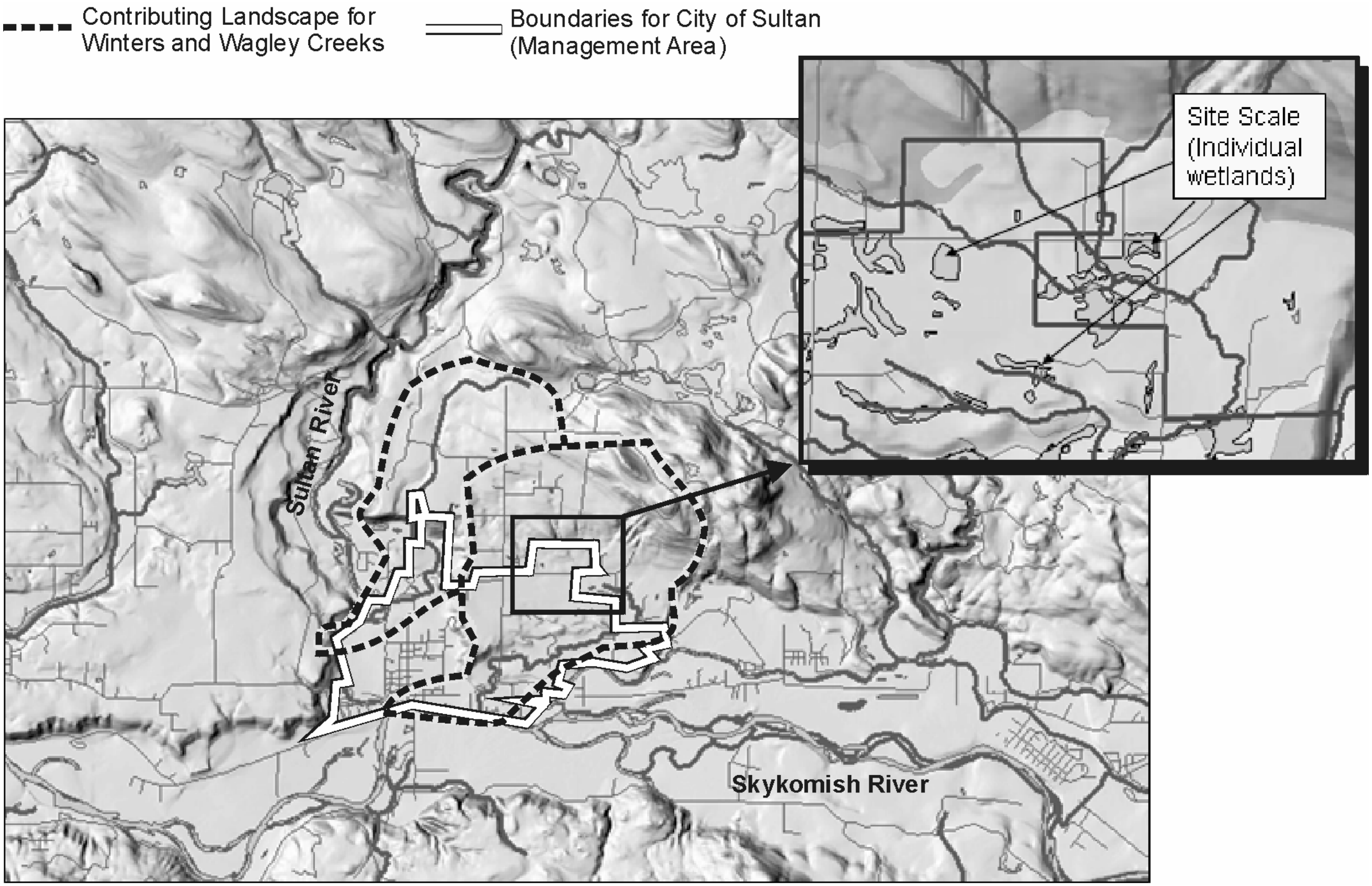
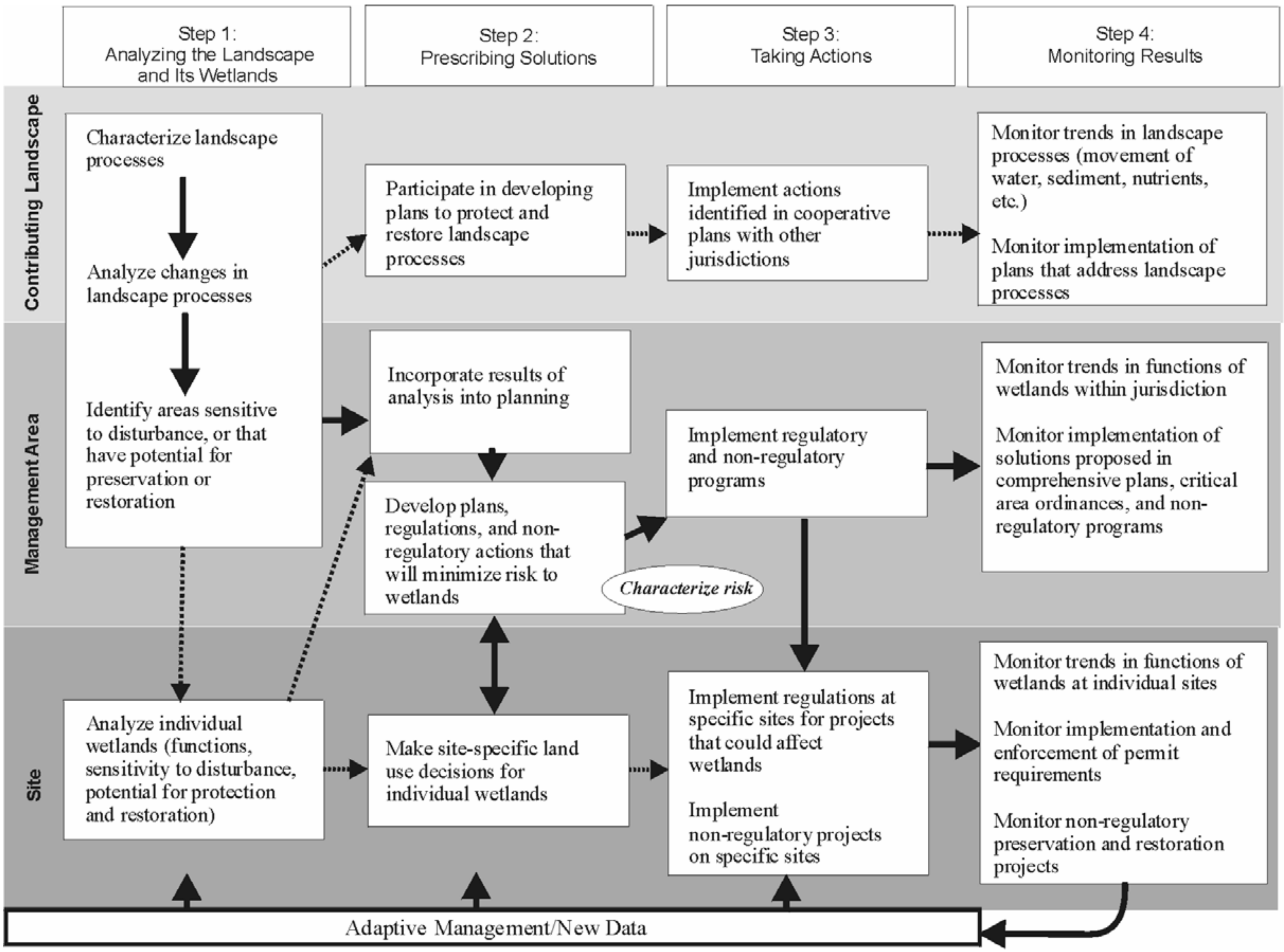


Figure 4-3. Four-step framework incorporating the three geographic scales. Solid arrows represent the process that should be undertaken in developing comprehensive plans and critical areas ordinances. Dashed arrows show additional pathways that can be followed to enhance a protection and management program for wetlands.



4.2.2 Step 1: Analyzing the Landscape and Its Wetlands (Landscape Analysis)

Step 1 involves a *landscape analysis,* which is needed to understand landscape processes and their influence on wetlands. A landscape analysis provides important information that forms the basis of a program to protect wetlands. For example, information from a landscape analysis is crucial in developing comprehensive plans (see Chapter 7) or for planning under an Alternative Futures approach (see Chapter 6). The analysis is applicable to all types of planning done at the scale of the watershed, sub-basin, contributing basin, or site. For example, a landscape analysis can be used to interpret an analysis of the functions of an individual wetland when a change in land use is being considered.

As will be discussed in Chapter 5, a landscape analysis is more complex than what is typically required for a wetland inventory, though the two share some similarities. When doing a landscape analysis, it is recommended that annotated maps be produced that identify areas of critical concern for managing wetlands and their contributing landscape. A series of annotated maps can summarize complex geographic information and provide a scientific basis for establishing land-use designations and in making other decisions about land use. The information can be used in evaluating the relative impacts for a range of alternative scenarios of future development, such as Alternative Futures, that are created in Step 2.

The paragraphs below briefly describe Step 1 at the various geographic scales shown in Figure 4-2. The process for the landscape analysis is described in detail in Chapter 5.

4.2.2.1 Analyses of the Contributing Landscape and the Management Area

The analyses of the contributing landscape and the management area are similar. The difference in the analyses for these two geographic scales is more an issue of resolution than of approach. If the management area is smaller than the contributing landscape, the analysis of the management area can make use of more detailed information, such as detailed wetland inventories and ratings. Local jurisdictions can then develop a more detailed program and have better assurance that the risks to their wetlands are minimized. The same tools and methods, however, can be used at either geographic scale.

The purpose of the analysis at either scale is to develop an understanding of landscape processes that can affect wetland functions. This includes understanding the movement of water, nutrients, sediments, and toxic compounds, and how wetlands that function as habitat are affected by fragmentation of the landscape. It involves inventorying wetland resources, identifying where critical landscape processes occur, and determining how those critical processes have been modified by human activities. From this understanding, one can then determine how these landscape processes may have been changed in the past, and how they might change with future development.

There are two main goals of the landscape analysis. The first goal is to identify locations within the contributing landscape and the management area where landscape processes could be negatively influenced by human land uses (e.g., paving areas that provide groundwater recharge). When planning future changes in land use, these areas can be considered sensitive and in need of specialized management approaches because changes in these locations can be a major cause of cumulative impacts. These areas may not necessarily include only wetlands but may encompass important upland areas that influence wetlands (e.g., areas where groundwater is recharged or corridors of undisturbed uplands that connect wetlands).

The second goal is to identify areas where landscape processes have been degraded but could be repaired, such as through wetland restoration. Planning for restoration could help offset unavoidable impacts identified through the planning process.

This information is used during Step 2 (Prescribing Solutions) and Step 3 (Taking Actions).

4.2.2.2 Analyzing Wetlands at the Site Scale

The main goal of the analysis at the site scale is to understand the functions of an individual wetland and how that wetland interacts with the landscape. This analysis can occur at two different times in the planning and regulatory process: during comprehensive planning and during review of permits for individual projects.

If a local jurisdiction's program to protect and manage wetlands involves preservation or restoration, then individual wetlands will need to be analyzed. Information from the analysis can be used during comprehensive planning (Step 2) to identify those wetlands most suited for preservation and restoration.

The functions of individual wetlands are also often analyzed when permits are sought to alter a wetland. It is, therefore, important for local governments to establish what will be required for site-specific analysis of wetlands during Step 2, when administrative rules, guidance, or regulations are developed (Chapter 8). For example, the requirements should state what must be included within wetland reports and plans for compensatory mitigation. The local jurisdiction should also consider methods for assessing wetland functions and for establishing ratings, buffers, and mitigation ratios. Site-specific analysis is usually the responsibility of the applicant who is proposing changes to a specific wetland.

For further guidance on Step 1, Analyzing the Landscape and Its Wetlands, see Chapter 5 and Appendices 5-A through 5-C of this volume.

4.2.3 Step 2: Prescribing Solutions

Step 2 describes the processes by which local governments develop solutions to protect and manage wetlands within their jurisdiction. The goal of Step 2 is to identify means for incorporating the results of the landscape analysis in Step 1 into effective planning, regulatory, and non-regulatory tools. This is the step in which Smart Growth planning approaches, such as Green Infrastructure or Alternative Futures (discussed in Chapter 6), can be applied and when comprehensive plans, critical areas ordinances, shoreline management plans, restoration plans, and incentives for conservation are typically developed.

4.2.3.1 Prescribing Solutions at the Scale of the Contributing Landscape

To develop solutions for a contributing landscape, which often extends outside the regulatory authority of a local jurisdiction, the jurisdiction will need to coordinate with other, contiguous governments. In reality, however, adjacent jurisdictions may not share the same values or priorities. Because the ability of a local jurisdiction to plan for geographic areas outside of its purview may, therefore, be limited, this document only provides general guidance at this time.

For areas of the contributing landscape that fall within the management area, the process of prescribing solutions is the same as for the management area, as described below.

4.2.3.2 Prescribing Solutions at the Scale of the Management Area

Solutions for protecting and managing wetlands within the management area can be prescribed in many forms. Generally, they include policies contained within comprehensive plans or community plans; codes (such as zoning) and ordinances (including those for critical areas and clearing and grading); stormwater management plans; shoreline master programs; non-regulatory approaches, such as preservation and restoration plans; and incentives for conservation, such as tax relief.

The approach proposed here is to plan for future development and the protection of wetlands by analyzing different alternative scenarios (called Alternative Futures) in terms of their impacts on wetlands and landscape processes. These scenarios should include both general planning approaches, such as different patterns of zoning, and more specific approaches, such as different widths of buffers for wetlands with different ratings. The local government usually incorporates other factors into the scenarios based on the priorities of citizens for their communities. (See Chapter 6 for further discussion.)

The effects of the different scenarios can be compared and evaluated to determine which solution might reduce or limit the impacts to landscape processes. Analyses of scenarios are an important way to summarize detailed scientific information, and they can be very helpful in decision-making.

Step 2 is also the step at which a jurisdiction should ensure consistency between various policies, plans, and regulations administered by the jurisdiction that may influence wetland resources. For example, a grading code may have to be modified to reflect considerations for wetlands or their buffers.

4.2.3.3 Prescribing Solutions at the Site Scale

Prescribing solutions at the site scale involves developing ways to protect wetlands which require tailored protection that is different from the protection afforded to most other wetlands through critical areas regulations. These wetlands are often called “wetlands of local significance.” They may include wetlands with a high value for recreation, aesthetics, potential for restoration, or potential as mitigation banks; or they may be crucial to supporting a landscape process, such as aquifer recharge.

The solutions for protecting these wetlands can be specified in advance by using policies in the comprehensive plan or community plans or even site-specific or wetland-type-specific regulatory language. For example, the City of Everett identified specific actions at individual wetlands at the mouth of the Snohomish River estuary that could be taken to restore landscape processes (City of Everett 1997). There was a high probability of success with an important increase in functions.

> For guidance regarding tools for Step 2, Prescribing Solutions, see Chapters 6 through 9 of this volume.

4.2.3.4 Characterizing the Risk from Proposed Solutions

A characterization of risks should be used to evaluate the different solutions being suggested for protecting and managing wetlands. Such a characterization provides a way to develop, organize, and understand the decisions being made about future land uses. It also enables decision-makers and the public to make more informed decisions about land uses and wetland resources. Solutions that cause a higher risk to the wetland resource because they are driven by other societal needs can be balanced by solutions that reduce the risks (e.g., through restoration). Avoiding impacts and maintaining functions, however, is generally more cost effective and less risky than trying to replace functions (see Volume 1 and Chapter 6 of this volume for further discussion).

> For guidance on characterizing the risk from proposed solutions see Chapter 10 of this volume.

Prescribing solutions incorporating shoreline planning

Solutions for protecting and managing wetlands can be provided in the context of both the Growth Management Act (GMA) and the Shoreline Management Act (SMA). The goal of Step 2 is to incorporate the results of the landscape analysis in Step 1 into plans, regulations, or other actions that will protect wetlands.

The SMA was adopted by Washington's public in a 1972 referendum "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." One of the policies in the SMA is to protect shoreline natural resources including "…the land and its vegetation and wildlife, and the water of the state and their aquatic life…" Some wetlands, therefore, are protected by both the SMA and the GMA. In 1995, the Legislature amended the GMA and the SMA to partially integrate the two statutes (1995 c 347). The amendments incorporate the goals and policies of the SMA as the 14^{th} goal of the GMA; specifically designating the goals and policies of a shoreline master program (SMP) as an element of a local government's comprehensive plan, and designating the balance of the SMP as a segment of the jurisdiction's development regulations (RCW 36.70A.480). In 2003 the Legislature added a requirement that new SMPs must provide a level of protection to critical areas within shoreline jurisdiction that is "at least equal" to the level of protection provided to critical areas under the local government's critical areas ordinances.

On December 17, 2003, Ecology adopted new guidelines for SMPs to implement the revisions to the SMA. The guidelines provide a process for local jurisdictions to implement the policy of the SMA of protecting natural resources of shorelines through the protection and restoration of ecological functions (and environmental processes) necessary to sustain these natural resources. The guidelines specifically state that effective management of shorelines depends on sustaining the functions provided by:
1) ecosystem-wide processes (i.e., flow and movement of water, sediment, and organic materials and movement of fish and wildlife; these are called landscape processes in this volume); and 2) individual components and localized processes such as those associated with shoreline vegetation, soils, and water movement through the soil and across the land [WAC 173.26.201(2)(c)]. The guidelines incorporate the use of scientific knowledge of environmental processes (physical, chemical, and biological processes) that affect the ecological functions of shorelines (and their associated wetlands). Thus, the guidelines for preparing SMPs include an assessment of many of the same environmental processes that are outlined in this volume.

Further, the new guidelines require that SMP policies and regulations ensure "no net loss" of ecological functions necessary to sustain natural ecosystems of shorelines. Updated SMPs must regulate new development in a manner that is protective of existing ecological functions and provide policies that "promote restoration of impaired ecological functions" (WAC 173.26.201(2)(c) and (f)).

The process for preparing an updated SMP is compatible with the four-step framework outlined in this document. The rules (WAC 173.26.201(3)) spell out a general process for updating SMPs that includes: comprehensive inventory of shoreline conditions; characterization and analysis of functions and ecosystem-wide processes; development of shoreline policies, regulations, and environment designations; and development of goals, policies, and actions for the long-term restoration of impaired shoreline ecological functions. The guidance for analyzing the aquatic resources, developing solutions, implementing the solutions, monitoring and adaptive management provided in this document can prove useful to jurisdictions planning under the SMA.

4.2.4 Step 3: Taking Actions

Step 3 ensures that the solutions developed and adopted in Step 2 are effectively implemented through taking actions at the different geographic scales. Examples of taking actions include:

- Implementing regional, subarea, or community plans on the ground
- Applying critical areas and clearing and grading ordinances at specific wetland sites when a development is proposed
- Restoring or preserving wetlands identified in a restoration plan through a landscape analysis
- Setting up a Public Benefit Rating System to provide tax relief for landowners with wetlands (see Chapter 9 for more information)

4.2.4.1 Taking Action at the Scale of the Contributing Landscape

Taking action at the scale of the contributing landscape requires adequate funding and coordination over time. Although the benefits can be great if the solutions are carried out, the challenges are great as well. For example, of the three regional plans that have been developed to protect wetlands—the Everett Snohomish Estuary Wetland Integration Plan (SEWIP) (City of Everett 1997), the Mill Creek Special Area Management Plan (SAMP) (U.S. Army Corps of Engineers 1997), and the Port of Skagit Wetland Industry Negotiations (WIN)—only one (Skagit WIN) was ever adopted and implemented. (For more information on the Skagit WIN contact the Port of Skagit County in Burlington, Washington.)

4.2.4.2 Taking Action at the Scale of the Management Area

Taking action to implement plans, regulations, and non-regulatory approaches adopted by a jurisdiction for its management area is critical to protecting wetlands. The scientific literature reviewed for Volume 1 indicated that one of the major reasons why the functions and values of wetlands continue to be degraded is a lack of resources to implement and monitor proposed solutions.

In the case of a critical areas ordinance for wetlands, an adequate number of staff is needed. The staff should be trained to review permit proposals and enforce the conditions placed on those proposals to ensure that wetlands are protected as planned. This holds true especially for compensatory mitigation. Chapter 6 of Volume 1 highlights the fact that many compensation projects designed to replace wetland functions lost through development have failed in part because of a lack of regulatory oversight and follow-through. Likewise, plans that call for restoration need staff and sources of funding to implement the plans, acquire sites, and monitor the efforts.

4.2.4.3 Taking Action at the Site Scale

Taking action at the site scale means applying the management measures identified for a specific wetland; for example, an individual wetland that is restored using a plan developed for a management area. Implementation at the site scale also requires monitoring the compliance and effectiveness of compensatory mitigation or non-regulatory actions taken at individual sites.

For further discussion of Step 3, Taking Actions, see Chapter 11 of this volume.

4.2.5 Step 4: Monitoring

Monitoring at all three geographic scales (contributing landscape, management area, and site) should be an integral part of a strategy to protect and manage wetlands. It is a key step in determining whether cumulative impacts have actually been minimized during Step 3, Taking Action. Monitoring should address the following central question: *Are the actions taken by a local jurisdiction effectively protecting or restoring the functions and values of the wetlands within its purview and thereby addressing cumulative impacts?*

Local jurisdictions cannot determine whether their solutions (developed in Step 2 and implemented in Step 3) are actually protecting wetlands without collecting data that monitor the success of their approach at the three geographic scales. Monitoring whether adequate protection has been achieved, followed by any needed corrective action, is especially critical. All the information collected to date and reviewed in Volume 1, indicates that there is continued loss of wetlands and their functions and values (cumulative impacts).

Monitoring associated with assessing the protection and management of wetlands by local jurisdictions can be divided into three categories:

- **Monitoring the effectiveness of actions taken to protect and manage wetlands** to determine how well the overall approach (including all solutions) is meeting the goals to protect and manage wetlands at all geographic scales

- **Monitoring the actions taken to implement** the regulatory and non-regulatory solutions developed at all geographic scales

- **Monitoring trends** regarding changes in landscape processes and the level of performance of the functions provided by wetlands at the site scale (i.e., monitoring cumulative impacts)

If the functions and values of wetlands are not adequately protected, managers need to know whether this results from inadequate implementation, inadequate standards, or inadequate strategies. Therefore, all three aspects of monitoring are important in providing feedback to guide future decision-making.

For further discussion of Step 4, Monitoring, see Chapter 12 of this volume.

4.2.6 Adaptive Management

Adaptive management—the feedback loop—is based on a review of the information collected through the monitoring step and a determination of what changes are necessary to improve protection when goals are not met. In this way, future management, policies, and regulations can be more effective in protecting the wetland resource (Washington State Joint Natural Resources Cabinet 1999). Scientists agree that some of the continued degradation of the functions and values of natural systems such as wetlands is a result of a lack of monitoring and adaptive management (Dale et al. 2000). This aspect of protecting and managing wetlands is, therefore, vital to successfully protecting wetlands over time.

The key element of adaptive management is a commitment to periodically revisit the four steps in the framework described earlier. Monitoring should provide new data and information that feed back into the analysis the landscape and its wetlands (Step 1). As the data are analyzed, new information can be generated that may require changing the solutions prescribed (Step 2) and the actions that need to be taken (Step 3). The effectiveness of the new solutions and actions then also needs to be monitored (Step 4), and the cycle repeated over time.

For further discussion of Adaptive Management, see Chapter 12 of this volume.

Chapter 5
Analyzing the Landscape and Its Wetlands

5.1 Introduction

This chapter describes the first step (Analyzing the Landscape and Its Wetlands) in the four-step framework for the program to protect wetlands outlined in Chapter 4. It describes how the landscape, and the wetlands found within it, might be analyzed by a local jurisdiction (see Figure 5-1). Section 5.2 summarizes the importance of the interaction between landscape processes and wetland functions because this information may not be common knowledge for some planners. Section 5.3 provides background on the goals of landscape analysis, because this is a relatively new approach in protecting and managing wetlands. Section 5.4 describes the basic questions that should be answered when analyzing the contributing landscape and management area to assist with decision-making. Identifying important questions should enable local governments to choose the most appropriate method to analyze the landscape for their jurisdiction. Any method or methods that provide answers to these questions can be used. Section 5.5 addresses analyses at the scale of individual wetlands.

The questions discussed in this chapter are derived from the work on environmental processes nationally and in the Pacific Northwest done by Bedford (1996, 1999), Beechie and Bolton (1999), Booth (1991), Brinson (1993), Gersib (2001), Horner (1986), Horner et al. (1996), LaBaugh et al. (1987), Naiman et al. (1992, 1993), Naiman and Rodgers (1997), Stanley and Grigsby (2003), Winter (1983, 1986, 1988, 1989, 1992), and Ziemer and Lisle (1998).

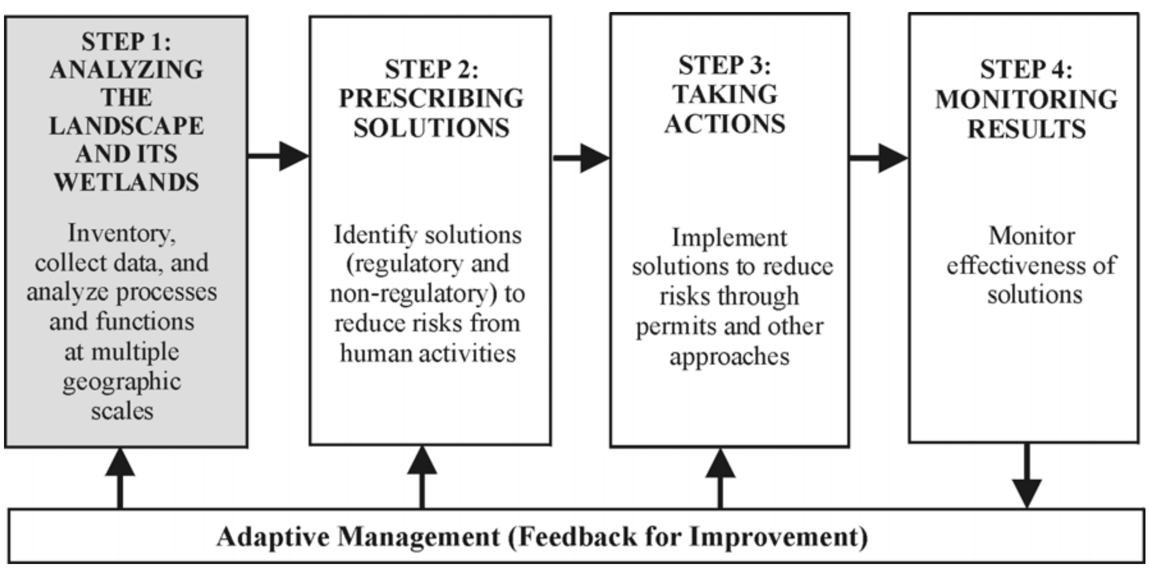


Figure 5-1. Step 1 in the process of protecting and managing wetlands is to analyze wetland resources (shaded box).

Why do we analyze more than just wetlands?

The synthesis of current science (Chapter 2 in Volume 1) indicates that the functions performed by wetlands are controlled by processes that may occur in other parts of the landscape as well as at the site of the wetland itself. To protect and manage the functions and values of wetlands, we therefore need to understand how changes to these wider-scale processes can impact wetlands. In this way, cumulative impacts to wetlands can be minimized.

The following appendices provide additional information and details to help the reader more fully understand the landscape analysis described in this chapter:

Appendix 5-A identifies some of the existing sources of data that can be used to answer the questions when analyzing the landscape and its wetlands.

Appendix 5-B summarizes numerous literature sources that provide more detail on how to analyze environmental processes at the contributing landscape, management area, and site scales.

The reader is also directed to a web site describing a method for completing a landscape analysis for aquatic systems being developed by Ecology (http://www.ecy.wa.gov/programs/sea/landscape/). The analysis uses existing geographic data to characterize environmental processes at the larger landscape scale, and helps identify the relationship of these processes to the functions of wetlands and other aquatic resources.

The method being developed can help local governments protect and manage wetlands as well as other aquatic resources. It is useful for both planning purposes as well as regulatory and non-regulatory applications at the site scale. Currently, however, the method does not address the analyses needed to protect and manage wildlife. This gap will be addressed in the near future as the departments of Fish and Wildlife and Ecology work together to expand the wildlife component of the analysis.

The questions that need to be addressed in the analysis of the landscape and its wetlands apply regardless of the methods used to analyze the resource. The method being developed by Ecology is one way they can be answered.

The web site for Ecology's method for analyzing the landscape is updated periodically as changes and innovations are incorporated. It is currently being revised following application in several jurisdictions. Even when undergoing revisions, the web site is useful in understanding the basic principles, information sources, and steps used in Ecology's method to analyze the landscape and apply the results in context of land-use planning.

5.2 Landscape Processes and Their Influence on Wetlands and Their Functions

Chapter 2 in Volume 1 describes how landscape processes interact with climate, topography, and surface geology to determine the biological, physical, and chemical characteristics (structure) of wetlands and other aquatic resources. The structure of wetlands (e.g., the soils, plant species, configuration of inlets and outlets, etc.) then has a direct influence on the type and level of functioning within wetlands. The sequence, however, does not go only in one direction. Some wetland functions can in turn influence the structure of other wetlands and landscape processes (e.g., when wetlands provide habitat for beavers; see Figure 5-2).

Terms used in this document to refer to environmental factors

Surface and subsurface water flows through the landscape within drainage systems. These drainage systems are often called basins, sub-basins, watersheds, or river basins depending on the size of the area. In this document, drainage systems are generally referred to using one of two terms:

- ***Watershed* -** A geographic area of land bounded by topographic high points in which water drains to a common destination.
- ***Contributing basin* -** The geographic area from which water drains to a particular wetland.

Environmental factors that affect wetland functions can occur at different geographic scales. In this document two scales are used.

- ***Landscape processes* -** Environmental factors that occur at larger geographic scales such as basins, sub-basins, and watersheds. Processes are dynamic and usually represent the movement of a basic environmental characteristic such as water, sediment, nutrients and chemicals, energy, or animals and plants. The interaction of landscape processes with the physical environment creates specific geographic locations where groundwater is recharged, flood waters are stored, stream water is oxygenated, or pollutants are removed, and wetlands are created.
- ***Site processes* -** Environmental factors that occur within the wetland itself or within its buffer. The interactions of site processes with landscape processes define how a wetland functions.

In the Pacific Northwest, the landscape processes that are often associated with wetland functions include:

- The movement of **water** (surface and subsurface) through the contributing landscape and at the wetland site itself
- The movement of **sediment**
- The movement of **nutrients** and other chemicals (salts, toxic contaminants)
- The movement of **energy** in the form of carbon (plant and animal material)
- The movement, population dynamics, and habitat use of **wildlife**
- The dispersal of **plants**

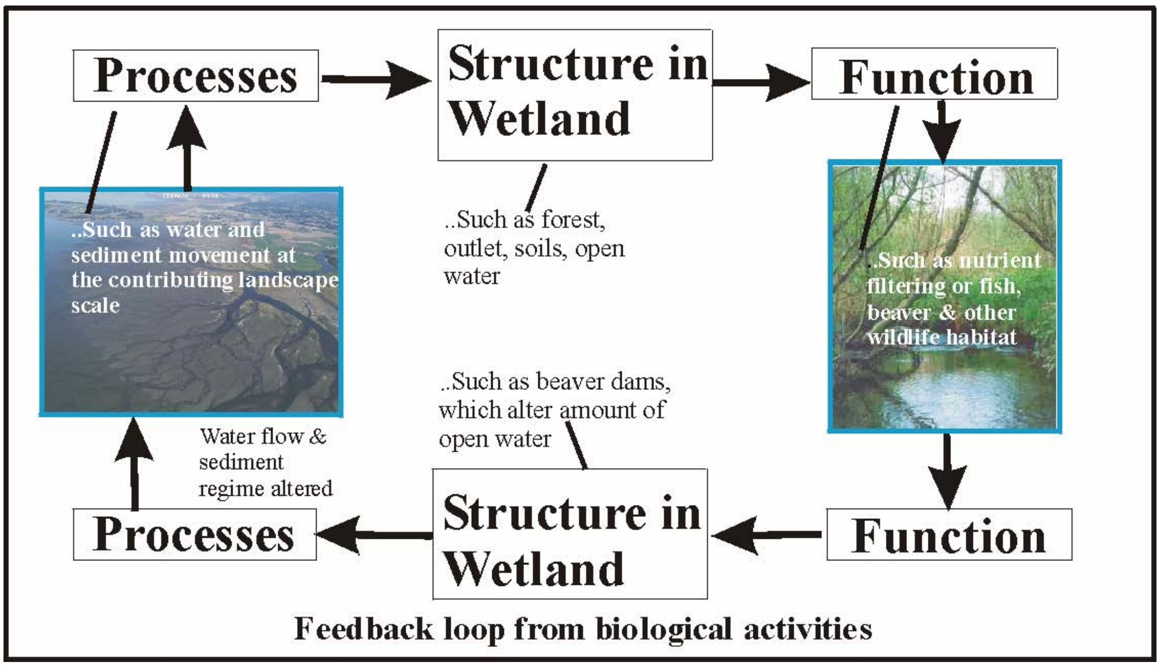


Figure 5-2. Wetlands and their functions are an expression of landscape processes. Wetland functions can in turn modify the landscape processes.

As an example, a wetland may function to support a rich food web in the aquatic resources downstream by exporting large quantities of plant material. In order to provide this function, the wetland needs to have the following:

- Water with adequate nutrients coming into the wetland
- Good exposure to sunlight
- A way for the plant material to pass from the wetland into downstream aquatic resources

The major processes that control the export of food are the movement of water to and from the wetland, and the movement of nutrients into and within the wetland. Thus, human alterations in the movement of water and nutrients into the wetland from the contributing landscape may change how the wetland supports the food web downstream.

5.3 Goals and Objectives of Analyzing the Landscape

The primary goal of a landscape analysis is to develop an understanding of where landscape processes occur and where they are particularly sensitive to human disturbances. As mentioned previously, changes to landscape processes will often result in changes to the functions in wetlands. An understanding of the geographic locations where processes are most sensitive to change is needed to identify appropriate and effective solutions for protecting wetlands and their functions (these solutions are then developed in Step 2 of the framework). Understanding environmental factors in the landscape is basic to planning how humans should use the land in the future, where they should preserve it, or how they might restore it.

Landscape analysis can support land-use planning, including comprehensive planning, because it provides a basis for understanding the future impacts of different zoning configurations and development scenarios. The following objectives for a landscape analysis help achieve this goal:

- Identifying which parts of the landscape provide essential environmental processes (landscape processes)
- Identifying the range of disturbances that affect landscape processes, and whether they are caused by human activities or natural disturbances
- Identifying which geographic areas are most susceptible to these disturbances, and therefore pose environmental constraints to land uses in these settings
- Determining how the landscape processes and the geographic areas that provide these processes influence wetlands and their functions

These objectives can be met by answering the questions posed in the following section.

The objectives apply to analyzing both the contributing landscape and the management area. Landscape processes are not geographically constrained by political boundaries. The reason for presenting a framework that separates the contributing landscape into two geographic units (the management area and the contributing landscape outside the management area) is to simplify the task of protecting and managing the wetland resources. Landscape processes and wetlands that occur within a jurisdictional boundary can be protected and managed by that jurisdiction. Protection outside the jurisdictional boundary will require a cooperative effort by several jurisdictions.

5.4 Questions that Can Be Used to Guide an Analysis of the Contributing Landscape and the Management Area

The questions listed below can be used to guide an analysis of the landscape and are phrased so the answers can be used to meet the goals and objectives described above. Each question is discussed in detail in the subsections that follow.

The questions that direct a landscape analysis are similar for both the contributing landscape and the management area. As previously mentioned, the difference in the analysis for these two geographic scales is more an issue of resolution than a different approach. If the management area is smaller in size than the contributing landscape, the analysis of the management area can make use of more detailed information. Local jurisdictions can then develop more detailed plans and be provided a better assurance that the risks to their wetlands are minimized. The same tools and methods, however, can be used at either geographic scale.

- **Question 1.** What are the landscape processes in the contributing landscape in the absence of human alterations (i.e., before they were altered by human activities on the land), and where are they located geographically?
- **Question 2.** What are the relationships between these original landscape processes and the wetlands and their functions in the management area?
- **Question 3.** What alterations to landscape processes have occurred, and how have these changes affected the wetlands and their functions?
- **Question 4.** What geographic areas are currently important for maintaining landscape processes and can be impacted by future activities and growth?
- **Question 5.** What measures can be used to protect and restore landscape processes in order to protect and restore the wetlands and their functions?

These questions should be answered by local jurisdictions prior to completing Step 2, Prescribing Solutions (e.g., developing critical areas ordinances, shoreline master programs, restoration programs, etc.), and Step 3, Taking Actions (i.e., implementing the solutions identified in Step 2), in the four-step framework. Although each question is directed toward wetlands and their functions, some of the landscape processes analyzed in answering these questions involve other aquatic resources and critical areas and can be used to help other planning efforts.

5.4.1 Question 1. What are the landscape processes in the contributing landscape in the absence of human alterations, and where are they located geographically?

The focus of this question is on processes that affect wetlands in the management area, but it can apply to all landscape processes in the contributing landscape because they are important factors for all natural resources and other critical areas. Understanding the landscape processes that were present in the absence of human disturbances defines the baseline conditions against which changes can be compared. In addition, it helps to identify the aspects of processes that are essential to maintaining current functions of wetlands.

Understanding the environmental processes in the absence of human disturbance is important even if recreating the "undisturbed conditions" is not a goal of the planning process.

This question can be answered by identifying and mapping the landscape processes that support or maintain wetlands and their functions. In general, these processes will fall into the following categories: the movement of water, sediment, nutrients, energy, and wildlife, as well as physical, chemical, and biological interactions that can occur at the watershed and sub-basin scale. To identify these processes, the jurisdiction will need to consider the historic condition and location of the following:

- Drainage patterns of surface water – how surface water reaches the wetlands (e.g., areas contributing water to the wetlands including streams, culverts, stormwater outfalls, and sheet flow)
- Flow paths of groundwater – where groundwater is recharged and discharged and where discharge has created wetlands
- Sediment and its path through the contributing landscape – likely sources of sediment, areas where sediment is deposited, and ways that sediment moves through the landscape to the wetlands
- Nutrients and their path through the contributing landscape – likely sources of nutrient inputs, areas where nutrients would be removed, and pathways for nutrients reaching the wetlands
- Corridors along which wildlife moves and plants are dispersed

Sources for this information include soils maps, aquifer recharge maps, stream inventories, topographic maps, resource/habitat maps from state and federal agencies, zoning maps of active agricultural lands, or even environmental documents such as environmental impact statements. Note that some of these landscape processes may occur at a scale much larger than the extent of the historic wetlands and may extend throughout the contributing landscape.

5.4.2 Question 2. What are the relationships between these original landscape processes and wetlands and their functions in the management area?

Answering this question requires analyzing the connections between the location of landscape processes and existing and historic wetland resources. The most important process to consider is where on the landscape water reaches the surface, or where surface water is slowed down enough to be ponded. Generally wetlands will form in these locations. For example, extensive peat deposits at the base of a slope where groundwater surfaces would indicate a probable location of wetlands. Topographic depressions in a floodplain would indicate locations where floodwaters can be stored and where wetlands also often occur.

The connections between wetlands and landscape processes are very specific to the topographic, geologic, and climatic conditions of an area. If an existing method to analyze the landscape, such as that being developed by Ecology, is not used, local experts will need to be consulted to develop an understanding of the links between wetlands and landscape processes.

5.4.3 Question 3. What alterations to landscape processes have occurred, and how have these changes affected wetlands and their functions?

Answering this question will require understanding where the following alterations have occurred:

- Changes to water flow. For example, areas where:
  - Surface water flow has been diverted, channelized, or culverted
  - Subsurface flow has been converted to surface flow
  - Increased flooding occurs
  - Stormwater management facilities have been installed
- Changes in the sources and transport of sediment. For example, areas where:
  - Active land clearing, construction activities, or agricultural practices occur
  - Sediments are deposited
  - Streams are entrenched
  - There is excessive bank erosion
  - Sediment enters streams from roads and roadside ditches

- Changes in water quality. For example, areas with:
  - Increased input and transport of nutrients (may be associated with sediment sources)
  - Increased input and transport of toxic compounds and pathogens
  - Biological impacts such as closure of shellfish beds or an increase in harmful algal blooms
- Wetlands have disappeared (e.g., from filling or ditching and draining)

Answering this question provides an understanding of how landscape processes and wetland resources have been altered. It is not necessary to measure or quantify changes in landscape processes directly to answer this question. Instead this can be accomplished by comparing maps of the disturbed conditions (generated through the analysis for this question) to the undisturbed conditions as mapped in the analysis needed to answer Question 1. Changes in processes can be inferred from specific indicators of change listed in the bullets above.

For example, the most readily available information on changes in types of land use may be through comparison of historic aerial photographs to current conditions. Such a comparison can illustrate changes such as conversion of forested lands to an agricultural or a built condition; conversion of agricultural lands to a built condition; changes in land use from low to high density or residential to commercial/industrial uses; and so on. Additional data on water quality from monitoring reports, information from surveys of the numbers and types of road crossings on streams and rivers, and/or information on the physical alteration of streams and rivers (e.g., ditching, diking, etc.) can all serve as indicators of changes in processes.

5.4.4 Question 4. What geographic areas are currently important for maintaining landscape processes and can be impacted by future activities and growth?

Once a jurisdiction has identified the areas where landscape processes historically occurred and where they have been changed, it is possible to identify those areas where landscape processes still occur today. This information can be used to predict where additional changes to processes and wetlands might occur from future activities. The purpose is to identify areas where the movement of water, sediment, nutrients, energy, and wildlife are particularly sensitive to additional human activities and disturbances.

The following are some human activities occurring in areas that are particularly sensitive:

- Filling in floodplains alters the movement of water and especially flood storage
- Paving in areas where groundwater is recharged resulting in reduced infiltration and baseflow to streams

- Building roads through the remaining vegetated corridors reduces the movement of animals and increases the potential invasion of unwanted plant species (Vegetated corridors are sensitive to being fragmented)

5.4.5 Question 5. What measures can be used to protect and restore landscape processes in order to protect and restore wetlands and their functions?

Answering this question is primarily an analytical process that relies on data and information collected in the previous questions. There are two objectives associated with this question. The first is to identify areas that have not yet been altered but are critical to maintaining processes and functions—the sensitive areas identified in Question 4. These should be managed to minimize the potential impacts of human activities through regulatory and non-regulatory means. The second is to identify where landscape processes have been altered but can be restored. Chapters 6 through 9 of this volume discuss in detail the regulatory and non-regulatory approaches that can be used for protection and restoration.

5.5 Questions that Can Be Used to Guide an Analysis of Individual Wetlands

The questions listed below can be used to guide an analysis of individual wetlands. The questions are phrased so the answers can be used to meet both regulatory and non-regulatory needs to protect and manage wetlands. The landscape analysis described in the previous section is appropriate for the development of land use and other plans. It does not, however, provide enough detail for making decisions about individual wetlands, either permit decisions which are site-specific or site-specific decisions about restoration or preservation. Questions 6 and 7 reflect analyses that are usually done during the planning process and in conjunction with the landscape analysis done for Questions 1-5. Question 8 addresses analyses that are most often done when proposals are submitted for altering specific wetlands.

- **Question 6.** What wetlands are currently performing functions that are associated with important processes identified in the landscape analysis?
- **Question 7.** What degraded wetlands or former wetlands are suitable for restoring landscape processes identified in Question 3?
- **Question 8.** What are the functions of individual wetlands that need to be protected, preserved, or managed?

5.5.1 Question 6. What wetlands are currently performing functions that are associated with important processes identified in the landscape analysis?

Answering this question is primarily an analytical process that relies on data and information collected in Question 4. The purpose is to identify specific wetlands where the movement of water, sediment, nutrients, energy, and wildlife are particularly sensitive to additional human activities and disturbances. These wetlands will be a subset of the sensitive areas identified in Question 4, and they should be specifically highlighted in any general plan to protect and manage wetlands.

For example, headwater wetlands are very important in desynchronizing flood flows in downgradient areas. This desynchronization maintains the landscape process of water flow, and protecting this function in headwater wetlands is important for the entire watershed downstream.

5.5.2 Question 7. What degraded wetlands or former wetlands are suitable for restoring landscape processes identified in Question 3?

Opportunities for restoration can be identified by developing a map of wetlands that have been degraded, and furthermore that may no longer meet the definition of a wetland. This is accomplished using hydric soils, wetland inventories, and land-use maps. The locations where these former or degraded wetlands intersect the areas where landscape processes occur (from Questions 1 and 4) are the areas best suited for restoration. This information is the basis for developing regional restoration plans, developing mitigation banks, and developing an understanding of the type of compensatory mitigation that is appropriate for permitted alterations to existing wetlands.

5.5.3 Question 8. What are the functions of individual wetlands that need to be protected, preserved, or managed?

The functions present in a wetland need to be understood in order to apply protective measures that will adequately protect these functions, such as buffers and appropriate mitigation plans. Not all wetlands provide the same functions or function at the same levels (see Chapters 2 through 4 in Volume 1 for further discussion). The analyses of functions of individual wetlands are usually done as part of permitting for actions that could affect that wetland.

Most analyses of wetlands at a specific site use rapid approaches that assess a range of wetland functions and values. Many methods have been developed in the last decade to analyze wetland functions and values, and these have been summarized in numerous compilations (e.g., Hruby 1999, Bartoldus 1999, and the Army Corps of Engineers Ecosystem Management and Restoration Information System http://el.erdc.usace.army.mil/emrrp/emris/ go to Index, Wetland Procedure Descriptions).

In addition, Ecology has developed several methods that can be used for the analysis of functions at the site scale. The *Washington State Wetlands Rating System for Eastern Washington - Revised* (Hruby 2004a) and the rating system for western Washington (Hruby 2004b) were developed to categorize wetlands based on their sensitivity to disturbance, how difficult they may be to replace through compensatory mitigation, the rarity of the wetland type, and the groups of functions they provide.

Methods for Assessing Wetland Functions (Hruby et. al. 1999, 2000) (also called Washington State Wetland Functions Assessment Method or WFAM) provides more detailed information on up to 15 specific functions that a wetland performs. Both the rating systems and the methods for assessing functions do not address other benefits wetlands provide such as aesthetics, provision of educational and recreational opportunities, etc. WFAM is currently available for a subset of wetland types in both eastern Washington (Hruby et al. 2000) and western Washington (Hruby et al. 1999).

Other methods that have been developed for analyzing individual wetlands in Washington State include the *Wetland Functions Characterization Tool for Linear Projects* from the Washington State Department of Transportation, which characterizes functions as "probably present" or "probably not present" and as "principal" or "secondary" functions (Null et al. 2000). A brief description of these and other assessment methods that are often used in the state is provided in Appendix 5-B.

In some cases all the wetlands in a basin or sub-basin are analyzed in advance of any actions as part of a regional plan using one of the "rapid" methods described above. This information is used to guide planning by identifying up front those individual wetlands that should not be altered because they perform important functions that cannot be replaced. Wetlands are also identified that do not function well. These can be identified as suitable for development with appropriate compensation. Potential or recommended mitigation sites can also be identified during this planning process. Examples from the Puget Sound area include the Mill Creek Special Area Management Plan or SAMP (U.S. Army Corps of Engineers 1997) and the Everett Snohomish Estuary Wetland Integration Plan or SEWIP (City of Everett 1997).

Chapter 6
Prescribing Solutions: Landscape-Based Land-Use Plans

6.1 Introduction

This chapter presents approaches to developing plans and policies that incorporate the information collected during Step 1 of the four-step framework—the analysis of the landscape and its wetlands—as described in Chapter 5. Developing plans and policies is part of Step 2 (Prescribing Solutions) in the framework of a wetland management program (Figure 6-1).

Plans and policies are enhanced by information generated in Step 1, which involves analyzing the role that wetlands play in landscape processes. Landscape processes both maintain and interact with wetlands and the functions they perform. Landscape processes can include physical processes such as those that maintain hydrology and the physical stability of shorelines; chemical processes such as those that maintain or degrade water quality; and ecological processes such as those that maintain habitats and species.

The results of these landscape analyses are used in Step 2 to identify solutions that reduce the risk of human activities that degrade or eliminate wetlands and landscape processes.

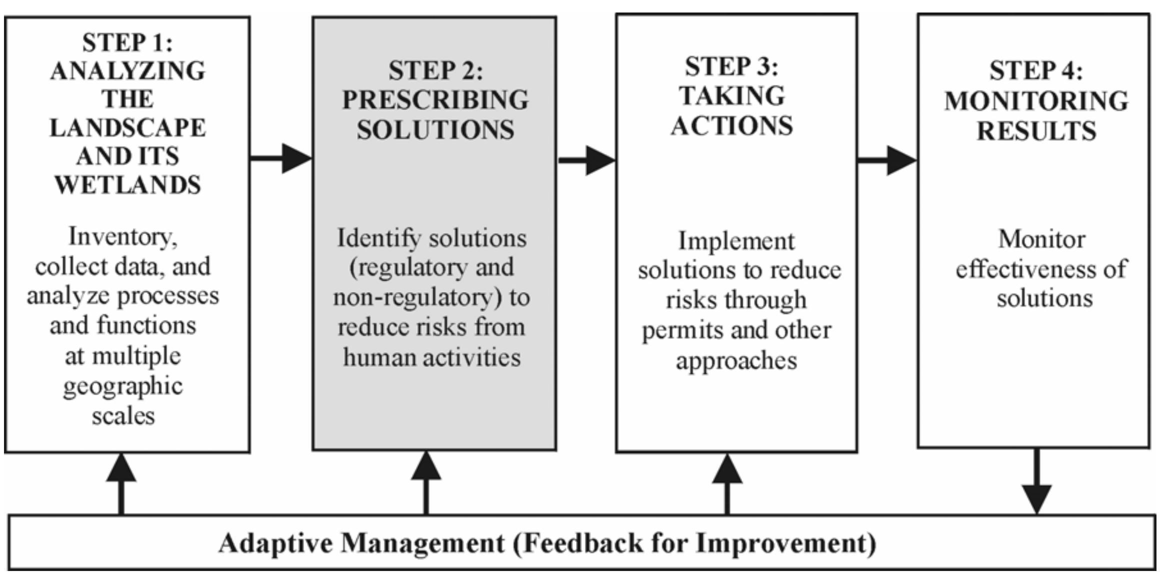


Figure 6-1. Developing plans and policies fits into Step 2 within the four-step framework recommended for protecting and managing wetlands (shaded box).

This chapter begins with a brief overview of planning and the Washington State Growth Management Act (GMA) (Section 6.2). It then describes the importance of using landscape analysis and approaches (at the appropriate scales) when initiating and completing planning processes (Section 6.3). Next, Smart Growth is introduced (Section 6.4); the concepts of which form the foundation for two complementary planning applications called Green Infrastructure and Alternative Futures which are described in some detail. These approaches have been used as reliable frameworks for the inclusion of landscape analysis and perspectives within both local (such as subarea plans) and comprehensive planning processes (described in Chapter 7). The chapter concludes (Section 6.5) with a discussion of the fiscal benefits of maintaining landscape processes by protecting critical areas such as wetlands, floodplains, streams and riparian areas, nearshore areas, etc.

6.2 Overview of Planning and the GMA

Land-use planning, in the context of resource management, is the formalized process by which jurisdictions identify what can or cannot occur on lands within their regulatory authority. In Washington State, land-use planning is implemented at a local (county or city) level of government and is directed by the Growth Management Act (GMA), with state agency technical assistance and oversight.

In 1990 the Washington State Legislature passed the GMA (RCW 36.70A) to guide local jurisdictions in their land-use planning efforts. The GMA dictates that counties and cities with certain characteristics must fully plan for future growth (RCW 36.70A.040). (Chapter 2 of this volume provides an overview of the GMA and a review of Hearings Board and court cases relating to the GMA, critical areas, and best available science.)

The GMA identifies goals to be used by local governments to “guide” the development of comprehensive plans. A full range of actions is included, such as concentrating development to limit urban sprawl; coordinating infrastructure for transportation; avoiding incompatible uses while maintaining the extraction of natural resources from forests and mines and agricultural production on designated lands of long-term commercial significance; as well as protecting the environment and the quality of life in the state. Cities and counties planning under the GMA have responded to these mandates by developing or updating their comprehensive plans and the codes and ordinances that implement the plans.

The planning process should begin with an understanding of existing natural resources (e.g., wetlands, floodplains, riparian areas, etc.) and the functions they provide, as well as the broader landscape processes with which they interact. Once these have been identified, they should be protected through comprehensive plans, other local plans, and the regulations and management practices that implement the plans.

Planning concepts and approaches described in this chapter (Smart Growth, Green Infrastructure, and Alternative Futures) use landscape-scale information to evaluate possible scenarios for future use and management of the land. They incorporate alternative approaches for meeting future community needs while protecting ecosystems. The general objective of these approaches is to help identify options that both minimize environmental impacts and use the functions (services) provided by the ecosystems that exist within a healthy landscape. Wetlands, for example, will retain and slow floodwaters and recharge both stream flow and aquifers – environmental functions which engineering cannot easily or inexpensively replace. Good planning is therefore vital for protecting ecosystems, including critical areas and the functions they provide, as well as saving money for the community in the long run.

The planning approaches described below can be used as a basis for revising comprehensive plans or subarea plans, developing watershed protection and restoration plans, and supporting other planning and management efforts. They also provide a pragmatic approach for actively engaging the public by incorporating their direct input in the evaluation phase and by participating in making decisions about the future of their communities and surrounding landscapes.

Factors to consider when making land-use decisions affecting the future

In the paper *Ecological Principles and Guidelines for Managing the Use of Land* by V.H. Dale et al. (2000), scientists from around the country collaborated to identify factors to consider when making land-use decisions. These factors include the following:

1. Examine the impacts of choices in a regional (or landscape) context

2. Plan for long-term change and unexpected events

3. Preserve rare landscape elements, critical habitats, and associated species

4. Avoid land uses that deplete natural resources over a broad area

5. Retain large contiguous or connected areas that contain critical habitats

6. Minimize the introduction and spread of non-native species

7. Avoid or compensate for the effects of development on ecological processes

8. Implement land use and land management practices that are compatible with the natural potential of the area

The paper provides guidance for applying each of these factors to the planning process. They note that the mobility of human activities is more flexible (within limits) than the mobility of important landscape processes and ecosystem functions. Therefore, ecological constraints (the need to manage landscape processes for the long term) can be used as the primary consideration in land-use planning. The planning sequence they suggest is to first plan for maintaining water and biodiversity; then for cultivation, grazing, and the harvesting of wood products; then for managing sewage and other wastes; and finally for the placement of homes and industry. (The goals in the list above are also listed in Chapter 1 and should be considered throughout the four-step framework for protecting and managing wetlands and other critical areas.)

6.3 The Importance of Incorporating a Landscape Perspective in Planning

Land-use planning has traditionally focused on human actions implemented through management decisions at the level of the individual site or parcel. It has done so without always considering what is needed to protect environmental processes and wetlands at the landscape level (Dale et al. 2000). The synthesis of the science in Volume 1 indicates that the lack of incorporating information about the landscape in decisions made about land use, including those involving wetlands and their functions, is a major deficiency. For example, Volume 1 concludes that cumulative impacts lead to the degradation of wetlands and other natural resources. This results in the loss of landscape and watershed processes over time. A cumulative impact is "*…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions...Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*" (Council on Environmental Quality 1997 http://ceq.eh.doe.gov/nepa/regs/ceq/1508.htm#1508).

Volume 1 goes on to state that regulatory programs that are based on a case-by-case approach and a lack of consistency between jurisdictions are two of the causes of cumulative impacts. Studies cited in Volume 1 found that decision-making that only considers individual projects without taking into account the larger landscape does not address cumulative effects (Johnston et al. 1990, U.S. Environmental Protection Agency 1999, Dale et al. 2000). This is especially significant for landscape processes that occur across jurisdictional boundaries (i.e., processes within the contributing landscape as depicted in Figure 4-2 in Chapter 4 of this volume).

One of the solutions for reducing cumulative impacts in the future, therefore, is developing plans and policies that incorporate information on larger landscape changes on these ecosystems and their respective landscape processes. Through analyses using data generated at this scale, local governments gain an understanding of where processes and functions occur, the interactions between ecosystems and the surrounding landscape, and how land uses may affect them.

With this knowledge comes the ability to minimize cumulative impacts to processes, functions, and resources by developing plans, policies, and setting clear management objectives that affect growth patterns. These can dictate which areas will be most fully protected and which may be degraded or remain in a degraded condition.

Plans, policies, and management objectives can in turn initiate protection programs that go beyond case-by-case decision-making by considering the larger landscape. For example, comprehensive planning based on landscape information can serve as the platform for critical areas ordinances, clearing and grading ordinances, zoning designations, shoreline master programs, protection measures through the Endangered Species Act, as well as non-regulatory restoration and preservation programs.

Local governments, therefore, benefit from having an understanding of key landscape processes and the functions that networks of critical areas provide. Landscape information can identify the capacity of natural resources like wetlands to provide important services to communities such as maintaining water quality, reducing flooding, etc. Local governments gain a clearer understanding of where these processes and functions occur in order to steer development to more appropriate areas and thereby reduce impacts to the processes and functions.

Plans and regulations based on scientific information may result in a more efficient permitting process by reducing the need to complete complex environmental review and detailed studies at the permitting level. They also can facilitate cooperation between jurisdictions, thereby further reducing cumulative impacts.

Minimizing the cumulative impacts of land use through landscape-based plans, policies, and implementing regulations can prevent costly problems by maintaining landscape processes and wetland functions over time. The result is a fiscally responsible approach to sustaining development.

6.4 Smart Growth

Smart Growth is a relatively new, conceptual framework for improving land-use planning and the management of growth in communities. It provides core defining principles intended to guide the development of land-use plans and policies as well as implementing regulations and practices. Its purpose is to minimize the negative effects of sprawl development on both local communities and the environment. Smart Growth integrates better economic, social, financial, and environmental outcomes for a community. It represents planned actions taken with all the community's benefits in mind both in the near term and well into the future.

Applying the principles of Smart Growth has been found to be fiscally beneficial by recognizing that certain patterns of growth and decline significantly hurt communities by undermining both their economies and the environment (Muro and Puentes 2004). In their paper *Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns,* Muro and Puentes (2004) found that Smart Growth can reduce public costs of installing new infrastructure and delivering new services, improve a region's economic performance, and bring economic gains to suburbs as well as cities. (See Appendix 6-A for additional references and web pages about Smart Growth.)

The National Governors' Association promotes the use of Smart Growth land-use planning and practices as beneficial for local communities. They recognize that it is not necessarily growth that is the problem but the patterns of sprawl-induced growth which are harmful (see the National Governors' Association web site www.nga.org).

Smart Growth focuses on growth that protects open space, revitalizes neighborhoods, and makes housing more affordable while improving the quality of life in communities. Fundamental to the Smart Growth concept are the following defining principles:

- Preserving and restoring critical environmental areas and the functions and services that these areas provide
- Strengthening and directing development toward existing communities
- Fostering attractive communities with a strong sense of place
- Reintegrating compatible uses in neighborhoods (mixed land use)
- Taking advantage of compact building design
- Creating walkable neighborhoods
- Providing a variety of transportation choices

When applying the concept of Smart Growth, local governments analyze the landscape using the best resource information available about the geographic area, identify the needs and desires of the citizens in visioning their community's future, and then evaluate different scenarios to accommodate future growth in a sustainable manner.

Landscape analysis is an important element of Smart Growth planning. However, it is only in recent years, since the advancement of the Geographic Information System (GIS), that conducting landscape analysis has been possible. Even more recent has been the development of methods to analyze landscape data which provide a scientific understanding of the sensitivities and stressors on natural resources and landscape processes. With this science-based knowledge, local governments and communities can, for the first time, improve their decisions about land uses and more effectively incorporate Smart Growth concepts into land management.

The concept of Smart Growth and its guiding principles can be applied through a variety of mechanisms. Land-use policies using Smart Growth principles encourage mixed-use zoning, limited outward expansion, higher density development, reduced travel, revitalization of urban centers, and preservation and restoration of open space essential to maintaining critical areas and landscape processes. Examples of planning tools using Smart Growth principles include Green Infrastructure planning and Alternative Futures analysis. Both are discussed later in this chapter.

Regulatory practices applying the Smart Growth concept focus on reduction of impervious surfaces, maintenance of tree and vegetative cover, compact building design, etc. Low impact development (LID), traditionally applied as a technical approach to reducing stormwater impacts from developed lands, conceptually falls within the parameters of Smart Growth principles as well. Non-regulatory programs adopted using Smart Growth approaches emphasize preserving and restoring core greenspace areas. Preserving and restoring these areas is most effective when non-regulatory and regulatory tools are both applied.

Smart Growth planning offers the opportunity to take a proactive and resource-based approach to minimizing cumulative impacts on the landscape while maximizing environmental processes that benefit the community. At its best, Smart Growth has the potential to help direct future growth in ways that maintain or improve landscape processes and promote a healthy, functioning environment.

Washington's GMA incorporates some Smart Growth considerations in the directives for the use of critical areas ordinances, concentrating urban development and infrastructure, and conserving resource lands for long-term use. Many of the other Smart Growth elements that are planning and implementation tools can certainly be applied within the GMA context to bring the best land management practices to Washington.

6.4.1 Smart Growth Can Be Used to Develop or Update Local Plans

Smart Growth concepts and associated planning approaches can be applied at any time in the local planning process. (See Sections 6.4.2, 6.4.3, and 6.4.4 for a discussion of planning approaches which use Smart Growth concepts.) It is optimal to incorporate landscape analysis and Smart Growth concepts early in the process whenever a local jurisdiction intends to update its comprehensive plan and implementing ordinances, develop new subarea plans, or expand urban growth areas.

Updates to comprehensive and subarea plans are particularly important times for re-assessing the conditions of local landscapes and evaluating different development options for minimizing future impacts on ecosystems and landscape processes. Smart Growth approaches are more likely to succeed when they are discussed, developed, and implemented as part of a formal planning process. *Watershed academies* or *councils* (committees of scientifically informed citizens) can help guide the planning process. They can make recommendations on how to incorporate information about the landscape and principles of Smart Growth into land-use planning.

In areas close to urban centers that are not yet developed, into which urban growth boundaries may be extended, there is still an opportunity to tailor management needs within the landscape context. In more rural areas, harmful losses can be prevented by re-directing development to the least sensitive locations. These opportunities may well reflect the "best case" scenarios for balancing community needs while maximizing resource protection prior to development, thus sustaining landscape processes and natural resources to avoid expensive land-use problems in the future.

Smart Growth, and other planning processes that incorporate landscape analysis, can help define and identify specific restoration, preservation, and conservation needs and develop plans to address those needs. While it is unrealistic to think that an already built environment will be "un-built," mitigating or compensating actions (e.g., using restoration and preservation) might be identified and take place elsewhere in the vicinity to recover lost functions deemed beneficial by communities and resource managers. In this respect, some of the approaches described in this chapter, and elsewhere in Volume 2, can help identify and address restoration, preservation, and conservation needs in terms of landscape processes and target the type of implementing action needed for each site. (See Chapter 9 for more discussion of non-regulatory tools.)

A case study of the benefits of Smart Growth

A recent study by Preuss and Vemuri (2004) projected the effectiveness of Smart Growth practices implemented in Montgomery County, Maryland, in the 1960s. At that time Montgomery County implemented tools incorporating Smart Growth principles including transfer of development rights, cluster development, and open space acquisition through their land-use plans.

Preuss and Vemuri applied a dynamic model to predict the implications of using Smart Growth tools in Montgomery County during the last four decades. They did so by reviewing three different scenarios: 1) traditional policies, 2) current Smart Growth, and 3) full development. They found that Montgomery's current Smart Growth practices reduced negative effects on water quality and preserved more open space than the other two scenarios. In addition, under Montgomery's existing Smart Growth practices, developable land would still remain into 2050 while being non-existent under the other scenarios.

6.4.2 Planning Approaches Using Smart Growth

To illustrate the application of Smart Growth principles to planning, two approaches are discussed in the following sections: Green Infrastructure (Section 6.4.3) and Alternative Futures (Section 6.4.4). Both of these very similar, yet complementary, approaches examine how the services and infrastructure provided by natural resources can be used to benefit communities while maintaining those resources into the future. These planning approaches can readily be used by local governments to help develop comprehensive plan elements and help guide implementation of regulatory and non-regulatory programs. Comprehensive plans are discussed in Chapter 7.

By developing plans using Green Infrastructure or Alternative Futures, a local jurisdiction can develop the best *greenprint* or preferred alternative for the future. (See Section 6.4.3.1 for a discussion of the approach to developing a Green Infrastructure plan.) The conceptual land-use plan, often presented in the form of a map or maps, includes the location and type of all essential (core) areas that need conservation, preservation, and/or restoration (including degraded areas that provide opportunities to restore processes and functions).

These approaches can include both an assessment of the current and projected needs for infrastructure (e.g., transportation corridors and water and sewage treatment options) as well as the desired land-use patterns that will maintain and protect important environmental processes and functions. The implementation tools used to conserve, preserve, and restore the identified areas may be either regulatory or non-regulatory. Which protection measures work best at any location are determined by the functional attributes of the landscape, the overall risk associated with loss of the resources identified, and, ultimately, the community's vision of the landscape for the future.

See Chapter 8 for a description of restoration and preservation used in a regulatory context and Chapter 9 for restoration, preservation and conservation used in relation to non-regulatory activities. These terms are also defined in the glossary.

6.4.3 Green Infrastructure Planning

Green Infrastructure or *GRIST* is defined as an interconnected network of protected land and water that includes a wide variety of both relatively undisturbed and restored ecosystems and landscape features that make up a system of hubs and links. The network supports native habitat and communities, maintains landscape processes, sustains air and water resources, and contributes to the physical and economic health and quality of life of communities. In addition, this network of lands provides corridors for wildlife movement. (See Section 6.4.3.3 for conceptual illustrations of "hubs and links" and a simplified overview of the typical steps in developing and implementing a GRIST plan.)

The resulting network of ecologically important lands integrates:

- Waterways, wetlands, forests, wildlife habitats, and other such features
- Greenways, parks, and recreation lands
- Working farms, ranches, and forests
- Wilderness and other open spaces that support native species and maintain landscape processes

GRIST plans are an important element of Smart Growth because they help local planners identify and prioritize resources to be preserved, ensure the economic viability of working landscapes, and guide development in a manner that is compatible with sustaining landscape processes and the character of the community. GRIST plans provide a greenprint for accommodating land-use patterns while preserving critical areas, ecosystems, resources, and areas with native species and cultural assets. By integrating the benefits of landscape processes and services, GRIST plans assess current conditions and guide future land uses similar to how a transportation plan provides a blueprint for existing and future travel needs.

The President's Council on Sustainable Development identified Green Infrastructure as a key strategy for achieving sustainability in the report *Towards a Sustainable America – Advancing Prosperity, Opportunity and a Healthy Environment for the 21st Century* (Williamson 2003). Additional references on Green Infrastructure and Smart Growth topics are provided in Appendix 6-A.

6.4.3.1 The GRIST Approach

When developing a GRIST plan (or greenprint), conservation of landscape processes and critical areas establishes the foundation on which the rest of the local comprehensive plan is built.

Integrating the results of landscape analysis (as described in Chapter 5) into the GRIST plan ensures that the functions and processes necessary to maintain long-term protection of natural resources including wetlands are thoroughly understood and considered in avoiding future impacts or loss. For example, areas where significant groundwater discharge/recharge and storage occur would not be appropriate to zone for uses that would result in a high percent of impervious surfaces (e.g., roofs, driveways, roadways, and parking lots). These areas would be more appropriately zoned as open space or other low-density uses, rather than being designated for high-density development. The local jurisdiction might want to consider preserving such areas from development altogether so that the community's water supply is assured into the future.

A GRIST plan can also identify areas that provide important landscape processes that need restoration. For example, this might include areas where construction of levees has separated rivers from their floodplains or where drainage channels are conveying subsurface waters away from wetlands.

Thus, integrating the results of landscape analysis allows a jurisdiction to direct human activities to locations that avoid or minimize impacts to critical areas and other natural resources, sustaining them over time while supporting the community's needs for adequate water supplies, water quality, flood attenuation, etc. In addition, GRIST planning tracks the pace and location of land use in relationship to these outcomes.

GRIST plans are not open space plans

Traditional Open Space Plans (OSP) have been used by jurisdictions throughout Washington for years. These plans are usually developed by the local parks and recreation departments with the intent of securing open spaces which can provide the citizenry with recreation opportunities and/or scenic amenities.

GRIST plans, or greenprints, take the OSP concept further by also examining the functions provided by undeveloped lands and assuring continuity and connectivity between protected features. As the name implies, GRIST plans are designed to protect the "green infrastructure" on the landscape that provides for such "free" functions as flood attenuation, groundwater recharge, water quality filtration, etc. These functions, if lost, would need to be replaced by "engineered infrastructure," if they can be replaced at all. Additionally, conservation of habitat and biodiversity are also critical aspects of greenprints which are addressed by maintaining core areas with linkages (hubs and links) on the landscape.

Greenprints can be viewed as vital components for achieving both a healthy environment and sustainable communities. As such, they are the building blocks for implementing regulatory and non-regulatory programs. Thus, greenprints represent a community commitment to avoid costly environmental problems through proactive measures. For example, funds traditionally used for engineered infrastructure can be committed to implementing the plan when the functions of "green infrastructure" replace the need for built solutions.

Note: Some local greenprints still primarily focus on recreational lands only. These plans do not incorporate all of the broader principles of GRIST planning. Therefore, any reference to GRIST plans or greenprints in this document is referring to the broader description provided here and not plans that focus strictly on recreation.

GRIST Works in Both Undeveloped and Developed Areas

Communities at any stage of planning or development can incorporate Green Infrastructure into their planning processes:

- **GRIST planning for areas with little urban development.** When applying the results of a landscape analysis through a GRIST plan for a jurisdiction (or portion thereof) that has experienced little human development, a network of critical areas and resource lands can be identified for conservation. This network can be coordinated with plans for the built infrastructure such as essential transportation corridors. Essential "green infrastructure" can be preserved and/or restored while transportation corridors and built environments are accommodated. This clearly identifies where both public and private development will be better suited, thereby allowing land uses that are compatible with maintaining the integrity of the landscape and its processes.

- **GRIST planning for areas that are largely developed.** In jurisdictions where the landscapes have already been largely developed, applying the results of a landscape analysis through a GRIST plan can designate and protect remaining natural resources and critical linkages while still considering the existing roads, urban centers, etc. Here the results of a landscape analysis may provide its greatest benefit by identifying those portions of the landscape where essential processes and functions can and need to be restored to fill in the gaps where functions are needed.

6.4.3.2 Implementing a GRIST Plan

Implementing GRIST planning begins with incorporating the GRIST plan into the Land Use Element of the comprehensive plan (as well as the Shoreline Master Program). Other relevant elements of comprehensive plans should include policies and directives for successfully implementing the GRIST plan. In line with these policies and directives, regulatory and non-regulatory programs and tools should also be updated or developed.

The specific programs and tools to be used for implementation, and where and how they are applied, will depend on the goals and needs of the GRIST plan in relation to landscape processes, their level of degradation, their sensitivity to disturbance, and development pressures. For example, in a particular sub-basin it might be most critical to protect and maintain wetlands because the quality of the water is threatened by non-point pollution. Thus, policies for that basin may direct agricultural landowners to provide stronger buffer protections around aquatic resources. They may also encourage active restoration of aquatic habitats and their buffers, while zoning designations could reflect more stringent wetland standards to protect their ability to improve water quality. In an undeveloped area that provides aquifer recharge, policies and regulations may recommend low-impact development practices or even land acquisition as the preferred tool for protection.

6.4.3.3 Typical Steps for a GRIST Plan

While each local jurisdiction might need to develop a GRIST plan in its own way, there are some key steps that each should address (discussed below). Some of these steps may overlap with the landscape analysis discussed in Chapter 5. For detailed guidance on GRIST planning, please refer to the four-volume workbook titled *Local Greenprinting for Growth* (Trust for Public Lands and National Association of County Officials 2002).

Step 1- Develop the Overall Approach and Define the Geographic Scope

Developing a GRIST plan requires 1) defining the scope of the project, 2) establishing a means of engaging the community through education and public input and providing a forum for group decisions on the plan, and 3) understanding fiscal costs and benefits.

Decisions will be needed regarding the geographic scope of the GRIST plan and the resources that will be examined. The geographic scope is the portion of the landscape under consideration: Is it at the scale of the contributing landscape involving several jurisdictions, or is it a management area such as a county, city, or sub-basin? Defining what areas should be part of a greenprint should ideally be examined in light of the sensitivity of different areas identified during the landscape analysis.

The community must be informed and engaged early in the process because GRIST planning is a process of community visioning and decision-making. Public understanding and involvement are essential to the success of the greenprint design. A communication plan should be created early in the process, identifying how the local citizens will be engaged, what committees will be used to make planning decisions, what will be their composition and decision-making power, etc.

It is advantageous to clearly articulate the fiscal savings that accrue as a result of GRIST planning from the start, both to the citizenry and government decision-makers. Some local jurisdictions conduct fiscal analyses comparing the cost of building infrastructure to the cost of protecting green infrastructure, including the tax savings that green infrastructure can provide to communities. Other fiscal benefits worth considering are those that result from attractive landscapes (e.g., parks and recreation lands, greenbelts, working farms, etc.). These greenspaces are increasingly important in attracting the creative workforce that can add to the economic growth of communities (Florida 2002). As mentioned previously, this is important information since the fiscal value of open space should be communicated to policy-makers as well as the community. (See Section 6.5 of this chapter for further discussion of fiscal benefits.)

Step 2 - Inventory Resources

Conducting an inventory of resources might consist of a landscape analysis as discussed in Chapter 5 or another method that is appropriate to assess the characteristics of the green infrastructure in the planning area. As discussed earlier in this chapter, using a landscape analysis ensures an understanding of the relationship of landscape processes and wetland functions (as well as other natural resources) and how they have been altered. Landscape data can be used in conjunction with information such as detailed ownership patterns and current or projected zoning overlays. Together, this information can assist with deciding how landscape processes and the functions provided by natural resources should be protected, as well as the type and location of preservation and restoration measures needed.

Figure 6-2 provides a simple, conceptual illustration of a landscape that has been inventoried as part of developing a GRIST plan. This graphic serves as the base for Figures 6-3 and 6-4 which illustrate subsequent steps in GRIST planning.

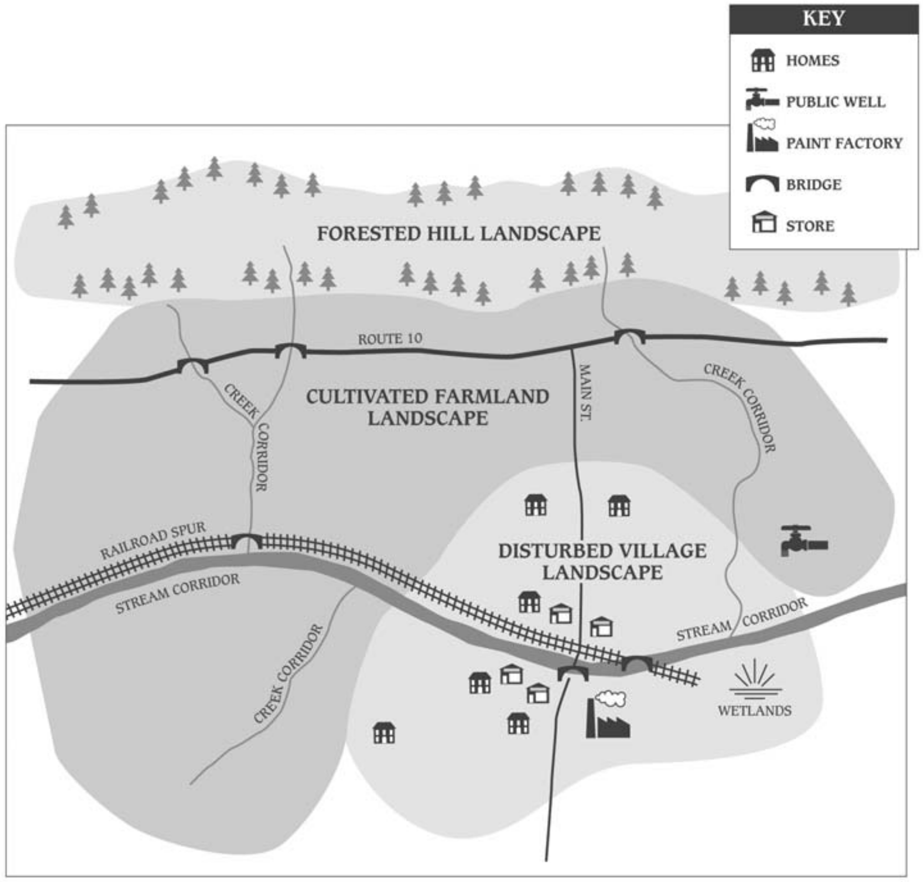


Figure 6-2. Conceptual representation of a landscape that has been inventoried as part of creating a GRIST plan (Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA).

Step 3 - Envision the Future

Envisioning the future is when the community establishes overriding principles that guide the development of the GRIST plan. These are the goals for the greenprint and may include preserving critical areas and natural resources within each landscape type, maintaining and/or restoring landscape processes, providing or enhancing open space corridors, and so on. The visioning process also inherently should include discussion and identification of the least sensitive lands that are most appropriate for development for a range of uses that are prioritized by the community.

Step 4 - Finding the Hubs and Links

Finding the hubs and links requires a detailed examination of key ownership and land use patterns and defining how they will be addressed in the GRIST plan. Applying a landscape analysis helps to target those areas needing special protection because of their sensitivity or importance. From the landscape analysis, identification of existing or potential hubs and links will become more readily apparent. For example, cultivated lands, areas covered by forest, and existing preserves will be obvious "hub" points from which to consider retaining or recreating "links" between the "hub" sites (see conceptual illustration in Figure 6-3). As this network is envisioned, steps needed to round out as well as implement the plan (e.g., purchasing parcels of land to connect habitat areas or restoring wetlands or riparian areas) become apparent.

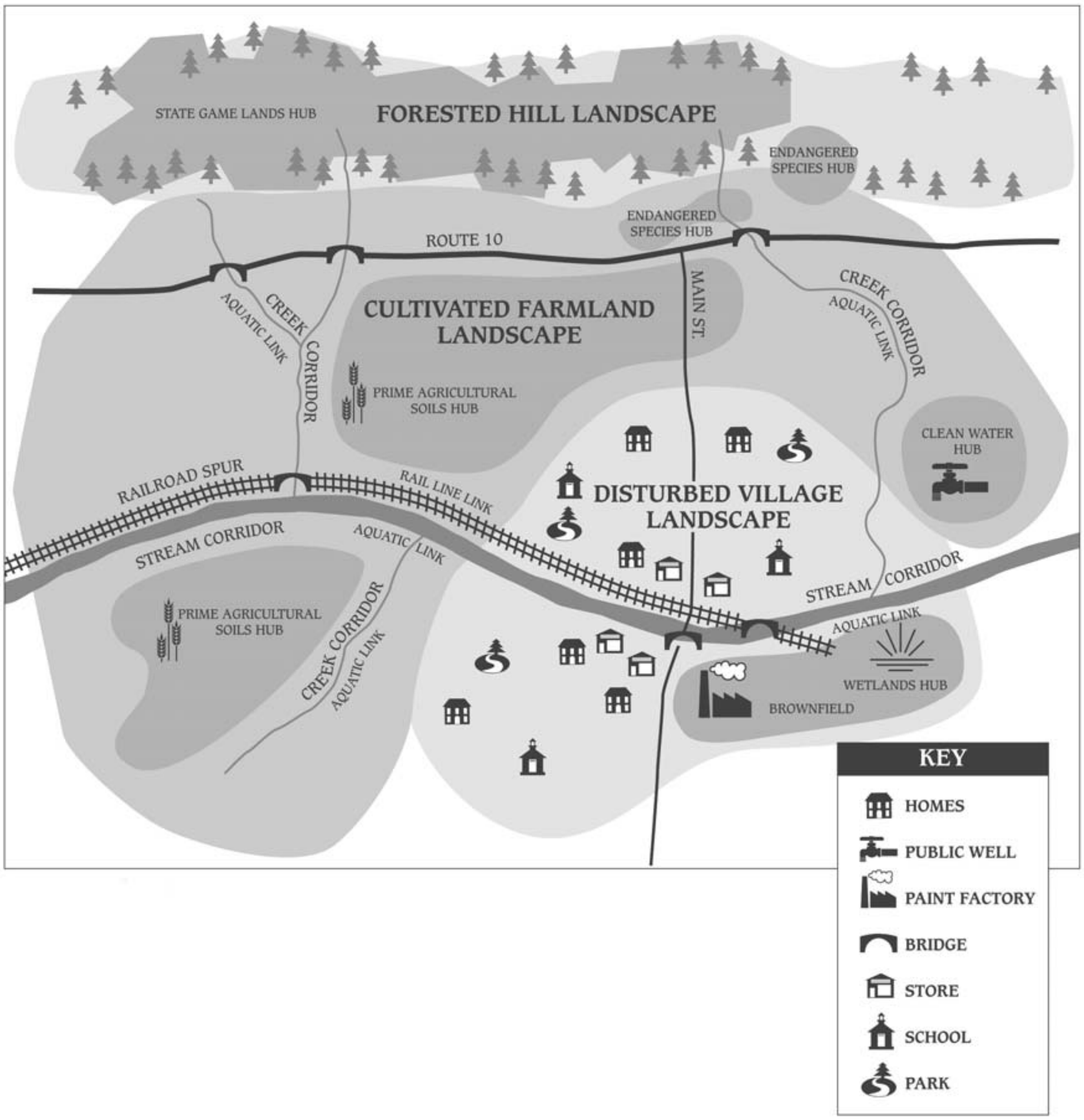


Figure 6-3. Conceptual representation of how hubs and links are identified as part of creating a GRIST plan (Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA).

Step 5 - Creating the GRIST Plan

Creating the GRIST plan involves identifying potential land-use scenarios based on the information described in the previous steps. Alternative scenarios can be examined using maps to apply different policy and zoning options. The community's goals for the future are applied to these options, and the appropriate course of action can be identified.

This stage in GRIST planning focuses on what specific provisions should be applied in various portions of the landscape to effectively conserve, preserve, and/or restore core areas of concern. At this stage of the process, the need to develop or revise the comprehensive plan, implementing policies and regulations, and non-regulatory tools should be apparent. Figure 6-4 provides a conceptual illustration of a completed GRIST plan.

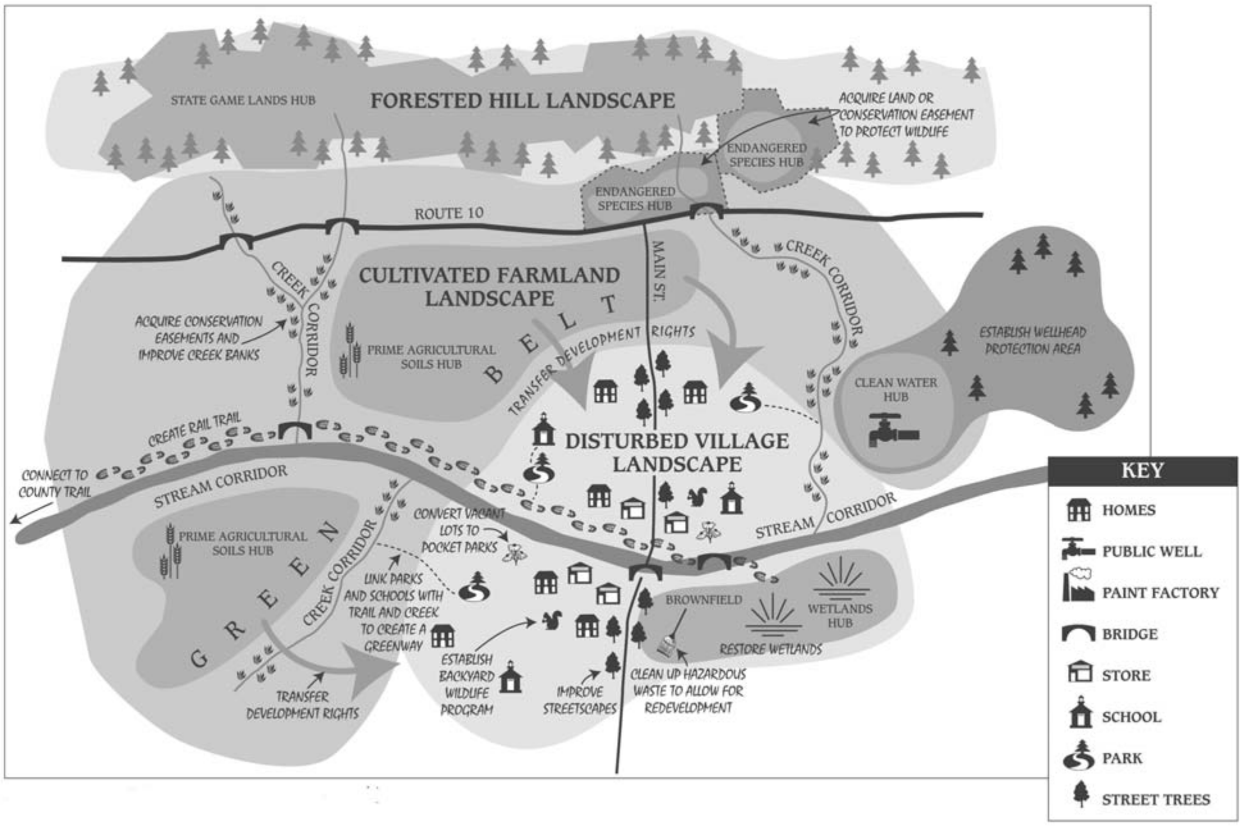


Figure 6-4. Conceptual representation of a completed GRIST plan (Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA).

Step 6 - Implementing the GRIST Plan

Several means can be used to implement a GRIST plan, beginning with revisions to the Land Use Element of the comprehensive plan. From there, zoning designations and critical areas ordinances or other regulations can be modified as needed. In addition, non-regulatory programs can be established which contain a mix of landowner incentives, acquisition funding, and restoration components. The GRIST plan should be applied throughout the planning area as new zoning decisions and new regulatory protections are developed in proposed urban growth areas, master-planned communities, etc.

6.4.4 Alternative Futures

Alternative Futures is another approach to land-use planning that uses Smart Growth principles. It is similar to Green Infrastructure planning; however, the analysis phase is especially well developed to scientifically quantify the impacts to ecosystems from different, future development scenarios. (See Section 6.4.4.1 on determining the scope of the analysis for more discussion on the topic.)

Alternative Futures offers an excellent example of how a scientific examination of the landscape, when combined with community involvement, leads to a more informed planning process that results in improved environmental conditions and community vitality. As with Green Infrastructure, the community helps to make the informed decisions about land use when evaluating the different scenarios for future development.

A landscape analysis is used to create a series of scientifically supported scenarios that depict what the landscape might look like and how it will perform under different future land-use options. Each scenario is analyzed in regard to the environmental concerns and community priorities that have been identified, similar to those already discussed in the sections on Smart Growth and Green Infrastructure. The analysis uses metric measures (discussed later in this section) to play out the future depictions of development, allowing communities to better assess and evaluate the potential benefits and impacts of each scenario on the environment and community's quality of life.

As with Green Infrastructure, Alternative Futures relies heavily on involving an interested and informed citizenry in the planning and design of a desired future. A strong emphasis is placed on early communication, education, and participation. Community meetings are held to provide the public with maps showing examples of how the landscape will look under the different scenarios. Maps are used to compare different scenarios which reflect various policy and regulatory choices (ranging from more to less stringent protections). The sensitivity of the landscape to disturbances that would result from each scenario is evaluated carefully. Visually comparing the impacts of these scenarios provides an exceptional tool for helping the public to better understand what is at stake and thus make more informed land-use choices about their community's future.

When the preferred option is selected, the result is likely to be a land-use plan based on both protection of the environment and the identified needs of the community. As with Green Infrastructure planning, it is most likely to be both fiscally and environmentally sustainable. It represents the most informed choice, therefore, making it a "smarter growth" alternative.

6.4.4.1 Determining the Scope of the Analysis

The analysis, which is the hallmark of Alternative Futures, involves a broad, logic-driven process that incorporates the specific needs of a local community while evaluating land-use scenarios for their ability to retain long-term environmental and economic vitality. It begins with assessing the current condition of the landscape and land uses.

The community, with the technical assistance of supporting agencies, develops the scope of the analysis: size of the planning unit to be analyzed, scale of the effort, functions and issues that are of interest, the approach, method, and metrics used in the analysis, and the capabilities of the local government.

Size of the Planning Unit

The size of the landscape planning unit to be analyzed may be as large as a regional, terrestrial ecosystem (such as the Puget Lowlands), a large drainage basin (like the Snohomish River) or as small as a local sub-basin. The unit may cross several political boundaries or only encompass a limited portion of one jurisdiction. It may cover many miles and acres or only a few.

Scale of the Effort

The scale of the effort refers to whether the analysis will be designed to provide information for broader strategies and visions or for a more focused effort. This decision affects the type of scientific method(s) chosen and the level of detail that will be used to conduct the analysis. Generally, the analysis for broader strategies or visions involves larger geographic areas, and less detailed (more general) methods are appropriate. By contrast, a more focused planning effort might involve a sub-basin, for example, and require methods that result in more detailed information that is focused on spatially explicit, management options and recommendations. With this information, specific on-the-ground actions, or consequences, can be clearly evaluated.

Functions and Issues of Interest

Analyzing the landscape is the best approach to understand landscape processes and ecosystem functions at work across the planning unit and to examine ecological issues of concern. Therefore, the analysis may need to broadly cover a suite of functions and/or issues, or it may need to focus on specific areas of greatest concern. The community may decide the analysis should focus on current problems or problems that may result from future land uses. For example, the community may select flooding, water quality, habitat and biodiversity, or groundwater recharge as the issues/functions they believe should be examined in the analysis.

Approach, Method, and Metrics

Selecting the approach for conducting the Alternative Futures analysis will follow the previous decisions. Approaches that are “geospatial” must be compatible with the size of the planning unit, the scope of the process, and the scale of the effort. Geospatial refers to the geographic location and characteristics of natural or constructed features and boundaries on the Earth. Generally, geospatial approaches are used to simulate the effects of land-use change on landscape processes and ecosystems.

There are two geospatial approaches that can be used in an Alternative Futures analysis depending on the local community's particular needs:

- **Forecasting**. The common approach is to apply models that evaluate the impacts and environmental outcomes expected under several different development scenarios. Here each policy option is simulated in the model to predict the appearance and environmental performance of the future landscape, resulting from that policy choice.

- **Backcasting.** Alternatively, a concept called "backcasting" can be applied to develop future scenarios aimed at achieving certain desired end-points (Robertson 2003). In this approach, the future landscape condition is selected first. Then analysis and modeling are focused on effectively finding development policies that will successfully achieve that pre-chosen outcome. This is a very effective approach for holding the line in places where further degradation will collapse an entire ecosystem, leaving the community's economic vitality in crisis.

Method for Analyzing the Landscape

Before selecting the approach to use for an Alternative Futures analysis, a good starting point, as previously mentioned, is analyzing the landscape. Appendix 5-B lists some methods that can be used to analyze the landscape and one of the methods is being developed by the Department of Ecology (www.ecy.wa.gov/programs/sea/landscape). It provides a geomorphic examination of landscape processes in a defined area using a Geographic Information System (GIS). It is designed to be used in planning and can provide information at more than one geographic scale. For example, it can be used for larger planning units to provide a broad understanding of the processes at work in the landscape and to identify regional issues of concern such as water quality problems. It can also be used within smaller areas of interest or concern to conduct more refined analyses.

Products of Ecology's method for landscape analysis include characterizations of past, current, and potential environmental conditions. The analysis can identify problem areas that are of concern and relate them to the existing landscape processes and the ecological functions in the area. Examples include beaches with shellfish beds that have been closed, areas with poor water quality, habitat areas that need to be restored, etc. The analysis can be used to develop proactive strategies to avoid future impacts of development.

Assessment Metrics

Along with the landscape analysis method, equally important in the Alternative Futures analysis is the use of appropriate assessment metrics or measures: environmental indicators of condition, stress, or response within an ecosystem that can be used in a predictive manner. Metrics are usually selected based on a significant statistical correlation with scientific data linking environmental stresses to a predictable environmental response (e.g., a correlation between impervious surface and the condition of aquatic habitats). Assessment metrics are often calibrated to better reflect local conditions within the specific area in which they will be applied. Several metrics are typically used in order to ensure the reliability of the analysis. The selection and use of such assessment metrics is an important and key component of evaluating alternative land-use scenarios.

Current research in the Pacific Northwest, and Puget Sound specifically, is building our understanding of some of the key stresses that affect landscape processes throughout the region and within particular local areas. Local researchers (e.g., Alberti et al. 2003), using geospatial techniques, are investigating and developing various assessment metrics essential to retaining watershed condition such as amounts of impervious surfaces, road density, number of stream crossings, and riparian and floodplain connectivity. These measures are being offered to practitioners for pilot testing and application.

When using these metrics, communities can expect to identify, for example, what percentage of cover from relatively undisturbed vegetation is needed to prevent problems within watersheds. Another example is what percentage of connectivity between habitats will assure that existing habitats remain viable. This information is directly used in the comparison of different land-use scenarios, for choosing the preferred alternative, and for implementation of the preventative or corrective actions that follow.

Local Government Capacity

It is important to recognize that the scientific rigor of the analysis and the success of the planning process may be dependent on a number of local factors such as:

- Type, extent, and reliability of natural resource data currently available in the landscape planning area
- Skills of existing staff in regard to conducting an Alternative Futures analysis, especially GIS applications
- Adequate funding to employ the assistance of consultants if needed
- Time needed to complete the steps of the analysis and planning process
- Ability to engage the public and coordinate the effort

Given all these factors, how an Alternative Futures process is conducted (both analysis and planning) will vary widely between jurisdictions and planning units. The value of conducting an Alternative Futures analysis, however, remains. It can provide important information such as the longer-term environmental costs and benefits of various development scenarios, thereby pointing out possible solutions and misperceptions. The result may be the achievement of multiple goals: protecting valued natural resources, maintaining or improving community quality of life, retaining economic vitality, and saving tax dollars. (See Section 6.5 for a discussion of fiscal benefits.)

6.4.4.2 Local Example of Alternative Futures Planning

In January 2001, the Kitsap County Department of Natural Resources used the Alternative Futures process to examine different scenarios in the Chico Creek watershed. The Chico Creek watershed drains 16.3 square miles of land west of Dyes Inlet in Kitsap County. Their goal was to develop an amendment to the County's comprehensive plan for this subarea. Locally referred to as "Planning by Watershed," the pilot Alternative Futures project was funded by the U.S. Environmental Protection Agency under a grant to the Puget Sound Action Team. Information regarding the details of the project can be found at: www.psat.wa.gov/Programs/growth/LID_futures.htm.

The County found the Alternative Futures approach was a unifying process that resulted in the integration of land-use planning with other regional efforts such as watershed planning, salmon recovery, clean water plans, as well as regulatory directives in the Growth Management Act. Using the Alternative Futures process, the county developed their preferred development scenario by:

- Conducting a technical analysis of current conditions in the watershed
- Involving citizens and interested parties in developing and selecting scenarios
- Testing the scenarios using Geographic Information System and scientific analyses
- Making an informed selection of the preferred scenario for future land use

To accomplish these tasks, they established goals for analysis of the watershed, analysis of the scenarios, and the planning process.

A strong component of Kitsap County's approach was public involvement. Five subcommittees were established, including an education work group, a public involvement work group, a technical work group, a restoration work group, and a watershed advisory committee. From these they constructed an effective education campaign and public involvement process.

Four scenarios were examined: 1) the "current regulatory" condition, 2) a "strong development" scenario, 3) a "strong conservation" scenario, and 4) a "moderate" scenario falling between development and conservation. A suite of analyses, using natural resource indicators, was conducted to identify the impacts of each alternative. The strong development scenario was quickly dropped due to the severity of impacts. The current regulatory condition then became the option with the greatest amount of development. In the end, the community selected the moderate development scenario which incorporated conservation-based patterns and practices.

Kitsap County officials were pleased with the benefits of the Chico Creek project and propose using the Alternative Futures process to develop subarea plans for other watersheds throughout the county.

6.4.5 Combining Complimentary Approaches

Landscape analysis, Green Infrastructure, and Alternative Futures are all complementary approaches. Applying the core elements of these three approaches in combination can offer a strong analytical package for making land-use decisions that will benefit communities while considering landscape processes.

Information about the landscape is an essential component of Green Infrastructure and especially Alternative Futures, as described in the preceding sections. In brief, it can be used as a tool to integrate information about different resources into the planning process in order to identify the issues of highest priority and develop alternative land-use scenarios. These scenarios can be analyzed (using GIS) and visually displayed as maps. Ecology's method for landscape analysis (www.ecy.wa.gov/programs/sea/landscape) can be used from a larger scale of analysis down to a smaller scale, thus assessing across scales and focusing in on key issues. Therefore, landscape analysis together with GRIST or Alternative Futures can provide a very useful complement for visually displaying and analyzing the effects of land-use decisions on the maintenance of landscape processes.

Adding the concepts of GRIST planning to Alternative Futures can:

- Reinforce the benefit of using landscape analysis as the basis for planning so that landscape processes can be sustained
- Emphasize the role of landscape processes and the functions of ecosystems such as wetlands as "infrastructure" and therefore worthy of protection for fiscal reasons
- Add hubs and links as corridors important to the maintenance of landscape processes
- Integrate working landscapes (such as agricultural and forest lands) as valued green space into land-use plans

The results of Alternative Futures may be more successfully implemented if combined with GRIST planning because it focuses on implementation using conservation measures and thus it can immediately advance conservation decisions which result from the Alternative Futures process.

Likewise, Alternative Futures compliments GRIST planning by:

- Applying metrics to quantify the impacts of disturbance on the landscape and to evaluate options
- Targeting sensitive features and critical functions which are important to include in a greenprint

6.5 Fiscal Savings and Other Benefits

Protection of landscape processes and the functions of ecosystems, such as wetlands and other critical areas, can provide important fiscal savings as well as other benefits. Many people assume that revenue will be lost as a result of land protection, while the costs of constructing infrastructure, to provide necessary services once green space is gone and landscape processes are degraded, are often overlooked.

Several recent papers have documented the costs associated with losing ecosystems that provide landscape processes and wetland functions. In *Taking its Toll: The Hidden Costs of Sprawl in Washington State*, Mazza and Fodor (2000) point to water quality and quantity impacts, smog and health issues, habitat and species losses, overall watershed decline, and general quality of life concerns. All of these losses can affect the economic viability of communities.

A report by the Trust for Public Land and The National Association of County Officials (2002) presents the numerous benefits of recognizing certain lands as necessities, not just amenities. The benefits include:

- Fiscal savings, which result when the benefits gained from preserving open space exceed the cost
- Economic benefits, when improved quality of life attracts business investment
- Free infrastructure, when green space provides services that avoid the expense of building infrastructure to replace functions, thus saving tax-payers' money
- Environmental benefits, when land-use planning is linked to the protection of landscape processes
- Health and social amenities, when, for example, recreation opportunities deter antisocial behavior by providing constructive activities, thereby contributing to the health and wellness of communities

The following paragraphs discuss and provide examples of three general types of fiscal savings resulting from protection of landscape processes through the planning processes described in this chapter.

6.5.1 Using Green Infrastructure Instead of Constructing Infrastructure

As demonstrated in the examples that follow, communities around the country that conduct a fiscal analysis of their revenues versus expenditures are finding that conservation of green infrastructure saves money in the long term. Purchasing and preserving land results in cost savings by avoiding the need to build infrastructure such as systems for controlling flood water when landscape processes and the functions of ecosytems are lost.

When New York City was faced with the need to spend $8 billion on new water filtration and treatment plants, they instead purchased 80,000 acres of land in the Catskill Mountains for $1.5 billion. The land functions to filter and purify drinking water. Purchasing the land (which is located in the watershed for the city) saved the city $6.5 billion by not building treatment plants and another $300 million a year in forgone costs of operating them.

In the Charles River Basin in Massachusetts, 8,500 acres of wetlands were acquired and preserved to provide storage for floodwater in the valley. The cost for acquisition was $10 million compared to the $100 million cost of an alternative proposal which would have resulted in the construction of dams and levees to accomplish the same goal (Fausold & Lilieholm, 1996).

The value of the tree canopy was illustrated in the Willamette/Lower Columbia region here in the Pacific Northwest. In a 7-million-acre area, the tree canopy has been reduced from 46% to 24% between 1972 and 2000 due to the expansion of roads, buildings, and pavement. This 28-year loss in canopy has resulted in $2.4 billion in costs for managing the increased stormwater runoff, according to a Regional Ecosystem Analysis by American Forests (2001). In addition, each year the lost canopy of trees would have absorbed 138 million pounds of pollutants and saved $322 million in related cleanup costs.

Despite the significant loss in tree canopy, the remaining forest continues to provide functions related to stormwater and water quality. According to the study, the region's remaining trees are still detaining and purifying a massive quantity of stormwater that would have otherwise required construction of a $20.2 billion treatment plant to manage runoff. The trees also absorb 178 million pounds of pollutants on an annual basis, whose potential cleanup would cost $419 million a year.

6.5.2 Increase in the Local Tax Base

Protecting areas that provide landscape processes can increase the tax base by attracting home buyers to properties near green spaces such as wetlands, thereby improving the homeowner's quality of life. This is called "enhancement value," the tendency of open space to enhance the property value of adjacent properties

Quality of life is a determining factor in real estate values and economic vitality. The green spaces of Portland, Oregon, for example, have helped build this city's reputation as one of the country's "most livable cities." A study in Portland found that residential property values increased, $436 for every $1000 feet, if they were in closer proximity to a wetland (Barclay et al. 2004). "The real estate market consistently demonstrates that many people are willing to pay a larger amount for property located close to parks and open space areas than for a home that does not offer this amenity," writes John L. Crompton, a professor at Texas A&M University (Sherer 2003).

The higher value of these homes means that their owners are paying higher property taxes, thereby benefiting the community as a whole. In some instances, the additional property taxes are sufficient to pay the annual charges on bonds used to finance the acquisition and development of open spaces. This has been demonstrated in a study examining the proximity of residences to greenbelts in Boulder, Colorado. Here the average values of homes next to the greenbelt were 32% higher than those just 3,200 feet away. The study showed that the greenbelt added $5.4 million to the total property values of one neighborhood, generating $500,000 per year in additional property taxes. This was enough to cover the $1.5 million purchase price of the greenbelt in only 3 years (Sherer 2003).

Home owners can get tax relief to off-set an increase in property values and taxes if conservation easements are involved. Federal income tax law (U.S. Treasury Regulation Sec. 14 (h)(3)(i)) states that valuation of conservation easements is required to take into account the resulting increase in adjacent property value on land owned by the same donor.

The ability to attract business to a community is also affected by the presence of open space and the health of the environment. Barclay et al. (2004) have noted that environmental quality plays a pivotal role in the ability of a region to attract workers and new firms. They state that a community with a degraded environment is more likely to suffer economically.

It is important to note that the value of natural resources is not fixed in time: The values of many of the landscape processes and the functions of natural resources are growing as they become increasingly scarce.

6.5.3 Reducing Costs of Public Services

The cost of providing public services (roads, fire & police protection, etc.) to a community is less in areas with open spaces. A national study by the American Farmland Trust (cited in Mazza and Fodor 2000) showed that for every $1 generated in tax revenue, the median cost to provide services to residential areas was $1.15, while only $0.37 was spent in areas with agricultural or natural resource lands. The Trust conducted a similar study in Skagit County and found that infrastructure costs for residential services were $1.32 for each dollar of tax revenue as compared to $0.32 for farm, forest, and open space lands.

In addition, the tax base generated by new homes does not cover the actual cost of providing the basic services required. A study in Washington showed that the added expense of off-site facilities (such as schools) that would provide services to a typical new home is $20,000 to $30,000, which does not match the tax revenue generated to cover these costs (Mazza and Fodor 2000). Additional information on this topic can be found in a paper on the *Three Myths of Growth* (Fodor 1996), which debunks the belief that growth builds a tax base that provides enough revenues to cover the necessary services.

Developing land using the guidance of a GRIST plan may result in lower property and school taxes. For example, the town of Pittsford, New York, commissioned Behan Planning Associates to apply a fiscal model to determine the costs of expanded urban development versus the costs of land protection. The fiscal model predicted future tax rates based upon the costs and revenues associated with future land-use patterns. The model estimated that, for the average tax payer, property and school taxes would increase only $1400 over 20 years using the "green infrastructure" scenario, in comparison to $5000 if the lands were fully developed under their existing policies. This analysis revealed that it would be much less expensive to implement the greenprint than allow development in the wrong locations (Trust for Public Land and National Association of County Officials 2002).

Additional resources

Many resources are available for local governments that wish to pursue Smart Growth, Green Infrastructure, Alternative Futures, and associated concepts discussed in this chapter. For further information, see the published and online resources listed in Appendix 6-A.

Chapter 7
Prescribing Solutions: Comprehensive Plans

7.1 Introduction

This chapter builds on the discussion in Chapter 6 about planning approaches that can be used to develop or update a comprehensive plan. The planning tools discussed in Chapter 6, such as Green Infrastructure and Alternative Futures, allow jurisdictions to use the data generated from a landscape analysis to create a vision of the future, integrating landscape-scale issues with the community's priorities regarding land uses.

Developing or updating a comprehensive plan, and the other planning approaches discussed in Chapter 6, are all part of Step 2 (Prescribing Solutions) in the four-step framework discussed in this volume (Figure 7-1). The tools for landscape analysis described in Step 1 (Chapter 5) can provide information to help guide the development or revision of a comprehensive plan, shoreline master program, or other planning effort. Regulatory and non-regulatory solutions, discussed later in Chapters 8 and 9, are also part of Step 2 and can be used to implement plans and policies.

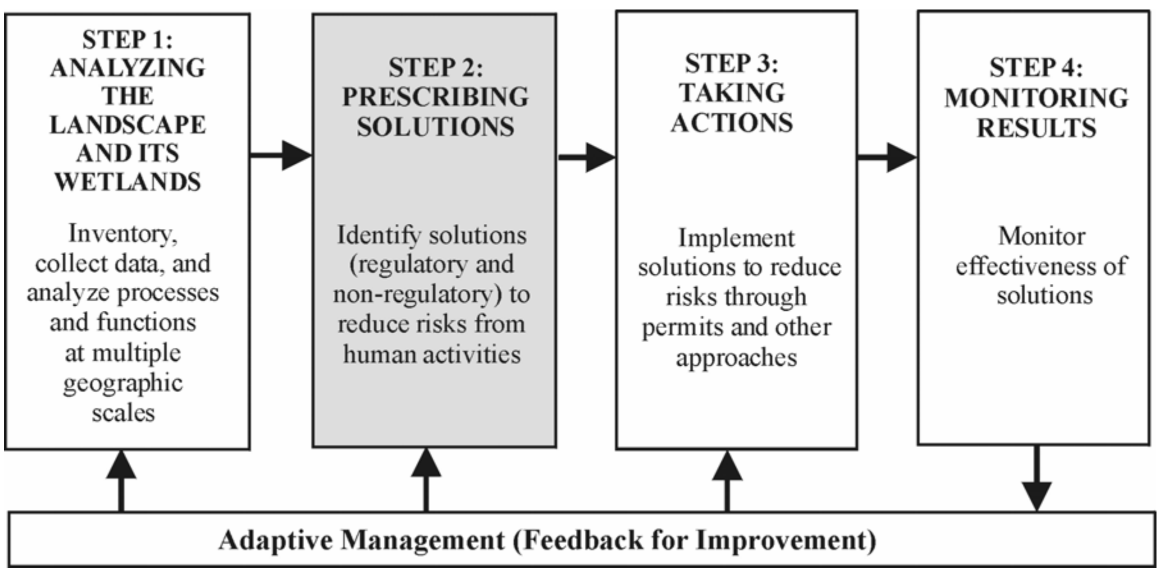


Figure 7-1. Comprehensive planning is part of Step 2 in the four-step framework recommended for protecting and managing wetlands (shaded box).

By integrating landscape analysis and public involvement into the planning process, effective policies and regulations can be developed that reflect choices about land use that will protect, maintain, and restore landscape processes. Therefore, the results of landscape analysis should be incorporated into the goals and policies of the relevant mandatory and/or optional elements included within comprehensive plans. Because comprehensive plan goals and policies establish the basis for much of the regulatory language and codes, such as zoning, developed by a jurisdiction, the information in a comprehensive plan should reflect what is needed to maintain landscape processes and protect wetland functions and values.

Doing a landscape analysis is not a recommendation to implement an entirely new process. Aspects of a landscape analysis, as described in this volume, are already a required part of developing or amending/updating a comprehensive plan. The reader is referred to Chapter 6 for a thorough discussion of the importance of using information generated by a landscape analysis to inform planning, including comprehensive planning.

Although it is important to use information that includes data from the scale of the contributing landscape, comprehensive planning is conducted at the scale of the management area. The management area is restricted to the lands over which a jurisdiction has authority, because the boundaries for planning are political, not driven by the environmental processes at a landscape scale. This chapter provides a brief overview of comprehensive planning (Section 7.2), followed by a discussion of the mandatory and optional elements, including subarea plans, of comprehensive plans as established by the Growth Management Act (GMA) (Sections 7.3 and 7.4). The chapter includes examples of how typical language in a comprehensive plan can be modified to incorporate landscape analysis. It also discusses how subarea plans can be used by jurisdictions that would like to incorporate landscape information within a smaller planning area.

7.2 An Overview of Comprehensive Planning

As discussed in detail in Chapter 2, and summarized briefly in the introduction of Chapter 6, the GMA dictates that counties and cities that meet certain provisions must plan for future growth (RCW 36.70A.040). They must develop comprehensive plans and development regulations, including critical areas ordinances, to meet the intent and requirements of the GMA (RCW 36.70A.020). Comprehensive plans and regulations are subject to continuing review and evaluation by the county or city that adopted them. The GMA also requires local jurisdictions to include best available science in the development of policies and development regulations used to protect the functions and values of critical areas, including wetlands (RCW 36.70A.172).

The key GMA requirements are as follows:

- Identify and protect critical areas and resource lands
- Designate county-wide planning policies and urban growth areas (for counties and cities fully planning under the GMA)
- Prepare and adopt comprehensive plans
- Adopt development regulations to implement the comprehensive plan
- Evaluate and update the comprehensive plan and development regulations

Comprehensive planning, as the name implies, is a planning process that encompasses all the activities that occur or may occur on the land over which a local government has jurisdiction. Typically, a comprehensive plan consists of a "map or maps and descriptive text covering objectives, principles and standards" used for its development (RCW 36.70A.070). A comprehensive plan is a document that provides direction for decisions about land use in a local jurisdiction. As described in the introduction to the Spokane County Comprehensive Plan (http://www.spokanecounty.org/BP/Documents/CompPlan/Chapter1.pdf):

> *The Comprehensive Plan is a set of goals, policies, maps, illustrations and implementation strategies that states how the County should grow physically, socially, and economically. The plan emphasizes innovative and flexible strategies to guide growth and development. One of the central themes of the Plan is the promotion of economic development that occurs in harmony with environmental protection and preservation of natural resources. The Plan recognizes the interests of the entire community and promotes cultural and ethnic diversity.*
>
> *The Comprehensive Plan establishes a pattern of land uses to shape the future in desirable ways...*

A comprehensive plan is composed of elements that address typical issues for a jurisdiction. Elements such as transportation and capital facilities (e.g., domestic water sources, sewage treatment, essential public facilities, and stormwater facilities) are incorporated into the planning process to ensure that adequate infrastructure is provided for existing and future land uses. In addition, there are elements that address the protection of natural resources, such as agricultural areas, and critical areas such as wetlands, geologic hazard zones, and fish and wildlife habitat.

Under the GMA, comprehensive plans must contain the following elements:

- Land Use Element
- Transportation Element
- Housing Element

- Capital Facilities Element
- Utilities Element
- Shorelines Element
- Rural Lands Element (for counties)

Also, if state funding is provided, Economic Development and Parks and Recreation Elements are required to be included in plans.

Optional elements may also be included in comprehensive plans, such as conservation, energy, recreation, and subarea plans, where appropriate. Some jurisdictions include additional elements that consider the environment. For example, Skagit County includes an Environment Element that specifically focuses on the influences of wetlands, streams, wildlife habitat, and other environmental factors on planning and land use, whereas Yakima County includes a Natural Setting Element. Overall, the plan "shall be internally consistent and all elements shall be consistent with the future lands use map" (RCW 36.70A.070) and shall be coordinated with the comprehensive plans of jurisdictions with common borders or related regional issues (RCW 36.70A.100).

The Legislature also set forth goals to guide the development of comprehensive plans. Application of a landscape analysis and principles for low impact development would assist in meeting the following of those goals:

- Encouraging development in existing urban areas
- Reducing sprawl
- Ensuring that adequate public facilities are in place for new development
- Retaining, enhancing, and conserving open space, recreation, and habitat areas
- Protecting the environment and enhancing water and air quality and availability of water
- Meeting the goals and policies of the Washington State Shoreline Management Act as set forth in RCW 90.58.020
- Encouraging economic development that is within the capacity of the state's existing natural resources

The Legislature also directed local governments to include innovative techniques for land-use management in their comprehensive plans, including density bonuses, cluster housing, planned unit developments, and transfer of development rights (RCW 36.70A.090). Landscape analysis and principles of low impact development would also assist local governments in meeting this provision.

7.2.1 County-wide Plans and Policies

The GMA establishes counties as the primary units for regional land-use planning. An important aspect of planning under the GMA is the requirement for counties to adopt planning policies that are county-wide under RCW 36.70A.210. County-wide planning policies are adopted in consultation with the municipalities in the county, to support and guide cross-jurisdictional cooperation between the county and the municipalities located within it.

At a minimum, a county-wide planning policy needs to address the development of urban growth areas, joint planning for these areas, siting public capital facilities of a county-wide or state-wide nature (such as transportation facilities), providing for affordable housing, economic development and employment, and analyzing the fiscal impact of the policies. The county-wide policies are binding on state agencies. Large urbanizing counties (those with population greater than 450,000 people) adjacent to each other are required to adopt multi-county planning policies.

Plans and policies for critical areas may need to be amended to create the basis of regulations that include best available science across jurisdictions. Because critical areas such as wetlands and the landscape processes that support them often span multiple jurisdictions, local governments should consider whether their current policies and regulations are consistent with the programs of neighboring jurisdictions. Jurisdictions should not, however, reduce regulatory protections for critical areas as the sole basis for achieving consistency across jurisdictions.

In fact, managing natural resources at the larger geographic scales of contributing landscapes or watersheds has become recognized internationally as an important approach to protecting aquatic resources, including wetlands (United Nations 1997). While planning at this scale may be beyond the purview of comprehensive planning for some local jurisdictions, it is possible for local jurisdictions to join existing programs to develop plans and actions at larger geographic scales. Examples of regional planning efforts being conducted by state and federal agencies related to aquatic resources are described in Appendix 7-A.

7.2.2 Tools for Implementing Comprehensive Plans

The policies of comprehensive plans can be implemented through a variety of means. The most common and effective approach is to include policies in development regulations adopted through ordinance that then become mandatory. In some jurisdictions, policy language can be implemented through provisions of the State Environmental Policy Act. However, policy language is often viewed as more discretionary than development regulations that are adopted.

Under the provisions of the GMA, development regulations have to be consistent with the comprehensive plan that the jurisdiction has adopted. This is one of the key provisions of the GMA related to comprehensive plans and regulations: Ensure consistency between plans, policies, and regulations, and provide coordination between contiguous jurisdictions.

The policies, goals, and values identified in the comprehensive plan are implemented through these regulations. Regulations are adopted through ordinances to prescribe general and permanent rules. In conflicts concerning development activity, the development regulations are the primary means for resolving disputes and carry more legal weight than the comprehensive plan policies. Regulatory tools are discussed in Chapter 8.

A comprehensive plan can also be implemented through non-regulatory tools, as discussed in Chapter 9 of this document.

7.3 Mandatory Elements of Comprehensive Plans

Under the GMA, comprehensive plans must contain certain mandatory elements. Many of the mandatory elements of a comprehensive plan (RCW 36.70A.070) can incorporate the results of a landscape analysis and the Smart Growth planning processes described in Chapters 5 and 6. The mandatory elements that are the most applicable to wetlands protection and management include:

- Land Use Element
- Capital Facilities Plan Element
- Rural Lands Element (for counties)
- Transportation Element

Optional plan elements, especially conservation plans and subarea plans, may also be important in order to create an effective program to protect and manage natural resources that minimize cumulative impacts. These optional elements are discussed in greater detail in Section 7.4.

Each of the mandatory elements that can most appropriately be used for protecting and managing the landscape processes that maintain wetlands and their functions are described below. Examples of text for policies that incorporate landscape analysis are provided for each element.

7.3.1 Land Use Element

The Land Use Element is the heart of the comprehensive plan. It determines the "proposed general distribution and general location and extent of the uses of land" including population densities, building intensities, and future population growth estimates (RCW 36.70A.070).

The tone of the Land Use Element is set by the text of the Introduction and Framework, which identify key guiding values and the priorities of the community. For example, as noted in the opening paragraphs of the City of Cheney Land Use Element (http://cityofcheney.org/planning/comp_plan/comp_plan7.pdf):

> *The Land Use Element of Cheney's Comprehensive Plan is central to the entire planning process. The land use patterns are what determine the character of the community and dictate the types and locations of future development. This element of the plan determines the traffic patterns and the ability or inability to effectively alter those patterns over time. It can be sensitive or insensitive to the natural and physical characteristics existing within a community and, overall, it is the primary element which will determine the quality of life for the citizens of Cheney.*

In Skagit County, the Land Use Element focuses almost exclusively on human uses of the land in current and future conditions. The County's Land Use Element assesses the condition, location, and distribution of existing land uses and identifies the appropriate intensity and density of land uses for the future based on development trends in the county and surrounding areas. The Land Use Element includes guidance for the development of commercial and industrial land uses as well as residential, agricultural, and other uses.

In some comprehensive plans, the Land Use Element begins by describing in some detail the natural history and ecological conditions of the landscape within the jurisdiction. This information is then used to plan land use on the landscape. The City of Bainbridge Island, for example, uses this approach to establish a "sense of place" before designating land use types. Other comprehensive plans do not include an extensive natural history section, but limit their descriptions to the existing and proposed land uses within the jurisdiction.

The Land Use Element must specifically provide for the protection of groundwater that is used for potable water. Also, where applicable, the Land Use Element must review drainage, flooding, and stormwater runoff and provide guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state.

Most comprehensive plans state one or more "goals" which are vision statements that attempt to identify the priorities and values of the community. Following the goals may be a series of one or more "policies" related specifically to each identified goal. Sometimes the policies overlap or are even repeated from one goal statement to the next or from one element of the comprehensive plan to another.

7.3.1.1 Incorporating Landscape Analysis into the Land Use Element

Logically, landscape data, or any environmental information, should be collected <u>and</u> analyzed prior to drafting the Land Use Element of the comprehensive plan. The analysis outlined in Chapter 5 identifies landscape processes as well as wetlands and their functions. It identifies which areas need special management because they provide important processes, such as groundwater recharge and how wetlands function and contribute to the larger landscape processes. This type of analysis can also identify areas that, if restored or preserved, could improve functions and reduce cumulative impacts that cannot be avoided.

The Land Use Element can identify:

- The location and type/intensity of development consistent with protecting critical resources
- Areas critical to maintaining processes that support wetlands (e.g., infiltration and recharge areas, areas of critical subsurface and surface flow, discharge areas, areas of potentially high runoff)
- Areas that require restoration of landscape processes
- Areas that require protection (i.e., no development) in order to maintain critical landscape processes

The results of the landscape analysis described in Chapter 5 and additional planning approaches, such as Green Infrastructure or Alternative Futures analysis discussed in Chapter 6, can be used to guide the choices of land-use designations within a jurisdiction. Conducting a landscape analysis identifies critical locations within the management area where key landscape processes or wetland functions are provided. Integrating that information into a Green Infrastructure plan or an Alternatives Futures analysis allows the community to make informed decisions about land use that incorporate both human needs and environmental considerations at many geographic scales. The resulting land use choices, priorities, and goals can then be included in the policies of the Land Use Element. Such an approach can help ensure long-term maintenance of landscape processes and reduce the deficiencies of case-by-case permitting decisions.

7.3.1.2 Using Landscape Analysis in Different Sections of the Land Use Element

The policies in the Land Use Element provide the foundation for developing subsequent elements of the comprehensive plan, other plans, and regulations, and non-regulatory components of programs. The Land Use Element of a comprehensive plan may typically be divided into Overviews, Goals, and Policies. The shaded box on the next two pages provides an example of the Table of Contents of a typical Land Use Element (the example is modified from a draft of the City of Bainbridge Island's Land Use Element). The major sections of a Land Use Element are then discussed in detail following the shaded box. For specific portions of the Land Use Element, modifications are suggested regarding where to incorporate landscape analysis. Explanatory text and policies for the relevant portions and, in some cases, examples of text that could be used directly are provided.

Sample Table of Contents for a Land Use Element

Introduction

Framework of the Plan

Overview of Existing Conditions – Natural Environment

Note: This section describes the biological, physical, and geographic conditions of the jurisdiction. The same combination of data can be used in the landscape analysis (described in Chapter 5) to establish baseline conditions. The results of the landscape analysis would be woven through each of these sections, identifying the physical and biological linkages and areas that are critical for maintaining landscape processes and wetland functions.

Geography

Climate

Geologically Hazardous Areas

Watersheds

Wetlands

Streams

Groundwater

Aquifer Recharge Areas

Fish and Wildlife

Overview of Existing Conditions – Built Environment

Note: This section describes the human-made conditions and land uses currently present in the jurisdiction.

Residential Development

Commercial Development

Overview of Existing Conditions – Resource Lands

Note: This section describes the resources that humans use for economic purposes.

Agriculture

Forest Land

Mining

Goal and Policies/Principles of the Built Environment

Note: This section outlines the overriding intent and values of the jurisdiction for the built environment. Each subsection below contains the policies or principles that create the framework on which subsequent community plans and/or regulations are developed.

Framework of the Plan

General Land Use

Neighborhood Service Centers

Light Manufacturing

Residential Open Space

Environment

Sample Table of Contents for a Land Use Element (continued)

Goals and Policies/Principles of the Natural Environment

Note: This section outlines the intent and values of the jurisdiction for the natural environment.

- Fish and Wildlife Policies
- Aquatic Resources
- Frequently Flooded Areas
- Geologically Hazardous Areas
- Atmospheric Conditions
- Greenways

Goals and Policies/Principles of Natural Resource Lands

Note: This section outlines the intent and values of the jurisdiction for managed natural resource lands.

- Agricultural Lands
- Forest Lands
- Mining

The **Introduction** to the Land Use Element provides an overview of the Land Use Element and how information was obtained. If landscape analysis, or other environmental data, Green Infrastructure planning, or Alternative Futures analysis are incorporated, there should be a brief description of the methods used to generate the information.

The **Overview of Existing Conditions - Natural Environment** is where the results of a landscape analysis can be presented. It can also be where the criteria for establishing priorities for proposed land uses are described. The existing condition and the criteria for priorities set the stage for the future and would benefit from incorporating information about natural resources at all geographic scales. This would also be the location to describe the findings of Green Infrastructure planning or Alternative Futures analysis (discussed in Chapter 6), particularly in reference to establishing priorities. In this section it would be reasonable to present the conclusions from any public process used to create criteria or priorities for land use designations, as well as recommendations for preservation or restoration.

The **Overview of Existing Conditions - Built Environment** provides a summary of the relevant conditions of the developed lands within the jurisdiction. The character and extent of housing and lands zoned for various levels of residential use are described and contrasted with expected demands. Depending upon the jurisdiction, the section may contain descriptions of commercial and industrial lands, infrastructure (e.g., domestic water and public sanitary sewer systems), and transportation in sufficient detail on which to base the planning process. The overview of infrastructure and capital facilities is usually brief to illustrate existing conditions; detailed discussions are contained in the appropriate elements of the comprehensive plan. This section may include a description and discussion of existing housing stock and residential zoning designations. If the results of a Green Infrastructure planning or Alternative Futures analysis include recommendations or criteria for housing considerations, this is the location for those findings.

The **Overview of Existing Conditions - Resource Lands** focuses on lands used for commodities: agricultural lands, commercial timberlands, and mining and mineral extraction. Depending upon the jurisdiction, the overview may or may not describe lands zoned for commercial resource use. The results of Green Infrastructure planning or Alternative Futures analysis may identify some of these lands as critical hubs or links from the perspective of maintaining or restoring landscape processes. It is appropriate to discuss those findings in this section.

The next sections of the Land Use Element present examples of policies for the Natural Environment, Built Environment, and Resource Lands. Polices are statements that guide more detailed planning documents conducted at a management scale, such as community plans, basin plans, or neighborhood plans, as well as Green Infrastructure or Alternative Futures plans. These policies also form the basis for a jurisdiction's regulations. The policies must reflect the priorities for the jurisdiction. The policies should reflect the findings of a landscape analysis (or any environmental analysis) and the priorities of the community.

7.3.1.3 Landscape Analysis in the Policy Language of the Land Use Element

Policies can be modified to reflect the need for analyzing and protecting landscape processes that are necessary for the long-term protection of wetlands and the functions they provide. Specifically, a statement in the Introduction or opening section of the Land Use Element can provide the foundation for subsequent policies and regulations.

A policy statement can be created that directs the jurisdiction to use landscape analysis to identify lands that are critical to maintaining landscape processes, then to use this information in determining land use designations. Example policy statements include:

- A landscape analysis shall be conducted for each [subarea/planning area/sub-basin] to identify lands that are critical for the maintenance or restoration of the landscape processes that maintain wetland functions and minimize cumulative impacts

- Green Infrastructure planning or an Alternative Futures analysis will be conducted within each [subarea/planning area/sub-basin] to establish criteria and set priorities for land-use designations and protection of the landscape processes that maintain wetland functions

Below are two examples of typical policy statements that have been modified to include landscape analysis (new language is shown in *italics* and deleted words are indicated by ~~strikethrough~~):

- ~~Identified~~ Critical areas, *critical habitats*, shorelands, aquatic resource areas and natural resource lands *identified through a landscape analysis* shall be protected by restricting conversion *or rezoning to a buildable designation*; encroachment by incompatible uses shall be prevented by maintenance of adequate buffering between conflicting uses *and habitat function shall be maintained by establishing connective linkages between critical habitats identified in the landscape analysis*

- Open space corridors within and between urban growth areas shall be identified *based on the landscape analysis of critical habitats and linkages*; these areas shall include lands useful for recreation, fish and wildlife habitat *including corridors for movement between habitats*, trails, and connection of critical areas *to essential habitats to avoid future fragmentation*

Many existing policies in typical planning documents already include language that suggests identification and protection of environmentally sensitive lands. Examples of policy language that could be used to revise the Land Use Element of a comprehensive plan follow. These are only examples; there are many ways that the intent of these examples can be incorporated into a Land Use Element.

General Land Use

General Land Use goals and policies provide more detailed guiding principles for overall land use within a jurisdiction. The general goals for land use listed below have been revised (new text is in *italics*) to show that little modification may be required to incorporate protection of landscape processes and wetland functions based on the results of landscape analysis.

- Support land-use development patterns which protect public, health, safety and welfare, *and the long-term protection of the environmental processes at all geographic scales that support the functions of critical areas, including wetlands*

- Encourage dedication of open space *that is identified as critical for maintaining environmental processes or for providing habitat linkages based on a landscape analysis*, preserve *existing upland forest to the extent feasible*, and encourage the restoration of trees and vegetation to maintain the feel of the community

- Guide future development into concentrated urban growth areas where adequate public facilities, utilities and services can be provided

- *Use appropriate development techniques to minimize impervious surface and maximize infiltration of surface runoff*

- Protect and conserve long-term, commercially viable forest, agricultural, and mineral natural resource lands

- Retain rural landscape features and lifestyles

- Maintain open space, recreation, fish and wildlife habitat, scenic and significant historic archeological cultural lands *by identifying, through a landscape analysis, the critical habitat areas and linkages across the landscape to ensure their protection*

- Enhance the community character, natural beauty, and environmental quality *by ensuring protection of critical areas and linkages through appropriate land-use designations*

- Help preserve rural economies

- Foster opportunities for rural-based employment, self-employment, and economic diversification

- Permit the operation of rural commercial businesses, natural resource related industries, recreation and tourism activities, cottage industries and small-scale businesses, and home occupations that are consistent with existing and planned land use patterns and are of an appropriate size and scale to maintain rural character

Residential Open Space

The Residential Open Space section can be the location for a goal that creates flexibility in lot configurations or density through such mechanisms as transfer of development rights (TDR), discussed in Chapter 9. The following are examples from typical policies for Residential Open Space that have been modified (in *italics* or ~~strikethrough~~) to incorporate landscape analysis:

- Protect open space, *assure the long-term protection of* critical areas *and the environmental processes that sustain them at all geographic scales*, and *assure sustainable* agricultural uses through public and private initiatives, including open space tax incentives, cluster development, planned unit development (PUD), transfer and purchase of development rights, public land acquisition, greenways, conservation easements, landowner compacts, down-zoning, limiting the amount of lot coverage, and other techniques

- *Encourage preservation of key habitat linkages between critical areas, allow* the aggregation of nonconforming lots of record and undeveloped subdivisions and short plats, so as to achieve ~~consistent with goals of the Plan~~, a development pattern that provides affordable housing, preserves open space, protects *critical areas and landscape linkages*, and protects water resources

- *Establish and maintain* vegetated buffers *around critical areas* to preserve the community's rural character *and maintain upland habitat adjacent to aquatic resources; to assure the presence of forest buffers over the long term, require the* *planting of native conifer seedlings within the margins of forested buffers left when adjacent upland forest is cleared for the creation of lot*

- New development should be responsive to the natural landscape conditions and should *reflect the results of a landscape analysis* so as to have the least environmental impact on the community's landscape

- *Forested steep slopes,* particularly ridge lines, shall be protected for their visual, aesthetic, *and habitat-linkage* benefits, *including* their functions as wildlife habitat, and *for control of* erosion and *sedimentation*

- A Flexible Lot Design Subdivision process will be created to encourage more creative development *that has the flexibility to reflect site conditions including the results of a landscape analysis.* Flexible lot design *can* integrate use of open space and placement of buildings and infrastructure to reflect site conditions. It will include a cluster zoning requirement in the subdivision process and ensures that the approval process is timely and efficient. The following criteria shall be considered for flexible lot design:

  – Suitable soils for individual, on-site septic systems *or the presence of a community treatment facility*

  – *The findings from the landscape analysis to identify key habitats, and appropriate habitat linkages across the landscape; flexible lot design shall incorporate a perimeter buffer to the development which also provides visual screening of the site from public roadways, and maintains public viewsheds*

  – *Where feasible, grading should be minimized and trees should be maintained as much as possible throughout the project area*

  – Land that is designated as permanent open spaces within Flexible Lot Design Subdivisions shall be used either for recreational, conservation, or *ongoing* agricultural uses; *lands designated for conservation shall not be used for active recreation or initiating agricultural uses;* recreation or agricultural lands shall *be* dedicated to the community, or to a private, non-profit organization

  – Revise the PUD section of the zoning ordinance to provide greater flexibility in design and provide density bonuses for imaginative design, preservation *of identified* environmentally sensitive areas *including aquifer recharge, floodplain, critical wetlands and habitat linkages identified through a landscape analysis*, and include a broad range of housing alternatives

Environment

Within the Environment Element, a variety of goals and policies can be established to implement the intent of the guiding policies. For example, the following three goals are stated in the opening text of the Environment Element of the City of Olympia comprehensive plan (http://www.trpc.org/resources/olycompplan03_ch2_environment.pdf):

- *Long-term economic progress and environmental protection are mutually dependent*
- *Future generations have a right to an environment which has greater environmental assets than today*
- *A healthy environment contributes to the economy no less than do roads and other public services*

Examples of typical Environment policies that have been modified (new text in *italics*) to include recommendations from this volume are:

- Whenever there is *a proposed rezoning* or subdivision of land, the community *shall use the information from a landscape analysis to help assess and* consider the impact of the proposed project on critical areas
- *Identification and prioritization of lands for protection or reduced zoning shall be based on the results of a landscape analysis, or a process like that found in the Green Infrastructure plan*
- The number and design of lots shall be based on minimizing impact to critical areas and protecting natural systems; development shall *incorporate the findings of the landscape analysis during development of the* objectives of the Critical Areas policies rather than maximizing the number of lots; in order to protect critical areas, the full density permitted under the zoning ordinance may not be achieved
- Creative solutions (e.g., flexible lot design, TDRs, and *purchase of development rights* [PDRs]), which may allow the maximum number of lots while protecting critical areas, should be explored

Fish and Wildlife Policies and Aquatic Resources

Policy language for fish and wildlife and aquatic resources may be the easiest to modify. Modifications to typical policy language may simply incorporate the requirement for conducting the landscape analysis, prioritizing lands for protection based on clearly identified criteria, and directing zoning to result in lower impact on high-priority habitats and critical areas. The following are examples of modifications (in *italics* or ~~strikethrough~~) of existing policy language:

- The protection, ~~and~~ enhancement, *or restoration* of wildlife habitat shall be an integral component of the land-use planning process
- The protection, ~~or~~ enhancement, *or restoration* of critical wildlife habitat *and linkages identified through landscape analysis* shall be ~~one of the criteria~~ *a primary criterion* used when evaluating the preservation of open space as part of development techniques, such as clustering, Flexible Lot Design Subdivisions, and creation of TDRs

- Protect critical wildlife habitat and limit fragmentation of habitat that isolates wildlife populations (physically and genetically) by developing an interconnected system of corridors which link critical wildlife habitat *based on a landscape analysis*

- Evaluate wildlife habitat and *linkages based on a landscape analysis, and* develop a classification system which will identify ~~priority~~ habitat to be preserved; the *analysis* shall consider watercourse areas, wetlands, shoreline, riparian areas, tidelands, public open space, forested areas, topography, *aquifer recharge areas, Washington Department of Fish and Wildlife Priority Habitats and Species data,* and intensity of adjacent development

- Structure regulatory processes and permitting decisions so that they reasonably balance natural values with the use of the land *by utilizing a landscape analysis to prioritize lands for protection or special management*

- Collect and analyze information relevant to the function of natural systems *by conducting a landscape analysis as well as collecting information at individual sites*

- Develop a community-wide program to educate the public about alternatives to using and disposing of herbicides, pesticides, and other household chemicals to reduce impacts *to aquatic resources* and other environmentally sensitive areas

- New development, using flexible lot design, should include any *aquatic resources, prioritized habitats and linkages, and regulated buffers* in separate tracts or easements to remain in common ownership

Frequently Flooded Areas and Geologically Hazardous Areas

Through the landscape analysis, frequently flooded areas (FFAs) and geologically hazardous areas can be identified as lands requiring particular zoning limitations in order to protect public health and safety. Policy statements that are “standard” for these types of lands are appropriate to use.

However, FFAs and the processes that occur in these areas such as sediment transport, recruitment of large woody debris, nutrient cycling, and habitat linkages are protected under GMA. *Diehl V. Mason County* (95-2-0073) states, “An FFA designation must be clearly mapped and must include buffers sufficient to protect critical area functions and values.” These areas can also function as wetlands and wildlife habitat and provide linkages between landscape processes. Therefore, policy language can be modified to protect the processes and functions of FFAs and geologically hazardous areas, and the wetlands that occur within them, based on landscape analysis.

Natural Resource Lands

Natural resource lands are designated for resource production and may include wetlands and other critical areas, as well as areas in which important landscape processes occur.

Development regulations should require buffers to protect the critical areas within these resource lands.

Typically these areas have already been designated; however, a landscape analysis may identify the linkage between these areas and landscape processes as well as the role that wetlands (and/or restored wetlands) play. For example, protection of shellfish areas is often related to water quality upstream of these resource lands. Wetlands and/or restored wetlands can provide important improvements in water quality. Shellfish growing areas are candidates for designated agricultural lands.

7.3.2 Capital Facilities Plan Element

A Capital Facilities Plan Element includes the analysis and planning for public water, sewer, transportation, and recreation facilities. A jurisdiction has the responsibility to provide water and sewer services, parks and recreation, public safety, transportation facilities such as adequate streets and roads, plus other basic public services and facilities. The Capital Facilities Plan Element includes a requirement to reassess the Land Use Element if funding falls short of meeting existing needs for public services and utilities.

The Capital Facilities Plan Element can address regional water drainage needs, planned parks and recreation facilities, and other capital expenses needed for critical areas protection. Funds to support open space tax assessments, transfers of development rights, conservation easements, and similar needs can be identified in the Capital Facilities Plan Element.

In addition, policies in the Capital Facilities Plan Element can provide guidance on the appropriate conditions and geologic settings in which to use low impact development (LID) practices, referencing such policies in the Land Use Element. The Capital Facilities Plan would state the costs to implement the policies over time, along with alternatives that offer potential cost savings through measures such as LID. LID practices address the control of stormwater and surface water runoff, which is important in protecting wetland hydrology. Traditional and regional stormwater management facilities can also be assessed through the landscape analysis to identify how to minimize adverse impacts of runoff.

Policy language for the Capital Facilities Plan Element in a comprehensive plan can be readily modified to reflect these issues. For example (new language below is in *italics*):

- Designate utility corridors *using landscape analysis to ensure that placement of facilities does not result in permanent impacts to critical areas, their buffers, or habitat linkages*
- Promote the placement of underground utility distribution lines *using information from a landscape analysis to minimize or eliminate permanent or temporary impacts to critical areas*

7.3.3 Rural Lands Element

The Rural Lands Element in county comprehensive plans addresses lands that are not designated for urban growth or lands used for agriculture, forest practices, or mining. It implies lower density land uses with the intention of maintaining the locally defined rural character of unincorporated areas. Measures used to protect and manage rural lands include clustering, density transfer, design guidelines, conservation easements, and other innovative techniques designed to accommodate appropriate rural population densities and land uses.

One of the most significant impacts in rural zones is the increasing tendency to clear residential lots for pastures or viewsheds. The removal of forest cover, as discussed in Chapter 3 of Volume 1, has a significant effect on hydrologic patterns within the contributing landscape. Thus, guidance and policy language within the Rural Lands Element of a comprehensive plan can address site clearing and provide recommendations or requirements for retaining forest cover on lots of certain dimensions.

Typical examples of modified policies for Rural Lands are provided below (new text is in *italics* and deleted words are indicated by ~~strikethrough~~). Note that many of these examples of policies from existing comprehensive plans already incorporate many of the goals in Chapters 5 and 6 of this volume:

- Land use regulations and development standards shall protect and enhance the following components of the Rural Area
  - The natural environment, particularly ~~as evidenced by the health of~~ wildlife and fisheries (especially salmon and trout), *shellfish resources, habitat areas including linkages between habitats as identified as a result of landscape analysis,* aquifers used for potable water, surface water bodies, *wetlands and* natural drainage systems and their riparian corridors
  - Commercial and non-commercial farming, forestry, fisheries *including shellfish aquaculture*, mining, and *home-based and* cottage industries
  - Historic resources, historical character, and continuity including archaeological and cultural sites important to tribes
  - Community small-town atmosphere, safety, and locally-owned small businesses
  - Economically and fiscally healthy rural cities and unincorporated towns and neighborhoods with clearly defined identities compatible with adjacent rural, agricultural, forestry, and mining uses
  - Regionally significant parks, trails, and open space *including corridor linkages identified through landscape analysis*
  - A variety of low-density housing choices compatible with adjacent farming, forestry, mining, *and open spaces,* and not needing urban facilities and services

- The Rural Area designations include areas that are rural in character and meet one or more of the following criteria
  - Opportunities exist for significant commercial or non-commercial farming and forestry (large-scale farms *or more intensive small-scale farms* and forest lands are *usually* designated as Natural Resource Lands)
  - The area will help buffer nearby Natural Resource Lands from conflicting urban uses
  - The area is contiguous to other lands in the Rural Area, Natural Resource Lands, *wetlands, aquifer recharge areas* or *lands identified as critical habitats, habitat linkages or aquatic resources based on a landscape analysis*
  - There are major physical barriers to providing urban services at reasonable cost, or such areas will help define the outer limits for providing urban public services and infrastructure
  - Significant environmental constraints make the area generally unsuitable for intensive urban development

7.3.4 Transportation Element

The Transportation Element is focused on implementing the Land Use Element and addressing intergovernmental coordination of regional transportation facilities and strategies. It is important that the environmental impacts of existing and planned transportation strategies and facilities be addressed in a comprehensive way.

By using the results of a landscape analysis, additions or revisions to existing transportation facilities can be planned to avoid or minimize additional impacts to critical areas and areas that support environmental processes at all geographic scales. Addressing regional transportation issues within the context of landscape information can 1) identify areas that should be avoided, 2) limit habitat fragmentation, and/or 3) facilitate linkages along rights-of-way.

In addition, an Alternative Futures analysis can identify the logical consequences of configuring transportation corridors in various ways. It is possible to anticipate long-range impacts and plan for the compensation for unavoidable effects in advance of the impacts. Jurisdictions can use this approach to identify opportunities to implement Low Impact Development techniques to decrease impervious surfaces by requiring surface parking lots (including retrofits) to be pervious and infiltrate precipitation and water run-off as appropriate to the soil and geology in the area." (For the January 2005 Puget Sound Action Team *Low Impact Development Technical Guidance Manual for Puget Sound* see http://www.psat.wa.gov/Publications/LID_tech_manual05/lid_index.htm.)

One of the requirements for the Transportation Element is financial planning. The Transportation Element has to ensure that, when combined with the Capital Facilities Plan Element, the true costs of planned public works are known in advance of rezoning and commitments to build. This type of analysis can be conducted through an

Alternative Futures assessment, where various costs (economic, community, as well as ecological costs) are determined and compared to help a community make informed choices.

7.3.5 Parks and Recreation Element

This element addresses active parks and recreation opportunities within the community and must be consistent with the Capital Facilities Plan. It may incorporate assessment of the need for organized sports fields, athletic fields, pools, beaches, skateboard parks, etc. It can incorporate passive recreation such as photography or bird watching, as well as other types of recreation such as hiking or mountain biking, or those elements can be contained within a separate Recreation Element.

7.3.6 Economic Development Element

Many jurisdictions are including an Economic Development Element. Some communities are drawing the links between a healthy environment and attracting tourist recreation spending, or building on the "watchable wildlife" program of the Department of Fish and Wildlife.

7.4 Optional Elements of Comprehensive Plans

7.4.1 Conservation Element

As noted in the beginning of this chapter, a jurisdiction may choose to add optional elements to its comprehensive plan that go beyond the mandatory elements, in order to more fully reflect the values and goals of the community. The GMA is open regarding potential elements that can be included as optional.

One optional element that can address the protection of critical areas is a Conservation Element. It can provide an alternative for jurisdictions that are not able to approach all of their comprehensive planning from the foundation of a Green Infrastructure plan or Alternative Futures analysis (discussed in Chapter 6). This can be an element within a comprehensive plan or it can take the form of an independent Conservation Plan. Unlike an Open Space Plan that protects resources through acquisition, the Conservation Element or Plan establishes a method or mechanism to protect and/or restore resource lands through incentives (such as tax credits). Programs such as the U.S. Department of Agriculture's Wetland Reserve Program, the Natural Resources Conservation Service's Conservation Reserve Program, as well as options offered through local land trusts, can also be used in relation to a Conservation Element. Whenever possible, lands to be managed in this way should be identified through landscape analysis or a Green Infrastructure plan.

A Conservation Element is different from the open space approach traditionally used in local planning. The difference is that Open Space Plans typically focus on protecting lands that are valued for aesthetic, recreational, and habitat features primarily through the acquisition of properties by the local parks department. The open space approach can fall short by 1) not including a broader definition of important features worthy of preservation for their contributions to landscape processes, and 2) not including sites that could be restored or enhanced to return processes and improved functions to the landscape.

During the development of a Conservation Element or Plan, sites for both potential acquisition and restoration can be identified. Appropriate sites, such as wetlands in key locations that have a high performance of functions or that support landscape processes, can be located using information generated during landscape analysis. Specific sites can be assessed using tools such as the Washington State wetland rating systems (Hruby 2004 a,b) and the Washington State wetland function assessment methods (Hruby et al. 1999, 2000).

A Conservation Plan should be implemented through both regulatory and non-regulatory components of a program to preserve and restore landscape features identified within the plan. Together, Conservation Plans and non-regulatory components of a program are important additions to comprehensive planning and regulations in providing protection for wetlands and other important landscape features. The tools a local jurisdiction needs to consider using for developing and implementing the non-regulatory component are discussed in Chapter 9.

7.4.1.1 Natural Setting Element Used in Yakima County

Yakima County has a Natural Setting Element that could be considered as part of a Conservation Element or Plan. The text below is taken from Yakima County's Natural Element (http://www.co.yakima.wa.us/planning/pdf/plan2015.pdf). The text has been modified to incorporate the recommendations of this volume (edits are shown in *italics* and ~~strikethrough~~):

- The Natural Setting Element serves ~~two~~ *three* purposes. The first is to clarify the relationship between the natural environment and our built-out surroundings. The second is to secure a balanced or sustainable approach to future development. *The third is to ensure that balanced and sustained economic growth is planned to ensure the existence of long-term landscape processes that sustain the natural environment and help define our community.* To help complete these purposes, the following guiding principles and assumptions were used:
  - Our cultural landscape "where we work, live and play" is shaped by our natural surroundings; *therefore, our future landscape must include the space and configurations needed to sustain the natural surroundings*
  - Our economic base of agriculture and forest products is dependent upon the County's natural setting and its resources

- In order to protect the long-term capacity of the environment to support growth, we need to understand the limits of natural systems *and we need to understand how our choices influence the processes that control those natural systems*
- Responsible growth requires us to work with and within our natural setting; we must work with nature rather than against it; *thus we must analyze, at a landscape scale, the processes that sustain the natural system and plan our future growth by working with nature*
- We must recognize our limits; humankind's problems, especially in regards to the natural setting, cannot always be solved with better science or a technological fix

7.4.2 Subarea Plans

RCW 36.70A.080 allows for the development of subarea plans as optional elements of a comprehensive plan. Subarea plans are essentially more detailed land-use plans for a specific area and must be consistent with the comprehensive plan. One benefit of subarea plans is that citizens typically have increased opportunities for participation.

Some jurisdictions have adopted subarea plans that emphasize elements of the comprehensive plan that are important to that specific area, whether for reasons of economic development or environmental protection. They provide local governments the opportunity to fully incorporate Smart Growth and the results of landscape analysis (e.g., Green Infrastructure or Alternative Futures) into the comprehensive plan. For example, Alternative Futures analysis in Kitsap County's Chico Creek (discussed in Chapter 6) resulted in a detailed subarea plan that addressed many of the issues covered in this chapter.

For jurisdictions that are not currently amending comprehensive plans to reflect the recommendations in this volume, it may be timelier and equally effective to incorporate the recommendations within subarea plans. This is particularly true for areas within the jurisdiction with a high density of critical areas. Planning only for a subarea does, however, reduce the geographic area that is included in landscape analysis. Therefore, it is advisable to have at least a cursory understanding of the landscape and its processes beyond the subarea as well as within its boundaries.

Plans and policies (discussed in this chapter as well as Chapter 6) are only some of the solutions that can be identified and developed as a part of Step 2, Prescribing Solutions. Regulatory and non-regulatory tools are identified and developed as common solutions. Chapters 8 and 9 discuss these tools in detail.

Chapter 8

Prescribing Solutions: Regulatory Tools

8.1 Introduction

This chapter describes the regulatory tools that can be used to protect and manage wetlands. It is intended to assist local governments in developing these tools. As with plans and policies described in Chapters 6 and 7, developing regulations is an important part of Step 2, Prescribing Solutions, in the four-step framework in a program to protect wetlands (Figure 8-1).

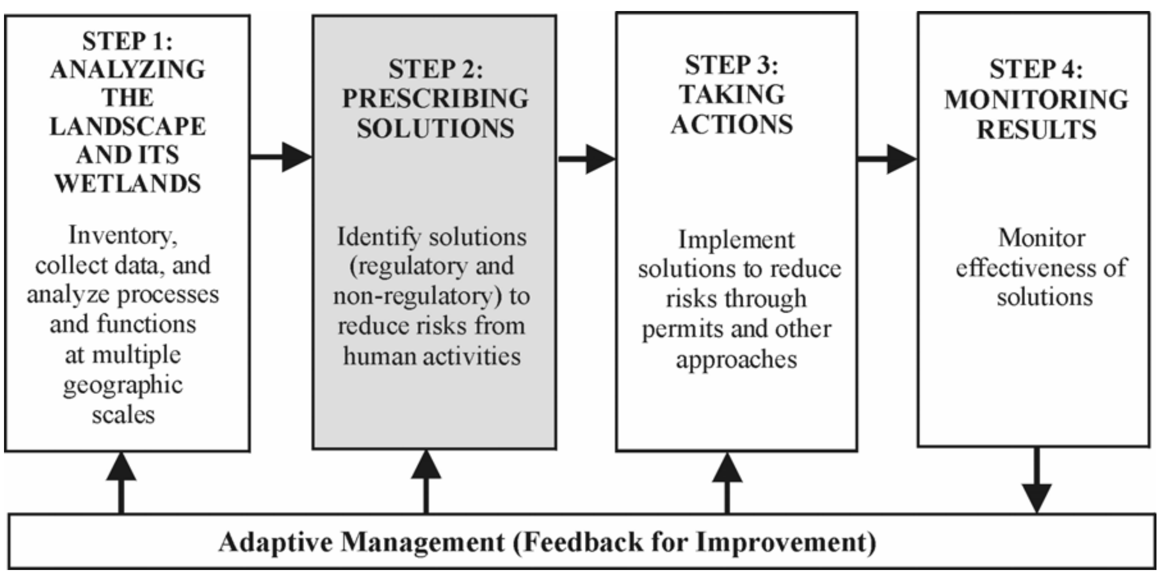


Figure 8-1. Developing regulations is part of Step 2 in the four-step framework discussed in this volume (shaded box).

Although, regulatory tools are only one part of the package of solutions recommended to protect wetland functions and values from future human impacts, they are usually the “backbone” of any wetland protection program implemented by local government.

As described in Chapter 2, the Washington State Growth Management Act (GMA) specifically requires that local governments adopt development regulations that include the best available science to protect the functions and values of critical areas (RCW 36.70A.172). These regulations are one of the primary means of implementing the goals and policies in the land-use plans of local governments.

Historically, most local governments have relied upon regulation as the sole means of protecting wetlands. A regulatory permitting component can, in fact, be very effective at limiting some of the adverse impacts associated with new development (if based on an understanding of the scientific literature in Volume 1). However, the synthesis of the science makes it clear that reliance upon a regulatory approach using case-by-case decision-making at the site scale as the sole means of protecting wetlands will result in loss of wetland functions. Wetland regulations are most effective in preventing direct physical loss of wetland area and functions resulting from a change in land use, but regulations that focus on the site scale are not effective in addressing the indirect and cumulative impacts from larger-scale changes in landscape processes.

Using the information generated by landscape analysis described in previous chapters can help in developing regulations that protect not only the functions of individual wetlands, but protect some landscape processes as well. Although beneficial at larger scales, this is best done at a sub-basin or subarea scale, where specific regulations can be developed to prevent degradation of landscape processes and to target protection of connected habitats.

Section 8.2 of this chapter discusses several factors that should be considered when establishing regulations, such as balancing predictability with flexibility, the expertise of in-house staff to review wetland reports and permits, the assessment of risk, and the use of a separate permit for critical areas vs. incorporating provisions for critical areas throughout a jurisdiction’s code. Section 8.3 discusses the specific elements that need to be addressed in local regulations, such as identifying wetlands, the applicability of regulations and permitting schemes, regulated activities and exemptions, wetland ratings, buffers, etc. The last section of this chapter (Section 8.4) briefly describes how to monitor the regulatory aspects of a protection program.

Regulations target site-scale activities (e.g. clearing vegetation, disturbing the soil, changing the movement of surface water and groundwater, and development together with its supporting infrastructure) that can impact adjacent and nearby wetlands (see Volume 1, Chapters 2 through 4). As discussed below and in Chapter 5 of this volume, such activities also have the potential for altering landscape processes and impacting wetlands not in the immediate vicinity of the alterations.

Important information is provided in appendices

Supporting information and additional detail on the topics discussed in this chapter are provided in a series of appendices (8-A through 8-H), listed in the shaded box on the next page. They contain examples of implementing language (e.g., for regulations, buffers, wetland ratings, criteria for technical experts, etc.) and other information. ***Chapter 8 and all of these appendices should be reviewed before a local jurisdiction decides to use any of the recommendations in this document in its critical area regulations.***

Appendix 8-A. An Overview of Ways to Protect and Manage Wetlands synthesizes the information available on what is needed to protect or replace wetland functions. The discussion is organized by the three major groups of functions (water quality, hydrologic, wildlife habitat) and by the different types of wetlands with other characteristics used in the Washington State wetland rating systems (e.g., bogs, Natural Heritage wetlands, etc.).

Appendix 8-B. Recommendations for Wetland Language in a Critical Areas Ordinance contains specific recommendations for ordinance language in a format similar to that used in many local critical area ordinances. This appendix revises the wetlands regulatory code language found in Appendix A of *Critical Areas Assistance Handbook* published by the state's Department of Community, Trade, and Economic Development (November 2003).

Appendix 8-C. Guidance on Widths of Buffers and Ratios for Compensatory Mitigation for Use with the Western Washington Wetland Rating System provides detailed guidance on buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetlands Rating System for Western Washington-Revised* (Hruby 2004b).

Appendix 8-D. Guidance on Widths of Buffers and Ratios for Compensatory Mitigation for Use with the Eastern Washington Wetland Rating System provides detailed guidance on buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetlands Rating System for Eastern Washington-Revised* (Hruby 2004a).

Appendix 8-E. Rationale for the Guidance on Recommended Widths of Buffers and Other Methods for Protecting Wetlands explains the rationale for the recommendations about buffers presented in Appendices 8-C and 8-D. It discusses why buffers of certain widths are recommended for wetlands that perform functions at different levels or for specific wetland types (e.g., bogs, etc).

Appendix 8-F. Rationale for the Guidance on Recommended Ratios for Compensatory Mitigation to be Used with the Wetland Rating Systems explains the rationale for the recommendations about compensatory mitigation ratios presented in Appendices 8-C and 8-D. It describes how mitigation ratios should be established based on risk of failure and temporal loss of functions, and can be further refined to reflect the category and type of wetland.

Appendix 8-G. Widths of Buffers Needed to Protect Some Threatened/Endangered/ Sensitive Wildlife Species Associated with Wetlands lists the widths of buffers needed to protect some of the wildlife species associated with wetlands. The species listed are the Federal Candidate, Federal Threatened, Federal Endangered species, State Sensitive, State Threatened, and State Endangered species found in Washington as of February 4, 2005.

Appendix 8-H. Hiring a Qualified Wetland Professional provides guidance on hiring a professional to provide wetlands services such as delineations, functions assessments, permit preparation, etc. It discusses the basic qualifications that should be considered by local governments and provides suggestions for locating a professional.

8.2 Issues in Establishing Regulations

Some of the key questions a local government should ask when establishing regulations that protect and manage wetlands and their functions include:

- Has a landscape analysis been conducted and have plans, policies, and zoning regulations been revised to reflect that information at the landscape scale?
- Are regulations the sole means of protecting wetlands, or are there (will there be) non-regulatory approaches that will help in protecting wetland functions?
- How much is known about the types and extent of wetlands in the jurisdiction and how they function?
- How well do the current zoning and critical area inventory maps incorporate reliable information on where wetlands and other critical areas are located?

Generally, a regulatory program should aim to prevent any further loss or degradation of wetland area or functions, thereby helping to maintain landscape processes as well. However, realistically even a very stringent regulatory program will not completely prevent all impacts to wetlands because some impacts occur as a result of land-use changes distant from wetlands. As discussed in Chapter 2, Section 2.3.4, of this volume, local government regulations may result in localized impacts upon, or even the loss of, some critical areas. However, the overall plan for the resources should result in no net loss of the value and functions of these resources within a watershed, etc. Thus, as previously mentioned, it is important to complement a regulatory permitting approach with planning based on landscape analysis as well as non-regulatory elements (these are discussed in Chapters 6, 7, and 9 of this volume). The following issues should be considered when establishing wetland regulations.

8.2.1 Balancing Predictability with Flexibility

One of the more common complaints about regulations is that they are either too unpredictable or too inflexible. Generally, these two characteristics are at odds with one another. A very predictable (prescriptive) approach provides clear, consistent standards that applicants can rely on. However, such an approach may not allow for flexibility to address site-specific or unique situations from the perspective of the resource or from that of the landowner. On the other hand, a more flexible approach may fail to provide the degree of specificity that allows applicants to have some certainty of the outcome early in the process.

In developing or revising regulations, one must consider how to balance these two competing needs. A balanced approach may set “sideboards” with criteria for selecting within the range of allowable options or a general standard with criteria for deviating from the standard. A more flexible approach implies more discretion on the part of local staff and managers.

8.2.2 Staff Expertise and the Role of Third-Party Review

As just mentioned, an important consideration in determining the appropriate regulations is the capacity of local staff to exercise independent judgment in applying protection standards, especially with a more flexible, less prescriptive approach. Flexibility requires time on the part of staff that are well versed in wetland ecology and management in order to make consistent and defensible decisions based on site- or situation-specific factors (see Chapter 11 for more discussion). Many local jurisdictions cannot afford to have this expertise on their staff and rely upon third-party review by a wetland professional who is retained by the local jurisdiction (usually at the applicant's expense), or through technical assistance from state or federal agencies (see Appendix 8-H on hiring a wetland professional).

8.2.3 Separate Critical Area Permit vs. Provisions Throughout the Code

Although critical areas ordinances are most often used as the sole regulation for wetlands and other critical areas, other code provisions may be directly relevant to the protection and management of critical areas. Some jurisdictions adopt critical areas provisions that establish a distinct permit that is required for any proposed activity within that type of critical area or its buffer. Other jurisdictions place provisions for critical areas and their buffers throughout their code, wherever consideration of impacts on critical areas is appropriate. For example, language addressing wetland/buffer protection may be adopted into clearing and grading regulations. (See Section 8.3.2 for more discussion.)

If a local jurisdiction decides to link wetland protection to other existing regulations and permits (e.g., clearing and grading regulations), it should bear in mind the issues described in the following sections (especially 8.3 and 8.3.2), as applicable.

8.2.4 Risk Management for Wetland Resources

In the end, the primary decision regarding the appropriate type and stringency of regulations for protecting wetlands is one of risk management. The key question is: *How much risk of loss or degradation of wetland functions and values is reasonable given; 1) what is known about the types of wetlands and their functions, 2) the types of land uses and their impacts, and 3) what othe, complementary components of protection, including planning based on landscape analysis and non-regulatory programs, are in place or will be implemented?* The scientific literature does not and cannot say what the appropriate level of risk should be; it can only assess the potential consequences of this type of decision. The final determination of the level of risk that is appropriate is made by government at the local level. (Risk assessment is discussed in greater detail in Chapter 10 of this volume.)

8.3 Important Elements of the Regulatory Component of a Protection Program

The current general approach to wetland regulation at the local level can be summarized as: *Avoid - Buffer - Compensate*. This means:

- **Avoid** direct impacts to a wetland or its buffer to the extent practicable by allowing impacts only when there is no reasonable alternative
- **Buffer** wetlands from indirect impacts through the retention of adjacent vegetated upland
- **Compensate** for unavoidable impacts by requiring the replacement of wetland and/or buffer area and function through the restoration, creation, enhancement, and/or preservation of wetlands and/or their buffers

This approach has been used in areas of the Puget Sound lowlands since 1984 and throughout Washington for the past 10 years. With appropriate protection standards and consistent implementation, such provisions can go a long way toward protecting wetland functions and values that are not strongly linked to landscape processes. For those that are affected by landscape processes, however, the review of the science in Volume 1 indicates that site-specific regulations alone will not protect all wetland functions.

Following is a discussion of the recommended key elements that should be addressed in the regulatory component of any local government's wetland program. For examples of recommended code language for each of these elements, please refer to Appendix 8-B.

8.3.1 Designating, Identifying, and Mapping Wetlands

The GMA requires that local governments designate and protect critical areas including wetlands (RCW 36.70A.170 and 172). The first step in regulating wetlands is to define what is being regulated and specify how these areas will be identified. The GMA provides the definition of wetlands and specifies how to identify and delineate them.

In designating wetlands for regulatory purposes, counties and cities are required to use the definition of wetlands in RCW 36.70A.030 (20):

> *"Wetland" or "wetlands" means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands*

may include those artificial wetlands intentionally created from non-wetland areas created to mitigate conversion of wetlands.

Wetlands are subject to a local government's regulatory authority if they meet the criteria in this definition. The GMA does not allow flexibility in adopting a modified definition of wetlands.

State legislation (RCW 36.70A.175) also requires local governments to use the *Washington State Wetlands Identification and Delineation Manual* (WAC 173-22-080) in implementing the GMA. The manual is used to identify the actual boundary of a wetland. The manual is based on the 1987 Corps of Engineers wetlands delineation manual and incorporates changes made by the Corps since 1987. Since the Washington State manual and the Corps manual rely upon the same criteria and indicators for hydrology, soils, and vegetation, proper use of either manual should result in the same wetland boundary.

Having reliable information about the location and extent of wetlands in a local jurisdiction is helpful to landowners and to regulatory staff. Reliable information provides greater predictability for landowners and helps ensure that wetlands are accurately identified for regulatory purposes. However, many local governments do not have accurate maps of wetlands within their jurisdiction. Inventory maps that have been checked on the ground can be time consuming and expensive to produce. Although field inventories conducted by local governments are recommended, existing information can be used to produce a useable, if less accurate, map of wetland locations.

Many local governments use a Geographic Information System (GIS) for decisions about planning and land uses and can generate a useful wetland map by combining several digital layers. The National Wetlands Inventory (NWI) can be combined with local soil surveys to produce a map that shows the approximate location, extent, and distribution of many (but usually not all) wetlands in the jurisdiction. The NWI was completed by the U.S. Fish and Wildlife Service and the soil surveys by the Natural Resources Conservation Service (formerly called the Soil Conservation Service). For many areas of the state, the NWI and hydric soil maps are available in digital format.

Two other layers of information that are also useful are 1) the maps of Priority Habitat and Species (PHS), generated from a database established and maintained by the Washington Department of Fish and Wildlife, and 2) the Flood Insurance Rate Maps (FIRMs), developed by the Federal Emergency Management Agency (FEMA). PHS data help identify fish and wildlife issues associated with wetlands that might arise. The FIRMs, although sometimes out-of-date, can be useful when used with other data, particularly when seasonal or forested wetlands may not have been mapped in the National Wetlands Inventory. Few FIRMs are currently digitized, but FEMA is in the process of digitizing all FIRMs for use with GIS.

Paper copies of FIRMs are available by calling toll-free 1-800-358-9616 or through the FEMA website: www.fema.gov (click on "FEMA flood map store"). Digitized FIRMs should be completed by around 2010 for the entire state but by 2008 for the urban centers. At this time, there are only two jurisdictions in the state (Whatcom County and the City of Anacortes) that have digital FIRMs that meet the current standards (i.e., GIS-based digital maps).

When superimposed, all of these maps can serve as a useful starting point for identifying the general location of areas that are likely to be wetlands in a planning area. However, as already mentioned, local field-based maps are superior because of the potential inaccuracy of the NWI and soil surveys, which are based on interpretation of aerial photographs (some 15 to 20 years old). This makes the existence of some wetlands as well as the extent of others hard to identify. Typically, the hydric soils maps have more field verification than the NWI maps, although aerial photography is the main source of information for both. In addition, wetland maps cannot replace the need for site- or parcel-scale delineations when activities are proposed that might affect wetlands.

To ensure the protection of wetlands, the regulatory code should contain language that clearly states that wetlands are to be regulated as they are defined in code and designated on site, not as they are mapped during inventories. In other words, areas that meet the regulatory definition of a wetland are regulated even if they are not mapped.

It is also important to understand how wetlands function and how they interact with landscape processes when applying local regulations. See the discussions later in this chapter and its appendices regarding wetland rating systems, as well as Chapter 5 for information on landscape analysis.

8.3.2 Applicability of Regulations

The applicability section of a code clarifies what types of activities the code is intended to regulate. There are two general ways in which protection measures for wetlands and other critical areas can be triggered through codes: 1) wetland provisions are integrated throughout various elements of the development code as applicable; or 2) a distinct permit for a specific critical area (e.g., wetland) is required for activities that may influence them. These two approaches are discussed below, along with a discussion of code language that address applicability and the pros and cons of each. Regardless of the approach selected to trigger the wetland protection, the code should, as mentioned previously, require that a site reconnaissance be conducted to evaluate the presence/absence of wetlands and their extent and to collect other information. This is particularly important given the limitations of wetland inventory maps as discussed above.

8.3.2.1 Protection of Wetlands Triggered by Various Development Permits

Measures used to protect wetlands or other critical areas can be initiated when any development permit (e.g., a grading, rezone, building, subdivision, short-plat permit, etc.) is required by the local jurisdiction. The code can be written to automatically allow the wetland provisions of the code to be applied to a permit when the applicant submits it. Thus, the law can be written such that the submittal of each development permit allows staff to review and condition the application with the regulatory standards for wetlands from the code.

Applicability language

Using this approach, the applicability section of the code should state that the critical areas provisions of the jurisdiction apply to "any permitted activity if a wetland or its buffer is present on the subject property, or the proposed actions could result in adverse impacts to offsite wetlands and/or their buffers." The language can specify that "all development permits" are included, or the code can specify which development permits trigger the critical area provisions. Such language makes it clear that any action within the jurisdiction that requires a permit (e.g., grading, rezoning, building permit, subdivision, etc.) will be subject to the protection measures in the critical areas code.

For example, some jurisdictions apply critical area provisions to all newly formed lots created **after** the critical area provisions have been implemented or revised (i.e., the applicability language cites the date of the adoption of the new provisions). The jurisdiction can require that all short-plats and subdivisions abide by the new wetland protection standards, **and** they may exempt single-family building permits from wetland review for such new lots. This means that the new lots will have the required critical area setbacks and buffers embedded into them, so the review of building permits for single-family homes is not necessary to assure that they meet the provisions of the code.

This also means that lots that were created **prior to** implementation of the current critical area standards (i.e., "grandfathered in") **may not** be subject to the new provisions (e.g., wetland rating, buffers, and setbacks, etc.) if it would deny all reasonable use of the parcel. This is one means to address reasonable-use provisions when new standards could possibly influence the use of an existing lot that was created under less restrictive standards. Although this may seem like a lessening of regulatory standards, it is a pragmatic approach to deal with the issue of reasonable use. This language also makes it implicit that any proposal to create new lots (e.g., a short-plat or long subdivision) requires implementation of the new standards.

Applicability language for development permits can also be modified to reduce the threshold that triggers a permit (such as a certain acreage) to zero for actions that pose a risk to wetlands and/or their buffers. For example, clearing of vegetation that falls below a minimum square footage (threshold) established for a clearing and grading permit would not trigger the requirement for the provisions for wetlands in the clearing and grading permit. However, the applicability section of the clearing and grading code can readily be amended to note that, "There is a zero threshold for any activity which may pose an adverse impact to wetlands and/or their regulated buffers; such activities will trigger the requirements of a clearing and grading permit." By this means, existing code language can simply be modified to extend the provisions for wetland review and conditioning to actions that would otherwise not trigger the underlying permit requirements.

Pros and Con

A benefit of this approach is that no new permitting mechanism needs to be established; review and conditioning for critical areas is linked directly to existing permit processes that applicants are already familiar with. Many jurisdictions are already employing this method in their codes, and thus major code revisions and changes in processes used to review permits would not be required. Some development permits (e.g., subdivisions and some rezones) trigger State Environmental Policy Act (SEPA) determinations that may provide a mechanism for greater analysis and public input in the decision-making process than a permit process that is for wetlands only.

Initiating critical area provisions through development permits requires coordination between wetlands staff and the staff who condition and issue development permits (if they are different people). Such coordination is needed to ensure consistency in the provisions of approval for permits. The option of not having a separate wetland permit may require additional review fees for fee-supported staff (as would a distinct wetland-only permit), and may or may not require additional review time compared to a distinct wetland-only permit. There is a risk that the timing of approving multiple permits may lengthen the time required to process an applicant's permit.

For an application to be subject to wetland review and conditioning, some type of development permit (e.g., clearing, grading, filling, etc.) must be triggered. If no development permit is required for an action, no wetland review process can be legally initiated, unless the applicability language is modified as noted above.

8.3.2.2 Separate Critical Area Permit

A separate process for critical areas permits means that an applicant would be required to obtain a separate and distinct wetland (or critical areas) permit whenever a wetland or its buffer is located on the site of a proposed action. This is a distinct permit that would be required **in addition** to any other development permit for a parcel. The applicability of this permit is linked to the presence of the critical area or its buffer on a site. The standards for when a permit would be required should be the same as the provisions for the development-related permits, including zero thresholds for actions such as grading, clearing of vegetation, or other physical alterations.

Applicability language

Code language can be drafted for a wetland permit that identifies the activities that trigger the need to obtain the permit. The language would have to specify actions, development permits, and/or thresholds of actions that would trigger a review according to the provisions of obtaining a permit. Unlike the previous option, this applicability section would have to include **all** actions or thresholds that would trigger the wetland permit: In the previous option, the applicability language of each existing development permit/action is modified to include wetland provisions. A discussion and description of suggested regulated and exempted activities follows in the Section 8.3.3.

Pros and Cons

Using a distinct wetland or critical areas permit involves many of the same issues described for the first option. The advantage of a wetland-specific permit is that it allows staff to clarify conditions of approval and perhaps, if the mechanism is established, to provide clarity for monitoring and enforcement with wetland permits. If the jurisdiction sets up a monitoring program, which is staffed to ensure that approved wetland permits are tracked and the conditions implemented, then a wetland-specific permit could facilitate such tracking and response**.**

A wetland-specific permit requires wetland staff to coordinate all conditions from all development permits for a particular project to ensure consistency for wetland protection. A wetland-specific permit could possibly result in higher permit and review fees. It should be assumed that a jurisdiction would either hire technical staff to implement a distinct permit program, or require an applicant to pay for review/conditioning of a permit by a third-party professional. The fee structure of the jurisdiction would determine whether fees would be higher for processing a wetland-specific permit compared to that needed to cover processing of multiple permits when protecting wetlands through the previous option.

There is a risk that the timing of approving multiple permits may lengthen the time required to process an applicant's permit. However, in a worst-case scenario, it is also possible that wetland staff may get backlogged in the case of wetland-only permits, in which case other development permits may be approved and issued before it. (The state law requires a 120-day "clock" for local permit review.)

8.3.3 Exempted Activities, Allowed Activities, and Exceptions

Critical areas ordinances are adopted to protect wetlands and their functions from the many types of activities that can adversely impact them as described in Volume 1. Therefore, local governments should regulate all activities with a potential to affect the functions of a wetland and its buffer. At a minimum, it is important to regulate all activities that would directly impact a wetland and its buffer such as filling, draining, excavating, clearing, flooding, and tilling. Other activities that should be included are herbicide application, stormwater discharges, and water diversions and withdrawals.

However, some activities pose little threat to wetlands and can be exempt from regulatory review or can trigger a lower level of review. Exempt activities should be limited to those that will not have a significant impact on a wetland's structure and function (including its water, soil, or vegetation) and those which are expected to be very short term. Local governments should, however, also consider the cumulative impacts from exempted activities.

The scope, coverage, and applicability of a critical areas ordinance should capture the full range of activities that are detrimental to wetland functions. Therefore, exemptions should be supported by the scientific literature and be carefully crafted to minimize the potential for adverse impacts. Likewise, a local government should not assume that an exemption is appropriate in the absence of science to refute the exemption. The language should clearly state whether a given exemption is from applicable standards in the code or whether it is exempt from needing a permit but still must comply with the code.

The types of activities that are excluded from wetland regulation are grouped in to three categories in the example code provided in the *Critical Areas Assistance Handbook*, Appendix A (Department of Community, Trade, and Economic Development (CTED) 2003). They are *exempted activities, allowed activities, and exceptions.* These three categories allow varying degrees of activities or uses either without review, or in a way that avoids the regulations associated with critical areas, as explained in the following paragraphs.

The first category, exempted activities, are those activities that are excluded from critical areas regulations on the premise that they would have little or no effect, or that the activity is an emergency and delay of the action could result in threats to public health or safety. In addition to emergencies, these activities can include passive outdoor activities, forest practices regulated by the state, as well as specific operation, maintenance, or repair activities.

Allowed activities comprise the second category and are those activities that, due to other regulations or previous reviews, are unlikely to result in critical areas impacts. Since these activities are not exempt, the wetland standards continue to apply and the underlying permit could be conditioned to ensure that the activity complies with critical areas protection.

The third category, exceptions, are granted in limited circumstances where a reasonable use permit is issued to only allow the minimum "reasonable" use of the property and avoid a constitutional taking. Refer to Section X.10.150 of CTED's example code provisions for additional guidance on reasonable use exceptions.

The section below discusses the types of activities that are often considered as exemptions in critical area regulations and how they may apply to different types of wetlands. For each, we discuss the relevant scientific findings and provide recommendations for how they should be treated.

- Wetland size
- Size of minimum wetland impact

- Isolated wetlands
- Wetlands that are designated as prior converted croplands
- Irrigation-induced wetlands
- Clearing, grading, and placement of fill
- Ongoing agriculture
- Conversion of wetlands to new agriculture
- Conversion of agricultural lands to other uses
- Removal of noxious weeds
- Forest practices and conversions
- Removal of hazard trees
- Non-compensatory restoration and enhancement
- Stormwater management and wetlands
- Emergency activities

8.3.3.1 Wetland Size

While recognizing that local governments have to make difficult choices about where to expend their efforts, we do not believe it is appropriate to recommend a general threshold for exempting small wetlands in Washington because the scientific literature does not provide support for such a general exemption. Volume 1 (Chapter 5) documents the relationship between the lower levels of protection afforded to small wetlands and the resulting fragmentation and increase in distance between wetlands on the landscape as well as the important functions provided by small wetlands. The loss of small wetlands is one of the most common cumulative impacts on wetlands and wildlife in Washington.

If a local government, however, wants to consider exempting some wetlands under a certain size, this should be done with an understanding of the potential cumulative impacts (e.g., how many acres of wetlands would be affected, what functions would be most affected, how such impacts would be compensated, etc.). Considering and documenting the potential implications is critical to protecting wetland functions. The decision, therefore, is best made after reviewing the information generated from a landscape analysis (as outlined in Chapter 5 of this volume) for the geographic area that would be affected by the exemption.

Limiting the exemption to certain areas (such as Urban Growth Areas or specific sub-basins) and to certain wetland types (e.g., Category IV wetlands, those with non-native species, non-riparian wetlands) will help minimize the risk of losing important functions.

Additionally, it may be important to limit the total acreage of wetlands exempted on a project basis or within a sub-basin.

A more appropriate way to deal with small wetlands would be to exempt projects from the need to avoid small wetlands. This type of exemption should still require that the loss of wetlands be compensated either directly or through an in-lieu fee program.

8.3.3.2 Size of Minimum Wetland Impact

As with exempting a certain wetland size, there is no scientific basis for exempting wetland impacts under any particular size without an analysis of the cumulative effects of the exemption. A study of the management area is needed in order to measure the net result of the exemption as applied over time. If a local government chooses to move forward with an exemption for small area impacts, a restoration program and/or in-lieu fees program should be created to offset the net impacts.

Given the potential for cumulative impacts from exempting small wetlands and small impacts to wetlands, local governments should monitor and report the effectiveness of their wetland provisions or critical areas ordinances to achieve "no net loss." This is discussed further in Section 8.4 of this chapter.

8.3.3.3 Isolated Wetlands

There is no scientific justification for exempting isolated wetlands from regulation (See Chapter 5 in Volume 1). Isolated wetlands are generally defined as those wetlands that are hydrologically isolated from other aquatic features. Hydrologic isolation is not a determinant factor in the function of wetlands. Isolated wetlands in Washington perform many of the same important functions as other wetlands, including recharging aquifers, storing flood waters, filtering pollutants from water, and providing habitat for a host of plants and animals. Many wildlife species, including amphibians and waterfowl, are particularly dependent on isolated wetlands for breeding and foraging.

The current lack of regulation of many isolated wetlands by federal agencies is the result of very different statutory language in the federal Clean Water Act that ties federal regulation to navigable waters and interstate commerce. No such restriction exists under the GMA or any other state laws.

8.3.3.4 Wetlands that are Prior Converted Croplands

There is also no scientific basis for exempting wetlands that are prior converted croplands (PCC) from wetland regulation under the GMA. Wetlands that are designated as PCC provide the same functions as other similarly degraded wetlands. The scientific information on wetlands designated as PCC is briefly discussed below, following a description of these wetlands, and is also addressed in Chapter 5 of Volume 1.

Prior converted croplands are defined in federal law as administered by the U.S. Army Corps of Engineers. PCC are those wetlands that were drained, dredged, filled, leveled, or otherwise manipulated, including the removal of woody vegetation, before December 23, 1985, to enable production of an agricultural commodity, and that:

1. Have had an agricultural commodity planted or produced at least once prior to December 23, 1985
2. Do not have standing water (ponding) for more than 14 consecutive days during the growing season
3. Have not since been abandoned

However, many of the wetlands meeting these criteria are still *biological* wetlands (i.e., they still meet the three criteria for hydrology, soils, and vegetation) and provide important functions.

Local governments cannot exempt wetlands that are designated as PCC in their regulations and rely on the federal exemption to satisfy the best available science requirement in the GMA. Although activities in these wetlands are not regulated under Swampbuster provisions of the federal Farm Bill or Section 404 of the federal Clean Water Act, the GMA requires local governments to regulate wetlands that meet its definition. This definition of wetlands includes PCCs that meet the three criteria in the *Washington State Wetland Identification and Delineation Manual*. It therefore does not distinguish wetlands designated as PCC from other wetlands.

The original assumption behind exempting PCCs from federal regulation was the belief that these wetlands had been so altered they were no longer wetlands or no longer provided important wetland functions. In some cases, PCC have been significantly altered so they provide functions at a level that is minimal. However, in many cases, PCC provide hydrologic and water quality functions (e.g., recharging aquifers, storing flood waters, filtering pollutants from water, etc.) and may provide wildlife habitat or important linkages between habitats. For example, in western Washington, many PCC used for agriculture are ponded during the winter, when overwintering waterfowl are highly dependent upon flooded areas for resting and feeding. Overwintering bald eagles and other raptors, in turn, depend on the waterfowl attracted to these flooded areas.

Local governments that rely on the Corps of Engineers to verify wetland delineations need to ensure that wetland delineations are conducted and verified using the state wetland delineation manual to determine if they are wetlands regulated under the GMA. Once these wetlands are delineated properly, a function assessment can be conducted to analyze the functions being provided by the wetlands. Most wetlands designated as PCC will be Category III or IV wetlands under the state wetland rating systems. The departments of Ecology and Fish and Wildlife recommend that wetlands designated as PCC be regulated similarly to other wetlands (i.e., commensurate with the functions they provide).

8.3.3.5 Irrigation-Induced Wetlands

Some confusion exists as to whether wetlands that have expanded or have been formed due to the influence of irrigation are considered *artificial* and whether they are, therefore, *jurisdictional* (i.e., that is, regulated under federal, state, or local laws). Many of the habitat types with deep soils in eastern Washington have been converted to agriculture. A large portion of this land, particularly in the Columbia Basin, is under irrigation. Additionally, some agricultural areas in western Washington are also irrigated. In many irrigated areas, the groundwater table is higher than it was prior to implementation of irrigation. Many wetlands have expanded or formed adjacent to irrigation conveyance systems and in low-lying areas where irrigation occurs and downslope of irrigated lands.

The definition of wetlands comes into play when trying to clarify the situation. Artificial wetlands are addressed in definitions of wetlands used in the three state laws that regulate wetlands. These laws include the Growth Management Act (RCW 36.0A.030 (20)); the Shoreline Management Act (RCW 90.58.030 2(h)); and the Water Pollution Control Act (WAC 173-201A.020). This definition reads:

> *Wetlands means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas created to mitigate conversion of wetlands,*

Basically, this definition means:

1. A wetland must have indicators of three features: water (wetland hydrology), plants (hydrophytic vegetation), and soils (hydric soils). It must have enough water to support water-dependent plants, so the water must be present during the growing season. The presence of water creates low-oxygen conditions that support those specialized plants and also creates unique soil characteristics.

2. That, for a wetland to be non-jurisdictional (artificial) it must meet both of the following characteristics:

    a. Be intentionally created

    b. Be located in a formerly non-wetland (upland) site

The term *intentionally created* and the examples given in the definition require that the artificial wetland not be the result of an accident or an unexpected byproduct of some other intentional act. Therefore, artificial, non-jurisdictional wetlands result from someone intentionally creating a water feature such as a ditch or pond in an area that is non-wetland. The only situation where an artificial, non-jurisdictional wetland results from an unintentional action is when construction of a road (after July 1, 1990) inadvertently creates a new wetland.

The term *non-wetland* means an area where wetland characteristics are lacking—that is, an upland area. Thus, if someone intentionally creates a new water feature, such as a ditch or pond, in an area that was already wetland, the "new" water feature is still under jurisdiction as a wetland.

The following examples may help illustrate real-world situations:

1. A ranch pond was built on a dry hillside to supply water to livestock, and wetland conditions have formed over time. Clearly, the pond meets both criteria for being an artificial, non-jurisdictional wetland: It is an intentionally created water feature in an upland site.

2. Wetland vegetation is found along the edge of an irrigation canal. The canal is an intentionally created water feature. If the canal was dug through uplands, then the wetland within the canal is non-jurisdictional per GMA (though it may be subject to federal regulation). If the canal was dug through an existing wetland, then the wetlands within the canal are jurisdictional.

3. A wetland is found downgradient of a leaking irrigation canal or pipe. The wetland is jurisdictional because it is an unintentional result of digging the canal. However, the canal (or a leaking irrigation pipe) can be repaired or lined to improve water conservation. If the wetland disappears as a result of the improvement, the loss of the wetland is not regulated. If wetland conditions persist, then the wetland cannot be further altered without a permit.

4. A wetland is found within a field that is irrigated. The wetland is jurisdictional because it was not intentionally created. Although filling the wetland would be regulated, changes in irrigation practices (such as changing from flood to drip irrigation) that would dry up the wetland would not be regulated.

5. A wetland is found in a field that is not irrigated, but irrigation water from a field higher up has raised the groundwater table. The wetland is jurisdictional because it was not intentionally created as part of a water feature.

6. Wetland indicators (water, plants, and soils) are found within a stormwater pond. The wetland is not jurisdictional if the stormwater pond was created in an upland. However, if the stormwater pond was created within a wetland, then it is jurisdictional.

8.3.3.6 Clearing, Grading, and Placement of Fill

The scientific literature does not support blanket exemptions for clearing, grading, and placement of fill in wetlands or their buffers without first understanding the direct and cumulative effects of such an exemption. Critical area regulations should be crafted to address these activities because of their significant and direct impacts to wetlands and their functions.

If a local jurisdiction believes it is important to exempt small amounts or areas of filling or grading in wetlands or their buffers, they should provide some analysis to document the potential cumulative impacts of such an exemption and provide some means of offsetting the expected cumulative impacts. This could include in-lieu fee and/or non-regulatory restoration programs to restore wetlands or increase wetland functions, provided that non-regulatory programs are evaluated to ensure that the no net loss goal is met.

To address cumulative effects of multiple small fills or clearings in the same wetland, the threshold for clearing, grading, or filling a critical area or its buffer should be reduced to zero.

8.3.3.7 Ongoing Agriculture

The literature synthesized in Chapters 2, 3, and 4 in Volume 1 demonstrated that agricultural activities can negatively affect wetlands. One of the goals of the GMA is to protect wetlands and other critical areas. Equally important, the GMA seeks to maintain and enhance industries that rely on natural resources, encourage the conservation of productive agricultural lands, and discourage incompatible uses. Designated agricultural lands are one of the three types of natural resource lands defined in GMA for which local governments need to plan.

The purpose of this volume is not to further evaluate or frame the issue of agricultural impacts. It is important, however, to recognize that different types of agricultural practices result in different types of potential impacts. Local governments should consider the types of agriculture being practiced in their watersheds and craft their critical area protection programs to address impacts from agriculture accordingly.

However, given that existing, ongoing agricultural activities take place in already drained and/or actively manipulated wetlands (such as grazed wetlands), impacts from bona fide ongoing agricultural activities are most effectively managed through best management practices.

The departments of Ecology and Fish and Wildlife recommend the use of best management practices (BMPs) and/or conservation plans for ongoing agricultural activities in wetlands.

There are two basic approaches that local governments should consider:

1. **Voluntary use of BMPs with monitoring.** This encourages the voluntary use of BMPs, farm conservation plans, and incentive-based programs to improve agricultural practices in and near wetlands. Local governments work with Conservation Districts or county staff with agricultural expertise regarding technical assistance to willing landowners. They should set up and implement a monitoring program to determine if the voluntary approach is effective. If problems are detected, the jurisdiction should require the use of specific BMPs and the approval of farm conservation plans in order to correct identified problems; OR

2. **Required BMPs and/or farm conservation plans.** These could be approved by an agency or organization with expertise in agricultural practices (such as a Conservation District), with appropriate local government oversight and monitoring. This type of approach is outlined in the *Critical Areas Assistance Handbook* (CTED 2003) where it describes how Whatcom County has approached this issue:

   Some agricultural uses are regulated by state or local government, usually because of a particular environmental concern related to ground or surface water or air quality. For example, Whatcom County regulates pre-existing agricultural activities that impact wetlands, fish and wildlife habitat conservation areas, and aquifer recharge areas or their buffers in conformance with an adopted conservation program. The conservation program is developed to be consistent with the Whatcom Conservation District's best management practice manual and requires the containment of livestock waste. The plan is then filed with both the conservation district and the county, to ensure that the agricultural practices are being implemented. Periodic monitoring of farm activities ensures that the management objectives are being met.

The CTED handbook acknowledges that while regulations provide certainty, they can be difficult and costly for agricultural activities, particularly without the understanding and cooperation of the landowners.

8.3.3.8 Conversion of Wetlands to New Agriculture

Conversion of wetlands that are not currently in agricultural use to a new agricultural use should be regulated by the same regulations as any new development. The scientific literature does not support the conversion of wetlands to new agricultural uses without review and conditioning through a critical areas ordinance.

8.3.3.9 Conversion of Agricultural Lands to Other Uses

A change in use from agriculture to non-agricultural uses should trigger review under the critical areas ordinance. Exemptions and special considerations for wetlands (i.e., targeted implementation of best management practices) crafted for agricultural activities should not be "grandfathered" when the land use changes from agriculture to another form of development. A change in use from one type of agricultural activity to another type of agricultural activity should be addressed through best management practices and farm plans.

Of particular concern is that a change in land use may be preceded by an activity that may be exempted by a local government because alterations may occur to the wetland before adequate review takes place. A common example is the exemption in many critical areas ordinances for the maintenance of existing drain tiles and ditches on drained agricultural lands. Ditches and drain tiles require maintenance from time to time in order to keep the water table low enough during the growing season for agricultural production. As long as the lands are being maintained for ongoing agricultural use, the maintenance exemption makes sense, provided that the original depth and dimension of ditches and tiles is maintained.

A critical areas ordinance should specify what constitutes "maintenance," what does not, and what documentation is necessary to prevent inappropriate or unlawful wetland draining activities. A conflict can arise when ditch and tile systems are enlarged or upgraded to effectively drain farmed wetlands so they no longer meet the definition of a wetland. This is a change in management and is the point where the local government has an interest in reviewing this change in use because new areas are being affected by the upgrade to drainage systems. Many agricultural areas often provide important habitat and other hydrologic functions (previously discussed in Section 8.3.3.4 on Wetlands that are Prior Converted Croplands).

Local governments are encouraged to work with agricultural landowners to implement the GMA's goal of protecting and enhancing agricultural lands, as well as provide notice of their authority to regulate converting wetlands, or expanding the extent of conversion, to non-wetlands for agricultural uses. This recommendation is reflected in the language in Appendix 8-B.

8.3.3.10 Removal of Noxious Weeds

Many current regulations that protect critical areas do not require a permit for the control and removal of noxious weeds in wetlands and buffers (as well as other critical areas), provided that the control is done by hand or with light equipment and does not involve the use of hazardous substances. Local governments should retain some oversight authority when more extensive control methods are proposed to make sure that wetland functions are adequately protected.

8.3.3.11 Forest Practices and Conversions

The state's Forest Practices Act (RCW 76.09 and WAC 222) regulates commercial woodlots and forest lands and contains provisions for protecting wetlands. The Act contains less stringent standards for wetland protection for commercial forestry than those required by local governments for non-forest lands through the GMA. The Forest

Practices Act does not protect forested wetlands from harvest and has weaker standards for avoidance, buffers, and mitigation than most local regulations. It provides standards for buffer protection for certain non-forested wetlands and bogs. The assumption in the Forest Practices Act is that many of the affected functions performed by forested wetlands recover during the time they regenerate trees old enough for another cycle of timber harvest.

However, the GMA requires that local governments protect the functions provided by forested wetlands. It is important for local governments to recognize and address the gap in wetland protection between the GMA and the Forest Practices Act. They should provide a framework to ensure compliance with their standards when forest lands are converted to residential, commercial, or other non-forestry uses. The jurisdiction should regulate the conversion of lands when they will no longer be regulated under the rules of forest practices. The regulations should provide guidance on how this issue will be managed in jurisdictions that contain commercial forest lands. It is important to note that the provisions should only apply when forest lands regulated by the Forest Practices Act are converted to other uses. It should not be the intent of the local jurisdiction to make the Forest Practices Act consistent with local government's more stringent requirements for forested wetlands.

8.3.3.12 Removing Hazard Trees

Provisions for the trimming or removal of hazard trees in buffers are legitimately addressed through an exemption to regulations protecting critical areas. Considering public safety is important in balancing exemptions with the goal of protecting critical areas. The needs for limits on the exemption are obvious: The exemption should be limited to situations where the "offending" tree is clearly a hazard, and removing the tree would not adversely affect the functions of a wetland or its buffer. One option is for the local government to involve a qualified arborist who has an understanding of the functions of wetlands and buffers to evaluate a request to remove a hazard tree.

The qualified arborist should establish that the hazard tree presents an imminent hazard and is threatening a structure. Some local governments use the definition in the Forest Practice Rules (WAC 222-21-010(4)) which define a *danger tree* as "any qualifying timber reasonably perceived to pose an imminent danger to life or improved property." This applies to any tree within 1.5 tree-lengths of the structure. The Washington Department of Natural Resources (WDNR) is not, however, charged with administering the requirements in the GMA. Therefore, a local government should not defer the determination of what constitutes a hazard tree, or the review of hazard tree cutting proposals, to WDNR or WDNR standards. Trees removed as hazards should be replaced either in kind or with species that are underrepresented in the community.

The exemption process should not allow for the creation of "view corridors" and the removal of healthy trees in a buffer under the pretext of control of hazard trees. When trees are removed, a restoration plan should be required. In some instances, pruning (not topping) of trees to maintain (not create) a limited view corridor may be considered by a jurisdiction as appropriate. A management plan for a view corridor, prepared by a certified arborist, should be required by the jurisdiction. The plan should also be reviewed by qualified staff or an arborist paid by the applicant. This approach is recommended to reduce the cases of illegal clearing to create a view, leaving the jurisdiction to deal with an enforcement action.

8.3.3.13 Non-Compensatory Restoration and Enhancement

Provisions for non-compensatory restoration and/or enhancement may legitimately be addressed as exemptions through critical areas regulations. Limits, however, should be defined so that proposals narrowly focused on or managing for a single function are not allowed to occur at the expense of other wetland functions.

Restoration and enhancement activities are considered non-compensatory when they improve wetland functions (and/or increase wetland acreage) and are not meant to compensate for impacts caused by development. Many restoration activities are by definition “self-mitigating” in that they may cause temporary impacts (during construction) that are ameliorated by the significant increase in function resulting from the activity.

Some non-compensatory activities are not beneficial from a landscape perspective because they are narrowly focused or do not fit the hydrogeomorphic setting in which they are carried out. Narrowly focused activities are those that provide benefits to single species at the expense of other wetland functions. For example, in the past some waterfowl management projects have been constructed to significantly increase waterfowl production, while reducing habitat for non-waterfowl species. An extreme example would be the clearing of a forested wetland for the construction of an impoundment to attract waterfowl.

Local governments should not assume that restoration activities supported by other agencies will result in an appropriate tradeoff of functions and should carefully look at the merits of the proposal. Beneficial projects should be encouraged as a means to offset net losses in the regulatory arena, provided that they result in wetlands of the appropriate hydrogeomorphic class and are supported by landscape processes.

Local governments may also consider relaxing some of the procedural requirements typically reserved for compensatory mitigation projects. For example, a requirement for a restriction on an easement or deed for a “native growth protection area” may only serve to needlessly frustrate the proponent of a project that is non-compensatory in nature. It may be appropriate for a local government to set up a separate review process for non-compensatory projects that is focused on facilitating projects while still complying with requirements of their local protection program.

8.3.3.14 Stormwater Management

The use of wetlands for stormwater management should be included in the list of regulated activities. Most wetlands are adversely affected when they are modified to treat and/or detain urban stormwater. The literature, much of it based on research done in the

Puget Sound area, suggests that there are very narrow circumstances under which wetlands can be managed to meet the stormwater requirements of new (and retrofitted) development. While it may be appropriate in some situations to allow a wetland performing at low levels to be used as part of a system for managing stormwater, local review and permitting should be required.

Ecology has published a manual to provide local jurisdictions with technical standards and guidance on stormwater management based on the current state of the science and the best technical information available. The 2001 revision to the *Stormwater Management Manual for Western Washington* includes practices to minimize stormwater impacts on receiving waters, including wetlands, in areas west of the crest of the Cascade Mountains. The manual is used to address the effects of changes in water quality and water quantity on receiving waters such as wetlands. The 2001 Ecology manual should be used by local governments in western Washington to include best available science in developing or revising protection programs for wetlands.

In the manual, Ecology states that stormwater discharges to wetlands "shall maintain the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses." To accomplish this, Ecology recommends use of the amended *Wetlands and Stormwater Management Guidelines* published in Appendix I-D of the manual.

Achieving the goal of maintaining hydrologic conditions requires the use of continuous modeling and spreadsheets to track events that exceed recommended water levels in the wetland receiving the run-off. The modeling tools, such as the Western Washington Hydrology Model (WWHM) provided in the appendices of the manual, are available but applying them is difficult. As a result, Ecology intends to add a spreadsheet to the WWHM, to help with tracking these events. The model can be used to develop strategies to protect wetlands and their hydrology from the negative effects of stormwater run-off if it is calibrated for the specific drainage area. Refer to the manual for more details.

Ecology also published a stormwater management manual for eastern Washington (Ecology 2004). The manual is more limited in scope (when compared to the western Washington manual) with respect to wetland management and does not include the management guidelines for wetlands and stormwater contained in the western Washington manual.

Ecology's manual for stormwater management

Details about changes to and requirements of the stormwater manual for western Washington are available on the internet at: http://www.ecy.wa.gov/programs/wq/stormwater/manual.html.

The manual for eastern Washington is available at http://www.ecy.wa.gov/programs/wq/stormwater/eastern_manual/index.html.

8.3.3.15 Emergency Activities

Local codes typically include provisions for emergency activities. These are intended to provide relief from procedural requirements of the code, namely from the time delays associated with having to obtain a permit prior to responding to an emergency. Local regulations should clearly differentiate between the need to quickly permit the emergency activity and providing any compensation needed for the emergency activity after-the-fact. There is no scientific justification for exempting emergency activities from having to provide compensatory mitigation after-the-fact when the emergency action results in adverse impacts to wetlands (or other critical areas).

8.3.4 Wetland Rating

A wetland rating system is a useful tool for dividing wetlands into groups that have similar needs for protection. The scientific literature makes it clear that wetlands in Washington are very diverse (see Volume 1, Chapter 2). Wetlands occur in a wide variety of locations as a result of very different influences (e.g., geomorphology, geology, water source, etc.) and have a wide range of characteristics that contribute to different types and degrees of functions.

Wetland rating systems allow tailoring of regulations to the protection needs of different types of wetlands or degrees of function. They offer a scientifically defensible approach to assigning protection standards as well as providing a significant degree of predictability for applicants. For example, the widths of buffers and ratios for compensatory mitigation can be determined based upon a wetland rating, in addition to other factors.

A rating system for wetlands should divide them into categories based on understanding how wetlands function and how they are affected by human activities. A rating system should use clear criteria for each wetland category and include methods for determining which category a wetland is in. Without detailed methods, it is not possible to consistently apply rating criteria. The primary factors that should be used to rate wetlands are:

- The **rarity** of the wetland type
- The **irreplaceability** of the wetland type
- The **sensitivity** of the wetland type to adjacent human disturbances
- The **functions** performed by the wetland type

Ecology has revised the wetland rating systems that were previously developed for eastern and western Washington based on current wetland science. The revisions to the rating systems were determined by interdisciplinary teams that included local planners and biologists and have been field tested across the state. If a local government wants to revise one of these updated rating systems or develop its own, it should do so based on the best available science and should include a detailed method for making site-specific decisions about categorization.

Approaches for applying protection measures by incorporating the wetland rating are discussed in Appendices 8-C through 8-F. The Washington State wetland rating systems are available at http://www.ecy.wa.gov/programs/sea/wetlan.html.

8.3.5 Requirements for Wetland Reports

Local regulations should specify when a wetland report is needed, in regard to requesting a development permit, and what should be included in the report. The Department of Community, Trade and Economic Development (CTED) provides guidance, in Appendix A of their handbook (CTED 2003), regarding what should be included in a wetland report for projects that will likely cause impacts to a wetland and require mitigation. Based on this guidance, such requirements for the preparation of wetland reports include, but are not limited to:

1. Preparation by a qualified professional
2. Use of scientifically valid methods and studies in the preparation of the report
3. Minimum contents for the report, which set the threshold for determining whether it is complete
4. Geographic limits of the study
5. Requirements for compensation, performance standards, construction plans, monitoring and maintenance, contingency plans, financial guarantees, and other details

Some projects may result in minor or "de minimus" impacts which may not require a full wetland report. In such cases, some jurisdictions may choose to implement a two-tiered process to segregate projects with de minimus impacts from those requiring more in-depth review and analysis, thereby limiting the need for comprehensive review of all permits that are submitted. To implement a tiered approach, a local jurisdiction would need to collect all information that is readily available about the site of the project and the wetland to complete an initial analysis to determine if a full wetland report is needed (e.g.. the likelihood of project to have more than de minimus impacts). Appendix F of CTED's handbook includes a "critical area identification form outline" that lists a series of indicators and information that can be used for such an analysis. In most circumstances, a jurisdiction would, at a minimum, need to have a wetland inventory that has included some field verification to determine the accuracy of the inventory.

The departments of Ecology and Fish and Wildlife recommend that the requirements for wetland reports, as outlined in the CTED handbook, be included in a local jurisdiction's critical areas code or the administrative rules adopted for implementing the code. Issues regarding the technical ability of local staff in reviewing wetland reports are covered in Section 8.2.2 of this chapter.

8.3.6 Mitigation Sequencing

Mitigation is a series of actions that requires addressing each action, or step, in a particular order. This sequence of steps is used to reduce the severity of negative impacts from activities that potentially affect wetlands and to determine what types of impacts may be permitted and what types of compensatory mitigation may be appropriate (see the following section for a discussion of compensatory mitigation).

According to the rules implementing the Washington State Environmental Policy Act, mitigation involves the following (WAC 197.11.768):

1. *Avoiding the impact altogether by not taking a certain action or parts of an action;*

2. *Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;*

3. *Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;*

4. *Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;*

5. *Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or*

6. *Monitoring the impact and taking appropriate corrective measures.*

The primary decision to be made with respect to avoidance is one of risk management. For example, using the state's system for wetland rating, impacts to Category I wetlands (which are rare, sensitive to disturbance, irreplaceable, or perform a high level of functions) are higher risk and should have to pass a higher avoidance threshold than impacts to a Category IV wetland. Category IV wetlands are usually significantly degraded, provide a low level of functions, and may be more successfully replaced. If the goal is to protect existing functions, it makes sense to apply more stringent protection to those wetlands that have a higher rating. See Appendices 8-A through 8-F for further discussion of incorporating wetland rating into regulations.

8.3.7 Compensatory Mitigation Requirements

Local regulations need to address how best to compensate for wetland area and the functions and values that will be lost due to the proposed impacts. This is called compensatory mitigation. The term mitigation is defined legally as the six-step sequencing process described in the previous section, of which compensation is step five. Wetland impacts can be significantly reduced or avoided altogether by following the first four steps in the sequence (i.e., avoiding, minimizing, rectifying, and reducing or eliminating impacts). When wetland impacts are unavoidable, the fifth and sixth steps in the sequence are engaged (i.e., compensating for impacts and monitoring the impact and taking appropriate corrective measures).

Step five, compensating for the impact, requires considerable attention to detail because the issues are complex and the current record for compensatory mitigation is variable (see Volume 1, Chapter 6). Based on the review of the scientific literature in Volume 1, regulations addressing compensatory mitigation need to include the following:

- Standards for the type, location, amount, and timing of the compensatory actions
- Clear guidance on the design considerations and reporting requirements for compensation plans

The last requirement allows the local agency to make a decision about the adequacy of the proposed compensatory mitigation.

Ecology reports on compensatory mitigation

A two-part report on compensatory mitigation was published jointly by Ecology, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. It is titled *Guidance on Wetland Mitigation in Washington State: Part 1 - Laws, Rules, Policies, and Guidance Related to Wetland Mitigation* (Ecology Publication 04-06-013a, April 2004); and *Part 2 – Guidelines for Developing Wetland Mitigation Plans and Proposals* (Ecology Publication 04-06-013b, April 2004). Access them on the internet at http://www.ecy.wa.gov/programs/sea/wet-updatedocs.htm. (The document is currently being revised).

Part 1 of this document outlines the general policies and requirements of federal and state agencies for compensatory mitigation. Part 2 provides detail on what information should be included in a compensatory mitigation plan.

Local governments are encouraged to adopt mitigation policies consistent with Part 1. This will help ensure consistency between levels of government and streamline the permitting process for applicants. The language in Appendix 8-B of this document is consistent with Part 1. Local governments should reference Part 2 as the standard for what should be included in a mitigation plan.

8.3.7.1 Standards for Compensatory Mitigation

The review of the scientific literature makes clear that compensatory mitigation has frequently failed to adequately replace wetland area and functions (see Volume 1, Chapter 6). The reasons for failure, among others, include:

- Poor site selection

- Poor site design
- Inappropriate or inadequate goals, objectives, and performance measures
- Lack of sufficient water
- Inappropriate water regime
- Poor implementation
- Inadequate maintenance
- Lack of regulatory follow-up

The reasons listed above point to a need for rigorous standards to address the type, amount, and location of mitigation projects that are permitted, and the type and extent of information that must be provided in a mitigation proposal. An adequately trained and funded regulatory staff is also vital for performing permit review, compliance monitoring, and enforcement.

Standards for compensatory mitigation should specifically address the following issues.

Goals of Compensatory Mitigation

The standards need to include a statement about the primary intent of compensatory mitigation. Is it to replace the functions being lost by the permitted impact? Is it to achieve greater area or functions? Are tradeoffs in functions allowed (i.e., allowing replacement with different functions than the functions being lost)? Generally, the goal of compensatory mitigation should be to achieve equivalent or greater area and functions.

Types of Mitigation Actions

Compensatory mitigation typically includes five basic types of activities:

- Creation or establishment of new wetlands where none previously existed
- Restoration of new wetland area and functions where wetlands previously existed (also called re-establishment)
- Restoration of wetland functions in an existing wetland area that is significantly degraded (also called rehabilitation)
- Enhancement of some wetland functions in an existing wetland that may reduce other functions
- Preservation (also called protection/maintenance) of an existing wetland that is otherwise likely to experience degradation (because it is not currently well protected by existing laws)

Standards for compensatory mitigation should specify whether any of these types of activities are preferred over others. Generally restoration (re-establishment and rehabilitation) is preferred because it is the most likely to succeed. Enhancement typically provides the least gain in functions, and preservation always results in a net loss of wetland area; thus, these types are usually the least preferred.

Replacement of Function vs. Area

Standards should address whether wetland area and function must be replaced on an individual project basis and to what extent tradeoffs in functions can be made. *Tradeoffs* means exchanging some functions in favor of others. It is a good idea to require a minimum of 1:1 replacement of wetland area except in unique circumstances, such as when it can be clearly demonstrated that a lesser area of wetland can provide greater functions than are being lost. It is reasonable to require that compensatory mitigation replace the same functions as those lost except when tradeoffs in functions are identified as desirable in a regional plan. As a general rule, replacement of the same functions on a project basis will help ensure that significant tradeoffs are not made on the scale of a landscape or basin without fitting into clearly identified regional priorities.

Tradeoffs in functions need to be evaluated at the site and basin scale. If a function is effectively being performed in a wetland or in a sub-basin, then it may be appropriate to prioritize a function that is currently lacking or being performed at a low level. For example, a project may affect a degraded pasture near a stream that has been diked. The pasture may provide water quality improvement and limited wildlife habitat (e,g,, small mammals and raptors) but is no longer seasonally flooded, therefore diminishing its hydrologic functions. Extensive diking in the basin may have also significantly decreased the flood attenuation and desynchronization functions once provided by the wetland. Suitable mitigation, therefore, may involve removal of a dike thereby increasing hydrologic functions. This would result in a tradeoff with habitat for small mammals, which would be lost. In addition, as discussed in the next section, the removal of the dike would be off-site in relation to the wetland impact.

A real-life example is the Snohomish Estuary Wetland Integration Plan (SEWIP) (Stanley et al. 1997). The SEWIP allows a tradeoff in the types of functions provided by depressional wetlands behind dikes to those provided by restored estuarine tidal wetlands.

Location of Mitigation

Historically, most regulatory agencies required that mitigation activities be performed on-site (i.e., on or very near the same parcel where the impact occurred). This was based on the belief that the closer the mitigation was to the impact site, the better chance it would have of replacing the functions that were lost. However, recent studies have concluded that this requirement too often has forced applicants to try to fit a mitigation project into an area that makes little ecological sense and is not sustainable (Johnson et al. 2002, Johnson et al. 2000).

Mitigation standards should emphasize that mitigation activities must occur in a location where the targeted functions can reasonably be performed and sustained. For example, the site needs to have an appropriate source of water and allow for control of invasive species, and adjacent land uses need to be compatible with the long-term functioning of the site. It is difficult to design a wetland for amphibian habitat in a location that is surrounded by dense, urban development and expect it to be sustainable.

Compensatory mitigation should not result in the creation, restoration, or enhancement of an atypical wetland. An atypical wetland refers to a compensation wetland (e.g., created or enhanced) that does not match the type of existing wetland that would be found in the geomorphic setting of the site (i.e., the water source(s) and hydroperiod proposed for the mitigation site are not typical for the geomorphic setting). Likewise, a compensation wetland should not provide exaggerated morphology or require a berm or other engineered structures to hold back water. Excavating a permanently inundated pond in an existing seasonally saturated or inundated wetland is one example of an enhancement that could result in an atypical wetland. Another example would be excavating depressions in an existing wetland on a slope, which requires the construction of berms to hold the water.

Amount of Mitigation

The acreage that should be required as compensation for lost wetland area is one of the most important and most contentious aspects of compensatory mitigation. The review of the science in Chapter 6 of Volume 1 indicates that compensatory mitigation frequently fails to produce the targeted wetland area and/or function, and it can take as long as 20 years to more than 100 years for a newly created or restored wetland to perform some functions.

The acreage of compensation required is usually expressed as mitigation ratios that are commonly used as tools to equalize the tradeoffs between the wetland lost and wetland used for compensation. While the overall goal is to replace lost functions with equivalent new functions, the reality is that it generally takes greater acreage and considerable time to provide equivalent functions. Additionally, some types of compensatory mitigation actions (e.g., enhancement, preservation) provide no new area and only a few new functions. The ratios help address the inherent disparities and act as a kind of “interest rate” to address the temporal loss of functions; there is almost always a significant time lag between when the permitted wetland impact occurs and when the compensatory wetland is fully functioning.

However, every mitigation project is unique, and it is possible to create or restore a wetland and provide greater functions than those that are being lost if the project impact is to a significantly degraded wetland. Additionally, some mitigation projects are more likely to succeed than others, particularly if good hydrologic information is available. Thus, mitigation ratios need to be flexible to address the wide range of situations that are encountered.

The recommended approach is to establish general mitigation ratios based on the wetland category and the type of mitigation activity, and then adjust the ratio on a case-by-case basis to account for project-specific factors. Criteria for increasing or reducing ratios should be specified in the standards used to protect wetlands. This provides some degree of predictability for applicants while retaining the flexibility to make site-specific adjustments.

Suggested code language for mitigation ratios is provided in Appendix 8-B. Guidance on compensatory mitigation ratios for use with the western and eastern Washington wetland rating systems is provided in Appendices 8-C and 8-D, respectively. Appendix 8-F provides the rationale behind these mitigation ratios.

Timing of Mitigation

Generally, mitigation actions are conducted concurrently with or soon after the wetland impact occurs. Standard ratios are typically established based on this assumption. If mitigation is conducted in advance of the impacts, then the risk and temporal loss are reduced and the ratio should be reduced commensurately. If the mitigation is conducted well after the impact, the ratio should be increased.

8.3.7.2 Special Types of Compensatory Mitigation

In addition to addressing the more common mitigation actions (e.g., creation, restoration, and enhancement), local jurisdictions should consider including language in their regulations specifying the circumstances under which special types of compensatory mitigation may be used, such as preservation, mitigation banks, in-lieu fee programs, and programmatic mitigation areas. These types of programs are discussed below.

Preservation

The preservation of existing wetlands as a means of compensating for wetland impacts is highly controversial because it always results in a net loss of wetland area and is perceived as trading one wetland for another one that is already protected. The reality is that some wetland types are not adequately protected under existing laws and can benefit from being placed in public ownership or protected by a conservation easement.

For example, many forested wetlands can be logged under current state laws, and wetlands with significant habitat value are very difficult to protect without large buffers and corridors to connect them to other habitats. Preservation of large tracts of wetlands and uplands can provide benefits that are impossible to achieve using typical regulatory approaches. One way to think about the issue of "net loss" with respect to preservation is that some wetlands are going to experience unmitigated impacts unless they are preserved. In that sense, preservation provides a "net gain" over what would otherwise occur.

Preservation has the following basic advantages as a compensatory mitigation tool:

- Larger mitigation areas can be set aside due to the higher mitigation ratios required for preservation
- Preservation can ensure protection for high-quality, highly functioning aquatic systems that are critical for the health of the watershed and aquatic resources that may otherwise be adversely affected

- Preservation of an existing system removes the uncertainty of success that is inherent in a restoration, creation, or enhancement project

Generally, the use of preservation to compensate for impacts is appropriate only in very limited circumstances. The preservation of a *high-quality* wetland in the same watershed or basin where a wetland loss has occurred, however, is often an acceptable form of compensation when done in combination with other forms of compensation such as re-establishment or creation. See Appendix 8-B for features indicative of high-quality sites.

Note that the use of preservation of wetlands as compensatory mitigation should not allow applicants to circumvent the standard mitigation sequence of avoiding and minimizing impacts first, followed by compensating for unavoidable losses. Additionally, preservation projects should be subject to the same requirements as other types of wetland mitigation (e.g., monitoring and long-term protection). Preservation of wetlands generally requires significantly higher ratios to offset impacts than wetland restoration or creation (see Appendix 8-C and D).

Generally, the preservation of at-risk, high-quality wetlands and habitat may be considered an acceptable part of a mitigation plan when the following criteria are met:

1. Preservation is used as a form of compensation only after the standard sequencing of mitigation (avoid, minimize, and then compensate)

2. Restoration (re-establishment and rehabilitation), creation, and enhancement opportunities have also been considered, and preservation is proposed by the applicant and approved by the permitting agencies as the best option for compensation

3. The preservation site is determined to be under imminent threat; that is, the site has the potential to experience a high rate of undesirable ecological change due to on-site or off-site activities that are not regulated (e.g., logging of forested wetlands). This potential includes permitted, planned, or likely actions

4. The area proposed for preservation is of high quality or critical for the health of the watershed or sub-basin due to its location

In addition, please refer to Appendices 8-B, 8-C, and 8-D for additional criteria and further guidance on the use of wetland preservation in compensatory mitigation.

Mitigation Banks

Mitigation banks offer an opportunity to implement compensatory mitigation at a regional scale and provide larger, better-connected habitat in advance of impacts. Mitigation banking involves the generation of “credits” through restoring, creating, enhancing and, in exceptional circumstances, preserving wetlands and other natural resources. These credits can then be sold to permit applicants who need to offset the adverse environmental impacts of projects that would occur within the *service area* of the bank. A bank’s service area is akin to its “market area” or the geographic area in which credits may be sold or used. Projects that use bank credits as compensation are called *debit projects*.

Wetland mitigation banks have two basic components as follows:

- **Bank site**. The bank is located at the physical site where credits for mitigation are generated by restoring, creating, enhancing, and/or preserving wetlands and associated natural resources.

- **Bank sponsor**. An organization operating under the provisions of a mitigation banking instrument that markets and sells credits, maintains a bank ledger, monitors and reports on the development of the bank site, and provides perpetual protection, management, and other services for the bank site.

Bank sites are normally protected in perpetuity by a legally binding protective covenant such as a conservation easement held by a long-term manager. Bank sponsors must also provide one or more temporary financial assurances to ensure the successful ecological development of the bank and an endowment to fund long-term management of the bank site(s).

Once released for sale, wetland bank credits are sold to permit applicants to compensate for wetland impacts that occur within the service area of the bank. As credits are sold, bankers debit them from the bank's ledger so they cannot be resold. Once all credits in a bank have been sold, the bank is closed.

Mitigation banks benefit the aquatic environment by consolidating numerous small wetland mitigation projects into larger, potentially more ecologically valuable projects. This results in economies of scale that benefit the regulated public, regulatory agencies, and the environment.

Another important feature of mitigation banks is that they are developed in advance of the adverse impacts for which they compensate, which ensures that the bank is ecologically successful before it is used to offset adverse impacts at other sites. Mitigation banks that are properly implemented offer improved ecological performance, lower mitigation costs to permit applicants, and a more streamlined permit process.

To date, few mitigation banks have been approved in Washington. However, as the regulatory agencies develop and implement the process to review and approve banks and gain experience in evaluating proposals, mitigation banks are likely to become more common in Washington.

As with any form of compensatory mitigation, the use of mitigation bank credits to offset impacts to the natural resources should not be considered prior to completing the two mitigation sequencing steps of avoidance and minimization. Then, the regulatory agency must determine whether purchasing credits from a particular bank would provide appropriate and practicable compensation for a proposed impact. In making its determination, the regulatory agency should consider whether any opportunity for mitigation that is environmentally preferable (e.g., on-site mitigation) is available, how closely a bank's credits correlate with the particular wetland functions that would be altered by a proposed action, and whether using a bank to compensate for a proposed action would be in the best interest of the natural resource, particularly the affected watershed.

Current information on the Ecology's Wetland Mitigation Banking Program is available at http://www.ecy.wa.gov/programs/sea/wetmitig/index.html.

In-Lieu Fee Programs

Mitigation using in-lieu fees (ILF) occurs when a permittee pays a fee to a third party in lieu of conducting project-specific compensatory mitigation, purchasing credits from a mitigation bank, or conducting some other form of compensatory mitigation. This fee represents the expected costs to a third party to replace the wetland functions that would be lost or impaired as a result of the permittee's project. ILFs are typically held in trust by a non-profit conservation organization until they can be combined with other ILFs to finance a project that replaces the lost and impaired functions represented by those ILFs. The entity operating the trust is typically an organization with demonstrated competence in natural resource management, such as a local land trust, private conservation group, or government agency that manages natural resources.

ILF mitigation is used primarily to compensate for minor adverse impacts to the aquatic resources when more preferable forms of compensation are not available, practicable, or in the best interest of the environment. Compensation for projects that result in more substantial adverse impacts is usually provided by project-specific mitigation or a mitigation bank. ILF mitigation may be appropriate when:

- The amount of compensatory mitigation required for a project is too small to justify the cost of designing and implementing project-specific mitigation
- Practicable opportunities to conduct appropriate project-specific mitigation or purchase credits from an approved mitigation bank are not available
- Project-specific mitigation that could be implemented would likely result in a low-performing aquatic system, have a high risk of failure, be incompatible with adjacent land uses, or fail to address the needs of the watershed
- A minor amount of additional mitigation is needed to supplement project-specific mitigation that would not, by itself, fully compensate for a project's adverse environmental impact
- The permit process does not adequately compensate for cumulative effects from a project

ILF mitigation and mitigation banking share many similarities. For example, both types of mitigation allow permittees to fulfill their compensatory mitigation responsibilities by paying a fee to a third party who will accept responsibility for the required mitigation.

Also, mitigation banks and ILF-funded projects must both fully comply with existing federal mitigation guidance and policy, including a requirement for a written implementing agreement that normally includes construction plans, performance standards, monitoring and reporting provisions, a long-term management plan, financial assurances, a protective real estate agreement (e.g., conservation easement), and other measures, as appropriate, to ensure the ecological success of each project.

The fundamental difference between mitigation banking and ILF mitigation is the relative timing of the activities that offset the adverse environmental impacts for which they compensate. With mitigation banks, the environment-enhancing activities are conducted in advance of the adverse impacts, whereas with ILF mitigation, those activities normally are not conducted in advance of the adverse impacts. While specific ILF-funded mitigation projects may not always be identified in advance of project-related impacts, quickly expending collected ILFs to fund mitigation projects should be a high priority for any ILF program. However, regulatory agencies may adjust the size of ILFs to compensate for anticipated delays in expending them.

Local governments interested in developing an ILF program should evaluate the potential for cumulative and unmitigated impacts to hydrologic and water quality functions that may result from the program. Local governments should consider the use of stormwater controls (such as over-sizing ponds and swales) as a way to replace wetland hydrologic and water quality functions on-site and reduce cumulative effects from an ILF program.

Programmatic Mitigation Areas at the Local Level

Another approach for consolidating compensatory wetland mitigation involves directing compensation projects to a *programmatic mitigation area*. Simply defined, a programmatic mitigation area is a site (or series of sites) that have been identified by the local jurisdiction or a state or federal agency as a preferable site(s) for wetland compensation. Wetland compensation projects are constructed separately on the site but are all part of a common design. The programmatic mitigation sites are subject to the same minimum requirements as other compensation sites such as permanent protection, monitoring, restrictions on other activities on the site, etc.

The goal of a program for programmatic mitigation areas to allow the restoration of larger wetland areas that are important to the functioning of a stream basin or watershed because of their position in the landscape. Since many projects require relatively small areas of compensatory wetland mitigation, the programmatic mitigation area program allows the consolidation of these small compensation sites into a larger project.

The following is a summary of how a programmatic mitigation areas work?:

1. The lead regulatory entity (county or city jurisdiction, state or federal agency) identifies an area or areas as priority restoration areas

2. The regulatory entity develops a site development plan for the entire site and may either purchase the site or purchase an easement on the site

3. As projects needing compensation arise, the applicants are directed to perform either certain activities on the site (to aid in the completion of the plan) or directed to implement the site design on specific areas within the overall site

This approach has not been used much in Washington. The closest example available is Kitsap County's work along Clear Creek where several mitigation projects have been completed adjacent and complementary to each other. The county has actively directed compensation projects to the Clear Creek area. Another example is along Mill Creek in Auburn where the Emerald Green Race Track and Washington State Department of Transportation located their compensation sites in an area identified in the draft Mill Creek Special Area Management Plan or SAMP (U.S. Army Corps of Engineers 1997).

8.3.7.3 Impacts to buffers

Impacts to buffers should be handled similarly as impacts to wetlands. Applicants should be required to use all available means of modifying their development proposal, as well as using existing provisions for buffer averaging, before they are allowed to build in buffers. Where buffer impacts are unavoidable, compensation should be required in the form of wetland and/or upland restoration or enhancement.

8.3.8 Buffers

Buffers are defined in many ways (see Chapter 5 in Volume 1) but generally include relatively undisturbed, vegetated areas adjacent to critical areas such as wetlands and streams. The review of the scientific literature in Chapter 5 of Volume 1 indicates that the protection of buffers around wetlands is necessary to protect wetland functions. The scientific literature also provides considerable guidance on buffer characteristics, including widths, which are necessary to protect specific wetland functions. The literature does not provide clear direction on how to structure buffer protection and management programs. However, in addition to providing technical information on buffer effectiveness, the literature provides information that should help guide the development of buffer protection policies and regulations. This information can be summarized as follows:

- Four primary factors should be considered in determining the appropriate width and character of buffers, no matter what the physical setting is:
  - The quality, sensitivity, and functions of the aquatic resource
  - The nature of adjacent land use activity and its potential for impacts on the aquatic resource
  - The character of the existing buffer area (including soils, slope, vegetation, etc.)
  - The intended functions of the buffer

- Site-specific information is needed to determine the characteristics and width of the buffer that will make it effective

- It is important to manage surface water discharges to wetland buffers to ensure effective treatment of pollutants

- Generally, buffer widths “shrink” over time as a result of infringement from adjacent activities

Ideally, this guidance should be incorporated into any local government’s buffer regulations. There are, however, many different ways to incorporate this information into a protection program for buffers. The challenge for local governments in Washington is to develop approaches to buffer protection and management that include the best available science and provide a reasonable and defensible means of establishing and maintaining effective wetland buffers.

Suggested code language for buffers is provided in Appendix 8-B. Guidance on buffers for use with the western and eastern Washington wetland rating systems is provided in Appendices 8-C and 8-D, respectively. Appendix 8-E provides the rationale behind the recommended buffer widths.

8.3.8.1 Issues Regarding the Regulation of Wetland Buffers

Regulations for the protection of wetland buffers should address a number of issues:

1. Standards for buffer characteristics and width

2. Criteria and procedures for varying from a standard

3. Allowable uses within buffers

4. Best management practices to enhance and ensure effective buffer function

5. Provisions for the delineation and demarcation of buffers and their maintenance over time

In most cases, the primary concern will be “how wide does the buffer need to be?” This issue dominates any discussion of buffer regulation and generates the most conflict. However, before determining appropriate standards for buffer widths, a local government needs to decide how best to balance the need for a predictable and cost-effective approach with the desire for an approach that is both flexible and responsive to specific situations.

The options for regulatory approaches to buffers range from variable-width buffers that are determined case-by-case based on multiple site-specific factors, to fixed-width buffer standards. Between these two extremes, there are many intermediate options that combine some elements of each.

Variable-Width Approach

The case-by-case, variable-width approach is probably the most consistent with what a review of the scientific literature reveals about buffer effectiveness (see Chapter 5 in Volume 1). This approach usually requires the development of a detailed formula and methodology for considering site-specific factors such as wetland type, adjacent land use, vegetation, soils, and slope. By considering all relevant site-specific factors prior to determining the appropriate width of the buffer width, this approach helps ensure that the buffer is adequate to protect wetland functions without being any larger than is necessary.

However, this approach is time-consuming, costly to implement, and provides a less predictable outcome. It requires either that the applicant hire a consultant to conduct the necessary analysis, or that the government agency staff conduct the analysis. In either event, the local government staff must have appropriate training and expertise to conduct or review the report produced. In addition, this approach initially requires considerable effort when the formula and methodology for site-evaluation is developed. This approach also does not provide any predictability for applicants. They have no idea how large a buffer may be required until considerable time and money are invested in the analysis. Using a case-by-case, variable-width approach can also result in attempts to manipulate the site-specific data, lead to frequent haggling with applicants, and create the perception that buffer widths are determined in an arbitrary and capricious manner.

Fixed-Width Approach

By contrast, a fixed-width approach provides predictability and is relatively inexpensive to administer. The downside of this "one-size-fits-all" approach is that it results in some buffers being too small to adequately protect wetland functions and some buffers being larger than necessary to protect wetland functions. Over time, this inequity may erode public and political support for the buffer program. Frustrated landowners can point to the "over-regulation" of those buffers that are larger than necessary, while environmentally-minded citizens can point to those buffers that are smaller than needed to protect wetland functions.

It also is difficult to determine an appropriate standard width, because no single-size buffer can be demonstrated to protect all wetland types adequately in all situations unless that standard width is very large. Furthermore, it is difficult to argue that an approach using fixed widths includes the best available science since the scientific literature clearly recommends different buffer widths based on a variety of different factors. While no local governments in Washington currently use a single, fixed-width approach, there are several states that do (e.g., California, New Hampshire, New Jersey).

Combining the Fixed-Width Approach with Site-Specific Variables

There are several ways to modify an approach using standard, fixed widths to incorporate some of the factors that contribute to the effectiveness of buffers. Some drawbacks of the fixed-width approach can be rectified by using a wetland rating system that divides wetlands into different categories based on specific characteristics. Then, different standards for buffer width can be assigned to each category. This approach provides predictable widths, yet allows some tailoring of buffer widths to wetland functions.

For example, as previously mentioned, the Washington State wetlands rating systems divide wetlands into four categories based on rarity, sensitivity to disturbance, irreplaceability, and functions. This hierarchical rating allows one to establish larger standard buffer widths for those in higher categories wetlands and smaller standard buffers for those in lower ones. Most local governments in Washington currently designate buffer widths based on the state wetland rating systems or a rating that is similar.

Another way to address site-specific factors while using fixed widths is to have different widths based on the type of adjacent land use, thus incorporating the four factors, discussed earlier, that are known to influence the effectiveness of buffers. A buffer regulation could require a larger buffer width for adjacent land uses with intense impacts and a smaller buffer width if the impacts from adjacent land uses are low. This strategy can be combined with a wetland rating system to provide a more scientific and defensible approach.

Other critical factors, such as the characteristics of the buffer itself and the functions of the buffer that are desired, can be addressed by establishing criteria and procedures for varying from a standard width. This approach allows for some site-specific tailoring of the standard widths on a case-by-case basis without the need for developing a detailed formula or methodology for determining the widths. In this approach, criteria for increases or reductions from the standard buffer width are developed, and the applicant or any other interested party is given the option of "making a case" as to why the standard buffer width should be increased or decreased. Agency staff then evaluate the proposal against the criteria and decide if such a deviation is warranted.

The criteria for allowing a deviation from the standard buffer width should include the various buffer characteristics that in the scientific literature have been determined to be most important. These include slope, soil type, vegetative cover, and/or the habitat needs of particular wildlife species. For reducing standard buffer widths, an applicant should have to demonstrate that a smaller buffer will protect the functions and values of the wetland. This will generally require hiring a qualified expert and preparing a site-specific report for the local government's review and approval. It is also important to have a minimum buffer width below which the buffer cannot be reduced.

Protecting wildlife species that are threatened, endangered and sensitive

Threatened, endangered, and sensitive (T/E/S) species need specific protection, but this protection cannot be accomplished using the protection measures linked with wetland rating systems. If a T/E/S species is found living in or using a wetland, the appropriate state or federal agency should be consulted to determine what is necessary to protect that species. This information can be considered an "overlay" on the wetland rating. A wetland containing T/E/S species should be protected to meet the requirements of the species as well as the measures associated with its rating category. The T/E/S species using the wetland may need larger buffers or other considerations (e.g., no disturbance during the nesting season).

For example, a Category II riverine wetland that provides overwintering habitat for endangered Coho may need larger buffers than those recommended for a Category II wetland that would protect fish that are not T/E/S species.

For these reasons, it is important that wetland rating forms be used in conjunction with detailed guidance on using the rating forms**. Inadequate protection for listed species may result if rating systems are misapplied.** See Appendix 8-G for buffer widths for some threatened, endangered, or sensitive wildlife species associated with wetlands.

8.3.8.2 Reasonable Use Criteria

Another situation in which standard buffer widths may need to be reduced on a case-by-case basis is when protection of the buffer will result in a property owner being denied reasonable use of his/her land. For example, if a landowner has a one-acre parcel that was zoned for one single-family residence and a wetland covers 80% of the parcel, protection of a buffer around the wetland might mean that the parcel is rendered undevelopable. In this case, the landowner would have a strong case that protection of the wetland and buffer would deny him/her all reasonable use of the property. However, if the buffer were reduced, it may be possible to construct a single house on the property and avoid a "takings" claim.

Thus, critical area regulations should include a provision allowing for buffer reduction in situations where reasonable use would be denied. Such a provision should include requirements that the applicant demonstrate that there are no feasible alternatives to reducing the buffer such as revising the development design, that critical wetland functions or public health and safety will not be impaired, and that the inability to derive reasonable economic use of the property is not the result of the applicant's own actions. For example, a landowner may divide the property in a way that created an unbuildable lot after the adoption of critical area regulations.

Reduction of wetland buffers increases the risk that the remaining buffer will be degraded and encroached upon over time. The allowance for the reduction should be coupled with requirements for permanent fencing and revegetation. Periodic monitoring may also be necessary. Significant reductions in buffers may require off-site mitigation for the reduced buffer.

8.3.8.3 Buffer Averaging

Buffer averaging is a tool for balancing buffer protection with specific site needs for development, or for tailoring a buffer to maximize protection of natural features in the wetland or surrounding upland. It allows a buffer to vary in width around a given wetland. For example, if the standard width for a buffer around a wetland is 100 feet, buffer averaging would allow the width to vary between a minimum and a maximum width but require that the buffer area average 100 feet in width. Typically this is done to allow development to occur closer than usual to the wetland in order to fit a particular development "footprint" onto a given site. However, it can also be used to protect a natural feature (e.g., a stand of trees or snags) that otherwise would fall outside of the standard buffer. Buffer averaging can also be used to provide connections with adjacent habitats or to address those situations where pre-existing development has reduced a buffer area to a width less than the required standard.

Criteria for averaging buffer widths typically require a minimum buffer width (either a designated width or a percentage of the standard buffer width) and documentation to ensure that the averaging of the buffer will improve, or at least, not impair overall buffer functions. Ideally, buffer widths should be narrowed in an area where it will cause the least disturbance and widened in an area where it will benefit the wetland the most.

8.3.8.4 Uses Within Buffers

Another critical issue that buffer regulations need to address is the type of uses that are allowed within buffers. Generally, buffers should be maintained in vegetation. However, uses that could be considered are some stormwater treatment facilities (e.g., bioswales) or trails to provide for some form of recreational use. In addition, over time, residents adjacent to the buffer might want to use it for some activity. Thus, it is essential that buffer regulations address which uses are allowed in buffers.

Generally, any use that results in the creation of impervious areas, clearing of vegetation, or compaction of soils will be incompatible with buffer functions. Typically, buffers need to be densely vegetated with appropriate native vegetation to perform water quality and habitat-related functions. In most cases, this requirement precludes any human uses of the buffer. However, it may be necessary in some situations to use the outer area of the buffer for initial treatment of surface water runoff, via the construction of biofiltration swales or water-spreading devices to ensure sheet flow.

In other situations, it may be desirable to allow some focused use of the buffer for educational and recreational activities and to prevent widespread disturbance of the buffer. If it appears inevitable that adjacent residents will use the buffer to gain access to a wetland for aesthetic or recreational enjoyment, then it may be preferable to concentrate that use in a smaller area and minimize disturbance of the soil, vegetation, and habitat by constructing trails, viewing platforms, or similar facilities. Additionally, providing some educational or recreational developments in buffers may enhance the general public's understanding and appreciation of wetlands and their functions and values.

Many regulations include criteria for evaluating proposals for use of buffers. These criteria typically include general language about prohibited uses but allow for variances if certain conditions are met. Care should be taken to ensure that low-impact trails are not later upgraded to paved trails that encourage activities with greater impacts. Construction of trails can allow greater access for pets to the wetland or wetland buffer and increase predation on fish and wildlife species. Regulations should minimize the impacts from trails and interpretive facilities to the extent practicable.

8.3.8.5 Enhancement and Restoration of Buffer Areas

Frequently, upland areas adjacent to wetlands have been altered by previous land-use practices. In many cases, the vegetation has been cleared or significantly degraded and the soil has been disturbed. Also, it is not uncommon to find that the existing buffer area is composed of non-native vegetation. In these situations, simply "protecting" a buffer with a set width may fail to provide the necessary characteristics to protect a wetland's functions. It is usually desirable, therefore, to restore the buffer to a more naturally vegetated condition.

In other cases, a buffer area may be in relatively good condition but still be sparsely vegetated with trees and shrubs. It may be desirable in this case to improve the screening and habitat value of the buffer by planting additional trees and shrubs or other vegetation appropriate to the ecological setting.

Buffer regulations should be designed to ensure that buffers provide adequate protection of wetland functions. Standard buffer widths should be set based on an assumption that the buffer is well vegetated. In cases where the buffer is not well vegetated, it is necessary to either increase the buffer width or require that the standard buffer width be revegetated. Generally, a well-vegetated buffer will function substantially better than a poorly vegetated buffer. Regulations can essentially give the applicant the option of revegetating the existing buffer in order to have the standard width or foregoing buffer restoration and providing a wider but poorly vegetated buffer.

Requirements for re-vegetating buffers should specify that the buffer be vegetated to a condition that is comparable to an undisturbed plant community in the ecoregion. Buffer enhancement and restoration requires the same diligence as wetland enhancement and restoration and requires monitoring and follow-up to ensure success.

8.3.8.6 Best Management Practices to Enhance or Ensure Effective Functions of Buffers

Water Quality Protection

A buffer's effectiveness at improving water quality is largely a factor of how polluted water travels across and through the buffer. The scientific literature has many references to pretreatment practices that enhance a buffer's effectiveness at removing pollutants, thereby reducing the width of buffer necessary.

In areas with agricultural or silvicultural land uses, the primary pollutants of concern are sediments, nutrients, and pesticides. Narrow (15- to 30-foot-wide) grass filter strips have been shown to be effective at removing coarse sediments and adsorbed pollutants as well as helping encourage sheetflow and infiltration of surface runoff, thus enhancing a buffer's effectiveness at removing remaining pollutants. Therefore, requiring or encouraging the construction of a narrow grass filter strip between agricultural or silvicultural areas and wetlands and their buffers is strongly advised.

In urban areas, the pollutants of concern are primarily sediments and metals from roads, parking lots, and construction sites. Adequate treatment of stormwater runoff is critical to remove most of the pollutants and to reduce peak flows prior to discharge to a wetland or its buffer (see below for more discussion of stormwater). To encourage sheetflow and infiltration, stormwater should be dispersed through a shallow infiltration trench at the outer edge of the buffer (i.e., farthest from the wetland).

In residential areas, the pollutants of concern include sediments, metals, nutrients, and pesticides (from lawns). A combination of appropriate stormwater treatment and the use of a grass filter strip or grassy swale is recommended to pretreat and disperse surface runoff prior to introduction into a buffer.

In rural residential areas, the primary concern is pollutants such as nutrients and fecal coliform from animals. Many hobby farms in rural areas house livestock that should be kept out of wetlands and their buffers.

Stormwater Management

In addition to the introduction of pollutants, development adjacent to or upgradient from a wetland can alter the quantity and timing of surface water and/or groundwater inputs to the wetland. Considerable research has documented the adverse impacts from changes in wetland hydroperiod. The scientific literature also shows that upland buffers around wetlands do little to ameliorate these impacts except in wetlands with small contributing basins. (See Chapter 4 in Volume 1 for further discussion.)

Thus, it is imperative that adequate stormwater management practices be applied to any project adjacent to or upgradient from a wetland. This includes such practices as the construction of settling/detention facilities as well as treatment with a grassy swale. Inadequately detained and treated stormwater will overwhelm a buffer's ability to filter and treat pollutants. Direct surface discharges to buffers usually result in surface flow that is channeled, which significantly reduces pollutant removal and can erode buffers. (Refer to Chapter 3 in Volume 1 for additional information on disturbances caused by urbanization.)

Wildlife Habitat

The two primary actions that can be taken to reduce impacts to wildlife habitat are to 1) ensure that the wetland and its buffer are connected to other habitat areas, and 2) reduce the intrusion of noise, light, people, and pets.

Ensuring connectivity is usually an issue of site design. Some wetlands are already isolated from other habitat areas, and it will not be possible to provide connectivity. On sites where wetlands are currently connected to other habitat areas, it is important to maintain that connectivity through corridors. While the scientific literature indicates that wildlife travel corridors should be as wide as 500 feet, it may be beneficial to provide a corridor of any size. Generally, corridors of less than 100 feet will only provide the cover needed for small mammals and less-sensitive birds.

Local wildlife experts should be consulted to determine the appropriate corridor design for a given site. Buffer averaging can be a useful tool to help ensure connectivity with adjacent habitat areas without unduly burdening the landowner.

Reducing the intrusion of noise, light, people, and pets can be accomplished in many ways. Buffers vegetated with dense trees and shrubs are effective at reducing intrusion of noise and light. Additionally, projects can be designed to reduce noise and light intrusion by locating noisy areas such as parking lots, playgrounds, and loading docks away from the edge of the buffer. Lighting can be designed and located so it points away from the wetland and its buffer. Fences or berms can be constructed to block noise and light. Fences can also be used to limit human and pet intrusion. Dense shrubs, particularly those with thorns, can be planted along the edge of a development to block noise and light and limit intrusion.

With forethought and careful planning, projects can be designed to reduce impacts to wildlife habitat. When combined with adequately vegetated buffers of sufficient width, these measures can help ensure that disturbance to wildlife use of a wetland is minimized.

8.3.8.7 Issues in Managing Buffers

Many steps need to be considered to ensure that, once established, buffers continue to provide the functions for which they were protected. These steps frequently are overlooked or given scant attention by local governments, resulting in the degradation of buffers over time.

Ownership of the Buffer

The issue of who owns the area included within a buffer is an important one. There are basically two options:

- The buffer area can be included in a separate tract or lot and held in common ownership by a homeowners association, agency, or non-profit organization
- The buffer can be included in lots owned by adjacent landowners

The second option is often pursued by a developer who wants to divide the buffer among individual lots in order to achieve a required minimum lot size. However, a study by Cooke (in Castelle et al. 1992) of buffer areas in two counties in western Washington showed that buffers that were owned by many different lot owners were more likely to be degraded over time. Even with easement language on each lot owner's deed specifying the buffer protection provisions, owners tend to clear buffer vegetation over time to expand lawns, build storage sheds, or serve other uses.

If the buffer area is not held in some kind of common ownership, it is much more difficult to take enforcement action against those landowners who encroach upon its boundaries. Therefore, when feasible, wetlands and their buffer areas should be placed in a separate, non-buildable tract that is owned and maintained by an organization that is dedicated to protecting the buffer. The boundaries of the tract should be clearly marked to help prevent unintentional encroachments.

Buffer Delineation, Recording, and Signage

Clearly delineating and marking a buffer area helps ensure that it is not degraded over time. Following project approval, and prior to site construction, the buffer should be measured, recorded on applicable legal documents, and clearly marked on the ground. During the construction phase, constructing a temporary sediment fence or "clearing limits" fence helps to ensure that the boundary is seen by equipment operators and that the wetland and buffer are protected from erosion during construction. Following construction, a fence may still be desirable to demarcate the boundary and to limit human and pet access and reduce the intrusion of noise and light.

Placement of signs along the buffer boundary is important for two reasons: to help mark the boundary, and to help educate landowners about the purpose and value of protecting buffer areas. In areas with high potential for human intrusion and degradation of the buffer, more extensive signage explaining the value of the buffer may be necessary to develop support for protecting the buffer. In addition to signs, brochures can be developed and distributed to adjacent landowners to explain the reasons why buffers and wetlands are protected and what human activities are allowed. Typically, applicants are responsible for developing and constructing fences and signs and for distributing educational materials. However, local jurisdictions can develop standards for fences, signs, and educational materials to ensure consistency and effectiveness. Maintenance of fences and signs is typically the responsibility of the adjacent landowner or a homeowners association, if applicable, or lies with the local jurisdiction.

Maintenance of Buffers

In cases where enhancement or restoration of a buffer is required, monitoring and maintaining the buffer area is essential. A monitoring/maintenance program should include evaluation of the success of plantings and provide for contingency measures if vegetation survival standards are not met. Responsibility for this is usually borne by the developer or landowner. It is also important to monitor buffer areas when human use is allowed or expected. Adverse effects of human access such as vegetation trampling, littering, and soil compaction or erosion should be monitored and corrected if found. Local jurisdictions can develop and implement a buffer maintenance and monitoring program but few have done so. Alternatively, applicants can be required to monitor and maintain buffers and submit regular reports to the local jurisdiction.

Enforcement

Simply designating and marking the boundaries of buffer areas is not sufficient to protect buffers in all cases. Regular observation of buffer areas is critical to determine whether vegetation and soils are being damaged and to ensure that adjacent development does not encroach on the buffer over time. Where illegal activities occur, enforcement actions to restore the buffer may be necessary. Local jurisdictions should establish a program to observe the buffer over time and take enforcement actions when necessary, similar to programs for private stormwater or wastewater facilities.

8.3.8.8 Buffers in Urban Areas

A frequent concern about buffers is their applicability to urban and urbanizing areas. The concerns generally fall into two categories: 1) the science on buffers comes largely from agricultural and forestry settings and is perceived to be irrelevant to urban areas; and 2) the need to maximize density of development in urban areas is in direct conflict with the protection of large upland areas around wetlands (and streams).

The concern over the relevancy of the literature on buffers to urban areas is largely unfounded. While most of the studies of buffer effectiveness occur in non-urban settings, the principles are the same. Buffers do not function any differently in urban settings than in rural settings. The same processes of sediment, nutrient, and toxics removal operate similarly in urban areas as they do in rural settings. However, a good stormwater management program can reduce the need for buffers to perform filtration functions, with the exception of lawns and landscaped areas which drain into wetlands rather than into stormwater collection areas.

The role of buffers in providing needed upland habitat for wetland species and in screening adjacent noise and light is also performed similarly. In fact, a case can be made that buffers in urban areas are even more important from a habitat standpoint because there is little other upland habitat available. The factors that may be different in urban areas are that urban wetlands may perform some functions at a lower level because of degradation, and the range of wildlife species utilizing urban wetlands may be smaller. However, remaining wetlands (and adjacent upland areas) in urban areas may, in fact, function as habitat islands and be critical to many species. Generally, the protection of wildlife habitat functions of wetlands requires larger buffers than protection of water quality functions, particularly when state-of-the-art stormwater management is employed.

However, the best way to address the issue of buffers in urban areas is to conduct a landscape analysis and develop a subarea plan that identifies, prioritizes, and protects the most important wetland, riparian, and upland habitats (see Chapters 5 through 7 of this volume for additional discussion). Maintaining and restoring connections between wetland, riparian, and upland habitats is key to protecting wildlife. A landscape analysis can help identify existing connections that should be protected as well as areas where connectivity can be restored. Combined with standards for low impact development and state-of-the-art stormwater management, this kind of approach could result in smaller buffers around the other critical areas that are not providing vital habitat. The studies should always be confirmed on the ground during project review.

The issue of balancing wetland protection with competing mandates in the GMA is a legitimate one that can be addressed in a number of ways. A buildable lands survey with a good wetlands inventory can provide important information on the actual conflicts that may exist (rather than a perceived conflict). Provisions to allow density trading from buffers to adjacent or nearby developable lands can help.

8.4 Monitoring the Effectiveness of the Regulatory Component of a Protection Program

A local government should be able to track the effects of decisions made in the implementation of its critical areas ordinance and produce regular status reports for the public to review. This is an important step to demonstrate that the goals and requirements of the GMA are being met. The following are examples of questions that should be answered:

- How many wetlands have been affected by permit decisions?
- How many acres have been filled?
- How much and what type of mitigation was required?
- How many requests for buffer reductions have been granted? (Associated questions include: how many projects included buffer increases, how narrow/wide was the buffer reduction/increase, how many acres of buffers were involved in buffer reduction/increases, and was off-site mitigation required as part of the buffer reduction?)
- How many projects included provisions for wildlife corridors to connect adjacent wetlands? (An associated question is: how many acres of upland buffers were affected by these buffer considerations?)

- How well have the mitigation projects succeeded in replacing wetland acreage and function?
- How many variances have been issued? (Associated questions include: how many exemptions have been granted, and how many violations have occurred?)
- How many emergency waivers have been issued? (An associated question is how many required after-the-fact mitigation?)
- How much non-compensatory restoration is being done?
- How many acres of impacts have been avoided, by basin?

Without the collection of these data, a local government cannot evaluate how well it is doing in moving toward a goal of "no net loss goal" for its regulation. Furthermore, these data are an integral part of a local government's adaptive management approach because they allow decision-makers to improve the regulations based on real data.

Monitoring does not have to be complicated but should be linked to the goals established for the regulations (discussed in Section 8.2). A regulation with rigid requirements will not require as much data collection as one that relies on case-by-case flexible implementation. Flexible programs by design represent a higher risk to wetlands because case-by-case decision-making can lead to greater cumulative effects than more rigid regulatory programs. (See Balancing Predictability with Flexibility in Section 8.2.1). Many of these data can be collected as part of follow-up work for permit compliance.

This chapter has not outlined the minimum features to include for monitoring because they are entirely dependent on what language is adopted in code. See Chapter 12 of this volume for additional information on monitoring and adaptive management.

Chapter 9
Prescribing Solutions: Non-Regulatory Tools

9.1 Introduction

Non-regulatory tools, discussed in this chapter, provide important solutions to protecting and managing wetlands, and they comprise a key component of any wetland protection program. Developing non-regulatory approaches is a part of Step 2, Prescribing Solutions, in the four-step framework discussed in this volume (Figure 9-1).

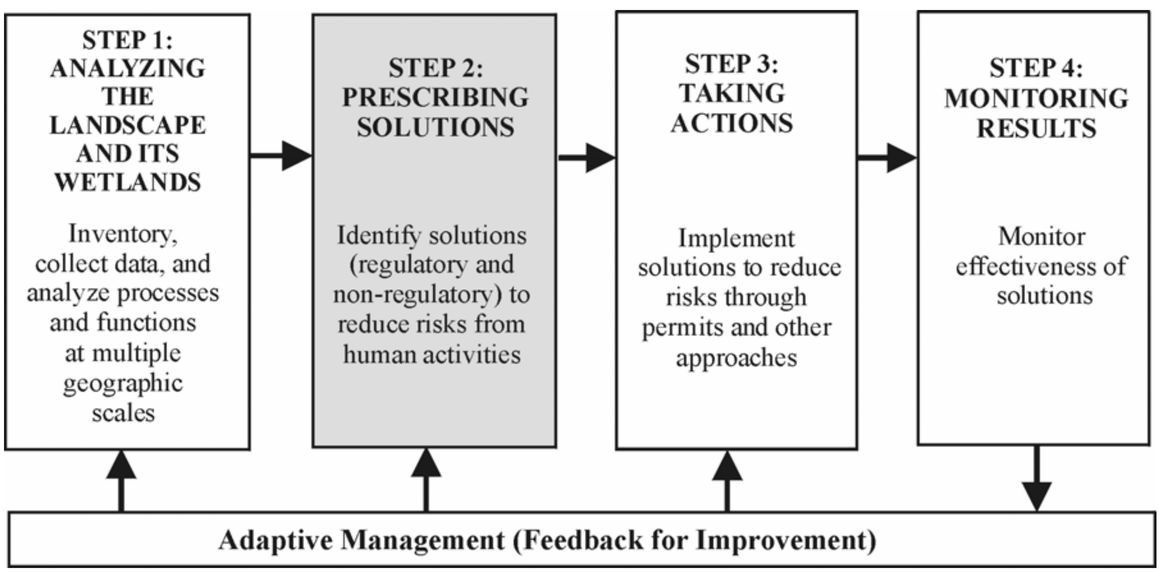


Figure 9-1. Developing non-regulatory tools is part of Step 2 in the four-step framework for protecting and managing wetlands (shaded box).

Non-regulatory activities are voluntary in nature and complement land-use regulations used to protect and manage wetlands. As mentioned in Chapter 8, regulations alone cannot adequately protect wetlands. For example, regulatory tools, such as buffers and compensatory mitigation, establish standards for protecting and managing resources when a land-use action is proposed on a specific site. Non-regulatory approaches, including preservation, conservation, restoration, and incentives, can be used on both a site-specific basis and can be applied to an entire management area.

In addition, non-regulatory activities, as a part of a wetland protection program, are important because they:

- Reduce risk of loss and/or degradation of critical wetlands (*Critical* in this context means those wetlands that provide essential contributions to the landscape or to society)

- Provide options for landowners and governments in the early stages of making decisions about the conservation of landscape processes and wetlands (see Section 9.2 for a description of "conservation")

- Can address large areas of the landscape and thus be effective in protecting landscape processes and wetland functions

- Meet the needs of those landowners who prefer a voluntary option

- Provide a proactive approach to improve landscape conditions that incorporates willing landowner and community participation

- Help to achieve no net loss and make eventual gains in wetland function and acreage

- Have financial and tax benefits

Therefore, the goal of protecting wetland functions and values, and associated landscape processes, is best accomplished when using wide range of activities: An effective protection program needs to include both regulatory and non-regulatory components.

Developing and incorporating non-regulatory tools can occur at any stage of a jurisdiction's planning process. However, non-regulatory efforts will be most effective if they are integrated in the early stages of planning; for example, during the formation of a Green Infrastructure plan (Chapter 6). During these early stages, the information from a landscape analysis (Chapter 5) can be used to help the jurisdiction assess options for maintaining landscape processes into the future and to decide which options provide the most desirable outcome. The non-regulatory component of a wetland protection program can then be used as a means to help achieve this outcome.

9.2 Three Categories of Non-Regulatory Actions to Consider

Non-regulatory actions fall into three general categories:

- **Preservation** provides a way to set lands aside so that they are not actively used for human activities

- **Conservation** allows for human activities but limits their impacts by applying best management practices and other measures to protect resource functions

- **Restoration** serves to return the land to a condition in which it performs functions and contributes to landscape processes in a manner similar to past conditions. For wetlands, the key step is re-establishing the appropriate water regime

Preservation, conservation, and restoration are actions that are used in both regulatory and non-regulatory contexts. In the regulatory context, these terms may represent actions that are more limited in scope. For example, preservation may be defined narrowly. As described in the recent regulatory guidance by Ecology and the U.S. Army Corps of Engineers (April 2004), preservation can be used only under specific conditions such as preserving a wetland that is under immediate threat. Comparatively, in a non-regulatory context, preservation can be applied whenever a particular wetland is considered of high importance thus warranting permanent protection to remove any future threats.

As previously mentioned, conducting a landscape analysis (see Chapter 5) is very helpful in determining how each of these types of non-regulatory actions can supplement regulatory tools to ensure that landscape processes are maintained. Generally, all three may be desirable for maintaining landscape processes. However, some jurisdictions may find that only one or two of these actions will be the primary focus, while others may incorporate all three.

Each of these non-regulatory actions can be used at various locations within a jurisdiction, and a landscape analysis clarifies which non-regulatory action is most relevant to respective locations. For example, a particular sub-basin may be dominated by agriculture and have water quality problems but have a high potential for water quality improvement if wetlands were restored. In this case, the focus of non-regulatory efforts could be improving *conservation* through application of best management practices in agricultural areas while initiating *restoration* of wetlands where landowners are willing. In another sub-basin with high growth rates, the need might be to use *preservation* of wetlands that provide high habitat functions at the fringe of an urban growth area.

Understanding the landscape processes therefore helps with the design of non-regulatory actions and implementation through non-regulatory tools. Appropriate tools can then be applied broadly throughout the entire management area or selectively in the areas in which they are most relevant.

A brief overview of preservation, conservation, and restoration in the non-regulatory context is provided below. The specific tools that can be used to implement these non-regulatory actions are discussed in more detail later in this chapter and in the chapter on implementation (see Chapter 11).

9.2.1 Preservation

In their paper on *Conservation of Biodiversity in a World of Use,* Redford and Richter (1999) state:

> *(1) different degrees of human use or alteration result in differential conservation of biodiversity components, (2) some components and attributes of biodiversity are more sensitive to human use than others, and (3) only extremely limited use or virtually no alteration will protect all components.*

Thus, a key role for preservation is to permanently protect those areas that are so highly sensitive to use, so rare or irreplaceable, or so critical to landscape processes that their degradation or loss cannot be afforded.

Preservation employs the permanent protection of land through either:

- Full-fee, title ownership of all property rights
- Partial ownership of the development and/or use rights to the land through a conservation easement

Conservation easements serve to protect the land into the future (often in perpetuity) by restricting the property deed with conditions for preservation. A "holder" of the conservation easement (such as a land trust) is designated to enforce the terms of the easement through time. Short of full-fee purchase, conservation easements are the strongest legal protections available for land preservation.

9.2.2 Conservation

As previously mentioned, conservation allows for the active use of the land while maintaining landscape processes over time. Conservation applies to areas used for resource production. For example, owners of land used for agriculture and forestry are encouraged to apply best management practices such as riparian and wetland buffers.

Conservation also applies to urbanizing areas where changes in land use might adversely impact a resource. Conservation of wetlands is a concern in urbanizing settings where adjacent use by humans affects wetlands and buffers. Improved management practices on the part of homeowner associations, private landowners, and land developers can help to reduce impacts. Education and outreach are vital in promoting the use of appropriate conservation tools.

9.2.3 Restoration

Restoration provides a method for recovering landscape processes and wetland functions that have been lost or degraded. While mitigation actions in a regulatory context compensate for the loss of acreage or functions as a result of a current development activity, they are not designed to recover wetland acreage or functions that have been lost in the past. However, voluntary (non-compensatory) restoration can restore acreage and functions lost as a result of past land uses.

Some types of wetlands have been more altered than others due to the relative ease of draining and converting them to other uses, as well as other factors. The net result has been a homogenization (i.e., reduction in diversity) of the remaining wetlands and a shift in the relative proportion of habitat types and functions performed (see Chapter 4 in Volume 1). Wetlands have also been affected in terms of their distance from each other, the connectivity of habitat between them, and their location, distribution, and position in the landscape. This affects the dispersal of animals and plants between wetlands and how wetlands affect water quality, flood attenuation, and hydrologic processes (Bedford 1999, citing Brinson 1993). These and other factors need to be considered as part of non-regulatory, wetland restoration efforts.

9.3 Fiscal Benefits of Using Non-Regulatory Tools

One of the most important considerations in using non-regulatory actions and tools in a wetland protection program is fiscal savings. Fiscal savings fall into two categories: 1) the efficiencies resulting from the maintenance of services performed by "green infrastructure", and 2) the savings gained by implementing actions at the optimal geographic location to effectively address problems in the landscape or watershed.

As discussed in Chapter 6, landscapes and their wetlands provide an array of green infrastructure services (e.g., flood attenuation, improvement in water quality, the recharge of water, etc.) Studies have indicated that protecting existing green infrastructure, instead of having to engineer and build "grey infrastructure" to replace the green infrastructure, actually saves money (see Chapter 6). For example, despite the common perception that non-regulatory programs are too expensive, money spent to purchase land for permanent preservation and thus protect its functions and services can result in a significant financial savings over the long term. Therefore, when considering the goals of non-regulatory efforts, the jurisdiction should understand these financial implications.

Cost efficiencies are increased when the non-regulatory actions and the funds to implement such actions are targeted to the ideal or optimal locations, such as "problem" areas within sub-basins or watersheds which have been identified using a landscape analysis. (The analysis can also help identify the appropriate non-regulatory actions to use to help correct the problems.) Thus, targeting the right action in the right place is a wise and effective use of funds. Also, prioritizing which locations need attention first helps to minimize further loss of landscape processes, thereby retaining existing green infrastructure.

An active education initiative that includes fiscal benefits is essential. As previously mentioned, it is important that citizens and political leaders are aware of fiscal benefits. They should understand that short-term costs to preserve land, and any loss of tax revenues on that land, will be offset over the long term by savings from the functions and services the land provides. In addition, it is also important to know that the cost of providing built infrastructure can out pace tax revenues generated by new development. Conveying this information to local leaders and citizens increases understanding and promotes support for non-regulatory programs.

Jurisdictions in several parts of the country have conducted fiscal analyses to document the cost savings that a non-regulatory approach can provide. Further information on these savings can be found in Chapter 6 and Appendix 6-A.

9.4 Important Considerations When Incorporating Non-Regulatory Tools

When establishing the non-regulatory components of a wetland program, developing the overall vision and the goals to be accomplished should be the first step. A clear foundation on which to build the non-regulatory effort will already have been laid if a Green Infrastructure plan has been prepared or the community has engaged in an Alternative Futures analysis (see Chapter 6). From there, the identification of the locations and type of actions (conservation, preservation, and restoration) for specific sites can readily be determined.

In addition to the vision and goals, several practical considerations must be addressed to initiate the non-regulatory components. The following are some essential parts of an effective non-regulatory effort:

- Staffing (e.g., coordinator, support staff, staff for site management, etc.)
- Identifying, mapping, and prioritizing where non-regulatory tools will be applied
- Creating partnerships with organization, government agencies, and others to help sponsor local projects
- Identifying a recipient to hold and manage land
- Obtaining funding for local actions
- Providing incentives to encourage participation by landowners
- Educating and involving the public and providing technical outreach to the public and landowners
- Monitoring project sites and the overall success of the non-regulatory actions

Most of these are discussed in the implementation portion of this document (see Chapter 11). However, an overview of key funding mechanisms and landowner incentives are provided in Section 9.4.1 in this chapter.

> For more details on funding and incentives, as well as complete coverage of landowner conservation tools, please refer to the *Exploring Wetlands Stewardship Guide: A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004). http://www.ecy.wa.gov/biblio/96120.html or http://www.ecy.wa.gov/pubs/96120.pdf

9.4.1 Funding Mechanisms

Purchasing land to preserve it, whether in *full-fee title* or *less-than-fee development rights,* requires some form of local revenue. Full-fee title (also *fee-simple, full purchase, or full-interest*) is the acquisition of all rights to a parcel of land, including development rights, mining rights, timber rights, etc. *Less-than-fee title* (or *partial-interest purchase*) is the acquisition of some of the rights to a parcel of land but not all (for example, the acquisition of development rights only).

Common forms of financing for preservation (and other conservation measures) include property taxes, sales or use taxes, real estate transfer taxes, impact fees, special assessment districts, general obligation bonds, and revenue bonds. The ability to raise local revenue for conservation allows the money to be used as a match to obtain additional funds through state or federal grants, thus enhancing the potential for funding local conservation.

In *Local Greenprinting for Growth*, the Trust for Public Lands and National Association of County Officials (2002) provide the following table which summarizes common sources of conservation financing with a list of pros and cons for each.

Table 9-1. Common sources of financing for conservation.

Financing Source	Definition	Pros	Cons
Property tax	Tax on real property paid by commercial and residential property owners	Steady source of revenue Relatively easily administered Tax burden is distributed Small increases create substantial funding Popular with voters when focuses on compelling needs of land conservation	Competition for other public uses Overall concern among taxpayers about higher rates
Sales & use tax	Tax in sales of goods and services	Relatively easy to administer Low reporting costs Can generate large sums, even at small tax levels May be paid in part by out-of-town visitors Can tap into tourism profits generated by open space amenities May include exemptions such as food & medicine	Revenues can drop when economy slows Considered regressive

Financing Source	Definition	Pros	Cons
Real estate tax	Tax on the sales of property paid by either the buyer or seller at time of transfer	Funds can be substantial Connection between taxing new development and protecting open space	Initial opposition from real estate/development interests can make passage difficult Less predictable revenue stream
Impact fees	One-time fee paid by developer to offset costs of infrastructure needed for new development	Connection between taxing new development and protecting open space	Parks and open space projects might require direct link to new development
Special assessment district	Special tax district for area that benefits from an open space area	Users finance acquisition and management Predictable revenue stream Accountability in government spending Sense of ownership of and responsibility for area parks and services Can establish in small increments May be able to set own election date and process	Possibly time consuming to implement Overall concern among taxpayers about high rates
General obligation bond	Loan taken out by a city or county against the value of the taxable property	Allows for immediate purchase of open space, locking in land at current prices Distributes the cost of acquisition over time	Extra costs associated with the interest accrued through borrowing Voter approval required, sometimes by supermajority levels
Revenue bond	Loan paid from proceeds of a tax levied for the use of a specific public project or with proceeds of fees charged to those who use the financed facility	Not constrained by the debt ceilings of general obligation bonds Voter approval rarely required	More expensive than general obligation bonds
Source: Trust for Public Lands and National Association of County Officials (2002).			

9.4.1.1 Common Forms of Conservation Revenue in Washington

In Washington, one of the most common forms of conservation revenue comes from the Conservation Futures Levy. RCW 84.34.200 and RCW 84.34.230 established the authorization for any Washington county to administer a real property tax in the amount of $0.0625 per $1000 of assessed valuation. This provision for conservation fund-raising at the local level is quite unique in the country and presents an opportunity for local communities to acquire and preserve wetlands and other areas that provide green infrastructure services. However, it is currently used by only a third of the counties in the state. Those counties that are using it have been quite successful, over the years, in preserving important lands within their communities.

General obligation bonds and impact fees have also been frequently used by local jurisdictions in Washington for conservation purposes. General obligation bonds are generated by local governments, and the revenue can be used to finance conservation activities, with the principle repaid over time. Impact fees are charged when a site is developed, and the fees can be dedicated to finance conservation of open space to compensate for losses caused by the development.

9.4.1.2 Land Banking

Land banking is a tool that raises funds from land acquisition by placing a tax on real estate sales within the jurisdiction. It was first initiated in Massachusetts in 1984. In 1990, Washington State authorized a real estate excise tax under RCW 82.46.070 for the establishment of land banks. This authority allows counties to impose a property transfer tax where tax proceeds are used exclusively for fee-simple or less-than-fee acquisition and/or maintenance of conservation areas. Initiated either by resolution of the county legislators or by the public through a petition, the excise tax is approved by citizen vote.

Only one Washington jurisdiction, San Juan County, has established this form of tax revenue. The San Juan County Land Bank, established in 1990, has successfully completed conservation easements on 17,000 acres and fee purchase on approximately 900 acres. To date, they have received between $18 million and $19 million in revenue. After its original authorization period of 12 years, the program was extended following active campaigning by local real estate agents. The land bank was reauthorized with a 74% approval by county residents (Shaffer, San Juan County Land Bank, personal communication 2003).

Communities in Cape Cod are also moving toward establishing land banks to address growth while protecting their resources. This is discussed in a paper by Cummiskey (2001) in which the author describes the development of a land bank in Cape Cod during the late 1990s. Cummiskey states that despite the existence of numerous tools such as building restrictions, zoning bylaws, subdivision regulations, and historic district designations, accelerating development continued to threaten shorelines and other resources. This necessitated the addition of other management tools to protect the lifestyle and natural qualities of Cape Cod. The author points out that more cities and towns in Massachusetts and other states are considering land banks as growth management tools to address coastal development, as well as urban, suburban, and rural sprawl.

9.4.2 Landowner Incentives

It is important to have a broad range of tools available to address the needs of each individual landowner. Tools that incorporate some form of market-based incentive help to motivate conservation. With this in mind, local governments can conduct full-interest and partial-interest land purchases (conservation easements), and/or they can establish tax-based incentives and incentive zoning with tradable development rights and cluster or higher density alternatives. As previously mentioned, it is best to institute these tools early in the planning process to allow for their optimum use. A few are discussed in this section as well as Section 9.4.3, Incentive Zoning and Regulation.

9.4.2.1 Incentive-based Tools: Open Space Current Use Taxation

"Land taxes often act as a disincentive to landowners wishing to conserve natural areas" (Edwards 1994). In *Developing America's Natural Areas Market*, Edwards states that government can assist in conservation by removing existing disincentives to private protection of land and by assisting in developing a market for areas that are maintained as "natural areas" rather than relying on private conservation programs alone.

Washington's Open Space Current Use Taxation (CUT) Program (RCW 84.34) removes such disincentives. It allows local governments to offer landowners voluntary enrollment of undeveloped property in their county's program. The open space element of the CUT program provides reductions in property tax for the conservation of features of natural resources considered of value to the community at large. The optional Public Benefit Rating System (PBRS) allows the local jurisdiction to identify which "features" of natural resources that will be considered in the program, targeting those that are deemed most beneficial to the community. In the PBRS, the specific criteria related to these features are clearly defined and are used to score a property. These criteria assess its eligibility for enrollment in the CUT program and determine the level of tax reduction. The PBRS therefore allows flexibility to shape the CUT Program to protect landscape processes by targeting features that help maintain those processes.

Applying the Public Benefit Rating System as a Watershed Action Tool (Rubey 1999) provides guidance for local jurisdictions who wish to use the PBRS more strategically. The guidance includes specific criteria to identify properties containing natural resource features that will help ameliorate water quality problems, flooding, habitat loss, etc.

Using the PBRS criteria can even be tailored to address the needs of different sub-basins within the overall jurisdiction. A tailored PBRS is an ideal tool when implementing Alternative Futures or Green Infrastructure plans.

9.4.2.2 Other Incentive-Based Tools

There are other incentive-based options, listed below and discussed briefly, from which landowners can benefit by protecting and enhancing ecosystems including wetlands:

- Transferring property title with compensation
- Retaining ownership and managing the property
- Conservation in the context of development (see Section 9.4.3)

The reader is referred to *Exploring Wetlands Stewardship, A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004) for a detailed discussion of these options, as well as the other conservation and stewardship issues. For example, Rubey (2004) covers the grant programs available to assist implementing preservation and restoration projects. The document also includes a complete listing of state and federal programs, with many local programs, as a resource to correspond non-regulatory wetland projects with potential funding.

Transferring Property Title with Compensation

Transfer of property title <u>*with*</u> *compensation* is used in the context of funding mechanisms for the purchase of property title. There are numerous non-regulatory tools available which can be employed to bring a purchase of land to closure. These include bargain sales, installment sales, land exchanges, options to buy, reserved life estate, right of first refusal, self finance, and tax deferred exchange. *Transfers of title* <u>*without*</u> *compensation* would include different forms of donations such as bequest, leaseback, outright, and reserved life estate or remainder interest.

Retaining Ownership and Managing the Property

A landowner can retain ownership and management of the property while providing conservation through a *conservation lease*. When purchase of property and/or a conservation easement (which provide permanent protection) are not available or acceptable to a private landowner, another less-permanent option is a conservation lease (also called a *resource conservation agreement*). The conservation lease offers tax relief or a conservation management payment as the incentive for conservation.

Conservation leases are often a preferred approach for agricultural or timber landowners. Main et al. (1999) point out that the system of taxation in the United States discourages agricultural landowners letting lands remain fallow when they are marginal for agriculture (e.g., wetlands), thus fueling the conversion of wetland habitats and resulting in loss or fragmentation. A conservation lease can offer some compensation to these landowners for conserving lands, rather than using them as marginal farmed lands.

Other options for retaining ownership with conservation are mutual covenants, open space current use classification, and undivided interest. As mentioned previously, more details on all of these tools are provided in *Exploring Wetlands Stewardship, A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004).

9.4.3 Incentive Zoning and Regulation

There are also some tools that provide conservation incentives to landowners within the context of regulating development. *Incentive zoning* operates within the regulatory component of an existing protection program to influence development toward preservation of open space. One example is clustered development. Clustered development requires that development be placed on a small portion of the parcel, thereby retaining the balance as open space. Incentives for denser development of up to 20% have been allowed in some communities where a larger number of lots than usually allowed are exchanged for dedicating additional open space (Smart Growth Network 2002).

The transfer of development rights (TDR) is also frequently considered. Basically, TDR moves the allowed rights of development from a less desirable site (with higher resource functions or values) to a less sensitive site (more suited to development). A strong real estate market is necessary to fuel the transfer, and very abundant and uncontroversial sites for the transfer (receiving sites) must exist. Also, the zone proposed for preservation must have comparatively lower activity in regard to the real estate market. For example, McGilvray et al. (1985) found that saltmarsh lagoons in coastal communities were hard to preserve using TDR because of the high property values associated with ocean views.

Brabec and Smith (2002) studied TDR, purchase of development rights (PDR), and cluster development in the eastern United States in regard to fragmentation in agricultural lands. They found that TDR and PDR worked best for maintaining viable agricultural practices and preventing isolation and reduction in size. Because the area they studied had a strong transfer market, the TDR tool performed well. The TDR resulted in the aggregation of 91% of the parcels into protected areas with an average size of 465 acres. The PDR programs aggregated 75 to 88% in the various communities studied. With the cluster program, 36% of the sites were aggregated (64% isolated) and averaged only 30 acres in size.

Avoiding fragmentation is a key aspect of any conservation strategy, so this study provides valuable insights regarding the potential of these tools for wetland applications. The analysis and comparison of these three incentive-based, regulatory tools reinforces the importance of using and coordinating a variety of non-regulatory and regulatory tools to achieve optimal results (Brabec and Smith 2002).

Chapter 10

Prescribing Solutions: Characterization of Risks

10.1 Introduction

This chapter builds on previous chapters by discussing the importance of characterizing the risks that are inherent in the solutions developed in Step 2 of the framework of a wetland protection program (Figure 10-1). The scientific information available indicates that as human populations grow, we increasingly impact the environmental processes that maintain the functions of our natural resources (Dale et al. 2000). We have not yet found the ways by which we can completely eliminate impacts in the face of our growing population. Therefore, the goal for protecting and managing our natural resources, including wetlands, should be to minimize the risk to resources from our activities, thereby, also reducing cumulative impacts (Cairns 1997).

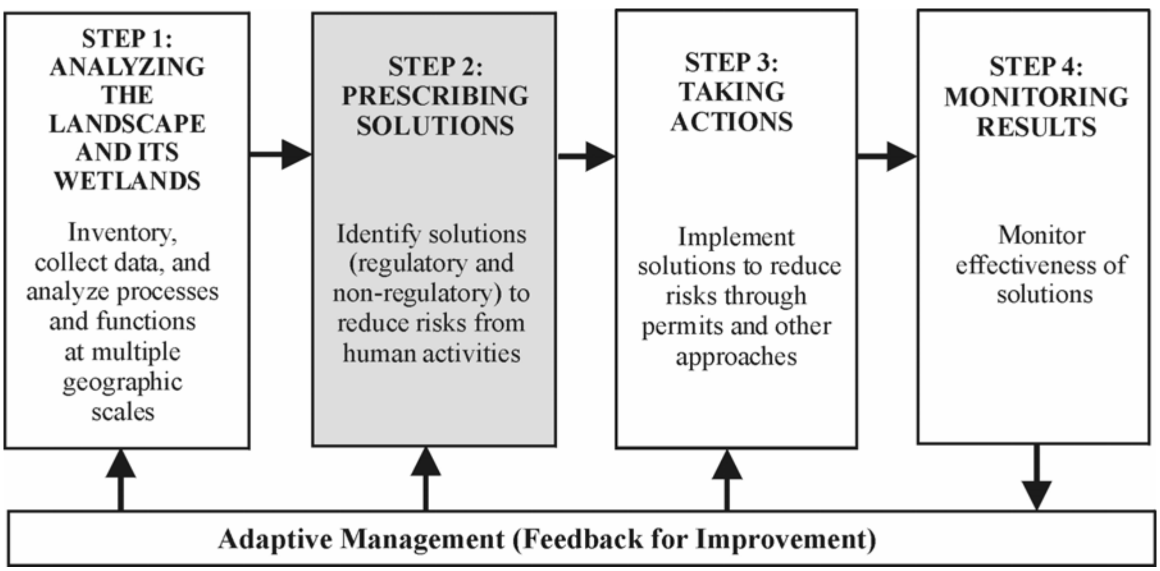


Figure 10-1. Characterizing risks is part of Step 2, Prescribing Solutions, within the four-step framework recommended for protecting and managing wetlands (shaded box).

Risks are minimized by first understanding the risks inherent in actions taken and then developing a program that minimizes those risks. The first step, developing an understanding of risks, is called a *characterization of risks* or *risk assessment.* A characterization of risks considers the impacts and benefits that result from actions that are proposed to be taken. A characterization provides a way to develop, organize, and present scientific information so that it is useful in making decisions about future land uses. The characterization can provide a basis for comparing different options for protecting and managing wetlands, and it should enable decision-makers and the public to make more informed decisions about wetland resources.

In a characterization of risks, local jurisdictions should consider whether the plans, policies, and regulations they are developing will minimize the risk of cumulative impacts to the functions and values of natural resources including wetlands. If the risk to the wetland resource is still high with the proposed actions in place, the jurisdiction should identify additional measures that can be taken to reduce the risk.

The descriptions of impacts and benefits used for a characterization of risks may range from qualitative judgments to numeric estimates of probability. The guidance for characterizing risks described in this chapter can be applied to both qualitative and quantitative approaches. Local governments are encouraged to characterize the risks of each policy, zoning plan, regulation, exemption, incentive, restoration program, etc. based on the impacts or benefits it poses to landscape processes and the wetland resource.

For example, a regulation that represents a relatively low risk to wetlands is to set a standard 300-foot buffer around every wetland. This is not necessarily recommended because it does not take into account differences among wetlands, but it would significantly reduce the risk to wetlands from human activities in the immediate vicinity. Such a standard could be characterized as having “low risk.” On another extreme, a local government may apply a 30-foot buffer around all their wetlands, which could be characterized as “high risk.” The review of the literature indicates that a 30-foot buffer alone is not large enough to protect most functions of a wetland. By consistently applying a 30-foot buffer around all wetlands, the functions of wetlands in the jurisdiction will be degraded and result in cumulative impacts such as “space crowding” and “fragmentation” (see Chapter 7 in Volume 1).

There are no simple, unambiguous methods to characterize the risks of different actions that can be taken by local jurisdictions to protect wetlands. The methods are being developed and are still quite subjective. The departments of Ecology and Fish and Wildlife recommend, however, that local jurisdictions try to characterize the risks of their actions. A subjective characterization is better than none at all if the choices and decisions made are documented. The following section outlines one type of process by which the risks can be characterized and documented.

10.2 Risk and the Growth Management Act

A characterization of risks of proposed solutions for protecting and managing wetlands is not a statutory requirement of the Growth Management Act. However, the procedural guidelines (WAC 365-195) adopted by the department of Community, Trade, and Economic Development (CTED) in 2001 recommend that risks to critical areas resulting from the adoption of policies and development regulations be identified. The risks should be identified if the policies and regulations depart from the best available science established in the record or where adequate scientific information is lacking. Following are relevant excerpts from WAC 365-195.

The following section describes the process that should be used when a local jurisdiction determines that it cannot, for some reason, include the best available science in its development policies and regulations. In these cases, the clear identification of risks to the functions and values of critical areas is essential (see bolded language below).

WAC 365-195-915 Criteria for including the best available science in developing policies and development regulations.

(1) To demonstrate that the best available science has been included in the development of critical areas policies and regulations, counties and cities should address each of the following on the record:

(a) The specific policies and development regulations adopted to protect the functions and values of the critical areas at issue.

(b) The relevant sources of best available scientific information included in the decision-making.

(c) Any nonscientific information -- including legal, social, cultural, economic, and political information -- used as a basis for critical area policies and regulations that depart from recommendations derived from the best available science. A county or city departing from science-based recommendations should:

(i) Identify the information in the record that supports its decision to depart from science-based recommendations;

(ii) Explain its rationale for departing from science-based recommendations; and

(iii) Identify potential risks to the functions and values of the critical area or areas at issue and any additional measures chosen to limit such risks. State Environmental Policy Act (SEPA) review often provides an opportunity to establish and publish the record of this assessment.

(2) Counties and cities should include the best available science in determining whether to grant applications for administrative variances and exemptions from generally applicable provisions in policies and development regulations adopted to protect the functions and values of critical areas. Counties and cities should adopt procedures and criteria to ensure that the best available science is included in every review of an application for an administrative variance or exemption.

In addition, the WAC addresses situations where there is a lack of adequate scientific information upon which to base development policies and regulations.

WAC 365-195-920 Criteria for addressing inadequate scientific information.

Where there is an absence of valid scientific information or incomplete scientific information relating to a county's or city's critical areas, leading to uncertainty about which development and land uses could lead to harm of critical areas or uncertainty about the risk to critical area function of permitting development, counties and cities should use the following approach:

(1) A "precautionary or a no-risk approach," in which development and land use activities are strictly limited until the uncertainty is sufficiently resolved; and

(2) As an interim approach, an effective adaptive management program that relies on scientific methods to evaluate how well regulatory and non-regulatory actions achieve their objectives. Management, policy, and regulatory actions are treated as experiments that are purposefully monitored and evaluated to determine whether they are effective and, if not, how they should be improved to increase their effectiveness. An adaptive management program is a formal and deliberate scientific approach to taking action and obtaining information in the face of uncertainty. To effectively implement an adaptive management program, counties and cities should be willing to:

(a) Address funding for the research component of the adaptive management program;

(b) Change course based on the results and interpretation of new information that resolves uncertainties; and

(c) Commit to the appropriate timeframe and scale necessary to reliably evaluate regulatory and non-regulatory actions affecting critical areas protection and anadromous fisheries.

10.3 A Process for Characterizing Risks

Ideally, local jurisdictions will be taking steps to protect and manage wetlands at the different geographic scales discussed in previous chapters. The goal is to reduce risks to natural resources to levels that can be considered acceptable. Please note however, that this document does not try to establish what might be considered an "acceptable risk" to the wetland resources. This has to be determined by each jurisdiction based on the laws and policies they are trying to implement and the functions and values of the resources they are trying to protect.

Whether planning is done at the scale of the management area or the site itself, the risks can be characterized by answering a series of questions about the actions being proposed:

- What disturbances or benefits will result from a proposed action (e.g., change in land use through zoning, regulations that affect how land is used, restoration plan, etc.)?
- What risks do these disturbances pose to the functions and values of wetlands?
- What measures are proposed to minimize the risks or replace the resource at risk?

10.3.1 Identifying the Environmental Disturbances or Benefits that Result from Proposed Actions

Chapter 3 in Volume 1 summarized the different types of environmental disturbances that can occur as humans modify ecosystems to meet their needs. The plans, regulations, restoration actions, etc. taken by local jurisdictions to direct and control the use of land can also be characterized in terms of the disturbances they may allow or rectify. The first step in characterizing the risk, therefore, is to identify how a specific type of land-use activity may cause an environmental disturbance or benefit.

The characterization of risks should start with a thorough list of the different actions being proposed to protect and manage wetlands (e.g., zoning categories, regulations, exemptions, ordinances, etc.). Each of these has the potential to cause an environmental disturbance by allowing certain land uses to occur or by changing the current land use to some other one.

The types of environmental disturbances identified in Volume 1 include:

- Changing the physical structure within a wetland (e.g., filling, removing vegetation, tilling soils, compacting soils)
- Changing the amount of water (increasing or decreasing the amount)
- Changing the fluctuation of water levels (frequency, amplitude, direction of flow)
- Changing the amount of sediment (increasing or decreasing the amount)
- Increasing the amount of nutrients
- Increasing the amount of toxic contaminants
- Changing the acidity (acidification)
- Increasing the concentration of salt (salinization)
- Fragmentation of habitats
- Other disturbances (noise, etc.)

For example, a jurisdiction may be revising their zoning ordinance and zone an area that was previously rural as urban to accommodate growth. The potential disturbances that may result from this action include changing the patterns of water flow, increasing the input of nutrients and toxic compounds, and causing fragmentation of habitat on the landscape. Another area may be re-zoned from low- to high-density residential. This would result in changes in the patterns of water flow, introduction of toxics from lawn care, and increase the disturbance to wildlife by introducing more predation by pets.

An example of disturbances caused by management actions at the site scale is allowing single-family residences, as an exemption, in the buffers of wetlands. Such an action would allow disturbances such as the introduction of nutrients and toxics from lawn care and pets, and possibly a change in water regime to occur.

Table 10-1 provides an example of how the environmental disturbances and risks associated with various management actions could be summarized.

Table 10-1. An example of a table summarizing risks associated with common land-use actions.

Action	Disturbance Caused by Allowing Action	Risk of Disturbance to Wetland Functions and Values
Urban zoning in a recharge area	Change in water regime, increased surface runoff, and less infiltration	High for wetlands fed by groundwater and for those that will receive the direct runoff from paved surfaces
Permit fill of wetlands	Change in structure of wetland and loss of wetland area	High for functions within wetland
300-ft buffers for wetlands with a high habitat score	Minimal	Low
200- to 300-ft buffers for high habitat score	Will allow some disturbance of wildlife and limit upland zones suitable for amphibians	Moderate
< 200-ft buffers for high habitat score	Significant disturbance of wildlife	High

10.3.2 Identifying the Risks of Disturbances to the Functions and Values of Wetlands

Not all human-caused disturbances will result in significant impacts to the functions and values of wetlands in a jurisdiction. Once all the possible disturbances have been identified (as discussed in the previous section), the next step in the characterization of risks is to identify which of the proposed land-use actions have the greatest risk of impacting wetlands (see third column in Table 10-1). This task is best done using maps, especially at the scale of the management area. The process described in Chapter 5 for performing a landscape analysis can be used to identify what parts of the landscape within the management area are sensitive to the different types of disturbance and risks that may be generated by proposed land use actions.

For example, if wetlands are located in an area zoned as urban or residential and the area serves to recharge an aquifer, then the risk to these wetlands is high as a result of the impervious surfaces created. Creating impervious surface in areas where water infiltrates rapidly into groundwater creates a risk to wetlands that rely on that groundwater.

Regulations that focus on the wetland sites themselves (site scale) can also be analyzed in terms of the risks they pose to wetlands. Using the example used previously, the exemption of single-family residences in the buffer of a wetland would pose a much higher risk to wetlands that have a high habitat value than those that function poorly as habitat.

Corrective actions (regulatory and non-regulatory) should also be considered when assessing risks. Areas that are proposed for restoration or preservation, for example, should be considered in terms of how these actions might reduce the risks to wetlands. For example, the restoration (by non-regulatory means) of a diked field to a floodplain wetland identified in the landscape analysis as important for restoring hydrologic processes, reduce the overall risk to the jurisdiction from losses of hydrologic functions in other locations targeted for development.

10.3.3 Proposing Measures to Minimize the Risk or Replace the Resource at Risk

If the characterization of risks indicates that some of the policies, regulations, or plans pose a risk to the functions and values of wetlands in a jurisdiction, it is important to identify what actions can be taken to minimize this risk. Using a previous example, if a comprehensive plan calls for urban development in an area where groundwater is recharged, the risk to the aquatic resources can be reduced by requiring that all runoff be infiltrated on site or that paved areas use some of the more innovative approaches such as permeable surfaces.

A summary table such as that shown in Table 10-2 can be used to document the risks identified and the actions taken to minimize risks.

Table 10-2. An example of a table summarizing the risks of land-use actions and measures to minimize the risks.

Action	Disturbance Caused by Action	Risk of Disturbance to Wetland Functions and Values	Measures to Minimize Risk	Does This Reduce Risk to an Acceptable Level?
Urban zoning in a recharge area outside of wetland	Change in water regime, increased surface runoff, and less infiltration	High for wetlands fed by groundwater and for those that will receive the direct runoff from paved surfaces	Change development standards in recharge area to require all surface water to be infiltrated	Yes
Permit fill of wetlands	Change in structure of wetland and loss of wetland area	High for functions within wetland	1. Require compensation at ratios that will ensure no net loss 2. Ensure compliance 3. Do not permit fill in wetlands that cannot be replaced (e.g., bogs)	Maybe

The King County example of a characterization of risk

As part of revisions to its critical areas ordinance, King County has prepared an *Assessment of Proposed Ordinances* that describes the risks to resources from the county's proposed regulatory and non-regulatory actions. Section 2.9 from Chapter 2 of the King County report describes the risks to the wetland resource from actions such as specified buffers, allowed alterations, classification (rating), and mitigation requirements. This section of the King County report is reproduced in Appendix 10-A of this volume. The full report is available on the web at http://www.metrokc.gov/ddes/cao/.

By first identifying and categorizing the risks to wetland resources and then identifying the actions necessary to minimize those risks a local jurisdiction will be in a better position to make decisions that incorporate existing scientific information. The characterization of risk can also be used as the first step in a program of adaptive management (see Chapter 12). Actions deemed to be of different levels of risk can be monitored to determine if the initial conclusions were valid.

Chapter 11
Taking Actions: Regulatory and Non-Regulatory Activities

11.1 Introduction

This chapter discusses Step 3 of the four-step framework, taking actions to reduce risks to the wetland resource (Figure 11-1). In Step 3, the regulatory and non-regulatory solutions, developed for a wetland protection program during Step 2, are implemented. The solutions are described in Chapters 6, 7, 8 and 9, whereas characterizing the risks of implementing those solutions is discussed in Chapter 10.

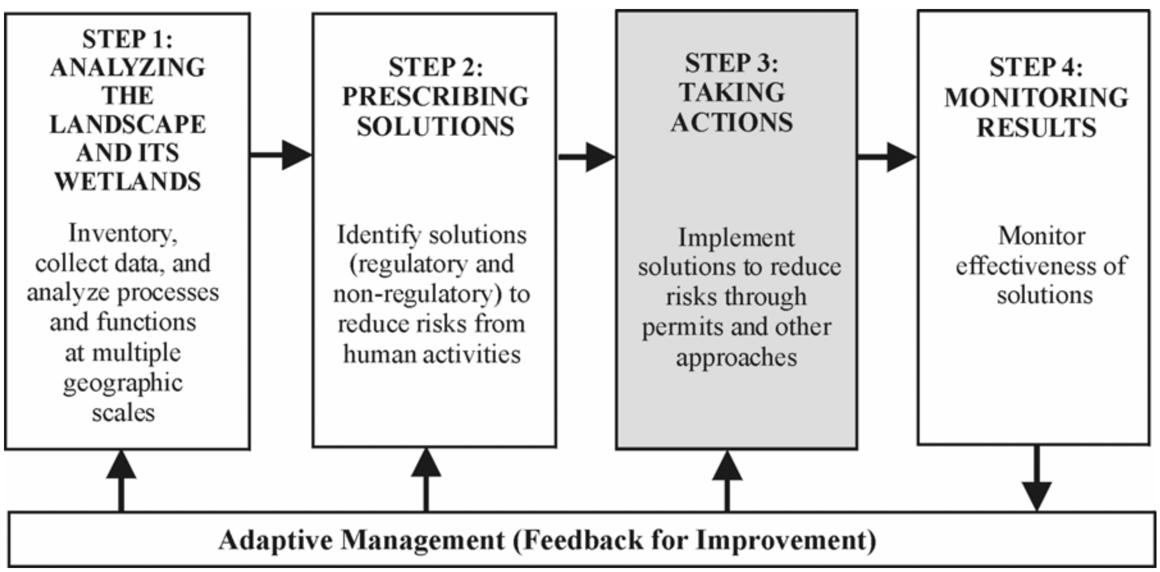


Figure 11-1. Implementing regulatory and non-regulatory components of a wetland protection program is Step 3 in the four-step framework presented in this volume (shaded box).

The chapter is divided into two major sections: implementing the regulatory and the non-regulatory components of a wetland protection program. As mentioned previously, both are needed to effectively protect and manage wetlands.

11.2 Implementing the Regulatory Component of a Protection Program

The single most important element in ensuring effective implementation of the regulatory component is having adequately trained staff or a qualified professional on contract. Other important elements include:

- A process to review permits that is clear and uses a team approach
- Inspecting the wetland site during construction of the development project
- Monitoring the wetland during and following construction
- Enforcing regulations
- Monitoring the effectiveness of regulations

The elements listed above require adequate funding for effective implementation. Local governments should include provisions, such as fees for permit review, for adequate funding of all the elements. It is also important to have an educational element such as materials for permit applicants and interested citizens.

11.2.1 Adequately Trained Staff or Qualified Wetland Professional

Local governments benefit greatly from having trained staff or access to qualified wetland professionals to implement their regulations, to make decisions where discretion is required, and to work with and review the materials submitted by the applicant's consultants. Most regulations pertaining to wetlands allow for some discretion in application to site-specific situations. They may pertain to site-specific buffer adjustments, stormwater considerations, or mitigation ratios. Even when regulations are written in a prescriptive fashion, many applicants and/or their consultants may make a case for why their projects should be granted some flexibility based on site-specific considerations over and above that allowed by the regulations.

In many instances, an applicant's consultant may be an individual with extensive experience and credentials in wetland science and it can be difficult for a local regulator to respond in a reasonable and appropriate manner to such requests. Additionally, while most applicants and their consultants provide accurate and complete information, occasionally a regulator will be confronted with information that is inaccurate or incomplete. It is critical that the local staff responsible for implementing wetland regulations have the knowledge or resources to effectively review submitted information and determine if it is accurate and complete.

Therefore, to effectively implement regulations, local government staff or wetland professionals on contract should have at least a basic familiarity with the following topics:

- Wetland identification and delineation
- Wetland rating
- Wetland function assessment
- Direct and indirect impacts to wetlands from different types of development projects
- Compensatory wetland mitigation, including site selection and design, construction oversight, monitoring, and maintenance
- Land-use regulations
- Writing permits and applying necessary conditions

The following resources can be used when becoming familiar with the basics of wetland regulation: Ecology's publications on wetland programs (www.ecy.wa.gov/programs/sea/ wetlan.html); periodic training offered by Ecology and other resource agencies; training classes provided by private vendors; and coursework such as the University of Washington's Certificate Program in Wetland Science and Management (www.extension.washington.edu/ext/certificates/wet/wet_gen.asp). Portland State University also offers various courses in wetland science and management through its Environmental Professional Development Program (www.esr.pdx.edu/epp/).

Some larger jurisdictions have one or more wetland professionals on staff. Most jurisdictions, however, rely on planning and general regulatory staff that have many responsibilities and who may not have the expertise in wetland ecology and management in order to effectively administer wetland regulations. To address this situation, many jurisdictions contract with a third-party wetland professional to provide the knowledge and experience needed to review proposals for changes in land uses such as development proposals. Considerations for choosing a qualified third-party wetland professional are discussed in Appendix 8-H, Hiring a Qualified Wetlands Professional.

11.2.2 The Process for Reviewing Permits

The process for review of permit applications for land development should be clear to both the applicant and the regulator. A local jurisdiction can require a separate permit for work in or near wetlands, or they can incorporate review for conformance with their wetland regulations into other permit review processes (see Appendix 8-B, the section on applicability). Regardless, the process for reviewing permit applications should include close coordination among appropriate regulatory staff, especially between those responsible for wetland protection, stormwater management, clearing and grading, and construction inspection.

Review of permit applications involving wetlands should at a minimum include a site investigation to verify delineation of the wetland boundary and confirmation of the rating of the wetland. Review for more complex projects that will alter wetlands should include assessment of wetland functions, analysis of project impacts, and review of proposed mitigation to compensate for adverse impacts. Some projects may require additional hydrologic analysis to ensure that wetland hydrology is not adversely affected. In such situations a hydrologist with understanding of wetland functions should become part of the review team to ensure that the project's stormwater management plan takes the wetland's hydrology into account.

Review of permit applications involving wetlands should result in written recommendations for approval, denial, or conditioning of the permit. Regulatory staff and/or qualified, third-party wetland professionals may be required to testify before the local Hearings Examiner to support decisions made during the review of the permit for certain types of applications.

11.2.3 Inspecting and Monitoring the Wetland During Construction

It is important that the conditions or wetland protection measures applied to permits upon their approval are in place and on the ground during and after construction of the project. For example, inspections during construction should ensure that clearing of vegetation is outside the wetland buffer or otherwise consistent with the approved plans and that measures for erosion and sediment control are protecting the wetland's water quality. Erosion and sediment controls should be in place and clearing limits well marked and easily visible on the ground.

When compensatory wetland mitigation is required for a permit, it is essential that the local jurisdiction inspect the mitigation project to see that it has been installed in accordance with the approved plans. Inspections at mitigation sites should take place annually or as specified on the approved mitigation plan to ensure that the project will be successful in compensating for the lost wetland functions.

11.2.4 Enforcing Regulations

Unfortunately, at times wetlands are altered without approval through a permit. A local jurisdiction should have specific authority in their critical areas ordinance to investigate the affected wetland, issue "stop work" orders (see Appendix 8-B), and require remediation of any violation. This includes the ability to require restoration of affected wetlands and/or compensatory mitigation for the reduction or loss of wetland functions. Effective enforcement often requires penalties for the unauthorized alteration of wetlands. These enforcement activities require adequate staff to investigate the initial violation, follow up on remediation, and coordinate with state and federal agencies as appropriate.

11.2.5 Monitoring the Effectiveness of Regulations

Local jurisdictions should create a tracking system to monitor the effectiveness of regulations in protecting wetlands. At a minimum, the jurisdiction should account for the acreage of wetlands altered as a result of permit activity and the success of compensatory mitigation projects. Evaluation of the results of the tracking system can be used by a local jurisdiction to revise regulations or procedures to provide better protection for wetlands. Please refer to Chapter 8 (Section 8.4) and Chapter 12 for additional discussion on monitoring the effectiveness of a wetland protection program. The tracking system can also be used to keep track of unauthorized activities in the jurisdiction.

11.2.6 Educational Materials

Many landowners and project applicants find it difficult to understand regulations and the requirements for permit application. Additionally, some landowners do not understand why wetlands are important and why regulations are needed. Brochures and other informational materials that discuss these topics and explain how applicants can get assistance can be very helpful and save regulatory staff a lot of time. Providing a clear explanation of the process for reviewing permits, such as a flow chart, can also be important to applicants. While general materials on some of these topics are available from federal and state agencies, materials developed locally are very useful.

11.3 Implementing the Non-Regulatory Component of a Protection Program

As with the regulatory component of a wetland protection program, implementing non-regulatory actions specified in plans and polices such as Green Infrastructure plans, Alternative Futures analysis, or comprehensive plans (discussed in Chapters 6, 7, and 9) requires dedicated staff to coordinate and support conservation, preservation, and restoration activities and manage sites. Other important elements include:

- Identifying, mapping, and prioritizing where non-regulatory tools should be applied
- Creating partnerships with organizations, government agencies, and others to help sponsor local projects
- Identifying a recipient to hold and manage land
- Obtaining funding for local actions
- Providing incentives to encourage participation by landowners

- Educating and involving the public and providing technical outreach to landowners
- Monitoring project sites
- Monitoring the overall success of the non-regulatory actions

An overview of each of these elements is provided below.

For more information about setting up a non-regulatory component of a wetland protection program, see *Designing Wetland Preservation Programs for Local Governments: A Guide to Non-Regulatory Protection* (Rubey 1992). This document is somewhat dated but still offers a general discussion of some of the topic.

11.3.1 Staffing the Non-Regulatory Component

It is optimal to have a dedicated coordinator overseeing the non-regulatory component of a wetland protection program. A coordinator would facilitate the numerous actions (e.g., restoration or preservation of high-priority areas that can be sponsored through the local government or through partnerships with other organizations. A coordinator would also work with private landowners to conserve the land through mechanisms such as conservation easements (see Chapter 9 for a description of non-regulatory tools). The following is a list of tasks a coordinator might oversee:

- Identifying appropriate sites for preservation and restoration
- Working with landowners to apply better conservation practices
- Establishing and updating incentive and funding mechanisms
- Engaging in education and outreach activities
- Providing technical assistance for non-regulatory actions
- Facilitating local projects sponsored by the local jurisdiction (obtaining grants, forming partnerships, developing the technical design, conducting site monitoring, etc.)
- Supervising support staff or volunteers working on non-regulatory actions
- Coordinating with other departments within the jurisdiction and with other organizations and agencies

The coordinator may perform all or some of these tasks depending on the number of staff available as support. The number of staff dedicated to implement the non-regulatory component of a protection program usually reflects the size of the local government and its emphasis on incorporating a non-regulatory approach.

11.3.2 Identifying, Mapping, and Prioritizing Sites

Identifying, mapping, and prioritizing sites for non-regulatory activities are best started during early planning stages such as landscape analysis, Green Infrastructure planning, or Alternative Futures analysis (see Chapters 5 and 6 for further discussion). If these plans have not been completed by the local jurisdiction, then non-regulatory actions such as acquisition and restoration could occur as opportunities arise. In addition, a jurisdiction could decide on potential projects based on technical reports and studies that point to desirable sites. In either case, projects will usually need to be prioritized and implemented sequentially.

Additional review and strategizing will probably be needed as implementation of the non-regulatory program begins. This might involve sorting through the various sub-basins or sensitive landscape areas within the entire management area to focus on sites with immediate threats or opportunities and deciding what projects can be funded over the immediate fiscal period. Prioritizing will likely be conducted on an ongoing basis as funding, staff, and opportunities fluctuate.

11.3.3 Creating Partnerships for Locally Sponsored Projects

Local governments benefit from partnerships with other agencies or organizations to successfully implement non-regulatory projects. Completing transactions associated with conservation, preservation, and restoration (e.g., purchasing, restoring, monitoring, managing sites, etc.) can be complex and take time. The following organizations are available to work with local governments on non-regulatory actions.

Land trusts offer the services of brokering land acquisitions, raising funds to purchase sites, and educating landowners about tax benefits and incentives. Land trusts protect land permanently. They work directly with landowners during transactions to acquire land. Land trusts are knowledgeable about the resources and the advantages of land preservation in regard to property taxes. They are perceived as non-adversarial by landowners (see Appendix 9-A). In addition, land trusts often attract the voluntary assistance of retired professionals who can provide technical assistance with site assessments and monitoring.

For example, a national land trust called the Trust for Public Land (TPL) will assist in securing properties for governments when funding is pending and the time available to preserve a parcel is short. TPL releases the property to the jurisdiction later when funding is available.

Partnerships with other **non-profit organizations** such as the local Audubon Society or Ducks Unlimited may be essential to completing site monitoring tasks (such as bird counts on restored wetlands) and for implementing actual site restoration plans.

State and federal agencies are also excellent partners to assist with non-regulatory efforts. These agencies can help with securing grant funds for projects. They can also offer technical knowledge about wetland functions, restoration techniques, and long-term management. Agency assistance is provided at no charge to the local jurisdiction.

Either **internal coordination** or **internal partnerships** will also be needed between various department and staff within the local government (such as parks or public works departments). As discussed below, they may be the recipients of lands that have been purchased and/or restored.

Information on land trusts and other partners, as well as funding program opportunities, can be found in the publication *Exploring Wetlands Stewardship: A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004).

11.3.4 Identifying a Recipient to Hold and Manage Land or Rights to Land

A local department such as parks or public works should be identified to receive and manage properties that are purchased or donated. For example, direct preservation of key critical areas is essential to maintaining landscape processes through time. Therefore, preservation resulting in permanent protection of land through *full-fee title* (ownership of all property rights) may be the best mechanism to use (see Chapter 9 for a description of full-fee). In such cases, as with restoration efforts, a recipient is needed for managing and monitoring the site.

Who the recipient should be will depend on whether or not the local jurisdiction buys land in full-fee and wishes to own and manage the land over time. If not, site ownership and management (or holding a conservation easement) may be handled by an external partner such as a land trust. However, a land trust usually requires an endowment to manage a site. Alternatively, property could be passed to a state agency. However, state agencies may not be willing to accept management of new properties. Therefore, as mentioned above, it is important to identify willing organizations and create partnerships for receiving and managing land as well as coordinating other aspects of conservation, restoration, and preservation projects.

11.3.5 Establishing Funding Mechanisms and Incentives for Landowners

Funding mechanisms and landowner incentives were reviewed in Chapter 9. These tools play an essential role in the non-regulatory component of a protection program. Obtaining funding is an absolute necessity to a local government that wishes to conduct voluntary preservation and restoration projects. Without a local funding source to provide a match, a local government cannot apply for state and federal grant programs. As mentioned elsewhere in this volume, lists of funding programs are provided in *Exploring Wetlands Stewardship: A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004).

One very strong funding tool that can be established by a local government is the Conservation Futures Levy. This levy can be implemented by legislative ordinance and a portion of the funds dedicated to preservation and restoration projects (see Chapter 9 for further details). It may also be appropriate for a local government to use the funds generated to finance "engineered infrastructure," such as levies for *special purpose districts* and *in-lieu fees* as well as general funds, to implement non-regulatory actions (i.e., preservation and restoration) to maintain the services provided by "green infrastructure."

Landowner incentives are also essential for engaging citizens in voluntary conservation actions and are discussed in detail in Chapter 9. In particular, local jurisdictions may wish to consider the value of establishing a watershed-based Public Benefit Rating System (PBRS) to implement their Current Use Taxation Program for "Natural" Open Space. As discussed in Chapter 9, the results of a landscape analysis can be integrated into a PBRS program.

11.3.6 Educating and Involving the Public

Education and public involvement are vital parts of a non-regulatory effort, both initially and on an ongoing basis. The importance of education and public involvement is demonstrated by its inclusion and emphasis in Green Infrastructure planning, Alternative Futures analysis, and the development of comprehensive plans (as discussed in Chapters 6 and 7).

Education is essential because it provides the public with an accurate understanding of why non-regulatory efforts are valuable to the community, as well as to maintaining and restoring landscape processes. For example, decision-makers and the public should be informed that the expenditures needed for conservation, restoration, and preservation are justified when compared to long-term costs. When landscape processes are maintained or improved, the public saves; engineered infrastructure that would be built to replace lost services (functions) is not needed (see Chapter 6 for information on the fiscal savings of non-regulatory efforts).

Education and outreach efforts are also key factors in increasing enrollment in incentive programs that foster conservation of the land. Likewise, they encourage the public to get involved through voluntary actions either on their own property or by supporting local projects (e.g., volunteers monitoring sites). In so doing, education and public involvement can also improve support for regulatory protection.

11.3.7 Monitoring Preservation and Restoration

When preserving and/or restoring wetlands, it is important that the local jurisdiction implement monitoring at both the site level and the program level.

At the site level, it is recommended that local governments:

- Allocate Conservation Futures dollars, or other funds, to secure properties and fund restoration activities
- Engage in restoration actions such as breaching dikes, removing exotic plants, planting native vegetation, etc.
- Monitor site conditions and manage preserved and restored lands

At the program level, it is recommended that local governments monitor the effectiveness of the success of the following elements to provide feedback for adaptive management:

- Goals for preservation and restoration that are aligned with the objectives of plans such as Green Infrastructure or conservation plans
- Incentive programs for landowners, such as current use taxation
- Education programs for citizens about local stewardship activities
- Technical assistance for landowners

Monitoring and adaptive management is discussed in more detail in Chapter 12.

Chapter 12
Monitoring and Adaptive Management

12.1 Introduction

This chapter discusses two aspects of the framework of a program for protecting wetlands: 1) *monitoring results*, determining the effectiveness of the program (Step 4) and 2) *adaptive management*, a feedback mechanism for making improvements to the program if needed (Figure 12-1). Monitoring and adaptive management have often been low on the list of priorities for local jurisdictions. Funding, the availability of staff, and technical issues make establishing a monitoring program difficult for some jurisdictions. In addition, monitoring may also expose what are perceived as failures and may require changes that are difficult or unpopular (Washington State Joint Natural Resources Cabinet 1999).

However, the benefits of a successful monitoring program and the changes that may result from it can be substantial. Many actions taken to protect and manage wetlands have to be considered as experiments because we have not tracked their success in the past.

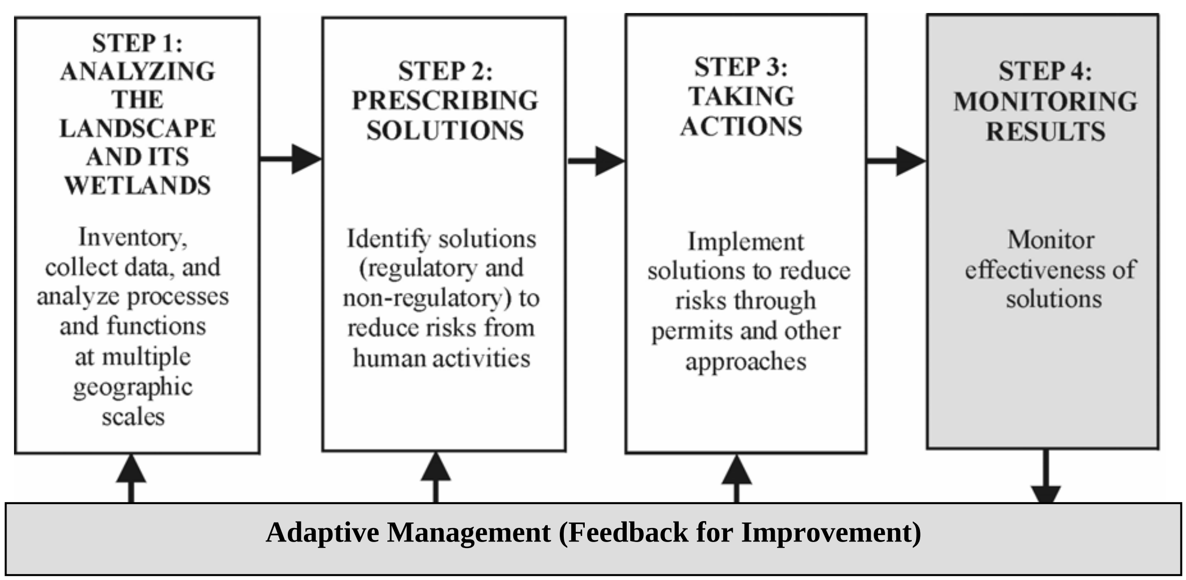


Figure 12-1. Monitoring is Step 4 of the four-step framework discussed in this volume, and Adaptive Management provides feedback for improving wetland protection programs (shaded box).

We do not know, or fully understand, all the cause and effect relationships between human actions on the land and the functions performed by wetlands (see Chapters 3 and 4 in Volume 1). Thus, we cannot fully predict the outcome of actions taken to protect and manage wetlands, other natural resources and critical areas, as well as landscape processes. Monitoring the effectiveness of protection measures in the context of adaptive management is the most efficient way to face this uncertainty. Adaptive management is a commitment by a local government to change approaches for protecting and managing wetlands and to redirect resources as warranted by new information. A willingness to make improvements to address insufficiencies identified through this monitoring step is important.

The focus is to monitor the effectiveness of solutions identified and actions taken in Steps 2 and 3 (described in previous chapters) and make changes as needed. The process is iterative as shown in Figure 12-2. The goal is to implement a system for modifying past decisions, if needed, that is based on information generated from monitoring the specific actions taken and on any scientific information that is newly available. Plans, regulations, and other actions should be reconsidered if the monitoring data show there are further losses of wetland functions and values. This will help to reduce cumulative impacts to wetlands and other resources.

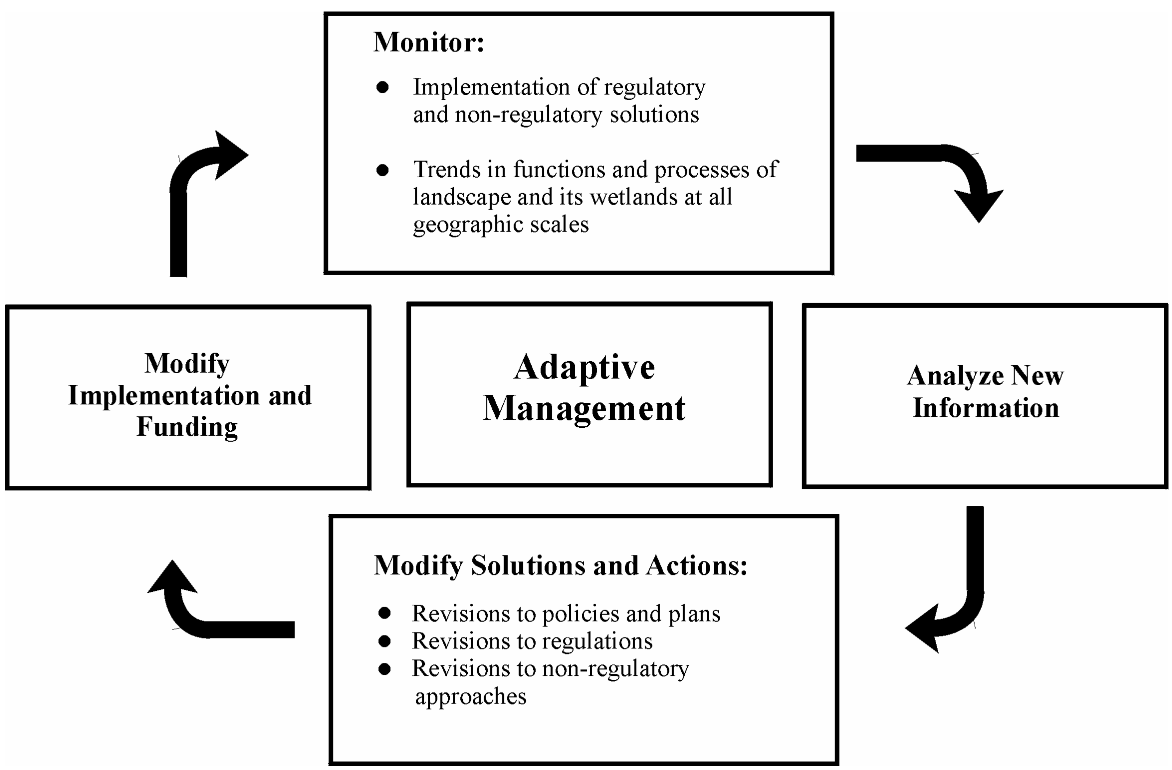


Figure 12-2. Conceptual representation of how wetlands can be protected and managed using adaptive management. Adaptive management implies that the process does not end with the completion of the four steps but keeps cycling.

12.2 What Should Be Monitored?

Monitoring associated with protecting and managing wetlands by local jurisdictions can be divided into three categories, as listed below. All aspects of monitoring are important in providing feedback to guide decisions for adaptive management. If the functions and values of wetlands are not adequately protected, managers need to know whether this results from inadequate implementation, inadequate standards, or inadequate strategies.

- **Monitoring trends** tracks landscape processes and wetlands over time at all geographic scales and records changes in functions and values at individual wetlands. The monitoring should determine if the goals and objectives established for the wetland resource by a local jurisdiction are being met. Monitoring trends is critical in interpreting the effectiveness of efforts to protect and manage wetlands. By monitoring trends, it is possible to document if cumulative impacts continue to occur.

- **Monitoring implementation** addresses the extent to which plans have been implemented and the extent to which regulatory and non-regulatory actions proposed in those plans and regulations have been taken. This type of monitoring provides a basis for tracking the actions taken and for quality assurance.

- **Monitoring the effectiveness of strategies** addresses how effectively the complete program, not just individual plans and actions, meets explicit objectives or conditions desired for the future.

Different approaches are needed to monitor at different geographic scales because the type of data collected is different. In addition, the objectives of a monitoring program may be met in many different ways, not all of which require extensive collection of data. It is not the intent of this chapter to describe the different monitoring approaches and methods that can be used. These will depend on the wetland resources present in a local jurisdiction, the goals and objectives set by that jurisdiction, the solutions they propose, and the actions they take.

The following sections outline some of the basic questions that need to be addressed when monitoring for an adaptive program for wetlands.

12.2.1 Monitoring Trends in the Resource

The goal of monitoring trends in wetlands is to understand if, and how, the landscape and site-specific processes that control structure and functions within a wetland(s) have been altered as a result of changes in land use. The resource needs to be monitored at all geographic scales used in the analysis of the resource (i.e., the contributing landscape, the management area, and the site scale).

The analysis can be undertaken using the guidance discussed in Chapter 5. Regardless of the methods used, however, there is one major question that needs to be addressed through monitoring: *Have changes in land use altered landscape processes to the extent that they impact the functions of wetlands in a jurisdiction?* Changes to processes and functions can be either negative (indicating further degradation), no change (indicating efforts at protecting existing levels of processes and functions are working), or positive (indicating that efforts at restoration are succeeding).

Monitoring trends at the landscape scale involves identifying:

- If the major sources of water to wetland(s) and flow paths have changed (either degraded or restored)
- If the major sources of sediment have changed
- If the major sources of nutrients have changed
- If the major sources of toxic compounds have changed
- If there has been an increase in the fragmentation of wildlife habitats

Monitoring trends at the wetlands themselves involves tracking how the functions and values of each individual wetland within a jurisdiction have changed. Continuously monitoring all wetlands, or even a random subset of them, in a jurisdiction is optimal but may not be feasible because of the cost. In the absence of such a program, it is suggested that a local jurisdiction track trends by analyzing the wetland assessments that applicants submit when they propose actions at individual sites. Qualitative trends can be tracked by noting the overall changes in the functions of wetlands being proposed for alteration within each hydrogeomorphic class (depressional, riverine, etc.) or wetlands of particular concern such as bogs and mature, forested wetlands.

The restoration of wetland functions at sites used for restoration should also be monitored to determine if the objectives of the projects are being met.

12.2.2 Monitoring the Implementation of Protection Measures

Monitoring implementation addresses the extent to which the solutions or actions proposed for protecting and managing wetlands, as developed in Step 2 (Prescribing Solutions), have actually been put into practice or carried out.

12.2.2.1 Monitoring Implementation at the Scale of the Contributing Landscape

Whether monitoring the implementation of solutions needs to take place at the scale of the contributing landscape depends on whether the contributing landscape falls entirely within the jurisdiction or if it includes several jurisdictions. In the former case, monitoring the contributing landscape is actually the same as monitoring the management area, described below. If the contributing landscape spans several jurisdictions, then monitoring at this scale is needed and should be based on the objectives of the plans and solutions developed among the jurisdictions.

It is not possible in this document to cover how to monitor all the possible watershed plans, regional plans, actions taken as a result of various partnerships, etc. However, it is important that each objective identified in such plans should have associated with it measures for monitoring its implementation. For example, a watershed plan may have an objective that all jurisdictions in the watershed adopt the same method for rating wetlands to ensure that wetland functions are characterized in the same way throughout the watershed. Monitoring this objective would involve examining the adoption and implementation of the chosen wetland rating system.

12.2.2.2 Monitoring Implementation at the Scale of the Management Area

Monitoring the implementation of solutions developed for the management area is a matter of keeping accurate records of the actions taken by the jurisdiction to protect and manage wetlands, and a commitment to compile and analyze the data at specified intervals. The analysis should include the actions actually taken compared to the solutions and actions proposed in the original comprehensive plan, critical areas ordinances, shoreline master programs, etc. For example, a critical areas ordinance may state that each permit that will result in a wetland impact requires that the wetland be rated on its functions and values. Monitoring the implementation of this would require an examination of how many permits were issued with a completed rating as well as how many were issued without a rating.

This type of monitoring should also be applied to non-regulatory programs. For example, if a jurisdiction has a program to acquire conservation easements on lands that it considers important to maintaining landscape processes, it should monitor how many easements have been acquired compared to the total number needed. Table 12-1 lists some of the common solutions used by jurisdictions in protecting and managing wetlands.

Table 12-1. Monitoring common solutions to protecting and managing wetlands at the scale of the management area. These are only a few examples, not an inclusive list of all that a jurisdiction should monitor.

Action	What to Monitor
Zoning	Number of zoning variances permitted
Development standards for areas sensitive to disturbance	Number of variances permitted
Setbacks, such as buffers or "no-spray" zones, to protect resources	Number of variances to setbacks permitted Number of violations
Preservation of important wetlands	Number of acres with conservation easements or fee title
Conservation of wetland resources	Number of acres enrolled in Current Use Taxation program or other applicable programs
Voluntary restoration of wetlands	Number of acres and types of functions successfully restored

12.2.2.3 Monitoring Implementation at the Site Scale

Monitoring the implementation at the site scale is a matter of keeping accurate records of the permits approved and other actions taken at individual sites. This includes, for example, monitoring the success of follow-up site visits, compliance with permit conditions, restoration efforts, and enforcement actions. The review of the scientific information presented in Volume 1, Chapter 6, highlighted the fact that many projects that compensate for impacts to wetlands are not successful because there has been no follow-up. Therefore, follow-up on projects is very important. As previously mentioned, this data can be used to ascertain general trends regarding the effectiveness of wetland protection and management in the jurisdiction.

12.3 Adaptive Management

Adaptive management has been defined in various ways since its development in the early 1970s. Different people and organizations continue to have somewhat differing views of the best definition for their purposes. In order to bring some consistency and clarity, the following working definition for this concept is used here:

> *Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of previous policies and practices.*

As mentioned earlier in the chapter, the goal of adaptive management, in the context of protecting and managing wetlands, is to implement a repetitive process for making decisions that is guided by scientific information that is newly available and data collected and analyzed through the monitoring program. The iterative nature of the process is shown in Figure 12-2. The results of the monitoring program provide the basis for revising past decisions, and these improved actions and solutions are subsequently monitored to determine their success in meeting the jurisdictions goals for protecting resources.

Adaptive management is based on the assumption that managed ecosystems are complex and inherently unpredictable. The approach incorporates the fact that, at present, humans do not know enough to adequately manage environmental resources. Adaptive management, from this perspective, treats management policies and practices as experiments, and it serves to assess the responses of natural resources as human behavior changes (Lee 1999). The goal is to learn and change objectives as needed. However, this has often not been considered the mark of a good manager, who is rewarded instead for steadfast pursuit of objectives (Lee 1999). The important point to stress is that adaptive management will only work if there is a willingness to actually change polices and practices as a result of monitoring.

Some of the characteristics of adaptive management are:

- Acknowledgement that there is still much uncertainty about what policy or practice is best for solving each particular issue related to protecting and managing wetlands
- Careful design and implementation of a monitoring plan designed to reveal the knowledge that is currently lacking
- Monitoring of both the resource itself and the implementation of plans and practices used to protect the resource
- Analysis of the outcomes of policies and practices in terms of the original objectives
- Incorporation of the results into future decisions

A brief history and additional resources for adaptive management

The text below is adapted from the University of Oregon (http://oregonstate.edu/instruction/anth481/ectop/ecadm.html).

C.S. Holling and several colleagues developed the concept of adaptive management at the University of British Columbia's Institute of Resource Ecology in the late 1960s. Adaptive management reached the scientific literature in Holling's book, *Resilience and Stability of Ecological Systems*, published in 1978. The emphasis of the Holling approach is to experiment to learn the boundaries of natural systems. Holling and his colleagues worked with resource managers in British Columbia on a number of management experiments and workshops designed for public participation, thereby testing the process.

Adaptive management became an important concept in resource management in the United States when K.N. Lee introduced it to the Northwest Power Planning Council in 1984. Lee studied adaptive management with Randall Peterman, who in February 1984 gave a talk about experimental management. Subsequently, different forms of adaptive management have become part of the Northwest Forest Plan, the Oregon Plan for Salmon and Watersheds, the Oregon Department of Forestry Plan to manage state forests, and many other processes for resource planning.

For additional information on adaptive management, see:

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The Collaborative Adaptive Management Network: http://www.iatp.org/AEAM/index.html

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The following is a list of references for Chapters 1 and 3-12 of Volume 2. The legal citations in Chapter 2 are included as footnotes to the chapter and are not repeated here. Citations listed as personal communications in the text are not listed here since the citation contains the information. Most of the references cited in the appendices are contained within the text or are included at the end of the appendix in which they are cited. If the information cited was from a web site, the web address is provided in the text and may not be repeated in this reference list. Not all references listed have been cited in the text.

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Glossary

Adaptive management. A systematic process for continually improving management policies and practices by learning from the outcomes of previous policies and practices. Related to compensatory mitigation, it involves the applicant and the regulatory agencies discussing the problems occurring on a compensation site and coming to agreement on possible solutions or alternative approaches necessary to bring the site into compliance.

Alternative Futures. An approach to prescribing solutions for future development and the protection of wetlands by analyzing different alternative scenarios in terms of their impacts on wetlands and landscape processes. The scenarios include both general planning approaches, such as different patterns of zoning, and more specific approaches, such as different widths of buffers for wetlands with different ratings. The local government usually incorporates other factors into the scenarios based on the priorities of citizens for their communities.

Aquatic resources (systems). Refers to ecological systems where the regular or occasional presence of water is the dominant factor determining the characteristics of the site. Aquatic systems are made up of wetlands, rivers, streams, lakes and other deepwater habitats.

Aspen stands. A type of Washington Department of Fish and Wildlife Priority Habitat, which consists of pure or mixed stands of aspen greater than 0.8 ha (2 acres). See *Priority Habitat and Species list.*

Assessment methods. Methods that generate a number representing an estimate of the performance of a wetland function. The number generated is relative to a predetermined standard (e.g., level of function provided by reference wetlands). Numbers do not reflect an actual level of function performance (Hruby 1999). Examples include the Washington State Methods for Assessing Wetland Functions (also known as WFAM) (Hruby et al. 1999 and 2000) and a Hydrogeomorphic wetland function assessment method (Brinson et al. 1995).

Assessment metrics or metric measures. Represent environmental indicators of condition, stress, or response within an ecosystem that can be used in a predictive manner. Metrics are usually selected based on a significant statistical correlation with scientific data linking environmental stresses to a predictable environmental response (e.g., a correlation between impervious surface and the condition of aquatic habitat). Metrics are frequently used in Alternative Futures analysis to quantify the impacts of different land use scenarios on the landscape.

Atypical wetland. A wetland developed for compensatory mitigation (e.g., created, restored, or enhanced) that does not match the type of existing wetland that would be found in the geomorphic setting of the site (i.e., the water source(s) and hydroperiod proposed for the mitigation site are not typical for the geomorphic setting). For example, excavating a permanently inundated pond in an existing seasonally saturated or inundated wetland is one example of an enhancement project that could result in an atypical wetland.

Avoidance. The first step of mitigation sequencing. See *mitigation*.

Beneficial uses. The term used in the federal and state Clean Water Acts to represent the societal values of aquatic resources that need to be protected. These include, but are not limited to: water supply; surface and groundwater treatment; stormwater attenuation; fish and shellfish migration, rearing, spawning, and harvesting; wildlife habitat; recreation; support of biotic diversity; and aesthetics.

Best management practices (BMPs). Management measures which are reasonable and available and commonly used by professionals in the appropriate field that mitigate adverse impacts to surface and groundwater, and to the functions and values of critical areas.

Biodiversity. The sum total of all the plants, animals (including humans), fungi and microorganisms, along with their individual variations and the interactions between them.

Biological wetland. A biological wetland is a wetland that meets the three parameter criteria of either the 1987 Corps of Engineers Delineation Manual or the 1997 Washington State Wetlands Identification and Delineation Manual (WAC 173-22-035). Compare to *jurisdictional wetland*.

Bog. A unique type of wetland dominated by mosses at the surface and that form peat soils. Bogs form in areas where the climate allows the accumulation of peat to exceed its decomposition. The water regime in bogs is dominated by precipitation rather than surface inflow. The plant community is specialized to survive in the nutrient-poor and highly acidic conditions typical of bog systems.

Buffer averaging. Establishing a width for a buffer around a wetland based on averaging the widths at different points around the wetland rather setting the width as a minimum size everywhere around the wetland. For example, if the standard width for a buffer around a wetland is 100 feet, buffer averaging would allow the width to vary between a minimum and a maximum width but require that the buffer area average be 100 feet in width.

Buffers or buffer areas. Vegetated areas adjacent to wetlands, or other aquatic resources, that can reduce impacts from adjacent land uses through various physical, chemical, and/or biological processes.

Class. A grouping based on shared characteristics in a classification scheme. In the Cowardin et al. (1979) classification of wetlands a class is the third level in the 'taxonomy' of wetlands whereas in the *hydrogeomorphic classification* (Brinson 1993b) it is the highest taxonomic unit.

Clearing. The surface removal of vegetation by cutting, pruning, limbing, topping, relocating, application of herbicides or pesticides, or any application of hazardous or toxic substance that has the affect of destroying or removing the vegetation.

Compensatory mitigation. The compensation stage of the mitigation sequence where impacts to the functions and values of wetlands are replaced through creation, restoration, or enhancement of other wetlands. Because regulatory requirements and policies tend to focus on the compensation stage, the term "mitigation" is often used to refer to compensation, which is just one part of the overall mitigation sequence. See *mitigation*.

Comprehensive plan. A generalized coordinated land use policy statement of the governing body of a county or city.

Connectivity. The structures on the landscape that facilitate movement of living organisms between patches or their habitat that are found across the landscape. The movement can occur either within the lifetime of an organism or over a period of generations. The purpose of facilitating movement is to maintain viable populations that allow species and communities of species to persist in time. Connectivity can be achieved via a continuous and linear habitat feature (as in a corridor) or discrete habitat patches comprised of but not limited to individual forests, wetlands, shrub lands, and shorelines.

Conservation. The protection, preservation, restoration, or careful management of the environment and of natural resources.

Conservation easement. A restriction placed on a piece of property to protect the resources (natural or man-made) associated with the parcel. It restricts the type and amount of development that can take place on a parcel of land. For example, the landowner may sell or donate the development rights while retaining the ownership of the property. Easements are recorded on the property deed and are held in trust by a conservation easement "holder" such as a land trust or government agency. The holder polices the terms of the easement for the duration of its existence, which is usually into perpetuity.

Conservation Futures Levy. Optional provision under RCW 84.34.200 and RCW 84.34.230 authorizing any Washington county to establish a real property tax in the amount of $0.0625 per $1,000 of assessed valuation specifically for the purpose of acquiring land with ecosystem features deemed of high conservation value to the local community.

Contingency plan. A plan outlining actions that would be triggered if monitoring of a project revealed a problem that would prevent the site from attaining its stated goals, objectives, and performance standards. Contingency plans should identify anticipated problems and the specific maintenance activity that would be implemented to rectify each problem.

Contributing basin. The geographic area from which surface water drains to a particular wetland.

Contributing landscape/area. The geographic extent within which the landscape processes occur that influence the functions or structure of associated aquatic resources. A contributing landscape may span jurisdictional boundaries and even span several watersheds.

Conversion. Modification of the vegetation for the purpose of changing land use such a development or agriculture.

Corridor. Corridors are areas that contain relatively undisturbed habitat and/or vegetation that maintain connections for wildlife throughout the landscape. Corridors usually represent linear habitats with the range of environmental functions necessary to permit the movement of animals between larger and more fully functioning habitats. Corridors can include but are not limited to, annual or seasonal migration corridors that connect wintering and breeding habitat, or intra-seasonal corridors that connect foraging and nesting habitat or breeding and dispersal habitat.

Cowardin classification. The first commonly used classification system for wetlands developed in 1979 by the U.S. Fish and Wildlife Service. The Cowardin system classifies wetlands based on water flow, substrate types, vegetation types, and dominant plant species.

Creation. See *establishment*.

Critical areas. As defined by the Growth Management Act RCW 36.70A.030 "include the following areas and ecosystems: (a) Wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas; (d) frequently flooded areas; and (e) geologically hazardous areas".

Cumulative impacts. The incremental effect of an impact added to other past, present, and reasonably foreseeable future impacts.

De minimus. A legal term meaning 'lacking significance or importance; so minor as to be disregarded.'

Deed restriction. Clauses in a deed limiting the future uses of the property. Deed restrictions may impose a vast variety of limitations and conditions, for example, they may limit the density of buildings, dictate the types of structures that can be erected or prevent buildings from being used for specific purposes or even from being used at all. (This definition is from a legal dictionary.)

Depressional wetland. A *class* of wetlands in the *hydrogeomorphic classification*. These are wetlands that occur in topographic depressions that exhibit closed contour interval(s) on three sides and elevations that are lower than the surrounding landscape.

Detention facility. A facility that collects water from developed areas and releases it at a slower rate than it enters the collection system. The excess of inflow over outflow is temporarily stored in a pond or a vault and is typically released over a few hours or a few days.

Disturbance. An event that disrupts the processes or structure of ecological systems. Disturbances may occur naturally (e.g., wildfires, storms, floods) or be caused by human actions (e.g., clearing land, building roads, altering stream channels). The effects of disturbances on ecological systems are controlled in large part by their intensity, duration, frequency, timing, and size and shape of area affected.

Ditch. Any channel that has been specifically dug to facilitate drainage.

Drainage systems. Often called basins, sub-basins, watersheds, or river basins depending on the size of the area. In this document, drainage systems are generally referred to using one of two terms: 1. *Watershed.* A watershed is a geographic area of land bounded by topographic high points in which water drains to a common destination; and 2. *Contributing basin*. An area from which surface water drains to a particular wetland.

Ecoregion. Geographic regions where climatic conditions are similar and the ecosystems (including wetlands) are relatively homogeneous. Omernik and Gallant (1986) mapped the following ecoregions in Washington: Coast Range, Puget Lowland, Cascades, Eastern Cascades Slopes and Foothills, North Cascades, Columbia Plateau, Blue Mountains, and Northern Rockies.

Ecosystem. A loosely defined assemblage of co-occurring organisms and the geographic location which they inhabit. The term is an operational convenience defined by the user of the term for the convenience of description (Levin 2001). There is no basic geographic scale associated with the term ecosystem, and that also has to be defined by a user. For example, the term can be used to describe the micro-organisms co-occurring in a spoonful of soil (soil ecosystem) at one end of the scale to the ecosystem of the world that encompasses all organisms on the planet.

Ecosystem management. The use of ecological principles in managing natural resources by blending social, physical, economic and biological needs and values to provide ecosystems that are properly functioning. Ecosystems, however, do not have well-defined attributes associated with proper functioning. "Hence, management of an ecosystem in accordance with some defined normative behavior rests on judgments as to what is important in those systems" (Levin 2001).

Edge. The boundary where different habitats meet or where successional stages of plant communities come together.

Effectively drained. Former wetlands that have been drained and converted to non-wetlands, primarily for the purposes of agricultural use. Compare to *partially drained.*

Emergent wetland. A wetland class under the Cowardin classification that is dominated by erect, rooted, herbaceous plants. Emergent wetlands include marshes and wet meadows.

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. Compare to *establishment, exchange,* and *restoration*.

Environmental processes. The same as *landscape processes*.

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. Activities typically involve excavation of upland soils to elevations that will produce a wetland hydroperiod, create hydric soils, and support the growth of hydrophytic plant species. Establishment results in a gain in wetland acres. Compare to *enhancement,* and *restoration*. (Note: The U.S. Army Corps of Engineers' Regulatory Guidance Letter 02-2 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.")

Estuarine wetland. Wetlands where salt tolerant plant species are dominant and the water regime is influenced by tidal action. The wetlands are usually partially enclosed by land with open, or partially obstructed access to open saline water. In areas where freshwater wetlands grade into estuarine areas, the boundary of the latter extends to an area where the salinity is less than 5 ppt (parts per thousand) during the period of average annual low flow.

Estuary, estuary-like. A type of Washington Department of Fish and Wildlife Priority Habitat, which consists of deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5% during the period of average annual low flow. This includes both estuaries and lagoons. See *Priority Habitat and Species list.*

Eutrophication. The undesirable overgrowth of vegetation caused by high concentrations of plant nutrients in bodies of water, especially nitrogen and phosphorous, often as a result of human activities.

Exchange. The conversion of one type of wetland for another. For example, resource managers may intend to enhance habitat value for waterfowl by excavating an area of open water within an existing emergent marsh. If the open water replaces the emergent wetland or a large proportion of it, wetland types have been exchanged. See *enhancement.*

Fen. A type of wetland similar to a bog, containing accumulated peat. Fens support marsh-like vegetation including sedges and wildflowers. Fens differ from bogs in their plant communities, hydrology, and water chemistry. They are fed mostly by groundwater and are not as acidic as bogs.

Filtration. The blockage of sediment by standing vegetation.

Flats. A *class* of wetlands in the *hydrogeomorphic classification*. These are wetlands that occur in topographically flat areas that are hydrologically isolated from surrounding ground or surface water. They are primarily maintained by precipitation.

Forested wetland. A wetland *class* in the Cowardin classification where woody plants taller than 20 feet form the dominant cover. Shrubs often form a second layer beneath the forest canopy, with a layer of herbaceous plants growing beneath the shrubs.

Fragmentation. The breaking up of ecosystems into patches of habitat that are separated by areas altered by human land uses. Fragmentation always consists of both the reduction in the area of the original habitat and a change in spatial configuration of what remains.

Functions. The physical, biological, chemical, and geologic interactions among different components of the environment. See *wetland functions*.

Function assessment. The process by which the capacity of a wetland to perform a function is measured or characterized. This approach analyzes the capacity to perform a function using a numeric model. See *assessment methods*.

Geographic Information System (GIS). A system of spatially referenced information, including computer programs that acquire, store, manipulate, analyze, and display spatial data.

Geomorphology. The geologic composition and structure of a landscape – its topography, landforms, soils, and geology.

Geospatial. Refers to the geographic location and characteristics of natural or constructed features and boundaries on the Earth.

Green infrastructure (GRIST). An interconnected network of relatively undisturbed land and water that is protected to support native species, maintains landscape processes, sustains air and water resources, and contributes to the physical and economic health and quality of life of communities. Green Infrastructure also refers to the "services" that this network of ecosystems provide to people and communities. Such services as water filtration and aquifer recharge, flood attenuation, and biodiversity.

Green infrastructure plan (greenprint or GRIST plan). A plan for conservation using the concepts of green infrastructure which is developed by a proactive planning approach that incorporates both an understanding of the landscape and visioning for the future by the community. The plan represents the preservation aspect of a Smart Growth action strategy. The plan identifies areas for preservation and conservation, ensures the economic vitality of working landscapes, and guides development in a manner that is compatible with sustaining landscape processes and the character, quality of life, and economic sustainability of the community.

Greenprint. See *green infrastructure plan*.

Hydrogeomorphic (HGM) classification. A system used to classify wetlands based on the position of the wetland in the landscape (geomorphic setting), the water source for the wetland, and the flow and fluctuation of the water once in the wetland.

Hydrogeomorphic wetland class. The highest level in the hydrogeomorphic classification of wetlands. There are six basic hydrogeomorphic wetland classes including depressional, tidal fringe, slope, riverine, lake fringe, and flat. See *class*.

Hydroperiod. The pattern of water level fluctuations in a wetland. Includes the depth, frequency, duration, and timing of inundation or flooding. Patterns can be daily, monthly, seasonal, annual or longer term.

Impervious surface. A hard surface area which either prevents or retards the entry of water into the soil relative to conditions prior to development; and/or a hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development.

In-kind mitigation. Defined in the 2000 State of Washington Alternative Mitigation Policy Guidance (Ecology 2000) as "replacing the same species, habitat type, and function as those affected. However, disturbed habitat shall not be replaced with additional disturbed habitat. In these cases the applicant must restore the site to its natural condition based on adjacent undisturbed sites, as approved by the permitting agencies."

In-lieu fee program. A program that allows applicants for permits that impact wetlands to compensate for wetland losses by paying a fee to a third party such as a government agency or conservation organization. The fees are intended to be used to restore, create, enhance, or preserve wetlands. Generally, in-lieu fee contributions are collected in advance of wetland losses. These funds are accumulated until they are sufficient to design and implement a wetland compensation project

Interdunal wetlands. Wetlands that form in the "deflation plains" and "swales" that are geomorphic features in areas of coastal dunes. These dune forms are the result of the interaction between sand, wind, water, and plants. The dune system immediately behind the ocean beach (i.e., the primary dune system) is very dynamic and can change from storm to storm. These wetlands provide critical habitat in this ecosystem.

Invasive species. Defined by the National Invasive Species Council (NISC) as "(1) a non-native (alien) to the ecosystem under consideration and (2) a species whose introduction is likely to cause economic or environmental harm, or harm to human health."

Isolated wetlands. Isolated wetlands are generally defined as those wetlands that have no surface water connections to other aquatic resources.

Jurisdictional wetland. A wetland that is regulated by the provisions of the law under the jurisdiction of one or more federal, state, or local agencies. Not all areas of the landscape that have the biological characteristics of wetlands are regulated or jurisdictional wetlands. Compare to *biological wetland*.

Keystone species. A keystone species is a species that plays an essential role in the structure, function, or productivity of a habitat or ecosystem at a defined level of organization (habitat, soil, seed dispersal, etc). They are species that have a greater effect on their ecosystems and associated environmentall processes than would otherwise be predicted from their relative abundance or biomass alone. The beaver is a good example of a keystone species because its activities can change the habitat (create open water) and many hydrologic processes (beaver dams reduce water velocities and create areas for water storage).

Lacustrine. Pertaining to lakes or lake shores.

Lacustrine (lake) fringe wetlands. A wetland *class* under the *hydrogeomorphic classification*. These are wetlands that occur at the margins of topographic depressions in which surface water is greater than 8 hectares (20 acres) and greater than 2 meters deep in western Washington and 3 meters in eastern Washington.

Land banking. Is a tool for funding the acquisition of land authorized under RCW 82.46.070. It allows for establishment of a real estate excise tax to generate revenue for land purchase under a "land banking program." Initiated either by resolution of the county legislators or by public petition, the excise tax is approved by citizen vote.

Landscape analysis. An analysis of environmental processes and human impacts that occur at the larger geographic scales. See *landscape processes.*

Landscape processes. Environmental factors that occur at larger geographic scales, such as basins, sub-basins, and watersheds. Processes are dynamic and usually represent the movement of a basic environmental characteristic, such as water, sediment, nutrients and chemicals, energy, or animals and plants. The interaction of landscape processes with the physical environment creates specific geographic locations where groundwater is recharged, flood waters are stored, stream water is oxygenated, pollutants are removed, and wetlands are created.

Landscape scale. The geographic scale that encompasses the broader landscape (i.e., large areas such as basins, sub-basins, watersheds, and habitat corridors). Also see *site scale* and *large scale*.

Land trust. A non-profit organization, with 501-c-3 status under federal tax law, whose purpose is to conserve natural lands through acquisition and ownership. Land Trusts are usually locally-based citizen run grass-roots organizations working to protect a range of different critical ecosystem features within their communities.

Large scale. Large in scope. This term is used specifically to indicate geographic areas that extend beyond the boundaries of an individual site, wetland, or resource. Please note that this term has the opposite meaning when it is used in cartography. Large-scale maps are ones that cover a smaller geographic area than a small-scale map.

Large woody debris (LWD). Large pieces of downed wood such as logs, rootwads, and limbs that are in or near a body of water. LWD provides habitat structure for fish and other aquatic organisms.

Lentic. Having slow moving or still water, such as a pond or lake. Compare to *lotic*.

Lotic. Having running water, such as a river or stream. Compare to *lentic*.

Low impact development. Low Impact Development (LID) is a stormwater management approach with a basic principle that is modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls. The goal of LID is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

Management area. The geographic area for which plans and regulations are being developed by a local government. The management area is usually a subset of the contributing landscape because it can be based on political boundaries (e.g., a jurisdiction such as a city), or it may be defined geographically to include a specific basin, sub-basin, or WRIA (Water Resource Inventory Area) in a county. Compare to *site scale* and *contributing landscape*.

Marine/estuarine shorelines. A Washington Department of Fish and Wildlife Priority Habitat, which include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows). See *Priority Habitat and Species list.*

Metric measures. See *assessment metrics*.

Minimization. The second step of mitigation sequencing, in which an activity that cannot avoid some impact on wetlands is designed in a manner to have minimal impact. See *mitigation*.

Mitigation banking. As defined by the 1995 federal guidance on wetland mitigation banking, “wetland restoration, creation, enhancement, and in exceptional circumstances, preservation undertaken expressly for the purpose of compensating for unavoidable wetland losses in advance of development actions, when such compensation cannot be achieved at the development site or would not be as environmentally beneficial."

Mitigation performance standards. See *performance standards*.

Mitigation (or mitigation sequencing). Mitigation is a series of actions that requires addressing each action, or step, in a particular order. This sequence of steps is used to reduce the severity of negative impacts from activities that potentially affect wetlands. Mitigation involves the following: 1) Avoiding the impact altogether by not taking a certain action or parts of an action; 2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps, such as project redesign, relocation, or timing, to avoid or reduce impacts; 3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; 5) Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and 6) Monitoring the required compensation and taking remedial action when necessary (WAC 197.11.768). See *compensatory mitigation*.

Monitoring. The repetitive measurement of some aspect of a natural resource and/or human activity using ecological indicators as the basis for identifying changes to that resource.

Natural Heritage wetlands. As defined by the Natural Heritage Program of the Washington State Department of Natural Resources, wetlands that are either high quality undisturbed wetlands or wetlands that support threatened, endangered, or sensitive plant species.

Natural resources. The aspects of the non-human environment (often called natural ecosystems) that are valued by a society or culture. This includes wildlife and aquatic resources such as wetlands, estuaries, lakes, and rivers. Other natural resources include land, forests, mineral deposits, water, etc.

Off-site mitigation. Compensatory mitigation in which the replacement wetlands are **not** located at or near to the project that is affecting wetlands. Off-site mitigation is often only allowed if mitigation on the project site is not practicable or if it is environmentally preferable to on-site compensation.

Old-growth/mature forests. A type of Washington Department of Fish and Wildlife Priority Habitat. <u>Old-growth west of Cascade crest:</u> 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; and > 10 snags/ha (4 snags/acre) over 51 cm (20 in) diameter and 4.6 m (15 ft) tall; with numerous downed logs, including 10 logs/ha (4 logs/acre) > 61 cm (24 in) diameter and > 15 m (50 ft) long. High elevation stands (> 762m [2500ft]) may have lesser dbh [> 76 cm (30 in)], fewer snags [> 0.6/ha (1.5/acre)], and fewer large downed logs [0.8 logs/ha (2 logs/acre) that are > 61 cm (24 in) diameter and > 15 m (50 ft) long]. <u>Old-growth east of Cascade crest:</u> Stands are highly variable in tree species composition and structural characteristics due to the influence of fire, climate, and soils. In general, stands will be >150 years of age, with 25 trees/ha (10 trees/acre)> 53 cm (21 in) dbh, and 2.5-7.5 snags/ha (1 - 3 snags/acre) > 30-35 cm (12-14 in) diameter. Downed logs may vary from abundant to absent. Canopies may be single or multi-layered. Evidence of human-caused alterations to the stand will be absent or so slight as to not affect the ecosystem's essential structures and functions. Mature forests: Stands with average diameters exceeding 53 cm (21 in) dbh; 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 and 80 - 160 years old east of the Cascade crest. See *Priority Habitat and Species list.*

Ongoing agriculture. The continuation of any activity defined as agriculture, including crop rotations and changes in activity (for example, from pasturing to crop farming), as long as they do not include bringing new areas into agricultural use. Ongoing agriculture does not include the conversion of farmed wetlands into uplands.

On-site mitigation. Compensatory mitigation in which the replacement wetlands are located at or near to the project that is affecting wetlands.

Open Space Current Use Taxation (CUT) program. Property tax reduction program for landowners who retain natural landscape features in their undeveloped condition, authorized under RCW 84.34. See *Public Benefit Rating System.*

Open space. An area of land that is valued for natural processes and wildlife, for agricultural production, forestry, for active and passive recreation, and/or for providing other public benefits.

Oregon white oak woodlands. A type of Washington Department of Fish and Wildlife Priority Habitat, which includes stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%; or where total canopy coverage of the stand is <25%, but oak accounts for at least 50% of the canopy coverage present. The latter is often referred to as oak savanna. In non-urbanized areas west of the Cascades, priority oak habitat consists of stands 0.4 ha (1.0 ac) in size. East of the Cascades, priority oak habitat consists of stands 2 ha (5 ac) in size. In urban or urbanizing areas, single oaks or stands < 0.4 ha (1 ac) may also be considered a priority when found to be particularly valuable to fish and wildlife.

Out-of-kind mitigation. Compensatory mitigation in which the wetland and its associated functions used to compensate for the impacts are of a different kind than those impacted. Out-of-kind mitigation is a fairly common practice, for example, when the affected wetlands are highly degraded (e.g., wet pastures dominated by exotic species), and they may be replaced by a native scrub-shrub wetland.

Partially drained. Refers to cases where the water regime of a wetland has been altered by such measures as ditching and/or tiling, but the area still retains sufficient water to meet the wetland criteria. See *effectively drained*.

Performance standards. Observable or measurable attributes used to determine whether a compensatory mitigation project meets its objectives. Standards are usually written as legally enforceable conditions on a permit.

Preservation. In a non-regulatory context, refers to permanently securing lands (using full-fee acquisition or *conservation easements*) to protect the important features of an ecosystem in an “un-impacted” condition. Preservation is essential when a feature of the ecosystem provides a high level of functions, is rare, or otherwise non-replaceable. See *protection/maintenance* for the definition of preservation used in a regulatory context.

Prior Converted Croplands (PCC). As defined in federal law, wetlands that were drained, dredged, filled, leveled, or otherwise manipulated, including the removal of woody vegetation, before December 23, 1985, to enable production of an agricultural commodity, and that: 1) Have had an agricultural commodity planted or produced at least once prior to December 23, 1985; 2) Do not have standing water (ponding) for more than 14 consecutive days during the growing season; and 3) Have not since been abandoned.

Priority Habitat and Species (PHS) list. The PHS List is a catalog of habitats and species considered to be priorities for conservation and management. “Priority species” require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. “Priority habitats” are those habitat types or elements with unique or significant value to a diverse assemblage of species. A priority habitat may consist of a unique vegetation type or dominant plant species, a described successional stage, or a specific structural element. There are 18 habitat types, 140 vertebrate species, 28 invertebrate species, and 14 species groups currently on the PHS List. These constitute about 16% of Washington's approximately 1000 vertebrate species and a fraction of the state's invertebrate fauna.

Programmatic mitigation area. A site (or series of sites) that have been identified by a local jurisdiction or a state or federal agency as the preferable area for wetland compensation.

Protection/maintenance (preservation). Removing a threat to, or preventing the decline of, wetland conditions by an action in or near a wetland. This includes the purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term preservation (in a regulatory context). Under regulatory actions preservation does not result in a gain of wetland acres, but may result in a gain in functions over the long term, and is used only in exceptional circumstances. Also see *preservation* for the definition used in a non-regulatory context.

Public Benefit Rating System (PBRS). An optional component of the *Open Space Current Use Taxation (CUT) program* allowing local jurisdictions to tailor their "open" category program to address protection of locally-important landscape features as defined and scored in their specific PBRS.

Reasonable use. That use of the land that is deemed appropriate by a reasonable person when balancing the public's interest against those of the private property owner. When balancing these interests, the reasonable person considers the seriousness of the public problem, the extent to which the owner's land contributes to that problem, the degree to which the proposed mitigating action or regulation solves the problem and the feasibility of less oppressive solutions. At the same time the reasonable person must consider the amount and percentage of value loss; the extent of remaining uses; the past, present, and future uses; the temporary or permanent nature of the regulation; and the extent to which the owner should have anticipated such mitigating actions or regulations and how feasible it is for the owner to alter present or currently planned uses.

Recruitment (of woody debris). The movement of large and small wood from surrounding areas into an aquatic system over time through the actions of wind, water, or other means. The potential for recruitment of woody debris influences the long-term habitat structure within an aquatic system.

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. Compare to *rehabilitation. S*ee also *restoration*.

Reference wetland. In the context of compensatory mitigation, means a wetland chosen to represent the functions and characteristics that are being created, restored, or enhanced at the "mitigation" site. A reference wetland, or wetlands, are used for monitoring the success of the mitigation project. Reference wetlands, in the context of methods for assessing wetland functions, mean the sites chosen to represent the full range of functioning in a region or hydrogeomorphic class. Data collected at these sites is used to calibrate the methods.

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. Compare to e*stablishment (creation)*, *re-establishment* and *enhancement.* See also *restoration*.

Restoration. The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into *re-establishment* and *rehabilitation*.

Richness. The number of different species of organisms present in a community.

Riparian. A Washington Department of Fish and Wildlife Priority Habitat, which includes the area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other. In riparian systems, the vegetation, water tables, soils, microclimate, and wildlife inhabitants of terrestrial ecosystems are influenced by perennial or intermittent water. Simultaneously, the biological and physical properties of the aquatic ecosystems are influenced by adjacent vegetation, nutrient and sediment loading, terrestrial wildlife, as well as organic and inorganic debris. Riparian habitat encompasses the area beginning at the ordinary high water mark and extends to that portion of the terrestrial landscape that is influenced by, or that directly influences, the aquatic ecosystem. Riparian habitat includes the entire extent of the floodplain and riparian areas of wetlands that are directly connected to stream courses. See *Priority Habitat and Species list*. Also see *riparian* below.

Riparian. The strip of land adjacent to a body of water that is transitional between the aquatic system and the upland. Some riparian areas contain wetlands. Also see *riparian* above.

Riparian areas. Vegetated ecosystems along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body. These systems encompass wetlands, uplands, or some combination of these two landforms. They will not in all cases have all the characteristics necessary for them to be also classified as wetlands.

Risk assessment. The process of establishing information regarding acceptable levels of a risk and/or levels of risk for an individual, group, society, or the environment.

Riverine wetlands. A *class* of wetlands in the *hydrogeomorphic classification*. Wetlands that occur in floodplains and riparian corridors in association with stream or river channels where there is frequent overbank flooding.

Rural natural open space. A Washington Department of Fish and Wildlife Priority Habitat, which includes open spaces in which a priority species resides within it or adjacent to it and the priority species uses it for breeding or regular feeding; and/or the open space functions as a corridor connecting other priority habitats, especially areas that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and surrounded by agricultural developments. Local consideration may be given to open space areas smaller than 4 ha (10 acres). Compare to *urban natural open space.* Also see *Priority Habitat and Species list.*

Sequencing (mitigation sequencing). A series of actions that requires addressing each action, or step, in a particular order. It is the process of working through a series of steps to determine what types of impacts may be permitted and what types of compensatory mitigation may be appropriate. See *mitigation.*

Site processes. Environmental factors that occur within the wetland itself or within its buffer. The interactions of site processes with landscape processes define how a wetland functions.

Site scale. The geographic scale that encompasses the area within the boundary of a single wetland and its immediate surroundings. Compare to *management area* and *contributing landscape*. Also see *landscape scale.*

Slope wetlands. A *class* of wetlands in the *hydrogeomorphic classification***.** These are wetlands that occur on the slopes of hills or valleys. The principal water source is usually seepage from groundwater.

Smart Growth. A concept for improving land-use planning and the management of growth in communities by combining principles of ecosystem management with those of comprehensive planning. Its purpose is to minimize the negative effects of sprawl development on both the economic vitality of communities and the environment. Generally, Smart Growth principles and policies encourage limited outward expansion, higher density development, preservation of green space, walk-able communities, and revitalization of urban centers.

Species richness. See *richness***.**

Stormwater. Stormwater is the water coming from rain or snow that runs off surfaces such as rooftops, paved streets, highways, and parking lots. It can also come from hard grassy surfaces like lawns, play fields, and from graveled roads and parking lots.

Sub-basin. A smaller drainage basin that is part of a larger drainage basin or watershed. For example, the watershed of a large river may be composed of several sub-basins, one for each of the river's tributaries.

Temporal impacts. Impacts to wetland functions that will eventually be replaced as a project of compensatory mitigation matures, but cannot achieve similar levels of function in a short period of time. Compare to *temporal loss.*

Temporal loss (of functions). The concept that there is a time lag between the loss of existing wetland functions through human or natural disturbance and the re-establishment of functions over time in a site that is newly constructed or modified.

Tidal fringe wetlands. A *class* of wetlands in the *hydrogeomorphic classification*. Wetlands that occur on continental margins where marine waters are greater than 2 meters deep and more than 8 hectares (20 acres) in size.

Transfer of Development Rights (TDR). A process by which development rights are severed from parcels of land and transferred to other parcels. Areas are designated where such rights can be bought and used.

Urban natural open space. A Washington Department of Fish and Wildlife Priority Habitat, which includes open spaces in which a priority species resides within it or adjacent to it and the priority species uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other priority habitats, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development. Local considerations may be given to open space areas smaller than 4 ha (10 acres). Compare to *rural natural open space.* Also see *Priority Habitat and Species list.*

Values. See *wetland values*.

Vegetated marine/estuarine. A Washington Department of Fish and Wildlife Priority Habitat, which includes the following: Eelgrass meadows - habitats consisting of intertidal and shallow subtidal shores which are colonized by rooted vascular angiosperms of the genus *Zostera;* Kelp beds - patches of sedentary floating aquatic vegetation of the genus *Macrocystis* and/or *Nereocystis; and* Turf algae - habitats consisting of non-emergent green, red, and/or brown algae plants growing on solid substrates (rocks, shell, hardpan). See *Priority Habitat and Species list.*

Vernal pool. Small depressions in the scabrock or in shallow soils of eastern Washington that fill with snowmelt or spring rains. They retain water until the late spring when reduced precipitation and increased evapotranspiration lead to a complete drying out. The wetlands hold water long enough throughout the year to allow some strictly aquatic organisms to flourish, but not long enough for the development of a typical wetland environment.

Watershed. A geographic area of land bounded by topographic high points in which water drains to a common destination.

Wetland functions. The physical, biological, chemical, and geologic interactions among different components of the environment that occur within a wetland. Wetlands perform many valuable functions and these can be grouped into three categories: functions that improve water quality, functions that change the water regime in a watershed such as flood storage, and functions that provide habitat for plants and animals.

Wetland rating. Also called a wetland rating system. is a tool for dividing or grouping wetlands into groups that have similar needs for protection. One method used in Washington is the Washington State wetland rating systems (Hruby 2004a,b), which places wetlands in categories based on their rarity, sensitivity, our inability to replace them, and their functions.

Wetland values. Wetland processes, characteristics, or attributes that are considered to benefit society.

Wetlands. As defined by the *Washington State Wetlands Delineation Manual* (Ecology 1997), "The Corps of Engineers (CE) (Federal Register 1982), the Environmental Protection Agency (EPA) (Federal Register 1985), the Shoreline Management Act (SMA) and the Growth Management Act (GMA) all define wetlands as: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. In addition, the SMA and GMA definitions add: "Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas to mitigate the conversion of wetlands."

Appendix 1-A

Members of Core Team and Local Government Wetlands Advisory Team

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Appendix 1-B
Reviewers of Volume 2

Representatives from the business and environmental community that provided input on concepts and early drafts of Volume 2:

Dee Arntz, WETNET (of Audubon)

Nina Carter, Audubon Washington

Andrew Cook, Business and Industry Association of Washington

Jerry Gorsline, Washington Environmental Council

Kristen Sawin, Association of Washington Business

Jody Slavik, Business and Industry Association of Washington

Tim Trohimovich, 1000 Friends of Washington (now called Futurewise)

Individuals and organizations that provided written comments during the public review period:

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Jerry Gorsline, Policy Associate, Washington Environmental Council

Maxine Keesling, Private Citizen

Mary J. Roberts, Watershed Steward, WSU Cooperative Extension/King County

Tim Trohimovich, AICP, Planning Director, 1000 Friends of Washington (now called Futurewise)

Sarah Cooke and Dee Arntz, Audubon WETNET Scientific Advisory Committee

Washington State Department of Fish and Wildlife (staff not on the Core Team)

Appendix 5-A
Some Sources of Existing Data for Use in Landscape Analysis

Type of Information	Database	Source
100-year flood hazard areas	FEMA	Federal Emergency Management Agency (Data distributed through the Department of Ecology) http://www.ecy.wa.gov/services/gis/data/flood/q3flood.htm or go to the Department of Ecology Floods home page http://www.ecy.wa.gov/programs/sea/floods/
Aerial photos	Digital Ortho Quads (DOQ)	University of Washington http://duff.geology.washington.edu/data/raster/index.html (See Images)
Boundaries of Water Resource Inventory Areas (WRIA) that can be used to define the contributing landscapes	WRIA/24	Washington State Department of Ecology http://www.ecy.wa.gov/services/gis/data/data.htm
Geologic formations under the soils	Surficial Geology	Washington State Department of Natural Resources http://www.dnr.wa.gov/geology/dig100k.htm
Land use/land cover data	National Land Cover Data (NLCD), 30-meter	The 30-meter NLCD http://landcover.usgs.gov Data for WA can be accessed directly at http://landcover.usgs.gov/nlcd/show_data.asp?code=WA&state=Washington
	GIRAS Land Use / Land Cover (LUCL) data	GIRAS LUCL data collected by USGS and converted to ARC/INFO by the EPA http://www.epa.gov/ngispgm3/spdata/EPAGIRAS/
Location, size, and type of wetlands in a landscape	NWI (National Wetland Inventory)	U.S. Fish and Wildlife Service NWI is available either in paper maps or in digital format (http://wetlands.fws.gov/downloads.htm)
Mapping of streams and rivers	HYDRO (GIS layer of streams and rivers)	Washington State Department of Natural Resources http://www.dnr.wa.gov/dataandmaps/ (go to Available GIS data, Hydrography)
Priority Habitats and Species	PHS (Priority Habitats and Species -several data layers)	Washington State Department of Fish and Wildlife (WDFW) http://www.wdfw.wa.gov/hab/phspage.htm

Type of Information	Database	Source
Roads and rails	TRANS (GIS layer of roads and rails)	Washington State Department of Natural Resources http://www.dnr.wa.gov/dataandmaps/ (go to Available GIS data, Transportation) Also, the Washington State Department of Transportation http://www.wsdot.wa.gov/mapsdata/geodatacatalog/default.htm.
Salmon and fish use	WLRIS, SSHIAP	Washington Lakes and Rivers Information System - Fish Distribution can be ordered from WDFW http://www.wdfw.wa.gov/hab/release.htm (go to Fish and Wildlife maps and digital data products available from WDFW) Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) is also available through WDFW at http://wdfw.wa.gov/hab/sshiap/
Soil types	SOILS	USDA, Natural Resources Conservation Service http://soildatamart.nrcs.usda.gov/
USGS quadrangle data (7 ½')	QUADS	University of Washington , digital raster graphics http://duff.geology.washington.edu/data/raster/index.html Washington State Department of Natural Resources http://www.dnr.wa.gov/dataandmaps/ (go to Available GIS data) Data also distributed through Washington State Department of Ecology http://www.ecy.wa.gov/services/gis/data/data.htm
USGS topographic grid data	DIGITAL ELEVATION MODEL (DEM), 10 meter or 30 meter	University of Washington http://duff.geology.washington.edu/data/raster/index.html

Appendix 5-B

Methods and Information Resources for Use in Analyzing Landscapes and Wetlands

Chapter 5 of this volume presents a number of questions, regardless of the method used, that should be answered when conducting landscape analysis. This appendix presents various methods and general references that are available for use in analyzing the landscape and its wetlands, as well as assessing the characteristics and functions of individual wetlands. These analyses can assist local governments in developing plans, regulations, and non-regulatory approaches to protect landscape processes and wetlands.

Methods for analyzing the larger geographic scales (contributing landscape and management area) are under development and being tested in pilot projects here in Washington. Therefore, there is very little information about the effectiveness of these methods at providing the information necessary to protect and manage wetlands from this broader perspective. One of the methods described briefly in this appendix is the approach that the Department of Ecology is developing for analyzing the landscape (a link to a web site is provided in that section of the appendix).

On the other hand, methods for analyzing the functions and characteristics of individual wetlands have been extensively used in Washington State. Numerous methods are summarized in this appendix.

References on Landscape Processes in the Pacific Northwest

The following two books are recommended for developing an understanding of landscape processes in the coastal region of the Pacific Northwest. Though these books focus on river systems in one geographic area of Washington, the concepts, principles, and research presented are very useful in understanding the interaction of processes that occur at larger geographic scales with all wetland types.

Naiman, R. and R. Bilby (eds.). 1998. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag, New York. 705 pp.

In particular, Chapters 2 through 4 in Part I (Physical Environment), Chapters 11 and 12 in Part III (Ecosystem Processes), and Chapters 19 and 20 in Part IV (Management) are very useful in understanding landscape processes and how to approach assessment of watersheds.

The following is text from the publisher's abstract:

> *Touching all parts of the natural environment and nearly all aspects of human culture, streams and rivers act as centers of organization within landscapes. They provide natural resources such as fish and clean water, transportation, energy, diffusion of wastes, and recreation. A basic ecological understanding of the structure and dynamics of running waters is needed to formulate sound management and policy decisions. The vast Pacific coastal ecoregion of the United States contains an extraordinary array of physical setting and examples of the range of dynamics associated with rivers and their management. The interface between the science and policy of natural resource management is illustrated by examples from this ecoregion, including the protection riparian forest, the marbled murrelet, salmon, and amphibians. This study includes sections on the physical environment, the biotic environments, ecosystem processes, management, and recommendations for the future. Specific topics include channel dynamics, hydrology, water quality, microbial process, primary production, fish and wildlife, riparian forest dynamics, organic matter and trophic dynamics, biogeochemical cycling, maintaining biodiversity, monitoring and assessment, economic perspectives, legal consideration, and the role of non-governmental organizations in river management.*

Montgomery, D., S. Bolton, D. Booth, and L. Wall (eds.). 2003. Restoration of Puget Sound Rivers. University of Washington Press. 512 pp.

The first five chapters of this book are very useful in gaining an understanding of landscape processes and the effect of alterations on these processes. The reference also addresses potential objectives for restoration based on landscape setting, geology, and land uses.

The following is text from the publisher's abstract:

> *In the Pacific Northwest, as in most regions of the United States, we are still learning about the processes that create habitat and river structure, how those processes influence aquatic ecosystems, and how to gauge the response of river systems to both land-use change and restoration efforts. River systems are still responding to historic changes, and degraded habitat may not be restored successfully if natural conditions are not well understood, particularly if massive change in watershed hydrology or other processes are the root cause…. The eighteen chapters of Restoration of Puget Sound Rivers – presented by the region's experts at a symposium of the Society for Ecological Restoration – examine geological and geomorphological controls on river and stream characteristics and dynamics, biological aspects of river systems in the region, and the application of fluvial river systems in the region, and the application of fluvial geomorphology, civil engineering, riparian ecology, and aquatic ecology in efforts to restore Puget Sound Rivers.*

General References for Analysis at a Landscape Scale

The following books provide some general information about tools for analyzing wetlands and aquatic resources at larger geographic scales. These may provide useful background information for anyone trying to develop an approach that will work in their jurisdiction.

Kroenert, R., U. Steinhardt, and M. Volk. 2001. Landscape Balance and Landscape Assessment. Springer-Verlag, New York. 304 pp.

The following is the abstract from the publisher:

> *During the last decades, landscape ecology has developed tremendously. It concerns both the theoretical basis and practical application. The authors follow a hierarchical approach that is inherent in landscape structures and processes as well as in planning practice. They show first approaches for the inclusion of factors of the landscape balance into planning procedures and new methods (GIS-coupled modeling, remote sensing) combined with more classical approaches from the basis of landscape assessment. Approaches for multi-criterial landscape assessments will be presented also. The overall target is to give recommendations for sustainable land-use and management. Each chapter concludes with a synthesis of the theme under discussion. Ideas concerning the state-of-the-art are integrated as well as future trends in research. All methodological approaches will be explained with examples from differing regions.*

Heathcote, I.W. 1998. Watershed Management: Principles and Practice. John Wiley & Sons, Inc. 414 pp.

The following is the abstract from the publisher:

> *This book presents a flexible, integrated framework for watershed management that addresses the biophysical, social, and economic issues affecting water resources and their use. Comprehensive in scope and multidisciplinary in approach, it equips you with the necessary tools and techniques to develop sound watershed management policy and practice - from problem definition and goal setting to electing management strategies and procedures for monitoring implementation. Topics include watershed components and processes; establishing management plan parameters and objectives; stakeholder identification and consultation; development of practical management options; both simple and detailed methods for the assessment of management alternatives; techniques for determining the legal implications and the environmental, economic, and social impact of a management plan; and choosing the best plan and putting it into action. Supplemented with case studies and examples, Integrated Watershed Management is an ideal resource for upper-level students and professionals in environmental science, natural resource management, and environmental engineering.*

Reimold, R.J. 1998. Watershed Management: Practice, Policies, and Coordination. McGraw-Hill Companies. 608 pp.

The following is the abstract from the publisher:

> *Ensuring a safe and adequate supply of water requires the combined efforts and expertise of resource managers, engineers, planners, technical experts, and policy analysts worldwide. This contributed volume is unique in recognizing this need and provides today's first truly comprehensive, international coverage of effective watershed management. Experts representing the full spectrum of environmental professions and viewpoints provide detailed case studies of how watershed management is being implemented around the world, focusing on the United States, France, the former Soviet Union, the Pacific Rim, the Nile River, and other areas. Successful approaches such as whole watershed and full stakeholder involvement; watershed sanitary surveys; urban watershed management; river basin planning; integrated management and water resource protection; watershed-based coastal management wetlands restoration; water quality monitoring and assessment; stormwater and other nonpoint pollution source management; water withdrawal; wastewater discharge permitting; and other tools for cost-effective watershed management are highlighted. Mathematical models demonstrate how various systems can be successfully managed for future sustainability.*

Methods for Analyzing the Contributing Landscape and Management Area

The following list identifies a few published methods that can provide information that can be used in protecting and managing wetlands at larger geographic scales.

Environmental Protection Agency's Synoptic Approach

Abbruzzese, B., and S.G. Leibowitz. 1997. A synoptic approach for assessing cumulative impacts to wetlands. Environmental Management 21(3): 457-475.

Leibowitz, S.G., B. Abbruzzese, P.R. Adamus, L.E. Hughes, and J.T. Irish. 1992. A synoptic approach to cumulative impact assessment: A proposed methodology. U.S. Environmental Protection Agency. EPA/600/R-92/167.

Washington State was one of the case studies used to demonstrate the concept of the synoptic approach.

The following is the abstract from the authors:

> *The U. S. Environmental Protection Agency's Wetlands Research Program has developed the synoptic approach as a proposed method for assessing cumulative impacts to wetlands by providing both a general and a comprehensive view of the environment. It can also be applied more broadly to regional prioritization of environmental issues. The synoptic approach is a framework for making comparisons between landscape subunits, such as watersheds, ecoregions, or counties, thereby allowing cumulative impacts to be considered in management decisions. Because there is a lack of tools that can be used to address cumulative impacts within regulatory constraints, the synoptic approach was designed as a method that could make use of available information and best professional judgment. Thus, the approach is a compromise between the need for rigorous results and the need for timely information. It is appropriate for decision-making when quantitative, accurate information is not available; the cost of improving existing information or obtaining better information is high; the cost of a wrong answer is low; there is a high demand for the information; and the situation calls for setting priorities between multiple decisions versus optimizing for a single decision. The synoptic approach should be useful for resource managers because an assessment is timely; it can be completed within one to two years at relatively low cost, tested, and improved over time. An assessment can also be customized to specific needs, and the results are presented in mapped format. However, the utility of a synoptic assessment depends on how well knowledge of the environment is incorporated into the assessment, relevant to particular management questions.*

The Washington State Department of Ecology's Guidance for Landscape Analysis

The Washington State Department of Ecology is developing guidance for conducting a landscape analysis. This guidance is designed to assist local governments in applying landscape principles to planning and regulatory activities (e.g., updating comprehensive plans, developing area-specific plans, creating land-use plans, etc.). A landscape analysis can be used to determine whether environmental processes have been altered, identify the mechanisms and geographic locations of the alterations, determine patterns of future land uses and development standards that are compatible with maintenance of landscape processes and natural resources, and identify viable restoration opportunities.

The purpose of Ecology's guidance is to

- Provide information that can be used to sustain and restore environmental processes and aquatic resources
- Establish a common environmental framework for developing, updating, and coordinating planning efforts

- Assist in the preparation of updates to comprehensive plans and Shoreline Master Plans:
  - Provide direction on appropriate designations for land use and zoning
  - Promote the integration of the Growth Management Act and Shoreline Management Act (SMA)
  - Establish a framework for characterizing environmental processes and developing a restoration plan as required under the new SMA guidelines
  - Promote "no net loss" of shoreline functions and the maintenance of landscape processes and wetland functions

By applying the guidance, a general model of the key environmental processes and their relationship to aquatic habitat is developed and areas important to maintaining those processes are identified. Next, specific indicators, such as land use, land cover, population density, channelization, and ditching are used to qualify the degree of alteration to these processes. By comparing the model of environmental conditions to the location and number of alterations, measures for protection and restoration can be identified. These can include determining appropriate land-use activities as well as identification and ranking of wetland restoration areas.

Ecology's guidance involves the following five steps. Information for completing these steps is available online at: www.ecy.wa.gov/programs/sea/landscape.

1. Identify and map the aquatic resources of interest
2. Identify and map the area that contributes surface and ground water to the resources of interest
3. Identify processes critical to the integrity and functions of the resources
4. Identify and map areas important for sustaining key processes
5. Identify and map the type of alterations that have affected key processes

The results of the analysis can then be used to develop:

- Land-use recommendations that protect key processes in important areas that are unaltered
- Land-use recommendations that restore key processes in important areas that have been altered

Ecology's approach to landscape analysis uses existing environmental data and land-use information including surficial geology and geologic hazards, soil types, topography, land cover and land use, water quality and quantity, and mapping of critical habitats.

Maryland Stream Corridor Assessment Survey

The following describes an assessment developed by Maryland's Department of Natural Resources. It was taken from the survey's web page in April 2004: http://www.dnr.state.md.us/streams/stream_corridor.html.

> *The Stream Corridor Assessment (SCA) survey was developed by DNR's Watershed Restoration Division as a tool to help environmental managers identify environmental problems and prioritize restoration opportunities on a watershed basis. As part of the survey, trained personnel walk the watershed's entire stream network and record information on a variety of environmental problems that can be easily observed within the stream corridor. Common environmental problems documented in the survey include: eroding stream banks, inadequate stream buffers, exposed pipes, altered stream channels, fish migration barriers, pipe outfalls, in-stream construction sites and trash dumping locations. In addition to identifying the location of common stream problems the survey also collects information on both in- and near-stream habitat conditions so that comparative assessments can be made of the condition of different stream segments.*
>
> *It is important to note that Stream Corridor Assessment Survey is not intended to be a detailed scientific evaluation of a stream system nor will it replace the more standard chemical and biological surveys. Instead the survey is intended to provide a rapid method of examining an entire drainage network so future monitoring and management efforts can be better targeted. Part of the need for this type of survey is that many existing scientific surveys are very time consuming, expensive and can only collect information for a relatively small section of stream at any one time. The Stream Corridor Assessment Survey, on the other hand, is designed so that teams of 2 or 3 volunteers are able to survey 2 or more stream miles per day. Individuals performing the survey receive training in both stream ecology and how to conduct the survey.*

North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS)

Sutter, L.A. and J.R. Wuenscher. 1996. NC-CREWS: A Wetland Functional Assessment Procedure for the North Carolina Coastal Area (Draft). Division of Coastal Management, North Carolina Department of Environment and Natural Resources, Raleigh, NC. 61 pp/appen.

The following description was taken from the NC-CREWS web page in April 2004: http://www.wes.army.mil/EL/emrrp/emris/emrishelp6/north_carolina_coastal_region_evaluation_of_wetland_significance_tools.htm. Note that this method was developed to rate wetlands in North Carolina. The indicators of function used would have to be modified to reflect conditions in the region of Washington where the method is being used.

Primary purpose: To predict the relative ecological significance of wetlands within their watershed and region using a GIS-based landscape-scale procedure. Developed for use in planning and overall management of wetlands rather than for regulatory decisions.

Eleven functions are addressed: surface runoff storage; floodwater storage; shoreline stabilization; terrestrial wildlife; aquatic life; nonpoint source; floodwater cleansing; landscape character; water characteristics; replacement difficulty; and restoration potential.

Procedure: Using GIS analysis, a High, Medium, or Low rating is assigned to each of 39 parameters that describe the landscape and internal wetland characteristics. The parameter ratings are successively combined to produce ratings (H, M, or L) for subfunctions and primary functions. The primary function ratings are combined to form an overall rating of the wetlands ecological significance (i.e., beneficial significance, substantial significance, or exceptional significance).

Output: Measure of overall ecological significance of a wetland within its watershed and the larger landscape.

Contact person: Jim Stanfill, Division of Coastal Management, North Carolina Department of Environment and Natural Resources, P.O. Box 27687, Raleigh, NC 27611 phone: (919) 733-2293; fax: (919) 733-1495; e-mail: jim_stanfill@mail.enr.state.nc.us

Limitations listed by authors: "The NC-CREWS models should not be used as a guide to design, however, individual variables (parameters) may provide useful information. It is not the intended purpose for the procedure, therefore, it contains properties that limit its application for this purpose. For example, NC-CREWS uses opportunity variables, but does not set upper limits on those opportunities that could potentially reduce functional capacity (e.g., a wetland located near a pollutant generating area is assigned a high rating). In some circumstances, a wetland may not have the capacity to remove all nutrient input. An upper limit on the opportunity must be defined to insure that the existing or planned wetland can predictably have the capacity to provide a function."

Spatial Wetland Assessment for Management and Planning (SWAMP)

Sutter, L.A., J.B. Stanfill, D.M. Haupt, C.J. Bruce, and J.E. Wuenscher. 1999. NC-CREWS: North Carolina Coastal Region Evaluation of Wetland Significance. North Carolina Division of Coastal Management, Department of Environment and Natural Resources. Raleigh, NC.

The following description was taken from the SWAMP web page in April 2004: http://www.csc.noaa.gov/lcr/swamp/text/p661.htm#intro. Note that this method was developed to rate wetlands in North Carolina. The indicators of function used would have to be modified to reflect conditions in the region of Washington where the method is being used. Ecology is presently working on adapting this method to the coastal region of the Pacific Northwest.

> *The Spatial Wetland Assessment for Management and Planning (SWAMP) uses basic ecological principles to evaluate the significance of wetlands within a watershed while allowing the decision maker to establish the rules for overall rating. The model is based on the NC-CREWS model (Sutter et al. 1999) but has significantly faster processing time and offers greater flexibility in adjustment of parameters and rating rules. Three groups of functions are evaluated including water quality, hydrology and habitat.*
>
> *Procedure: Requires digital information in GIS format. including:(1) wetland boundaries and types; (2) land cover; (3) soils data; (4) hydrography; and (5) watershed boundaries.*
>
> *The functional significance of wetlands is rated (non quantitative) on the basis of three broad categories: exceptional functional significance, substantial functional significance, and beneficial functional significance.*
>
> *Output: To produce information about the relative ecological importance of wetlands that would be useful for wetland planning and management.*

The authors describe its limitations as follows:

> *The result of the procedure is not a substitute for a site visit in making regulatory decisions, but a predictor of what a site visit would determine. The parameters and thresholds developed for the ACE Basin would be more defensible if data had been collected to specifically support the assumptions behind each parameter*.

Methods for Analyzing Wetlands at the Site Scale

An assessment of the functions performed by a wetland is often required when impacts to that wetland will result from a change in land use. In many jurisdictions, the level of analysis depends upon the type, severity, and extent of the proposed impacts such that the detail necessary will be commensurate with the impacts.

As a minimum, many local governments require an analysis of functions be performed using a rating system. Rating systems also help determine if particular features or situations of concern exist at the site, such as the presence of a mature forest (see Chapter 8, Section 8.3.4, for more on rating). If Ecology is involved in a project, the applicant will generally be requested to apply the wetlands rating system for western Washington or eastern Washington (see below) to determine the category of the wetland and how well it performs three basic functions (improving water quality, reducing flooding and erosion, and potential to provide habitat for many species). However, a more thorough assessment of functions may be needed when wetland impacts will be significant. In such cases regulatory agencies may request that an applicant complete an assessment using the wetland function assessment method for Washington State, if the wetland is in one of the classes for which a method has been developed (see below).

The following is a list of methods that were specifically developed to analyze wetlands in Washington or are commonly used in the state.

Washington State Wetlands Rating Systems

Hruby, T. 2004. Washington State Wetland Rating System for Eastern Washington – Revised. Washington State Department of Ecology Publication #04-06-015. Olympia, WA.

Hruby, T. 2004. Washington State Wetland Rating System for Western Washington – Revised. Washington State Department of Ecology Publication #04-06-025. Olympia, WA.

The Washington State Wetlands rating systems for eastern and western Washington are technically characterizations that group wetlands based on sensitivity, rarity, functions, and other criteria including the performance of basic functions as described above. For more information and to download the rating systems go to the following web addresses:

For western Washington: http://www.ecy.wa.gov/biblio/0406025.html

For eastern Washington: http://www.ecy.wa.gov/biblio/0406015.html

Advantages

- Designed to categorize wetlands into one of four groups which allow agencies/local governments to determine how the wetlands should be protected and managed

- Rapid and relatively easy to perform; the vast majority of sites can be rated within 1 to 2 hours in the field

Limitations

- Not a numeric assessment of functions, but a characterization
- May oversimplify the performance of functions and understanding of the wetland functions needed to adequately protect it, especially in large wetlands having several types within one boundary

Recommended Uses

- Determine into which category a wetland is grouped, often for regulatory purposes to determine buffer widths and ratios for compensatory mitigation
- May provide sufficient characterization of potential functions for impacts to small (e.g., <1 acre), degraded wetlands when determining needs for compensation

Washington State Wetland Function Assessment Methods (WFAM)

Hruby, T, S. Stanley, T. Granger, T. Duebendorfer, R. Friesz, B. Lang, B. Leonard, K. March, and A. Wald. 2000. Methods for Assessing Wetland Functions, Volume II: Depressional Wetlands in the Columbia Basin of Eastern Washington. Parts I and II. Washington State Department of Ecology Publication #00-06-47 and#00-06-48. Olympia, WA.

Hruby, T., T. Granger, K. Brunner, S. Cooke, K. Dublanica, R. Gersib, L. Reinelt, K. Richter, D. Sheldon, E. Teachout, A. Wald, and F. Weinmann. 1999. Methods for Assessing Wetland Functions, Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington. Parts I and II. Washington State Department of Ecology Publication #99-115 and #99-116. Olympia, WA.

Methods for Assessing Wetland Functions, commonly called Washington State Wetland Function Assessment Methods (WFAM), are a collection of assessment methods developed by interdisciplinary teams of experts and published by Ecology. Unlike rating systems which categorize wetlands using information about basic functions, the assessments provide a score for the degree to which several functions (up to 15) are performed by a wetland. The methods are based on the hydrogeomorphic (HGM) classification for wetlands. For more information and to download the methods go to the following web address: http://www.ecy.wa.gov/programs/sea/wfap/index.html.

Advantages

- Relatively rapid for the scientific rigor of the assessments that are needed
- Provide a numeric expression of the level of performance of wetlands in regard to their potential to perform and their opportunity to perform numerous functions
- Developed for specific areas in Washington and for specific wetland types
- Peer reviewed and field tested in the area for which they were developed
- Results are reproducible to ±10%, especially with training

Limitations

- Large, structurally complex sites may require a few days to complete an assessment
- Site visits at different times of the year may be necessary to accurately determine the water regime (e.g., the length and extent of inundation)
- Specific training in the application of WFAMs is required before one uses it for regulatory purposes
- WFAMs are lacking for specific wetland types. Methods do not exist for riverine wetlands in eastern Washington, any montane areas, or any slope, tidal, or interdunal wetlands
- Numeric results may be misused to assume scores are continuous functions rather than discrete integers

Recommended Uses

- Projects involving significant wetland impacts in terms of size (e.g. >2 acres) or estimated level of performance of the wetland
- Determine if functions lost to impacts have been adequately replaced in compensatory mitigation

Wetland Functions Characterization Tool for Linear Projects

Null, W., G. Skinner, and W. Leonard. 2000. Wetland Functions Characterization Tool for Linear Projects. Washington State Department of Transportation Environmental Affairs Office, Olympia, WA.

This method is also a characterization. It uses a list of criteria for each function to guide decision-making. It relies on professional judgment regarding the likelihood that the function is being performed. The tool is available online at: http://www.wsdot.wa.gov/environment/biology/docs/bpjtool.pdf.

Advantages

- Provides documentation of the criteria and rationale used when applying best professional judgment to analyze functions
- Can be very rapid when used by trained wetland ecologists
- Can also be used to characterize a portion of a larger wetland when a wetland exists on multiple properties and access to all parts of the wetland is restricted
- Based on WFAM, which corresponds to "best available science"

Limitations

- Cannot determine the level at which a function may be performed to plan compensatory mitigation
- This method should not be used to measure change over time or as the result of alterations (e.g., impacts or mitigation)
- Method is subjective and results may vary significantly based on the experience and expertise of the user

Recommended Uses

- Rapid screening of many wetlands to determine best areas for development or roads

Semi-Quantitative Assessment Methodology (SAM)

Cooke Scientific Services Inc. 2000. Wetland and Buffer Functions Semi-quantitative Assessment Methodology (SAM). Final Working Draft User's Manual. Cooke Scientific Services Inc. Seattle, WA.

This method has not been published but is available on the web at: http://www.cookescientific.com/sam.htm or http://www.cookescientific.com/SAM%20Stuff/SAM2000.pdf.

Although SAM is in wide use, better tools have been developed more recently. The WFAM method is much more accurate in its ability to characterize the functions and their performance in wetlands and should be used in its place, especially for larger (> 1 acre) wetlands.

SAM provides a rapid method for rating various wetland attributes, including functions, with high, medium, and low rating.

Advantages

- Easy to use and requires no specific training (some knowledge of wetland ecology would obviously be beneficial)
- Reproducible between users
- Developed for western Washington

Limitations

- Provides very general information
- "Low" ratings miss many site-specific details that are important for protection and management
- Allocates high ratings to large, rural, undisturbed wetlands, while smaller wetlands in urban areas rate lower
- Should not be used for wetlands east of the crest of the Cascade Mountains

Wetland Evaluation Technique (WET)

Adamus, P.R., E.J. Clairain, Jr., R.D. Smith, and R.E. Young. 1987. Wetland evaluation technique (WET), volume II: Methodology. Department of the Army, Waterways Experiment Station, Vicksburg, MS. NTIS No. ADA 189968.

WET is a rating method that was developed in the late 1980s by the U.S. Army Corps of Engineers in cooperation with Paul Adamus.

WET is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently.

Wetland Values: Concepts and Methods for Wetlands Evaluation (often called the Reppert method after the author)

Reppert, R.T., W. Sigleo, E. Stakhiv, L. Messman and C. Beyers. 1979. Wetland Values: Concepts and Methods for Wetland Evaluation. U.S. Army Corps of Engineers, Institute for Water Resources. Fort Belvoir, Virginia.

Published in 1979, this was one of the first methods developed to help determine how wetlands function. It is a rating that groups wetlands into high, medium, or low based on "functional values."

This method is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently.

Proper Functioning Condition for Lentic Areas (PFC)

Prichard, D., C. Bridges, R. Krapf, S. Leonard, and W. Hagenbuck. 1994. Riparian Area Management: Process for Assessing Proper Functioning Condition for Lentic Riparian-Wetland Areas. TR 1737-11. Bureau of Land Management, BLM/SC/ST-94/008+1737, Service Center, CO. 37 pp.

PFC is a qualitative method to characterize streams, riparian areas, and riparian wetlands. It was developed by the Bureau of Land Management to assess how well the physical processes in a wetland are functioning.

Advantages

- Provides good information for designing restoration of riparian wetlands

Limitations

- Correct application of this method requires an interdisciplinary team of experts
- Does not separate wetlands from the rest of the riparian resources
- Primarily for riparian wetlands
- Not an assessment that can be used independently to rate, characterize, or assess wetlands and their functions

Recommended Uses

- Could be useful in combination with other assessment methods
- For wetlands that are "functional - at risk" or "nonfunctional" the methods can help to identify what is lacking (vegetation, soil, water) and may provide guidance on the likelihood of improving the condition and what actions could be taken to improve the condition

Best Professional Judgment (BPJ)

Application of BPJ is the most common method used to determine the functions that a wetland provides. Application of this method requires that a wetland biologist/consultant decide how well a wetland performs functions based on his/her own experience or knowledge.

Most methods are based to some degree on the best professional judgment of the individuals or the teams of individuals who developed them.

Advantages

- Can be very rapid
- If the expert has local knowledge, the information on functions may be very specific to the region and wetland type

Limitations

- Not reproducible. Reliability of results varies greatly with expertise
- Can't track the criteria used to base the judgment unless they are carefully recorded
- Easier to be biased in regard to functions for which the expert has more knowledge

Recommended Uses

BPJ may be used in analyzing functions for small impacts where more intensive analysis is not warranted. BPJ should also be used in concert with other methods to help define and clarify the functional performance of wetlands, based on specific site conditions of the wetland and adjacent watersheds.

Hydrogeomorphic Approach (HGM)

Smith, D. R., Ammann, A., Bartoldus, C., and Brinson, M. M. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A307 121.

The HGM approach is not a method to assess, characterize, or rate wetlands. This approach has been developed by the U.S. Army Corps of Engineers to provide guidance on how to develop regional methods for analyzing functions. It was put forth by the Corps for use in Section 404 permitting. WFAM is based on many concepts in this approach. Other documents associated with this approach are available at: http://www.wes.army.mil/el/wetlands/hgmhp.html.

Appendix 6-A

References on Smart Growth and Related Topics

This appendix provides references for additional information on Smart Growth and related topics, as discussed in Chapter 6 of this volume. Web pages and phone numbers are provided where available.

Documents

Baker J.P., D.W. Hulse, S.V. Gregory, D. White, J. Van Sickle, P.A. Berger, D. Dole and N.H. Schumaker. 2004. Alternative Futures for the Willamette River Basin, Oregon. Ecological Applications 14: 313-324.

Benedict, M.A. and E.T. McMahan. 2002. Green Infrastructure: Smart Conservation for the 21st Century. Renewable Resources Journal 20: 12-17. The Conservation Fund. Available: www.sprawlwatch.org/green

Bolte, J.P., D.W. Hulse, S.V. Gregory, and C. Smith. 2004. Modeling Biocomplexity - Actors, Landscapes and Alternative Futures. International conference proceedings, Complexity and Integrated Resources Management, Transactions of the 2nd Biennial Meeting of the International Environmental Modelling and Software Society, iEMSs: Manno, Switzerland, 2004. Available: www.iemss.org

Hammond, A. 1998. Which World? Scenarios for the 21st Century: Global Destinies, Regional Choices. Island Press/Shearwater Books, Washington, D.C.

Harms, B., J. P. Knaapen and J. G. Rademakers. 1993. Landscape Planning for Nature Restoration: Comparing Regional Scenarios. In: C. Vos & P. Opdam, (eds.), Landscape ecology of a stressed environment. Chapman & Hall, London.

Hirschhorn, J.S. and P. Souze. 2001. New Community Design to the Rescue: Fulfilling Another American Dream. July 24, 2001. 101pp. National Governor's Association. Available: www.nga.org/center

Hulse, D., S.V. Gregory, and J.P. Baker (eds). 2002. Willamette River Basin Planning Atlas: Trajectories of Environmental and Ecological Change. Oregon State University Press, Corvallis, OR.

Morris, H. 2002. Trails and Greenways: Advancing the Smart Growth Agenda. Rails to Trails Conservancy. 43 pp. Available: www.trailsandgreenways.org

Nelson, P. and S. Graham. 2004. Assembling and Presenting Watershed Process Models for Evaluating Future Land Use. In: T.W. Droscher and D.A. Fraser (eds.), Proceedings of the 2003 Georgia Basin/Puget Sound Research Conference. CD-ROM or Online. Available: www.psat.wa.gov/03_proceedings/start.htm [February 2004]

Northwest Environment Watch. 2002. This Place on Earth 2002. Measuring What Matters. Seattle, WA. Available: www.northwestwatch.org/publications

Northwest Environment Watch. 2004. Cascadia Scorecard: Seven Key Trends Shaping the Northwest. Seattle, WA. Available: www.northwestwatch.org/publications

Ogilvy, J. A. 2002. Creating Better Futures: Scenario Planning as a Tool for a Better Tomorrow. Oxford University Press, Inc., New York, N.Y. 238 pp.

Parsell, D.L. 2002. "Green-Based" Urban Growth: Next Wave of Environmentalism. National Geographic News, April 22, 2002. Available: http://news.nationalgeographic.com/news/2002/04/0422_020422_landplan.html

Smart Growth Network. Getting to Smart Growth – 100 Policies for Implementation. Available: www.smartgrowth.org

Trust for Public Land. 1999. Building Green Infrastructure: Land Conservation as a Watershed Protection Strategy, Available: www.tpl.org

Trust for Public Land. 2002. Local Greenprinting for Growth, Volumes I– IV. Available: www.tpl.org

Williamson, K.S. 2003. Growing with Green Infrastructure. Heritage Conservancy. Available: www.greeninfrastructure.net OR www.heritageconservancy.org

Fiscal Models

Behan Planning Associates. Fiscal analysis model for assessing the financial impact of Greenprint plans. Call (518) 583-4335. Web site: www.behanplanning.com

Frank, M. 2003. Opportunity Knocks – Open Space is a Community Investment. [Helps calculate the fiscal savings from purchasing open space]. Web site: www.heritageconservancy.org

Mittelstaedt, G. Sustainable Community Solutions, Issaquah, WA. Fiscal analysis on Compact Building Design. Call (425) 427-6443.

Penn State Cooperative Extension, 2000. Costs and Revenue of Residential Development: A Workbook for Local Officials and Citizens. Call (814) 865-6713. Web site: http://cax.aers.psu.edu/residentialimpact/

Funding Assistance

Green Communities Program, Center for Green Space Design. [Fifty percent matching grants to design Greenprint Plans]. Call (801) 483-2100. Web site: www.greenspacedesign.org

Washington State Department of Ecology – Coastal Zone Management 306 Planning Grants. Contact Bev Huether at (360) 407-7254. Web site: www.ecy.wa.gov/programs/sea/grants/czm/index.html

The Environmental Protection Agency's (EPAs) Smart Growth Implementation Assistance. Web site: www.epa.gov/smartgrowth/sg_implementation.htm

Federal Funding Grants. Web site: www.grants.gov

Washington State Department of Community, Trade, and Economic Development (CTED) offers several grant programs as follows:

- Competitive Grants Funds (CGF) for furthering planning. Note: this grant has been used for Green Infrastructure planning. Contact Ike Nwanko at (360)825-3056 or visit the website below.
- Emerging Issues Grant (EIG) – limited to $10K per project. Contact Ike Nwanko at (360)825-3056 or visit the website below.
- Community Development Block Grants (CDBG) – for infrastructure planning. Contact Dan Riebli at (360) 725-3017 or visit the website below.

For information on all of CTED's grants go to www.cted.wa.gov (Divisions>Local Government>Programs & Services>Growth Management Services>Grants)

Other Web Sites

Organization/Topics Associated with Smart Growth or Green Infrastructure	Web Address
The Conservation Fund	www.conservationfund.org
Green Infrastructure	www.greeninfrastructure.net
Lincoln Institute on Smart Growth	www.lincolninst.edu
Maryland Dept. of Natural Resources	www.dnr.state.md.us
National Governors Association – Center for Best Practices	www.nga.org/center
Pennsylvania State Education Center	www.pennscapes.psu.ecu/
Planning Commissioners Journal	www.plannersweb.com
Puget Sound Action Team	www.psat.wa.gov/Programs/Growth.htm
Smart Growth	www.smartgrowth.org
Smart Growth in Washington	www.smartgrowth.wa.gov

Organization/Topics Associated with Smart Growth or Green Infrastructure	Web Address
Sprawl Watch	www.sprawlwatch.org/green/
The Trust for Public Lands	www.tpl.org
U.S. EPA, Green Kit	www.epa.gov/greenkit/index.html
Western Governors Association – Economic Benefits of Open Space	www.westgov.org/wga/initiatives/tpl/ecoben.htm

Appendix 7-A

Examples of Cross-Jurisdictional Planning for Aquatic Resources

Managing natural resources across jurisdictions at larger geographic scales has become recognized internationally as an important approach to protecting aquatic resources, including wetlands (United Nations 1997). While planning at this scale may be difficult for some local jurisdictions, it is possible for them to join existing programs that are developing plans and actions at larger, geographic scales. Examples of planning efforts at a larger scale that are being conducted by state and federal agencies in relation to aquatic resources are provided below.

Watershed Planning

In 1998, the Washington State Legislature passed the Watershed Planning Act (RCW 90.82) providing a framework for developing local solutions to water supply issues on a watershed-wide basis. The planning is based on Water Resource Inventory Areas (WRIAs) which are framed around watersheds or subwatersheds. This voluntary planning process is designed to encourage local citizens, governments, and tribes to form planning units for the development of watershed management plans. Through the Act, state agencies manage grants, provide technical assistance and, if requested, serve on the planning units. Planning units may choose to develop strategies for improving water quality, protecting or enhancing fish habitat and, in collaboration with Ecology, setting minimum instream flows. At present, 45 of Washington's 62 WRIAs are represented by 36 planning units engaged in watershed planning.

See the Ecology watershed homepage for the status and listings of watershed planning efforts by WRIA throughout the state: www.ecy.wa.gov/watershed/. Many WRIA plans were due by December 2004, with completion being required for all by December 2006 and 2007.

Total Maximum Daily Load or Water Cleanup Plan

The Water Cleanup Plan, also known as Total Maximum Daily Load (TMDL), is a process for planning to facilitate the improvement of the quality of surface water. It was established by Section 303(d) of the Clean Water Act. This federal law requires states to identify sources of pollution in waters that fail to meet state water quality standards and to develop Water Cleanup Plans to address those pollutants. The Water Cleanup Plan establishes limits on pollutants that can be discharged to a waterbody and still allow state standards to be met. Setting such standards requires planning and monitoring at large geographic scales, and this is currently being done by Ecology's Water Quality Program.

The protection, management and restoration of wetlands are an important part of planning for water cleanup. Wetlands play an important role in reducing the amount of pollutants in a watershed because they function to remove nutrients, sediments, and toxic compounds (see Chapter 2 in Volume 1).

TMDL Water Cleanup Plans, however, do not presently consider wetland protection, restoration, and enhancement as elements in meeting the cleanup standards. Ecology has not yet adopted water quality standards for wetlands.

Interior Columbia Basin Ecosystem Management Project

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) was charged by several federal agencies with developing a management strategy for the region that is scientifically and ecologically based. It may potentially alter the direction of management on over 60 million acres of lands administered by the Forest Service and Bureau of Land Management (BLM).

This effort combines science and management. Scientists developed a framework for ecosystem management and an assessment of the ecological, bio-physical, social, and economic conditions of the Columbia Basin including lands outside of federal control. Land managers are using the scientific information to develop management strategies and provide context for Forest Service and BLM plans for land management.

A large focus of this effort is on protecting and managing the aquatic resources that are related to salmon, including wetlands. Local governments in the region can use the information and analyses done by the ICBEMP to manage resources at larger geographic scales.

Columbia River Initiative

The Columbia River Initiative was developed as a way to manage the increasing conflict related to the river's water resources. The public has been divided on the issue of whether additional water can be diverted from the river to off-stream uses without negatively affecting endangered salmon runs. The purpose of the Columbia River Initiative, therefore, is to develop an integrated state program for managing the water resources of the Columbia River to allow new water withdrawals while providing support for salmon recovery.

To address this issue, scientific studies are being performed to serve as the cornerstone of a new management program that defines the conditions under which Ecology may issue water rights from the river. Since wetlands play an important role in the hydrologic cycle on which salmon depend, there is both an opportunity and a need to integrate the protection and management of wetlands into this process.

Appendix 8-A

An Overview of Ways to Protect and Manage Wetlands

Introduction

An important component of wetland protection and management is to identify what wetland functions need to be protected, and which wetlands need additional protection because they have other important characteristics. The first section of this appendix discusses ways to protect and manage wetland functions, whereas the second describes what is needed to protect wetlands with other characteristics such as “Natural Heritage” wetlands.

Wetland functions can be grouped into three broad categories: water quality improvement, hydrologic functions, and habitat functions. Each of these can be further divided into more specific functions. For example, habitat functions can be divided into habitat for amphibians, habitat for mammals, etc. At the finest scale, we can consider the function of habitat for an individual species. (Chapter 2 in Volume 1 discusses the functions of wetlands in Washington State in detail.)

In addition to identifying what functions need to be protected, managing wetlands requires an understanding of how the functions are performed. Wetlands in each hydrogeomorphic class (see Chapter 2 of Volume 1) perform a particular set of functions; some are the same and some are different from wetlands in other classes. For example, the functions performed by wetlands in the depressional class are not the same as those performed in the riverine class. In addition, individual wetlands perform each function to a different degree based on a variety of factors. Some functions of wetlands are greatly affected by processes or influences that operate at large scales, while other functions are affected more by site-specific characteristics (see Chapter 2 of Volume 1).

Understanding how each function operates and how human activities can affect that function is critical to determining the appropriate type and level of protection and management that will be achieved through comprehensive plans, critical areas ordinances, and other regulations, as well as non-regulatory tools. Chapter 4 in Volume 1 provides more information on how functions can be changed by human activities.

In spite of the many differences in how wetlands function, one can generalize several approaches that will be effective in protecting each of the three groups of wetland functions (e.g., water quality improvement, hydrologic functions, and habitat functions). This appendix synthesizes the information available on what is needed to protect a wetland and its immediate vicinity to maintain performance of functions or to replace functions if impacts are unavoidable. The discussion is organized by the three major groups of functions and by the different types of wetlands with other characteristics used to categorize wetlands using the Washington State wetland rating systems (Hruby 2004a,b).

The two most common methods for protecting wetland functions have been the use of buffers and compensatory mitigation. Buffers are used to maintain existing functions by reducing the impacts of adjacent land uses. When impacts to wetlands are unavoidable, replacement of lost functions has typically been through compensatory mitigation in which other wetlands are created, restored, or enhanced using specific ratios based on area.

Scientific information regarding buffers and ratios are discussed in detail in Chapters 5 and 6 of Volume 1. The authors have also recommended specific widths for buffers and specific ratios for compensatory mitigation to be used in conjunction with the Washington State wetland rating systems (Hruby 2004a,b) in Appendices 8-C and 8-D of this document. Although the rating systems are referenced frequently in this appendix, the citations are not repeated again.

Wetland protection should encompass more than buffers and compensatory mitigation

The review of recent scientific information (Volume 1) has shown that protecting the functions of wetlands by using only buffers and establishing "mitigation ratios" is not adequate. These measures by themselves will not completely protect many wetland functions from disturbances or replace the functions lost if impacts are unavoidable. Providing protection in the immediate vicinity of a wetland (e.g., buffers, use restrictions, etc.) will not always adequately protect wetland functions from disturbances that may occur elsewhere in the landscape. Other measures that take a larger landscape approach and that use tools outside of the traditional regulatory realm may also be needed to fully protect wetland functions. See Chapters 6, 7, and 9 in this document for more details on additional approaches.

Protecting and Managing Habitat Functions for Animals

Wetlands provide habitat for a large number of animal species and play an integral part in maintaining the richness of species in the environment. Many different environmental factors affect the suitability of wetlands as habitat, the most important being the physical structure of the vegetation in the wetland, the water regime, and the condition of the vegetated and hydrologic connections between the wetland, uplands, and other aquatic resources. More detailed descriptions of how wetlands provide habitat are given in Volume 1.

The main question that arises when protecting and managing wetlands to maintain their capacity to provide habitat is: *What species of vertebrates and invertebrates use the* *wetland and need protection?* The recommendations made here are based on the assumption that wetlands with good structure and good connections to other habitats will provide habitat for a large range of species. In the absence of information on use, or lack of use, of an individual wetland by certain species, adequate protection should be based on the probability that the species are there. Wetlands that score highly for the habitat function in the rating system have a higher probability of providing habitat for a variety of species than those with a low score. High-scoring wetlands have the connections and structure to provide relatively diverse habitat.

Widths of Buffers for Habitat Functions

The review of the literature indicates that there are several aspects of buffers that are important for wildlife. First, the width of vegetated buffers needed to protect habitat functions depends on the individual species needing protection. Some species using wetlands need buffers in excess of 600 feet. Others, however, need only 100 feet. In general, the information available indicates that buffers between 100 and 300 feet are adequate to protect most species closely associated with wetlands in Washington.

Second, most studies on the effectiveness of buffers have been done using buffers that were relatively undisturbed. It is difficult to extrapolate this information to judge the effectiveness of buffers that consist of lawns or tilled fields or that have otherwise been disturbed.

Third, the width of the buffer needed to protect species depends on the type of disturbance the buffer is intended to reduce. Noise, light, or the movement of humans and pets may be reduced by providing a buffer of 100 feet. However, protecting the nesting and breeding of waterfowl from pets or human disturbance generally requires a buffer of at least 200 to 300 feet depending on the type of disturbance and species of waterfowl.

The scientific information summarized in Volume 1 also points out that fragmentation and the disruption of the vegetated corridors between undeveloped areas that provide habitat are major causes of the loss of species richness (biodiversity). Existing connections and corridors between wetlands and other habitats, as well as the structure within the wetland and its buffer, need to be protected to maintain the wetland's habitat functions.

Replacing Habitat Functions Through Compensatory Mitigation

Historically, the loss of habitat functions has been mitigated by creating, restoring, or enhancing wetlands with the physical structure (e.g., vegetation, large woody debris) that provides ecological niches for different species. Studies of mitigation projects have shown, however, that less attention is given to other environmental factors that play an important role in the provision of habitat (i.e., time of ponding, depth of ponding, temperature of water, connectivity with other habitats that provide access for wildlife etc.). The studies of compensatory mitigation also indicate that high mitigation ratios alone will not guarantee that habitat functions will be adequately replaced. Chapter 6 of

Volume 1 summarizes the many factors involved in determining whether a mitigation site is successful or not, and concludes that adequate ratios are only one factor.

At a minimum, a mitigation ratio should compensate for the loss of habitat during the time it takes the habitat structure to develop and the species to colonize the mitigation site (i.e., temporal loss of function). In the case of forested wetlands, this temporal loss can be as long as 100 years or more, and as reported in Volume 1, no studies have found that all functions in a forested wetland have been reproduced through compensatory mitigation. Thus, some functions cannot be replaced within a regulatory time frame.

The authors recommend several strategies to address this difficulty. First, avoidance of the wetland altogether can be emphasized for the wetland types that are most difficult to compensate or take the longest to replace. Another strategy can be to require higher ratios for unavoidable impacts to these types of wetlands. A third strategy can be to require longer monitoring ($\geq$ 10 years) of the compensation site to ensure that the site is on a trajectory to actually replace the habitat functions that were lost.

Protecting and Managing Functions That Improve Water Quality

Wetlands generally improve water quality by trapping pollutants (e.g., sediment) or by chemically transforming some pollutants into compounds that are no longer polluting (e.g., changing nitrates into nitrogen gas). The performance of the water quality functions by wetlands (i.e., removing sediment, removing nutrients, and removing toxic compounds) depends mostly on the structure of the vegetation that reduces water velocities and causes sediments and pollutants to settle and on the chemical and biological properties of the soil in the wetland. It is the geomorphic characteristics of the wetland and the physical structures found therein that control how a wetland improves water quality. Thus, a dense stand of invasive reed canarygrass can be just as effective at trapping pollutants as a dense stand of native sedges. More detailed descriptions of how these functions are performed are available in Volume 1.

The primary question when protecting and managing wetlands to maintain their capacity to improve water quality is: *How much pollution is too much?* Wetlands in watersheds where human activities generate pollutants provide important functions by removing some of these pollutants. Large quantities of pollutants, however, can overwhelm the capacity of a wetland to improve water quality. For example, too much sediment entering a wetland can cover the organic soils that are important in trapping phosphorus and removing nitrogen.

To protect the water quality functions of a wetland, the authors of Volume 1 recommend minimizing the local input of any additional pollutants generated by changes in land use. For example, when a forest adjacent to a wetland is changed to a residential development care should be taken to control the new input of sediment from construction and the pollutants coming from lawns, landscaping, septic systems, and pets.

Widths of Buffer for Functions that Improve Water Quality

Buffers trap pollutants before they reach the wetland. This helps to maintain the existing capability of a wetland for improving water quality. Protecting the water quality functions currently performed by a wetland would therefore require that any existing, vegetated buffers be protected from further degradation in the portion of the buffer that is most effective at trapping pollutants.

The review of existing literature in Volume 1 indicates that the effectiveness of buffers at trapping pollutants depends on many different factors, including the type of soils present, the type of vegetation present, and the slope. Furthermore, the effectiveness is not linear. For example, a buffer of approximately 33 feet will remove approximately 60% of the sediment and other pollutants, while it takes a buffer of approximately 150 feet to remove 75% or more of the sediment and other pollutants, and a buffer of 660 feet to remove 90% of the sediment and other pollutants.

Buffers will not adequately protect functions in a wetland if polluted waters bypass the buffer and enter the wetland directly via pipes, ditches, or other channels. To maintain the current levels at which a wetland improves water quality, it may be necessary to limit the introduction of any additional pollutants that might come in through untreated runoff that bypasses the buffer. In most cases, runoff from lawns and landscaped areas adjacent to wetlands will contain pollutants (particularly nutrients and pesticides). This runoff is rarely collected and treated in stormwater treatment facilities and thus, larger well-vegetated buffers are particularly important to protecting wetlands in these situations.

Replacing Functions That Improve Water Quality Through Compensatory Mitigation

The review of the information on mitigation in Volume 1 found very few projects in which the replacement of the water quality functions was an objective. These functions have not been the focus of compensatory mitigation in the past. A study by Johnson et al. (2002), however, found that creation or restoration of wetlands generally resulted in the creation and restoration of the water quality functions to some degree. Enhancement, on the other hand, did not often improve the water quality functions of the wetlands enhanced and may even have reduced them. Over half of the enhanced sites that were evaluated in Washington State had minimal or no increase in the levels of the water quality functions.

If a wetland is created or restored, some of the water quality functions will tend to be established fairly quickly while others may take much longer. The temporal loss of functions incurred during compensatory mitigation is very dependent on site-specific conditions. The structural characteristics and water regime needed to perform the water quality functions can be established early, while the organic soils needed to more effectively trap phosphorus and remove nitrogen can take over 50 years to develop.

At a minimum, a mitigation ratio should compensate for the loss of the water quality functions during the time it takes to build the mitigation site. The study by Johnson et al.

(2002) found that the risks of replacing the water quality functions through restoration and creation are less than those for wildlife habitat. Therefore, replacing lost water quality functions may be possible through mitigation ratios that are lower than those for wildlife habitat functions.

Ratios for enhancement, however, may have to be high because most enhancement projects that require revegetation of disturbed wetlands result in little, if any, increase in water quality functions. Many of the wetlands used for enhancement are degraded in terms of their habitat but actually perform water quality functions at a high level. It is not likely that enhancement will increase the sites effectiveness at improving water quality to mitigate for the loss of those functions. For example, if enhancement increases the water quality functions by only 5%, a ratio of 20:1 (by area) is needed to compensate for the impacts.

Protecting and Maintaining Hydrologic Functions

The group of hydrologic functions characterized in the rating systems include reducing flooding, reducing erosive flows, and recharging groundwater. The performance of these functions depends mostly on the water storage available in the wetland, the density of vegetation that can reduce the velocity of flood waters, the permeability of the soils, and the distance from the wetland surface to groundwater. More detailed descriptions of how these functions are performed are available in Chapter 2 of Volume 1.

Widths of Buffers for Hydrologic Functions

Generally speaking, the factors that control the hydrologic functions in a wetland are not significantly altered by changes in the buffer. The amount of water coming into a wetland, its velocity, and its timing are controlled by processes that occur at the larger scale of the watershed or the contributing basin of that wetland.

There is one case, however, in which buffers may help protect hydrologic functions. Buffers may protect the storage capacity of depressional wetlands by trapping sediments that might otherwise fill the wetland. In the absence of buffers that trap sediment, a wetland can slowly fill with sediment, reducing the amount of water it can store. In this case, the requirements for a buffer would be similar to those for the water quality functions described above.

Replacing Hydrologic Functions Through Compensatory Mitigation

The review of the information on compensatory mitigation in Volume 1 found very few projects in which the replacement of hydrologic functions was an objective. The study by Johnson et al. (2002), however, found that creation or restoration of wetlands generally resulted in the creation and restoration of hydrologic functions to some degree. Enhancement, on the other hand, did not often improve the hydrologic functions of the wetlands enhanced. Approximately two-thirds of the enhanced sites that were evaluated had no increase in the performance of hydrologic functions.

If a wetland is created or restored, the hydrologic functions will tend to be established fairly quickly because they depend mostly on the physical structure of the wetland (e.g., storage capacity, permeability of soils). Compensation for impacts to these functions is more dependent on the structure and water regime of the mitigation site rather than the mitigation ratio.

Protecting and Managing Wetlands with Other Characteristics

The Washington State wetland rating systems (described in Appendix 5-B) also differentiate between wetlands based on their sensitivity to disturbance, their significance in the landscape, their rarity, and our ability to replace them through compensatory mitigation. These other characteristics were chosen because they can be used to provide additional guidance on the ways in which these wetlands need to be protected and managed. The following discussion provides a general summary of what is needed to protect these types of wetlands.

Natural Heritage Wetlands (Freshwater)

"Natural Heritage" wetlands, as defined by the Natural Heritage Program of the Washington State Department of Natural Resources, contain rare plants or those that are particularly sensitive to disturbance. These types of plant species are very sensitive to nutrient enrichment (*eutrophication*) that results from the input of nutrient-laden waters. The greatest richness of plant species, especially rare species, is found in nutrient-poor wetlands. Rare plant species are outcompeted by large, regionally common species when excess nutrients are introduced to a wetland. Protection of Natural Heritage wetlands should focus on keeping nutrients out of these wetlands, maintaining the natural water regime, and reducing physical disturbance by humans (trampling, cutting vegetation, draining, etc.) within the wetlands.

Widths of Buffers for Natural Heritage Wetlands

The buffer around a Natural Heritage wetland is needed to remove excess nutrients before they reach the wetland. The most efficient vegetated buffer, based on width-to-removal ratios, is about 197 feet for removal of nitrogen and 253 feet for phosphorus. However, a 250-foot buffer alone may not protect the rare or sensitive plants in the wetland if the watershed has high nutrient loadings or a water regime that is unstable.

Buffers will not adequately protect rare plants in a wetland if polluted waters bypass the buffer and enter the wetland directly via pipes, ditches, or other channels. Furthermore, discharges of stormwater and changes in the water regime resulting from development will also change the plant communities in a wetland (see review in Chapter 4 of Volume 1). Such changes might also impact the populations of the rare species in the wetland. Designs for treating stormwater do not reduce the nutrient loads significantly because they do not effectively remove nitrogen. To protect rare plants, it is necessary to limit the introduction of any additional nutrients that might come into the wetland through untreated runoff that bypasses the buffer.

Replacing Natural Heritage Wetlands Through Compensatory Mitigation

To our knowledge, there have been no successful mitigation projects that replaced the rare, threatened or endangered plant species found in a Natural Heritage wetland. The Departments of Ecology and Fish and Wildlife assume that it is impossible to replace a Natural Heritage wetland through compensatory mitigation because the habitat required by rare and sensitive plant species cannot be reconstructed. The reconstruction of the habitat would require an extremely detailed understanding of the geological, biological, chemical, and physical requirements of each rare species found in the wetland. Such an understanding is not currently available in the existing scientific literature and would have to be developed through basic research.

Bogs

Bogs are also particularly sensitive to nutrient enrichment (eutrophication) because they have naturally low levels of nutrients (see discussion in Chapter 2 of Volume 1). Also, bogs often contain a high richness of plant species, especially rare ones, and ones that are found only in nutrient-poor wetlands. The rare plants in bogs, as in Natural Heritage wetlands, can be outcompeted by large, regionally common species when excess nutrients are introduced to a wetland.

Width of Buffers for Bogs

The buffer needs to remove excess nutrients before they reach the bog. The most efficient vegetated buffer, based on width-to-removal ratios, is about 197 feet for removal of nitrogen and 253 feet for phosphorus.

Buffers will not adequately protect the functions of a bog if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. To protect the bog it is necessary to limit the introduction of any additional nutrients and excess water that might come in through untreated runoff that bypasses the buffer.

Replacing Bogs Through Compensatory Mitigation

Bogs are characterized by their highly organic soil conditions, unique water regimes, and water chemistries. Studies of bog and fen restoration in Northern Europe and Canada (reviewed in Volume 1) concluded that restoration may not be possible due to irreversible changes of the characteristics of a bog. No information was available on the success of bogs or fens that were restored or created as wetland compensation. However, the literature suggests that even if it is possible to recreate the appropriate environmental conditions, bogs and fens cannot be reproduced within a regulatory time frame. In Washington, Rigg (1958) reports that peat accumulates naturally in the Puget Sound lowlands at an average rate of 1 inch per 41 years. For 55 bogs studied in eastern and northeastern Washington, Idaho, and British Columbia, Rigg reported an average rate of accumulation of 1 inch per 48.5 years. The Departments of Ecology and Fish and Wildlife therefore assume that it is not feasible to replace bogs through compensatory mitigation.

Mature or Old-Growth Forested Wetlands

Mature or "old-growth" forested wetlands are given extra consideration because they are difficult to replace through compensatory mitigation. The protection they need is based on the functions they provide. Buffers and other measures to protect the functions, therefore, should be determined based on how well the wetland performs these functions rather than on the presence of a forested community.

Replacing Forested Wetlands Through Compensatory Mitigation

Though the studies reviewed in Volume 1 have found that trees can be planted in Washington State wetlands and they will grow, mature forested wetlands have not been successfully reproduced simply because of the time necessary for the trees and the structural characteristics of the forest to mature. Enhanced and created sites that have been planted often have a high density of stems to rapidly provide woody cover and shade out invasive species in the understory. Unless these sites are thinned, they will not reproduce the attributes of mature forested wetlands.

Alkali Wetlands

Alkali wetlands are characterized by the occurrence of shallow saline water. These wetlands provide the primary habitat for several species of migrant shorebirds and are also heavily used by migrant waterfowl. They also have unique plants and animals that are not found anywhere else in eastern Washington. The salt concentrations in these wetlands have resulted from a relatively long-term process of groundwater surfacing and evaporating.

Width of Buffers for Alkali Wetlands

The ecological process that maintains an alkali wetland is the dynamic between the inflow of groundwater and evaporation. Buffers have little impact on maintaining this process. The width of buffer needed for an alkali wetland should therefore be based on the wetland's habitat functions. Alkali wetlands in eastern Washington are a major resource for migratory shorebirds and other water-dependent birds, and the buffers are needed to protect the shorebirds and waterfowl from disturbance.

The routing of additional surface water to alkali wetlands will change the balance between inflow of groundwater and evaporation. No information was found, however, on the impacts this may have on the ecosystem in the alkali wetland. There is a significant risk, therefore, that the ecosystem may be impacted if discharges into alkali wetlands are allowed.

Replacing Alkali Wetlands Through Compensatory Mitigation

The salt concentrations in alkali wetlands have resulted from a relatively, long-term process of groundwater surfacing and evaporating. These conditions cannot be easily reproduced through compensatory mitigation because the balance of salts, evaporation, and water inflows is hard to reproduce. No references were found suggesting that alkali wetlands have ever been created or restored. Until alkali wetlands have been successfully created, the departments of Ecology and Fish and Wildlife view any proposed creation project as highly experimental.

Vernal Pools

Vernal pools in the scablands of eastern Washington are the first areas of open water to melt in the early spring even though they dry out by late spring. This open water provides areas where migrating waterfowl can find food while other, larger bodies of water are still frozen. Furthermore, the open water provides areas for pair bonding of waterfowl. Thus, vernal pools are very important for migratory waterfowl during a short period in the early spring. The rest of the time the vernal pools provide little habitat for larger animals that need larger buffers.

Width of Buffers for Vernal Pools

The review of the literature indicates that waterfowl need at least 200-foot buffers to protect them from disturbance. In a vernal pool that is currently undisturbed, such a buffer would protect the birds from disturbance while they feed and use the pool for courtship activities.

Replacing Vernal Pools Through Compensatory Mitigation

Vernal pools are characterized by the short duration of their inundation. Thus, in order to reproduce a vernal pool, a site with a suitable substrate must be found and the correct depth and water regime must be created or restored. The literature as reviewed for Volume 1, Chapter 6, suggests that, in California, vernal pools may be reproduced under the right conditions. No information was found on the reproducibility of vernal pools in Washington.

Wetlands in Estuaries and Coastal Lagoons

Wetlands in areas where the water has salinity higher than 0.5 parts per thousand are classified as *estuarine* or *coastal lagoons* for the purposes of rating and management. The ecological process that maintains estuarine wetlands and those in coastal lagoons is the mixing of marine waters coming from the ocean and fresh waters coming from land. Both types of wetlands are found along the coast and in the mouths of rivers.

Width of Buffers for Estuaries and Lagoons

Although wetlands in estuaries and coastal lagoons are not the focus of this synthesis as described in Chapter 1 of Volume 1, we are including some information about these wetlands because they are included in the Washington State wetland rating systems. Please note, therefore, that the information presented here is not as detailed as for freshwater wetlands.

Estuarine wetlands and coastal lagoons are a major resource for migratory shorebirds and other water-dependent birds, and buffers are definitely needed to protect the shorebirds and waterfowl from disturbance. In estuarine systems, buffers also provide a source of wood and sediment that nourish the beaches. In addition, estuaries and coastal lagoons have a high density of fish and wildlife and high species diversity, provide important breeding habitat, and serve as movement corridors (see Washington Department of Fish and Wildlife web page, http://wdfw.wa.gov/hab/phshabs.htm). Both types of wetlands are also a habitat that has been significantly impacted by human activities and are highly vulnerable to alteration. Therefore, the width of buffers needed to protect these wetlands will have to be based on protecting a wide range of functions.

Replacing Wetlands in Estuaries and Coastal Lagoons Through Compensatory Mitigation

The main focus of Volume 1 was freshwater wetlands. Information on mitigating impacts to estuaries and coastal lagoons was not compiled, so no recommendations can be made. Decisions about compensating for impacts to these types of wetlands will have to be made on a case-by-case basis.

Also, it is not possible to specify in advance what other tools or non-regulatory approaches are needed to protect these types of wetlands because of the many different habitat functions they provide. Protecting the functions of these wetlands will require considering each wetland on a case-by-case basis.

Interdunal Wetlands

Interdunal wetlands form in the *deflation plains* and *swales* that are geomorphic features in areas of coastal dunes. These dune forms are the result of the interaction between sand, wind, water, and plants. Interdunal wetlands provide critical habitat in this ecosystem (Wiedemann 1984), but no methods have been developed to characterize how well these wetlands function.

Width of Buffers for Interdunal Wetlands

Although we have little detailed information on how interdunal wetlands function as habitat, the information does show that these wetlands provide an important resource for many species. In the absence of more detailed information about the needs of species using interdunal wetlands, the width of buffers should be based on the assumption that these wetlands provide a moderately high level of habitat. It is assumed that species using interdunal wetlands will need some protection from disturbance, but not the 300 feet needed by the more sensitive species. Interdunal wetlands are physically highly dynamic and exposed, and it is assumed that species using these wetlands do have some adaptations to disturbance.

Replacing Interdunal Wetlands Through Compensatory Mitigation

One of the mitigation sites assessed by Johnson et al. (2002) was an interdunal wetland that was found to be moderately successful. Other undocumented observations would also suggest that creating wetlands in the interdunal ecosystem is usually fairly successful (P. Lund, Department of Ecology, personal communications 2003). As a result, the recommended ratios for creating these types of wetlands are lower than for other types. The one stipulation, however, is that losses of interdunal wetlands should be compensated only by creating other interdunal wetlands. The interdunal ecosystem in Washington and elsewhere along the Pacific Coast covers a very limited area. Any further losses of this resource should be minimized.

References

Johnson, P., D.L. Mock, A. McMillan, L. Driscoll, and T. Hruby. 2002. Washington State Wetland Mitigation Evaluation Study Phase 2: Evaluating Success. Publication # 02-06-009. Washington State Department of Ecology. Olympia, WA.

Rigg, G. B. 1958. Peat Resources of Washington. Bulletin No. 44 Division of Mines and Geology, State of Washington.

Wiedemann, A.M. 1984. The Ecology of Pacific Northwest Coastal Sand Dunes: A Community Profile. U.S. Fish and Wildlife Service FWS/OBS-84/04.

Appendix 8-B

Recommendations for Wetland Language in a Critical Areas Ordinance

Appendix 8-B is a complement to Chapter 8 and its other appendices. Local governments should not use suggested language contained in Appendix 8-B in their critical areas ordinances without also carefully reviewing all of Chapter 8 and its supporting appendices.

This appendix contains specific recommendations for language that can be used in critical area regulations to protect wetlands. The recommendations are based on the relevant best available science from Volume 1. While other language may also adequately include the best available science, the language recommended in this appendix represents the State of Washington's best attempt to provide a reasonable, science-based approach to wetlands regulation.

The language below is provided in a format similar to that found in many local critical areas ordinances and therefore is different from other appendices. This appendix does not include the more general provisions typically found in critical areas regulations that relate to all critical areas. These can be found in Appendix A of the *Critical Areas Assistance Handbook* published by the Washington State Department of Community, Trade and Economic Development in November 2003 (http://www.cted.wa.gov/uploads/CA_Handbook.pdf). This appendix revises the wetland specific provisions in Appendix A of the *Critical Areas Assistance Handbook*.

Appendix 8-B should be used in conjunction with Appendices 8-C through 8-F, which contain guidance on wetland mitigation ratios and buffer widths with supporting rationale as well as with Chapter 8, which includes additional discussion on developing the necessary elements of a wetland regulatory ordinance. This appendix includes:

Wetland Provisions

- Designating, Defining, Identifying, and Mapping Wetlands
- Applicability
- Regulated Activities
- Activities Allowed in Wetlands
- Wetland Ratings
- Standards
  - General Requirements
  - Criteria for a Critical Area Report for Wetlands
  - Requirements for Compensatory Mitigation
  - Subdivisions
  - Signs and Fencing of Wetlands
  - Wetland Buffers

- Stormwater Management Impacts to Wetlands
- Agricultural Impacts to Wetlands
- Removal of Hazard Trees
- Unauthorized Alterations and Enforcement

Wetland Provisions

Designating, Defining, Identifying, and Mapping Wetlands

A. **Designating, Defining, and Identifying Wetlands.** Wetlands are those areas, identified in accordance with the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997), that meet the following definition: "Wetland" or "wetlands" means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas created to mitigate conversion of wetlands.

All areas within the [city/county] meeting the criteria in the wetland definition in the *Wetlands Identification and Delineation Manual* (Ecology 1997), regardless of whether these areas have previously been identified or mapped, are hereby designated critical areas and are subject to the provisions of this Title.

B. **Mapping.** The approximate location and extent of wetlands are shown on the adopted critical area(s) maps. The following critical area(s) maps, including [*locally adopted maps or the National Wetlands Inventory*] are hereby adopted. Additionally, soil maps produced by U.S. Department of Agriculture Natural Resources Conservation Service may be useful in helping to identify potential wetland areas. These maps are to be used as a guide for the [city/county], project applicants, and/or property owners to identify potential wetland areas that may be subject to the provisions of this Title.

It is the actual presence of wetlands on a parcel, as delineated by the requirements of the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997), that triggers the requirements of this Title, whether or not the wetland is identified on the adopted maps. The exact location of a wetland's boundary shall be determined through the performance of a field delineation by a qualified wetlands professional, applying the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997) as required by RCW 36.70A.175.

Applicability

No sample language is provided for the applicability section of a critical areas ordinance. Please see Chapter 8.3.2 for the discussion on applicability. Code language needs to be crafted to align with the manner in which the local government chooses to trigger its regulations. The two options discussed in Chapter 8 are: 1) integrating provisions for wetland protection throughout various elements of the development code as appropriate (e.g., grading and filling ordinance, stormwater management, etc.); or 2) developing a specific critical areas (or wetland) ordinance and permit that encompasses all activities that may influence a wetland. Section 8.3.2 in Chapter 8 includes a discussion of applicability for both options.

Regulated Activities

The following activities are regulated if they occur in a regulated wetland or its buffer:

A. The removal, excavation, grading, or dredging of soil, sand, gravel, minerals, organic matter, or material of any kind;

B. The dumping of, discharging of, or filling with any material;

C. The draining, flooding, or disturbing of the water level or water table;

D. The driving of pilings;

E. The placing of obstructions;

F. The construction, reconstruction, demolition, or expansion of any structure;

G. The destruction or alteration of wetland vegetation through clearing, harvesting, shading, intentional burning, or planting of vegetation that would alter the character of a regulated wetland, provided that these activities are not part of a forest practice governed under Chapter 76.09 RCW and its rules; or

H. Activities that result in:

1. a significant change of water temperature;
2. a significant change of physical or chemical characteristics of the sources of water to the wetland;
3. a significant change in the quantity, timing or duration of the water entering the wetland, or
4. the introduction of pollutants.

Activities Allowed in Wetlands

The activities listed below are allowed in wetlands in addition to those activities listed in the provisions established in *Allowed Activities* (Section [#]) in this Title. These activities do not require submission of a critical area report, except where such activities result in a loss to the functions and values of a wetland or wetland buffer. These activities include:

A. Conservation or preservation of soil, water, vegetation, fish, shellfish, and other wildlife that does not entail changing the structure or functions of the existing wetland;

B. The harvesting of wild crops in a manner that is not injurious to natural reproduction of such crops and provided the harvesting does not require tilling of soil, planting of crops, chemical applications, or alteration of the wetland by changing existing topography, water conditions, or water sources;

C. Drilling for utilities/utility corridors under a wetland, with entrance/exit portals located completely outside of the wetland boundary, provided that the drilling does not interrupt the ground water connection to the wetland or percolation of surface water down through the soil column. Specific studies by a hydrologist are necessary to determine whether the ground water connection to the wetland or percolation of surface water down through the soil column is disturbed; or

D. Enhancement of a wetland through the removal of non-native invasive plant species. Removal of invasive plant species shall be restricted to hand removal. All removed plant material shall be taken away from the site and appropriately disposed of. Revegetation with appropriate native species at natural densities is allowed in conjunction with removal of invasive plant species.

Wetland Ratings

A. Wetlands shall be rated according to the Washington State wetland rating system for [*eastern or western Washington*] (*Washington State Wetland Rating System for Eastern Washington - Revised*, Ecology Publication #04-06-015; *Washington State Wetland Rating System for Western Washington - Revised*, Ecology Publication #04-06-025) or as revised by Ecology. Wetland rating categories shall be applied as the wetland exists at the time of the adoption of this Title or as it exists at the time of an associated permit application. Wetland rating categories shall not change due to illegal modifications.

Note: Choose either the rating system for eastern or western Washington as appropriate.

Wetland Rating Categories – Eastern Washington

1. **Category I.** Category I wetlands are: 1) those identified by the Washington Natural Heritage Program/DNR as high quality, relatively undisturbed wetlands, or wetlands that support state Threatened or Endangered plant species; 2) alkali wetlands; 3) bogs; 4) mature and old-growth forested wetlands over ¼ acre in size dominated by slow-growing native trees; 5) forested wetlands with stands of Aspen; or 6) wetlands that perform many functions very well.

   Category I wetlands represent a unique or rare wetland type, are more sensitive to disturbance than most wetlands, are relatively undisturbed and contain some ecological attributes that are impossible to replace within a human lifetime, or provide a very high level of functions.

2. **Category II.** Category II wetlands are: 1) forested wetlands in the channel migration zone of rivers; 2) mature forested wetlands containing fast growing trees; 3) vernal pools present within a mosaic of other wetlands; or 4) wetlands with a moderately high level of functions. These wetlands are difficult, though not impossible, to replace, and provide high levels of some functions. These wetlands occur more commonly than Category I wetlands, but still need a high level of protection.

3. **Category III.** Category III wetlands are: 1) vernal pools that are isolated; or 2) wetlands with a moderate level of functions. Generally, wetlands in this category have been disturbed in some way, and are often smaller, less diverse and/or more isolated in the landscape than Category II wetlands. They may not need as much protection as Category I and II wetlands.

4. **Category IV.** Category IV wetlands have the lowest levels of functions and are often heavily disturbed. These are wetlands that should be replaceable, and in some cases may be improved. However, experience has shown that replacement cannot be guaranteed in any specific case. These wetlands do provide some important functions and should be protected to some degree.

Wetland Rating Categories – Western Washington

1. **Category I.** Category I wetlands are: 1) relatively undisturbed estuarine wetlands larger than 1 acre; 2) wetlands that are identified by scientists of the Washington Natural Heritage Program/DNR as high quality wetlands; 3) bogs larger than ½ acre; 4) mature and old-growth forested wetlands larger than 1 acre; 5) wetlands in coastal lagoons; or 6) wetlands that perform many functions well.

   Category I wetlands represent a unique or rare wetland type, are more sensitive to disturbance than most wetlands, are relatively undisturbed and contain some ecological attributes that are impossible to replace within a human lifetime, or provide a very high level of functions.

2. **Category II.** Category II wetlands are: 1) estuarine wetlands smaller than 1 acre, or disturbed estuarine wetlands larger than 1 acre; 2) a wetland identified by the Washington State Department of Natural Resources as containing “sensitive” plant species; 3) a bog between ¼ and ½ acre in size; 4) an interdunal wetland larger than 1 acre; or 5) wetlands with a moderately high level of functions.

   Category II wetlands are difficult, though not impossible, to replace, and provide high levels of some functions. These wetlands occur more commonly than Category I wetlands, but they still need a relatively high level of protection.

3. **Category III.** Category III wetlands are: 1) wetlands with a moderate level of functions; or 2) interdunal wetlands between 0.1 and 1 acre in size. Generally, wetlands in this category may have been disturbed in some way and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands.

4. **Category IV.** Category IV wetlands have the lowest levels of functions and are often heavily disturbed. These are wetlands that should be replaceable, and in some cases may be improved. However, experience has shown that replacement cannot be guaranteed in any specific case. These wetlands may provide some important functions, and should be protected to some degree.

Standards

General Requirements

A. Activities and uses shall be prohibited in wetlands and wetland buffers, except as provided for in this Title.

B. **Category I Wetlands.** Activities and uses shall be prohibited from Category I wetlands, except as provided for in the *Public Agency and Utility Exception* (Section [#]), *Reasonable Use Exception* (Section [#]), and *Variance* (Section [#]) elements of this Title.

C. **Category II and III Wetlands.** For Category II and III wetlands, the following standard shall apply:

1. Where wetland fill is proposed, it is presumed that an alternative development location exists; activities and uses shall be prohibited unless the applicant can demonstrate that:

a. The basic project purpose cannot reasonably be accomplished on another site or sites in the general region while still successfully avoiding or resulting in less adverse impact on a wetland; and

b. All on-site alternative designs that would avoid or result in less adverse impact on a wetland or its buffer, such as a reduction in the size, scope, configuration or density of the project, are not feasible.

Full compensation for the loss of acreage and functions of wetland and buffers shall be provided under the terms established under *Mitigation* (Section [#]) in this Title.

D. **Category IV Wetlands.** Activities and uses that result in unavoidable impacts may be permitted in Category IV wetlands and associated buffers in accordance with an approved critical area(s) report and compensatory mitigation plan, and only if the proposed activity is the only reasonable alternative that will accomplish the applicant's objectives. Full compensation for the loss of acreage and functions of wetland and buffers shall be provided under the terms established under *Mitigation* (Section [#]) in this Title.

Criteria for a Critical Area Report for Wetlands

A. **Preparation by a Qualified Professional.** A critical area report for wetlands shall be prepared by a qualified professional who is a certified Professional Wetland Scientist or a non-certified professional wetland scientist with a minimum of five (5) years of experience in the field of wetland science, including experience preparing wetland reports.

> See Appendix 8-H for further information on what constitutes a qualified wetland professional.

B. **Minimum Standards for Wetland Reports.** The written report and the accompanying plan sheets shall contain the following information, at a minimum:

1. The written report shall include at a minimum:

   a. The name and contact information of the applicant; the name, qualifications, and contact information for the primary author(s) of the wetland critical area report; a description of the proposal; identification of all the local, state, and/or federal wetland-related permit(s) required for the project; and a vicinity map for the project;

   b. A statement specifying the accuracy of the report and all assumptions made and relied upon;

   c. Documentation of any fieldwork performed on the site, including field data sheets for delineations, function assessments, baseline hydrologic data, etc.;

d. A description of the methodologies used to conduct the wetland delineations, function assessments, or impact analyses including references;

e. Identification and characterization of all critical areas, wetlands, water bodies, shorelines, floodplains, and buffers on or adjacent to the proposed project area. For areas off-site of the project site, estimate conditions within 300 feet of the project boundaries using the best available information;

f. For each wetland identified on-site and within 300 feet of the project site provide: the wetland rating per *Wetland Ratings* (Section [#]) of this Title; required buffers; hydrogeomorphic classification; wetland acreage based on a professional survey from the field delineation (acreages for on-site portion and entire wetland area including off-site portions); Cowardin classification of vegetation communities; habitat elements; soil conditions based on site assessment and/or soil survey information; and to the extent possible, hydrologic information such as location and condition of inlet/outlets (if they can be legally accessed), estimated water depths within the wetland, and estimated hydroperiod patterns based on visual cues (e.g., algal mats, drift lines, flood debris, etc.). Provide acreage estimates, classifications, and ratings based on entire wetland complexes, not only the portion present on the proposed project site;

g. A description of the proposed actions including an estimation of acreages of impacts to wetlands and buffers based on the field delineation and survey and an analysis of site development alternatives including a no-development alternative;

h. An assessment of the probable cumulative impacts to the wetlands and buffers resulting from the proposed development;

i. A description of reasonable efforts made to apply mitigation sequencing pursuant to *Mitigation Sequencing* (Section [#]) to avoid, minimize, and mitigate impacts to critical areas;

j. A discussion of measures, including avoidance, minimization, and compensation, proposed to preserve existing wetlands and restore any wetlands that were degraded prior to the current proposed land use activity;

k. A conservation strategy for habitat and native vegetation that addresses methods to protect and enhance on-site habitat and wetland functions, and;

l. Evaluation of functions of the wetland and adjacent buffer using a functions assessment method recognized by local or state agency staff and including the reference for the method used and all data sheets.

2. A copy of the site plan sheet(s) for the project must be included with the written report and must include, at a minimum:

   a. Maps (to scale) depicting delineated and surveyed wetland and required buffers on-site, including buffers for off-site critical areas that extend onto the project site; the development proposal; other critical areas; grading and clearing limits; areas of proposed impacts to wetlands and/or buffers (include square footage estimates);

   b. A depiction of the proposed stormwater management facilities and outlets (to scale) for the development, including estimated areas of intrusion into the buffers of any critical areas. The written report shall contain a discussion of the potential impacts to the wetland(s) associated with anticipated hydroperiod alterations from the project.

C. **Compensatory Mitigation Reports.** When a project involves wetland and/or buffer impacts, a compensatory mitigation report shall be required, meeting the following minimum standards:

1. **Preparation by a Qualified Professional.** A compensatory mitigation report for wetland or buffer impacts shall be prepared by one or more qualified professional(s) including someone who is a certified Professional Wetland Scientist or a non-certified professional wetland scientist with a minimum of five (5) years experience designing compensatory mitigation projects. The compensatory mitigation projects must have been installed and monitored for a minimum of two (2) years, in order to verify success. In addition, the design team may include civil engineers, landscape architects, or landscape designers depending upon the complexity of the project.

2. **Wetland Critical Area Report.** A critical area report for wetlands must accompany or be included in the compensatory mitigation report and include the minimum parameters described in *Minimum Standards for Wetland Reports* (Section [#]) of this Title.

3. **Compensatory Mitigation Report**. The report must include a written report and plan sheets that must contain, at a minimum, the following elements. Full guidance can be found in the *Guidance on Wetland Mitigation in Washington State - Part 2: Guidelines for Developing Wetland Mitigation Plans and Proposals,* April 2004 (Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10; Ecology Publication #04-06-013b) or as revised.

   a. The written report must contain, at a minimum:

i. The name and contact information of the applicant; the name, qualifications, and contact information for the primary author(s) of the Compensatory Mitigation Report; a description of the proposal; a summary of the impacts and proposed compensation concept; identification of all the local, state, and/or federal wetland related permit(s) required for the project; and a vicinity map for the project;

ii. Description of the existing wetland and buffer areas proposed to be impacted including: acreages (or square footage) based on professional surveys of the delineations; Cowardin classifications including dominant vegetation community types (for upland and wetland habitats); hydrogeomorphic classification of wetland(s) on and adjacent to the site; the results of a functional assessment for the entire wetland and the portions proposed to be impacted; wetland rating based on *Wetland Ratings* (Section [#]) of this Title;

iii. An assessment of the potential changes in wetland hydroperiod from the proposed project and how the design has been modified to avoid, minimize, or reduce adverse impacts to the wetland hydroperiod;

iv. An assessment of existing conditions in the zone of the proposed compensation, including: vegetation community structure and composition, existing hydroperiod, existing soil conditions, existing habitat functions. Estimate future conditions in this location if the compensation actions are NOT undertaken (i.e., how would this site progress through natural succession?);

v. A description of the proposed conceptual actions for compensation of wetland and upland areas affected by the project. Describe future vegetation community types for years 1, 3, 5, 10, and 25 post-installation including the succession of vegetation community types and dominants expected. Describe the successional sequence of expected changes in hydroperiod for the compensation site(s) for the same time periods as vegetation success. Describe the change in habitat characteristics expected over the same 25-year time period;

vi. The field data collected to document existing conditions and on which future condition assumptions are based for hydroperiod (e.g., existing hydroperiod based on piezometer data, staff/crest gage data, hydrologic modeling, visual observations, etc.) and soils (e.g., soil pit data - hand dug or mechanically trenched, and soil boring data. Do not rely upon soil survey data for establishing existing conditions.);

vii. A discussion of ongoing management practices that will protect wetlands after the project site has been developed, including proposed monitoring and maintenance programs (for remaining wetlands and compensatory mitigation wetlands);

viii. A bond estimate for the entire compensatory mitigation including the following elements: site preparation, plant materials, construction materials, installation oversight, maintenance twice/year for up to five (5) years, annual monitoring field work and reporting, and contingency actions for a maximum of the total required number of years for monitoring;

ix. Proof of establishment of Notice on Title for the wetlands and buffers on the project site, including the compensatory mitigation areas.

b. The scaled plan sheets for the compensatory mitigation must contain, at a minimum:

i. Surveyed edges of the existing wetland and buffers, proposed areas of wetland and/or buffer impacts, location of proposed wetland and/or buffer compensation actions;

ii. Existing topography, ground-proofed, at two-foot contour intervals in the zone of the proposed compensation actions if any grading activity is proposed to create the compensation area(s). Also existing cross-sections of on-site wetland areas that are proposed to be impacted, and cross-section(s) (estimated one-foot intervals) for the proposed areas of wetland or buffer compensation;

iii. Surface and subsurface hydrologic conditions including an analysis of existing and proposed hydrologic regimes for enhanced, created, or restored compensatory mitigation areas. Also, illustrations of how data for existing hydrologic conditions were used to determine the estimates of future hydrologic conditions;

iv. Proposed conditions expected from the proposed actions on site including future hydrogeomorphic types, vegetation community types by dominant species (wetland and upland), and future hydrologic regimes;

v. Required wetland buffers for existing wetlands and proposed compensation areas. Also, identify any zones where buffers are proposed to be reduced or enlarged outside of the standards identified in this Title;

vi. A plant schedule for the compensatory area including all species by proposed community type and hydrologic regime, size and type of plant material to be installed, spacing of plants, "typical" clustering patterns, total number of each species by community type, timing of installation;

vii. Performance standards (measurable standards reflective of years post-installation) for upland and wetland communities, monitoring schedule, and maintenance schedule and actions by each biennium.

D. **Additional Information.** When appropriate, the [director] may also require the wetland report to include an evaluation by the State Department of Ecology or an independent qualified expert regarding the applicant's analysis and the effectiveness of any proposed mitigating measures or programs and to include any recommendations as appropriate.

1. If the development proposal site contains or is within a wetland area, the applicant shall submit an affidavit, which declares whether the applicant has knowledge of any illegal alteration to any or all wetlands on the proposed site and whether the applicant previously had been found in violation of this ordinance. If the applicant has been found previously in violation, the applicant shall declare whether such violation has been corrected to the satisfaction of the jurisdiction.

2. The [director] shall determine if the mitigation and monitoring plans and bonding measures proposed by the applicant are sufficient to protect the public health, safety, and welfare, consistent with the goals, purposes, objectives, and requirements of this Title.

Requirements for Compensatory Mitigation

A. Compensatory mitigation for alterations to wetlands shall achieve equivalent or greater biologic functions. Compensatory mitigation plans shall be consistent with the *Guidance on Wetland Mitigation in Washington State - Part 2: Guidelines for Developing Wetland Mitigation Plans and Proposals,* April 2004 (Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10; Ecology Publication #04-06-013b), or as revised.

B. **Mitigation Shall Be Required in the Following Order of Preference:**

1. Avoiding the impact altogether by not taking a certain action or parts of an action.

2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts.

3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

4. Reducing or eliminating the impact over time by preservation and maintenance operations.

5. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments.

6. Monitoring the required compensation and taking remedial or corrective measures when necessary.

C. **Compensating for Lost or Affected Functions.** Compensatory mitigation shall address the functions affected by the proposed project, with an intention to achieve functional equivalency or improvement of functions. The goal shall be for the compensatory mitigation to provide similar wetland functions as those lost, except when either:

1. The lost wetland provides minimal functions as determined by a site-specific function assessment, and the proposed compensatory mitigation action(s) will provide equal or greater functions or will provide functions shown to be limiting within a watershed through a formal Washington State watershed assessment plan or protocol; or

2. Out-of-kind replacement of wetland type or functions will best meet watershed goals formally identified by the [city/county], such as replacement of historically diminished wetland types.

D. **Preference of Mitigation Actions.** Methods to achieve compensation for wetland functions shall be approached in the following order of preference:

1. Restoration (re-establishment and rehabilitation) of wetlands.

2. Creation (establishment) of wetlands on disturbed upland sites such as those with vegetative cover consisting primarily of non-native introduced species. This should only be attempted when there is an adequate source of water and it can be shown that the surface and subsurface hydrologic regime is conducive for the wetland community that is anticipated in the design.

3. Enhancement of significantly degraded wetlands in combination with restoration or creation. Such enhancement should be part of a mitigation package that includes replacing the impacted area and meeting appropriate ratio requirements.

> See Appendices 8-C and 8-D for definitions of the types of compensatory mitigation actions (restoration, creation, enhancement).

E. **Type and Location of Compensatory Mitigation.** Unless it is demonstrated that a higher level of ecological functioning would result from an alternate approach, compensatory mitigation for ecological functions shall be either in-kind and on-site, or in-kind and within the same stream reach, sub-basin, or drift cell (if estuarine wetlands are impacted). Compensatory mitigation actions shall be conducted within the same sub-drainage basin and on the site of the alteration except when all of the following apply:

1. There are no reasonable on-site or in sub-drainage basin opportunities (e.g., on-site options would require elimination of high-functioning upland habitat), or on-site and in sub-drainage basin opportunities do not have a high likelihood of success based on a determination of the capacity of the site to compensate for the impacts. Considerations should include: anticipated replacement ratios for wetland mitigation, buffer conditions and proposed widths, available water to maintain anticipated hydrogeomorphic classes of wetlands when restored, proposed flood storage capacity, and potential to mitigate riparian fish and wildlife impacts (such as connectivity);

2. Off-site mitigation has a greater likelihood of providing equal or improved wetland functions than the impacted wetland; and

3. Off-site locations shall be in the same sub-drainage basin unless:

   a. Established watershed goals for water quality, flood storage or conveyance, habitat, or other wetland functions have been established by the [city/county] and strongly justify location of mitigation at another site; or

   b. Credits from a state-certified wetland mitigation bank are used as compensation and the use of credits is consistent with the terms of the bank's certification.

4. The design for the compensatory mitigation project needs to be appropriate for its location (i.e., position in the landscape). Therefore, compensatory mitigation should not result in the creation, restoration, or enhancement of an atypical wetland. An atypical wetland refers to a compensation wetland (e.g., created or enhanced)

that does not match the type of existing wetland that would be found in the geomorphic setting of the site (i.e., the water source(s) and hydroperiod proposed for the mitigation site are not typical for the geomorphic setting). Likewise, it should not provide exaggerated morphology or require a berm or other engineered structures to hold back water. For example, excavating a permanently inundated pond in an existing seasonally saturated or inundated wetland is one example of an enhancement project that could result in an atypical wetland. Another example would be excavating depressions in an existing wetland on a slope, which required the construction of berms to hold the water.

F. **Timing of Compensatory Mitigation.** It is preferred that compensatory mitigation projects be completed prior to activities that will disturb the on-site wetlands. At the least, compensatory mitigation shall be completed immediately following disturbance and prior to use or occupancy of the action or development. Construction of mitigation projects shall be timed to reduce impacts to existing fisheries, wildlife, and flora.

The [director] may authorize a one-time temporary delay in completing construction or installation of the compensatory mitigation when the applicant provides a written explanation from a qualified wetland professional as to the rationale for the delay. An appropriate rationale would include identification of the environmental conditions that could produce a high probability of failure or significant construction difficulties (e.g., project delay lapses past a fisheries window; or installing plants should be delayed until the dormant season to ensure greater survival of installed materials). The delay shall not create or perpetuate hazardous conditions or environmental damage or degradation, and the delay shall not be injurious to the health, safety, and general welfare of the public. The request for the temporary delay must include a written justification that documents the environmental constraints that preclude implementation of the compensatory mitigation plan. The justification must be verified and approved by the [city/county].

G. **Mitigation Ratios.** [insert appropriate acreage ratios]

> See Appendices 8-C and 8-D for recommended mitigation ratios and criteria for increasing or reducing ratios to be used with the Washington State wetland rating systems. Appendix 8-F provides the rationale for the recommended ratios.

1. The mitigation ratio is the acreage required for compensatory mitigation divided by the acreage of impact.

2. The ratios are for a concurrent compensatory mitigation project. If the impacts to a wetland are to be mitigated by using an approved and established mitigation bank, the rules and ratios applicable to the bank should be used.

3. The ratios are based on the assumption that the category, based on *Wetland Rating*s (Section [#]) of this Title, and hydrogeomorphic (HGM) class/subclass of the wetland proposed as compensation are the same as the category and HGM class/subclass of the wetland impacts.

4. Ratios for projects in which the category and HGM class/subclass of wetlands proposed as compensation is not the same as that of the wetland impacts will be determined on a case-by-case basis using the recommended ratios as a starting point. The ratios could be higher in such cases.

5. The ratio for using rehabilitation as compensation is 2 times that for using re-establishment or creation (R/C) (1 acre of R/C = 2 acres of rehabilitation). The ratio for using enhancement as compensation is 4 times that for using R/C (1 acre of R/C = 4 acres of enhancement).

6. Re-establishment or creation (R/C) can be used in combination with rehabilitation or enhancement. For example, 1 acre of impact to a Category III wetland would require two acres of R/C. If an applicant provides 1 acre of R/C (i.e. replacing the lost acreage at a 1:1 ratio), the remaining 1 acre of R/C necessary to compensate for the impact could be substituted with 2 acres of rehabilitation or 4 acres of enhancement.

7. Generally the use of enhancement alone as compensation is discouraged. Using enhancement in combination with the replacement of wetland area at a minimum of 1:1 through re-establishment or creation is preferred.

H. **Preservation.** Impacts to wetlands may be mitigated by preservation of wetland areas when used in combination with other forms of mitigation such as creation, restoration, or enhancement. Preservation may also be used by itself, but more restrictions apply as outlined below.

1. **Acceptable Uses of Preservation.** The preservation of at-risk, high-quality wetlands and habitat may be considered as part of an acceptable mitigation plan when the following criteria are met:

   a. Preservation is used as a form of compensation only after the standard sequencing of mitigation (avoid, minimize, and then compensate). Refer to *Mitigation Sequencing* (Section [#]) of this Title;

   b. Restoration (re-establishment and rehabilitation), creation, and enhancement opportunities have also been considered, and preservation is proposed by the applicant and approved by the permitting agencies as the best compensation option;

c. The preservation site is determined to be under imminent threat; that is, the site has the potential to experience a high rate of undesirable ecological change due to on-site or off-site activities that are not regulated (e.g., logging of forested wetlands). This potential includes permitted, planned, or likely actions;

d. The area proposed for preservation is of high quality or critical for the health of the watershed or basin due to its location. Some of the following features may be indicative of high-quality sites:

   i. Category I or II wetland rating (using the Washington State wetland rating system for eastern or western WA);

   ii. Rare or irreplaceable wetland type (e.g., bogs, mature forested wetlands, estuaries) or aquatic habitat that is rare or a limited resource in the area;

   iii. Habitat for threatened or endangered species;

   iv. Provides biological and/or hydrological connectivity;

   vi. High regional or watershed importance (e.g., listed as priority site in a watershed or basin plan);

   vii. Large size with high species diversity (plants and/or animals) and/or high abundance of native species;

   viii. A site that is continuous with the head of a watershed, or with a lake or pond in an upper watershed that significantly improves outflow hydrology and water quality.

2. **Preservation in combination with other forms of compensation.** Using preservation as compensation is acceptable when done in combination with restoration, creation, or enhancement, provided that a minimum of 1:1 acreage replacement is provided by re-establishment or creation and the criteria below are met:

   a. All criteria listed in [H.1] are met.

   b. The impact area is small and/or impacts are occurring to a low-functioning system (Category III or IV wetland);

   c. Preservation of a high-quality system occurs in the same watershed or basin as the wetland impact;

d. Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation; and

e. Mitigation ratios for preservation in combination with other forms of mitigation shall range from 10:1 to 20:1, as determined on a case-by-case basis, depending on the quality of the wetlands being impacted and the quality of the wetlands being preserved.

3. **Preservation as the sole means of compensation for wetland impacts.** Preservation alone shall only be used as compensatory mitigation in exceptional circumstances. Preservation alone shall not apply if impacts are occurring to functions that must be replaced on site, such as flood storage or water quality treatment that need to be replicated by water quality measures implemented within the project limits. Preservation of at-risk, high-quality wetlands and habitat (as defined above) may be considered as the sole means of compensation for wetland impacts when the following criteria are met:

   a. All criteria listed in [H.1] and [H.2] are met;

   b. There are no adverse impacts to habitat for fish and species listed as endangered and threatened;

   c. There is no net loss of habitat functions within the watershed or basin;

   d. Higher mitigation ratios are applied. Mitigation ratios for preservation as the sole means of mitigation shall generally start at 20:1. Specific ratios should depend upon the significance of the preservation project and the quality of the wetland resources lost.

I. **Wetland Mitigation Banks.**

1. Credits from a wetland mitigation bank may be approved for use as compensation for unavoidable impacts to wetlands when:

   a. The bank is certified under Chapter 173-700 WAC;

   b. The [director] determines that the wetland mitigation bank provides appropriate compensation for the authorized impacts; and

   c. The proposed use of credits is consistent with the terms and conditions of the bank's certification.

2. Replacement ratios for projects using bank credits shall be consistent with replacement ratios specified in the bank's certification.

3. Credits from a certified wetland mitigation bank may be used to compensate for impacts located within the service area specified in the bank's certification. In some cases, the service area of the bank may include portions of more than one adjacent drainage basin for specific wetland functions.

Subdivisions

The subdivision and short subdivision of land in wetlands and associated buffers is subject to the following:

A. Land that is located wholly within a wetland or its buffer may not be subdivided.

B. Land that is located partially within a wetland or its buffer may be subdivided provided that an accessible and contiguous portion of each new lot is:

1. Located outside of the wetland and its buffer; and

2. Meets the minimum lot size requirements of [locally adopted zoning dimensions].

C. Access roads and utilities serving the proposed subdivision may be permitted within the wetland and associated buffers only if the [city/county] determines that no other feasible alternative exists, consistent with this Title.

Signs and Fencing of Wetlands

A. **Temporary Markers.** The outer perimeter of the wetland buffer and the clearing limits identified by an approved permit or authorization shall be marked in the field with temporary "clearing limits" fencing in such a way as to ensure that no unauthorized intrusion will occur. The marking is subject to inspection by the [director] prior to the commencement of permitted activities. This temporary marking shall be maintained throughout construction and shall not be removed until permanent signs, if required, are in place.

B. **Permanent Signs.** As a condition of any permit or authorization issued pursuant to this Title, the [director] may require the applicant to install permanent signs along the boundary of a wetland or buffer.

1. Permanent signs shall be made of an enamel-coated metal face and attached to a metal post or another non-treated material of equal durability. Signs must be posted at an interval of one (1) per lot or every fifty (50) feet, whichever is less, and must be maintained by

the property owner in perpetuity. The sign shall be worded as follows or with alternative language approved by the director:

Protected Wetland Area
Do Not Disturb
Contact [Local Jurisdiction]
Regarding Uses, Restrictions, and Opportunities for Stewardship

2. The provisions of Subsection (1) may be modified as necessary to assure protection of sensitive features or wildlife.

C. **Fencing**

1. The [director] shall determine if fencing is necessary to protect the functions and values of the critical area. If found to be necessary, the [director] shall condition any permit or authorization issued pursuant to this Title to require the applicant to install a permanent fence at the edge of the wetland buffer, when fencing will prevent future impacts to the wetland.

2. The applicant shall be required to install a permanent fence around the wetland or buffer when domestic grazing animals are present or may be introduced on site.

3. Fencing installed as part of a proposed activity or as required in this Subsection shall be designed so as to not interfere with species migration, including fish runs, and shall be constructed in a manner that minimizes impacts to the wetland and associated habitat.

Wetland Buffers

A. **Buffer Requirements.** [insert buffer requirements]

See Appendices 8-C and 8-D for recommended buffer widths and criteria for increasing, reducing and averaging buffers to be used with the Washington State wetland rating systems. Appendix 8-E provides the rationale for the recommended buffers.

B. **Measurement of Wetland Buffers.** All buffers shall be measured from the wetland boundary as surveyed in the field. The width of the wetland buffer shall be determined according to the wetland category and the proposed land use as identified in this Title. The buffer for a wetland created, restored, or enhanced as compensation for approved wetland alterations shall be the same as the buffer required for the category of the created, restored, or enhanced wetland. Only fully vegetated buffers will be considered. Lawns, walkways, driveways, and other mowed or paved areas will not be considered buffers.

C. **Buffers on Mitigation Sites.** All mitigation sites shall have buffers consistent with the buffer requirements of this Title and based on the expected category of the wetland once the mitigation actions are completed.

D. **Buffer Maintenance.** Except as otherwise specified or allowed in accordance with this Title, wetland buffers shall be retained in an undisturbed or enhanced condition. In the case of compensatory mitigation sites, removal of invasive non-native weeds is required for the duration of the mitigation bond.

E. **Impacts to Buffers.** Requirements for the compensation for impacts to buffers are outlined in *Compensatory Mitigation Requirements* (Section [#]) of this title.

F. **Overlapping Critical Area Buffers.** If buffers for two contiguous critical areas overlap (such as buffers for a stream and a wetland), the wider buffer applies.

G. **Buffer Uses.** The following uses may be permitted within a wetland buffer in accordance with the review procedures of this Title, provided they are not prohibited by any other applicable law and they are conducted in a manner so as to minimize impacts to the buffer and adjacent wetland:

1. **Conservation and Restoration Activities.** Conservation or restoration activities aimed at protecting the soil, water, vegetation, or wildlife.

2. **Passive Recreation.** Passive recreation facilities designed and in accordance with an approved critical area report, including:

    a. Walkways and trails, provided that those pathways are limited to minor crossings having no adverse impact on water quality. They should be generally parallel to the perimeter of the wetland, located only in the outer twenty-five percent (25%) of the wetland buffer area, and located to avoid removal of significant trees. They should be limited to pervious surfaces no more than five (5) feet in width for pedestrian use only. Raised boardwalks utilizing non-treated pilings may be acceptable; and

    b. Wildlife viewing structures.

3. **Stormwater Management Facilities.** Stormwater management facilities, limited to stormwater dispersion outfalls and bioswales, may be allowed within the outer twenty-five percent (25%) of the buffer of Category III or IV wetlands only, provided that:

    a. No other location is feasible; and

    b. The location of such facilities will not degrade the functions or values of the wetland; and

c. Stormwater management facilities are not allowed in buffers of Category I or II wetlands.

Stormwater Management Impacts to Wetlands

A. **Protection of Wetland Hydrology.** Wetland hydrology shall be protected through the development process. Post-development wetland hydrology shall match pre-development wetland hydrology to the maximum extent feasible.

B. **Construction of New Surface Water Conveyance Systems.** Construction of new surface water conveyance systems in wetland buffers is allowed only if discharging at the wetland edge has less adverse impact upon the wetland or wetland buffer than if the surface water is discharged at the buffer edge and allowed to naturally drain through the buffer.

C. **Stormwater Facilities on Roads Adjacent to Wetlands and their Buffers.** Construction of new surface water flow control or surface water quality treatment facilities are only allowed in wetlands and buffers when such facilities are located in the right-of-way of an existing road and conducted consistent with established guidelines for road maintenance and best management practices. This does NOT include an outlet structure for a detention facility that is designed to impound water in a wetland up-gradient of a road, unless the provisions in *Limits on Use of Wetlands for Stormwater Detention* (Subsection [#]) are satisfied.

D. **Limits on Use of Wetlands for Stormwater Detention.** Wetlands cannot be used for stormwater detention and treatment unless the project satisfies the guidance and criteria developed by the Puget Sound Wetlands and Stormwater Management Research Program (Azous and Horner, eds, 2001, *Wetlands and Urbanization: Implications for the Future*) and contained in Appendix I-D of the *Stormwater Management Manual for Western Washington*, titled "Wetlands and Stormwater Management Guidelines." Compensatory mitigation should be provided for unavoidable loss of functions through hydrologic or structural modification of wetlands.

At this point we are not aware of wetland management guidelines that have been developed to address stormwater issues specific to eastern Washington. However, many of the wetland management principles embodied in Appendix I-D of the stormwater manual are applicable to wetlands regardless of the region in which they are located.

Agricultural Impacts to Wetlands

Chapter 8 of this volume recommends that a local government regulate on-going agricultural activities in wetlands through best management practices and farm plans. The scope and details of such practices and plans are too site-specific and detailed for the purposes of this appendix.

The following language addresses the conversion of wetlands to new agricultural uses, and conversion of wetlands currently in agricultural use to non-agricultural uses. Both of these activities are legitimately regulated by a local government through its critical areas ordinance.

A. The conversion of wetlands not currently in agricultural use to a new agricultural use is subject to the compensatory mitigation provisions of this Title, including avoidance, minimization, and compensatory mitigation. Conversion includes the clearing of wetland vegetation for pasture or preparation for planting of crops.

B. The conversion of wetlands currently in agricultural uses to non-agricultural uses is subject to the compensatory mitigation provisions of this Title, including avoidance, minimization, and mitigation.

Removal of Hazard Trees

Refer to Section 8.3.3.12 in Chapter 8 of this volume for the discussion on the removal hazard trees in wetlands and their buffers. A local critical areas ordinance may defer to its clearing, landscaping, or other applicable code to address the removal of hazard trees. Local governments should require that hazard trees be replaced either in kind or with species that are underrepresented in the community and under the direction of an arborist. A recommended goal for the replacement of hazard trees is 2:1 for younger trees and 4:1 for mature and old-growth trees.

Unauthorized Alterations and Enforcement

A. When a wetland or its buffer has been altered in violation of this Title, all ongoing development work shall stop and the critical area shall be restored. The [city/county] shall have the authority to issue a “stop-work” order to cease all ongoing development work and order restoration, rehabilitation, or replacement measures at the owner’s or other responsible party’s expense to compensate for violation of provisions of this Title.

B. **Requirement for Restoration Plan.** All development work shall remain stopped until a restoration plan is prepared and approved by [city/county]. Such a plan shall be prepared by a qualified professional using the currently accepted scientific principles and shall describe how the actions proposed meet the minimum requirements described in Subsection (C). The [director] shall, at the violator’s expense, seek expert advice in determining the adequacy of the plan. Inadequate plans shall be returned to the applicant or violator for revision and resubmittal.

C. **Minimum Performance Standards for Restoration.** The following minimum performance standards shall be met for the restoration of a wetland, provided that if the violator can demonstrate that greater functions and habitat values can be obtained, these standards may be modified:

1. The historic structure, functions, and values of the affected wetland shall be restored, including water quality and habitat functions;

2. The historic soil types and configuration shall be replicated;

3. The wetland and buffers shall be replanted with native vegetation that replicates the vegetation historically found on the site in species types, sizes, and densities. The historic functions and values should be replicated at the location of the alteration; and

4. Information demonstrating compliance with other applicable provisions of this Title shall be submitted to the [director].

D. **Site Investigations.** The [director] is authorized to make site inspections and take such actions as are necessary to enforce this Title. The [director] shall present proper credentials and make a reasonable effort to contact any property owner before entering onto private property.

E. **Penalties.** Any person, party, firm, corporation, or other legal entity convicted of violating any of the provisions of this Title shall be guilty of a misdemeanor. Each day or portion of a day during which a violation of this Title is committed or continued shall constitute a separate offense. Any development carried out contrary to the provisions of this Title shall constitute a public nuisance and may be enjoined as provided by the statutes of the State of Washington. The [city/county] may levy civil penalties against any person, party, firm, corporation, or other legal entity for violation of any of the provisions of this Title. The civil penalty shall be assessed at a maximum rate of [amount] dollars per day per violation.

If the wetland affected cannot be restored, monies collected as penalties shall be deposited in a dedicated account for the preservation or restoration of landscape processes and functions in the watershed in which the affected wetland is located. The [city/county] may coordinate its preservation or restoration activities with other [city/county] in the watershed to optimize the effectiveness of the restoration action.

Appendix 8-C

Guidance on Widths of Buffers and Ratios for Compensatory Mitigation for Use with the Western Washington Wetland Rating System

8C.1 Introduction

This appendix provides guidance on widths of buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetland Rating System for Western Washington-Revised* (Hruby 2004b). Refer to Appendix 8-D for guidance for eastern Washington. Appendices 8-C through 8-F have been formatted similar to the main text of this volume (i.e., with a numbering system) to help with organization.

The tables below list the recommended widths of buffers for various alternatives, examples of measures to minimize impacts, and ratios for compensatory mitigation.

- **Table 8C-9.** Comparison of recommended buffer widths for high intensity land uses between Alternative 3 (step-wise scale) and Alternative 3A (graduated scale) based on score for habitat functions [Page 14].
- **Table 8C-10.** Comparison of recommended widths for buffers between Alternative 3 and Alternative 3A for proposed land uses with high impacts with mitigation for impacts. [Page 15]
- **Table 8C-11.** Mitigation ratios for projects in western Washington. [Page 21]

The guidance in this appendix can be used in developing regulations such as critical areas ordinances for protecting and managing the functions and values of wetlands. The recommendations are based on the analysis of the current scientific literature found in Volume 1. The detailed rationale for the recommendations is provided in Appendices 8-E and 8-F.

> The recommendations on buffer widths and mitigation ratios are general, and there may be some wetlands for which these recommendations are either too restrictive or not protective enough. The recommendations are based on the assumption that a wetland will be protected only at the scale of the site itself. They do not reflect buffers and ratios that might result from regulations that are developed based on a larger landscape-scale approach.

8C.2 Widths of Buffers

Requiring buffers of a specific width has been one of the primary methods by which local jurisdictions in Washington have protected the functions and values of wetlands. Generally, buffers are the uplands adjacent to an aquatic resource that can, through various physical, chemical, and biological processes, reduce impacts to wetlands from adjacent land uses. The physical characteristics of buffers (e.g., slope, soils, vegetation, and width) determine how well buffers reduce the adverse impacts of human development. These characteristics are discussed in detail in Chapter 5, Volume 1.

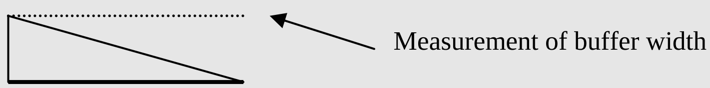
In addition to reducing the impacts of adjacent land uses, buffers also protect and maintain a wide variety of functions and values provided by wetlands. For example, buffers can provide the terrestrial habitats needed by many species of wildlife that use wetlands to meet some of their needs.

The review of the scientific literature has shown, however, that buffers alone cannot adequately protect all functions that a wetland performs. Additional guidance is, therefore, provided on other ways in which wetlands can be managed and regulated to provide some of the necessary protection that buffers alone do not provide. The following guidance for protecting the functions and values of wetlands is based on their category as determined through the rating system for western Washington.

Basic assumptions for using the guidance on widths for buffers

Recommendations for widths of buffers assume that:

- The wetland has been categorized using the *Washington State Wetland Rating System for Western Washington-Revised* (Hruby 2004b).
- The buffer is vegetated with native plant communities that are appropriate for the *ecoregion* or with a plant community that provides similar functions. Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. The U.S. Environmental Protection Agency maintains updated maps of ecoregions that are available at http://www.epa.gov/naaujydh/pages/models/ecoregions.htm . Ecoregions currently mapped for Washington are: Coast Range, Puget Lowland, Cascades, Eastern Cascades Slopes and Foothills, North Cascades, Columbia Plateau, Blue Mountains, and Northern Rockies.
- If the vegetation in the buffer is disturbed (grazed, mowed, etc.), proponents planning changes to land use that will increase impacts to wetlands need to rehabilitate the buffer with native plant communities that are appropriate for the ecoregion, or with a plant community that provides similar functions.
- The width of the buffer is measured along the horizontal plane (see drawing below):



- The buffer will remain relatively undisturbed in the future within the width specified.

Three alternatives for protecting the functions of wetlands using buffers are described in the following sections:

- **Buffer Alternative 1.** Width based only on wetland category.
- **Buffer Alternative 2.** Width based on wetland category and the intensity of impacts from proposed changes in land use.
- **Buffer Alternative 3.** Width based on wetland category, intensity of impacts, and wetland functions or special characteristics. This alternative has two options for determining the widths of buffers when they are based on the score for habitat. Alternative 3 provides three buffer widths based on habitat scores, while Alternative 3A provides a graduated scale of widths for buffers based on habitat scores.

The buffer widths recommended for each alternative were based on the review of scientific information in Volume 1. The guidance in this appendix synthesizes the information about the types and sizes of buffers needed to protect the functions and special characteristics of wetlands.

Appendices 8-C and 8-D do not provide the metric equivalents for buffer widths even though most of the research on buffers uses the metric scale. This decision was made because most local governments use the English Customary measures. For example, a buffer width is set at 50 feet rather than 15 meters.

8C.2.1 Buffer Alternative 1: Width Based Only on Wetland Category

This alternative, in which the width of buffers is based only on the category of the wetland, is the simplest (Table 8C-1). The width recommended for each category of wetland in Alternative 1 is the widest recommended for that category in both Alternatives 2 and 3 (discussed below). Alternative 1 provides the least flexibility because many different types of wetlands and types of human impacts are combined. For example, not all wetlands that fall into Category I or II need a 300-foot buffer. If no distinctions are made between the wetlands that fall into Category I or II, all wetlands that fall into these categories have to be protected with a 300-foot buffer so adequate protection is provided for those wetlands that do need a buffer this wide. Also, the widths recommended for this alternative are those needed to protect the wetland from proposed land uses that have the greatest impacts since no distinctions between impacts are made.

Table 8C-1. Width of buffers needed to protect wetlands in western Washington if impacts from land use and wetland functions are NOT incorporated (Buffer Alternative 1).

Category of Wetland	Widths of Buffers
IV	50 ft
III	150 ft
II	300 ft
I	300 ft

8C.2.2 Buffer Alternative 2: Width Based on Wetland Category and Modified by the Intensity of the Impacts from Proposed Land Use

The second alternative increases the regulatory flexibility by including the concept that not all proposed changes in land uses have the same level of impact (Table 8C-2). For example, one new residence being built on 5 acres of land near a wetland is expected to have a smaller impact than 20 houses built on the same 5 acres. Three categories of impacts from proposed land uses are outlined: land uses that can create high impacts, moderate impacts, and low impacts to wetlands. Different land uses that can cause these levels of impacts are listed in Table 8C-3.

Table 8C-2. Width of buffers needed to protect wetlands in western Washington considering impacts of proposed land uses (Buffer Alternative 2)**.**

Category of Wetland	Land Use with Low Impact *	Land Use with Moderate Impact *	Land Use with High Impact*
IV	25 ft	40 ft	50 ft
III	75 ft	110 ft	150 ft
II	150 ft	225 ft	300 ft
I	150 ft	225 ft	300 ft
* See Table 8C-3 below for types of land uses that can result in low, moderate, and high impacts to wetlands.			

Table 8C-3. Types of proposed land use that can result in high, moderate, and low levels of impacts to adjacent wetlands.

Level of Impact from Proposed Change in Land Use	Types of Land Use Based on Common Zoning Designations *
High	• Commercial • Urban • Industrial • Institutional • Retail sales • Residential (more than 1 unit/acre) • Conversion to 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.) • Hobby farms
Moderate	• Residential (1 unit/acre or less) • Moderate-intensity open space (parks with biking, jogging, etc.) • Conversion to moderate-intensity agriculture (orchards, hay fields, etc.) • Paved trails • Building of logging roads • Utility corridor or right-of-way shared by several utilities and including access/maintenance road
Low	• Forestry (cutting of trees only) • Low-intensity open space (hiking, bird-watching, preservation of natural resources, etc.) • Unpaved trails • Utility corridor without a maintenance road and little or no vegetation management.
* Local governments are encouraged to create land-use designations for zoning that are consistent with these examples.	

8C.2.3 Buffer Alternative 3: Width Based on Wetland Category, Intensity of Impacts, Wetland Functions, or Special Characteristics

The third alternative provides the most flexibility by basing the widths of buffers on three factors: the wetland category, the intensity of the impacts (as used in Alternative 2), and the functions or special characteristics of the wetland that need to be protected as determined through the rating system. The recommended widths for buffers are shown in Tables 8C-4 to 8C-7. Using this alternative, a wetland may fall into more than one category in the table. For example, an interdunal wetland may be rated a Category III wetland because it is an isolated interdunal wetland, but it may be rated a Category II wetland based on its score for functions.

If a wetland meets more than one of the characteristics listed in Tables 8C-4 to 8C-7, the buffer recommended to protect the wetland is the widest one. For example, if a Category I wetland (Table 8C-7) scores 32 points for habitat and 27 points for water quality functions, a 300-foot buffer is needed for land uses with high impacts because the widths needed to protect habitat are wider than those needed for the other functions.

Table 8C-4. Width of buffers needed to protect Category IV wetlands in western Washington (Buffer Alternative 3 for wetlands scoring less than 30 points for all functions).

Wetland Characteristics	Buffer Widths by Impact of Proposed Land Use	Other Measures Recommended for Protection
Score for all 3 basic functions is less than 30 points	Low - 25 ft Moderate – 40 ft High – 50 ft	No recommendations at this time[1]

Table 8C-5. Width of buffers needed to protect Category III wetlands in western Washington (Buffer Alternative 3 for wetlands scoring 30 – 50 points for all functions).

Wetland Characteristics	Buffer Widths by Impact of Proposed Land Use	Other Measures Recommended for Protection
Moderate level of function for habitat (score for habitat 20 - 28 points)	Low - 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[1]
Not meeting above characteristic	Low - 40 ft Moderate – 60 ft High – 80 ft	No recommendations at this time[1]

[1] No information on other measures for protection was available at the time this document was written. The Washington State Department of Ecology will continue to collect new information for future updates to this document.

Table 8C-6. Width of buffers needed to protect Category II wetlands in western Washington (Buffer Alternative 3 for wetlands scoring 51-69 points for all functions or having the "Special Characteristics" identified in the rating system).

Wetland Characteristics	**Buffer Widths by Impact of Proposed Land Use** (Apply most protective if more than one criterion is met.)	**Other Measures Recommended for Protection**
High level of function for habitat (score for habitat 29 - 36 points)	Low - 150 ft Moderate – 225 ft High – 300 ft*	Maintain connections to other habitat areas
Moderate level of function for habitat (score for habitat 20 - 28 points)	Low - 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[2]
High level of function for water quality improvement and low for habitat (score for water quality 24 - 32 points; habitat less than 20 points)	Low - 50 ft Moderate – 75 ft High – 100 ft	No additional surface discharges of untreated runoff
Estuarine	Low - 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[2]
Interdunal	Low - 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[2]
Not meeting above characteristics	Low - 50 ft Moderate – 75 ft High – 100 ft	No recommendations at this time[2]
* Fifty of the 122 wetlands used to calibrate the rating system for western Washington were Category II. Of these 50, only five (10%) would require 300-foot buffers to protect them from high-impact land uses. The maximum buffer width for the remaining 45 wetlands would be 150 feet.		

[2] See footnote on the previous page.

Table 8C-7. Width of buffers needed to protect Category I wetlands in western Washington (Buffer Alternative 3 for wetlands scoring 70 points or more for all functions or having the "Special Characteristics" identified in the rating system).

Wetland Characteristics	**Buffer Widths by Impact of Proposed Land Use** (Apply most protective if more than one criterion is met)	**Other Measures Recommended for Protection**
Natural Heritage Wetlands	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional surface discharges to wetland or its tributaries No septic systems within 300 ft of wetland Restore degraded parts of buffer
Bogs	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional surface discharges to wetland or its tributaries Restore degraded parts of buffer
Forested	Buffer width to be based on score for habitat functions or water quality functions	If forested wetland scores high for habitat, need to maintain connections to other habitat areas Restore degraded parts of buffer
Estuarine	Low - 100 ft Moderate – 150 ft High – 200 ft	No recommendations at this time[3]
Wetlands in Coastal Lagoons	Low - 100 ft Moderate – 150 ft High – 200 ft	No recommendations at this time[3]
High level of function for habitat (score for habitat 29 - 36 points)	Low – 150 ft Moderate – 225 ft High – 300 ft	Maintain connections to other habitat areas Restore degraded parts of buffer
Moderate level of function for habitat (score for habitat 20 - 28 points)	Low – 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[3]
High level of function for water quality improvement (24 – 32 points) and low for habitat (less than 20 points)	Low – 50 ft Moderate – 75 ft High – 100 ft	No additional surface discharges of untreated runoff
Not meeting any of the above characteristics	Low – 50 ft Moderate – 75 ft High – 100 ft	No recommendations at this time[3]

[3] See footnote on page 6.

8C.2.4 Special Conditions for a Possible Reduction in Buffer Widths

8C.2.4.1 Condition 1: Reduction in Buffer Width Based on Reducing the Intensity of Impacts from Proposed Land Uses

The buffer widths recommended for proposed land uses with high-intensity impacts to wetlands can be reduced to those recommended for moderate-intensity impacts under the following conditions:

- For wetlands that score moderate or high for habitat (20 points or more for the habitat functions), the width of the buffer can be reduced if both of the following criteria are met:

  1) A relatively undisturbed, vegetated corridor at least 100-feet wide is protected between the wetland and any other Priority Habitats as defined by the Washington State Department of Fish and Wildlife ("relatively undisturbed" and "vegetated corridor" are defined in questions H 2.1 and H 2.2.1 of the *Washington State Wetland Rating System for Western Washington – Revised,* (Hruby 2004b)). Priority Habitats in western Washington include:

     - Wetlands
     - Riparian zones
     - Aspen stands
     - Cliffs
     - Prairies
     - Caves
     - Stands of Oregon White Oak
     - Old-growth forests
     - Estuary/estuary-like
     - Marine/estuarine shorelines
     - Eelgrass meadows
     - Talus slopes
     - Urban natural open space (for current definitions of Priority Habitats, see http://wdfw.wa.gov/hab/phshabs.htm)

     The corridor must be protected for the entire distance between the wetland and the Priority Habitat by some type of legal protection such as a conservation easement.

  2) Measures to minimize the impacts of different land uses on wetlands, such as the examples summarized in Table 8C-8, are applied.

- For wetlands that score less than 20 points for habitat, the buffer width can be reduced to that required for moderate land-use impacts by applying measures to minimize the impacts of the proposed land uses (see examples in Table 8C-8).

Table 8C-8. Examples of measures to minimize impacts to wetlands from proposed change in land use that have high impacts. (This is not a complete list of measures.)

Examples of Disturbance	Activities and Uses that Cause Disturbances	Examples of Measures to Minimize Impacts
Lights	• Parking lots • Warehouses • Manufacturing • Residential	• Direct lights away from wetland
Noise	• Manufacturing • Residential	• Locate activity that generates noise away from wetland
Toxic runoff*	• Parking lots • Roads • Manufacturing • Residential areas • Application of agricultural pesticides • Landscaping	• Route all new, untreated runoff away from wetland while ensuring wetland is not dewatered • Establish covenants limiting use of pesticides within 150 ft of wetland • Apply integrated pest management
Stormwater runoff	• Parking lots • Roads • Manufacturing • Residential areas • Commercial • Landscaping	• Retrofit stormwater detention and treatment for roads and existing adjacent development • Prevent channelized flow from lawns that directly enters the buffer
Change in water regime	• Impermeable surfaces • Lawns • Tilling	• Infiltrate or treat, detain, and disperse into buffer new runoff from impervious surfaces and new lawns
Pets and human disturbance	• Residential areas	• Use privacy fencing; plant dense vegetation to delineate buffer edge and to discourage disturbance using vegetation appropriate for the ecoregion; place wetland and its buffer in a separate tract
Dust	• Tilled fields	• Use best management practices to control dust
* These examples are not necessarily adequate for minimizing toxic runoff if threatened or endangered species are present at the site.		

8C.2.4.2 Condition 2: Reductions in Buffer Widths Where Existing Roads or Structures Lie Within the Buffer

Where a legally established, non-conforming use of the buffer exists (e.g., a road or structure that lies within the width of buffer recommended for that wetland), proposed actions in the buffer may be permitted as long as they do not increase the degree of non-conformity. This means no increase in the impacts to the wetland from activities in the buffer.

For example, if a land use with high impacts (e.g., building an urban road) is being proposed next to a Category II wetland with a moderate level of function for habitat, a 150-foot buffer would be needed to protect functions (see Table 8C-6). If, however, an existing urban road is already present and only 50 feet from the edge of the Category II wetland, the additional 100 feet of buffer may not be needed if the road is being widened. A vegetated buffer on the other side of the road would not help buffer the existing impacts to the wetland from the road. If the existing road is resurfaced or widened (e.g., to add a sidewalk) along the upland edge, without any further roadside development that would increase the degree of non-conformity, the additional buffer is not necessary. The associated increase in impervious surface from widening a road, however, may necessitate mitigation for impacts from stormwater.

If, however, the proposal is to build a new development (e.g., shopping center) along the upland side of the road, the impacts to the wetland and its functions may increase. This would increase the degree of non-conformity. The project proponent would need to provide the additional 100 feet of buffer extending beyond the road or apply buffer averaging (see Section 8C.2.6).

8C.2.4.3 Condition 3: Reduction in Buffer Widths Through an Individual Rural Stewardship Plan

A Rural Stewardship Plan (RSP) is the product of a collaborative effort between rural property owners and a local government to tailor a management plan specific for a rural parcel of land. The goal of the RSP is better management of wetlands than what would be achieved through strict adherence to regulations. In exchange, the landowner gains flexibility in the widths of buffers required, in clearing limits, and in other requirements found in the regulations. For example, dense development in rural residential areas can be treated as having a low level of impact when the development of the site is managed through a locally approved RSP. The voluntary agreement includes provisions for restoration, maintenance, and long-term monitoring and specifies the widths of buffers needed to protect each wetland within the RSP.

8C.2.5 Conditions for Increasing the Width of, or Enhancing, the Buffer

8C.2.5.1 Condition 1: Buffer is Not Vegetated with Plants Appropriate for the Region

The recommended widths for buffers are based on the assumption that the buffer is vegetated with a native plant community appropriate for the ecoregion or with one that performs similar functions. If the existing buffer is unvegetated, sparsely vegetated, or vegetated with invasive species that do not perform needed functions, the buffer should either be planted to create the appropriate plant community or the buffer should be widened to ensure that adequate functions of the buffer are provided. Generally, improving the vegetation will be more effective than widening the buffer.

8C.2.5.2 Condition 2: Buffer Has a Steep Slope

The review of the literature (Volume 1) indicates that the effectiveness of buffers at removing pollutants before they enter a wetland decreases as the slope increases. If a buffer is to be based on the score for its ability to improve water quality (see Tables 8C-4 through 8C-7) rather than habitat or other criteria, then the buffer should be increased by 50% if the slope is greater than 30% (a 3-foot rise for every 10 feet of horizontal distance).

8C.2.5.3 Condition 3: Buffer Is Used by Species Sensitive to Disturbance

If the wetland provides habitat for a species that is particularly sensitive to disturbance (such as a threatened or endangered species), the width of the buffer should be increased to provide adequate protection for the species based on its particular, life-history needs. Some buffer requirements for priority species are available on the Washington State Department of Fish and Wildlife web page (http://wdfw.wa.gov/hab/phsrecs.htm). The list of priority species for vertebrates is at http://wdfw.wa.gov/hab/phsvert.htm; for invertebrates it is at http://wdfw.wa.gov/hab/phsinvrt.htm. Information on the buffer widths needed by some threatened, endangered, and sensitive species of wildlife is provided in Appendix 8-H.

8C.2.6 Buffer Averaging

The widths of buffers may be averaged if this will improve the protection of wetland functions, or if it is the only way to allow for reasonable use of a parcel. There is no scientific information available to determine if averaging the widths of buffers actually protects functions of wetlands. The authors have concluded that averaging could be allowed in the following situations:

Averaging may not be used in conjunction with any of the other provisions for reductions in buffers (listed above).

- Averaging to **improve wetland protection** may be permitted when **all** of the following conditions are met:
  - The wetland has significant differences in characteristics that affect its habitat functions, such as a wetland with a forested component adjacent to a degraded emergent component or a “dual-rated” wetland with a Category I area adjacent to a lower rated area
  - The buffer is increased adjacent to the higher-functioning area of habitat or more sensitive portion of the wetland and decreased adjacent to the lower-functioning or less sensitive portion
  - The total area of the buffer after averaging is equal to the area required without averaging
  - The buffer at its narrowest point is never less than 3/4 of the required width
- Averaging to **allow reasonable use** of a parcel may be permitted when **all** of the following are met:
  - There are no feasible alternatives to the site design that could be accomplished without buffer averaging
  - The averaged buffer will not result in degradation of the wetland’s functions and values as demonstrated by a report from a qualified wetland professional (see Appendix 8-G for a definition of a qualified wetland professional)
  - The total buffer area after averaging is equal to the area required without averaging
  - The buffer at its narrowest point is never less than 3/4 of the required width

8C.2.7 Modifying Buffer Widths in Alternative 3 Using a Graduated Scale for the Habitat Functions (Alternative 3A)

Alternative 3 contains recommendations for protecting the habitat functions of wetlands using only three groupings of scores (0-19, 20-28, 29-36). As a result, a one-point difference between 28 and 29 can result in a 150-foot increase in the width of a buffer around a wetland. The habitat scores were divided into three groups to simplify the regulations based on this guidance. This division is not based on a characterization of risks since the scientific information indicates that the decrease in risk with increasing widths of buffers is relatively continuous for habitat functions.

Such a large increase in width with a one-point increase in the habitat score may be contentious. A jurisdiction may wish to reduce the increments in the widths for buffers by developing a more graduated (but inherently more complicated) scale based on the scores for habitat. Table 8C-9 provides one example of a graduated scale for widths of buffers where the width increases by 20 feet for every one point increase in the habitat score (Figure 8C-1 shows the buffer widths graphically).

Table 8C-9. Comparison of widths for buffers in Alternatives 3 (step-wise scale) and 3A (graduated scale) for proposed land uses with high impacts based on the score for habitat functions in western Washington

Points for Habitat from Wetland Rating Form	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Alternative 3	100	150	150	150	150	150	150	150	150	150	300	300	300	300	300	300	300	300
Alternative 3A	100	100	100	120	140	160	180	200	220	240	260	280	300	300	300	300	300	300

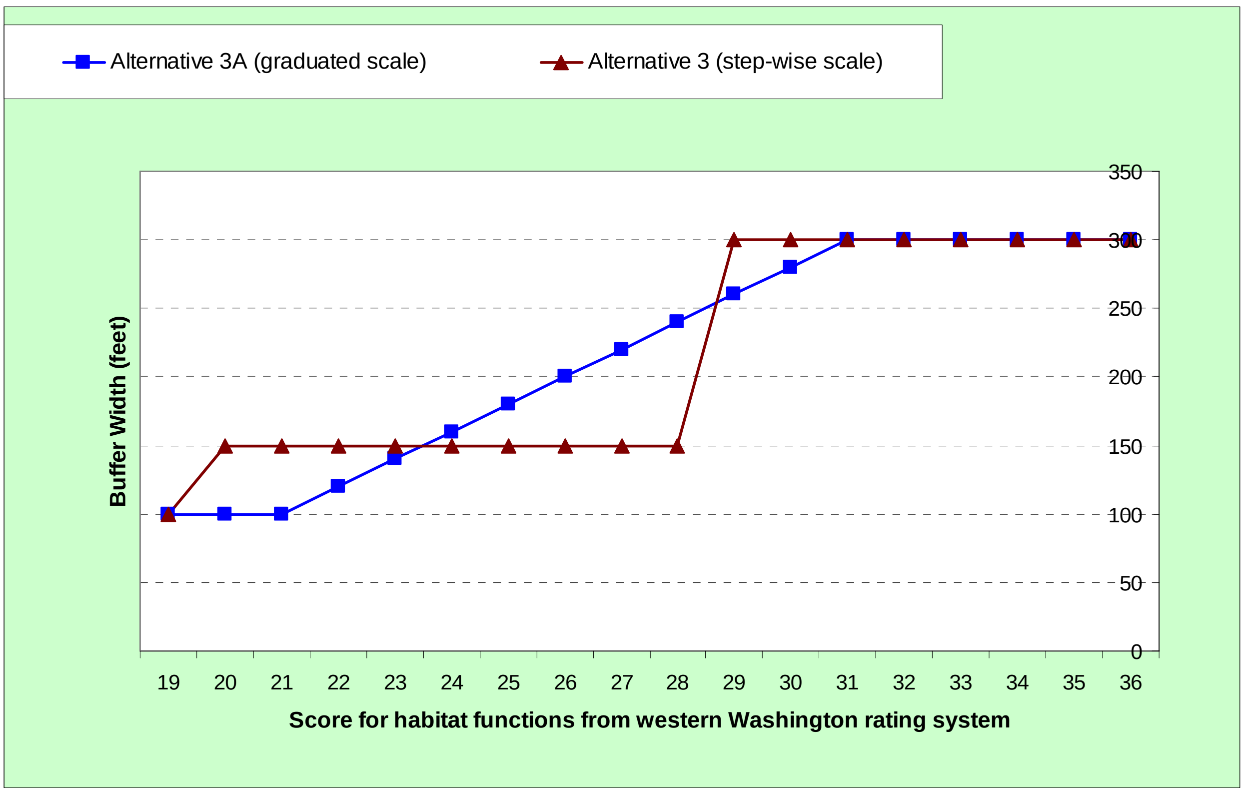


Figure 8C-1. Graphical comparison of widths for buffers in Alternative 3 and 3A for proposed land uses with high impacts based on the score for habitat functions in western Washington.

Other scales are possible as long as they keep within the limits established from the scientific information currently available: wetlands with scores for habitat that are higher than 31 points need buffers that are at least 300-feet wide; wetlands with a score of 26 points need buffers of at least 150 feet; and wetlands with a score of 22 points need buffers that are at least 100-feet wide.

These buffer widths can be further reduced by 25 percent if a proposed project with high impacts implements the mitigation measures such as those described in Table 8C-8. The measures are part of "Condition 1" in Section 8C.2.4 (Special Conditions for a Possible Reduction in Buffer Widths). The buffer widths under Buffer Alternatives 3 and 3A, and the corresponding 25 percent reduction (per buffer reduction condition 1) are shown in Table 8C-10 and represented graphically below in Figure 8C-2.

Table 8C-10. Comparison of widths for buffers in Alternatives 3 (step-wise scale) and 3A (graduated scale) for proposed land uses with high impacts based on the score for habitat functions in western Washington if the impacts are mitigated.

Points for Habitat from Wetland Rating Form	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Alternative 3 (**with** mitigation of impacts)	75	110	110	110	110	110	110	110	110	110	225	225	225	225	225	225	225	225
Alternative 3A (**with** mitigation of impacts)	75	75	75	90	105	120	135	150	165	180	195	210	225	225	225	225	225	225

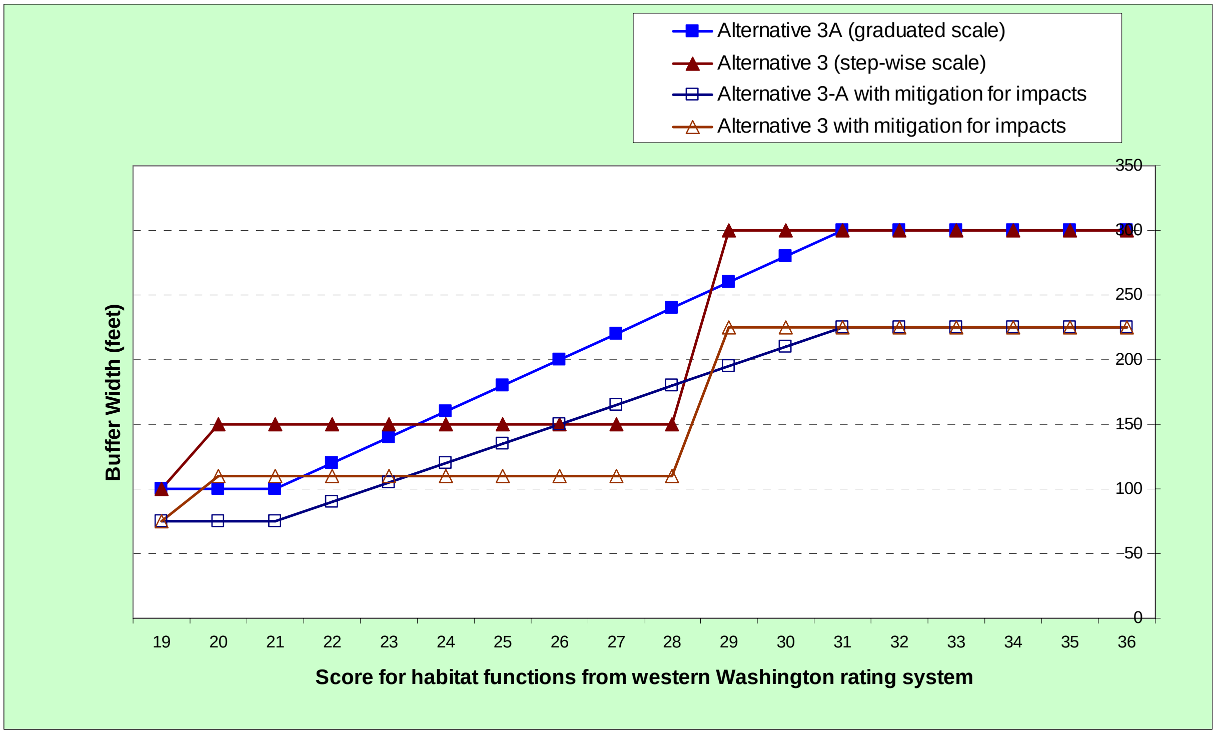


Figure 8C-2. Graphical comparison of widths for buffers in Alternatives 3 and 3A based on the score for habitat functions in western Washington with and without mitigating impacts of proposed development outside the buffer.

Alternatives 3 and 3A represent two separate approaches for determining widths of buffers for wetlands scoring between 20 and 31 points for the habitat functions. Local governments should select one of the two approaches and should not hybridize the approaches or adopt both at the same time.

8C.3 Ratios for Compensatory Mitigation

When the acreage required for compensatory mitigation is divided by the acreage of impact, the result is a number known variously as a *replacement, compensation,* or *mitigation* ratio. Compensatory mitigation ratios are used to help ensure that compensatory mitigation actions are adequate to offset unavoidable wetland impacts by requiring a greater amount of mitigation area than the area of impact. Requiring greater mitigation area helps compensate for the risk that a mitigation action will fail and for the time lag that occurs between the wetland impact and achieving a fully functioning mitigation site.

8C.3.1 Definitions of Types of Compensatory Mitigation

The ratios presented are based on the type of compensatory mitigation proposed (e.g., restoration, creation, and enhancement). In its *Regulatory Guidance Letter 02-02*, the U.S. Army Corps of Engineers provided definitions for these types of compensatory mitigation. For consistency, the authors of this document use the same definitions which are provided below.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into:

- **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. Re-establishment results in a gain in wetland acres (and functions). Activities could include removing fill material, plugging ditches, or breaking drain tiles.
- **Rehabilitation.** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions of a **degraded** wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres. Activities could involve breaching a dike to reconnect wetlands to a floodplain or return tidal influence to a wetland.

Creation (Establishment): 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 acres. Activities typically involve excavation of upland soils to elevations that will produce a wetland hydroperiod, create hydric soils, and support the growth of hydrophytic plant species.

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. 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. 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 activities.

Protection/Maintenance (Preservation): Removing a threat to, or preventing the decline of, wetland conditions by an action in or near a wetland. This includes the purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term *preservation*. Preservation does not result in a gain of wetland acres, may result in a gain in functions, and will be used only in exceptional circumstances.

Distinction between rehabilitation and enhancement

The distinction between rehabilitation and enhancement as defined above is not clear-cut and can be hard to understand. Actions that rehabilitate or enhance wetlands span a continuum of activities that cannot be defined by specific criteria.

Rehabilitation ◄——————————————► *Enhancement*

In general, rehabilitation involves actions that are more sustainable and that reinstate environmental processes, both at the site and landscape scale (e.g., reinstating hydrologic processes in a diked floodplain by breaching the dikes). Rehabilitation actions often focus on restoring environmental processes that have been disturbed or altered by previous or ongoing, human activity. Ecology further defines *rehabilitation* as:

- Actions that restore the original hydrogeomorphic (HGM) class, or subclass, to a wetland whose current HGM class, or subclass, has been changed by human activities
- Actions that restore the water regime that was present and maintained the wetland before human activities changed it

Any other actions taken in existing wetlands would be considered *enhancement.* Enhancement typically involves actions that provide gains in only one or a few functions and can lead to a decline in other functions. Enhancement actions often focus on structural or superficial improvements to a site and generally do not address larger-scale environmental processes.

For example, a wetland that was once a forested, riverine wetland was changed to a depressional, emergent wetland by the construction of a dike and through grazing. Rehabilitating the wetland would involve breaching the dike so the wetland becomes a riverine wetland again, discontinuing the grazing, and reforesting the area. Discontinuing the grazing and reforesting the wetland without re-establishing the links to the riverine system would be considered enhancement.

Basic assumptions for using the guidance on ratios

- The ratios are for a compensatory mitigation project that is concurrent with impacts to wetlands. If impacts are to be mitigated by using an approved and established mitigation bank, the rules and ratios applicable to the bank should be used.
- The ratios are based on the assumption that the category (based on the rating system for western Washington) and hydrogeomorphic (HGM) class or subclass of the wetland proposed as compensation are the same as the category and HGM class or subclass of the affected wetland (e.g., impacts to a Category II riverine wetland are compensated by creating, restoring, or enhancing a Category II riverine wetland).
- Ratios for projects in which the category and HGM class or subclass of wetlands proposed as compensation is not the same as that of the wetland affected will be determined on a case-by-case basis using the recommended ratios as a starting point. The ratios could be higher in such cases.
- The ratio for using rehabilitation as compensation is 2 times that for using re-establishment or creation (R/C) (2 acres of rehabilitation are equivalent to 1 acre of R/C). The ratio for using enhancement as compensation is 4 times that for using R/C (4 acres of enhancement are equivalent to 1 acre of R/C).
- Re-establishment or creation can be used in combination with rehabilitation or enhancement. For example, 1 acre of impact to a Category III wetland would require 2 acres of R/C. If an applicant provides 1 acre of R/C (i.e., replacing the lost acreage at a 1:1 ratio), the remaining 1 acre of R/C necessary to compensate for the impact could be substituted with 2 acres of rehabilitation or 4 acres of enhancement.
- Generally the use of enhancement alone as compensation is discouraged. Using enhancement in combination with the replacement of wetland area at a minimum of 1:1 through re-establishment or creation is preferred.

These ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They are based on the observations of the success and risk of compensatory mitigation, as reviewed in Volume 1, and do not represent the specific risk or opportunities of any individual project.

As noted above, the ratios for compensatory mitigation are based on the assumption that the category and hydrogeomorphic (HGM) class or subclass of the affected wetland and the mitigation wetland are the same. The ratios may be adjusted either up or down if the category or HGM class or subclass of the wetland proposed for compensation is different. For example, ratios may be lower if impacts to a Category IV wetland are to be mitigated by creating a Category II wetland. The same is true for impacts to wetlands that currently would be considered *atypical* (see definition below).

Also, compensatory mitigation should not result in the creation, restoration, or enhancement of an atypical wetland. An atypical wetland is defined as a wetland whose design does not match the type of wetland that would be found in the geomorphic setting of the proposed site (i.e., the water source(s) and hydroperiod proposed for the mitigation site are not typical for the geomorphic setting). In addition, any designs that provide exaggerated morphology or require a berm or other engineered structures to hold back water would be considered atypical. For example, excavating a permanently inundated pond in an existing seasonally saturated or inundated wetland is one example of an enhancement project that could result in an atypical wetland. Another example would be excavating depressions in an existing wetland on a slope that required the construction of berms to impound water.

On a case-by-case basis, it is possible to use the scores from the Washington State wetland rating system to compare functions between the mitigation wetland and the impacted wetland. This information may also be used to adjust replacement ratios. Scores from the methods for assessing wetland functions (Hruby et al. 1999) provide another option to establish whether the functions lost will be replaced if both the affected wetland and the wetland used for compensation are of the same HGM class and subclass.

Mitigation ratios for projects in western Washington are shown in Table 8C-11. Refer to the text box on the basic assumptions on the previous page before reading the table. As mentioned previously, these ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They only factor in the observations of mitigation success and risk at a programmatic level, and do not represent the specific risk or opportunity of any individual project.

Table 8C-11. Mitigation ratios for projects in western Washington.

Category and Type of Wetland Impacts	Re-establishment or Creation	Rehabilitation Only[4]	Re-establishment or Creation (R/C) and Rehabilitation (RH)[4]	Re-establishment or Creation (R/C) and Enhancement (E)[4]	Enhancement Only[4]
All Category IV	1.5:1	3:1	1:1 R/C and 1:1RH	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 RH	1:1 R/C and 4:1 E	8:1
Category II Estuarine	Case-by-case	4:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
Category II Interdunal	2:1 Compensation has to be interdunal wetland	4:1 Compensation has to be interdunal wetland	1:1 R/C and 2:1 RH Compensation has to be interdunal wetland	Not considered an option[5]	Not considered an option[5]
All other Category II	3:1	6:1	1:1 R/C and 4:1 RH	1:1 R/C and 8:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 RH	1:1 R/C and 20:1 E	24:1
Category I based on score for functions	4:1	8:1	1:1 R/C and 6:1 RH	1:1 R/C and 12:1 E	16:1
Category I Natural Heritage site	Not considered possible[6]	6:1 Rehabilitation of a Natural Heritage site	R/C Not considered possible[6]	R/C Not considered possible[6]	Case-by-case
Category I Coastal Lagoon	Not considered possible[6]	6:1 Rehabilitation of a coastal lagoon	R/C not considered possible[6]	R/C not considered possible[6]	Case-by-case
Category I Bog	Not considered possible[6]	6:1 Rehabilitation of a bog	R/C Not considered possible[6]	R/C Not considered possible[6]	Case-by-case
Category I Estuarine	Case-by-case	6:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
NOTE: Preservation is discussed in the following section.					

[4] These ratios are based on the assumption that the rehabilitation or enhancement actions implemented represent the average degree of improvement possible for the site. Proposals to implement more effective rehabilitation or enhancement actions may result in a lower ratio, while less effective actions may result in a higher ratio. The distinction between rehabilitation and enhancement is not clear-cut. Instead, rehabilitation and enhancement actions span a continuum. Proposals that fall within the gray area between rehabilitation and enhancement will result in a ratio that lies between the ratios for rehabilitation and the ratios for enhancement.

[5] Due to the dynamic nature of interdunal systems, enhancement is not considered an ecologically appropriate action.

[6] Natural Heritage sites, coastal lagoons, and bogs are considered irreplaceable wetlands because they perform some special functions that cannot be replaced through compensatory mitigation. Impacts to such wetlands would therefore result in a net loss of some functions no matter what kind of compensation is proposed.

8C.3.2 Conditions for Increasing or Reducing Replacement Ratios

Increases in replacement ratios are appropriate under the following circumstances:

- Success of the proposed restoration or creation is uncertain
- A long time will elapse between impact and establishment of wetland functions at the mitigation site
- Proposed mitigation will result in a lower category wetland or reduced functions relative to the wetland being impacted
- The impact was unauthorized

Reductions in replacement ratios are appropriate under the following circumstances:

- Documentation by a qualified wetland specialist (see Appendix 8-H) demonstrates that the proposed mitigation actions have a very high likelihood of success based on prior experience
- Documentation by a qualified wetland specialist demonstrates that the proposed actions for compensation will provide functions and values that are significantly greater than the wetland being affected
- The proposed actions for compensation are conducted in advance of the impact and are shown to be successful
- In wetlands where several HGM classes are found within one delineated boundary, the areas of the wetlands within each HGM class can be scored and rated separately and the ratios adjusted accordingly, if **all of the following** apply:
  - The wetland does not meet any of the criteria for wetlands with “Special Characteristics” as defined in the rating system
  - The rating and score for the entire wetland is provided along with the scores and ratings for each area with a different HGM class.
  - Impacts to the wetland are all within an area that has a different HGM class from the one used to establish the initial category
  - The proponents provide adequate hydrologic and geomorphic data to establish that the boundary between HGM classes lies at least 50 feet outside of the footprint of the impacts

8C.3.3 Replacement Ratios for Preservation

In some cases, preservation of existing wetlands may be acceptable as compensation for wetland losses. Acceptable sites for preservation include those that:

- Are important due to their landscape position
- Are rare or limited wetland types
- Provide high levels of functions

Ratios for preservation in combination with other forms of mitigation generally range from 10:1 to 20:1, as determined on a case-by-case basis, depending on the quality of the wetlands being impacted and the quality of the wetlands being preserved. Ratios for preservation as the sole means of mitigation generally start at 20:1. Specific ratios will depend upon the significance of the preservation project and the quality of the wetland resources lost.

See Chapter 8 (Section 8.3.7.2) and Appendix 8-B for more information on preservation and the criteria for its use as compensation.

8C.3.4 Replacement Ratios for Temporal Impacts and Conversions

When impacts to wetlands are not permanent, local governments often require some compensation for the temporal loss of wetland functions. *Temporal impacts* refer to impacts to those functions that will eventually be replaced but cannot achieve similar functionality in a short time. For example, clearing forested wetland vegetation for pipeline construction could result in the temporal loss of functions, such as song bird habitat provided by the tree canopy. It may take over 20 years to re-establish the level of function lost as a result of clearing the trees. Although the wetlands will be re-vegetated and over time it is anticipated that their previous level of functioning will be re-established, a temporal loss of functions will occur. There is also some risk of failure associated with the impacts or alterations, especially when soil is compacted by equipment, deep excavation is required, and pipeline trenches alter the water regime at the site.

Therefore, in addition to restoring the affected wetland to its previous condition, local governments should consider requiring compensation to account for the risk and temporal loss of wetland functions. Generally, the ratios for temporal impacts to forested and scrub-shrub wetlands are <u>one-quarter</u> of the recommended ratios for permanent impacts (refer to Table 8C-11), provided that the following measures are satisfied:

- An explanation of how hydric soil, especially deep organic soil, is stored and handled in the areas where the soil profile will be severely disturbed for a fairly significant depth or time

- Surface and groundwater flow patterns are maintained or can be restored immediately following construction

- A 10-year monitoring and maintenance plan is developed and implemented for the restored forest and scrub-shrub wetlands

- Disturbed buffers are re-vegetated and monitored

- Where appropriate, the hydroseed mix to be applied on re-establishment areas is identified

When impacts are to a native emergent community and there is a potential risk that its re-establishment will be unsuccessful, compensation for temporal loss and the potential risk should be required in addition to restoring the affected wetland and monitoring the site. If the impacts are to wetlands dominated by non-native vegetation (e.g., blackberry, reed canarygrass, or pasture grasses), restoration of the affected wetland with native species and monitoring after construction is generally all that is required.

Loss of functions due to the permanent conversion of wetlands from one type to another also requires compensation. When wetlands are not completely lost but are converted to another type, such as a forested wetland converted to an emergent or shrub wetland (e.g., for a utility right-of-way), some functions are lost or reduced.

The ratios for conversion of wetlands from one type to another will vary based on the degree of the alteration, but they are generally one-half of the recommended ratios for permanent impacts (refer to Table 8C-11).

Refer to Appendix 8-F for the rationale for the ratios provided in this appendix.

Specific guidance has been developed for conversions of wetlands to cranberry bogs. Please refer to the 1998 *Guidelines for Implementation of Compensatory Mitigation Requirements for Conversion of Wetlands to Cranberry Bogs* for information on ratios associated with this activity (Washington State Department of Ecology, U.S. Environmental Protection Agency Region 10, U.S. Army Corps of Engineers Seattle District, and U.S. Fish and Wildlife Service. 1998. Special Public Notice: http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/ACF101C.pdf).

Appendix 8-D

Guidance on Widths of Buffers and Ratios for Compensatory Mitigation for Use with the Eastern Washington Wetland Rating System

8D.1 Introduction

This appendix provides guidance on widths of buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetland Rating System for Eastern Washington-Revised* (Hruby 2004a). Refer to Appendix 8-C for guidance for western Washington. Appendices 8-C through 8-F have been formatted similar to the main text of this volume (i.e., with a numbering system) to help with organization.

The tables below list the recommended widths of buffers for various alternatives, examples of measures to minimize impacts, and ratios for compensatory mitigation.

- **Table 8D-1.** Width of buffers needed to protect wetlands in eastern Washington if impacts from land use and wetland functions are NOT incorporated (Buffer Alternative 1). [Page 4]
- **Table 8D-2.** Width of buffers based on wetland category and modified by the intensity of the impacts from changes in proposed land use (Buffer Alternative 2). [Page 5]
- **Table 8D-3.** Types of land uses that can result in high, moderate, and low levels of impacts to adjacent wetlands (used in Buffer Alternatives 2 and 3). [Page 5]
- **Table 8D-4.** Width of buffers needed to protect Category IV wetlands in eastern Washington (Buffer Alternative 3). [Page 6]
- **Table 8D-5.** Width of buffers needed to protect Category III wetlands in eastern Washington (Buffer Alternative 3). [Page 6]
- **Table 8D-6**. Width of buffers needed to protect Category II wetlands in eastern Washington (Buffer Alternative 3). [Page 7]
- **Table 8D-7.** Width of buffers needed to protect Category I wetlands in eastern Washington (Buffer Alternative 3). [Page 8]
- **Table 8D-8.** Examples of measures to minimize impacts to wetlands from different types of activities. [Page 10]

- **Table 8D-9.** Comparison of recommended buffer widths for high intensity land uses between Alternative 3 (step-wise scale) and Alternative 3A (graduated scale) based on score for habitat functions [Page 14].
- **Table 8D-10.** Comparison of recommended widths for buffers between Alternative 3 and Alternative 3A for proposed land uses with high impacts with mitigation for impacts. [Page 15]
- **Table 8D-11.** Mitigation ratios for projects in eastern Washington. [Page 21]

The guidance in this appendix can be used in developing regulations such as critical areas ordinances for protecting and managing the functions and values of wetlands. The recommendations are based on the analysis of the current scientific literature found in Volume 1. The detailed rationale for the recommendations is provided in Appendices 8-E and 8-F.

The recommendations on buffer widths and mitigation ratios are general, and there may be some wetlands for which these recommendations are either too restrictive or not protective enough. The recommendations are based on the assumption that a wetland will be protected only at the scale of the site itself. They do not reflect buffers and ratios that might result from regulations that are developed based on a larger landscape-scale approach.

8D.2 Widths of Buffers

Requiring buffers of a specific width has been one of the primary methods by which local jurisdictions in Washington have protected the functions and values of wetlands. Generally, buffers are the uplands adjacent to an aquatic resource that can, through various physical, chemical, and biological processes, reduce impacts to wetlands from adjacent land uses. The physical characteristics of buffers (e.g., slope, soils, vegetation, and width) determine how well buffers reduce the adverse impacts of human development. These characteristics are discussed in detail in Chapter 5, Volume 1.

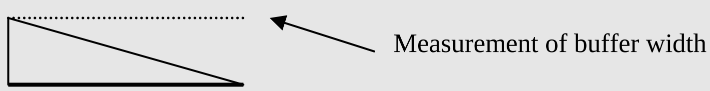
In addition to reducing the impacts of adjacent land uses, buffers also protect and maintain a wide variety of functions and values provided by wetlands. For example, buffers can provide the terrestrial habitats needed by many species of wildlife that use wetlands to meet some of their needs.

The review of the scientific literature has shown, however, that buffers alone cannot adequately protect all functions that a wetland performs. Additional guidance is, therefore, provided on other ways in which wetlands can be managed and regulated to provide some of the necessary protection that buffers alone do not provide. The following guidance for protecting the functions and values of wetlands is based on their category as determined through the rating system for eastern Washington.

Basic assumptions for using the guidance on widths for buffers

Recommendations for widths of buffers assume that:

- The wetland has been categorized using the *Washington State Wetland Rating System for Eastern Washington-Revised* (Hruby 2004a).
- The buffer is vegetated with native plant communities that are appropriate for the *ecoregion* or with a plant community that provides similar functions. Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. The U.S. Environmental Protection Agency maintains updated maps of ecoregions that are available at http://www.epa.gov/naaujydh/pages/models/ecoregions.htm . Ecoregions currently mapped for Washington are: Coast Range, Puget Lowland, Cascades, Eastern Cascades Slopes and Foothills, North Cascades, Columbia Plateau, Blue Mountains, and Northern Rockies.
- If the vegetation in the buffer is disturbed (grazed, mowed, etc.), proponents planning changes to land use that will increase impacts to wetlands need to rehabilitate the buffer with native plant communities that are appropriate for the ecoregion, or with a plant community that provides similar functions.
- The width of the buffer is measured in horizontal distance (see drawing below).



- The buffer will remain relatively undisturbed in the future within the width specified.

Three alternatives for protecting the functions of wetlands using buffers are described in the following sections:

- **Buffer Alternative 1.** Width based only on wetland category.
- **Buffer Alternative 2**. Width based on wetland category and the intensity of impacts from proposed changes in land use.
- **Buffer Alternative 3.** Width based on wetland category, intensity of impacts, and wetland functions or special characteristics. This alternative has two options for determining the widths of buffers when they are based on the score for habitat. Alternative 3 provides three buffer widths based on habitat scores, while Alternative 3A provides a graduated scale of widths for buffers based on habitat scores.

The buffer widths recommended for each alternative were based on the review of scientific information in Volume 1. The guidance in this appendix synthesizes the information about the types and sizes of buffers needed to protect the functions and special characteristics of wetlands.

Appendices 8-C and 8-D do not provide the metric equivalents for buffer widths even though most of the research on buffers uses the metric scale. This decision was made because most local governments use the English Standard measures. For example, a buffer width is set at 50 feet rather than 15 meters.

8D.2.1 Buffer Alternative 1: Width Based Only on Wetland Category

This alternative, in which the width of buffers is based only on the category of the wetland, is the simplest (Table 8D-1). The width recommended for each category of wetland in Alternative 1 is the widest recommended for that category in both Alternatives 2 and 3 (discussed below). Alternative 1 provides the least flexibility because many different types of wetlands and types of human impacts are combined. For example, not all wetlands that fall into Category I or II need a 300-foot buffer. If no distinctions are made between the wetlands that fall into Category I or II, all wetlands that fall into these categories have to be protected with a 300-foot buffer so adequate protection is provided for those wetlands that do need a buffer this wide. Also, the widths recommended for this alternative are those needed to protect the wetland from proposed land uses that have the greatest impacts since no distinctions between impacts are made.

Table 8D-1. Width of buffers needed to protect wetlands in eastern Washington if impacts from land use and wetland functions are NOT incorporated (Buffer Alternative 1).

Category of Wetland	Widths of Buffers
IV	50 ft
III	150 ft
II	200 ft
I	250 ft

8D.2.2 Buffer Alternative 2: Width Based on Wetland Category and Modified by the Intensity of the Impacts from Proposed Land Use

The second alternative increases the regulatory flexibility by including the concept that not all proposed changes in land uses have the same level of impact (Table 8D-2). For example, one new residence being built on 5 acres of land near a wetland is expected to have a smaller impact than 20 houses built on the same 5 acres. Three categories of impacts from proposed land uses are outlined: land uses that can create high impacts, moderate impacts, and low impacts to wetlands. Different land uses that can cause these levels of impacts are listed in Table 8D-3.

Table 8D-2. Width of buffers needed to protect wetlands in eastern Washington considering impacts of proposed land uses (Buffer Alternative 2).

Category of Wetland	Land Use with Low Impact *	Land Use with Moderate Impact *	Land Use with High Impact*
IV	25 ft	40 ft	50 ft
III	75 ft	110 ft	150 ft
II	100 ft	150 ft	200 ft
I	125 ft	190 ft	250 ft
* See Table 8D-3 in this appendix for types of land uses that can result in low, moderate, and high impacts to wetlands.			

Table 8D-3. Types of proposed land use that can result in high, moderate, and low levels of impacts to adjacent wetlands.

Level of Impact from Proposed Change in Land Use	Types of Land Use Based on Common Zoning Designations *
High	• Commercial • Urban • Industrial • Institutional • Retail sales • Residential (more than 1 unit/acre) • Conversion to 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.) • Hobby farms
Moderate	• Residential (1 unit/acre or less) • Moderate-intensity open space (parks with biking, jogging, etc.) • Conversion to moderate-intensity agriculture (orchards, hay fields, etc.) • Paved trails • Building of logging roads • Utility corridor or right-of-way shared by several utilities and including access/maintenance road
Low	• Forestry (cutting of trees only) • Low-intensity open space (hiking, bird-watching, preservation of natural resources, etc.) • Unpaved trails • Utility corridor without a maintenance road and little or no vegetation management.
* Local governments are encouraged to land-use designations for zoning that are consistent with these examples.	

8D.2.3 Buffer Alternative 3: Width Based on Wetland Category, Intensity of Impacts, Wetland Functions, or Special Characteristics

The third alternative provides the most flexibility by basing the widths of buffers on three factors: the wetland category, the intensity of the impacts (as used in Alternative 2), and the functions or special characteristics of the wetland that need to be protected as determined through the rating system. The recommended widths for buffers are shown in Tables 8D-4 to 8D-7. Using this alternative, a wetland may fall into more than one category in the table. For example, a forested, riparian, wetland may be rated a Category II wetland because it is a riparian forest, but it may be rated a Category I wetland based on its score for functions.

If a wetland meets more than one of the characteristics listed in Tables 8D-4 to 8D-7, the buffer recommended to protect the wetland is the widest one. For example, if a Category I wetland (Table 8D-7) scores 32 points for habitat and 27 points for water quality functions, a 200-foot buffer is needed for land uses with high impacts because the widths needed to protect habitat are wider than those needed for the other functions.

Table 8D-4. Width of buffers needed to protect Category IV wetlands in eastern Washington (Buffer Alternative 3 for wetlands scoring less than 30 points for all functions).

Wetland Characteristics	Buffer Widths by Impact of Proposed Land Use	Other Measures Recommended for Protection
Score for all 3 basic functions is less than 30 points	Low - 25 ft Moderate – 40 ft High – 50 ft	No recommendations at this time[1]

Table 8D-5. Width of buffers needed to protect Category III wetlands in eastern Washington (Buffer Alternative 3 for wetlands scoring 30 – 50 points for all functions or isolated vernal pools).

Wetland Characteristics	Buffer Widths by Impact of Proposed Land Use	Other Measures Recommended for Protection
Moderate level of function for habitat (score for habitat 20 - 28 points)	Low - 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[1]
Not meeting above characteristic	Low - 40 ft Moderate – 60 ft High – 80 ft	No recommendations at this time[1]

[1] No information on other measures for protection was available at the time this document was written. The Washington State Department of Ecology will continue to collect new information for future updates to this document.

Table 8D-6. Width of buffers needed to protect Category II wetlands in eastern Washington (Buffer Alternative 3 for wetlands scoring 51-69 points for all functions or having the "Special Characteristics" identified in the rating system).

Wetland Characteristics	Buffer Widths by Impact of Proposed Land Use (apply most protective if more than one criterion is met)	Other Measures Recommended for Protection
High level of function for habitat (score for habitat 29 - 36 points)	Low - 100 ft Moderate – 150 ft High – 200 ft	Maintain connections to other habitat areas
Moderate level of function for habitat (score for habitat 20 - 28 points)	Low - 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[2]
High level of function for water quality improvement and low for habitat (score for water quality 24 - 32 points; habitat less than 20 points)	Low - 50 ft Moderate – 75 ft High – 100 ft	No additional surface discharges of untreated runoff
Vernal pool	Low - 100 ft Moderate – 150 ft High – 200 ft OR Develop a regional plan to protect the most important vernal pool complexes – buffers of vernal pools outside protection zones can then be reduced to: Low - 40 ft Moderate – 60 ft High – 80 ft	No intensive grazing or tilling in the wetland
Riparian forest	Buffer width to be based on score for habitat functions or water quality functions	Riparian forest wetlands need to be protected at a watershed or sub-basin scale (protection of the water regime in the watershed) Other protection based on needs to protect habitat and/or water quality functions
Not meeting above characteristics	Low - 50 ft Moderate – 75 ft High – 100 ft	No recommendations at this time[2]

[2] See footnote on the previous page.

Table 8D-7. Width of buffers needed to protect Category I wetlands in eastern Washington (Buffer Alternative 3 for wetlands scoring 70 points or more for all functions or having the "Special Characteristics" identified in the rating system).

Wetland Characteristics	Buffer Widths by Impact of Proposed Land Use (apply most protective if more than one criterion is met)	Other Measures Recommended for Protection
Natural Heritage Wetlands	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional surface discharges to wetland or its tributaries No septic systems within 300 ft Restore degraded parts of buffer
Bogs	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional surface discharges to wetland or its tributaries Restore degraded parts of buffer
Forested	Buffer size to be based on score for habitat functions or water quality functions	If forested wetland scores high for habitat, need to maintain connectivity to other natural areas Restore degraded parts of buffer
Alkali	Low – 100 ft Moderate – 150 ft High – 200 ft	No additional surface discharges to wetland or its tributaries Restore degraded parts of buffer
High level of function for habitat (score for habitat 29 - 36 points)	Low – 100 ft Moderate – 150 ft High – 200 ft	Maintain connections to other habitat areas Restore degraded parts of buffer
Moderate level of function for habitat (score for habitat 20 - 28 points)	Low – 75 ft Moderate – 110 ft High – 150 ft	No recommendations at this time[3]
High level of function for water quality improvement (24 – 32 points) and low for habitat (less than 20 points)	Low – 50 ft Moderate – 75 ft High – 100 ft	No additional surface discharges of untreated runoff
Not meeting any of the above characteristics	Low – 50 ft Moderate – 75 ft High – 100 ft	No recommendations at this time[3]

[3] See footnote on page 6.

8D.2.4 Special Conditions for a Possible Reduction in Buffer Widths

8D.2.4.1 Condition 1: Reduction in Buffer Width Based on Reducing the Intensity of Impacts from Proposed Land Uses

The buffer widths recommended for proposed land uses with high-intensity impacts to wetlands can be reduced to those recommended for moderate-intensity impacts under the following conditions:

- For wetlands that score moderate or high for habitat (20 points or more for the habitat functions), the width of the buffer can be reduced if both of the following criteria are met:

  1) A relatively undisturbed, vegetated corridor at least 100 feet wide is protected between the wetland and any other Priority Habitats as defined by the Washington State Department of Fish and Wildlife ("relatively undisturbed" and "vegetated corridor" are defined in questions H 2.1 and H 2.2.1 of the *Washington State Wetland Rating System for Eastern Washington – Revised* (Hruby 2004a)). Priority Habitats in eastern Washington include:

     - Wetlands
     - Riparian zones
     - Aspen stands
     - Cliffs
     - Prairies
     - Caves
     - Stands of Oregon White Oak
     - Old growth forests
     - Talus slopes
     - Urban natural open space (for current definitions of Priority Habitats see http://wdfw.wa.gov/hab/phshabs.htm)

     The corridor must be protected for the entire distance between the wetland and the Priority Habitat by some type of legal protection such as a conservation easement.

  2) Measures to minimize the impacts of different land uses on wetlands, such as the examples summarized in Table 8D-8, are applied.

- For wetlands that score less than 20 points for habitat, the buffer width can be reduced to that required for moderate land-use impacts by applying measures to minimize the impacts of the proposed land uses (see examples in Table 8D-8).

Table 8D-8. Examples of measures to minimize impacts to wetlands from proposed change in land use that have high impacts. (This is not a complete list of measures.)

Examples of Disturbance	Activities and Uses that Cause Disturbances	Examples of Measures to Minimize Impacts
Lights	• Parking lots • Warehouses • Manufacturing • Residential	• Direct lights away from wetland
Noise	• Manufacturing • Residential	• Locate activity that generates noise away from wetland
Toxic runoff*	• Parking lots • Roads • Manufacturing • Residential areas • Application of agricultural pesticides • Landscaping	• Route all new, untreated runoff away from wetland while ensuring wetland is not dewatered • Establish covenants limiting use of pesticides within 150 ft of wetland • Apply integrated pest management
Stormwater runoff	• Parking lots • Roads • Manufacturing • Residential areas • Commercial • Landscaping	• Retrofit stormwater detention and treatment for roads and existing adjacent development • Prevent channelized flow from lawns that directly enters the buffer
Change in water regime	• Impermeable surfaces • Lawns • Tilling	• Infiltrate or treat, detain, and disperse into buffer new runoff from impervious surfaces and new lawns
Pets and human disturbance	• Residential areas	• Use privacy fencing; plant dense vegetation to delineate buffer edge and to discourage disturbance using vegetation appropriate for the ecoregion; place wetland and its buffer in a separate tract
Dust	• Tilled fields	• Use best management practices to control dust
* These examples are not necessarily adequate for minimizing toxic runoff if threatened or endangered species are present at the site.		

8D.2.4.2 Condition 2: Reductions in Buffer Widths Where Existing Roads or Structures Lie Within the Buffer

Where a legally established, non-conforming use of the buffer exists (such as a road or structure that lies within the width of buffer recommended for that wetland), proposed actions in the buffer may be permitted as long as they do not increase the degree of non-conformity. This means no increase in the impacts to the wetland from activities in the buffer.

For example, if a land use with high impacts (e.g., building an urban road) is being proposed next to a Category II wetland with a moderate level of function for habitat, a 150-foot buffer would be needed to protect functions (see Table 8D-6). If, however, an existing urban road is already present and only 50 feet from the edge of the Category II wetland, the additional 100 feet of buffer may not be needed if the road is being widened. A vegetated buffer on the other side of the road would not help buffer the existing impacts to the wetland from the road. If the existing road is resurfaced or widened (e.g., to add a sidewalk) along the upland edge, without any further roadside development that would increase the degree of non-conformity, the additional buffer is not necessary. The associated increase in impervious surface from widening a road, however, may necessitate mitigation for impacts from stormwater.

If, however, the proposal is to build a new development (e.g., shopping center) along the upland side of the road, the impacts to the wetland and its functions may increase. This would increase the degree of non-conformity. The project proponent would need to provide the additional 100 feet of buffer extending beyond the road or apply buffer averaging (see Section 8D.1.6).

8D.2.4.3 Condition 3: Reduction in Buffer Widths Through an Individual Rural Stewardship Plan

A Rural Stewardship Plan (RSP) is the product of a collaborative effort between rural property owners and a local government to tailor a management plan specific for a rural parcel of land. The goal of a RSP is better management of wetlands than would be achieved through strict adherence to regulations. In exchange, the landowner gains flexibility in the widths of buffers required, in clearing limits, and in other requirements found in the regulations. For example, dense development in rural residential areas can be treated as having a low level of impact when the development of the site is managed through a locally approved RSP. The voluntary agreement includes provisions for restoration, maintenance, and long-term monitoring and specifies the widths of buffers needed to protect each wetland within the RSP.

8D.2.5 Conditions for Increasing the Width of, or Enhancing, the Buffer

8D.2.5.1 Condition 1: Buffer is Not Vegetated with Plants Appropriate for the Region

The recommended widths for buffers are based on the assumption that the buffer is vegetated with a native plant community appropriate for the ecoregion or with one that performs similar functions. If the existing buffer is unvegetated, sparsely vegetated, or vegetated with invasive species that do not perform needed functions, the buffer should either be planted to create the appropriate plant community or the buffer should be widened to ensure that adequate functions of the buffer are provided. Generally, improving the vegetation will be more effective than widening the buffer.

8D.2.5.2 Condition 2: Buffer Has a Steep Slope

The review of the literature (Volume 1) indicates that the effectiveness of buffers at removing pollutants before they enter a wetland decreases as the slope increases. If a buffer is to be based on the score for its ability to improve water quality (see Tables 8D-4 through 8D-7) rather than habitat or other criteria, then the buffer should be increased by 50% if the slope is greater than 30% (a 3-foot rise for every 10 feet of horizontal distance).

8D.2.5.3 Condition 3: Buffer Is Used by Species Sensitive to Disturbance

If the wetland provides habitat for a species that is particularly sensitive to disturbance (such as a threatened or endangered species), the width of the buffer should be increased to provide adequate protection for the species based on its particular, life-history needs. Some buffer requirements for priority species are available on the Washington State Department of Fish and Wildlife web page (http://wdfw.wa.gov/hab/phsrecs.htm). The list of priority species for vertebrates is at http://wdfw.wa.gov/hab/phsvert.htm; for invertebrates it is at http://wdfw.wa.gov/hab/phsinvrt.htm. Information on the buffer widths needed by some threatened, endangered, and sensitive species of wildlife is provided in Appendix 8-H.

8D.2.6 Buffer Averaging

The widths of buffers may be averaged if this will improve the protection of wetland functions, or if it is the only way to allow for reasonable use of a parcel. There is no scientific information available to determine if averaging the widths of buffers actually protects functions of wetlands. The authors have concluded that averaging could be allowed in the following situations:

Averaging may not be used in conjunction with any of the other provisions for reductions in buffers listed above (listed above).

- Averaging to **improve wetland protection** may be permitted when **all** of the following conditions are met:
  - The wetland has significant differences in characteristics that affect its habitat functions, such as a wetland with a forested component adjacent to a degraded emergent component or a "dual-rated" wetland with a Category I area adjacent to a lower rated area
  - The buffer is increased adjacent to the higher-functioning area of habitat or more sensitive portion of the wetland and decreased adjacent to the lower-functioning or less sensitive portion
  - The total area of the buffer after averaging is equal to the area required without averaging
  - The buffer at its narrowest point is never less than 3/4 of the required width
- Averaging to **allow reasonable use** of a parcel may be permitted when **all** of the following are met:
  - There are no feasible alternatives to the site design that could be accomplished without buffer averaging
  - The averaged buffer will not result in degradation of the wetland's functions and values as demonstrated by a report from a qualified wetland expert (see Appendix 8-G for a definition of a qualified wetland expert)
  - The total buffer area after averaging is equal to the area required without averaging
  - The buffer at its narrowest point is never less than 3/4 of the required width

8D.2.7 Modifying Buffer Widths in Alternative 3 Using a Graduated Scale for the Habitat Functions (Alternative 3A)

Alternative 3 contains recommendations for protecting the habitat functions of wetlands using only three groupings of scores (0-19, 20-28, 29-36). As a result, a one-point difference between 28 and 29 can result in a 150-foot increase in the width of a buffer around a wetland. The habitat scores were divided into three groups to simplify the regulations based on this guidance. This division is not based on a characterization of risks since the scientific information indicates that the decrease in risk with increasing widths of buffers is relatively continuous for habitat functions.

Such a large increase in width with a one-point increase in the habitat score may be contentious. A jurisdiction may wish to reduce the increments in the widths for buffers by developing a more graduated (but inherently more complicated) scale based on the scores for habitat. Table 8D-9 provides one example of a graduated scale for widths of buffers where the width increases by 10 feet for every one-point increase in the habitat score. (Figure 8D-1 shows the buffer widths graphically.)

Table 8D-9. Comparison of widths for buffers in Alternatives 3 (step-wise scale) and 3A (graduated scale) for proposed land uses with high impacts based on the score for habitat functions in eastern Washington.

Points for Habitat from Wetland Rating Form	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Alternative 3	100	150	150	150	150	150	150	150	150	150	200	200	200	200	200	200	200	200
Alternative 3A	100	100	100	110	120	130	140	150	160	170	180	190	200	200	200	200	200	200

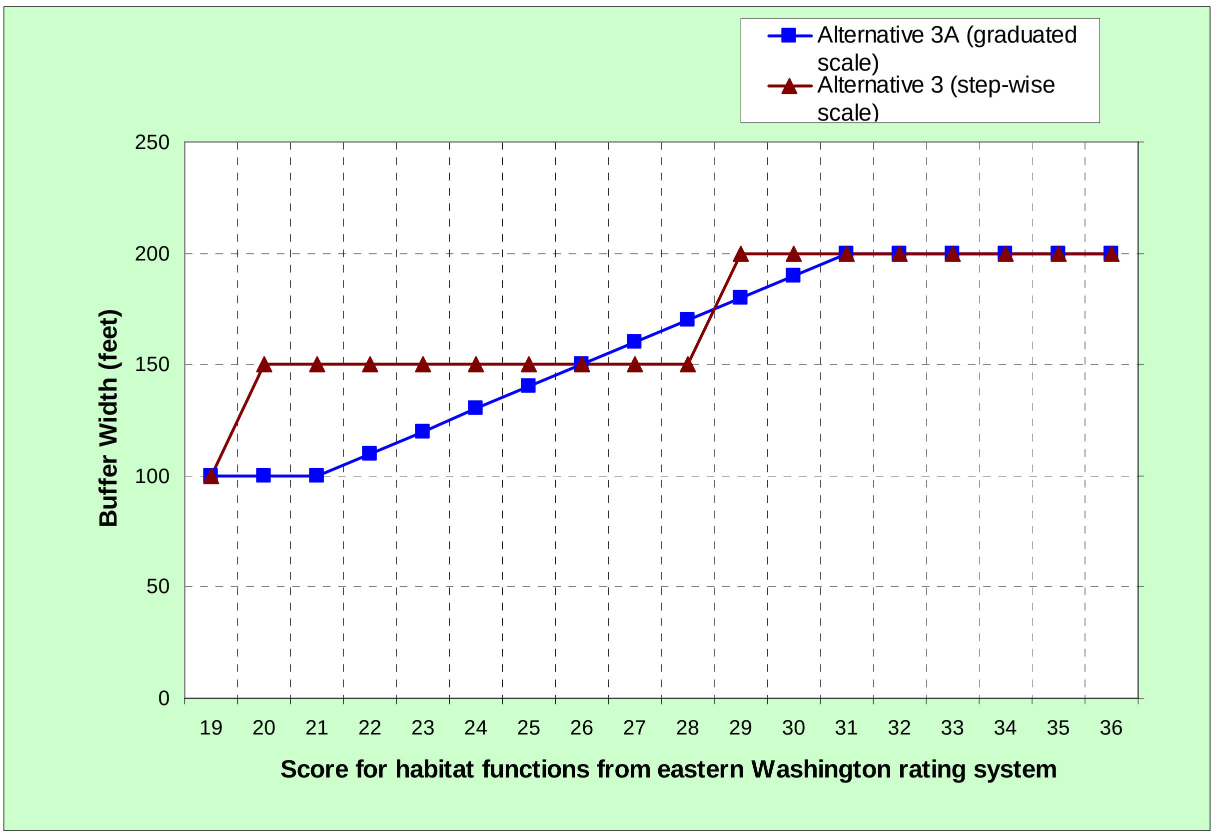


Figure 8D-1. Graphical comparison of widths for buffers in Alternative 3 and 3A for proposed land uses with high impacts based on the score for habitat functions in eastern Washington.

Other scales are possible as long as they keep within the limits established from the scientific information currently available: wetlands with scores for habitat that are higher than 31 points need buffers that are at least 200-feet wide; wetlands with a score of 26 points need buffers of at least 150 feet; and wetlands with a score of 22 points need buffers that are at least 100-feet wide.

These buffer widths can be further reduced by 25 percent if a proposed project with high impacts implements mitigation measures such as those described in Table 8D-8. The measures are part of "Condition 1" in Section 8D.1.4 (Special Conditions for a Possible Reduction in Buffer Widths). The buffer widths under Buffer Alternatives 3 and 3A, and the corresponding 25 percent reduction (per buffer reduction condition 1) are shown in Table 8C-10 and represented graphically below in Figure 8D-2.

Table 8D-10. Comparison of widths for buffers in Alternatives 3 (step-wise scale) and 3A (graduated scale) for proposed land uses with high impacts based on the score for habitat functions in eastern Washington if the impacts are mitigated.

Points for Habitat from Wetland Rating Form	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Alternative 3 (**with** mitigation of impacts)	75	110	110	110	110	110	110	110	110	110	150	150	150	150	150	150	150	150
Alternative 3A (**with** mitigation of impacts)	75	75	75	83	90	98	105	113	20	128	135	143	150	150	150	150	150	150

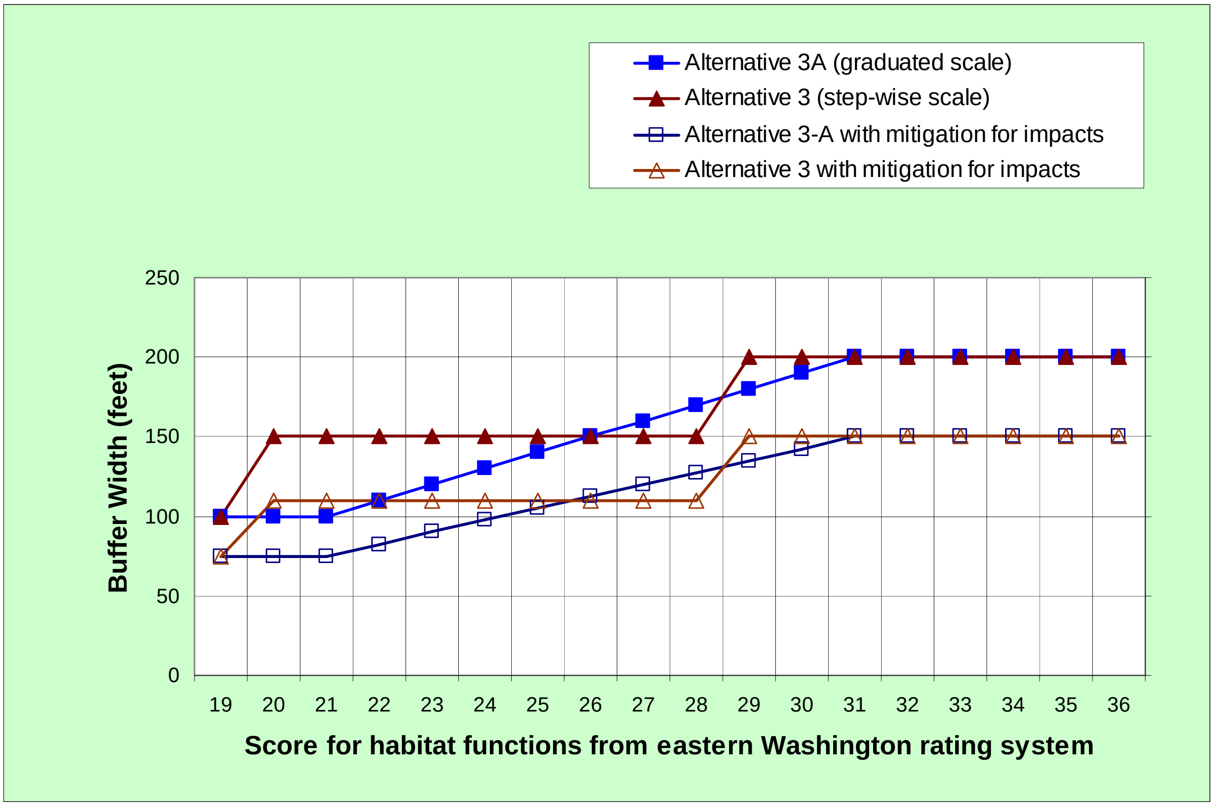


Figure 8D-2. Graphical comparison of widths for buffers in Alternatives 3 and 3A based on the score for habitat functions in eastern Washington with and without mitigating impacts of proposed development outside the buffer.

> Alternatives 3 and 3A represent two separate approaches for determining widths of buffers for wetlands scoring between 20 and 31 points for the habitat functions. Local governments should select one of the two approaches and should not hybridize the approaches or adopt both at the same time.

8D.3 Ratios for Compensatory Mitigation

When the acreage required for compensatory mitigation is divided by the acreage of impact, the result is a number known variously as a *replacement,* compensation, or *mitigation* ratio. Compensatory mitigation ratios are used to help ensure that compensatory mitigation actions are adequate to offset unavoidable wetland impacts by requiring a greater amount of mitigation area than the area of impact. Requiring greater mitigation area helps compensate for the risk that a mitigation action will fail and for the time lag that occurs between the wetland impact and achieving a fully functioning mitigation site.

8D.3.1 Definitions of Types of Compensatory Mitigation

The ratios presented are based on the type of compensatory mitigation proposed (e.g., restoration, creation, and enhancement). In its *Regulatory Guidance Letter 02-02*, the U.S. Army Corps of Engineers provided definitions for these types of compensatory mitigation. For consistency, the authors of this document use the same definitions which are provided below.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into:

- **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. Re-establishment results in a gain in wetland acres (and functions). Activities could include removing fill material, plugging ditches, or breaking drain tiles.
- **Rehabilitation:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions of a **degraded** wetland. Rehabilitation results in a gain in wetland function but does <u>not</u> result in a gain in wetland acres. Activities could involve breaching a dike to reconnect wetlands to a floodplain or return tidal influence to a wetland.

Creation (Establishment): 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 acres. Activities typically involve excavation of upland soils to elevations that will produce a wetland hydroperiod, create hydric soils, and support the growth of hydrophytic plant species.

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. 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. 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 activities.

Protection/Maintenance (Preservation): Removing a threat to, or preventing the decline of, wetland conditions by an action in or near a wetland. This includes the purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term *preservation*. Preservation does not result in a gain of wetland acres, may result in a gain in functions, and will be used only in exceptional circumstances.

Distinction between rehabilitation and enhancement

The distinction between rehabilitation and enhancement as defined above is not clear-cut and can be hard to understand. Actions that rehabilitate or enhance wetlands span a continuum of activities that cannot be defined by specific criteria.

Rehabilitation ←——————————→ *Enhancement*

In general, rehabilitation involves actions that are more sustainable and that reinstate environmental processes, both at the site and landscape scale (e.g., reinstating hydrologic processes in a diked floodplain by breaching the dikes). Rehabilitation actions often focus on restoring environmental processes that have been disturbed or altered by previous or ongoing human activity. Ecology further defines *rehabilitation* as:

- Actions that restore the original hydrogeomorphic (HGM) class, or subclass, to a wetland whose current HGM class, or subclass, has been changed by human activities
- Actions that restore the water regime that was present and maintained the wetland before human activities changed it

Any other actions taken in existing wetlands would be considered *enhancement.* Enhancement typically involves actions that provide gains in only one or a few functions and can lead to a decline in other functions. Enhancement actions often focus on structural or superficial improvements to a site and generally do not address larger-scale environmental processes.

For example, a wetland that was once a forested, riverine wetland was changed to a depressional, emergent wetland by the construction of a dike and through grazing. Rehabilitating the wetland would involve breaching the dike so the wetland becomes a riverine wetland again, discontinuing the grazing, and reforesting the area. Discontinuing the grazing and reforesting the wetland without re-establishing the links to the riverine system would be considered enhancement.

Basic assumptions for using the guidance on ratios

- The ratios are for a compensatory mitigation project that is concurrent with impacts to wetlands. If impacts are to be mitigated by using an approved and established mitigation bank, the rules and ratios applicable to the bank should be used.
- The ratios are based on the assumption that the category (based on the rating system for eastern Washington) and hydrogeomorphic (HGM) class or subclass of the wetland proposed as compensation are the same as the category and HGM class or subclass of the affected wetland (e.g., impacts to a Category II, riverine wetland are compensated by creating, restoring, or enhancing a Category II riverine wetland).
- Ratios for projects in which the category and HGM class or subclass of wetlands proposed as compensation is not the same as that of the wetland affected will be determined on a case-by-case basis using the recommended ratios as a starting point. The ratios could be higher in such cases.
- The ratio for using rehabilitation as compensation is 2 times that for using re-establishment or creation (R/C) (2 acres of rehabilitation are equivalent to 1 acre of R/C). The ratio for using enhancement as compensation is 4 times that for using R/C (4 acres of enhancement are equivalent to 1 acre of R/C).
- Re-establishment or creation can be used in combination with rehabilitation or enhancement. For example, 1 acre of impact to a Category III wetland would require 2 acres of R/C. If an applicant provides 1 acre of R/C (i.e., replacing the lost acreage at a 1:1 ratio), the remaining 1 acre of R/C necessary to compensate for the impact could be substituted with 2 acres of rehabilitation or 4 acres of enhancement.
- Generally the use of enhancement alone as compensation is discouraged. Using enhancement in combination with the replacement of wetland area at a minimum of 1:1 through re-establishment or creation is preferred.

These ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They are based on the observations of the success and risk of compensatory mitigation, as reviewed in Volume 1, and do not represent the specific risk or opportunities of any individual project.

As noted above, the ratios for compensatory mitigation are based on the assumption that the category and hydrogeomorphic (HGM) class or subclass of the affected wetland and the mitigation wetland are the same. The ratios may be adjusted either up or down if the category or HGM class or subclass of the wetland proposed for compensation is different. For example, ratios may be lower if impacts to a Category IV wetland are to be mitigated by creating a Category II wetland. The same is true for impacts to wetlands that currently would be considered *atypical* (see definition below).

Also, compensatory mitigation should not result in the creation, restoration, or enhancement of an atypical wetland. An atypical wetland is defined as a wetland whose design does not match the type of wetland that would be found in the geomorphic setting of the proposed site (i.e., the water source(s) and hydroperiod proposed for the mitigation site are not typical for the geomorphic setting). In addition, any designs that provide exaggerated morphology or require a berm or other engineered structures to hold back water would be considered atypical. For example, excavating a permanently inundated pond in an existing seasonally saturated or inundated wetland is one example of an enhancement project that could result in an atypical wetland. Another example would be excavating depressions in an existing wetland on a slope that required the construction of berms to impound water.

On a case-by-case basis, it is possible to use the scores from the Washington State wetland rating system to compare functions between the mitigation wetland and the impacted wetland. This information may also be used to adjust replacement ratios. Scores from the methods for assessing wetland functions (Hruby et al. 1999) provide another option to establish whether the functions lost will be replaced if both the affected wetland and the wetland used for compensation are of the same HGM class and subclass.

Mitigation ratios for projects in eastern Washington are shown in Table 8D-11. Refer to the text box on the basic assumptions on the previous page before reading the table. As mentioned previously, these ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They only factor in the observations of mitigation success and risk at a programmatic level, and do not represent the specific risk or opportunity of any individual project.

Table 8D-11: Mitigation ratios for projects in eastern Washington.

Category and Type of Wetland Impacts	Re-establishment or Creation	Rehabilitation Only[4]	Re-establishment or Creation (R/C) and Rehabilitation (RH)[4]	Re-establishment or Creation (R/C) and Enhancement (E)[4]	Enhancement Only[4]
All Category IV	1.5:1	3:1	1:1 R/C and 1:1 RH	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 RH	1:1 R/C and 4:1 E	8:1
Category II Forested	4:1	8:1	1:1 R/C and 4:1 RH	1:1 R/C and 6:1 E	16:1
Category II Vernal pool	2:1 Replacement has to be seasonally ponded wetland	4:1 Replacement has to be seasonally ponded wetland	1:1 R/C and 2:1 RH	Case-by-case	Case-by-case
All other Category II	3:1	6:1	1:1 R/C and 4:1 RH	1:1 R/C and 8:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 RH	1:1 R/C and 20:1 E	24:1
Category I based on score for functions	4:1	8:1	1:1 R/C and 6:1 RH	1:1 R/C and 12:1 E	16:1
Category I Natural Heritage site	Not considered possible[5]	6:1 Rehabilitation of a Natural Heritage site	R/C Not considered possible[5]	R/C Not considered possible[5]	Case-by-case
Category I Alkali	Not considered possible[5]	6:1 rehabilitation of an alkali wetland	R/C Not considered possible[5]	R/C Not considered possible[5]	Case-by-case
Category I Bog	Not considered possible[5]	6:1 Rehabilitation of a bog	R/C Not considered possible[5]	R/C Not considered possible[5]	Case-by-case
NOTE: Preservation is discussed in the following section.					

[4] These ratios are based on the assumption that the rehabilitation or enhancement actions implemented represent the average degree of improvement possible for the site. Proposals to implement more effective rehabilitation or enhancement actions may result in a lower ratio, while less effective actions may result in a higher ratio. The distinction between rehabilitation and enhancement is not clear-cut. Instead, rehabilitation and enhancement actions span a continuum. Proposals that fall within the gray area between rehabilitation and enhancement will result in a ratio that lies between the ratios for rehabilitation and the ratios for enhancement.

[5] Natural Heritage sites, alkali wetland, and bogs are considered irreplaceable wetlands because they perform some special functions that cannot be replaced through compensatory mitigation. Impacts to such wetlands would therefore result in a net loss of some functions no matter what kind of compensation is proposed.

8D.3.2 Conditions for Increasing or Reducing Replacement Ratios

Increases in replacement ratios are appropriate under the following circumstances:

- Success of the proposed restoration or creation is uncertain
- A long time will elapse between impact and establishment of wetland functions at the mitigation site
- Proposed mitigation will result in a lower category wetland or reduced functions relative to the wetland being impacted
- The impact was unauthorized

Reductions in replacement ratios are appropriate under the following circumstances:

- Documentation by a qualified wetland specialist (see Appendix 8-H) demonstrates that the proposed mitigation actions have a very high likelihood of success based on prior experience
- Documentation by a qualified wetland specialist demonstrates that the proposed actions for compensation will provide functions and values that are significantly greater than the wetland being affected
- The proposed actions for compensation are conducted in advance of the impact and are shown to be successful
- In wetlands where several HGM classes are found within one delineated boundary, the areas of the wetlands within each HGM class can be scored and rated separately and the ratios adjusted accordingly if **all of the following** apply:
  - The wetland does not meet any of the criteria for wetlands with “Special Characteristics” as defined in the rating system
  - The rating and score for the entire wetland is provided as well as the scores and ratings for each area with a different HGM class
  - Impacts to the wetland are all within an area that has a different HGM class from the one used to establish the initial category
  - The proponents provide adequate hydrologic and geomorphic data to establish that the boundary between HGM classes lies at least 50 feet outside of the footprint of the impacts

8D.3.3 Replacement Ratios for Preservation

In some cases, preservation of existing wetlands may be acceptable as compensation for wetland losses. Acceptable sites for preservation include those that:

- Are important due to their landscape position
- Are rare or limited wetland types
- Provide high levels of functions

Ratios for preservation in combination with other forms of mitigation generally range from 10:1 to 20:1, as determined on a case-by-case basis, depending on the quality of the wetlands being impacted and the quality of the wetlands being preserved. Ratios for preservation as the sole means of mitigation generally start at 20:1. Specific ratios will depend upon the significance of the preservation project and the quality of the wetland resources lost.

Please see Chapter 8 (Section 8.3.7.2) and Appendix 8-B for more information on preservation and the criteria for its use as compensation.

8D.3.4 Replacement Ratios for Temporal Impacts and Conversions

When impacts to wetlands are not permanent, local governments often require some compensation for the temporal loss of wetland functions. *Temporal impacts* refer to impacts to those functions that will eventually be replaced but cannot achieve similar functionality in a short time. For example, clearing forested wetland vegetation for pipeline construction could result in the temporal loss of functions, such as song bird habitat provided by the tree canopy. It may take over 20 years to re-establish the level of function lost as a result of clearing the trees. Although the wetlands will be re-vegetated and over time it is anticipated that their previous level of functioning will be re-established, a temporal loss of functions will occur. There is also some risk of failure associated with the impacts or alterations, especially when soil is compacted by equipment, deep excavation is required, and pipeline trenches alter the water regime at the site.

Therefore, in addition to restoring the affected wetland to its previous condition, local governments should consider requiring compensation to account for the risk and temporal loss of wetland functions. Generally, the ratios for temporal impacts to forested and scrub-shrub wetlands are <u>one-quarter</u> of the recommended ratios for permanent impacts (refer to Table 8D-11), provided that the following measures are satisfied:

- An explanation of how hydric soil, especially deep organic soil, is stored and handled in the areas where the soil profile will be severely disturbed for a fairly significant depth or time

- Surface and groundwater flow patterns are maintained or can be restored immediately following construction
- A 10-year monitoring and maintenance plan is developed and implemented for the restored forest and scrub-shrub wetlands
- Disturbed buffers are re-vegetated and monitored
- Where appropriate, the hydroseed mix to be applied on re-establishment areas is identified

When impacts are to a native emergent community and there is a potential risk that its re-establishment will be unsuccessful, compensation for temporal loss and the risk should be required in addition to restoring the affected wetland and monitoring the site. If the impacts are to wetlands dominated by non-native vegetation (e.g., blackberry, reed canarygrass, or pasture grasses), restoration of the affected wetland with native species and monitoring after construction is generally all that is required.

Loss of functions due to the permanent conversion of wetlands from one type to another also requires compensation. When wetlands are not completely lost but are converted to another type, such as a forested wetland converted to an emergent or shrub wetland (e.g., for a utility right-of-way), some functions are lost or reduced.

The ratios for conversion of wetlands from one type to another will vary based on the degree of the alteration, but they are generally one-half of the recommended ratios for permanent impacts (refer to Table 8D-11).

Refer to Appendix 8-F for the rationale for the ratios provided in this appendix.

Appendix 8-E

Rationale for the Guidance on Recommended Widths of Buffers and Other Methods for Protecting Wetlands

8E.1 Introduction

This appendix provides the rationale for the widths of buffers and other measures recommended to protect and manage wetlands, specifically for Buffer Alternative 3 (Tables 4-7) in Appendices 8-C and 8-D. The rationale is based to a large degree on the synthesis of the scientific literature presented in Volume 1 (Sheldon et al. 2005), which will not be cited further. Other citations are included where they are relevant. The information provided here is also relevant to Alternatives 1 and 2 since these two alternatives are simplified versions of Alternative 3.

The authors recommend that the reader review and fully understand Appendices 8-C and 8-D, and particularly Alternative 3 (Tables 4-7), before reading this appendix. Each table associated with Alternative 3 provides guidance for widths of buffers and other measures for protecting each of the four categories of wetlands as determined by the wetland rating systems for eastern and western Washington (Hruby 2004 a,b). The tables also summarize the characteristics used to determine the recommended width or other measures for protection.

The guidance on wetland buffers is based closely on the scientific literature. This literature clearly recommends that buffers should be based on three primary factors: the type of wetland and the functions and values needing protection, the type of adjacent land use and its expected impacts, and the physical character of the buffer. The recommended buffer widths are based on these factors, and the guidance is based on the following elements that reflect this:

- Using the Washington State wetland rating systems to determine the wetland type and the functions and values needing protection
- Identifying three primary levels of land use based on the severity of potential impacts
- Assuming that the buffer is well vegetated and not on a steep slope

In addition, the guidance assumes that an approach to management that provides a moderate risk is appropriate. Since the scientific literature reports effective buffer widths in ranges, one must select buffer widths from within reported ranges that vary from 25 –

100 feet to protect some wetland functions such as coarse sediment removal, to 100 – 600 feet or more for functions such as wildlife habitat. The widths for buffers have deliberately been selected to fall in the middle of these published ranges. The assumption is that using buffers of these widths will provide a moderate risk to the resource. Using these variable criteria ensures that this guidance will work in a wide range of management settings, including rural, urban, and urbanizing environments.

The widths of buffers are based on the score a wetland receives, including the overall score (i.e., the wetland category), the score for the habitat functions, or the score for the functions that improve water quality. The widths of buffers can also be modified by the presence of special characteristics the wetland may have, as defined in the rating systems (e.g., bogs), as well as the expected impacts of proposed adjacent land uses.

For example, using Alternative 3, two wetlands in western Washington, one rated as a Category I and one as Category II, might both have the same high score (e.g., 31 points) for habitat functions. Both would need to be protected with the same width of buffer (300 feet, 225 feet, or 150 feet depending on the intensity of the impacts of the proposed land uses) because both wetlands have a high level of habitat functions that requires the same protection. If, however, a Category II wetland does not have a high or moderate score for habitat functions or a high score for the functions that improve water quality, it would only require buffers of 100 feet, 75 feet, or 50 feet depending on the proposed land uses.

The widths of buffers required to protect habitat are usually larger than those needed to protect functions that improve water quality. Thus, the highest widths are recommended for wetlands with high scores for habitat.

The score for the hydrologic functions (i.e., flood storage, groundwater recharge, and reducing erosion) is not part of the criteria used to determine buffer widths. The hydrologic functions are not significantly influenced by the width of the buffer. These functions need to be protected at the scale of the watershed or sub-basin in which the wetland is found. Measures to protect the hydrologic functions of wetlands need to be developed from a landscape analysis as described in Chapter 5 of this document.

This appendix is divided into two sections. The first addresses wetlands that provide a high or moderate level of functions for habitat and for improving water quality, and the second addresses wetlands with special characteristics such as bogs and vernal pools.

8E.2 Rationale for Protection Based on the Scores for Functions

8E.2.1 Protection for Wetlands that Provide a High Level of Habitat for Wildlife (Category I and II wetlands with a score of 29 – 36 points for the habitat functions in Tables 6 and 7 of Appendices 8-C and 8-D)

8E.2.1.1 Width of Buffers

In eastern Washington: 200 feet for proposed land uses with high impacts; 150 feet for moderate impacts; 100 feet for low impacts.

In western Washington: 300 feet for proposed land uses with high impacts; 225 feet for moderate impacts; 150 feet for low impacts.

A wetland with a high score for habitat functions (29 - 36 points) has both the physical structures (e.g., vegetation, open water, etc.) and the connections to other wildlife habitats that are necessary for a wide range of species, including birds, mammals and amphibians. This means that the wetland is very likely to be providing habitat for one or more species that needs a larger buffer. Without direct evidence that such species are not using the wetland, one should assume that wildlife species that require a large buffer are using it for habitat.

The review of the literature in Chapter 5 of Volume 1 indicates that the widths of buffers needed to protect wildlife using wetlands range from 100 to 600 feet or more. Most authors who have synthesized the literature on buffers with respect to wildlife habitat recommend buffers of 200 to 300 feet for wetlands that provide good habitat. One synthesis recommended that a buffer adjacent to high-intensity land uses of 200 feet is adequate for protecting most species found in wetlands in eastern Washington and 300 feet in western Washington (Castelle et al. 1992). This difference between eastern and western Washington was based on literature that showed that wildlife species tend to concentrate more around wetlands and streams in arid climates. The specific buffer widths proposed for the different types of land uses fall within the recommendations found in the review of the scientific literature (See Chapter 5 in Volume 1).

Thirteen of the 90 wetlands (14%) used to calibrate the rating system for eastern Washington had scores of 29 or higher for the habitat functions. These were judged to provide the best habitat potential and would require a buffer of 200 feet. Thirteen of the 122 wetlands in western Washington (11%) had scores of 29 or greater and would require a 300-foot buffer.

A 200 or 300-foot buffer alone will not protect the habitat functions of a wetland with a high score for habitat. The connection to other habitat areas also needs to be maintained (see below).

8E.2.1.2 Other Protection Needed for Wetlands that Provide a High Level of Habitat Functions

Maintaining Connections to other Habitat Areas

Wetlands with a high score for habitat functions have the connections to other wildlife habitats that are necessary for a wide range of species. The scientific information summarized in Chapter 3 of Volume 1 points out that fragmentation and disruption of the vegetated corridors between undeveloped areas are a major cause of the loss of species richness (i.e., biodiversity). Existing connections and corridors need to be protected. This can be done by regulating the type and nature of road crossings in the corridor and by limiting changes in land use in the corridor. Such protection is best accomplished through planning based on landscape analysis that identifies critical habitat corridors and protects the mosaic of different ecosystems (see Chapters 5-7 of this Volume).

8E.2.2 Protection for Wetlands that Provide a Moderate Level of Habitat for Wildlife (Category I, II, and III wetlands with a score of 20 - 28 points for the habitat functions in Tables 5, 6, and 7 of Appendices 8-C and 8-D)

8E.2.2.1 Width of Buffers

In both eastern and western Washington: 150 feet for proposed land uses with high impacts; 110 feet for moderate impacts; 75 feet for low impacts.

A wetland with a moderate score for its habitat functions (20 - 28 points out of 36) has some of the physical structures (e.g., vegetation, open water, etc.) and some connections to other wildlife habitats that are necessary for a wide range of species. This means that the wetland is less likely to provide habitat for species that need the largest buffers. On the other hand, wetlands that score in this range do provide habitat for a wide variety of species, some of which, such as waterfowl, still need a relatively large buffer to protect them from disturbance.

8E.2.2.2 Other Protection Needed for Wetlands that Provide a Moderate Level of Habitat Functions

No recommendations are made at this time.

8E.2.3 Wetlands that Provide a High Level of Functions in Improving Water Quality (Category I and II wetlands with a score of 24-32 points for improving water quality in Tables 6 and 7 of Appendices 8-C and 8-D)

8E.2.3.1 Width of Buffers

In both eastern and western Washington: 100 feet for proposed land uses with high impacts; 75 feet for moderate impacts; 50 feet for low impacts.

The functions of water quality improvement within a wetland can be degraded if excess pollutants (e.g., sediments, nutrients, toxic materials) enter the wetland. Buffers of 100 feet are recommended for wetlands that are currently performing these functions well, in order to prevent further degradation. Reviews of data indicate that a buffer of approximately 100 feet will remove 70% or more of the sediment and pollutants from surface runoff before they reach the wetland (Desbonnet et al. 1994). This was judged to be adequate to prevent further degradation even though specific experimental data are lacking to confirm this assumption.

8E.2.3.2 Other Protection Needed to Maintain Functions that Improve Water Quality

No Additional Surface Discharges of Untreated Runoff

Buffers will not adequately protect the water quality improvement functions of wetlands if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. To protect these functions, it is necessary to limit the introduction of any additional pollutants, from new development or other activities (e.g. lawns, golf courses, etc.), that might enter the wetland through untreated runoff that bypasses the buffer. Changes in land uses adjacent to these wetlands should meet current stormwater detention and treatment requirements, and discharge of stormwater to the buffer diffused through spreaders or other means.

8E.2.4 Category I Wetlands that Do Not Score High Enough for Habitat and Improving Water Quality (Wetlands scoring 70 points or more overall but less than 20 points for habitat functions or less than 24 points for improving water quality in Table 7 of Appendices 8-C and 8-D)

8E.2.4.1 Width of Buffers

In both eastern and western Washington: 100 feet for proposed land uses with high impacts; 75 feet for moderate impacts; 50 feet for low impacts.

It is possible that a wetland could score 70 points or more (Category I) and not score at least 20 points for habitat or 24 points for improving water quality, although none were found in the 212 wetlands used to calibrate the rating system. If a Category I wetland does not meet the criteria for habitat or improving water quality, a standard buffer width of 100 feet for proposed land uses with high impacts is recommended in Alternative 3 as a default. This is based on the assumption that a Category I or II wetland scoring more than 50 points out of 100 will have some functions worth protecting that are not adequately identified using the rating system, especially if buffers are the only protection being provided. A 100-foot buffer provides protection with an overall moderate level of risk to the wetland from any change in land use that generally has a high impact to wetlands.

8E.2.4.2 Other Protection Needed for These Category I Wetlands

No recommendations are made at this time.

8E.2.5 Category II Wetlands that Do Not Score High Enough for Habitat or Improving Water Quality (Wetlands scoring 51-69 points overall but less than 20 points for the habitat functions or less than 24 points for improving water quality in Table 6 of Appendices 8-C and 8-D)

8E.2.5.1 Width of Buffers

In both eastern and western Washington: 100 feet for proposed land uses with high impacts; 75 feet for moderate impacts; 50 feet for low impacts.

If a Category II wetland does not meet the criteria listed for habitat or improving water quality, a standard buffer width of 100 feet for proposed land uses with high impacts is recommended in Alternative 3 as a default. This is based on the assumption that a Category II wetland, scoring more than 50 points out of 100, will have some functions worth protecting that are not adequately identified using the rating system, especially if buffers are the only protection being provided. A 100-foot buffer provides protection with an overall moderate level of risk to the wetland from any proposed land use that has a high impact on wetlands.

8E.2.5.2 Other Protection Needed for These Category II Wetlands

No recommendations are made at this time.

8E.2.6 Category III Wetlands that Do Not Score High Enough for Habitat (Wetlands scoring 30-50 points overall but less than 20 points for habitat functions in Table 5 of Appendices 8-C and 8-D)

8E.2.6.1 Width of Buffers

In both eastern and western Washington: 80 feet for proposed land uses with high impacts; 60 feet for moderate impacts; 40 feet for low impacts

When a Category III wetland does not meet the criteria for habitat, a standard buffer width of 80 feet for proposed land uses with high impacts is recommended in Alternative 3 as a default. This is based on the assumption that a wetland scoring more than 30 points out of 100 will have some functions worth protecting that are not adequately identified using the rating system, especially if buffers are the only protection being provided. Because the overall sensitivity of a Category III wetland is less than that of a Category II or I wetland, the default is set at 80 feet. An 80-foot buffer provides protection with an overall moderate level of risk to the wetland from any change in land use that generally has a high impact to wetlands.

8E.2.6.2 Other Protection Needed for These Category III Wetlands

No recommendations are made at this time.

8E.2.7 Category IV Wetlands (Wetlands scoring less than 30 points overall in Table 4 of Appendices 8-C and 8-D)

8E.2.7.1 Width of Buffers

In both eastern and western Washington: 50 feet for proposed land uses with high impacts; 40 feet for moderate impacts; 25 feet for low impacts.

Category IV wetlands do not meet the criteria listed for habitat or improving water quality so a default of 50 feet for proposed land uses with high impacts is recommended. This is based on the assumption that even low scoring wetlands will need some protection from encroachment, especially if buffers are the only protection being provided. A 50-foot buffer provides protection with an overall moderate level of risk to the wetland from proposed land uses that have a high impact on wetlands.

8E.2.7.2 Other Protection Needed for These Category IV Wetlands

No recommendations are made at this time.

8E.3 Rationale for Wetlands with Special Characteristics in the Rating Systems

The rating systems differentiate between wetlands based on their sensitivity to disturbance, their significance, their rarity, and our ability to replace them in addition to the functions they provide. These characteristics can be considered values that are somewhat independent of the functions provided by a wetland. Because different criteria were used to categorize these wetlands, recommendations for the protection they need has been based on protecting the special characteristics of the wetland, in addition to its functions.

8E.3.1 Natural Heritage Wetlands (Table 7 in Appendices 8-C and 8-D)

8E.3.1.1 Width of Buffers

In both eastern and western Washington: 250 feet for proposed land uses with high impacts; 190 feet for moderate impacts; 125 feet for low impacts.

Natural Heritage wetlands contain rare plants or those that are particularly sensitive to disturbance. These types of species are very sensitive to nutrient enrichment (eutrophication) from the input of nutrient-rich waters (see Chapter 4 of Volume 1). The buffer needs to remove excess nutrients before they reach the wetland. The most efficient vegetated buffer, based on width-to-removal ratios, is about 197 feet for removal of nitrogen and 253 feet for phosphorus (Desbonnet et al. 1994). A buffer of 250 feet, therefore, is recommended for Natural Heritage wetlands that could be affected by proposed land uses that have high impacts.

A 250-foot buffer alone may not protect the species that are rare or sensitive to disturbance if the watershed has high nutrient loadings or a water regime that is unstable. These factors may allow invasive plant species to become established and out-compete the species sensitive to disturbance.

8E.3.1.2 Other Protection Needed for Natural Heritage Wetlands

No Additional Surface Discharges to Wetland or its Tributaries

Buffers will not adequately protect rare plants or those sensitive to disturbance if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. Furthermore, discharges of stormwater and changes in the water regime from development will change the wetland plant communities (see Chapter 4 of Volume 1). Such changes might reduce the populations of species in the wetland that are rare or sensitive to disturbance. To protect the plants, it is necessary to limit the introduction of additional nutrients that might bypass the buffer and enter the wetland through untreated runoff from new development or changes in land use.

No Septic Systems within 300 Feet of Wetland

Septic systems do not prevent nitrates, a major plant nutrient in wastewater, from entering groundwater. Many wetlands in Washington receive at least some of their water, if not all, from groundwater. This means that nutrients released by septic systems can enter a wetland and impact species that are rare or sensitive to disturbance in the same way as surface water. By keeping septic systems at least 300 feet from the wetland edge (usually called a *setback* in regulations) there is a better chance that impacts from nutrients will be minimized. There is no "safe" setback, however, for septic systems if there is a direct groundwater connection (underground flow) between the septic system and the wetland. A 300-foot distance, however, will increase the chance that the nitrogen will be diluted before it reaches the wetland.

8E.3.2 Bogs (Table 7 in Appendices 8-C and 8-D)

8E.3.2.1 Width of Buffers

In both eastern and western Washington: 250 feet for proposed land uses with high impacts; 190 feet for moderate impacts; 125 feet for low impacts

Bogs are particularly sensitive to nutrient enrichment (eutrophication) from the input of nutrient-rich waters because they contain plant species that have adapted to very low nutrient levels. A vegetated buffer, therefore, is needed to remove excess nutrients before they reach the bog. The most efficient vegetated buffer, based on width-to-removal ratios, is about 197 feet for removal of nitrogen and 253 feet for phosphorus (Desbonnet et al. 1994).

A 250-foot buffer alone may not protect the bog and its species if the watershed has high nutrient loadings, and nutrients are transported into the bog in a stream.

8E.3.2.2 Other Protection Needed for Bogs

No Surface Discharges to Wetland or its Tributaries

Buffers will not adequately protect the functions of a bog if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. It is necessary to limit the introduction of additional nutrients that might be transported through untreated runoff that bypasses the buffer.

8E.3.3 Category I Forested Wetlands and Category II Riparian Forest (Table 7 in Appendices 8-C and 8-D and Table 6 in Appendix 8-D)

8E.3.3.1 Width of Buffers

In both eastern and western Washington: Buffer widths for mature or old-growth forested wetlands that are Category I, or for Category II riparian forest in eastern Washington, are based on the score for habitat functions or water quality functions described in Section 8E.2.

Forested wetlands are given special consideration because they are hard to replace through compensatory mitigation. This is especially true for mature or old-growth forests which can not be replaced in a human life-time. The protection they need should be based on the functions they provide. Therefore, buffers and other measures to protect their functions should be based on how well the wetland scores for habitat or water quality functions.

8E.3.3.2 Other Protection Needed for Forested Wetlands

Protect Water Regime in Watershed

Riparian forested wetlands, whether a mature forest or not, need protection at a watershed scale. Buffers alone will not protect riparian forested wetlands because they are directly connected to the water flow and dynamics in the watershed. Changes in the water regime of the watershed that result from changes in land use can have a significant impact on all types of riparian wetlands.

8E.3.4 Alkali Wetlands (Table 7 in Appendix 8-D)

8E.3.4.1 Width of Buffers

In eastern Washington: 200 feet for proposed land uses with high impacts; 150 feet for moderate impacts; 100 feet for low impacts.

The ecological process that maintains an alkali wetland is the dynamic interaction between water inflow and evaporation. Buffers have little effect on this process. The 200-foot buffer recommended for alkali wetlands is based on their habitat functions. Alkali wetlands in eastern Washington are a major resource for migratory shorebirds and other water-dependent birds. The 200-foot buffer recommended is intended to protect these birds and minimize disturbance during migration and feeding (see Chapter 5 in Volume 1).

8E.3.4.2 Other Protection Needed for Alkali Wetlands

No Additional Surface Discharges to Wetland or its Tributaries

The routing of additional surface water into alkali wetlands will change the balance between inflow and evaporation because the incoming water will usually be less salty than that in the wetland. This may lower the alkalinity (salt content) and change the highly specialized fauna and flora that inhabit these systems. No specific information was found on the impacts this may have on the ecosystem in the alkali wetland. In the absence of direct information, we can assume that there is a risk to the ecosystem in alkali wetlands if discharges are allowed. The recommendation is that no surface discharges (e.g., stormwater, irrigation, etc.) be allowed into alkali wetlands.

8E.3.5 Category II Vernal Pools (Tables 6 in Appendix 8-D)

8E.3.5.1 Width of Buffers

In eastern Washington: 200 feet for proposed land uses with high impacts; 150 feet for moderate impacts; 100 feet for low impacts.

As an alternative, a jurisdiction may wish to develop a regional plan to protect the most important complexes of vernal pools. If a plan is developed, buffers of vernal pools outside the protection zones can then be reduced to 80 feet for proposed land uses with high impacts, 60 feet for moderate impacts, and 40 feet for low impacts.

Vernal pools that are currently relatively undisturbed are very important for migratory waterfowl during a short period in the early spring. The review of the literature indicates that waterfowl need at least 200 feet of buffer during that short period to protect them from the disturbance that can occur from land uses with high impacts. The rest of the time the vernal pools provide little habitat for animals that require larger buffers. Because the requirement for a 200-foot buffer around a very small wetland for only a very short time may seem to be excessive, Ecology and the Washington Department of Fish and Wildlife (WDFW) strongly recommend that local jurisdictions identify the complexes of vernal pools that are the most important for waterfowl and develop a plan to protect them.

8E.3.5.2 Other Protection Needed for Vernal Pools

No recommendations are made at this time.

8E.3.6 Estuarine Wetlands and Wetlands in Coastal Lagoons (Tables 6 and 7 in Appendix 8-C)

Although wetlands in estuaries and coastal lagoons were not a focus of the synthesis of the science in Volume 1, some information about these wetlands is included because they are included in the Washington State wetland rating systems, which have identified these aquatic resources as needing protection. Some recent scientific information on coastal and estuarine wetlands has been summarized by Ecology, WDFW, and other agencies through the Aquatic Habitat Guidelines Project (see www.wa.gov/wdfw/hab/ahg).

8E.3.6.1 Width of Buffers

In western Washington: 200 feet for proposed land uses with high impacts; 150 feet for moderate impacts; 100 feet for low impacts.

It is not possible to make recommendations on buffers that reflect an extensive review of the current scientific information since that review was not done. However, the buffers recommended in Tables 6 and 7 of Appendix 8-C for estuarine wetlands and coastal lagoons in western Washington are based on generally accepted habitat functions.

Estuarine wetlands and coastal lagoons are a major resource for migratory shorebirds and other water-dependent birds (Simenstad 1983). In estuarine systems, buffers provide a source of wood and sediment that nourish the beaches. In addition, estuaries and coastal lagoons have a high density of fish and wildlife and high species diversity, provide important breeding habitat, and serve as movement corridors (see Washington Department of Fish and Wildlife web page, http://wdfw.wa.gov/hab/phshabs.htm). Both types of wetlands are also a habitat that has been significantly impacted by human activities and are highly vulnerable to alteration. Therefore, the width of buffers needed to protect these wetlands will have to be based on protecting a wide range of functions. The widths of buffers recommended (150 feet, 125 feet, and 75 feet respectively for proposed land uses with different levels of impacts) are intended to protect these birds and minimize disturbance during migration and feeding (see Chapter 5 in Volume 1).

8E.3.6.2 Other Protection Needed for Estuarine Wetlands and Wetlands in Coastal Lagoons

No recommendations are made at this time.

8E.3.7 Category II Interdunal Wetlands (Table 6 in Appendix 8-C)

8E.3.7.1 Width of Buffers

In western Washington: 150 feet for proposed land uses with high impacts; 110 feet for moderate impacts; 75 feet for low impacts.

Wetlands in coastal dune systems were excluded from the synthesis of the scientific literature in Volume 1 (see Chapter 1). The recommendations, therefore, do not reflect an extensive review of the current scientific information. However, buffer recommendations in Table 6 of Appendix 8-C for interdunal wetlands in western Washington are based on generally accepted habitat functions. These wetlands are considered to be a major resource for migratory shorebirds (Wiedemann 1984). The buffers recommended are intended to protect these birds and minimize disturbance during migration and feeding (see Chapter 5 in Volume 1 for a discussion of buffers generally needed to protect birds).

8E.3.7.2 Other Protection Needed for Interdunal Wetlands

No recommendations are made at this time.

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Appendix 8-F
Rationale for the Guidance on Recommended Ratios for Compensatory Mitigation

8F.1 Introduction and Background on Mitigation Ratios

This appendix provides some background information on ratios for compensatory mitigation (mitigation ratios), and the rationale and assumptions used in establishing ratios based on the Washington State wetland rating systems in Appendices 8-C and 8-D. The reader should become familiar with Appendices 8-C and 8-D before reading the rationale in this appendix.

The acreage of creation, restoration (re-establishment or rehabilitation), and enhancement that is required by regulatory agencies, including local governments, to compensate for impacts to wetlands is usually greater than the acreage of impact. This difference is expressed as a ratio (a mitigation ratio) of the area required for compensation vs. the area of impact. For example, a ratio of 3:1 means that 3 acres of compensatory mitigation are required for every acre of impact to a wetland.

> See Appendices 8-C or 8-D for definitions of creation, re-establishment, rehabilitation, and enhancement as types of compensatory mitigation.

There are two major reasons why the ratios are greater than 1:1. The first is based on the risk of failure of a project designed to compensate for impacts to wetlands (hereafter called *mitigation project*), and the second is based on the loss or reduction of functions during the time it takes a mitigation project to achieve the targeted level of performance for all of its functions (called “temporal loss”).

First, all of the studies of compensatory mitigation summarized in Volume 1 (see Chapter 6) indicate that a fairly large percentage of mitigation projects do not successfully replace all the functions lost. The result is an overall net loss of wetlands and their functions. Thus, at a programmatic level, more wetland area should be created or restored than is impacted to ensure that wetland functions and area are adequately replaced.

Secondly, the studies reviewed in Volume 1 also indicate that functions in wetlands may take decades, if not centuries, to develop fully. By requiring a ratio greater than 1:1, the temporal loss of functioning is addressed by providing more acreage of wetland that may not be performing as well as the impacted wetland. The trade-off is that a smaller wetland with a higher level of functioning is replaced with a larger wetland that does not function as well for many years.

Therefore, higher ratios should be set if there is an increasing risk of not adequately compensating for the functions lost, and as the time needed to establish the lost functions increases. If, however, compensatory mitigation is done in advance of impacts and is fully successful, it is reasonable to reduce the ratios to as low as 1:1.

Kusler (2003) has summarized some of the factors that should be considered in evaluating the risks of success or failure of compensatory mitigation and temporal loss and thereby establishing an appropriate mitigation ratio:

1. **The functions present in the impacted wetland and those proposed for the "replacement" wetland.** Larger ratios are justified where a replacement wetland will have fewer functions and values or perform the functions at a lower level. The net loss of function per acre of wetland has to be compensated by increasing the area of compensation required.

2. **The overall ecological conditions of the impacted wetland and the "replacement" wetland.** Larger ratios are justified where a "replacement" wetland will be less persistent, diverse, or has less ecological integrity than the original wetland. The risk of losing "ecological integrity" has to be compensated by increasing the area of mitigation required.

3. **The probable success for wetlands of the type proposed as "replacement."** Larger ratios are justified for wetland types that have proven to be difficult to restore or create, thereby increasing the risk of failure.

4. **The expertise and experience of the agency or consultant proposing to carry out the project.** Larger ratios are justified for proponents who are less expert and less experienced. Lack of experience increases the risk that the project will not be successful.

5. **Threats to the "replacement" site.** Larger ratios are justified where there are threats to the site such as possible changes to the water regime, sedimentation, or pollution. These threats increase the risk that functions will be impaired in the future (See Chapters 3 and 4 in Volume 1).

6. **Whether the site will be susceptible to "mid-course" corrections.** Larger ratios are justified when there is little capability for correcting problems as they develop, and smaller ratios are justified where that capability exists. Projects where problems have been corrected tend to be more successful than those that have not (See Chapter 6 in Volume 1).

The ratios discussed in this appendix were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. The ratios provided as guidance are based on the factors discussed in this appendix including the likelihood of success of compensatory mitigation, the amount of temporal loss, and the risk at a programmatic level. They <u>DO NOT</u> address the specific considerations and risks of any particular individual project.

8F.2 Assumptions Used in Establishing the Recommended Ratios

8F.2.1 Baseline Ratios for Creation and Re-establishment

Creation and re-establishment both lead to the formation of wetlands in areas that are currently not wetlands. As a result, there can be a no net loss of wetland area if the area of compensatory mitigation is at least as large as the area of impact. However, the study by Johnson et al. (2002), summarized in Chapter 6 of Volume 1, found that only about half of the mitigation projects in Washington State that created or re-established wetlands were "moderately successful" or "successful" at replacing the functions lost. This means that overall there is about a 50 percent risk of failure. Other studies of the success of mitigation projects, summarized in Chapter 6 of Volume 1, suggest the risk of failure is even higher. These data suggest that a minimum ratio of 2:1 is needed to ensure no net loss of functions at a programmatic level.

As previously mentioned, this ratio also needs to be adjusted to account for the temporal loss of functions. There are no scientific studies that have quantified the temporal loss in terms of how many acres of additional wetlands are required. Trying to quantify this experimentally is not possible because the data are not compatible; one cannot equate time with area.

As a result, the additional area required to compensate for the temporal loss of functions is a value judgment. *How highly do we value the loss of some functions for 5 to 10 years, some for 30 years, and others for 100 years or more?* As a starting point for discussion, it is suggested that the compensation for the temporal loss of functions be equal to the area of impact**.** Thus, the basic 2:1 ratio proposed to compensate for the risk of failure should be increased to 3:1 to account for the temporal loss of functions**.**

Thus, one-third of the ratio is assigned to the temporal loss of function. In the case of temporal losses of functions due to conversion of vegetation, however, we recommend a ratio for temporal losses of functions that is one-quarter that of creation or re-establishment (e.g., in the construction of pipelines – see section 8C.2.4 or 8D.2.4). The ratios recommended are different because in the case of creation or re-establishment, most of the functions (e.g., improving water quality and hydrologic) will also take some time to develop. In the case of a pipeline construction and conversion of forest to emergent, we do not expect to have a temporal loss of these other functions because the wetland already exists.

The basic 2:1 ratio proposed to compensate for the risk of failure should be increased to 3:1 to account for the temporal loss of functions.

8F.2.2 Baseline Ratios for Rehabilitation and Enhancement

Rehabilitation and enhancement of existing wetlands (see Appendices 8-C or 8-D for definitions) are also used in compensatory mitigation. Rehabilitation and enhancement activities are conducted on an existing wetland, therefore if either of these types is used as the only form of compensation, there will always be a net loss of wetland area. Thus the ratios for these two types of compensatory mitigation will need to be higher than for creation or re-establishment since a net loss of wetland area will result.

Furthermore, the information on the risks associated with enhancement indicates this type of compensatory mitigation has even a lower rate of success than creation or re-establishment. Only about 10% of the enhancement projects analyzed in Washington State were even moderately successful at replacing the functions lost (Johnson et al. 2002). No data were available on the success of rehabilitation.

The recommended ratio for using rehabilitation as compensation is two times that for using re-establishment or creation based on the need to compensate for the loss of wetland area. Thus, two acres of rehabilitation are equivalent to one acre of re-establishment or creation in determining the acreage needed to replace an impacted wetland.

The recommended ratio for using enhancement alone as compensation is four times that for using re-establishment or creation based on the need to compensate for the loss of wetland area and the fact that enhancement tends to be even less effective at replacing the functions lost. This means that four acres of enhancement are equivalent to one acre of re-establishment or creation in determining the acreage needed to replace an impacted wetland.

The ratio for rehabilitation is less than that for enhancement alone because the former often focuses on restoring environmental or hydrologic processes that have been disturbed or altered by previous or ongoing human activity. These actions are more likely to replace a full suite of wetland functions than enhancement. Enhancement typically involves actions that provide gains in only one or a few functions and can lead to a decline in other functions.

The recommended ratios for rehabilitation or enhancement are based on a multiplication factor that is applied to the ratio for creation or re-establishment (2x for rehabilitation and 4x for enhancement). This applies to all the different ratios for creation and rehabilitation recommended in Tables 8C-9 and 8D-9.

8F.2.3 Adapting the Ratios Based on the Wetland Functions

The baseline ratios for each type of compensatory mitigation described above can be applied to or modified based on the four categories in the rating systems for Washington State (Hruby 2004 a,b). It is assumed, first, that the basic ratios described above apply to mitigation projects where the proposed compensatory mitigation site is the same category as the affected wetland (e.g., impacts to a wetland rated Category II for its functions are compensated by creating, re-establishing, rehabilitating or enhancing a wetland that will become a Category II wetland based on its score for functions). Second, it is assumed that the hydrogeomorphic (HGM) class or subclass of the wetland proposed as compensation is the same as the category and class or subclass of the wetland being altered (e.g., impacts to a Category II riverine wetland are compensated by a Category II riverine, wetland). This is considered to be the *average condition*.

The studies of compensatory mitigation by Johnson et al. (2002) found that the highest rating that could usually be expected in a compensatory project was a Category II when the wetland was rated based on its functions, and this category was chosen as the average from which to develop the ratios for other categories.

The basic ratios may be modified if the conditions for the proposed mitigation project are different from the average condition. For example, the ratios recommended for compensating impacts to Category III wetlands (based on the score for functions) in Tables 8C-9 and 8D-9 are lower (2:1 instead of 3:1). The ratios are lower because it is assumed that the risks are lower with mitigating impacts to a Category III wetland. First, it is assumed that there is a better chance for a successful creation or re-establishment of a Category III wetland than a Category II wetland because the wetland does not have to function at the same level. Second, Category III wetlands usually have simpler structure, and it may take less time to establish the required level of functions (i.e., temporal losses of functions are reduced). The ratios for rehabilitation and enhancement only are also lower because they are based on the lower ratio for creation and re-establishment. At present, however, these are assumptions that need to be validated by more thorough monitoring.

The recommended ratio to compensate for impacts to Category IV wetlands is even lower (1.5:1 rather than 3:1) because it is assumed that the risks and temporal losses are less than with creation or restoration of a Category III wetland.

On the other hand, the ratio for impacts to a Category I wetland are higher (4:1 rather than 3:1) for the opposite reasons. First, it is assumed that there is a reduced chance for successful creation or restoration of a Category I wetland than a Category II wetland because the wetland has to function at the highest levels. The data from existing studies (see Chapter 6 in Volume 1) indicates that creation or re-establishment to these levels rarely, if ever, happens. Second, Category I wetlands usually have a more complex structure, and it may take more time to establish these structures and the resulting functions (i.e., temporal losses are increased).

8F.2.4 Adapting the Ratios Based on Special Characteristics Defined in the Rating System

8F.2.4.1 Ratios for Category I Forested Wetlands

Studies of mitigation projects (see Chapter 6 in Volume 1) have shown that forested wetlands may take over 100 years to become established (the studies didn't specifically state if the forests were mature or old-growth). The recommended ratio (6:1) is designed to compensate for the additional temporal loss of the functions of a Category I mature or old-growth forested wetland during the long time it takes to establish this type of wetland.

8F.2.4.2 Ratios for Wetlands that are Difficult to Create (Natural Heritage, Bogs, Alkali Wetlands, Estuarine Wetlands, Wetlands in Coastal Lagoons)

No data are available for mitigation projects that involved creating Natural Heritage wetlands, alkali wetlands, estuarine wetlands, or wetlands in coastal lagoons from uplands. Bogs are the only type of wetland for which studies on compensation through creation have been attempted. This information indicates that it is not possible to re-create the necessary physical, hydrologic, and chemical conditions needed to replace a bog through compensatory mitigation (see Chapter 6 in Volume 1).

Until more data are available, the authors of Volume 2 assume that, in addition to bogs, it is not possible to create Natural Heritage wetlands, alkali wetlands, estuarine wetlands, or wetlands in coastal lagoons from uplands or to enhance wetlands of other types to reproduce their special characteristics and functions. We do not fully understand the hydrologic and biological conditions that lead to the formation of these wetlands, so we cannot assume that it is possible to create them without this understanding.

As a result, the authors of Volume 2 recommend that compensation for impacts to these types of wetlands should involve the rehabilitation of degraded wetlands of a similar type, rather than creation or enhancement. Rehabilitation has proven to be successful for estuarine wetlands (Simenstad and Thom 1992), and it is assumed that rehabilitation of the other types is also feasible. It is more feasible, at least, than attempting to create these wetlands or enhance a wetland of another type in order to try to recreate the necessary ecological conditions.

In the absence of any definitive information on the success of such rehabilitation, the recommended ratio for rehabilitation is 6:1 to be consistent with the other ratios. Mitigation projects that propose enhancement as compensation for impacts to these wetlands will have to be evaluated on a case-by-case basis. Enhancement would involve a net loss of acreage as well as an extremely high risk that the functions represented by these wetland types will not be replaced.

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Appendix 8-G

Widths of Buffers Needed to Protect Some Threatened/Endangered/Sensitive Wildlife Species Associated with Wetlands

The following table lists information regarding the widths of buffers needed by legally protected wildlife species associated with wetlands (as defined below). The species in the table are Federal Candidate, Federal Threatened, Federal Endangered, Federally Warranted But Precluded, State Sensitive, State Threatened, and State Endangered found in Washington as of February 4, 2005. These species are collectively called Threatened, Endangered, or Sensitive (T/E/S) species in this appendix. Although this information is not directly linked to the guidance provided in Appendices 8-C and 8-D, it can be useful to local governments developing a program to protect and manage wetlands. The T/E/S species for which wetlands provide habitat, as well as the other functions as established by the rating systems, need to be addressed in protection measures.

The list of species and their level of association with wetlands in Johnson and O'Neil's (2001) *Wildlife-Habitat Relationships in Oregon and Washington* (see Appendix 2-B in Volume 1) was used to identify only the T/E/S species that are *Closely Associated* with wetlands in Washington (the first column in the matrix). A species *Closely Associated* with wetlands is defined as a species that is widely known to depend on a habitat for part or all of its life history requirements. Identifying this association implies that the species has an essential need for this habitat for its maintenance and viability.

The Washington Department of Fish and Wildlife (WDFW) identified two additional species that should be considered as associated with wetlands based on their expertise in Washington (the second column) (E. Neatherlin, WDFW, personal communication 2005). The fourth column (activity in wetlands) is also from Johnson and O'Neil (2001). The fifth column includes widths of buffers needed by these species and was derived from the scientific literature as cited in the table and listed at the end of the appendix. Finally, WDFW provided additional notes/comments for some of the species (sixth column).

Buffers alone may not provide adequate protection for some of these species. Please check with the Washington Department of Fish and Wildlife for more details on what is needed to protect individual Threatened/Endangered/Sensitive species.

Table 8G-1. Width of buffers needed to protect Threatened/Endangered/Sensitive wildlife species associated with freshwater wetlands in Washington.

T/E/S Species Identified as *Closely Associated* with Wetlands in WA from Johnson and O'Neil (2001)	T/E/S Species Associated with Wetlands in Washington Based on WDFW Expertise	Status*	Activity in Wetlands	Widths of Buffers Reported in the Scientific Literature as Needed to Protect the Species	Notes/Comments (Provided by WDFW biologists)
Oregon Spotted Frog		FC, SE	Feeds and Breeds	No information	Only 3 known populations in WA - Dempsey Creek, Trout Lake, and Conboy Lake (McAllister and Leonard 1997). Emerging data suggests that some frogs cannot persist through time without landscape connectivity between uplands and wetlands. Buffers are often inadequate and ineffective.
	Great Basin Spotted Frog	FWP		No information	One small population in SE Washington. Emerging data suggests that some frogs cannot persist through time without landscape connectivity between uplands and wetlands. Buffers are often inadequate and ineffective.
Northern Leopard Frog		SE	Feeds and Breeds	> 120 m (395ft) impacts noted up to 3000 m (1.9 miles) (Houlahan and Findlay 2003)	Emerging data suggests that some frogs cannot persist through time without landscape connectivity between uplands and wetlands. Buffers are often inadequate and ineffective.

* Status: FC = Federal Candidate, FT = Federal Threatened, FE = Federal Endangered, FWP = Federally Warranted But Precluded, SS = State Sensitive, ST = State Threatened, SE = State Endangered

T/E/S Species Identified as *Closely Associated* with Wetlands in WA from Johnson and O'Neil (2001)	T/E/S Species Associated with Wetlands in Washington Based on WDFW Expertise	Status*	Activity in Wetlands	Widths of Buffers Reported in the Scientific Literature as Needed to Protect the Species	Notes/Comments (Provided by WDFW biologists)
Western Pond Turtle		SE	Feeds	400-500m (1300-1600ft) (Larsen 1997 citing Holland 1994)	
	American White Pelican	SE		400-800m (1312-2624ft) around breeding colonies (WDFW 2004)	
Sharp-tailed Grouse		SE	Feeds	1.2 miles during breeding and rearing season (WDFW 2004)	
Fisher		SE	Feeds and Breeds	No information	Not useful to generate buffer database for fishers until their populations increase. Despite extensive surveys, WDFW has been unable to confirm the existence of a fisher population in the state (Stinson and Lewis 1998).
Common Loon		SS	Feeds and Breeds	492 ft. April 1 to July 15 (WDFW 2004)	
Sandhill Crane		SE	Feeds and Breeds	400m (1312ft) during breeding season (WDFW 2004); buffer roosts (roost, nest, and loaf in wetlands) by >500m (1640ft) from new roads or buildings, and buffer feeding areas (includes wetlands) by >800m (2624ft) from new construction, road building or traffic increases (Bettinger and Milner 2000 in Littlefield and Ivey 2001); >300m from roads and human activity elicited no disruption in feeding, roosting, loafing (Burger and Gochfeld 2001)	

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Appendix 8-H
Hiring a Qualified Wetland Professional

This appendix contains recommendations to help locate and select a professional who is qualified to assist with wetland issues. Wetland professionals are usually hired to identify and delineate wetlands, rate them, assess functions and values, and provide assistance with wetland regulations and permits. They often complete the necessary application forms and studies needed to meet regulations and also provide advice about designing and implementing compensatory mitigation projects that are needed to replace wetlands if they are impacted.

Wetland professionals are generally hired by landowners or developers who want to do something on their property that may affect a wetland. In addition, many local governments hire professionals to provide review as a third party. Some professionals are self-employed; others work for larger environmental or engineering consulting firms.

What is a Qualified Wetland Professional?

There is no government sanctioned program for certifying someone as a “qualified wetland professional” or “qualified wetland specialist.” Generally, the term means a person with professional experience and comprehensive training in wetland issues, including experience performing wetland delineations, assessing wetland functions and values, analyzing wetland impacts, and recommending and designing wetland mitigation projects.

The Society of Wetland Scientists administers a professional certification program for wetland scientists that has two levels of certification: Professional Wetland Scientist (PWS) and Wetland Professional In-Training (WPIT). A person certified as a PWS would be considered a qualified wetlands expert. This program is discussed further in the shaded box at the end of this appendix.

If the person is not a certified PWS, there is no simple means of determining if they are adequately qualified to undertake the tasks listed above. However, the following criteria are indicators of someone who may be qualified to perform the wide range of tasks typically required of a wetland professional:

- At a minimum, **a Bachelor of Science or Bachelor of Arts** or equivalent degree in hydrology, soil science, botany, ecology, resource management, or related field. A graduate degree in one of these fields is usually an indication of more advanced expertise.

- At least **two years of full-time work experience** as a wetland professional; including delineating wetlands using the state or federal manuals, preparing wetland reports, conducting function assessments, and developing and implementing mitigation plans. Generally, the more years of experience, the greater the expertise.

- **Completion of additional wetland-specific training programs**. This could include a more comprehensive program such as the University of Washington Wetland Science and Management Certificate Program or individual workshops on wetland delineation, function assessment, mitigation design, hydrophytic plant or hydric soil identification, etc.

Keep in mind that most people engaged in professional wetland work have greater expertise in some aspects of the field than others. A person may have in-depth training in plant ecology or soils or hydrology, but few people have all three. A person may have extensive experience in wetland delineation or function assessment and have little experience in designing and implementing mitigation projects. Thus, it is important to be clear what specific tasks need to be completed and make sure the person or firm being hired has the specific expertise needed. Generally, more complex projects require multiple individuals that provide collective expertise to address all aspects of the project.

How to Find a Qualified Wetland Professional

There are a number of ways to find the names of wetland professionals. Finding a qualified one, however, can be difficult since this group of professionals is not required to be certified, licensed, or bonded in the State of Washington. One approach is to look in the Yellow Pages under *Environmental and Ecological Services*. You can also contact the local government planning office and ask for a list of professionals that work in their jurisdiction. Some local governments maintain lists of wetland professionals they consider to be well qualified.

Wetland professionals may also be found by requesting the advice of associations or businesses that commonly encounter wetlands in their work, such as the Building Industry Association and Association of Washington Business. Finally, state and federal resource agencies can be asked for referrals. Be aware, however, that most agencies will not be able to provide recommendations because of questions of fairness.

How to Select a Qualified Wetland Professional

A number of factors should be considered before hiring a wetlands professional. When interviewing professionals, their qualifications should be carefully considered (see above for the minimum recommended). Be sure to ask the following questions before making a selection:

- **Does the professional have training or experience in the use of the 1987 federal or 1997 Washington State wetland delineation manuals?** The selected professional should have the ability to apply the methods for identifying wetlands used by state and federal agencies. Make sure that the professional can identify wetlands and their boundaries consistent with regulating agencies.

- **Has the professional had additional training or expertise in related fields** such as hydrology, soil science, botany, or ecology?

- **Is the professional familiar with local, state, and federal wetland regulation**s?

- **How long has the professional been doing wetlands work?** How much experience do they have delineating wetlands in the field, assessing wetlands functions and values, or working with wetland regulations? Has the person worked in the part of the state where you propose to develop? Ask the professional for examples of previous work similar to the services being requested. Can the professional take you to a successful wetland mitigation project they designed and/or implemented?

- **Does the professional have experience working with regulatory agencies?** Ask the professional to describe their working relationship with the agencies that will be reviewing and/or permitting your project.

- **Does the professional have experience working on a team?** Given the complexity of some projects, it is expected that a wetland professional will team up with others who have experience in related fields such as water quality, wildlife, stormwater management, and hydrogeology. Ask the professional for a list of people with whom they have worked on a team in the past.

- **Who were some of the professional's past clients?** Request referrals and ask clients if they were satisfied with the professional's work. Ask whether there were any problems that occurred during or after the project, how the professional handled those problems, and what they charged for their work. Find out what type of track record the company has with local, state, and federal agencies. Be sure to ask for references that include clients who have had projects reviewed and approved by the regulatory agencies (Corps, Ecology, and local government).

- **Talk with colleagues and other businesses**, such as real estate, land development, homebuilding, etc. that are routinely involved in wetland concerns. Ask them about their experiences and knowledge regarding the professional being considered.

- **If you are considering a consulting firm, find out exactly who will be working on your project.** Will it be the principal professional with the years of experience, or someone with less experience who works for them?

- **Get an estimate of how much the professional will charge.** Compare rates but do not let cost be the sole criterion. Be sure to consider training, experience, and the other factors as well. A good professional who charges more may end up saving money by reducing permit processing delays.

Society of Wetland Scientists Professional Certification Program

The Society of Wetland Scientists keeps a list of those who have qualified for their professional certification program for wetland scientists. The certification program website http://www.wetlandcert.org allows you to search by name, city, and/or state.

As explained in the Professional Wetland Scientist program overview:

Certification is not required by any agency and has no official or legal standing. However, certification signifies that the academic and work experience of a Professional Wetland Scientist (PWS) meets the standards expected by his or her peers of a practicing wetland professional and provides acknowledgment to his or her peers of adherence to standards of professional ethics with regard to the conduct and practice of wetland science.

Wetland Professional in Training (WPIT) is considered a preliminary step for persons who meet the requirements for either (but not both) education and experience. Professional Wetland Scientist (PWS) certification is awarded for those meeting both educational and experience requirements.

Minimum degree requirements for WPIT and PWS are the BA or BS degrees, with course distribution of 15 semester hours each in biological and physical sciences and 6 hours in quantitative areas. For certification as a PWS, an additional 15 semester hours in wetland-related courses are required. In addition to comprehensive training in wetland science, a PWS is expected to have professional experience of at least 5 years as a wetland scientist, demonstrating the application of current technical knowledge dealing with wetland resources and activities.

Appendix 9-A
Additional Information on Preservation, Conservation, and Restoration

This appendix provides additional background information in three areas: the significant role local government can play in conservation and preservation; land trusts as potential partners for local governments; and considering threshold effects for planning restoration.

A Role for Local Governments: Conservation and Preservation in Lower Elevation Lands

Local governments and private landowners must be included when creating a diversified system of preserved areas. The lands owned by these two groups encompass the most underrepresented areas of the landscape in systems of land preservation. The legacy of land preservation in the United States has been weighted toward high-elevation or least productive lands (Scott et al. 2001). A recent study conducted by the State of Washington's Interagency Committee for Outdoor Recreation (IAC) (2001) found that over half of all public and tribal reservation lands are located above 3,000 feet. However, species richness tends to be greatest at lower, more productive elevations. More than 60% of the federally listed threatened and endangered species occur on private, lower elevation lands.

In addition, the IAC (2001) found that 40% of the state's 45.9 million acres are owned by federal, state, tribal, and local public entities, with federal lands making up the bulk of public land ownership. Only 6% of this acreage is aquatic, while 94% is upland. It is interesting to note that, as stated in IAC's report, Washington has the smallest amount of major public and tribal lands in the 11 western states, as well as the second lowest overall percentage of public and tribal lands following Montana. They add that although Washington is the smallest of the 11 western states, it has the second highest population in the West and the second highest population density following California.

Local governments could play a key role in conserving and preserving important lands in the lower elevations. In their paper *The Role of Local Government in the Conservation of Rare Species*, Press et al. (1996) make three claims about the need for local government involvement in land preservation:

> *(1) the scale of local and regional land use control and open-space acquisitions matches the range sizes of many rare, endemic species, (2) land acquisition is the most attractive approach to conserving many rare taxa, especially endangered flora, and (3) at least some local governments and non-governmental organizations have the policy capacity necessary to identify, acquire, and manage critical habitats for endangered species.*

They go on to acknowledge that conservation is always a land-use matter that requires local support. Local governments have the benefit of being able to broker larger land deals with other partners than they themselves could purchase alone. They can also acquire some smaller areas of habitat that add to a larger conservation landscape, fostering local sympathies for wildlife and habitats.

DeFreese (1995) recognizes that partnership with local government complements and enhances state and federal initiatives in conservation efforts. Brumback and Brumback (1988) critique early land acquisition programs in three states (New Jersey, Florida, and California), concluding that land acquisition efforts can overcome the legal and sociopolitical constraints of regulation and make it possible to reserve environmentally significant lands for the future.

Ian McHarg in 1969 was an early proponent of acquiring development rights, maintaining that "planned growth is more desirable, and just as profitable, as unplanned growth." He saw purchase as a way to make plans for development more acceptable to the public (Buckland 1987). "The need is growing for policies and institutions that can balance the requirements of economic development with the benefits of species, habitat, and open-space conservation" (Boyd et al. 1999).

Land Trusts Are Growing and Can Help

National land trusts such as The Nature Conservancy (TNC) and The Trust for Public Land (TPL) are working more closely in partnerships with local communities. Land trusts provide an opportunity for partnerships since they are growing in popularity and in numbers, thereby being able to preserve and manage more lands.

A census of land trusts by the National Land Trust Alliance counted 1,263 land trusts in existence across the country, a 42% increase from the decade before (www.lta.org). The census documented that permanently-preserved private land was approximately 6.4 million acres by the end of 2000. This was triple the 1.9 million acres preserved nationally by 1990. Of the 6.4 million acres, 52% was wetland. In Washington State, land trusts have also grown significantly. There are now 29 land trusts, while only 19 existed a decade ago.

The Nature Conservancy notes that the work of preservation is changing. They identify the need to target larger, and presumably more functional, preservation sites and to place a greater emphasis on representing all communities and ecological systems (Czech 2002).

Considering Threshold Effects for Restoration

In examining efforts in the Pacific Northwest to recover salmon habitat, Wu and Skelton-Groth (2002) offer some insights to the preservation and restoration efforts now underway. Conducting an empirical analysis that focuses on investments in riparian habitat for salmon recovery, they show that a large portion of conservation benefits would be lost when "threshold effects" are ignored. To explain the threshold effect, imagine a stream temperature that is necessary for healthy salmon populations. Until that temperature is reached, salmon populations cannot survive, so the habitat has no value to salmon until the threshold is achieved.

Wu and Skelton-Groth state, "When a threshold effect is present, the marginal benefits of conservation efforts may be zero or increase slowly at first, and then more rapidly as conservation efforts approach the threshold. After the threshold is reached, additional efforts may have little effect on environmental benefits." They add, "When threshold effects are ignored, funds may be overly dispersed geographically, and funding levels in any given program area may be inadequate to reach the threshold needed for a significant environmental improvement." They argue that funds should be allocated so that the total value of environmental benefits is maximized, not the total amount of resources protected. To target funding based on physical criteria measured on site (such as erosion or water quality) ignores the threshold effect of conservation efforts in degraded systems.

For example, when addressing temperatures in streams, priority would be given to streams closer to threshold levels rather than those far from it unless, of course, enough funding were available to do additional work in a stream with significantly warmer temperatures to successfully reach the threshold level.

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Appendix 10-A
Example of a Characterization of the Risks to Wetlands

As part of revisions to its critical areas ordinance, King County has prepared an *Assessment of Proposed Ordinances* that describes the risks to resources from the county's proposed regulatory and non-regulatory actions. This appendix reproduces Section 2.9 from Chapter 2 of the King County report, which describes the risks to the wetland resource from actions such as specified buffers, allowed alterations, classification (rating), and mitigation requirements. It is offered here as an example of characterizing risks as discussed in Chapter 10 of this volume. The full report by King County is available on the web at http://www.metrokc.gov/ddes/cao/.

POLICY DISCUSSION:

King County has an obligation to protect wildlife species through Federal, State and local regulations. The King County Comprehensive Plan requires a comprehensive approach to protecting wildlife species while balancing other requirements.

2.9 WETLANDS

Wetland Classification

Standard –Wetland Classification:

Wetlands are categorized based on the Washington State Wetland Rating System for Western Washington (DOE #93-74, 1993).

The standard wetland protection proposed for the CAO is in large part based on the Department of Ecology's classification and rating system for wetlands. Although DOE's classification system is more comprehensive than King County's current SAO system, this proposed DOE method is outdated and does not accurately reflect the current state of scientific understanding i.e., BAS of wetland ecology and conservation. Recognizing this weakness DOE is reviewing wetland BAS and concomitantly revising the rating system with expected completion by late 2004 (McMillan pers. com.). King County has tried to overcome weaknesses in the DOE method by augmenting the existing classification-only approach with additional regulations covering wetland complexes, and landscape approaches including clearing and impervious area restrictions.

There are many ways of classifying wetlands for ecological and regulatory purposes with no one method being, or remaining, the optimum method. As scientists learn more about wetland characteristics and functions, classification and ranking methods change accordingly to better protect wetland functions. Currently, the science of classification is moving from the more descriptive historical assessment methods towards newer process-oriented, functional methods. The proposed CAO does not reflect this more comprehensive and empirical approach of classifying wetlands and consequently there is a high certainty that King County's chosen classification system will not adequately protect certain wetland types (e.g., fragmented wetlands, bogs) or some wetland functions (e.g., wildlife habitat).

In general, the level of risk to wetland functions and values will decrease from existing levels because the proposed CAO standards are more restrictive than the current SAO standards. However, risks remain because additional buffer widths may not provide adequate protection depending on wetland, adjoining area and watershed topography, soils, ground water, surface hydrology and vegetation conditions. The proposed DOE's ranking and classification system is also based mainly on habitat functions, with little emphasis on other wetland functions, which are important to protect. Hence these other functions may not be protected by fixed buffers to the extent that habitat is protected.

It is difficult to assess the potential effect of implementing the proposed CAO Classification System and its associated buffers on wetland functions, as King County's current information regarding wetland distribution, abundance, and characterization is incomplete. This fact is especially true for smaller wetlands and for forested wetlands, which are difficult to find through remote sensing techniques. There is little information regarding the functions that wetlands provide. Reasonably reliable habitat classification data exists (Cowardin et al., 1979) for most large, open water wetlands and select other wetlands that were surveyed in the past. Specific data on wetland habitat condition and data on other wetland functions are unavailable because formalized functional analysis did not exist during King County's historical wetland surveys in the late 1980s. Since these surveys, adjoining area and watershed development suggest that wetlands may be much different than twenty years ago. As a result, much of King County's assessment of wetland functions is based on historical descriptions and extrapolations, augmented by more recent remote sensing interpretations. Site-specific data can be gleaned from some project (e.g., development, restoration) specific reports, however, the overall lack of critical data necessary to assess specific wetland functions results in uncertainty when assessing the adequacy of fixed buffers for protecting wetland functions, and other standards, in the proposed CAO.

In summary, the chosen wetland rating system poses risks to wetland protection because it does not identify, consider, or rank the multiple functions that wetlands may exhibit. Included are relatively few and are biased towards habitat characteristics. Therefore the associated fixed-buffer widths and mitigation measures that are based on classification and rating may fail to adequately protect those functions not identified. Without adequate information on the additional functions needing protection, the level of risk remains high.

Buffers

Standard – Minimum Buffer Widths:

Minimum buffer widths of 300, 200, 100, and 50 ft. shall protect Category I-IV wetlands, respectively, in rural areas or within the Urban Growth Area if not a subdivision, short subdivision, urban planned development or binding site plan, with the exception of permitted alterations.

Minimum buffer widths of 100, 50, 50, and 25 ft. shall protect Category I-IV wetlands, respectively, within the Urban Growth Area provided a functional assessment of the wetland and buffers is provided and approved. Restoration and enhancement will be required to restore the wetlands and its buffer to a fully functioning condition.

Assessment:

This standard for minimum buffer widths in rural areas is within the range of recommendations in the BAS literature, while the standard in urban areas are lower and depart from the larger buffers suggested by BAS. However, BAS also indicates that wetland protection by fixed buffer widths alone may be insufficient. Specifically, fixed buffers are essential but inadequate to protect wetland functions because the buffers may not encompass the processes that drive respective wetland functions. Moreover, fixed buffers also allow development and other disturbances to completely encircle wetlands, thereby isolating such wetlands and segregating them from other wetlands, aquatic habitats, and from essential upland habitats. Eventually such isolation leads to a shift in their wildlife and possibly the alteration of hydrology and other wetland functions.

Under ideal geologic, soil, and vegetation conditions, BAS suggests the recommended fixed buffers may be sufficiently wide to protect water quality of Category I and II wetlands in rural areas or Category I wetlands that have been enhanced per the report requirements in the urban areas. Buffers adjoining Category III, and IV wetlands in rural areas and Category II, III and IV in urban areas are at the narrow width limit for protecting wetlands from anthropogenic water quality impacts. Moreover, proposed buffers widths are insufficient to protect unique wetland vegetation and fragile wildlife that are sensitive to microclimatological changes associated with clearing or altering adjoining land. Proposed buffers may also not protect certain features of wetland hydrology and groundwater interactions, as these functions (given all conditions being equal) are proportional to buffer widths.

Level of Risk to Function and Values

In general, most wetland functions may be at some risk by only protecting wetlands in rural areas with standard, fixed 50 to 300 ft. wide buffers. Wetlands in urban areas will be at high risk for most or all wetland functions even with the enhanced buffer approach with the possible exception of water quality enhancement under unique conditions. Water quality enhancement functions on level terrain and for a well-vegetated, grass, shrub, and tree buffers, would exhibit the least level of risk. For wetlands greater than 500 feet from each other (i.e., non-complex wetlands), the greatest risk would be to maintain the full suite of wildlife functions as fixed buffers may not provide sufficient habitat for wetland species if development encircles wetlands. This level of risk in the rural area would be more difficult to judge because narrower buffers than in the urban area provide less remaining habitat and greater edge effect, although enhancement of the buffer itself could provide habitat features of benefit to some wildlife. Clearly, it would depend on the condition of the adjoining area, as a high quality, narrow rural buffer would not benefit from enhancement and would only be detrimentally impacted by narrower widths.

The risk of declines and local extinctions of native species increases as wetlands get physically isolated from each other by roads, development, and other potential barriers to migration. These risks would be greatest for amphibian and mammal populations as development, agriculture, forest practices, roads and other actions encircle entire wetlands, thereby isolating them from life-support habitat found at other wetlands and in upland watershed locations. The risk of declines would accelerate as populations become increasingly smaller from deterministic (e.g., pollution), and random (e.g., drought, freezing), and inbreeding. The risk to amphibians, birds, small mammals may also increase with urbanization beyond fixed buffers as bullfrogs, rats, cats, and dog populations increase and roam through buffers to prey on, or "play" with vulnerable wetland wildlife. The risk is highest in the urban areas where buffer widths are inadequate to provide protection from non-native wildlife.

BAS also suggests that the proposed maximum 300-ft buffer for rural areas is inadequate in most situations to protect microclimate (wind, humidity, temperature, soil moisture, etc.) within these and narrower buffers. Microclimate can not be protected in the urban area, even with the maximum 100-foot buffers for wetlands. Hence the existing soil conditions (e.g., organics, bacteria, mycorrhizal associates and fungi of decomposition) and vegetation associations in the buffer (mosses, herbs) most likely will change in proportion to buffer width. Often these climatological and soil changes enable non-indigenous species to outcompete and replace the original biota. The risk to wetland groundwater and hydrological functions will vary widely depending on geology, soils, vegetation, topography and watershed size and condition. Therefore, the risk to wetland functions by the proposed buffers is conjectural, although with all things being equal, the least risk occurs to either of these two functions, microclimate and hydrology, when the buffers are largest and the greatest risk occurs in the urban areas.

Level of Uncertainty

Specific information relative to urbanization impacts to wetlands in King County does not exist regarding the optimum widths of buffers adjacent to wetlands and their respective effectiveness in protecting wetland functions. The best information covers buffer widths required to protect water quality enhancement functions of streams but even this data is mostly extrapolated from agricultural and silvicultural studies. Some data exists on the widths of various stream buffers and their wildlife following clearcutting of adjacent forests however these studies are relatively recent and therefore have not yet monitored wildlife for sufficient lengths of time. Moreover, clearcutting and subsequent reforestation impacts are significantly different than the permanent primary and secondary impacts of urbanization. Consequently, there is a high degree of uncertainty regarding the ability of 50-300-ft. buffer widths in rural areas to protect wetland hydrology, groundwater interchange, and fish, wildlife and habitat functions of specific wetlands from adjoining area and watershed urbanization. In contrast for wetlands in general within an urbanizing area, BAS suggests that wetland functions will definitely decline with only fixed buffers of 25 to 100 ft.

Standard – Buffer Averaging:

> *Minimum buffer widths may be modified on a case-by-case basis. There would be no net loss of buffer area and the buffer width is not reduced to less than 75 percent of the standard buffer width.*

Assessment:

Buffer averaging is consistent with BAS if implemented to increase widths and wetland functions at specific sites and concurrently not harm functions from reduced widths elsewhere. For this select situation, there would be equal total buffer area and a net increase in select functions, a goal supported by BAS.

Level of Risk to Function and Values

Buffer averaging provides the opportunity to decrease the level of risk to wetland functions if buffer widths are reduced where they are not necessary and increased where they would be beneficial. However, buffer averaging could pose an increased risk to functions if averaging increased buffers for one function at the expense of another. For example, at a wetland with low flood control function and high wildlife function, buffer averaging to increase the flood control function could pose a risk to wildlife function.

Level of Uncertainty

The implementation of ecologically supported buffer averaging may prove difficult without standardized empirically and scientifically accepted methods of consistently identifying and determining functions. In general, wetland ecologists do not have the tools to trade off buffer widths with a high degree of certainty unless adequate information has been obtained. Any certainty that does exist depends on function to be gained by increasing buffers. Consequently, the certainty of improved water quality enhancement function by wider grass, shrub, and tree buffer is greater than the certainty of improving groundwater recharge or wildlife functions. Clearly, it would take considerable studies of groundwater recharge capacities, including the presence and flow of aquifers, to reduce the uncertainty in providing groundwater interchange functions within an enlarged buffer. Finally, the increase in wetland buffers allowed by buffer averaging might only marginally benefit functions. For example, wildlife may additionally be protected from adjoining noises and other disturbances by wider buffer widths at certain locations but most likely will not benefit appreciably by the relatively small increases in habitat from buffer averaging.

Standard – Grazed and Tilled Wet Meadows:

Existing grazing and tilling activities may continue in wet meadows.

Assessment:

Wet meadows exhibit the ability to provide significant groundwater recharge, flood control, water quality enhancement, and wildlife functions depending on their vegetation, morphometry, soil porosity and subsurface geology. BAS suggests that grazing in wet meadows is compatible with BAS if best management practices (BMPs) are used (see Chapter 3, Section 3.2 Farm Planning). For example, if meadows are used for nesting or foraging by waterfowl and waterbirds, grazing may only be permitted at times when wildlife is not present or at locations where livestock will not harm wildlife.

Level of Risk to Function and Values

The timing and density of grazing can significantly increase the risk to wet meadow functions, particularly to water quality and wildlife functions The timing of grazing is controlled by the proposed BMPs therefore the risk from livestock may be low if animal units, timing and other aspects of meadow use are appropriate for the site. High livestock numbers however, can result in high nutrient concentrations within meadows and in runoff, potentially causing large algal blooms, anoxic conditions (of detriment to macrophytes, invertebrates, waterfowl and other taxa) and other eutrophic situation in nearby wetlands and other aquatic areas. Overgrazing may also lead to increase soil compaction, soil erosion and other disturbances leading to higher water quality and associated ecological risks from sediment runoff.

Level of Uncertainty

Compliance with BMPs would provide important certainty to protecting wet meadows from overgrazing and other detrimental agricultural effects. Storage sheds barns and additional residences however may continue to be built on wet meadows reducing or eliminating the functions the replaced wet meadows may have been serving.

Mitigation

Standard – Mitigation Ratios:

Under special situations mitigation ratios shall be used to mitigate adverse impacts and will vary based on wetland location and category.

Assessment:

The proposed CAO provides restoration and replacement ratios for wetland impacts and losses that are based on "best professional judgement", as there are no scientific studies that identify empirically determined mitigation ratios. The NRC (2001) references studies that imply a '1.5 to 1' ratio of 'mitigation to lost acreage' would be needed to equal the area lost (if all other permit conditions are met including functional equivalency). However, these ratios are often additionally adjusted to reflect temporal loss of wetland functions, functional values of the impact site, and other factors. Specifically, replacement ratios increase proportionately with the length of time it takes to reach equivalent function. Higher ratios are also suggested for replacing pristine wetlands with higher functional values than that for mitigating severely degraded wetlands, which essentially reflects scientific uncertainties in replicating certain kinds of wetlands. King County's proposed mitigation ratios are within the ratio range of BAS by requiring equivalent or greater function for impacts. However, King County ratios may be lower than what is implied by BAS when recognizing and considering the temporal lag in replacement of wetland functions. It is also lower than BAS in situations were equivalent or greater function is not possible, as for example, when replacing a mature forested wetland with a new shrub-scrub wetland.

The proposed CAO standard also differs from BAS in that it is based on wetland category, with the assumption that wetland category is a surrogate for function which may not necessarily be the case. BAS further notes that preferences for on-site and in-kind mitigation should not be automatic, but rather based on an analytical assessment method of the wetland needs in the watershed, and the potential for the compensatory wetland to persist over time (NRC 2001). Although King County has considered similar functional criteria in their mitigation process no formalized assessment tool is currently proposed.

Level of Risk to Function and Values

Mitigating for lost wetland acreage is difficult and highly risky. Functional replacement is even more difficult and requires extensive training, information gathering and monitoring. BAS indicates that mitigated wetlands have not yet succeeded in replacing lost acreage or functions with any predictability. Consequently the risk to replacement of wetland acreage and their functions and values remains high. Mitigation has not met the "no-net loss of area, function and values" goal in King County's Comprehensive Plan and if past performance is an indicator of future success the risks remain high. Wetland enhancement and restoration, regardless of proposed ratio, as mitigation for wetland losses always results in a decline of wetland acreage.

The risks of replacing lost functions and values depend at least on two factors: (1) the availability of restoration sites; and (2) the complexity of functions and values required to be replaced. If restoration sites are unavailable within the same basin as the impacted wetland then the risk is high that some of the irreplaceable functions that the wetland provided (e.g., groundwater interactions, habitat for wildlife, vegetation, recreation etc.) will be lost to that basin. It also remains uncertain whether flood control, water quality enhancement and other wetland functions that are lost by permitted activities can adequately be replaced through engineered projects. Regardless, a loss of functions remains between the time the permitted wetland is altered and the mitigated wetland provides the full capacity of the suite of functions of the original wetland.

Level of Uncertainty

The level of uncertainty in wetland mitigation in general does not lie in the ratios. Rather, to a large degree, success lies in the extent of project planning, construction, monitoring, and overall oversight. Consequently, with proper funding and other resources the uncertainty of success can be decreased and minimized regardless of ratios.

Standard – Mitigation Banking:

> *The department may approve mitigation in advance of unavoidable adverse impacts to wetlands caused by the development activities through an approved wetland mitigation bank.*

Assessment:

Wetland mitigation banking is a valuable compensatory mitigation tool to stem the loss of wetland functions and values. Mitigation Banking has been implemented in other regions in the U.S. and in Washington is being used by the Department of Transportation (WSDOT). King County has one mitigation bank. As recommended in the BAS literature, banks are established and fully functional prior to permitted losses at existing sites. In practice however, credits are released incrementally as hydrological performance and other developmental and functional stages are attained. When done carefully and according to specified standards such as those developed in the King County Mitigation Banking Rules, mitigation banking may successfully implement siting as recommended by BAS literature. The replacement of small, marginal wetlands of low, single function such as small totally isolated wetlands and those adjacent to roads and highways with larger wetlands of higher and potentially multiple functions is consistent with BAS. Nevertheless, concerns regarding replacement ratios (see previous section), in-kind versus out-of-kind replacement and bank sighting when projects are permitted that harm or destroy higher quality wetlands remain. Although BAS suggests that a wide diversity of banks, bank sizes and bank functions should be created, the economy of scale benefits may not be realized unless banks are of certain minimum size and in certain economically-determined locations. The proposed CAO provides the flexibility to mitigate with a diversity of bank sizes and functions and hence there is no departure from BAS. In practice however, market forces result in larger, easily constructed wetland types. Finally, mitigation banks are relatively new and have not been monitored long enough to ecologically assess their success or failures. Although wetland losses are mitigated by mitigation banking, empirically determined success of specific targeted goals for hydrology, water quality, vegetation, and wildlife functions are limited to only a few sites and not commonly undertaken.

Level of Risk to Function and Values

Decreases in total wetland acreage always occur when wetland enhancement and restoration mitigate wetland acreage loss. Otherwise mitigation banking poses a low level of risk as full functions are required to be demonstrated at the bank site prior to loss of any wetland functions at the permitted site. Currently however, restoration is not ideal, and credits are released prior to full wetland mitigation resulting in loss of wetland acreage and functions. Moreover, wetlands may not be replaced within the watershed in which they are situated; thereby posing risks to the remaining watersheds for unreplaced transferred functions. Risks of lost functions may accrue in areas of high mitigation pressure such as in urban areas as mitigation for lost functions moves elsewhere.

Level of Uncertainty

Generally there is less compliance uncertainty with mitigation banks than other wetland restoration programs because of their larger size and diverse institutional oversight. Larger sites also provide a greater economy of scale than smaller projects and potentially enables a more carefully thought out process considering all aspects of project design, construction and monitoring presumably leading to greater certainty in success. Uncertainty increases with respect to bank complexity and habitat types with permanent, smaller seasonal and semi-permanently flooded banks being difficult to create. Scientific uncertainty remains high regarding the best method for achieving overall functional benefits.

Allowed Alteration

Standards – Development Standards and Alterations:

> *Alterations identified in the proposed CAO (K.C.C. 21A.24.) are allowed within a wetland or wetland buffer if the alteration complies with all applicable requirements, standards, and mitigation requirements established in the proposed CAO.*

Assessment:

The County allows numerous actions that allow activities within a wetland or wetland buffer. For some situations, these allowed alterations might be inconsistent with recommendations suggested by BAS. These include some rural activities and the building of roads, utilities, and other necessary infrastructure. Data to the extent to which these activities influence wetland functions and are adequately mitigated is unavailable. Tree removal in buffers, for whatever reason, influences water budgets through transpiration and nutrient storage as mentioned in the literature review. The removal of trees and other vegetation influences microclimate, which in turn influences remaining plants and wildlife. Incrementally, and collectively these exemptions continue to erode the wetland base in King County and therefore reduce the multiple functions they may provide.

Reasonable Use Exemptions also may enable encroachment on wetlands and their functions if no other on-site development possibilities are available. Consequently, the non-mitigated exemptions and allowed alterations are not consistent with BAS for wetland protection if they lead to incremental, cumulative losses in wetland area, functions and values. Conditions on allowed alterations may lessen these impacts but do not mitigate for their losses.

Level of Risk to Functions and Values

Individually departures under exemptions and allowed alterations are small and may seem not to pose any risk. Collectively however, they contribute to the cumulative loss of wetland functions and values because for the most part, these losses are permitted without mitigation. Consequently the immediate risk to wetlands may be small and localized although cumulatively over many years the risks increase and spread over larger areas. For many allowed alterations such as the construction of large roads and powerline corridors the impacts to wetland functions and values may not be mitigatable. For example, the groundwater interchange and wildlife functions of roads cannot readily be mitigated on site or replaced elsewhere. Roads and utility corridors may result in permanent habitat loss, reduced habitat quality and permanently fragment wildlife habitat resulting in smaller isolated populations and therefore increased risks of extinction. Roads additionally kill wildlife through animal vehicle collisions or harm animals through altered wildlife behavior. Roads and utility corridors also indirectly pose high risk to wetlands because of their large direct and indirect watershed and landscape effects.

In summary, BAS indicates that permitted activity whether residential, non-residential, silvicultural, agricultural or infrastructure related may have negative impacts on wetlands and their functions. In King County, some of these impacts do not have to be mitigated, and for the ones that do have to be mitigated, information indicates that the existing mitigation strategy is not working. Without specific assessments of departures, we should assume that larger projects and cumulatively smaller projects might continue to lead to wetland aerial and functional loss.

Level of Uncertainty:

Data on the number of exemptions and allowed alterations and their influence on wetland acreages and functions and values are unavailable. Hence the prevalence of risk to wetland functions and values remain undetermined. Conditions on allowed alterations may lessen these impacts but impacts nevertheless occur. There is little uncertainty in the ongoing and cumulative loss of wetland functions and values from unmitigated permitted activities.

POLICY DISCUSSION:

Buffers are one tool that King County is proposing in conjunction with clearing restrictions, rural stewardship, and other regulatory and incentive based provisions. The adopted King County Comprehensive Plan provides guidance as to the management strategy for protection of wetland functions:

> E- 132 King County's overall goal for the protection of wetlands is no net loss of wetland functions within each drainage basin. Acquisition, enhancement, regulations, and incentive programs shall be used independently or in combination with one another to protect and enhance wetland functions.
>
> E- 133 Development adjacent to wetlands shall be sited such that wetland functions are protected, an adequate buffer around the wetlands is provided, and significant adverse impacts to wetlands are prevented

The proposed ordinance requires that within the Urban Growth Area the applicant complete a critical area report showing that the wetland and its adjoining buffer are fully functioning, or have a restoration/ enhancement plan that will be implemented to achieve a fully functioning wetland and buffer.

Balancing of King County's other responsibilities under the Growth Management Act further influence the widths of buffers proposed, particularly within the Urban Growth Area. These responsibilities, outlined in the King County Comprehensive Plan are:

- ***Preserve the high quality of life*** by balancing infrastructure needs with social, cultural, educational, recreational, civic, health and safety needs.

- ***Spend money wisely and deliver services efficiently*** by:

- Concentrating infrastructure investments and service delivery to support the regional development pattern near cities where a full range of local services are located or can be made available;

- Solving service deficiencies within the County to meet existing service needs and phasing service improvements for the needs of future growth;

- Looking to King County to provide countywide facilities and services, and;

- Relying primarily upon cities and special purpose districts as the providers of local facilities and services appropriate to serve those local needs, except where the County is the local service provider (e.g., Rural Area).

- ***Continue our economic prosperity*** by promoting a strong and diverse economy for King County residents through policies and programs that encourage new business opportunities, increase family wage jobs and create a predictable regulatory environment for businesses and citizens.

- ***Increase the housing choices for all residents*** by permitting a wide variety of home styles and by increasing housing opportunities for all residents in locations closer to jobs.

- ***Ensure that necessary transportation facilities and services are available to serve development at the time of occupancy and use*** by targeting road and transit investments where growth is desired and for equitable contributions to the transportation system by new development.

- ***Balance urban uses and environmental protection*** through careful site planning that maximizes developable land while respecting natural systems.

- ***Preserve rural, resource and ecologically fragile areas for future generations*** by maintaining low residential densities in the rural areas and in areas containing regionally and nationally important ecosystems for fish and wildlife and by recognizing that resource lands, such as farms and forests, provide economic, social and environmental benefits.

With regard to grazed wet meadows and other agricultural practices, the proposed ordinance exempts existing agricultural activities. To apply standards retroactively would not only be detrimental to existing agricultural enterprises but also inconsistent with how other existing activities are regulated by this ordinance. In addition, King County Comprehensive Plan policies support ongoing agricultural activities as part of a diverse landscape.

> R- 503 King County shall promote and support forestry, agriculture, mining and other resource-based industries as a part of a diverse, regional and sustainable economy.
>
> R- 504 Well-managed forestry and agriculture practices are encouraged because of their multiple benefits, including natural resource protection.