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.

References

Castelle, A.J., C. Conolly, M. Emers, E.D. Metz, S. Meyer, M. Witter, S. Mauermann, M. Bentley, D. Sheldon, and D. Dole. 1992. Wetland Mitigation Replacement Ratios: Defining Equivalency. Publication # 92-08. Washington Department of Ecology, Olympia, WA.

Desbonnet, A., P. Pogue, V. Lee, and N. Wolff. 1994. Vegetated Buffers in the Coastal Zone: A Summary Review and Bibliography. Coastal Resources Center Technical Report No. 2064. University of Rhode Island. 72pp.

Sheldon, D., T. Hruby, P. Johnson, K. Harper, A. McMillan, T. Granger, S. Stanley, and E. Stockdale. 2005. Freshwater Wetlands in Washington State, Volume 1: A Synthesis of the Science. Publication #05-06-006. Washington State Department of Ecology, Olympia, Washington.

Simenstad, C.A. 1983. The Ecology of Estuarine Channels of the Pacific Northwest coast: A Community Profile. U.S. Fish and Wildlife Service FWS/OBS-83/05.

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.