



September 2, 2016

Mary Ellen Winborn
Director, Clallam County Community Development
223 E Fourth St.
Port Angeles, WA 98362

RE: Critical Areas Ordinance Update – Agricultural Exemption

Dear Ms. Winborn,

Thank you for the opportunity to comment on Clallam County's update to the Critical Area Code to address the critical area regulations for existing and ongoing Agriculture. As you know, critical areas protection are important for sustaining many of the Clallam County resources that are valued for intrinsic, aesthetic and commercial purposes, including finfish and shellfish Treaty Resources. Jamestown Tribe is glad that Clallam County is addressing the need to regulate agricultural practices in critical areas. However, the proposed updates are deficient to achieve aquatic resource protection from existing and ongoing agricultural practices.

The proposed amendments rely upon a risk assessment of agricultural practices (Table 27.12.037(A)) that are not supported by scientific literature. In 2013, NOAA Fisheries reviewed the current scientific information associated with riparian buffers and function, especially in the context of agricultural land use and aquatic resource protection and developed riparian buffer recommendations for streams in Puget Sound agricultural landscapes. While buffers as narrow as 35 feet are identified for limited situations, in most settings buffers need to be significantly wider to meet salmon habitat needs. In general, Clallam County has grossly underestimated the level of risk to aquatic resources per Table 27.12.037(A). Instead, Jamestown Tribe urges Clallam County to deem existing and ongoing agricultural activities compliant only IF they achieve the minimum riparian buffers per stream type presented in the NOAA Fisheries 2013 matrix. The matrix has its origins in the Washington Agriculture, Fish and Water process (AFW), which occurred from 1999 to 2003 and included participation by state and federal agencies, tribal governments and diverse agricultural interests. One of the efforts undertaken in the AFW process was to identify riparian buffers for agricultural landscapes that provide adequate salmon habitat and are implementable. Several options were developed by the AFW caucuses. For the sake of clarity, the enclosed matrix displays the proposal developed by the federal caucus at the request of the AFW Executive Committee, Option 3. It was presented to the Executive Committee by NOAA Fisheries, along with several caveats which still hold true today: 1) there is a technical basis for the buffer table, supported by the refereed literature and other references; 2) it represents a coarse-scale classification; and 3) the goal of the matrix is to meet state and federal water quality standards and improve salmon habitat.

The Tribe believes farm planning can be an effective tool for resource conservation. However, the proposed amendment is overly reliant on farm plans. It may be helpful to consider the results of the Whidbey Environmental Action Network (WEAN) litigation regarding the portion of the Island County CAO addressing existing agriculture. In that case, the county adopted an ordinance that would exempt farmers from the CAO if they were to adopt a farm plan that used management practices developed by NRCS. The Court (Thurston County Superior Court – April 2013) found that NRCS BMPs were not expressly designed to protect the functions and values of critical areas nor give special consideration to the presence of salmon. Additionally, the farm plan process allows landowners to pick and choose whatever BMPs they want to implement. They don't necessarily have to pick the best BMPs, or even any water quality or fish habitat BMPs, in order to get a farm plan. Accordingly, a farm plan, by itself, is no guarantee that the right BMPs or even any BMPs relevant to water quality have been adopted. Also, farm plans are exempt from disclosure under Washington state public records law. The Court in WEAN noted that the County had failed to fund adequate oversight of the program. Without a robust monitoring program to assess the adequacy of the ordinance at protecting critical areas, it cannot meet the requirements of the GMA to be able to detect negative changes in critical areas.

Finally, the establishment of baseline conditions must be given further consideration. The proposed amendment simply references current conditions, which have already been impacted by existing, ongoing land-uses, including agricultural practices. In many cases, the baseline that will be established is seriously degraded. Therefore, agricultural practices should be deemed as degrading/ or non-compliant if adjacent to any surface/ground water that does not meet water quality standards.

Thank you so much for your important work in updating the Critical Areas Code.

Sincerely,



Hansi Hals
Environmental Planning Manager

Attachments:

Matrix - Interim Riparian Buffer Recommendations for Streams in Puget Sound Agricultural Landscapes (Originally proposed as federal Option 3 for the Agriculture Fish and Water (AFW) Process, March 2002) Guidance; October 28, 2013 Final.

Memo – U. Varanasi, March 2003. Review "Efficacy and Economics of Riparian Buffers on Agricultural Lands"

Letter of Opinion – Thurston Superior Court, April 2003. WEAN v. WWGMHB et al

Superior Court of the State of Washington
For Thurston County

Gary R. Tabor, Judge
Department No. 1
Chris Wickham, Judge
Department No. 2
Anne Hirsch, Judge
Department No. 3
Carol Murphy, Judge
Department No. 4



Lisa L. Sutton, Judge
Department No. 5
James J. Dixon, Judge
Department No. 6
Christine Schaller, Judge
Department No. 7
Erik D. Price, Judge
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April 2, 2013

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Re: *WEAN v WWGMHB et al*
Thurston County Cause No. 06-2-02026-7

LETTER OPINION

RECEIVED

APR 04 2013

BRICKLIN & NEWMAN, LLP

All Counsel
April 2, 2013
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Dear Counsel:

The Court conducted a hearing on Plaintiff's Petition for Review on January 2, 2013. The decision follows.

Whidbey Environmental Action Network (WEAN) has challenged the Western Washington Growth Management Hearings Board (GMHB) approval of the Island County Critical Areas Ordinance. Plaintiff argues that the County has provided sufficient environmental protection for new agriculture but insufficient regulation of existing agriculture under the Growth Management Act (RCW 36.70A) and, in particular, RCW 36.70A.060(2).

Litigation over the Critical Area Ordinance of Island County is not new. This litigation has been pending before various boards and courts since 1998. Many issues have been resolved. The remaining issue raised in this proceeding is the County's regulation of existing and on-going agricultural activities within rural lands. Under Ordinance C-150-5, the County would exempt the landowner from the general Critical Area Ordinance if the landowner prepared a farm plan based on management practices developed by the Natural Resources Conservation Service (NRCS).

WEAN challenged this provision, but this case was stayed pending resolution of *Swinomish Indian Tribal Community v. W. Wash. Growth Mgmt. Hearings Board*, 161 Wn.2d 415 (2007). In that case, the Supreme Court approved the GMHB standard of "no-harm" to critical areas and did not require Skagit County to "enhance" degraded waterways.

Other stays have been entered by agreement but the final stay was lifted in 2012, allowing this Court to hear the Petition for Judicial Review.

The GMHB, in reviewing County ordinances, must determine that the action taken by local jurisdictions is "clearly erroneous in view of the entire record before the board and in light of the goals and requirements of the GMA. RCW 36.70A.320(3). The Board must be left with a firm and definite conviction that a mistake has been made. Judicial review of the Board's decisions is governed by the Administrative Procedure Act, RCW 34.05, which has specific bases for review that are allowed. The Court reviews issues of law de novo. Substantial weight is accorded to the Board's interpretation of the GMA, but the Court is not bound by the Board's interpretations. *Thurston County v. W. Wash. Growth Management Hearings Bd.*, 164 Wn.2d 329 (2008).

In this case, WEAN argues that the GMHB's decisions were an erroneous interpretation and/or application of the law and/or were not supported by substantial evidence.

Island County Ordinance C-150-05 allows farms in existence before 1998 to be exempt from the stricter sections of the Critical Areas Ordinance so long as the landowner adopts a standard or custom "farm plan." These plans are supposed to be based on Best Available Science in the form of Best Management Practices (BMPs) as determined by the National Resources Conservation Services (NRCS). The plans must also encourage farm practices that will minimize negative impacts on critical areas. These BMPs, however, were not expressly designed to "protect" the "function and values" of critical areas nor give "special consideration" to the presence of salmon. The Ordinance does not require that the BAS protocols in WAC 365-195 be followed.

Applying the standard set forth above, this Court finds that the actions of the County in exempting existing agricultural uses that adopt management plans "is clearly erroneous in view of the entire record before the board and in light of the goals and requirements" of the GMA. The use of the NRCS BMPs does not meet the requirement that BAS be included and considered substantively in the development of critical areas policies and regulations. *WEAN v. Island County*, 122 Wn. App. 156 (2004). Furthermore, the use of the farm plans developed by individual landowners does not provide a bench mark or base line to determine existing conditions until six or more years after implementation of the program. The list of parameters to be monitored, as noted by Plaintiff, is not adequate to fully assess the impact of agricultural practices on critical areas. The measures to be considered in monitoring pertain only to water quality, not other important parameters such as vegetation. There is, therefore, no meaningful determination of base line conditions and evaluation of impacts over time.

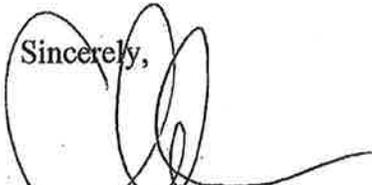
In permitting the farm plans, the Ordinance allows a landowner to select from a list of controls to modify or restrict agricultural practices with minimal oversight. There is no assurance that critical areas will be "protected" by this methodology. Plaintiff has also pointed out the delay in implementation sanctioned under the ordinance. This further allows degradation of existing conditions. In addition, the County failed to adequately fund any oversight of the program. Finally, the farm plans are exempt from public disclosure unless certain conditions are met.

It is clear to this Court that the methodology adopted by Island County to protect critical areas from agricultural uses on lands in agricultural use prior to 1998

All Counsel
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violates the Growth Management Act. Further, the approach adopted by the County regarding agricultural land does not satisfy the ruling in *Swinomish Indian Tribal Community*, that the County cannot manage its critical areas if the County "is unable to adequately detect changes to them." 161 Wn.2d 415, 437. The case is remanded to the GMHB to consider an alternative approach consistent with the statute.

Sincerely,

A handwritten signature in black ink, appearing to read "Chris Wickham", with a long horizontal flourish extending to the right.

Chris Wickham
Superior Court Judge

C: Clerk for filing

Interim Riparian Buffer Recommendations for Streams in Puget Sound Agricultural Landscapes (Originally proposed as federal Option 3 for the Agriculture Fish and Water (AFW) Process, March 2002)
Guidance

October 28, 2013 Final

NMFS Channel Type ¹	Channel Types	Habitat Functions/Composition	Buffer – Minimum Default Width ²
Class I Constructed ditches; fishless streams.	<ol style="list-style-type: none"> Constructed Ditches, Intermittent Streams and Ephemeral Streams that are not identified as being accessed and were historically not accessed by anadromous or ESA listed fish species Perennial waters that are not identified as being accessed and were historically not accessed by anadromous or ESA listed fish species 	Water quality protection; shade; sediment filtration	<ol style="list-style-type: none"> 35' 50'
Class II Fish bearing, modified natural channel, entrenched or spring fed watercourses that do not move	Modified or highly entrenched perennial, intermittent and ephemeral waters that are identified as being accessed or were historically accessed by anadromous or ESA listed fish species	Water quality, large wood debris (LWD) for cover, complexity and shade	100' supporting site assessment recommended to increase buffer width
Class III Fish bearing	Unconfined perennial, intermittent and ephemeral waters that are identified as being accessed or were historically accessed by anadromous or ESA listed fish species	Water quality, large wood debris (LWD) for cover, complexity and shade	100' supporting site assessment recommended to increase buffer width
Class IV. Diked, permanently fixed ⁱⁱⁱ	N/A	N/A	N/A
Class V^{iv} Fish bearing, intertidal/estuary	Perennial, intermittent and ephemeral waters that are identified as being accessed or were historically accessed by anadromous or ESA listed fish species in intertidal and estuarine streams and channels	Site potential vegetation (salt water) sedges, shrubs, etc.	35' – 75' Supporting site assessment of adjacent land use recommended to increase buffer protections needed to meet all applicable water quality standards.

Interim Riparian Buffer Recommendations for Streams in Puget Sound Agricultural Landscapes (Originally proposed as federal Option 3 for the Agriculture Fish and Water (AFW) Process, March 2002)

Guidance

October 28, 2013 Final

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- ⁱ Fish presence based on Washington's Integrated Fish Distribution database. Fish presence includes all classes of presence of anadromous or ESA listed fish. Where no fish distribution data is available, fish presence must be determined by contacting local WDFW or Tribal biologist.
- ⁱⁱ Buffer widths are required minimums, however, if a landowner believes that the buffers called for by the table significantly interfere with his/her ability to reasonably use their property, there is a process to identify alternative buffers that are smaller. Please see FAQs for more information.
- ⁱⁱⁱ Generally, buffer vegetation is required between the watercourse and dike, based upon the criteria of the corresponding channel type. However, levee vegetation requirements are subject to U.S. Army Corps of Engineers (Corps) guidance which can be found in Engineering Technical Letter No. 1110-2-571, "Engineering and Design: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures", as well as in the USACE Levee Owner's Manual for Non-Federal Flood Control Works.
- ^{iv} Estuarine channels are defined as stream channels having direct, daily tidal influence such that the vegetation is adapted to saltwater or intertidal conditions.

Northwest Fisheries Science Center
Environmental Conservation Division
2725 Montlake Boulevard East
Seattle, Washington 9812-2097

March 17, 2003

MEMORANDUM FOR: F/NWR - Robert D. Lohn
FROM: F/NWC - Usha Varanasi
SUBJECT: Review "Efficacy and Economics of
Riparian Buffers on Agricultural Lands"

We have reviewed the scientific merit of "Efficacy and Economics of Riparian Buffers on Agricultural Lands" (herein referred to as the "Report") as it relates to conservation and recovery of Pacific salmon. Our general comments are summarized below along with section-by-section detailed comments (See attached).

Introduction

The Washington Hops Association, Agricultural Caucus, and the Agriculture Fish Water Process hired GEI consultants to review the functions and design dimensions for riparian buffers, their use and efficacy, their applicability to agricultural lands, and potential alternatives to fixed-width buffers. The question they address is whether it is necessary to "broadly prescribe buffers of a specific width on agricultural lands to protect listed salmon", and the Report has two primary objectives: (1) to determine what scientific and technical data and analyses have been applied to the issue of agricultural buffers, and whether the data and analyses are being appropriately matched to buffer zone applications, and (2) to evaluate the economic costs associated with the proposed set asides. We do not have the expertise to comment on the economic analysis in the report; therefore, our analysis focuses on evaluating the first objective.

The authors of the Report do not dispute the ecological importance of riparian vegetation for fish, wildlife, and water quality. The premises and conclusions of the Report can be summarized as follows: 1) current regulations to

manage riparian areas are based on studies conducted in high-elevation, high-gradient forested lands of western Washington and Oregon; 2) standards based on these studies are not applicable to low-gradient agricultural lands; 3) buffer standards applied to forested lands are intended to maintain recruitment of large woody debris (LWD; 4) these standards are the principal basis for wide buffer recommendations in agricultural lands; 5) buffers in agricultural lands should be designed to stabilize stream banks, trap sediments, filter pollutants, retain stormwater, and protect the stream from direct and indirect effects from farm animals; and 6) peer-reviewed literature suggest that relatively narrow buffers of 10 meters or less, can be highly effective in protecting ecological functions against these types of agricultural impacts.

General Comments

We have three major comments related to this document: 1) the lack of sufficient evidence, especially relevant field studies, to support the assumption that narrow buffers are adequate for both protecting key habitat functions and ameliorating the effects of agricultural practices and pollution on aquatic biota and their habitat, 2) the heavy reliance on gray literature and incomplete studies, and 3) giving no weight to recent studies that clearly show the importance of wood and riparian areas in the function of low elevation, low gradient streams and rivers typical of agricultural areas.

It is the major conclusion of the Report that narrow buffers (about 10 m or less) are sufficient for protecting low-elevation streams in agricultural lands from impacts specific to farming (sediment, pollutants, nutrients). This conclusion is supported primarily by citation of non peer-reviewed gray literature, which is in contrast to the statement that the report relies "primarily on reviews of peer-reviewed scientific literature". This approach is not consistent with the criteria presented in the report of using all the best available science (Appendix B of the Report). Additionally, because we were only able to obtain some of this gray literature for review (a major problem with gray literature is that it is often difficult to obtain), it is unclear whether the cited literature actually supports the statements made in the report. Moreover, at times peer-reviewed literature was misquoted or inaccurately cited. We acknowledge, however, that in some cases gray literature is the only available source of

information for supporting technical issues. In FEMAT, gray literature documents were used frequently to support development of standards and guidelines for forest practices. The Report reviewed here, however, relies heavily on often obscure and difficult to obtain gray literature to support conclusions. The conclusions are, therefore, speculative without additional documentation of findings from several gray literature sources and accurate citation of data from peer-reviewed papers.

Furthermore, the cited literature which we were able to obtain (much was not readily available) does not evaluate the long-term consequences of chronic inputs that can negatively impact aquatic habitat. Nor are the cited studies clearly linked with potential impacts on Pacific salmon. Because the Report recommends buffer widths much narrower than what the bulk of the scientific literature supports, the Report should clearly demonstrate that narrow buffers would provide protection to maintain properly functioning aquatic habitat for Pacific salmon.

Fully functioning riparian zones are critical to properly functioning stream ecosystems. Riparian forests regulate nutrient cycling and productivity, maintain water quality, and exert strong influences on stream ecosystems by modifying the flow of materials (e.g., energy, light) across the landscape. Alterations of riparian forests are felt throughout the stream network. There has been extensive review of the effects of buffer width on stream ecosystems. These include studies on microclimatic gradients (Brooks et al. 1997), nutrients (Pinay and Dècamps 1988; invertebrate communities (Newbold et al. 1980; Murphy et al. 1986; Davies and Nelson 1994), and fish (Murphy et al. 1986). These studies have consistently shown that narrow buffers (30 m or less) are not as effective at protecting streams from the impacts of upslope activities. We agree that fewer studies have been conducted on lowland streams and rivers impacted by agricultural activities, especially as they pertain to fish. However, recent studies have clearly shown the link between fully functioning riparian forests of large, low elevation rivers and habitat conditions in the adjacent river (Abbe and Montgomery 1996; Hyatt and Naiman 2001; Collins and Montgomery 2002; Collins et al. 2002). Moreover, it has been shown that Pacific salmon prefer stream habitats associated with large wood debris. Therefore, we conclude that the full breadth of evidence

demonstrates the strong link between well-developed riparian forests and the structure and function of streams, even large rivers.

It is suggested in the Report that 10 m buffers are sufficient for protecting the stream from a host of impacts associated with agricultural practices. Absent from the Report is a discussion of long-term consequences of chronic inputs of sediment, nutrients, and pollutants on low-elevation streams or how these impacts may interact. For example, high sediment loads to streams has negative effects on stream invertebrates (Zweig and Rabeni 2001; Osmundson et al. 2002) and fish communities (Osmundson et al. 2002). The long-term effectiveness of these narrow buffer strips has been questioned in other studies (Osborne and Kovacic 1993). From the information presented and our inability to obtain several reports, we cannot determine the relevance of studies cited in the report on the effectiveness of narrow buffers to conditions in the Pacific Northwest or whether the proposed 10 m buffers would be adequate to conserve and restore listed salmon stocks. The information presented suggests that there is substantial uncertainty on whether 10 m buffers would be adequate.

Providing adequate riparian protection along lowland streams and associated riparian habitats is especially important for salmon populations, as these areas were historically the most productive in many watersheds (Beechie et al. 1994). Habitat functions do not vary by land-use type (e.g., fish still need instream LWD, regardless of whether land use activities in the uplands is agriculture or logging). Because the majority of the ecological literature demonstrates that buffers that are 30-60 m or greater provide more protection than narrow buffers for the full suite of habitat functions, we suggest there is more certainty that a wider buffer is more protective of aquatic habitat and fish populations than a buffer that is less than 30 m. Moreover, unconstrained (floodplain) stream channels may migrate from less than tenths to tens of meters during the course of a winter or even one high flow event (Nanson and Beech 1977; Abbe and Montgomery 1996). Thus, narrow fixed buffers may be particularly inappropriate for dynamic floodplain channels as narrow buffers could easily be eliminated during a high flow event on an active channel.

The Report acknowledges that agricultural activities place an additional suite of burdens or needed functions on riparian buffers. For example, agricultural activities often include the application of numerous pesticides, herbicides and chemical fertilizers, many of which can degrade instream habitat or have direct toxic impacts to salmon and other instream biota (Hunt et al. 2003). Similarly, agricultural practices also can result in sheet erosion because of tilling activities, something not seen in forested landscapes. The report does not adequately discuss how 10 m buffers would address these additional stressors. There have been a number of studies suggesting buffer widths needed to protect streams from agricultural practices that cause substantial erosion, and also numerous studies demonstrating buffer widths needed to prevent contamination of streams from fertilizer (e.g. nitrates and phosphorus) run-off (references summarized in Correll 2003). However, there have been few studies providing information that can be used to determine buffer widths needed to protect salmon from the many biocides in use on agricultural crops. There are numerous difficulties inherent in making such a determination, among them the fact that biocides have differing toxic effects on salmon, that they differ in their breakdown or absorption rates as they move through riparian buffers, and that these rates vary depending on the vegetation type, hydrology, geology and soil characteristics.

The Report, however, did cite some of the few papers that are available regarding relations between buffer width and biocide breakdown, and these papers are instructive to understand the range of buffer widths that might be needed, and whether 10 m wide buffers are adequate for agricultural areas. Lowrance and others (1997) examined how the common herbicides alachlor and atrazine are transported through a riparian buffer. Their results are complex and not easily distilled, but generally, a 45 m wide forested buffer was able to reduce concentrations of these two herbicides to about 1 ug/L or about a 97% and 91% reduction in atrazine and alachlor, respectively, relative to the initial concentrations after application at the upland edge of the buffer. What, if any effects that concentrations of 1 ug/L might have on stream biota was not discussed, but other studies suggest that even short-term exposure to atrazine at concentrations of as little as 2 ug/L have serious sublethal effects on salmonids (Moore and Waring 2002). Thus it is unclear what the proper buffer widths to protect

stream biota against biocides, but available studies suggest something much greater than 10m.

Arora and others (1995) examined retention of the herbicides atrazine, metachlor and cyanazine by a 20 m wide grass buffer and found that such a buffer retained anywhere from 8% to 100% of these compounds, depending on soil moisture conditions, and when the initial concentrations were 580, 730 and 1200 ug/L for each of these herbicides, respectively. While these studies do not offer conclusive support for how wide buffers need to be to adequately filter biocides, they also do not support the contention that 10 m wide buffers are sufficient for agricultural lands. Rather, they suggest that in at least some circumstances, substantially wider buffers may be needed.

Finally, the Report does not cite much of the published literature concerning the role of LWD in low-elevation streams, leading to the inaccurate conclusions that riparian forests along such streams do not contribute substantially to regulation of stream temperatures, instream LWD, or that LWD is an important component of habitat for Pacific Salmon in larger river/stream systems. To support this contention, the Report cites a personal communication with one of our scientists Dr. Blake Feist. When we contacted Dr. Feist directly, he was unaware of any such personal communication.

Current conditions in low-elevation streams are highly modified from historic conditions and LWD was removed for many decades for navigation and other purposes, because the benefits of this wood to fish were not known. It is our opinion that to examine the role of wood in low elevation streams one needs to examine relatively unmanaged systems and compare this to modified streams. Recent studies addressing this issue strongly suggest that floodplain forests are a major source of LWD in unmanaged streams, that LWD is orders of magnitude more abundant in these streams than modified streams, that this wood plays a major role in creating habitat complexity, and that abundance of Pacific salmon is higher in habitat with LWD compared to similar habitat without wood (Abbe and Montgomery 1996; Collins and Montgomery 2002, Collins et al. 2002).

To conclude, low-elevation streams were and in many cases still are major producers of Pacific salmon (e.g., Williams et al. 1975; Groot and Margolis; Beechie et al. 1994;

Collins et al. 2003). Therefore, restoring natural processes that created the complex habitat in these streams would be a substantive contribution to the recovery of listed stocks. The Report does not present new information to the contrary or present convincing arguments that the use of narrow buffer strips are adequate to mitigate the impacts of the full range of agricultural practices. Even if the effects of buffer width on LWD recruitment and physical habitat are ignored, there is still scientific uncertainty that narrow (≤ 10 m) buffers would be adequate for protecting against long-term chronic impacts of sedimentation and alterations to water quality.

If you have any questions concerning our general or specific comments, please contact Dr. John Stein at (206) 860-3330.

Attachment

Cc: F/NWR3 - Landino
F/NWC5 - Kiffney
F/NWC5 - Pollock
F/NWC5 - Roni
F/NWC5 - Stein

Specific Comments

Page 5, section 2.4, 2nd paragraph: It is suggested that "the use of buffer prescriptions for timber exaggerates the conditions that apply to agriculture for a variety of ecological needs, impact assessment, or salmon protection".

We found that evidence presented in this report was not adequate to support this assertion. There was not a clear substantiation that narrow buffers would be protective of aquatic habitat and would ensure the sustainability of listed salmon populations.

Page 6, first full paragraph: It is suggested, "that LWD is primarily a product and function of large trees from coniferous forests, rather than valley bottoms. LWD from upland forests eventually reaches valley bottoms via hydraulic transport". In other words, most of the in-stream LWD in low elevation agricultural streams comes from high-elevation forested streams. There is little scientific support for this conclusion. Published literature was not cited to support this statement. A statement on page 21, para 2 demonstrates how this argument is not well substantiated. They note that LWD was removed from streams between 1950 and 1970 because it was considered harmful to salmon. It was also suggested that LWD in low-elevation rivers was not historically linked to riparian forests by citing a personal communication from Dr. Feist that states there was no significant correlation between LWD and riparian condition in the Willamette Basin. This was followed by a statement that the presence of riparian forests is not a good predictor of salmon abundance.

These statements are misleading and not entirely accurate because large wood was pulled from many low-elevation streams for decades often for navigation purposes. Moreover, harvest of large riparian trees and creation of bank levees along these large rivers has fundamentally altered the natural processes that led to the recruitment of wood into the channels. Therefore, the relationship between LWD and riparian forest cited in the Feist personal communication is confounded by the fact wood was removed and habitat alteration has dramatically reduced the amount of wood in these channels. The relationship in the Willamette River reflects current conditions in a highly altered system. This relationship needs to be evaluated in

Page 15, 2nd full paragraph: We suggest that the relevant comparison should be between grass buffer strips and forested strips. Historically, floodplains along large rivers were dominated by forests not grass strips. The functional attributes of these floodplain forests are much different from grass strips. Grass strips do not provide large woody debris nor shade protection, and minimal inputs of organic matter. Furthermore, although grass strips remove sediment, there is no mention of concentrations of sediment still entering the stream nor flow rates. Nor is there a mention of the long-term consequences of sediment input. Sediment concentrations may be high enough to impact the river food web.

How relevant are these data to conditions expected on low-elevation streams of Western Washington or Oregon? Sediment dynamics in streams of the PNW are related to a variety of factors such as precipitation and streamflow (Welch et al. 1998); therefore, effort should be made to relate conditions used in studies cited in the Report to environmental conditions in the PNW.

Page 15, last paragraph, top of page 16: It is noted that most of the studies cited were short-term studies that did not address the long-term impacts of chronic inputs of sediment to streams. Two studies were cited that suggest wider riparian buffers (30 to 100 m wide) would be needed to mitigate these long-term impacts. This is an important finding and one we discussed previously. Specifically, many of the impacts discussed should be considered long-term, chronic impacts that over time can have negative effects on stream habitat.

Page 16, Water Quality Protection, 2nd para: It is suggested in the Report that pollutants are removed by riparian buffers. There is no attempt to discuss the relevancy of these studies to conditions in the Pacific Northwest (PNW). Environmental conditions that are critical to evaluating these studies include soil type, organic matter content of soils, flow rate, soil temperature, etc. Without providing this environmental context, it is impossible to determine the relevancy of these studies to the PNW.

Page 16, first bullet, bottom of page: How far into the buffer did these reductions occur?

Page 17, top of page: Grass strips removed only 10 to 40% of atrazine, cyanazine, and metalachlor, and thus were inefficient at removing these contaminants.

Page 17, 1st full paragraph, 1st bulleted item: No documentation of the basis for this recommendation was provided.

Page 17, 2nd bulleted item: These streams were not very efficient at removing solids, phosphorus or nitrogen; therefore, a substantial amount of nutrients and solids will enter the stream under this buffer scenario. This implies high risk for elevated levels of these substances for stream habitat. High levels of nitrogen and phosphorus can lead to eutrophic conditions, which are detrimental to stream organisms (Welch et al. 1998)

Page 17, 4th bulleted item: How much is a "substantial reduction"?

Pages 16-19: Another way to examine the effectiveness of forest buffers in protecting water quality is to examine input-output budgets. Lowrance et al. (1985) compared input-output budgets for a suite of materials in watersheds that were comprised of different proportions of forest and agricultural land. Export of total N from a fully forested watershed ($6.9 \text{ kg ha}^{-1} \text{ yr}^{-1}$) was 2.5 to 8.4 times less compared to watersheds with a mix of forest and agricultural crops (%forest/%agricultural=47/38, 30/54, and 59/36). Therefore, the more the landscape is composed of forests the less export of nitrogen from the ecosystem.

Page 19, Shade protection: The discussion in this section oversimplifies the complex interaction between stream and air temperature and the role that shade has in affecting both of these parameters. A detailed discussion of the interactions is not appropriately discussed here, but briefly, shade is important and helps to both reduce heating of streams and to cool them. In small streams this effect is more pronounced. As streams get larger, the effect of shade on stream temperature diminishes, but is still important.

Page 20, 1st full paragraph: The authors state that the study by Steinblum et al. (1984) defined buffer strip effectiveness in terms of angular canopy density (ACD), and buffer strips of 6 and 31 m yielded ACD's of 17 and 73%,

respectively and that a buffer of 17-m would provide an ACD of 90%. These statements are contradictory and inaccurate. According to Steinblum's study, 90% shade is achieved at a buffer width of approximately 38 m. Additionally, the use of ACD to measure shade is a somewhat dated technique. A more recent study (in the PNW) using more sophisticated light measuring instrumentation demonstrated that wider buffers are actually needed to obtain similar amounts of shade (e.g. 90% shade is achieved with a 53 m buffer) (Brosfoske et al 1997).

Page 21, Large Woody Debris, 1st full paragraph: It is suggested in the report that LWD is most important in small, forested streams. Several studies show that it is also important in large rivers (Abbe and Montgomery 1996, Hyatt and Naiman 2001).

Page 21, 2nd full paragraph: Recent data suggests that LWD is also important in large rivers, and there is no scientific evidence suggesting that LWD is more important to small rivers compared to large rivers.

Page 22, 4th paragraph: There is no scientific evidence suggesting that LWD is more important in terms of pool formation, velocity refugia, and spawning gravel retention in high gradient streams compared to low gradient streams.

Page 22, 5th paragraph: We agree that less is known about LWD in large rivers, but recent papers have documented the importance of floodplain forests as a source for LWD, the role of LWD in shaping physical habitat of large rivers, and the preference of stream salmonids for habitat associated with LWD (e.g., Abbe and Montgomery 1996; Collins and Montgomery 2002; Collins et al. 2002).

Page 22, 5th paragraph: The Report uses a research proposal by Blake Feist as the "Best Available Science" to show support for the weak relationship between riparian forest condition and in-stream LWD in the Willamette. We have already commented on this statement. To reiterate, this conclusion is flawed because LWD has been removed from many low-elevation rivers for decades. In addition, much of the riparian forests along these rivers are in marginal condition. Therefore, the lack of relationship is more a statement on the condition of the system than the actual relationship between forest condition and instream LWD. To better understand the relationship between forest cover and

and to riparian areas with fully functional forests. For example, studies that have looked at such a gradient have shown that streams with 30-m buffers provide more protection from the effects of logging than narrow buffers (10-m) (Newbold et al. 1980; Murphy et al. 1986; Davies and Nelson 1994).

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