E. Stockdale

BEFORE THE POLLUTION CONTROL HEARINGS BOARD
STATE OF WASHINGTON

AIRPORT COMMUNITIES COALITION, Appellant, CITIZENS AGAINST SEA-TAC EXPANSION, Intervenor/Appellant, v. STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY; and PORT OF SEATTLE, Respondents.	PCHB No. 01-160 DIRECT TESTIMONY OF ERIK STOCKDALE SUBMITTED ON BEHALF OF THE DEPARTMENT OF ECOLOGY

AR 015670

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Erik Stockdale declares as follows:

I. Introduction

1. I am a Senior Wetlands Specialist with the Washington State Department of Ecology (Ecology) in the Shorelands and Environmental Assistance Program. I am a certified Professional Wetlands Scientist with the Society of Wetland Scientists (SWS). I served on the board of the Pacific Northwest chapter of SWS for three years. A copy of my resume detailing my education and experience is attached hereto as Attachment A.

2. Construction of the Port of Seattle's (Port) Master Plan Update improvement projects at Seattle-Tacoma International Airport (STIA) will necessitate the filling of 18.37 acres of palustrine freshwater wetlands in the Miller, Walker and Des Moines Creek basins, three highly urbanized basins. At the Vacca Farm, an additional 0.92 acres of "prior converted croplands" will be filled by the embankment, bringing the total permanent impact to 19.29 acres.[1] The wetlands slated for development have all been modified and degraded to varying degrees. Many of the wetlands have been maintained as lawn and landscaping over several decades "in the back yards" of homes recently condemned and purchased by the Port. Other wetlands formed on the embankment of the fill placed for the existing second runway. Wetlands are also located in the Vacca Farm area, and within several of the fairways at the Tyee Golf course on Des Moines Creek. In addition, the project will temporarily affect 2.05 acres of wetlands for several years with temporary stormwater control ponds.[2]

3. In Ecology's review of the Port's application for a Clean Water Act § 401 Certification (401 Certification), I was responsible for evaluating impacts to wetlands and aquatic resources and determining if there was reasonable assurance that the project would comply with water quality standards with regard to those resources. Since 1996, I have

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[1] The Corps Public Notice does not include impacts to prior converted croplands because these wetlands are exempt from federal regulation under the Clean Water Act. Ecology regulates the filling of prior converted croplands and requires mitigation under ch. 90.48. RCW.

[2] Ecology decided to address these impacts as a separate impact in terms of calculating compensatory mitigation because the stormwater ponds will be in place for a couple of years, after which time the area will be restored to natural wetland conditions.

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worked with a team of Ecology staff on the Port's applications for a 401 Certification. In that capacity, I reviewed the Port's Natural Resource Mitigation Plan (NRMP) for compliance with state laws and regulations. In 2001, my day to day involvement in the project was transferred to Katie Walter, a Certified Professional Wetlands Scientist at Shannon & Wilson. Ms. Walter and I worked closely, thus allowing me to remain informed of any changes to the NRMP.

4. Wetlands are waters of the state and are regulated under the state's water quality laws, ch. 90.48 RCW, and applicable regulations in Title 173 WAC. Ecology has developed several policy and guidance documents that outline Ecology's regulatory authority and mitigation approach regarding wetlands. They include: How Ecology Regulates Wetlands,[3] Water Quality Guidelines for Wetlands,[4] and the Alternative Mitigation Policy Guidance for Aquatic Permitting Requirements from the Departments of Ecology and Fish and Wildlife.[5] In addition, ch. 90.74 RCW addresses out-of-basin mitigation.

II. The NRMP Will Result In A Net Environmental Benefit

5. The 401 Certification requires that the Port implement the mitigation detailed in the NRMP. Table 4.1-3 of the NRMP provides a "bean count" of the mitigation actions. To compensate for the 19.29 acres of wetland fill, the in-basin mitigation includes:

(a) 11.95 acres of wetland restoration;

(b) 22.32 acres of wetland enhancement;

(c) 54.93 acres of wetland buffer enhancement and riparian corridor restoration; and

(d) 23.55 acres of wetland and buffer preservation.

The out-of-basin mitigation includes:

(a) 29.98 acres of wetland creation;

(b) 19.5 acres of wetland enhancement; and

(c) 15.9 acres of wetland buffer enhancement.

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[3] Washington State Department of Ecology, Publication No. 97-112 (March 1998)
[4] Washington State Department of Ecology, Publication No. 96-06 (April 1996)
[5] Washington State Departments of Ecology, Fish & Wildlife, and Transportation. 2000.

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The Port's compensatory mitigation plan will restore and enhance ecological and hydrological functions to 176 acres of land. Of that, approximately 112 acres of the mitigation occurs on-site.

6. One tool Ecology employed in its evaluation of the adequacy of the Port's NRMP was its wetlands guidance document setting forth general mitigation ratios.[6] Mitigation ratios are a generally accepted method, based primarily on a scientific understanding of wetland functions, the risks of various mitigation actions, and the time required for their establishment of wetland processes and functions. Ratios help determine equivalency between the wetland functions lost and proposed mitigation. The general ratios should be adjusted based on numerous site-specific factors including:

a. What type(s) of wetlands are being filled;

b. The likelihood that the mitigation action will be successful;

c. How long it will take the mitigation action to be fully successful;

d. How much gain in aquatic resource function will result from the mitigation action;

e. The location of the mitigation actions; and

f. How well the mitigation wetlands will persist on the landscape.

Relative to the general ratios, applying these factors results in a more accurate ratio based on scientifically-based assessment of impacts. The ACC's witnesses state that Ecology was inconsistent with its own guidance because Ecology did not apply the correct mitigation ratios to the proposed wetland impacts as outlined in Ecology's guidance documents. As explained below, this conclusion is erroneous.[7]

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[6] McMillan, A. 1998. How Ecology Regulates Wetlands. Ecology publication 97-112, available at http://www.ecy.wa.gov/biblio/97112.html

[7] One criticism regarding Ecology's mitigation guidance that can fairly be leveled is that the guidance documents are out of date with the agency's current mitigation practice. The documents do not discuss changes made to agency policy and practice by the following: the Washington Alternative Mitigation Policy Guidance for Aquatic Permitting Requirements; changes made to RCW 90.48 and RCW 90.74 by Engrossed Substitute Senate Bill 5273; and the mitigation banking rule. The guidance documents are also silent on Ecology's current practice of granting mitigation credit for upland buffers, as well as Ecology' recognition of the FAA's legitimate concern over wetland mitigation in and around airports. Ecology staff, including Andy McMillan and I, are presently

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7. The NRMP is the culmination of several years of intensive project impact assessment and negotiations between the Port, Ecology and the Army Corps of Engineers (Corps). Early in the process the Port argued that Federal Aviation Administration (FAA) requirements prevented in-basin mitigation. Instead, the Port proposed the out of basin mitigation in Auburn as the primary mitigation strategy. The Port argued that the hydrologic and water quality functions provided by the wetlands being filled could be replicated in-basin by the project's stormwater management plan. Ecology did not accept either argument. At a meeting with the Port in November 1998, Ecology laid out a set of minimum "environmental objectives" for the project. One of the minimum objectives was that wetlands needed to be replaced in-basin on a one-to-one basis (1:1)—one acre of mitigation credit is provided for one acre of impact.

8. There are at least two means to apply mitigation ratios. One way is to give credit of 1:1 for every new acre of wetland created or restored, credit of 2:1 for wetland area enhanced, credit of between 5:1 and 10:1 for riparian/buffer enhancement and preservation, and require that the total mitigation credit equal at least double the area being filled. This was the approach used on the Port's project and resulted in mitigation credit approximately four times the amount of wetland area proposed for fill. Table 4.1-3 of the NRMP provides a summary of the mitigation credits agreed to by Ecology and the Corps of Engineers for the project.[8]

9. The other method is to follow the general ratios contained in Ecology's guidance. To demonstrate that Ecology's acceptance of the mitigation in the NRMP meets Ecology's mitigation guidance, Mr. Andy McMillan, Ecology's senior wetland policy specialist (and author of Ecology's wetland guidance documents) and I prepared the following three tables. Those tables apply ratios based on site-specific anticipated gains in wetland

engaged in the process of updating several of Ecology's wetlands guidance documents to make them reflect current practice.

[8] Natural Resource Mitigation Plan, Master Plan Update Improvements Seattle-Tacoma International Airport, Parametrix, Inc., November 2001, page 4-13.

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function and based on the general ratios of 2:1 for creation/restoration, 4:1 for wetland enhancement, and 10:1 to 20:1 for riparian/buffer enhancement and preservation. Using this approach, one would require the mitigation credit to be roughly equivalent to the amount of wetland area being filled. In fact, under this approach the amount of credit attributable to the mitigation required of the Port is double the amount of impact. The application of mitigation ratios by either method demonstrates that the mitigation package for this project exceeds Ecology's recommended mitigation ratios.

Table 1. In-Basin Mitigation

Mitigation Action	Credit ratio	Mitigation Area (acres)	Mitigation credit
Creation/Restoration			
Remove fill at Lora Lake	1:1	1.0	1.0
Remove fill at Des Moines Way nursery site	1:1	2.0	2.0
Remove fill at wetland A17	1:1	0.3	0.3
Vacca Farm "restoration"[9]	2:1	6.6	3.3
TOTAL		**9.9**	**6.6**
Wetland Enhancement			
Des Moines Way Nursery	4:1	0.86	0.21
Vacca Farm "enhancement"	4:1	5.7	1.42
Miller Creek wetland enhancement	4:1	10.25	2.56
Tyee Golf Course	4:1	4.5	1.12
Des Moines Creek wetlands	4:1	1.01	0.25
TOTAL		**22.32**	**5.56**
Wetland Buffer Enhancement and Riparian Corridor Restoration			
Miller Creek Buffer	10:1	40.86	4.08
Vacca Farm	10:1	4.58	0.46
Lora Lake	10:1	1.81	0.18
Tyee Mitigation Buffer	10:1	1.57	0.16
W. Des Moines Creek	10:1	3.38	0.38
Des Moines Way Nursery	10:1	2.73	0.27
TOTAL		**54.93**	**5.53**
Preservation			
Borrow Area 3 wetland complex	10:1	2.35	0.23
Borrow Area 3 buffer	20:1	21.20	1.06
TOTAL		23.55	1.29
TOTAL In-Basin		**110.7**	**18.98**
Mitigation ratio based on 19.29 acres of impact (18.37 acres from Public Notice plus 0.92 acres prior converted croplands)		**5.74 to 1**	**0.98 to 1**

[9] Includes prior converted croplands and some fill removal from former wetland areas.

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Table 2. Out-of-Basin Mitigation (Auburn)			
Mitigation Action	**Credit ratio**	**Mitigation Area**	**Mitigation credit**
Wetland Creation	2:1	29.98	14.99
Wetland Enhancement	4:1	19.5	4.87
Buffer Enhancement	10:1	15.9	1.59
TOTAL Out-of-Basin		**65.38**	**21.45**
Mitigation ratio based on 19.29 acres of impact (18.37 acres from Public Notice plus 0.92 acres prior converted croplands)		**3.39 to 1**	**1.11 to 1**

Table 3. Mitigation Package Summary				
	Mitigation Area	Mitigation Area Ratio	Mitigation Credit	Mitigation Credit Ratio
In-basin mitigation	110.7	5.74 to 1	18.98	0.984 to 1
Out-of-basin	65.38	3.39 to 1	21.45	1.11 to 1
Total	**176.08**	**9.12 to 1**	**40.43**	**2.1 to 1**

10. The result of applying the mitigation ratios in this manner demonstrates that the mitigation actions for the project provide approximately equivalent mitigation in-basin to what is being lost. Additionally, out-of-basin mitigation actions provide mitigation that is more than equivalent to what is being lost. Taken together, these actions provide considerably more mitigation than would be required if the mitigation was based strictly on Ecology's general mitigation ratio guidance.

11. Though the overall mitigation will result in a net gain in acreage, a net loss of wetland area will occur within the basin where the impacts occur. Generally, out-of-basin mitigation is acceptable if it is not technically or scientifically feasible to provide a sustainable mitigation that replaces wetland functions lost in basin. The National Academy of Sciences wetland mitigation study and other studies have discouraged mitigation that simply attempts to "fit" new wetlands into locations where they have little chance to succeed in order to meet the objective of "no net loss" of wetland area in a particular location. [10,11,12] Given the highly

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[10] National Research Council, 2001. Compensating for Wetland Losses under the Clean Water Act, National Academy Press, Washington, D.C. See http://www.nap.edu/books/0309074320/html/

[11] Johnson, P., and others. 2000. Washington State Wetland Mitigation Evaluation Study, Phase 1: Compliance. Ecology publication 00-06-016. Available at http://www.ecy.wa.gov/biblio/0006016.html; and Johnson, P. and others 2001. Washington State Wetland Evaluation Study, Phase 2: Evaluating Success. Ecology publication 02-06-009. Available at http://www.ecy.wa.gov/biblio/0206009.html

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developed condition of the Miller, Walker and Des Moines Creek basins, it is a reality that few opportunities for wetland creation or restoration remain. Furthermore, FAA regulations strongly circumscribe habitat mitigation activities in and around airports in the United States.[13] The NRMP will provide sustainable aquatic resource mitigation in-basin by restoring the riparian processes, habitat structures and functions of a severely degraded urban reach of Miller Creek. Additionally, a considerable amount of out-of-basin mitigation is being provided on the Green River in Auburn, to ensure that wetland area is maintained in a larger geographic area—the WRIA.

12. The ACC asserts that the mitigation activities at the Vacca Farm are more in the nature of enhancement than restoration and should, therefore, be given less credit. The ACC's position, however, ignores the fact that the differences between enhancement and restoration are more a matter of degree than a matter of kind. Ecology recognizes that wetland restoration and enhancement exist on a continuum rather than on an either/or dichotomous key. Ecology often reviews projects with wetlands that are highly altered by human activity, like those at the site of the Port's project. Many of these wetlands are highly altered in terms of their structure and function, and provide limited and highly depressed functions. For example, the Vacca Farm wetlands are being actively farmed, where ditching, disking, cropping and drainage continues to remove most habitat structure and wetland functions and severely degrade hydrological functions. In their wetlands textbook, Mitsch & Gosselink (2000)[14] recognize the value of this type of restoration in their discussion of "agricultural land restoration." The authors state that "the [Conservation Reserve Program] guidelines announced in 1997 give increased emphasis to the enrollment and <u>restoration</u> of cropped wetlands, that is, wetlands that

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[12] Gwin, Stephanie, Mary Kentula, and Paul Shaffer. 1999. Evaluating the Effects of Wetland Regulation Through Hydrogeomorphic Classification and Landscape Profiles. WETLANDS 19 (3):477-489.

[13] FAA Advisory Circular 150/5200-33 "Hazardous Wildlife Attractants on or Near Airports." See also Natural Resource Mitigation Plan, Master Plan Update Improvements Seattle-Tacoma International Airport, Parametrix, Inc., November 2001, Section 7, p. 7-9.

[14] Mitsch, W.J., and J.G. Gosselink. 2000. <u>Wetlands</u>. John Wiley & Sons, Inc. Third edition.

produce crops but serve wetland functions." (Emphasis added.) The authors do not refer to "enhancement" of cropped wetlands.

13. For the Vacca Farm, Ecology seeks to achieve a mitigation design that results in a restoration of the significantly degraded functions present at the site. Furthermore, the National Academy of Sciences report on wetland mitigation weighs in on the matter of improving wetland function at the expense of acreage by stating:[15]

> A watershed perspective provides the context for considering wetland enhancement as mitigation. If the proposed mitigation is to enhance an existing degraded jurisdictional wetland, the result could be a net loss of wetland area in exchange for an increase in wetland functioning. Here, changing the condition of the degraded wetland to some other ecosystem state (enhanced to become a better example of the current type or remodeled to become a more functional / valuable wetland type) at the expense of lost area might be judged a desirable exchange.

14. The Society of Wetland Scientists issued a position paper on the definition of wetland restoration in August 2000.[16] The Society defines restoration as:

> Actions taken in a converted or degraded natural wetland that result in the reestablishment of ecological processes, and biotic/abiotic linkages and lead to a persistent, resilient system integrated within its landscape.

The position paper goes on to list five key elements of restoration:

a. Restoration is the reinstatement of driving ecological processes.

b. Restoration must be integrated with the surrounding landscape.

c. The goal of wetland restoration is a persistent, resilient system.

d. Wetland restoration should result in the historic type of wetland but may not always result in the historic biological community and structure.

e. Restoration planning should include the development of structural and functional objectives and performance standards for measuring achievement of the objectives.

This definition of restoration is mirrored in the seminal textbook Wetlands which defines restoration as "to return a site to an approximation of its condition before alteration."[17]

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[15] National Research Council, 2001. Compensating for Wetland Losses under the Clean Water Act, National Academy Press, Washington, D.C., p. 142. Available at http://www.nap.edu/books/0309051347/html/

16 Society of Wetland Scientists. 2000. Position Paper on the Definition of Wetland Restoration.. Available on-line at http://www.sws.org/wetlandconcerns/restoration.html

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15. The NRMP is a plan that clearly meets the five key restoration elements articulated by the Society. The ACC fails to acknowledge the very meaningful actions being required in the 401 Certification and NRMP to offset the impacts that will result from the Port's project.

III. Credit Properly Given for Miller Creek Riparian Buffer

16. In its analysis of the NRMP, the ACC dismisses the value of the landscape-scale restoration and enhancement plan of the Miller Creek riparian zone. The ACC must do so in order to maintain its assertion that the NRMP does not provide sufficient in-basin mitigation.

17. The NRMP contains very detailed plans on how a 200-foot wide, 1.7 mile-long reach of Miller Creek will become "un-urbanized". When one considers that Miller Creek is 5.3 miles long, the 1.7 mile long restoration constitutes 32 percent of the length of the creek. There are 75 homes within the 1.7 mile long, 200-foot wide zone that are being removed. Removal of the homes, driveways, patios, etc. will reduce 4.3 acres of impervious area which currently drain untreated and un-detained to the creek. Removal of impervious surface area in an urban watershed is one of the most beneficial actions that can be taken to restore the physical, chemical and biological systems in a watershed. The "net impervious" area in the basin will further decrease when the Port retrofits its stormwater system. Removal of human habitation from the riparian zone will reduce the watershed-scale effects of fertilizer and pesticide runoff.[18] It will also remove chronic effects caused by tree clearing, lawn care, soil compaction, pet waste and predation, among others. Over 380 homes are being removed from the basin as part of the Port's buyout plan. The scale of this effort has never been done before in the State of Washington.

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[17] Mitsch, W.J., and J.G. Gosselink. 2000. Wetlands. John Wiley & Sons, Inc. Third edition.

[18] U.S. Geological Survey (USGS). 1999. Pesticides detected in urban streams during rainstorms and relations to retail sales of pesticides in King County, WA. USGS Fact Sheet 097-99. Available on-line at http://wa.water.usgs.gov/pugt/fs.097-99/fs.097-99.pdf. Miller and Des Moines creek basins were included in this study.

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18. Though ACC's witnesses both acknowledge the value of riparian habitat, they stop short in their analysis and fail to give any credit for the important riparian functions being restored and enhanced along Miller Creek by the Port.[19] As described below, the restoration and enhancement of riparian corridors provide important functions to riparian areas and, particularly in this instance, improve the overall health of the basins and/or watershed.

19. For regulatory purposes, society classifies natural systems into "boxes" so that we can grapple with variability that exists in nature. Arbitrary boundaries are placed on a landscape and it is stated that functions and environmental processes change at that boundary. The box (*e.g.*, wetland) on one side of the boundary is said to have a certain suite of functions that are uniform across that box, and the box on the other side (*e.g.*, riparian upland, stream, etc.) has another set of functions that are considered to be uniform as well. These boxes, however, are a simplification imposed on nature; natural systems do not have the sharp boundary associated with the boundaries of the boxes.

20. In reviewing the NRMP, it is important to recognize that the environmental conditions used to categorize wetlands and uplands occur along gradients of scale and intensity. As a result, functions change gradually as the gradients change. Riparian corridors are one area where gradients and functions change gradually. However, the classification and regulation of wetlands requires defining sharp boundaries on these environmental gradients and the assumption that the functions also change significantly at these boundaries. Because wetlands occur at the interface of terrestrial and aquatic systems, their functions overlap and ignore the boundaries we force on them. Our legal system requires that we draw sharp boundaries where they simply do not exist. This has led to the common misperception that somehow, almost magically, landscape functions suddenly become less valuable on the landward side of a wetland boundary.

[19] Pre-filed Testimony of Amanda Azous, ¶ 12; Pre-filed Testimony of Dyanne Sheldon, ¶ 22.

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21. The National Academy of Sciences presents one of the more compelling summaries of the value of riparian areas.[20] In a study related to the problems with defining and delineating wetlands, the National Academy states the following:

> Riparian zones, which can be defined several ways, contain or adjoin riverine wetlands and share with them a multitude of functions including surface and subsurface water storage, sediment retention, nutrient and contaminant removal, and maintenance of habitat for plants and animals. [page 152]
>
> Riparian ecosystems are among the nations highly valued and threatened natural resources. [page 153]
>
> Because of their proximity to flowing water, riparian ecosystems are closely associated with the maintenance of the physical, chemical and biological processes of streams. **Although widely recognized as important to the goals of the Clean Water Act, riparian zones are not fully protected by it.** [Emphasis added; page 153]

At the conclusion of Chapter 6, the National Academy report lists the following recommendation with respect to riparian zones:

> **Riparian zones perform many of the same functions as do wetlands, including maintenance of water quality, storage of floodwaters, and enhancement of biodiversity**, especially in the western United States. Although they typically contain wetlands, riparian zones cannot be defined wholly as wetlands by any broad definition. If national policy extends to protection of riparian zones pursuant to the goals of the Clean Water Act, regulation must be achieved through legislation that recognizes the special attributes of these landscape features, and not by attempting to define them as wetlands. [Emphasis added; page 166]

22. Rivers, streams and wetlands are closely linked, ecologically, with their surrounding terrestrial ecosystems. The transition zone between the aquatic ecosystem and upland or terrestrial habitat is commonly referred to as the riparian ecotone.[21] Riparian areas are more than just buffers. They include the groundwater, the vegetative canopy, the floodplain, and extend laterally into the terrestrial ecosystem. The term ecotone implies a zone of transition from one ecosystem to another. It also implies that this zone is ecologically

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[20] National Research Council. 1995. Wetlands: Characteristics and Boundaries. National Academy Press, Washington, D.C., Chapter 6, pp. 149-167. Available at http://www.nap.edu/books/0309051347/html/.

[21] Naiman, R.J., and R.E. Bilby, eds. 1998. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag, New York, 705 pp.

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important to both adjoining ecosystems. The literature clearly indicates this is the case for stream-riparian ecosystems of our region.[22,23]

23. The distance the riparian area extends into the terrestrial zone varies with each function in question and is not a fixed distance from the creek or river.[24,25] Riparian functions decrease with an increase in distance from the water, though each at a different rate. For example, bank stability functions are stronger immediately adjacent to the creek. The input of organic matter extends approximately 130 feet from the creek. The value of the riparian zone for habitat depends on the individual species in question. There are now over 700 publications on the water quality functions of riparian buffers, not including the hundreds of scientific papers reporting on other riparian buffer functions.[26]

24. There are **six key functions provided by riparian zones** that influence aquatic habitats. As in wetlands, many of these functions are interrelated. Where comparable, I discuss similarities between riparian and wetland functions.

25. **Production and delivery of large and small woody debris**:[27] Well-established riparian zones contribute to the structure and function of stream ecosystems by contributing "woody debris" to the channel in the form of snapped limbs, broken tree tops, root

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[22] Knutson, K. Lea and Virginia L. Naef. 1997. Washington State Department of Fish & Wildlife. Management Recommendations for Washington's Priority Habitats: Riparian. Washington Dept. of Fish & Wildlife, Olympia, WA 181 pp. http://www.wa.gov/wdfw/hab/ripxsum.htm

[23] Bilby, R.E. 1988. Interactions between aquatic and terrestrial systems. Pages 13-43 in K.J. Raedeke, editor. Streamside Management: Riparian Wildlife and Forestry Interactions. Institute of Forest Resources, Contribution no. 59. University of Washington, Seattle, WA.

[24] Wenger, Seth. 1999. A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia. Available at http://outreach.ecology.uga.edu/tools/buffers/lit_review.pdf

[25] Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An Ecosystem Perspective on Riparian Zones. BioScience 41:540-551.

[26] Correll, D.S. 2001. Vegetated Stream Riparian Zones: Their Effects on Stream Nutrients, Sediments, and Toxic Substances. An Annotated and Indexed Bibliography of the world literature including buffer strips, and interactions with hyporheic zones and floodplains. Tenth Edition. Sustainable Florida Ecosystems, Inc., Crystal River, FL. Available at http://www.riparian.net/correll.htm

[27] The important role of woody debris in the formation of stream habitat structure and function is well documented in the literature. See, for example, 1. Bolton, S. and J. Shellberg. 2001. Ecological Issues in Floodplains and Riparian Corridors. Aquatic Habitat Guidelines white paper. See http://www.wa.gov/wdfw/hab/ahg/floodrip.htm; 2. Beechie, T., and S.M. Bolton. 1999. An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries Habitat 24:6-15; 3. Fetherston, K.L., R.J. Naiman, R.E. Bilby. 1995. Large woody debris, physical processes, and riparian forest development in montane river networks of the Pacific Northwest. Geomorphology 13:133-144; 4 Spence, B. et al. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR. See www.nwr.noaa.gov/1habcon/habweb/ManTech/front.htm

wads, and entire trees. The ability of a tree to contribute to this function is related to its height and distance from the stream, regardless of whether the area is wetland or upland. The greatest contribution comes from trees within one tree height of the channel. Large woody debris influences the retention and flow of sediment and spawning gravel through a basin, affects habitat complexity and diversity, and determines the retention of nutrients for aquatic invertebrates, among other functions. Coniferous wood has a much higher longevity rate in streams than deciduous wood. Restoration of forested riparian communities is a key element of salmon restoration planning efforts around the state.

26. **Food-chain support**. Wetlands are commonly referred to as "supermarkets of the landscape" due to the high primary productivity of certain wetlands, such as sedge meadows and other emergent wetlands. This metaphor does not necessarily carry to forested wetlands, where tree growth is slower than trees in adjacent uplands or riparian zones.[28] Trees growing on the drier areas of riparian areas tend to grow faster than in wetter areas as their growth is not limited by the stress of anaerobic soils. The leaf and litter fall from trees contributes a tremendous amount of energy to the riparian and stream food web.[29] In addition, the insect fall from riparian zones during the summer is a critical source of food for fish, at a time when aquatic insect production is generally at its lowest.[30,31] Though leaf fall forms the basis of the detrital-based food web in streams, the input of terrestrial insects to streams from riparian vegetation provides food for fish that are directly available, forming "a potentially more energy-efficient linkage of food webs at the interface between terrestrial and aquatic ecosystems."[32] In addition to leaf and insect fall, riparian vegetation contributes small organic matter to the stream in terms of twigs and branches.

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[28] The "Site Potential Tree Height" or SPT is the average height of the dominant trees native to a site, upon maturity.

[29] Nakano, S. 1999. Terrestrial-aquatic linkages: riparian arthropod inputs alter trophic cascades in a stream food web. Ecology, Oct 1999.

[30] Nakano, S. 1999.

[31] Wallace, J. B., S. L. Eggert, J. L. Meyer, and J. R. Webster. 1997. Multiple trophic levels of a forest stream linked to terrestrial litter inputs. Science 277:102-104.

[32] Nakano, S. 1999.

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27. **Regulation of nutrient, sediment and pollutant inputs to streams**: Riparian zones control the input of sediments, nutrients and pollutants to streams. Several variables affect the ability of riparian buffers to regulate these inputs, including slope, soil type, vegetation community, and drainage characteristics. Riparian vegetation takes up nutrients that flow across the riparian zone in surface or subsurface waters.

28. **Moderation of water temperature, creation of thermal microclimate:** The presence of trees in the riparian zone not only influences the amount of solar radiation that reaches a stream but it also influences soil moisture, soil temperature, air temperature, and relative humidity within the riparian zone. The thermal buffering function provided by trees in riparian areas is a function of stand age, density, and distance from the stream. Riparian vegetation shades stream water during summer days, providing thermal control to running waters. During the winter, riparian forest cover provides thermal insulation.[33] Due of the high level of urbanization in the basins, these functions are depressed in Miller and Des Moines Creek basins.

29. **Habitat for wildlife**: Riparian buffer zones are critical for maintaining the species composition and ecological functions of both aquatic and terrestrial ecosystems.[34] Approximately 87% of wildlife species in western Oregon and Washington use wetlands or riparian areas during some or all of their life cycle.[35] A Study in Oregon determined that eight of eleven species of amphibians and five of six species of reptiles either reside or breed in aquatic or riparian habitats.[36] An extensive review of the wildlife value of riparian areas in

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33 Spence, B. et al. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR. See www.nwr.noaa.gov/1habcon/habweb/ManTech/front.htm

34 Naiman, R.J., K.L. Fetherston, S. McKay, and J. Chen. 1998. Riparian forests. Pages 289-323 (chapter 12), in R.J. Naiman and R.E. Bilby (eds). River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag, NY. See http://www.fish.washington.edu/people/naiman/CV/reprints/chapter_12.pdf

35 Brown, E. R. 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington. Publication R6-F&WL-192-1985. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Portland, Oregon.

36 Bury, R. B. 1988. Habitat relationships and ecological importance of amphibians and reptiles. Pages 61-76 *in* K. J. Raedeke, editor. Streamside management: riparian wildlife and forestry interactions. Contribution No. 59. University of Washington, Institute of Forest Resources, Seattle.

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Washington State is provided in O'Connell et al. (1993).[37] The Washington Department of Fish and Wildlife has developed recommendations for minimum buffer widths to protect wildlife. The widths depend on the habitat requirements of different species.[38]

30. **Migration and dispersal corridors**: Furthermore, riparian areas serve as migration and/or dispersal corridors for wildlife species. Restoration of the 1.7 mile-long reach will re-connect habitat that has been fragmented by urbanization for decades.

31. The removal of riparian vegetation through urbanization, agriculture and logging has significantly disrupted and diminished the functions of the riparian zone in the affected basins. Landowners have simplified the structural complexity of the riparian zone on Miller Creek by removing native understory vegetation, limbing/topping and clearing trees, and installing lawns. Residential lawn care typically requires the use of pesticides and fertilizers and results in discharges of pesticides and fertilizers that end up in the creek.[39] Human activity within the riparian zone has also compacted the soil, decreasing the soils ability to infiltrate water. When limbs and/or whole trees fall in creeks on single family lots, landowners typically remove the trees, denying the creek this critical habitat forming structure. The restoration and maintenance of natural vegetation communities within the Miller and Des Moines Creek basins is designed to restore and enhance these functions. The NRMP will essentially turn the clock back to a time prior to urbanization, and remove the chronic human disturbance from the area.

32. Ms. Azous claims the riparian buffers proposed for enhancement and restoration are "already protected by stream buffer regulations" and that "a minimum 100-foot buffer

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[37] O'Connell, M.A., J.G. Hallett, and S.D. West. 1993. Wildlife Use of Riparian Habitats: A Literature Review. Timber Fish and Wildlife Program, Washington Department of Natural Resources, Olympia, WA. TFW-WL1-93-001. 162 pp.

[38] Knutson, K. Lea and Virginia L. Naef. 1997. Washington State Department of Fish & Wildlife. Management Recommendations for Washington's Priority Habitats: Riparian. Washington Dept. of Fish & Wildlife, Olympia, WA 181 pp. See http://www.wa.gov/wdfw/hab/ripxsum.htm

[39] U.S. Geological Survey (USGS). 1999. Pesticides detected in urban streams during rainstorms and relations to retail sales of pesticides in King County, WA. USGS Fact Sheet 097-99. Available on-line at http://wa.water.usgs.gov/pugt/fs.097-99/fs.097-99.pdf. Miller and Des Moines creek basins were included in this study.

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would be required for any new development adjacent to Miller Creek."[40] However, in order to make that statement Ms. Azous assumes that functional, protective buffers are currently in place on the Vacca Farm and on Miller Creek, which of course they are not. Until the Port condemned the buyout area, the creek ran through the back yards of approximately 75 homes, and through a vegetable farm. These areas were platted and converted long before local governments developed buffer standards in their local ordinances. The current degraded condition of the riparian zone on Miller Creek speaks for itself. The riparian zone restoration required by the NRMP will substantially improve upon existing conditions, and will achieve a level of landscape-scale benefits the City's existing regulations cannot require.

33. Despite statements to the contrary, current buffers along the creeks and wetlands do not protect and maintain aquatic functions. Absent a development proposal, regulatory authorities have no ability to improve the buffers through existing regulations and have no mechanism to make a landowner improve the buffers. Moreover, the Port is doing more than merely setting aside land adjacent to the creek as a buffer; it is significantly enhancing the buffer to provide needed riparian functions.

IV. Ecology Properly Credited Preservation/Avoidance

34. The ACC criticizes Ecology's granting of wetland mitigation credit for the preservation of high quality wetlands and their buffers. Given the important functions provided by those wetlands and attendant buffers, the criticism in unwarranted. The only way to truly protect a forested wetland is to remove the threat of logging. Most forested wetlands, and certainly areas that function as buffers, can be legally cleared under federal and state laws, thus eliminating most of the functions that the buffers would provide and altering the nature of the former forested wetland.

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[40] Pre-filed Testimony of Amanda Azous, ¶¶ 3, 14.

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35. In particular, Ecology agreed to recognize the value of the Port's avoidance of the 2.35 acre Wetland 30 complex in borrow area 3.[41] The wetland complex is the only closed depression wetland in the project area with extended period of inundation. As such, it is unlike other wetlands owned by the Port. Because of its hydrologic isolation and persistence, it provides ideal habitat for the pacific treefrog and other native amphibians. The wetland complex is surrounded by a maturing second growth forest. The buffer provided around the wetlands totals 21.20 acres. Because Wetland 30 dries out in the fall it is not subject to invasion by bullfrogs, an introduced species highly predatory on native amphibians. The preservation area is adjacent to Des Moines Creek Park, providing an important habitat linkage to the creek. An abandoned road separates the preservation area from the park.

36. Ecology granted credit of the preservation at a ratio 10:1 in the NRMP. Ecology granted mitigation credit because the Port is setting aside a valuable wetland that is not otherwise protected from logging, along with a very significant buffer. Without the ability to give credit for the preservation of forested wetlands and forested buffers, Ecology would not be able to protect these important resources from further degradation due to logging.

V. Vacca Farm Is Not Currently A Highly Functioning Wetland System.

37. The ACC claims that the Vacca Farm is a high quality wetland. According to Ecology's wetland rating system,[42] Vacca Farm is a Category II wetland, not a Category I wetland as asserted by the ACC. ACC's witnesses imply that the wetland is a high quality wetland because it meets the City of SeaTac's Class 1 wetland criteria. Ecology and the Corps do not use the City of SeaTac's rating system because it is technically flawed. The top rating in any wetland classification system is reserved for high quality "cream of the crop" wetlands. The City's rating system is not based on "best available science." It is a simplistic rating

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41 The "wetland photographs and maps" report by Parametrix dated May 2001 depicts the wetland complex and its forested buffer on map #23 and image #23. The complex includes wetland 29 (0.74 acres), wetland B9 (0.05 acres), wetland B10 (0.02 acres), wetland B7 (0.03 acres), wetland B6 (0.55 acres) and wetland B5 (0.08 acres).

42 Washington State Wetland Rating System for Western Washington. Department of Ecology publication 93-74.

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system written by King County close to twenty years ago.[43] Understanding of wetland ecology has grown significantly since that rating system was written. Review of the photographs in Attachment B of my testimony supports Ecology's conclusion that the Vacca Farm wetland is highly degraded. In fact, it could be argued that the Vacca Farm wetland should not even be rated as Category II because of its severely degraded condition. The only reason it does rate this highly is because it is part of a larger wetland complex that includes higher quality wetland conditions.

38. Prior to human modification the wetland complex was undoubtedly a Category I wetland. Sixty years of peat extraction, filling, drainage, ditching, clearing, agricultural production, residential development, road construction and other disturbances have significantly depressed the level of wetland functions performing at the wetland. Implying that Vacca Farm is a high quality wetland is simply misleading. And while the ACC overstates the present level of wetland functions at the Vacca Farm, it also underrates the significant opportunity that exists at this location for meaningful in-basin restoration.

39. Ms. Sheldon contributes to the mischaracterization of the farm by stating in her testimony at paragraph 16:

> For example, anticipated increases in small mammal habitat and passerine birds fails to recognize the structural complexity and abundant food sources present in existing conditions from a high diversity of vegetation types related to agriculture, "weedy" margins, and high plant species diversity related to typical mature residential landscaping.

This statement seems to indicate that Ms. Sheldon believes that residential landscaping with non-native species and agricultural areas with non-native weedy species provides good wildlife habitat. Ms. Sheldon ignores the fact that most scientists who deal with assessment of wetland functions base performance of habitat function on structural complexity and presence of native plant species. The farm is neither structurally complex nor vegetated with native species.

[43] King County staff recognize their rating system is not based on "best available science" and are in the process of amending the county code to replace it with Ecology's four-tier wetland rating system.

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40. Species richness is directly related to structural complexity.[44] Agricultural ecosystems are noted for being homogenous in structural complexity and have low species richness. Rather, they are noted for supporting a high abundance of a limited number of species. Research in the Puget Sound lowlands establishes the fact that as areas urbanize, they lose many of the deep forest species that rely on structural complexity and in turn shift in populations to a limited number of bird species that are characteristic of disturbed environments.[45] These include crows, seagulls, starlings, song sparrows, robins and other urban-tolerant songbirds. A number of these species (particularly crows and magpies) are highly predatory and eliminate native bird species through predation of eggs and young. On the other hand, structural complexity in native systems consists of multiple layers of vegetation, different types of vegetation communities (forested, scrub shrub, emergent, aquatic bed) and the interspersion of these structural features with one another that together create a higher number of habitat niches than a one-dimensional agricultural monoculture. Agricultural activities tend to encourage the spread of aggressive, non-native species such as reed canarygrass, which in turn reduce native habitat and structural complexity. They also contribute to non-point source pollution problems.

41. To say that the Vacca Farm is currently providing high levels of wetland functions in its existing condition is not supported by the reality at the site, nor current scientific principles. The restoration plan at Vacca Farm will result in a higher functioning system than what currently exists at the site. In addition, restoration of the Vacca Farm, as well as the Tyee Golf course fairways, will decrease the current level of "bird strike hazard" present at the sites. The areas are hazards because they attract large number of waterfowl such as ducks and geese, particularly during the winter when the fields are inundated.

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[44] Species richness is defined as the number of species in a study area.

[45] Azous, A.L., and R.R. Horner (eds). 2001. Wetlands and Urbanization. Implications for the Future. Chapter 6: Bird distribution, abundance, and habitat use. Lewis Publishers.

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VI. Floodplain Excavation Is Necessary To Protect Miller Creek

42. The excavation of the floodplain at Vacca Farm is necessary to replace the floodplain storage volume that will be lost by the embankment fill at the northwest corner of the runway. It is not a required element of the wetland restoration effort. Rather it is driven by an important environmental objective: the need to ensure no net loss of floodplain storage. Without floodplain storage compensation, the hydrologic processes in the creek can be significantly disrupted by the embankment fill. Maintaining the hydrologic processes in a basin is key to maintaining the habitat structure and function in a basin. The excavation has been designed to accommodate the need for compensatory floodplain storage without compromising the wetland mitigation goals at the site. The wetland community designed at the Vacca Farm is not atypical of the type of community that could be expected in that landscape setting under natural condition.

VII. Trading Functions

43. Ms. Azous states that trading functions is not ecologically sound. She seems to suggest that the only functions that are ecologically sound are the existing ones, no matter the level of alteration. In fact, regulatory agencies permit the trading of wetland and other aquatic resource functions with virtually every permit that authorizes fill in wetlands. No two wetlands perform the exact same functions to the same degree. In the past, regulatory agencies, including Ecology, insisted that mitigation provide the same type of wetlands in the same location in an attempt to replicate the wetland type and functions being filled. This practice has been significantly revised in recent years as the agency has learned that trying to fit "new" wetlands into the projects to meet "on-site, in-kind" requirements flies in the face of landscape ecology. I am confident that had Ecology gone down that road the agency would have been criticized for perpetuating the mitigation mistakes of the past.

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44. Ecology is not alone in recognizing the watershed benefits that can accrue from "trading functions". In a recent Regulatory Guidance Letter, the Corps Headquarters states the following under a paragraph Watershed/Holistic Approach for Mitigation:

> Increasingly, the Corps is taking a watershed approach in the regulatory program. Mitigation projects are most successful if a holistic approach is taken where a variety of aquatic resource types are protected in a mitigation project (whether mitigation bank, in-lieu fee, or project-specific mitigation), including open water, wetland and upland mixes. Where such mix of ecological factors is included in the mitigation, all of those features (open water, wetland, and upland resources which add to the aquatic functions) should be included in the "credits" established.[46]

The mitigation proposed in the NRMP will result in a net benefit to wetland and aquatic resource functions in the affected basins.

VIII. In-Basin vs. Out-Of-Basin Mitigation and RCW 90.74

45. The Port proposed to provide a portion of its wetland mitigation out-of-basin with a 65.38 acre wetland mitigation site in Auburn, consisting of a combination of wetland creation (29.98 acres), wetland enhancement (19.5 acres) and buffer enhancement (15.9 acres). While not located in the basins where the Port is constructing its project, the Auburn mitigation site is within the same WRIA as the wetlands being impacted. Under Chapter 90.74 RCW, the legislature directed the Departments of Fish and Wildlife and Ecology to consider out-of-basin, in-WRIA mitigation when reviewing public infrastructure projects such as that proposed by the Port. The statute sets forth criteria to consider when evaluating such mitigation proposals. See RCW 90.74.020(1). The Port's proposed mitigation in Auburn meets the statutory elements and provides meaningful mitigation for the impacts created by the project.

46. Ms. Azous states that the "use of WRIA 9 as a planning unit for aquatic resource protection in Miller and Des Moines Creek watersheds is inconsistent with best available science and will result in degradation of beneficial uses within these watersheds."[47]

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[46] Regulatory Guidance Letter No. 01-1 dated October 31, 2001, titled "Guidance for the Establishment and Maintenance of Compensatory Mitigation Projects under the Corps Regulatory Program Pursuant to Section 404(a) of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899." See http://www.spk.usace.army.mil/pub/outgoing/co/reg/rgl/rgl01-01.pdf

[47] Pre-filed Testimony of Amanda Azous, ¶ 3.

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Ecology respectfully disagrees. The approach taken on this project was to look first at in-basin opportunities for replacing lost functions. There are very limited options within the Miller and Des Moines Creek basins for wetland creation or restoration. Thus, Ecology pursued the reasonable options of restoring wetlands at Vacca Farm and restoring the riparian corridor along Miller Creek. These activities will replace most of the beneficial uses lost or degraded by the development of the third runway.

47. Once reasonable in-basin opportunities are exhausted Ecology looked to other options within the WRIA. Ecology determined that there were multiple options within the Green River basin that would address functions that were identified as limiting in the Mill Creek Special Area Management Plan.[48] The wetland mitigation in the Green River basin was designed to address these limiting functions; primarily water quality improvement and waterfowl habitat.

48. The important thing to consider is that making resource tradeoff decisions is not simply a matter of applying scientific knowledge. Rather, it is essentially a policy decision where a determination is made based on what is feasible and what provides the greatest environmental benefit. The state has determined that out-of-kind and off-site tradeoffs are justifiable and desirable in many situations. Chapter 90.74 RCW and the state's Alternative Mitigation Policy Guidance for Aquatic Permitting Requirements from the Departments of Ecology and Fish and Wildlife[49] provide the framework and guidance for making such decisions. The alternative mitigation guidance spells out when off-site mitigation may be acceptable and lays out specific circumstances under which wetland preservation can be accepted as an element of compensatory mitigation. With respect to the basin boundaries for off-site mitigation, the guidance clearly states that it can occur at the WRIA scale:

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[48] Mill Creek Special Area Management, http://www.nws.usace.army.mil/reg/millcrk/main.htm
[49] Washington State Departments of Ecology, Fish & Wildlife, and Transportation. 2000.

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> Acceptable off-site mitigation must occur in the same Water Resource Inventory Area (WRIA), basin or sub-basin as the impacts, unless otherwise approved by the permitting agencies.

49. It is not always possible or desirable to attempt to replace all functions in the same place to the same degree. The bottom line in this case is that significant in-basin mitigation is provided that will offset the impacts to critical functions in Miller and Des Moines Creek basins while at the same time, additional mitigation is provided to address critical functions in the adjoining Green River basin.

IX. Conclusion

50. After thorough analysis of the Port's submittals and consultation with Katie Walter, I concluded that Ecology has reasonable assurance that the mitigation contained in the NRMP, in combination with the conditions in the 401 Certification, that the Port's project will meet applicable water quality standards with regards to impacts to wetlands and aquatic resources. I subsequently communicated my recommendation that Ecology issue a 401 Certification to Ann Kenny and Gordon White. Ecology's amendment of the August 10, 2001 401 Certification did not alter my reasonable assurance determination.

I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

DATED this 7th day of March, 2002 at Bellevue, Washington.

Erik Stockdale

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SUMMARY OF QUALIFICATIONS

- Nine years experience as a senior wetlands specialist with the Washington Department of Ecology, focusing on technical and policy aspects of wetland management: science, restoration, delineation, and regulation. Certified Professional Wetland Scientist.
- Over six and a half years experience as a natural resource planner with King County, focusing on both policy and technical aspects of land use impacts on wetlands and other aquatic resources.
- Demonstrated ability to work with federal, state, and local governments, tribes, citizen groups, and business interests.
- Recognized regional expert on wetlands and stormwater management issues, wetland restoration, and effects of urbanization.
- Effective public speaker and instructor; skilled presenter of technical and policy-related information to a variety of audiences.

EDUCATION

Master of Marine Affairs. School of Marine Affairs (formerly the Institute for Marine Studies), University of Washington, Seattle, WA. Concentration in Coastal Zone Management and Resource Policy. Minor degree in Business Administration. December 1987.

Bachelor of Arts. University of California at Santa Barbara. Double major in Aquatic Biology and Environmental Studies. Graduated with Honors. June 1983.

Languages: Oral and written fluency in Spanish.

PROFESSIONAL EXPERIENCE

Senior Wetlands Specialist, Washington Department of Ecology, Shorelands & Environmental Assistance Program, Bellevue, WA. October 1992 - Present. Provide scientific and technical expertise to local governments in wetland identification, delineation, inventory and restoration, evaluation of project impacts, functional assessment, and training. Assist local governments in the implementation of the Growth Management Act and Shoreline Management Act. Represent Ecology on a variety of inter-agency planning projects; in enforcement actions, hearings and other legal proceedings. Provide comprehensive habitat and planning related expertise to locally-based watershed planning initiatives to promote the integration of planning elements pursuant to the watershed management act. Assist in development of state wetland policy development, training and mentoring of junior staff; and project/permit dispute resolution. Provide technical support to Ecology's regulatory responsibilities under the Clean Water Act, Shoreline Management Act, and Water Pollution Control Act.

Resource Planner, Resource Planning Section, Environmental Division, King County Department of Parks Planning and Resources, Seattle, WA. February 1986 - October 1992. Project manager, critical areas mapping project; project manager, wetlands inventory update; project manager, environmental review program; lead staff, Wetlands Research Program; forest practice permit review; resource planner to Snoqualmie Valley Community Plan team; technical assistance to Sensitive Areas Ordinance; extensive involvement in all aspects of King County's wetland management program.

Instructor, National Wetlands Science Training Cooperative. Co-taught a four-day course on "Constructed Wetlands for Stormwater Management." Seattle, WA., Oct. 15-18, 1991.

Resource Analyst, California Coastal Conservancy, Resource Enhancement Staff. Development of wetland enhancement monitoring program. Summer 1985.

PAPERS and PUBLICATIONS

Stockdale, E.C. 1992. "The Science Behind Surface Water and Wetland Issues." Chapter 5, course materials, Continuing Legal Education Seminar, Washington State Bar Association, Environmental & Land Use Law Section, March 13, 1992.

Stockdale, E.C. 1991. Freshwater Wetlands, Urban Stormwater, and Nonpoint Source Pollution: A Literature Review and Annotated Bibliography. King County and Washington State Department of Ecology, Olympia, WA. 274 pp. Second Edition.

Stockdale, E.C., and R.R. Horner. 1988. "Using Freshwater Wetlands for Stormwater Management: A Progress Report." Presented to the Wetlands '88: Urban Wetlands and Riparian Habitat Symposium, June 26-29, 1988, Oakland, CA. Organized by the Association of State Wetland Managers, Inc.

Stockdale, E.C., and R.R. Horner. 1987. "Prospects for Wetlands Use in Stormwater Management." Proceedings of the Coastal Zone '87 Symposium, Seattle, WA. pp. 3701-3714.

Stockdale, E.C. 1987. "Should Freshwater Wetlands Be Used For Stormwater Management? A Discussion of Wetlands Management in King County, Washington." Master's Thesis, University of Washington, School of Marine Affairs, Seattle, WA. 148 pp.

Stockdale, E.C. 1986. The Use of Wetlands for Stormwater Management and Nonpoint Pollution Control: A Review of the Literature. Washington State Department of Ecology, publication 87-7A. (revised in 1991).

Stockdale, E.C. 1986. Viability of Freshwater Wetlands for Urban Surface Water Management and Nonpoint Pollution Control: An Annotated Bibliography. Washington State Department of Ecology, publication 87-7B. (revised in 1991).

Stockdale, E.C. 1985. "Bibliography of Niño Effects in the Eastern Subarctic Pacific." In: W.S. Wooster and D.L. Fluharty (eds.), El Niño North: Niño Effects in the Eastern Subarctic Pacific Ocean. Washington Sea Grant Program, University of Washington, Seattle.

Stockdale, E.C. 1985. On the Monitoring of Wetland Enhancement Projects. California State Coastal Conservancy, Oakland, CA.

Stockdale, E.C. 1983. "Effects of Acid Rain on Aquatic and Terrestrial Ecosystems." Bachelor's Thesis, University of California at Santa Barbara, Environmental Studies Program.

Stockdale, E.C. 1983. "Natural and Anthropogenic Impacts to Coral Reef Ecosystems." Senior paper, B.A. Aquatic Biology, University of California, Santa Barbara.

CERTIFICATIONS

Professional Wetland Scientist (number 0411), Society of Wetland Scientists Professional Certification Program.

HONORS

Graduated with honors, UC Santa Barbara, June 1983. Recipient, Edna Bailey Sussman Fund grant to support internship with California Coastal Conservancy.

PROFESSIONAL AFFILIATIONS

Society of Wetland Scientists, Pacific Northwest Chapter (Chapter Treasurer from 1992-1995)

REFERENCES, ADDITIONAL INFORMATION

References, chronology of training, and list of public presentations available upon request.

PHOTO A: Discarded pumpkins at Vacca Farm, 11-16-98. Hundreds of crows, starlings and seagulls were feeding on the pumpkins before being scared away by my visit. Notice highly degraded condition of wetland, where wetland plant community is disrupted yearly by agricultural planting. Vegetable stand (on east side of Des Moines Memorial Drive) was located to right of blackberry bramble in center right of photo. The yearly disposal of pumpkins at site attracts a significant number of birds which in turn creates a significant bird strike hazard.

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PHOTO B: Flock of geese at Vacca Farm 11-16-98. Photo is taken towards ESE. Miller Creek runs in ditch to east of (behind) single tree at center top of photo. Creek is not buffered. Homes in background are located in zone of proposed embankment fill. Field had been planted in pumpkins earlier in year. Several hundred mallards and widgeons were using field at the time. Waterfowl use at site will significantly decrease after restoration. These photos represent the baseline conditions for the project at the farm.

Attachment B

Photo C: Vacca Farm pumpkin field 4-29-97. This field over-wintered without a cover crop, resulting in chronic discharges of sediment and nutrients to the un-buffered creek. Urban waterfowl are a significant source of fecal coliform in urban basins.

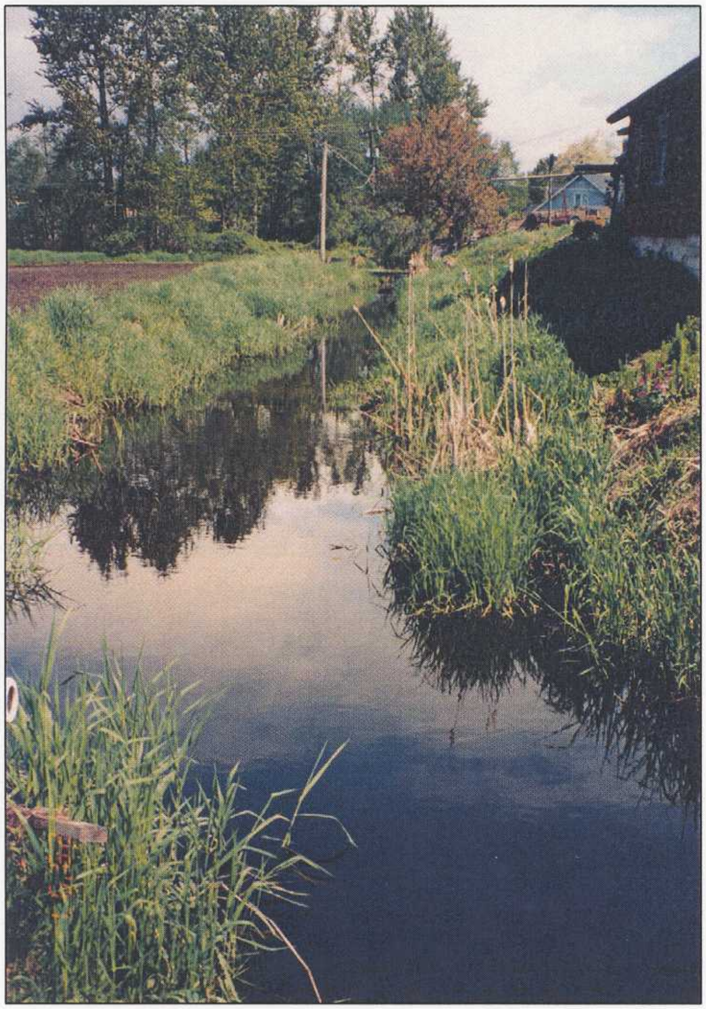

Photo D: Miller Creek through Vacca Farm 4-29-97. Note lack of buffer on creek, with structures built on edge of creek on right side, and field ploughed within ten feet of creek on the left.

PHOTO E: Flooded corn field at Vacca Farm 11-16-98. Peat soils are sufficiently drained by on-going agricultural manipulations during the growing season to support a crop of corn. November 1998 had unusually high amount of rainfall. This flooding is unusual.

PHOTO F: Flooded corn field at Vacca Farm, 11-16-98.

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Photo G: Photo of Des Moines Creek as it flows through the golf course at the southern end of the runway, taken 11-16-98. Visit followed storm event, which resulting in fairly significant flooding of golf course fairways. Golf course attracts waterfowl, presenting a bird strike hazard to the airport. Implementation of the NRMP will result in the restoration of the golf course fairways that are wetland to a scrub-shrub wetland community.

Photo H: Tyee Golf Course, flooding after storm event. Des Moines Creek flows from right to left. Use of golf course by waterfowl presents a significant bird strike hazard. Taken 11-16-98.