Jefferson County Critical Area Ordinance Review Committee

Comments prepared by Dr. Kenneth M. Brooks
March 29, 2007

In June, 2006, Jefferson Counties Planning Commissioner held a public hearing in preparation for adopting what has become known as the May 17 draft of a new Critical Area Ordinance. Hundreds of Jefferson County residents attended the meeting expressing outrage with the draft's onerous and prescriptive contents that attempted to micromanage private property throughout the county. In response, the county organized a Jefferson County Critical Area Ordinance Review Committee (CAORC), which first met in September 2006. Because of my 20 years of experience in delineating wetlands in Western Washington, I was asked by the Department of Community Development to participate in the committee and I reluctantly agreed to do so. My initial efforts were directed at developing critical area management recommendations that were specific to Jefferson County's rural character using Ecology's Best Available Science (Sheldon *et al.*, 2005). A small number of scientific papers were requested from DOE for review. That request was denied by Ecology and the papers were obtained from private sources. Based on nearly 30 years of experience in assessing and managing natural resources, it was apparent that Sheldon *et al.* (2005) had selectively reviewed papers and that significant additional documentation was available. That additional documentation was obtained from the Washington State Extension Service through Jefferson County's Conservation District. That literature was used to define minimum buffer widths necessary to protect wetland functions and values in what has been subsequently been called *Supplemental Best Available Science* (Brooks, 2006). These results were coupled with a strategy to use the Washington State Department of Ecology Rating System for Western Washington (WDOE, 2004) together with a numeric rating system to define wetland function and hazard specific buffers. This was considered an expansion of the third option for defining buffers included in Granger *et al.* (2005). These minimum buffers were combined with emphasis on monitoring and a local stewardship program to promote win-win management of critical areas in a way that forms a stewardship partnership between land owners and local government. Brooks (2006) and the recommendations of the Committee were then sent to a number of reviewers for review. One of those reviewers was the Department of Ecology.

Hruby *et al.* (2007) provides a critique for the agency and this document responds to that critique. In preparing this response, it because evident that additional scrutiny of peer reviewed and published papers was necessary to understand the conclusions reached in Sheldon *et al.* (2005). Fourteen of 15 requested papers were obtained from private resources. The results of an in-depth review of those papers has been added to Brooks (2006), and the revised document is now cited as Brooks (2007). In order to fully appreciate this response, the reader is encouraged to carefully read Brooks (2007) and the final recommendations of the CAORC regarding wetland buffers and fish and wildlife habitat conservation areas (including wildlife corridors). Brooks (2007) carefully reviews additional documents relating to protection of wetland hydrology and water quality and goes on to examine the issue of habitat fragmentation effects on the biodiversity of amphibians and birds. Review of these two areas in Sheldon *et al.* (2005) find that:

1) Ecology's BAS is incomplete in that ignores a significant body of literature supporting much smaller buffer widths than are currently asserted.

2) Ecology's BAS is inaccurate in that the review of peer reviewed publication cited by Sheldon *et al.* (2005) do not support and in fact contradict the conclusions reached regarding the effects of fragmentation on biodiversity of amphibians or birds.

These findings suggest that Sheldon *et al.* (2005) does not represent Best Available Science and that this document requires independent critical review by credible scientists who are known to not agree with Ecology's approach to managing wetlands and stream corridors before it is accepted as credible BAS. This statement is made in full knowledge that Ecology sent the document to reviewers nominated by the authors and to the general public. However, as evidenced by the findings of Brooks (2007) that process does not appear to have resulted in a document that is sufficiently robust to be considered Best Available Science.

The following point by point response is provided to the Washington State Department of Ecology critique of the *Supplemental Best Available Science* (Brooks, 2006). In general, Hruby *et al.* have failed to understand and incorporate the demographic, land-use, climate and existing regulatory framework, particularly zoning, that exists in Jefferson County. Rather, the quote decisions of the Central Broad hearing cases involving the highly urbanized counties of Washington State and ignore decisions of the Western Board, which decides issues regarding rural western Washington counties. In addition, Hruby *et al.* appear addicted to a regulatory response that emphasizes prescriptive buffer requirements they would impose equally on highly urbanized areas and areas like Jefferson County, whose landscape is 95% parks and forest land and where only low density residential development (RR5, RR10 & RR20) is allowed by the current Unified Development Code. To aid the reader, Ecologies critique is provided in black and Dr. Brooks' responses are highlighted in blue. Citations for literature not included in Brooks (2007) are provided at the end of the document. Brooks (2007) is provided as appendix (1) and the recommendations of the CAORC in appendix 2.

Critique of Brooks (2006) by Dr. Tom Hruby, Andy McMillan and Rick Mraz with the Washington State Department of Ecology dated March 9, 2007. Dr. Brooks' response is highlighted in blue.

Hruby *et al.* Thus, we believe that much of the "supplemental" literature that Dr. Brooks provides in his paper is applicable to whatever approach the County utilizes to address existing, ongoing agriculture. However, we would also direct the County to the extensive guidance already developed by the Natural Resources Conservation Service and the Conservation Districts with respect to BMPs for agricultural lands. We concur with Dr. Brooks that these agencies are the ones with the appropriate expertise and experience to help the County develop and implement an appropriate program for managing the impacts of existing, on-going commercial agriculture.

However, we believe that Dr. Brooks makes a serious error in attempting to apply the limited cited literature in his paper to the broader issue of protecting wetland functions and values across the suite of land uses found in the County. While he introduces his paper as being supplemental to the much more extensive literature review in Volume I BAS, he goes on to apply the limited, supplemental information to the overall protection of wetland functions and values from the impacts of commercial, industrial, and residential land uses. We believe this is a

misapplication of scientific information and represents an example of the kind of "one-dimensional" thinking that Dr. Brooks describes in his paper.

Response: Brooks (2007) focused on literature describing the effects of agriculture on hydrology and water quality because there is significant documentation devoted to those effects. Ecology's response asserts that it is inappropriate to apply the results of agricultural studies assessing management of suspended solids resulting from erosion and water quality (nutrients and pesticides) to residential landscapes. Common sense suggests that erosion and pesticide hazards associated with agriculture pose a far greater threat to wetlands and surface waters than residential landscapes do. This is particularly true when one considers that development permits required grading and erosion control plans specifically designed to minimize these effects during construction.

Ecology's discussion of these effects associated with urbanization cover a total of nine pages in Section 3.4 of their BAS. The information is devoted to high density urban and commercially developed areas having large impervious surfaces. There is virtually no information in Sheldon *et al.* (2004) describing environmental hazards associated with low density residential development.

What land uses can be anticipated in Jefferson County? Hruby *et al.* (2007) focus much of their criticism on the inadequacy of the minimum buffer widths described by Brooks (2007) for protection of wildlife and water quality in the highly urbanized areas heard by the Central GMB. For instance, at page 23, they quote the Central Board's rejection of the wetland size exclusions included in Kitsap County's CAO. Kitsap County lies within the Central Board's highly urbanized jurisdictions of Snohomish, King, Pierce and Kitsap County. Hruby *et al.* (2007) err in assuming that the Central Board's decision should be applied to rural areas within the Western GMB's purview.

Figure 1 is Jefferson County's Designated Land Uses as defined in the 2003 Comprehensive Land Use Plan. In the second paragraph of Section 2.2, Hruby *et al.* (2007) state that, "The presence of large tracts of forestland and parks in **central and western Jefferson County is not relevant to whether the protection of wetland-dependent species in eastern Jefferson** is adequate." Even a glance at Figure 1 demonstrates the lack of care that Hruby *et al.* (2007) took in preparing their response. Nearly all of eastern Jefferson County is consumed by Commercial Forest Land , Rural Forest Land and Commercial Agriculture . The small remaining areas of Rural Residential lands are zoned RR5, RR10 and RR20. Outside the Port Townsend, Port Ludlow, and Irondale & Port Hadlock UGAs, zoning will control growth – not the CAO. There are no areas zoned for new commercial or industrial development outside the immediate Port Townsend area. Some sense of the inappropriateness of Hruby *et al.'s* (2007) assertion is seen by assuming that a residence occupies one quarter of an acre. In the RR5 zone, this will lead to 5% of the landscape devoted to residential uses. In the RR20 zone, the result is that only 1.25% of the landscape will be residential. No evidence was found in the literature supporting an adverse effect on birds or amphibians at this level of development and Ecology has presented no documentation in Sheldon *et al.* (2005) or in Hruby *et al.* (2007) that residential densities of this low magnitude have any affect at all on wildlife.

In many instances, low density rural residential development likely has less potential to adversely impact wetlands and wildlife than agriculture does. For instance, Figure 1 describes a fjord used by cattle in Casselary Creek during agricultural production. The property was broken into ten acre parcels and Figure 2 describes the same location following partial implementation of a mitigation plan required in order to place the culvert and construct the driveway through this

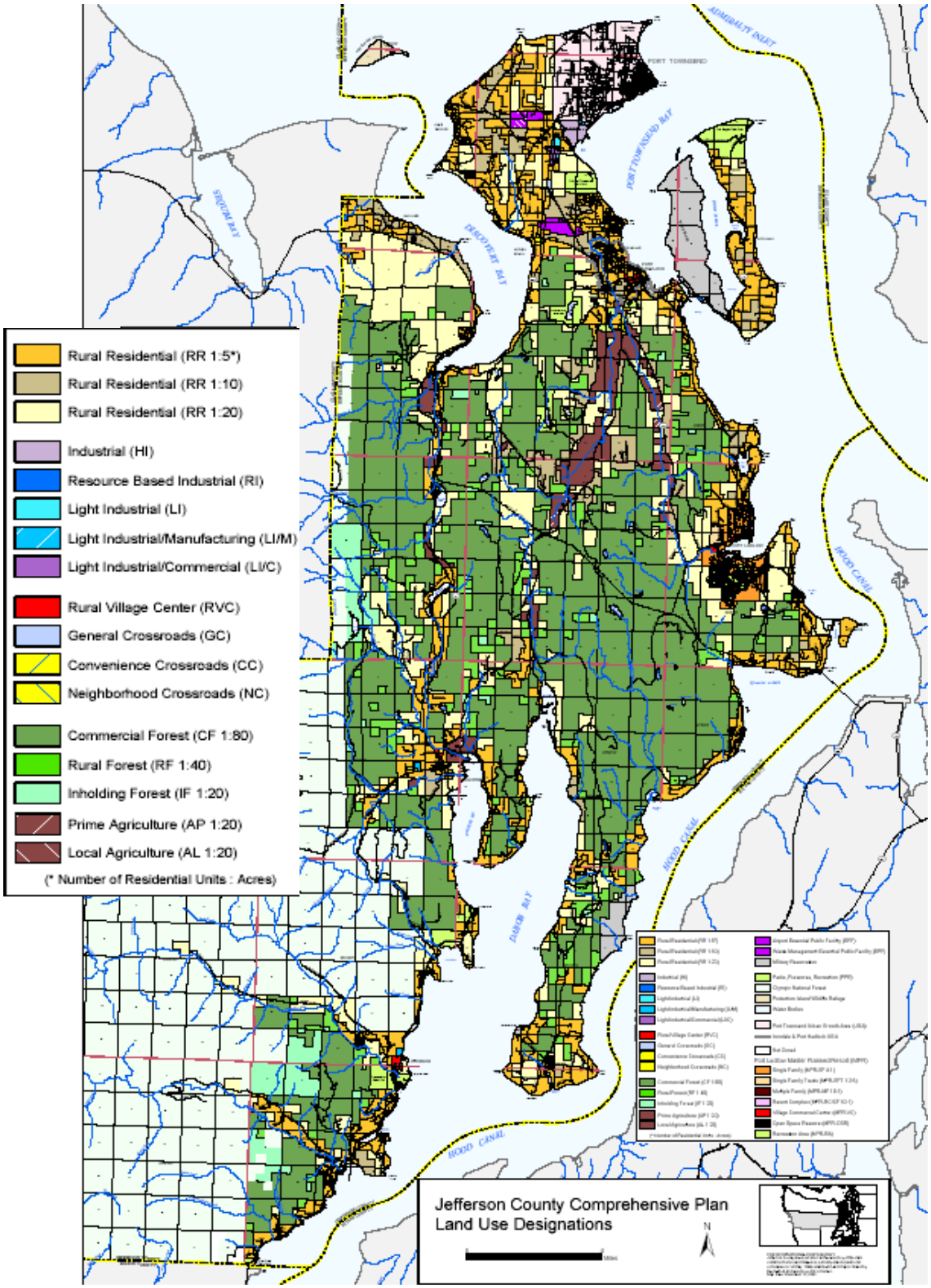

Figure 1 Jefferson County Comprehensive Plan – Land Use Designations.

area. Even a cursory examination of Jefferson County's UDC would have allowed Hruby *et al.* (2007) to avoid the significant errors in their response. There is simply no basis for demanding same buffers and wetland size exemptions in urban King County and rural Jefferson Counties. Fortunately, the Western Washington GMB has a more multidimensional view of these issues than Ecology does. Table 1 summarizes existing wetland buffers for rural counties in the western region and Table 2 compares buffer widths recommended by Brooks (2007) with the habitat specific optional buffers included in Skagit County's draft CAO and Figure 3 describes existing exclusions for regulation of wetlands in the western region.

How do the Committee's recommendations compare with other jurisdictions?

While the Central Board may have found Kitsap County's proposed exemptions unacceptable, the Western Board has allowed exemptions similar to those proposed by the CAO Review Committee. An attempt to influence the development of Jefferson County's CAO has been made by references to decisions made by the Central Puget Sound Growth Management Hearings Board (Central Board). This board hears appeals of GMA issues from highly urbanized Snohomish, King, Pierce and Kitsap Counties. In contrast, Jefferson County lies within the rural area heard by the Western Washington Growth Management Hearings Board (Western Board). The Growth Management Act emphasizes the need for implementing the act in a way that responds to local environmental, demographic and economic needs. The areas served by the Hearings Boards were not likely defined by accident. They were probably designed to enable each board to focus on a group of counties sharing similar conditions. For these reasons, the decisions of the Central Board and the ordinances developed for its highly urbanized jurisdiction have little relevance to development of Jefferson County's CAO. For these reasons, the *Supplemental BAS* has focused on decisions of the Western Board and the following CAO comparisons will focus on rural counties served by the Western Board. To do otherwise would be to compare apples and oranges and it would jeopardize the legitimacy of Jefferson County's ordinance.

The buffer recommendations made by the CAO Review Committee (CAORC) are wetland and hazard specific. They form a continuum of possible buffer sizes. However, by assuming minimum functional scores together with low hazard multipliers, it is possible to put a lower bound on the buffer widths defined using this approach. Similarly, it is possible to use the maximum functional scores reasonably associated with each wetland category together with high hazard multipliers to estimate maximum buffer widths. These likely minimal and maximal widths are compared by wetland category in Table 1 with buffer widths defined in the Western Region. The recommended voluntary enhancement widths are added from Table 4 of the CAORC recommendations in parentheses for each category of wetland. This comparison shows that the buffer widths recommended by the CAORC are not necessarily narrower than those adopted by other jurisdictions. They do appear to be more sensitive to site and hazard specific conditions because they span broader ranges of widths. The popular appeal of the CAORC's recommendations is that they provide function, wetland and hazard specific buffers in a continuum of widths that approach the goal of creating site-specific buffer widths. Both Ecology and NRCS have stated that given the necessary resources, site and hazard specific management plans provide optimum protection of resources with minimum restrictions on property rights. Ecology appears to endorse the concept and it is uncertain why they have attacked it in the CAORC's proposal.

This preferred approach is not unique to the CAORC recommendations. The March 2, 2007 draft CAO from Skagit County contains a similar recommendation in the form of *Optional Buffers*. Table 2 provides a comparison of the Skagit County draft with that of the CAORC. Recommendations of the CAOCR are for buffers that are less than recommended by Skagit County for high habitat scores and equal to or greater than the Skagit recommendations for the lowest scores. When the voluntary buffer enhancement distances recommended as part of Jefferson County's emphasis on stewardship are included, the values are similar between the two jurisdictions. The point to be made is that as this process matures, it is likely that jurisdictions will attempt to move from Ecology's prescriptive buffers to a more site and hazard specific approach that will provide better natural resource protection with reduced restrictions on property owners' use of their property.

Table 1. Comparison of reasonably minimum and maximum buffer widths developed using the procedures described by Jefferson County's Critical Area Ordinance Review Committee with buffer widths prescribed in adjacent jurisdictions. The values in parentheses in the CAORC Recommendations include the recommended voluntary buffer widths described in Table 4.

Jurisdiction	Category I	Category II	Category III	Category IV
Skagit County	75 – 300	75 – 300	75 – 150	25 – 50
Island County	A = 100		B = 25	
Island County (Rural R)	A = 100		B = 50	
Jefferson County (existing)	150	100	50	25
Mason County	50 - 250	50 – 225	25 - 150	25 – 50
Clallam County	100 - 200	75 – 150	50 - 75	25 – 50
CAORC Recommendations	15 – 180 (50 to 280)	15 – 180 (50 to 235)	10 – 100 (35 to 150)	7.5 – 75

Table 2. Comparison of the habitat score dependent optional buffers recommended by Skagit County with the recommendations of Jefferson County's Critical Area Ordinance Review Committee contained herein. Jefferson CAOCR recommendations given in parentheses include the voluntary buffer enhancements recommended in Table 4.

	Optional Buffers in Feet Intensity			
	Skagit County		Jefferson CAOCR	
Habitat Score	Moderate	High	Moderate	High
31 or higher	225	300	108 (132)	180 (230)
30	200	270	90 (115)	150 (200)
29	175	240	87 (112)	145 (195)
28	155	210	84 (109)	140 (190)
27	135	180	81 (106)	135 (185)
26	115	150	78 (103)	130 (180)
25	105	136	75 (100)	125 (175)
24	95	124	72(97)	120 (170)
23	85	112	69(94)	115 (165)
22 or lower	75	100	66(91)	110 (160)

Size exemptions associated with wetlands. Due to historic glaciation on the Olympic Peninsula, Jefferson County soils are frequently thin and underlain by impermeable glacial till (Brooks, 2006). In the county's lowlands this results in a multitude of isolated, small wetlands formed in shallow depressions that retain water during storm events and in some cases for a few weeks afterward. The plant community in many of these small wetlands is dominated by *Juncus*

effusus and *Ranunculus repens*. These small, isolated wetlands typically provide few or no services (functions) for the watersheds in which they are found other than for stormwater peak flow reduction.

Isolated wetlands that are exempted from regulation by other rural jurisdictions in Western Washington are summarized in Table 3. The Committee's recommendation that isolated Class III wetlands covering <2,500 square feet and Class IV wetlands covering <10,000 square feet not be regulated is more restrictive that the county's existing exemptions and they are very consistent with exemptions adopted in other Western Region counties. Some of these CAOs have only recently been drafted (Skagit County on March 2, 2007). The Island County CAO is least restrictive in this regard and it obviously "passed muster" with the WWGRHB.

Table 3. Comparison of the exemption from local regulation of isolated Class III and Class IV wetlands based on size found in local jurisdictions located on the Olympic Peninsula and Kitsap Peninsula.

	Wetland Category		
	II	III	IV
Island County	A <10,000	B <43,280	
Island County Rural	A <2,500	B <10,000	
Jefferson County (existing)	<2500	<10000	<10000
Mason County		<2500	<7500
Skagit County	<2,500	<2,500	<10,000
Clallam County			<10000
Jefferson County CAORC Recommendation		<2500	<10000

At page 2 of their critique, Hruby *et al.* (2007) note that, "However, we believe that Dr. Brooks makes a serious error in attempting to apply the limited cited literature in his paper to the broader issue of protecting wetland functions and values **across the suite of land uses found in the County**." As noted above, Brooks (2007) has assumed that low density residential development poses the same generic risks to wetlands as does agriculture. Hruby *et al.* (2007) are directed to Table 3-3 in Sheldon *et al.* (2004). This table compares disturbances associated with different activities. Supporting Dr. Brooks' use of agricultural studies to estimate hydrologic and water quality hazards associated with low density residential they will find that the comparisons are nearly identical for agriculture and urbanization. The only difference is that agriculture has a potential for increasing the concentrations of salt whereas urbanization does not – and even that conclusion is suspect, especially in areas where salt is used in urban areas to reduce freezing of water on roads. It is difficult to understand how Hruby *et al.* (2007) would have assessed Jefferson County's land use patterns (Figure 1) and concluded that there is a broad suite of land uses found in the county.

In particular, we believe that Dr. Brook's recommendations for wetland protection outside of existing, ongoing agricultural land uses:

- Fail to incorporate the large body of best available science summarized in Volume I BAS;

Response. As clearly stated, the intent of the Supplemental Best Available Science (BAS) presented in (Brooks, 2006) was not to conduct a broad wetland literature review. The intent

was to show that Sheldon *et al.* (2005), commonly referred to as Ecology's BAS, presents a narrow point of view characterized as one-dimensional. This is not a view that is unique to Brooks (2007). The NRCS State Resource Conservationist with 36 years of experience in Washington and Oregon noted in his review of Brooks (2007) that:

- "That science typically used by regulatory agencies is conservative and one dimensional."

- "That balanced documents and decisions made by regulatory agencies related to the Growth Management Act and Critical Areas Ordinance are very hard to find." and;

  "That 'one size fits all buffers' will not work socially, economically or environmentally on private lands."

Brooks (2007) clearly stated that his focus was on defining minimum buffer widths appropriate to protecting wetlands and surface waters from sedimentation, nutrients and other contaminants. Those minima are a dimension that is missing from Ecology's BAS. These minimum buffers were then proposed for use in the absence of a *showing of harm* (as expressed by the WWGMB). There is an underlying philosophical difference between the approach of Brooks (2007) and Ecology's approach to managing critical areas. Brooks (2007) focuses on enhancing natural resources through a stewardship approach in which citizens and their government forms a partnership to work together in a sustainable program. The approach depends on minimum protections with monitoring and adaptive management to correct identified environmental insults. This approach requires 60 to 70% education; 20% incentives and 10% in regulatory backup to address uncooperative landowners.

- Emphasizes the use of bare minimum buffers which would result in the certain degradation of significant wetland functions and values in the County, particularly with respect to fish and wildlife habitat;

Response. The buffer recommendations of Brooks (2007) are based on a body of literature that Sheldon *et al.* (2004) chose to ignore. The authors of literature supporting these recommendations do not describe their results as **bare minimum buffers, which would result in the certain degradation of significant wetland functions and values."** Rather they are the considered opinions of a number of scientists and policy analysts. It is uncertain why Hruby *et al.* (2007) chose to continue to ignore the literature that is cited in Brooks (2007). Their assertion is made with no supporting analysis and it is an insult to the numerous authors whose work was reviewed.

- Place too great of a reliance on voluntary measures with little evidence of effectiveness;

Response. Hruby, *et al.* (2007) are referred to the long history of voluntary stewardship programs successfully undertaken in Jefferson County and elsewhere in Washington State and throughout the country. There are dozens of organizations, such as *Wild Olympic Salmon,* who have undertaken voluntary efforts to restore salmon habitat. Brooks (2007) cites Isenhart *et al.'s*

(1998) report describing the success of voluntary watershed restoration in Bear Creek, Iowa. Letters from Al Latham (Jefferson County Conservation District), Jefferson Conservation District (2001) and Mark Clark (Executive Director of the Washington State Conservation Commission) are appended to this response. It is uncertain why Hruby *et al.* (2007) denigrate over sixty years of voluntary conservation in the United States. However, their response further illustrates Ecology's one dimensional thinking. In this case, it appears that Ecology understands only regulatory approaches to natural resource conservation and the agency obviously has little confidence in the citizens of Washington State.

- Places too great of a reliance on monitoring and adaptive management which are difficult and expensive to implement with limited resources.

Response. First, Ecology presents an opinion with no supporting documentation. Second, this statement is contradicted by Ecology's recommendation in Appendix C that agricultural effects by management through implementation of BMPs **and monitoring.** As noted in Brooks (2007), the Western Washington GHB does not share Ecology's view and has endorsed Island County's program, which relies on monitoring to show harm and adaptive management to correct that harm when it is demonstrated. Ecology has not provided any cogent arguments indicating why the same approach cannot be applied to all of the low density rural residential development allowed by zoning in Jefferson County.

Detailed comments on BROOKS (2007) by Hruby *et al.* (2007)

1.0 Background

Dr. Brooks' introduction asserts that the Volume 1 and 2 documents produced by the state agencies are the result of "one-dimensional" thinking. While he does not explicitly state what he believes to be the outcome of such an approach, he implies that it results in a failure to consider legal, social, political and economic factors. It is unfortunate that Dr. Brooks did not participate in the development and review of these documents when they were being produced. However, a careful reading of just the introductions to the two volumes would alert the reader to the intent and scope of the documents as well as the extensive public process used to develop the documents. It is also important to distinguish between the two Volumes.

Response. The stated intent and scope of the documents and the actual extent and scope of the documents are two separate issues. Brooks (2007) has reviewed additional peer reviewed literature demonstrating that much smaller buffers are appropriate in many instances for controlling TSS, nutrients and pesticides than were disclosed by Sheldon *et al.* (2005). If Ecology had simply overlooked this body of evidence, the department would have embraced the additional information when presented. However, they have chosen to disregard the information even after it has been brought to their attention. That and Ecology's criticisms in the previous sections of this response reinforce the perception that their approach to critical area protection is one dimensional. It relies on imposing un-necessarily broad buffers on critical areas that are insensitive, even in Option 3 of Granger *et al.* (2005), to site specific environmental conditions and the hazards of the proposed development. The conscientious reader should examine Mr. Easter's comments regarding the sole reliance on buffers for protecting critical areas.

Volume 1 is a synthesis of the scientific information. It provides no recommendations for specific management or protection measures. The process used to access the scientific information as well as how that information was culled, assessed and summarized and peer reviewed is described in detail in Chapter 1 and Appendix 1-C.

Volume 2 constitutes the guidance and recommendations of the Departments of Ecology and Fish and Wildlife for the management and protection of wetland functions and values under the GMA. However, this guidance was developed JOINTLY with the direction and input of the intended users of the information: local government staff and consultants (see Vol. 2, Appendix 1-A). This group provided critical input into the feasibility and reasonableness of the recommended protection measures. Thus, the guidance was developed precisely as Dr. Brooks seems to recommend: with the direct involvement of the people who are charged with implementing the guidance in a real world setting.

In addition, Ecology determined early on that we would not focus our guidance on existing, ongoing forest practices or agricultural land uses because these land uses are best addressed by other agencies. Thus, both Volumes focused primarily on the impacts of new growth and development and more intensive land uses such as commercial, industrial and residential.

Response. This statement is simply not true. For instance, nearly all of the references cited in Table 15-2 were derived from the forest and agriculture literature.

1.1 Peer Review

We concur with Dr. Brooks that peer review is important. In fact, we believe it is the single most important part of the process of developing good recommendations for managing and protecting wetlands based on science. This is why the state agencies undertook the extensive and transparent process used in the development of both volumes. We directly solicited the input of a wide range of perspectives in the initial scoping of the documents as well as in the review of drafts. We not only asked a wide range of key experts in the field of wetland science and management to review the draft documents, we specifically invited key stakeholder groups most likely to be effected by the use of the documents as well as every single member of the public in Washington state to review and comment. Most importantly, we specifically responded in writing to every single comment received by all reviewers. This provided the most expansive and transparent process of peer review that we are aware of ever having been conducted for similar documents.

Response. If Ecology had sent Volumes 1 & 2 to those firms and individuals recognized by various jurisdictions in Washington State as qualified wetland biologists, Dr. Brooks would have been included in the review. However, it appears that Ecology sent the papers to a selected list of reviewers. That does not result in critical review. True peer review does not allow the author's to decide which comments are relevant. The editor decides that. The bottom line is that

Ecology's BAS has not been through an independent review process and the process used has no merit with respect to validating the contents of either report.

1.2 Purpose

Dr. Brooks suggests that his document is "supplemental best available science", noting that his work is to "amplify" one of Ecology's guidance documents, (Volume 1: BAS). The document may supplement Ecology's best available science (BAS), but only within a very narrow range of application. That supplementation and applicability appears to be limited to assessment of existing and ongoing agriculture. The bibliography in Brooks (2007) contains some 45 references. Excluding those documents that can be considered reference materials, such as the Corps of Engineers Wetlands Delineation Manual, Petersens "Introduction to Meteorology", the WAC references and Ecology's own guidance documents, the majority of the bibliography (approximately 32 references) contains studies that focus primarily on controlling sediment and on the effects of agricultural practices on water quality. As such, we concur that the scientific information provided in Brooks (2007) provides some supplemental information relevant to the management of existing, ongoing agriculture, but does little to address the management of changes in land use that result from development.

Response. The reader is referred to the previous response dealing with land use in Jefferson County. The GMA emphasizes the need for tailor critical area management approaches to the needs and conditions existing in local jurisdictions. Ecology's reference to decisions by the Central Board and Granger *et al.'s* (2005) failure to consider the differences in potential development between urban counties and rural counties is another example of Ecology's one-dimension thinking with respect to management of critical areas.

2.0 Wetland functions

2.1 Hydrologic functions.

The discussion of hydrologic functions in Section 2.1 of Brooks (2007) seems to be focused only on the functions provided by depressional wetlands. Riverine, slope, and lake-fringe wetlands also have an important role in the hydrologic cycle. An understanding of how these other types of wetlands function is needed to adequately protect them. Dr. Brook focuses much of his discussion on the role wetlands play in sediment dynamics, but has omitted the importance of riverine wetlands in the sediment dynamics of river systems and the importance of lake-fringe wetland in stabilizing shorelines.

We believe the best available science provides clear and compelling information that buffers are generally not very effective at maintaining wetland hydraulic functions and that other management measures are far more critical (e.g. limiting impervious surface; not altering wetland morphology; etc.).

Response. We are in agreement that buffers are not particularly useful for protecting wetland hydrology. That is why the CAORC recommendations result in narrow buffers to

protect only the hydrologic functions of wetlands. The fact is that many wetlands in Jefferson County are small depressional wetlands that store water for short periods of time following storm events. Frequently, vegetation within these wetlands is dominated by common rush and creeping buttercup. Their short periods of inundation and homogeneous emergent vegetation provide little habitat value. They need minimum buffers and the recommendations in Sheldon *et al.* (2005) are overprotective. Illustrating that was one of the objectives of the *Supplemental BAS.*

2.2 Fish and Wildlife Habitat functions

A fundamental assertion in this and other discussions of habitat by Brooks (2007) is the lack of a defined minimum habitat value for wildlife to maintain viable populations. We concur that there is not adequate scientific information to establish precise minimum buffers necessary to protect all species. However, this does not mean that we lack scientific information regarding what is adequate to provide habitat for most species. The information contained in Vol. 1 BAS includes extensive information on the ranges of habitat widths that ARE used by wildlife. These values constitute important information that serves to define home ranges and habitat needs for many wetland associated and dependent species (Table 5-5, Chapter 5, Volume 1, Sheldon, et al., 2005).

Response. The distances from critical habitat at which wildlife species are found and/or the distances at which their attention is drawn to an outsider do not define their home ranges. This issue will be discussed in more depth later in this response.

Dr. Brooks asserts that "most wildlife is highly adaptable and most species can maintain viable populations in minimal habitats – especially if there are larger core habitat areas available." In fact, some wildlife species are highly adaptable and others are not. Some wetland-dependent species have specific habitat needs that are critical to their survival. The presence of large tracts of forestland and parks in central and western Jefferson County is not relevant to whether the protection of wetland-dependent species in eastern Jefferson is adequate.

Response. As previously discussed, Ecology has not looked examined actual land uses or zoning in Jefferson County. Even a glance at Figure 1 would have show Hruby *et al.* (2007) that, "The presence of large tracts of forestland and parks in central and western Jefferson County is not relevant to whether the protection of wetland-dependent species in eastern Jefferson is adequate." In contrast to Ecology's perception, nearly all of Jefferson County, including the eastern portions, is dominated by forestland and the zoning restricts residential development generally to one home in 10 or 20 acres. High density rural residential development is restricted to Port Townsend, which has its own CAO and to two other very small UGAs.

Secondly, one of the underlying principles of Brooks (2007) is that there is a *Shared Onus* with respect to management of natural resources. In this instance, there is a requirement for Ecology and/or WDFW to define specific species requiring large buffers to sustain their populations at some acceptable level. Species that are in jeopardy are listed by the state as Priority Species. This list includes those species federally listed under the Endangered Species Act. Ecology has not provided any evidence that there are species in Jefferson County whose

populations are threatened by allowed land uses (Figure 1). Ecology's demand for large wildlife buffers is contrary to the Western Washington GHB's decision that it is inappropriate to impose additional restrictions on private property in the *absence of a showing of harm*.

Dr. Brooks asserts that the need for buffers, corridors, and upland habitats is not substantiated by empirical evidence provided in the BAS documents. This is wrong. In section 4.11.5.1 (pages 4-56, 57) there are at least 12 citations that describe empirical evidence of the impact of loss of corridors and habitat (i.e. fragmentation) on populations and species distributions of amphibians alone. Loss of corridors is linked to the local extinction of some amphibian species.

Response. The assertions made by Sheldon *et al.* (2005) in Section 4.11.5 and 4.11.7 were examined in more depth by critically reviewing 13 papers dealing with amphibians and birds cited in those sections. In contrast to the assertion made above that, ". . there are at least 12 citations that describe empirical evidence of the impact of loss of corridors and habitat (i.e. fragmentation) on populations and species distributions of amphibians alone. Loss of corridors is linked to the local extinction of some amphibian species." What do these papers actually say?

- Adams (1999). The most important factors for red-legged frog populations were negative associations with substrate slope and aspect (orientation with respect to the sun). **Distance to the nearest neighboring population (a measure of fragmentation) was not a significant factor.**

- Baker and Halliday (1999). Frogs occupied new ponds that were not inoculated with frog spawn independent of the distance or density of nearby ponds. However, newts were found more often in new ponds where the distance to the nearest neighboring pond was small. **Terrestrial habitat quality (buffers) was not a significant factor for any of the populations.** In fairness the authors noted that, "It is possible that terrestrial habitat effects were not detected because the quantification technique used in the present study was not sufficiently sensitve. **Alternatively, the mixed farm land surrounding the new ponds may have provided sufficient habitat diversity such that land surrounding all new ponds was equally likely top support amphibian populations."**

- Fahrig (1997) observed that the **Amount of breeding habitat had a much greater effect on frog populations than fragmentation did.**

- Fahrig (2003) reviewed 100 recent fragmentation studies and concluded that:

    - "Individual species have minimum patch size requirements." This statement suggests that the size of wetlands does matter and that at least with respect to very small wetlands, there is a minimum size necessary to provide adequate habitat. This will be discussed in more detail in the response to minimum wetland size appropriate for regulation.

    - "There have been very few direct empirical tests of the extinction threshold hypothesis . . . .However, the occurrence of the extinction threshold is a response to habitat loss, **not fragmentation per se."**

- "The empirical evidence to date suggests that the effects of fragmentation per se are generally much weaker than the effects of habitat loss. Unlike the effects of habitat loss, **and in contrast to current theory, empirical studies suggest that the effects of fragmentation per se are at least as likely to be positive as negative."** Note that of 17 empirical studies reviewed in her paper, no effect of fragmentation on biodiversity was found in three papers; positive effects of fragmentation were observed in 11 studies; and negative effects were found in 5 studies. ` In contrast to Ecology's assertion, Fahrig (2003) concludes that, "**The fact that effects of fragmentation per se are usually small and at least as likely to be positive as negative suggests that conservation actions that attempt to minimize fragmentation (for a given habitat amount) may often be ineffectual."**

- Fairbairn and Dinsmore (2001) found that the most important factors explaining the variation in bird species richness was the total amount of wetland habitat in an area and the percentage of the wetlands within a complex that was covered by emergent vegetation. The amount of open water was not a factor in the abundance of any of the 15 bird species. The total wetland area within 3 km of a site was a significant factor for only one of the birds and the coefficient on the independent variable was very small (0.00000003) indicating that total wetland area within a 3 km area would have to be increased by 9% in order to increase the species richness of birds from 12 to 13.

- Knutson *et al.* (1999) concluded that anurans were preferentially associated with high patch **diversity having long edges and numerous pools. There was no indication that environmental fragmentation negatively affected anural populations.** They cite Bonin *et al.'s* **finding that fragmentation of forests in Quebec did not affect anuran species.** This study failed to find strong negative associations between anurans and agriculture. Agricultural area was positively associated with anurans in Wisconsin but not in Iowa.

- Knutson *et al.* (2004) found that landscape variables (corridors, patchiness, etc.) did not appear in the final model for either species richness or multispecies reproductive success. The significant factors were pond area, presence of fish, abundance of the tiger salamander (a predator on anural larvae) and concentrations of dissolved inorganic nitrogen. **The final models did not indicate that the density of surrounding ponds or nearest neighbor pond distance were significant factors.**

- Lehtinen *et al.* (1999) found that the only landscape variable that significantly influenced the occurrence of any species was the presence of forests within 500 and 2,500 m of the site. In the deciduous forest area, species richness was strongly influenced only by urbanization, which covered about 25% of the landscape in their area. **These authors did find that the distance to the nearest neighboring pond was a significant factor affecting anuran diversity.** However, the coefficient on distance was small (-0.00297) suggesting that the number of species would be reduced by one when the nearest neighbor wetland was located 1,094 feet away. These authors assert that the negative

coefficient on distance to the nearest neighbor support the fragmentation hypothesis. However, this factor accounted for only 19 to 28% of the variation in the models for individual species presented in Table 6. Brooks (2007) used more appropriate (for the data presented) non-linear regression to show that their data actually shows little affect on species richness until the distance between ponds increases to 900 meters (2,953 feet). Note that the coefficient of determination in Lehtinen *et al.* (1999) was 0.65 whereas it was 0.82 for the model in Brooks (2007). Consistent with other reports, the authors noted that wetlands restored in urban areas had the lowest species richness of the sites samples. When the two urban sites are excluded from their data, the coefficient on distance is not significant indicating that there was no affect associated with distance to the nearest neighboring pond. The actual affect was a finding of reduced diversity in urban environments when compared with rural environments.

- Naugle *et al.* (2001) found that the total wetland area and the proportion of that area that was vegetated were significant factors affecting 20 species of game and non-game birds in wetlands that were inundated for long periods. Total wetland area was positively correlated with 18 of 20 species. The area inundated, percent vegetation cover, treed shoreline an the proportion of the surrounding landscape that was ungrazed grassland had mixed effects on individual species. Thirty percent (30%) fewer bird species were observed in seasonal compared with semi-permanent wetlands.

- Richter and Azous (1995). Amphibian species richness was not dependent on the size of the wetlands within the range inventoried (1.0 to 30.6 acres/wetland). **No significant relationship was found between species richness and the distance to the nearest favorable wetland or the nearest favorable breeding habitat.** Amphibian species richness positively correlated with the presence of an aquatic bed (relatively deep water). However, equally high numbers of lentic breeding species were found in semi-permanent and persistent water regimes. High fluctuation in the depth of water was a negative factor. **Wetlands in watershed with more than 40% urbanization were more likely to have low amphibian richness (<4 species) that wetlands in less urbanized areas.** Note that assuming a residence covers 0.25 acres (10,000 ft^2), RR5 zoning results in about 5% urbanization; RR10 in 2.5%; and RR20 in 1.25% of the landscape being urban (not including roads). Amphibian species richness was not related to the presence of fish or other amphibian predators regardless of wetland size. Fish included rainbow trout, cutthroat trout and coho salmon.

- Semlitsch (2000). This paper contains many assertions that appear to be opinions rather than the result of rigorous analysis. Contrary to several of the reports reviewed above, this author concluded that "Fish are considered the most critical and widespread problem because they can be both competitors and predators of amphibian larvae."

The papers reviewed above are those included in Sheldon *et al.* (2005). They are not papers selected in a broad literature review by this author. This is pointed out because Ecology asserts that these papers support a need for wildlife corridors, the importance of avoiding fragmentation as a means of reducing the potential for amphibian species extinctions. Quite to

the contrary, a more careful examination and analysis of the results presented in the papers cited by Ecology reveals that:

1. There is little or no evidence supporting habitat fragmentation as a significant factor affecting anuran species richness and that the empirical evidence indicates that the affects of fragmentation, while small, are more often positive than negative. The disbelieving reviewer should read the review of Lenore Fahrig (2003). Like Sheldon *et al.* (2005), two of the 11 authors reviewed above claim negative effects associated with fragmentation. However, a more sophisticated analysis of the data in Lehtinen *et al.* (1999) indicates that the only real effect was a difference between rural areas, where there was no effect and >25% urbanized areas where several authors have noted decreased amphibian species diversity.

2. The most important factor reported in the above citations is the total habitat area available – not the distance between fragmented habitats.

3. The presence of standing water is obviously necessary for the breeding of lentic and lotic amphibians (most amphibians). These citations demonstrate that programs in the Midwestern U.S. and in England that deepen at least portions of wetlands to provide standing water for longer periods of time is beneficial to both birds and amphibians.

4. Given sufficient wetland habitat diversity, these citations indicate that fish, birds and amphibians can live successfully cohabitate wetland environments.

This review of Ecology's citations contradictions the statement made by Hruby *et al.* (2005) and clearly demonstrates the shallowness of Sheldon *et al.'s* (2005) review of these two issues and the inappropriateness of the conclusions they reached.

In Section 2.2- paragraph #2: The example of population dynamics in species that inhabit rocky shores is difficult to extrapolate to the terrestrial environment. It cannot be used as an example to describe how terrestrial populations respond to changes in the landscape. Almost all of the species identified by Dr. Brook have a "planktonic" (i.e. free floating) life stage that permits the species to disperse freely through the water. Human alterations of the landscape have not had a major impact on the dispersal of marine organisms through the water and by tidal currents. On land however, the movement and dispersal of animals can be impacted by human activities and this can have an impact on populations as summarized in Section 4.11 of the BAS document.

Response. Hruby *et al.* (2007) have missed the point in this discussion by Brooks (2007). Nowhere in my discussion was recolonization of extirpated marine invertebrate populations a focus. The point made was that all populations have core habitat requirements. However, as the population grows, individuals move further and further from their preferred habitats into marginal habitats where they are more sensitive to natural environmental perturbations than they are in their core habitats. The species use of marginal habitats or the extremities of their critical habitats has little to do with the overall health of the populations. The mussels living at about near MLLW provide the core reproductive potential for the population – just as the adult

amphibians inhabiting some likely small but unknown upland area around their critical breeding habitat form the core reproductive potential of the population.

In Section 2.2 – paragraph #3: Statements in Brooks (2007) mischaracterize Ecology's guidance on how to protect and manage wetlands from a "risk management" approach. In Section 2.2, Dr. Brooks states that the "recommendations of Sheldon *et al.* (2005) and Knudsen and Naef (1997) provide … the maximum distances at which species might be found from their preferred habitat and they provide buffers necessary to exclude all anthropogenic influence…: This is incorrect. Ecology provides information about the range of buffers needed to protect wildlife (see Table 5-5, Sheldon et al. (2005)). Ecology's recommendations, summarized in Appendix 8-C of Vol. 2 Guidance, represent widths of buffers from the literature that are in the middle of the ranges reported. This was by design, as we determined that it was reasonable to recommend a moderate risk approach, especially as it relates to buffer widths. Far from recommending the optimum or maximum buffers for wildlife as concluded by Dr. Brooks, Ecology's suggestions represent the middle of the range of widths recommended by the best available science. Additionally, the general statement that wildlife adapt "very nicely to human activity" represents a generalization that is not supported by conclusive evidence. While some species (such as the geese Dr. Brooks references) not only adapt to human environments and thrive in human-altered environments, many others do not. In addition, habitat loss is clearly identified in the scientific literature as the predominant threat to wildlife populations and loss of biodiversity (Section 4.11 Vol. 1 BAS).

Response. Ecology has not provided "information about the range of buffers needed to protect wildlife. I have not reviewed all of the citations. However, Castelle *et al.*

In Section 2.2 – paragraph #4: The discussion of number of species found in wetland and agricultural areas is not a scientifically appropriate comparison. Agricultural environments span a wide range of ecosystems. Total species counts that sum the species in many ecosystems can be expected to have a higher species richness than just one ecosystem such as wetlands. The scientifically correct comparison would be to report on species found in agricultural wetlands and those in all wetlands. Furthermore, Dr. Brooks makes the statement that agricultural areas might be more important to wildlife than wetlands based on the number of species that use these different habitats. However, Dr. Brooks has pulled selectively from the data in chapter by Edge and ignored other data in the book in which the chapter by Edge appears (Johnson and O'Neill, 2001). In his discussion of the value of agricultural landscapes for wildlife, Edge makes the following points:

Response. Agricultural environmental may span a wide range of ecosystems, but wetlands span an even broader range and Hruby *et al.'s* statement that ". . .just one ecosystem such as wetlands" demonstrates a lack of familiarity with the broad range of wetland ecosystems existing even in just Jefferson County. In fact, wetlands are found in far more diverse landscapes that farmlands are. Farmlands are not found in mountainous regions where wetlands are found. Few farms occur in coastal estuaries where some of Washington State's most valuable wetlands occur. Therefore a mature scientist would note that both environments are highly diverse and

that individual wetlands and or agricultural landscapes support a small portion of the total number of species found in either aggregate environment.

Hruby *et al.* are also incorrect in stating that, "The scientifically correct comparison would be to report on species found in agricultural wetlands and those in all wetlands." The only valid comparison would be to compare biodiversity in identical or highly similar environments where some wetlands are part of an agricultural landscape and others are not. A good sense of that comparison is available in the review of fragmentation effects on amphibian biodiversity provided in Brooks (2007). While not a focus of his review, it is apparent that significant differences were not found between amphibian diversity in farm ponds when compared with undisturbed landscapes. The only consistently significant difference in biodiversity was observed between rural and highly urbanized landscapes.

- "The most common characteristic (*of agricultural lands*) is a regular pattern of disturbance…. Because of these disturbances, many agricultural habitats are important for wildlife only on a seasonal basis, whereas others may be ecological traps during the breeding season." (p. 342).

  Response. Hruby *et al.* ignore Edges recommendations to manage agricultural lands to maximize their habitat value. The literature clearly states that wetlands can also be traps for wildlife. This is particularly true of some amphibian species attempting to inhabit ephemeral wetlands that retain water for insufficient periods (March through July) for larvae to complete their aquatic phase. Many wetlands provide habitat for waterfowl only when inundated in late winter and early spring. When these wetlands dry up in summer, they no longer provide habitat for waterfowl. The point being that many wetlands also provide only seasonal habitat for many species. Brooks (2007) has recommended mitigation and enhancement through improvements in low value wetlands (Class III and IV) to increase water retention in some cases in portions of the wetland to increase their seasonal value. Hruby *et al.* have objected in their response to that option in spite of its demonstrated success in many areas of the world.

- "Agricultural habitats have a high potential to become ecological traps because of farm operations and the abundance and distribution of habitat features in agricultural landscapes. Ecological traps are human-made areas that, based on physical or vegetation characteristics, appear suitable for nesting but which, by virtue of some confounding factor(s), result in population sinks rather than sources for species that use those sites." (pp. 348-349)

  Response. As noted above, wetlands can also be ecological traps.

- "Modern agriculture typically requires extensive chemical inputs in the form of pesticides and fertilizers. These chemicals used in agricultural areas have both direct and indirect effects on wildlife living in farm landscapes, and have been a concern of wildlife biologists. The impact of chemical pollutants on nontarget species, primarily birds and mammals, is of special concern for threatened or endangered species or species that exist in small isolated populations." (p.350)

Response. Special rules and restrictions are applied by management plans for threatened or endangered species. Those rules apply overlay requirements imposed by local Critical Area Ordinances. As noted in Brooks (2007), the literature reviewed regarding birds and amphibians does not support Ecology's emphasis on fragmentation. In fact, the literature cited by Ecology in that regard contradictions their assertions and that is a significant flaw in Sheldon *et al.* (2005).

- "Many of the species that use agricultural habitats are habitat generalists, adapted for using several cover types for both feeding and breeding." (p. 342)

- "Most amphibians, reptiles, birds and mammals are only partially associated with or present in agricultural habitats." (p. 346)

Response. The literature cited by Sheldon *et al.* (2005) regarding fragmentation suggests that amphibian diversity is not significantly different in farm ponds when compared with natural wetland ponds.

The definition of "closely associated" means, "A species is widely known to depend on a habitat or structural condition for part or all of its life history requirements. Identifying this association implies that the species has an essential need for this habitat or structural condition for its maintenance and viability." (p.4, Johnson and O'Neill, 2001).

Response. The affinity of particular species for specific niches is well known and not controversial. However, empirical evidence describing buffer requirements for wildlife around their essential habitats is not documented and that is a central issue in the credibility of Ecology's BAS.

In fact, of the 342 species that Edge reports as using agricultural habitats, only 68 (<20%) are "closely associated", whereas 174 are "generally associated", and 99 are simply "present".

Response. Agricultural lands provide benefits to society other than for wildlife. Agriculture feeds the multitudes and it is the presence of intensive agriculture that allows wildlife to exist. Absent intensive agriculture there would be little or no wildlife – it would all be gathered as food. The important fact is that 68 species of wildlife are closely associated with agricultural lands and 174 are able to use this land, which is critical to the very existence of both the human population and wildlife. The bottom line is that more species of wildlife are associated with agricultural lands (342) than are associated with herbaceous wetlands. That is a remarkable statement of the potential for multiple uses of the landscape.

Contrast this with the numbers for herbaceous wetlands (e.g. marshes, wet meadows): Of the 228 species known to use this habitat, 105 (46%) are closely associated, the highest percent for any habitat described in Johnson and O'Neill.

Response. However, if one were to inventory wildlife use of most Class IV wetlands in Western Washington, one would fine that nearly all of the species using those wetlands are generalists that are only "present" in the wetland. That is why the recommendations of Brooks (2007) result in a broader range of wetland buffers than are proposed Ecology's recommendations (Granger *et al.*, 2005).

These numbers point out that, while some species are highly adaptable and can survive, or even thrive in human-altered landscapes, others are more dependent on particular habitats.

Response. There is no disagreement on this point. However, within the concept of a *Shared Onus,* government has a responsibility to demonstrate that:

1. landscapes, including parks, refuges, state and federal forestlands, etc. do not provide adequate habitat to sustain species that cannot live sympatrically with the low density residential uses allowed in Jefferson County;

2. That species of concern actual use the landscape that is proposed for development;

3. That a habitat management plan cannot be developed to mitigate the interaction between the species of concern and the development to allow for coexistence.

This list could be greatly expanded, but citizens are likely to understand that the point is that Ecology's approach is to impose large prescriptive buffers in the belief that all of the conditions exist everywhere. In the end society, the legislature and the judiciary will likely determine the appropriateness of Ecology's demands. However, the numerous lawsuits brought regarding implementation of the GMA suggests that many people, jurisdictions and the judiciary do not agree with this prescriptive approach. Jim is this are area that you could respond to? Should I stay from this argument?

That said, Dr. Brooks broader point that agricultural lands can and do provide habitat for many wildlife species is well taken. We concur that agricultural lands can provide habitat for a wide range of species, especially so if the lands are managed with wildlife needs in mind. We also concur that landowners can make improvements in the habitat value of agricultural lands by implementing the types of management measures described in the chapter by Edge. We believe it is important to recognize the important contribution that well-managed agricultural lands can provide to the overall provision of wildlife habitat, particularly when compared to the impacts of more intensively developed residential and urban areas.

Response. Agreed. However, I also believe that the same situation can be applied to the low density residential uses allowed in Jefferson County.

Section 2.2 – paragraph #5: Again the focus seems to be on depressional wetland with surface. This is only a small subset of the wetlands found in Jefferson County.

Response. Having delineated hundreds of wetlands on the Olympic Peninsula, I can state with confidence that other than estuarine wetlands, the majority of those wetlands are depressional wetlands that are saturated during the rainy season and dry in the summer. If Ecology believes this to not be true, then some evidence to the contrary should be provided.

Section 2.2 Water Quality Functions (this should probably be Section 2.3)

Response. Agreed. The section has been changed to 2.3.

Paragraph #1: Dr. Brooks makes the following statement: "However, because our rainfall occurs primarily in winter when these water bodies are light limited, wetland functions with respect to the sequestering of nutrients is not as important is (sic) it might be in other areas of the country." This is a very strong statement without any substantiating evidence from empirical studies. It can also be argued that the time of the rainfall is not a major factor in the transport of nutrients because the nutrients can be held back by the soils and then slowly released. Also, nutrients such as phosphorus are not transformed in wetlands and keep building up in aquatic resources. Most of the phosphorus is bound to sediments and can be re-suspended and made available to plants under different environmental conditions (Section 2.6.1.2 p. 2-38 Vol. 1 BAS

Response. These issues were discussed in a great deal more detail in Section 2.3 of Brooks (2007) than is provided above. A more careful reading of this paragraph reveals that the sentence provided above was applied to the importance of the transport of nutrients into marine areas, including Hood Canal. Phosphorus is seldom a limiting nutrient in marine environments and it is uncertain when Hruby *et al.* assert that phosphorus is a problem in this part of the discussion in paragraph 2.3. The reader is referred to Brooks (2000, 2006) for in-depth discussions of nutrients in Puget Sound.

Section 3.0 Supplemental information regarding wetland functions

Paragraph #1, Dr. Brooks makes the following unsupported statement: "The analysis presented in Sheldon et al. (2005) appears designed to protect wetlands on a worst case basis." The information in Volume 1 BAS (Sheldon et al. 2005) represents a summary of the scientific information relevant to the management of wetlands in Washington and was not "designed" for any particular level of protection. All of the guidance on protection measures is found in Vol.2 Guidance. In fact, the information in Sheldon includes a wide range of information on wetland functions, potential human impacts and the effectiveness of different management tools. The document expresses no bias towards any particular level of protection.

Response. Brooks (2007) has demonstrated that Sheldon *et al.* (2005) was incomplete in their discussion of buffer requirements to protect wetlands and surface waters from total suspended solids, nutrients and pesticides in stormwater. That document has now been expanded to include an assessment of the literature cited by Sheldon *et al.* (2005) regarding the importance of fragmentation on the biodiversity of amphibians and birds and found that the literature cited by the authors does not support their conclusions and in fact contradicts them. Despite Hruby, *et*

al.'s repeated assertions herein that Sheldon *et al.* (2005) represents BAS, the review by Brooks (2007) brings into question the credibility of the entire Ecology BAS.

Dr. Brooks contests the validity of statements from Castelle et al. (1994) regarding the effectiveness of relative buffer widths and claims that there is a "significant body of literature supporting minimum buffer widths less than 5 meters." In fact, the literature "supporting" widths of less than 5 meters is limited primarily to managing the effects of agricultural land uses on water quality parameters. This specific qualification is examined in the analysis of Section 3.1. This section also introduces the concept of adopting minimum buffers for water quality and hydraulic protection and utilizing a citizen monitoring effort to ascertain if such an approach is adequate, followed by adaptive management to address any shortcomings. This approach is discussed in more detail in sections 3.1, 6.0, 7.0 and 8.0.

Response. As noted elsewhere in the response, Hruby *et al.* would have been better served to describe why buffer requirements for agriculture are not applicable to the low density residential development allowed by zoning in nearly all of Jefferson County outside the county's very limited UGAs.

Section 3.1 Hydraulic and water quality functions

In Section 3.1, Dr. Brooks generally addresses additional references on the effectiveness of buffers at removing nutrients and sediments. The references cited add to the body of literature summarized in Volume 1 BAS and reinforce the conclusion that the effectiveness of a buffer is highly dependent on local conditions of soil type, slope, vegetation and sources of pollutants. Some of these studies illustrate the ability of very narrow buffers to provide significant reduction in sediments and nutrients, particularly in highly managed settings. They also support the generally accepted rule that increasing effectiveness of buffers at removing sediment and nutrients is achieved through a disproportional increase in buffer width. However, we have not had an opportunity to review the referenced citations in detail, as Dr. Brooks rightly points out is very important. We are, however, very familiar with the excellent synthesis of buffer literature provided by Desbonnet et al. (1994) and find Dr. Brooks characterization of Desbonnet et al (1994) to be misleading. Dr. Brooks quotes one passage from this, but fails to put this in proper context with language following the quote that he cites. Desbonnet et al go on to say:
"A five-meter-wide vegetated buffer could be established as a minimum goal ***for the restoration of already developed areas***." (emphasis added) and;

Response. As previously noted, the goal of Brooks (2007) has been to determine **minimum buffer widths** necessary to protect the functions and values of wetlands and surface waters. Hruby *et al.* continue to selectively quote from publications in support of the highly prescriptive buffers they pursue. For instance, Desbonet *et al.* (1994) also state that:

"While great emphasis is being placed on the use of vegetated buffers to abate nonpoint source degradation of waterways, none of the above uses are exclusive of the others. **It makes**

both good sense and good economics to pursue a multiple-use application of the vegetated buffer concept in coastal ecosystems." Emphasis added.

"The value of narrow buffers as habitat will therefore be directly related to the amount of disturbance they receive from adjacent areas." Ecology has not assessed or considered the amount of disturbance received from adjacent low density residential uses that are allowed in Jefferson County.

"From the values presented in Table 7, a multiple-use vegetated buffer of five meters could be considered a minimum-buffer-width standard." In the same paragraph at page 31 of his paper he states that, "While a vegetated buffer of this width may not provide good overall wildlife habitat, it may be sufficient to provide resting and feeding areas for both resident and migratory species." These statements were not made in the context of highly developed lands as asserted by Hruby *et al.* above. Rather they are general recommendations for private property.

"It should be kept in mind, however, that a five-meter-wide vegetated buffer removing approximately 50 percent of pollutants and sediment contained in surface waters may not meet minimum performance measures in all instances. If an approximate performance criterion of 80 percent removal is desired, then a 75-meterwide vegetated buffer may be the acceptable minimum. This buffer width will also provide minimum general habitat value."

Response. The recommendations of Brooks (2007) and the Jefferson County Critical Area Ordinance Review Committee include a requirement for watershed monitoring to insure that Washington State Water Quality Criteria are not exceeded. Furthermore, those recommendations include provisions for designating critical habitat and species of local concern requiring additional habitat management considerations. Note that throughout this part of Desbonet *et al.'s* (1994) discussion, they refer to **multiple use buffers.** They do not refer to **no-touch buffers** promoted by Ecology.

Desbonnet et al. provide an excellent overview of the general effectiveness of varying buffer widths in the Table 7 that Brooks references. This table illustrates three very important points about buffers that are echoed throughout the literature:

1. Buffer effectiveness increases with width;
2. For water quality improvement, effectiveness increases disproportionally with width (5 meters = 50% effectiveness; 10-15 meters = 60%; 30 meters = 70%);
3. For wildlife habitat, wider buffers are needed than for water quality (15 -50 meters = minimal habitat value; 75 meters = moderate habitat value; 100+ meters = good to excellent habitat value.

This illustrates the difficulty in trying to identify minimum buffer widths – it all depends on what "minimum" functions one is trying to protect.

Response. This also demonstrates the difficulty in defining any buffer width. The need for open legislative definitions of the word protection is evident and this is discussed in more depth at the end of this response. As noted in the quotes from Desbonet *et al.* (1994) provided

above, he does not state that minimum habitat value is provided with a 15 to 50 m buffer. He states that **multiple use buffers of five meters width provide minimum wildlife habitat.**

Section 3.2 Wildlife functions

Paragraph #1: Wetland dependent species, like all wildlife, have specific habitat needs, which can be complex and multi-faceted. From numerous studies, we know a lot about how species utilize different habitats to meet their life needs. We agree with Dr. Brooks that, just because a species uses an area of a particular habitat, we cannot be certain that the species needs that entire area of the habitat to survive. However, as Dr. Brooks concedes, it is much more difficult to establish minimum habitat needs for wildlife. In fact, establishing such minimums would be exceedingly complex and require considerably more information than is generally available, particularly at a local level. It would entail identifying the minimum areas necessary to fully comprise a complete and functional habitat, including ecosystem interactions, for a viable breeding population of each of many different species. For example, determining the minimum habitat necessary to sustain a viable breeding population of a single wetland dependent species, the mink, could include the following:

* Minimum prey base of small mammals, amphibians, reptiles, birds and invertebrates available and sufficient for the dietary needs of the viable breeding population.

* Analysis of recruitment potential and dynamics within and from outside the localized population in consideration of carrying capacity (equilibrium within the minimum habitat) and in consideration of genetic variability.

* Analysis of the dynamics of outmigration.

*Density of aerial vegetation coverage and density of terrestrial vegetation and shelter locations to minimize exposure to predators, which maintains the size of the population necessary for replacement.

* Presence and density in the region of raptors, otter, coyote, cats, dogs and other predators of this species.

* Presence of suitable and sufficient den sites and identification of sufficient distance from dens to allow prevent interaction between these generally solitary species yet provides adequate shelter for the baseline viable population.

* Analysis of the seasonally available food source as it correlates to this species delayed implanation of embryos.

* Genetic distribution and variability within the subject population that will be subjected to the minimum habitat, such that genetic isolation would not result in diminished variability and adaptability. Genetic variability within wild populations is

generally regarded as important in maintaining high levels of fitness and allows for adaptation to a changing environment. In small populations, random fluctuation in gene frequency tends to reduce genetic variation, leading eventually to homozygosity and loss of evolutionary adaptability to environmental change. Small population size sustained for several generations can severely deplete genetic variability (Franklin 1980, Lande 1988).

* Assessment of the potential for individuals to move to other available habitat, to avoid conflicts common to this species.
Several additional facets might also require detailed analysis to determine a minimum necessary habitat for this single species. It would be important to conduct a thorough analysis, because relying upon minimums for protection would be fraught with risk. If one were wrong, the consequences for the species in a geographic area could be dire.

Fortunately, there is another way to approach the issue of protecting the wildlife habitat functions of critical areas such as wetlands. If certain wetland dependent species are identified by research efforts to regularly and consistently occupy a range that is characterized by minimum and maximum distances from wetlands throughout all life stages, these ranges clearly constitute reasonable parameters within which the species may be said to have their habitat needs met. The issue then becomes one of selecting within the range of reported distances. Thus, Ecology recommends that local governments select buffer widths that are somewhere in the middle of the range in order to adopt a moderate level of risk that the species will in fact, be protected. Taking a low-risk approach and selecting buffers at the higher end of the range would provide a greater level of certainty that the wetland-dependent species would be protected, but would impose a much greater level of restrictions on property owners. Taking a high-risk approach and selecting buffers at the higher end of the range would impose a much lower level of restriction on property owners but would provide a much lower level of certainty that the wetland-dependent species would be protected.

Response. As will be discussed in some detail later in this response. The Department of Ecology has a history of developing scientifically defensible water and sediment quality criteria that are considered appropriate to meet stated levels of protection of natural resources, including wildlife. The U.S. EPA does likewise. The problem is not that the processes needed to accomplish these tasks are unknown or that they are impossibly complex and expensive. The problem is that Ecology is, in this instance, trying to avoid the responsibility to provide scientifically defensible standards and instead, the agency is attempting to impose standards that are based on perceived needs and flawed science derived by selectively quoting and misinterpreting the available science (see Brooks, 2007).

Brooks (2007) does not contain any of the analysis necessary to begin to prescribe a minimum buffer strategy. His approach would constitute a high risk that the fish and wildlife habitat functions of wetlands would not be protected.

Response. An outline of one effort to define a science based performance standard is provided near the end of this response. Ecology has provided no empirical evidence demonstrating that the buffer widths proposed in Brooks (2007) are not protective. This statement above is therefore pure speculation on the part of Hruby *et al.* (2007). I will state emphatically that I believe that the proposed buffer widths in Jefferson County's Critical Area Ordinance Review Committee's recommendations are fully protective of all of the functions and values of wetlands and surface waters in the county. This is especially true when coupled with the required monitoring program and the innovative approach to designation of wildlife corridors and habitats and species of local concern. State and Federally listed species and habitats are managed separately by the appropriate government agencies.

Section 3.2, Bullet #1 – Dr. Brooks' statements about the behavior of birds in response to human intrusion seems focused primarily on mere human presence, as in a passive pedestrian observation of bird life. However, the notion of a birds "interest" in an intrusion fails to fully characterize the range of possible reactions to it. Many, more permanent, human intrusions such as land clearing, construction, or other permanent habitat-altering activities, have been incontrovertibly demonstrated to have complete and deleterious effects on bird populations and behavior. In addition, the effects of intrusions and predation by domestic pets such as cats and dogs have an adverse impact on many wildlife species.

Response. This statement suggests that Ecology is adverse to human occupation of Jefferson County's landscape. Property owners have a right to enjoy the fruits of their labors. That includes the right to clear land for construction of a home or other allowed development. I will agree that large scale habitat loss has an adverse effect on wildlife. However, all habitats are important to one species or another as plants and animals inevitably expand their populations to fill all available landscape. One of the misnomers in the GMA is designation of wetlands as critical areas. They are a component of the landscape. The value of many Class IV wetlands with respect to wildlife is likely much less than the value of a rural resident's orchard. These Class IV wetlands are no more critical than any other component of the landscape. The point is that while habitat loss does adversely affect wildlife, people have a right to occupy human habitat as well. The interaction between human occupation and the occupation of the landscape by wildlife is properly controlled through zoning ordinances – not through critical area ordinances. The reader should not misinterpret my intention here. There are high value Class I wetlands that are irreplaceable and particularly valuable to individual species that may be in jeopardy. Those wetlands deserve greater protection than low value wetlands. However, it is my belief that agriculture and the low density residential development currently allowed in nearly all areas of Jefferson County is compatible with all wildlife needs. This is especially true if Jefferson County focuses its available resources on education and a backup regulatory program to create a partnership between residents and government leading to multiple use win-win stewardship programs.

Contrary to Dr. Brooks' claim in the first bullet on p. 12 of Brooks (2007), significant empirical evidence as presented in Washington Department of Fish and Wildlife's Best Available Science documents on Priority Habitats and Species (Larson et al, 2004). For example, the PHS data identifies that Great Blue Heron colonies have

been abandoned in response to housing and industrial development, highway construction, logging, vehicle traffic, and repeated human intrusions (Leonard 1985, Parker 1980, Kelsall and Simpson 1979, Werschkul et al. 1976). In King and Kitsap counties, Jensen (unpublished data) found that great blue heron colony size decreased as distance to the nearest human disturbance within 300 m (984 ft) decreased, and as the amount of human development within 300 m (984 ft) of the colony increased. Nests occupied first in each of 3 King County colonies in 1991 were furthest from development and had more than twice as many fledgling than nests closer to development (3.13 versus 1.51 young/nest) (Jensen unpublished data). While the PHS data does assert that colonies that are located near disturbances can develop a greater tolerance to that disturbance, Larson et al conclude that wherever possible, a habitat protection buffer at least 300 m (984 ft) wide should be established around the periphery of a colony.

Response. It is not the intent of the Committee's recommendations to attempt to manage priority species designated by either Washington State or the federal government through its critical area ordinance. The Committee recommends that the county and its residents abide by published management plans for these species. The issue here is not priority species. The issue is general wildlife and Ecology's apparent desire to turn areas outside the UGAs into refuges.

Additional examples include the effects of human intrusion on shorebird resting areas (estuarine wetlands), the impact of human encroachment in the form of development or land modification on bald eagle nest fidelity and nesting success. PHS data states that human disturbance has the potential to influence shorebirds in at least 3 ways First, substantial disturbances force birds to alter their normal activity patterns resulting in an increase in energetic costs. Second, shorebirds forced to leave an area due to human disturbance may settle in lower-quality alternate habitats. Third, increased energetic costs and use of lower-quality habitats may expose shorebirds to greater risks of predation.

Response. Estuarine wetlands are nearly always designated Category I in WDOE (2004). Therefore they receive the highest level of protection – particularly where they provide significant habitat. Ecology has provided no evidence that the buffers recommended for Jefferson County do not provide adequate protection for shorebirds. Once again, Hruby *et al.* focus their attention on possible effects on wildlife and provide no evidence that the proposed buffers are inadequate.

The PHS data includes among the limiting factors on bald eagles activities that permanently alter bald eagle habitat (e.g., removal of nest, roost, and perch trees, and removal of buffers without regeneration of trees of adequate size and structure), and activities that temporarily disturb eagles to the point of reproductive failure or reduced vigor (e.g., construction, logging, pedestrian activity, boating). These are identified as the greatest threats to nesting and wintering eagle populations in Washington state (Larson et al, 2004).

Response. First, bald eagles have recovered sufficiently that they may be removed from ESA protection. Second, as noted above, they are managed through special management plans. Their habitat needs are not assured by CAO buffers.

The species referenced above demonstrate that human-caused disturbances can have profound and deleterious effects on wildlife. Many more species have not been studied for these effects but can be inferred to have similar sensitivities.

Response. Eagles are now found throughout the Olympic Peninsula. They may have become numerous enough such that the limiting factor will be food availability and not habitat. Under any circumstances, the 95% of Jefferson County that is forestland of one ownership type or another provides the core habitats necessary to sustain bald eagle habitat needs. I am aware of numerous eagle nests in Clallam and Jefferson Counties that are situated in adjacent to or within both commercial and residential developments. There is no demonstration that low density rural residential development on five, ten or twenty acre parcels has any affect on bald eagle behavior at all. The assertion that, "Many more species have not been studied for these effects but can be inferred to have similar sensitivities" is conjecture that needs to be demonstrated by empirical evidence.

Bullet #2 – We disagree with Dr. Brook's assertion that the review in Sheldon et al (2005) is lacking documentation of the degree to which species are affected when its range is limited. Section 4.11 addresses the impacts of fragmentation of a wide range of species. Fragmentation directly limits the ranges of species by creating a landscape matrix through which species have difficulty passing. There is much empirical evidence that fragmentation results in lower species richness. This is another way of saying that fragmentation is linked to the local extinction of species that were once present, and this represents the highest degree to which a species can be affected (The empirical studies describing reduced species richness for plants, amphibians, and birds are summarizes in Section 4.11 Vol. 1 BAS).

Response. Brooks (2007) has carefully reviewed the literature cited by Sheldon *et al.* (2005) in support of Ecology's assertion that fragmentation adversely affects birds and amphibians. Contrary to the above statement, that literature suggests that Ecology has misinterpreted the actual results reported by the various authors. Most of that literature contradicts the above assertion. The reader is encouraged to read the syntheses of Fahrig (1997 and 2003). Contrary to the assertions of Sheldon *et al.* (2005) and Hruby *et al.* herein, she found that fragmentation has minimal effect on biodiversity and that the effects are more likely to be positive than negative. As previously noted, Brooks (2007) brings into question the scientific credibility of Sheldon *et al.* (2005) and the omissions and errors in just the two areas reviewed suggests that the entire document requires critical review by scientists known to not share Ecology's views on the need for large prescriptive buffers. Jim Tracy help.

Dr. Brooks states that the synthesis presented in Sheldon et al. (2005) "argue for increased restrictions on society". We would like to know what sections of the document would lead to such a conclusion. As stated before, the purpose of the document was to summarize and synthesize the scientific literature; not argue for or against specific management options. Recommendations for management measures

are found in Volume 2 Guidance (Granger et al 2005).

Response. The use of Sheldon *et al.* (2005) as the basis for the recommendations made by Granger *et al.* (2005) is by Hruby *et al.* throughout their response. The connection is obvious and it is uncertain why the reviewers try to distance the two documents.

Bullet #3 – While we concur that some wildlife species are highly adaptable, the literature is full of studies documenting the narrow requirements of certain species, as detailed above. The comparison of data presented by Edge (2001) to data from wetlands is not particularly revealing, as explained in our comments on Section 2.2.
Bullet #4 – Whether a significant portion of a local jurisdiction is devoted to state and national parks, timberland and other less intensively developed land uses is a factor that local governments should consider in developing an overall approach to managing growth and protecting critical areas. However, it does not remove the GMA requirement to protect functions and values of critical areas.

Response. Responses to these comments have been provided in other sections of this document. However, a part of the problem is that the term "protect functions and values of critical areas" is vague and does not specify a level of protection. Even if Sheldon *et al.* (2005) does stand true peer review, it does not provide a basis for establishing wildlife buffers because it does not provide information describing how various buffer widths may affect the viability of commonly found populations of wildlife. Jim Tracy – can you expand on this?

Dr. Brooks states that the Growth Management Act (GMA) does not require private land owners to manage their property for the benefit of wildlife. The GMA does require local jurisdictions to protect critical areas (including wetlands and fish and wildlife habitat) functions, including the habitat they provide for fish and wildlife species. It is up to local jurisdiction to determine how this can be accomplished, but they must include the best available science and they must protect critical area functions and values. The tools available to local governments include the regulation of private property.

Response. All of Ecology's recommendations with respect to wildlife functions are vague and not supported by empirical evidence – despite their claim that Sheldon *et al.* (2005) represents BAS. Brooks (2007) brings that claim into dispute. All areas of Washington State have some potential as fish and wildlife habitat and absent forcing all residents into high density urban environments and creating wildlife refuges in all of the remainder of Washington State's landscape, human habitation will eliminate some habitat. However, existing zoning in Jefferson County severely restricts increases in human occupation of the vast undeveloped areas in the county.

Continuing with analysis of those items apparently under bullet #4, we note the following:

The Pizzimenti reference relates to agricultural land uses only.

Response. Pizzimenti's work was done for the Agriculture Caucus. However, his conclusion regarding the need for and effects of large woody debris in lowland streams having low gradients applies to all land uses – not just to agriculture. Ecology has supported the need for large prescriptive buffers, in part, on the need for recruitment of LOD. Ecology has not segregated the need for large prescriptive buffers between landscapes having moderate and high gradient fish bearing streams – but applies the same buffer requirements, justified in part by the need for LOD recruitment, to low-gradient streams where LOD might actual be detrimental to fish by exacerbating flooding of adjacent uplands during high rainfall events. Historically, this type of flooding happened repeatedly in Chimacum Creek prior to the Conservation District's program to maintain an open channel.

The Todd reference is in concurrence with the guidance provided in Volume 2 (Todd recommends 30-300 foot buffers and Ecology 25-300).

Response. This statement is not correct. Todd did not recommended 30-300' buffers. He cited Petit (1994) recommendation for this width in some instances. Todd's doesn't provide evidence of any required widths. His discussion focuses on the different approaches that can be taken to protect natural resources. In his conclusion, he states, "The scientific literature does not support an ideal buffer width for applications in all areas. A number of criteria are appropriate for consideration in determining adequate minimum buffer widths in an ecosystem context. Evaluating factors such as site and watershed characteristics, resource value, intensity of land use, and desired buffer functions all provided considerations from a scientific viewpoint. Because most buffers are established on private lands or public lands managed for a variety of uses, landowner/manager and public objectives are also considered. . . ." Quantification of the specific functions requiring protection and identification of the potential hazards of the proposed development form the basis of establishing the minimum buffer widths recommended in Brooks (2007). Ecology's assertion that Todd (2000) recommends a buffer width of 30 to 300' is simply untrue. Defining specific buffer widths needed to support various function and values was not the purpose of his paper and he was simply conveying the opinion of another author.

The Desbonnet et al reference is misleading. (See comments under 3.1 above).

Response. The reference to Desbonnet *et al.* was a quote from that author – not an assessment of his text. Brooks (2007) is focused on defining **minimum buffer widths** necessary to protect critical area functions and values for application in the absence of a **showing of harm.** The quote from Desbonnet *et al.* is not misleading.

We do not concur that these references support minimum wildlife buffers of 5-9 meters for most land uses.

Response. This is opinion that is unsupported by any analysis or rebuttal of the recommendations made in the cited references.

3.3 Stream temperatures

Ecology defers to the Department of Fish and Wildlife to provide guidance on stream temperature issues.

Response. Hruby *et al.* are in error. Ecology does not defer to WDFW on issues regarding performance standards for stream temperature. They should read Hicks (1998a, 1998b) WAC 173-201A-030 (or the most current regulation) where acceptable stream temperature performance standards use the words *shall not* exceed temperature limits. For instance, For Class A (excellent) freshwaters, (iv), Temperature shall not exceed 18.0 ^{o}C (freshwater due to human activities. There are other parts of this performance standard.

4.0 Climatic conditions and soils in Jefferson County

Climate:

In Section 4.2, Growing season in Jefferson County, Dr. Brooks seems to be confused regarding the accepted definition of growing season recommended by the U.S. Army Corps of Engineers for wetland delineation. Specifically the growing season is based on the median dates (i.e. 5 years in 10, or 50% probability) of 280 F air temperature in spring and fall (not 32o as shown in Fig. 4). Thus Appendix 2 should not be used to establish the growing season. More recently the Corps is developing a regional supplement for delineation that states:

"The growing season has begun on a site in a given year when two or more different, non-evergreen vascular plant species growing in the wetland or surrounding areas exhibit one or more of the following indicators of biological activity:

a. Emergence of herbaceous plants from the ground
b. Appearance of new growth from vegetative crowns
c. Coleoptile/cotyledon emergence from seed
d. Bud burst on woody plants
e. Emergence or elongation of leaves on woody plants
f. Emergence or opening of flowers
(U.S. Army Corp of Engineers. (in prep.). "Interim regional supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region," J.S. Wakely et al. Technical Report____, U.S. Army Engineer Research and Development Center. Vicksburg, MS.

Also, the 41^{o} F temperature stated as biological zero is associated with the temperatures measured in the soils at a depth of 19.7 inches (or 12 inches in the supplemental guidance - see citation above), and should not be used with reference to air temperatures as in Figure 4 to determine the growing season.
The discussion of climate is again limited only to depressional wetlands and the functions they provide (see summary section 4.5). The discussion of the impacts of climate needs to be expanded to include riverine, slope, and lake-fringe wetlands in the county to adequately inform decision-making.

Response. Local jurisdictions require delineations using either the 1987 Corps manual or the 1997 WDOE manual. The same definition of growing season is provided in both manuals:

USACE (1987) and WDOE (1997). Growing season – The portion of the year when soil temperatures at 19.7 inches below the surface are higher than biologic zero (5 ^{o}C) (US Department of Agriculture – Soil Conservation Service 1985). For ease of determination, this period can be approximated by the number of frost-free days (US Department of the Interior 1970).

In guidance issued May 23, 1994, the Corps notes the following:

"- - Each county soil survey has several locations for which air temperature data is tabulated. This can result in numerous growing seasons for each county."

"- - The data location nearest to a wetland delineation site may not be representative of the growing season for the site being investigated. For example, SCS data may be from **a site at sea level but the delineation site may be at high elevation with an annual temperature regime much different than the SCS data site."**

The Corps Guidance describes the need for sound professional judgment based on careful observation and gives examples of indications of growth, such as evidence of new or recent growth such as flowers, new shoots, new leaves, or swollen buds on plants suggests that active growth is occurring. Basically, if plants are growing, it is the growing season." This Guidance suggests that for much of Western Washington the mesic growing season has, in the past, been considered a good rule of thumb; i.e., 1 March to 31 October (except for some coastal areas which may have a year round growing seasons and in areas that have more extreme winter temperatures which may result in a shorter growing season.

The discussion regarding growing season in Brooks (2007) is not restricted to depressional wetlands. Neither is the definition given in USACE (1987) and Ecology (1997). Ecology's assertion that it is inappropriate to apply air temperatures to ground temperatures at 19.7" depth, which forms the basis of the USACE definition is completely without merit. Note in the definition currently adopted by both USACE and Ecology that, "**For ease of determination, this period can be approximated by the number of frost-free days (US Department of the Interior 1970).** With respect to temperature, the presence of frost is determined primarily by air temperatures – not by the temperature at 19.7 cm depth. In including this information the USACE (1987) and Ecology (1997) obviously recognize that air temperatures are generally available and useful and that soil temperatures at 19.7 inches depth are not. It is uncertain why Ecology would include a new definition that is "in prep" – meaning that it is a work in progress that has not been formally adopted. Those of us who actually do wetland delineations are bound by the rules of the jurisdictions within which we work. Those rules define which manual is required. If and when USACE formally adopts the "in-prep" definition, it can be utilized by those who actually do the work in jurisdictions requiring use of the USACE (1987) manual. If and when Ecology formally adopts this new definition into its 1997 manual, then we can use that definition. The new definition appears will likely be embraced by those of us who actually work in the field. However, the new definition will continue to require the use of judgment by those using the manuals.

In this instance, Hruby *et al.* (2007) indicate that they are unfamiliar with the current definitions required in either manual. The definitions are not wetland type specific, they apply generally – just as the "in-prep" definition applies. The discussion in Appendix 2 is very much

complementary to the May 23, 1994 guidance provided by the USACE and in the context of the current manuals, it does provide appropriate guidance.

4.3 Growing season and the effects of elevation.

We note that the wet adiabatic lapse rate may approach ~5.4° F/1000 feet, but it is generally less. The figure quoted in Brooks (2007) is actually the dry (constant) adiabatic lapse rate (DALR). When moisture is present in a parcel of air and the parcel is lifted to its lifting condensation level, latent heat release during condensation provides some warming to the air mass when the vapor within the parcel condenses into cloud droplets. This moist or saturated adiabatic lapse rate (SALR) is dependent on temperature and pressure, but at lower levels in temperate latitudes it is about half of the DALR due to the heat released. It can be estimated as ~6ºC/km or .6ºC/100m [~2ºC or ~3.6ºF/1000 ft].

Response. Hruby *et al.* (2007) did not examine the rainfall isopluvials provided in Figure 2 of Brooks (2007). If they had, they would have noted that most of Eastern Jefferson County lies in the rain shadow of the Olympic Mountains. The rainshadow is created, in part, because air masses moving across the mountains are lifted, and cooled along the Pacific Coast resulting in high rainfall on the western slopes of the Olympic Mountains. After passing over the Olympic Mountains, the air mass descends, warms and moisture evaporates. My point is not that the actual temperature decrease may be less than the dry adiabatic rate. Rather my point is that the conditions described by Ecology are somewhat the opposite to what actually happens to air masses in Eastern Jefferson County and depending on the direction from which storm fronts are intercepted by the Olympic Mountains, adiabatic losses may be more like the dry rate (Eastern Jefferson County) or the wet rate (Western Jefferson County). Under any circumstances, it is undeniable that temperatures generally decrease with altitude and that the growing season becomes shorter at higher elevations. If Ecology had read the May 23, 2004 USACE Guidance, they could have avoided the obvious error in their criticism. The highlighted portion of the USACE Guidance from USACE states the same thoughts expressed in Brooks (2007). The only difference is that Brooks (2007) used quantitative data from NRCS to illustrate the well know fact that temperature declines with elevation. That's why our mountains have snow on them when the lowlands do not.

5.0 Growth Management Act

Dr. Brook's analysis of the GMA is based on a reading of one compliance order of one of the Growth Board's in a case dealing with ongoing agriculture in Skagit County. As such, it is very limited in its application to Jefferson County. For a comprehensive analysis on the GMA and how it applies to critical areas, we would direct Dr. Brooks and any other readers to Chapter 2 in Volume 2 Guidance, as well as documents authored by Alan Copsey, a state Assistant Attorney General, including:

- "The Designation and Protection of Critical Areas under the Growth Management Act," by Alan D. Copsey, May 9, 2002; and
- Decisions of the Growth Management Hearings Boards, May 1, 2005

through April 30, 2006, Prepared by Alan D. Copsey Assistant Attorney General.

Response. I have read these documents. Many of the decisions described in them come from the Central Board. Hruby *et al.* (2007) are once again reminded that Jefferson County is not King County and does not face the same growth challenges that Snohomish, King, Thurston and Kitsap Counties face. Growth in Jefferson County is controlled using zoning not using protection of natural resources as a surrogate for controlling growth. It cannot be stated emphatically enough that Jefferson County lies within the purview of the Western Washington GMB and that is where legal decisions need to be reviewed.

We concur with much of what Dr. Brooks concludes about the GMA, particularly with respect to existing, ongoing agriculture. Specifically, we concur that:

- The GMA does not prescribe a specific approach to protecting critical areas. Each local jurisdiction is able to develop an approach that is tailored to the particular local circumstances. Ecology encourages local governments to develop locally-specific approaches that combine regulatory and nonregulatory elements. However, as we lay out in great detail in *Volume 2 Guidance*, it is essential that local governments base their approach on landscape-scale assessment and analysis.

Response. The goal of landscape-scale assessments is commendable. However, Jefferson County, with 29,000 residents, does not have the resources for these kinds of assessments, not has Ecology demonstrated in either Volume I or II that landscape assessments are necessary in order to adequately protect natural resources in the county's forest dominated landscape where only very low density residential development is allowed. As seen in the previous discussion, Ecology's conclusions regarding the need for landscape scale management in response to the perceived hazards associated with habitat fragmentation were not substantiated in the literature they cited. The quality of the remainder of Ecology's BAS was not examined. However, the errors in this section suggest that a thorough critique of Volume 1 is necessary to substantiate any of the conclusions reached. Until that independent review is completed, Volume 1 should not be accepted as representing an accurate reflection of the literature.

- The GMA allows local governments to use either a prescriptive approach that utilizes established standards, or a performance-based approach that incorporates monitoring and adaptive management, or a combination of the two approaches. However, using a performance-based approach is difficult, if not impossible, for most local governments to implement, given the high cost of adequate monitoring.

Response. This response by Ecology is contradicted by the recommendation in Appendix C of Hruby *et al.* (2007) where the authors encouraging monitoring of agricultural BMPs by local jurisdictions. Monitoring of the type recommended in Appendix C is generally accomplished on a watershed scale. The same monitoring will identify exceedances of stated performance standards regardless the source of the activity causing the exceedance. There are few lowland watersheds in Jefferson County that do not involve some form of agriculture and these are currently being monitored. It is agreed that moving away from the heavily regulatory approach

recommended in Ecology's Volume 2 to the stewardship based partnership approach backed by minimum buffers recommended in Brooks (2007) will involve some additional monitoring. However, this performance-based approach is not, "difficult, if not impossible, for most local governments to implement."

- Designated long-term commercial agricultural lands must be treated differently under the GMA than other lands. The requirement to maintain these lands viability for agriculture is to be balanced with the requirement to protect critical areas. However, the general goals of the GMA may not be balanced against the specific requirement to protect critical area functions and values.

Jim Tracy.

- Local governments may allow individual impacts to critical areas as long as they protect critical area functions and values overall. This may be done on a "functional catchment" basis (e.g. basin) or on a case-by-case basis (e.g. mitigation).

Response. Agreed.

- The GMA does not require restoration or enhancement of critical area functions and values. The primary purpose of the GMA is to address new growth and development. Where the damage has been done, the GMA cannot compel restoration or enhancement. These actions must be undertaken voluntarily. However, the Boards and Courts have consistently ruled that ongoing degradation of critical area functions and values from existing land uses can and should be addressed. Thus, where the damage is ongoing, local governments must enact measures to reduce and eliminate the degradation.

Response. Agreed and provisions for a regulatory component for natural resource protection is clearly stated in the recommendations of Brooks (2007). Where we disagree is that I feel that an environmentally, economically and socially sustainable natural resource protection program is comprised of 60 to 70 percent education, 20 percent incentives and 10 to 20% regulation. Numerous statements in Hruby *et al.* (2007) indicate that Ecology little or no faith in voluntary stewardship programs; in *win-win* solutions or faith in the citizens of Washington State.

In this section, Dr. Brooks introduces the idea that a "win-win" situation can result if landowners are allowed to enhance existing wetlands in exchange for reducing their area. We have serious concerns about such an approach, if it is promoted as a part of protecting critical areas. Certainly, unavoidable impacts to critical areas can be permitted as long as adequate mitigation is provided. However, based on extensive studies of mitigation, wetland enhancement frequently fails to produce the desired results. Thus, the federal and state wetland regulatory agencies discourage the practice of enhancement of wetlands to mitigate unavoidable impacts. To promote such an approach as part of the County's efforts to protect critical areas is inappropriate outside of the parameters of mitigation. That said, voluntary efforts to

restore and enhance wetlands can be an important part of the County's approach.

Response. One of the reasons that mitigation projects frequently fail it that agencies take a position, like that espoused in this response from Hruby, *et al.* that mitigation should not be accomplished by enhancing existing wetlands. The result is that mitigation planners are forced to attempt to create wetlands in upland areas. That seldom doesn't work because the basis of a wetland is hydrology. Wetlands generally exist where there is appropriate hydrology. Attempting to create wetland conditions in an upland area means that supplemental water must be supplied. In most cases it is difficult to provide the quantities of water required and to sustain the supply. I have designed and implemented numerous wetland mitigation projects – all of which involve enhancement of existing or marginal wetland conditions. All of these have proven to be successful. The reader should note that several of the papers cited in Sheldon *et al.* (2005) and reviewed in this response, several have demonstrated large and successful efforts to enhance wetlands through increased water retention and to create new habitat by creating ponds on private property in Britain and the U.S. Midwest. My experience suggests that Ecology's discouragement of these kinds of habitat improvement projects, as stated above, in counter-productive with respect to wildlife, hydrology and water quality.

6.0 Defining minimum buffer widths

As stated before, Dr. Brooks has provided some supplemental references with respect to potential minimum buffers that may be applicable to agricultural land uses. He has also provided considerable personal and professional opinions on how he thinks Jefferson County should address the protection of critical area functions and values. However, he has made a critical error in attempting to apply this limited scientific information to the overall management and protection of critical area functions and values in Jefferson County. On the one hand, he states that his information and perspective is "supplemental" to the extensive work produced in the Ecology/DFW documents. On the other, he largely ignores the information and recommendations in these documents in favor of the limited perspective provided by his supplemental report. As a result, his recommendations do not adequately include the best available science and will not result in adequate protection of wetland functions and values in Jefferson County. Table 2 contains some references applicable to buffers for protecting water quality in wetlands and streams. However, they represent only a portion of the relevant literature on that topic.

Response. As noted earlier, the purpose of the *Supplemental BAS* was to demonstrate that Sheldon *et al.* (2005) was misleading and incomplete. Ecology has not responded to the specific points made in that supplement. Neither has Ecology provided a rebuttal to the conclusions reached in the cited papers – most of which were peer reviewed and published. Ecology's BAS is clearly shown to be incomplete and that was the purpose of Brooks (2007). It is disappointing to see that Ecology refuses to address the science by rebutting the arguments of the cited authors and rather simply refers back to the conclusions reached in their obviously incomplete BAS as substantiating the need for larger buffers. That is an unsatisfying circular argument.

Volume 1 BAS identifies and examines wetland impacts associated with a large

variety of land uses and alterations (see Chapters 3&4). Additionally, Ecology's "Vol. 2 Guidance identifies and prescribes wetland buffers in consideration of the intensity of these adjacent land uses. Brooks (2007) may prove applicable to certain agricultural uses. However, it provides no analysis of the wetland impacts associated with other land uses. In Section 6.1, Brooks (2007) states 'buffer width requirements specific to residential development were not reviewed in preparation of the report." Assessment of wetland impacts associated with commercial development is limited to a single sentence on the bottom of page 29. The document contains no assessment of the impacts associated with industrial use or large transportation infrastructure. Dr. Brooks draws several conclusions that are wholly inconsistent with Ecology's BAS and, as such, many of his statements are contradictory rather than supplementary. His resulting buffer recommendations constitute a high risk approach to protecting and managing wetlands because they are based only on the impacts of current agriculture, not the more severe impacts that can result from increased development.

Response. The reader is referred to Table 1 in this response. The buffer recommendations provided in Brooks (2007) are more variable than the buffer requirements in other rural counties of overheard by the Western Board. However, the mean or median values are very consistent with requirements of those other approved CAOs. When the additional recommendations for voluntary increases in managed buffers are included, the recommendations of Brooks (2007) are nearer the high end of the range than the middle for other CAOs. The lowest buffer widths recommended by Brooks (2007) are all associated with development posing a low risk and wetlands have low habitat value. Ecology provides no evidence that existing Jefferson County wetland buffers have had a detrimental effect on any function or value, including wildlife. The increase in buffer widths now being promoted as necessary impose a burden on residents of the county when there is no showing of a need for those increases in Jefferson County.

6.1 Minimum buffer widths necessary to protect hydraulic functions

This section of the report provides specific recommendations for buffer widths for different land uses to protect hydraulic functions of wetlands. However, Dr. Brooks appears to mix water quality considerations into this section as well. As stated earlier, the scientific literature makes clear that buffers are not the primary tool that should be used to protect wetland hydraulic functions. Buffers needed to protect the water quality and habitat functions of wetlands will always be larger than those needed to protect hydraulic functions, so it is not necessary to establish buffers for this function.

Response. There are many wetlands in Jefferson County primary function in some cases, there sole function, is hydrologic. If Ecology is recommending that no buffers are required for these wetlands, then I will agree. In those cases where water quality or habitat considerations impose larger buffers than are required to protect hydrology, those larger buffers are invoked. The bottom line is that I don't disagree with Ecology and assume that they will not object to removing consideration of buffer requirements to protect hydrology.

6.2 Minimum buffer widths necessary to protect wetland water and sediment quality

As mentioned by Dr. Brooks in Section 6.2 and also in Sheldon et al. (2005) the actual efficiency of removal depends on many site specific factors and using these site specific characteristics to establish a suitable buffer is "beyond the resources available to the Department of Ecology and Jefferson County," (2d paragraph section 6.2), and especially beyond the resources of private individuals. Thus, the standards developed by the county need to be based on a characterization of the risks posed by different buffer widths rather than on the minimum values obtained in some scientific studies for specific conditions. The question that has not been adequately addressed is whether the minimum widths proposed will actually protect the functions of wetlands. The approach taken by Ecology has been to consider the range of widths reported in the scientific literature and chose a value that represents the approximate median of the values reported rather than the minimum. Deviations from this median value, either higher or lower, can be based on local conditions. In our view this represents a moderate risk to the resources because under some site specific conditions functions will not be adequately protected based on the scientific information available to us.

Response. An acceptable response from Ecology would have been the citation of information supporting buffers larger than those proposed by Brooks (2007). Those citations should be specific to the low density residential zoning allowed in Jefferson County or to the scale of commercial development that would be allowed by the current UDC. Absent those citations, Ecology's assertions are unfounded.

We do not agree with Dr Brooks that his recommendations "are intentionally conservative from the environment's point of view." In fact, we find his recommendations to be exactly the opposite. He clearly errs on the side of posing a very high risk to the functions and values of wetlands in the County.

Response. This is an opinion that is not supported by a review of the buffer requirements in Table 1 or the wetland size requirements reviewed in Table 2. We have found Sheldon *et al.'s* (2005) interpretation of the literature they cited in support of habitat needs of amphibians to be inaccurate – especially as applied to low density rural environments dominated by forests characteristic of Jefferson County. Ecology needs to focus its attention on the conditions that actually exist in Jefferson and other rural counties of Western Washington and it is inappropriate for the agency to attempt to impose their perceptions based on growth management issues in highly urbanized areas.

6.3 Minimum habitat buffer widths

In his document, Dr. Brooks provides few references to support the buffers that he recommends to protect wetland habitat functions and misrepresents the reference to Desbonnet et al. (1994) (see sections 3.1 and 3.2 above). In this section he focuses on the legality of regulating private property to protect wildlife habitat functions. We hope that his accusatory statement under the fourth bullet is not directed at the Department of Ecology.

Response. It is uncertain what Hruby *et al.* are referring to here. The forth bullet discusses Edge (2001), *win-win* landscapes and the extension of BMPs to low density residential developments.

Dr. Brook's conclusion that voluntary measures will "put more conservation on the ground" is not supported by any scientific evidence. While we concur that working collaboratively with landowners to voluntarily provide restoration of wetlands and other critical areas can and should be an essential component of addressing existing, legal land uses, we do not believe that "minimum" buffers and voluntary measures are adequate to protect wetland functions and values from new development.

7.0 Application of minimum buffer widths

Dr. Brooks has developed an elaborate method of determining the relative "hazard" of different land uses and quantified these with "multipliers". The quantification of these multipliers implies a level of precision that is not supported by any science. Dr. Brooks concedes that he has not attempted to investigate the impacts of residential, commercial or industrial land uses, yet provides detailed metrics for assessing their relative impacts. The result is a system that is complex but not well-grounded in science.

Response. The process is simple. The most difficult part is completion of the Wetlands Rating Form (WDOE, 2004). After than it is simply looking up two multipliers in the tables and applying them to each of the three wetland function scores derived using WDOE (2004). No level of precision is implied. The process simply results in a continuum of buffer widths, each of which is keyed to a specific wetland function and the hazards associated with the proposed development. The process is viewed as a small step toward site specific management plans, which are included as an option for those willing to produce them.

It is difficult to compare the guidance provided by Dr. Brooks with that recommended by Ecology because the calculations require several steps. In almost all cases, however, the recommendations made by Dr. Brooks are significantly lower than those proposed by Ecology. The highest recommended buffer for a wetland with 36 habitat points (the highest possible) is only 180 ft and that is for only two types of land use (compared to Ecology's recommendations of 300 ft. The following page contains a summary of Brooks' suggested buffers for 4 habitat scores from the rating system compared to the recommendations provided by Ecology in Vol. 2 Guidance (Appendix 8-C Alternative 3A). In Appendix B of this document, we include more background information on how decision-makers should evaluate the wetland buffer issue.

Response. A comparison is provided both in Hruby's critique and in Table

7.1 Development of residential and perhaps commercial BMPs

Dr. Brooks should review Table 8C8 in Appendix 8C of *Volume 2 Guidance* to see general BMPs that Ecology recommends for residential and commercial land uses. These BMPs could be further refined, but represent the types of design practices that landowners can utilize to justify buffer reductions from a high-intensity land use width to a moderate-intensity land use width.

Response. Residential and Commercial BMPs are being developed at this time for Jefferson County and the information in Volume 2, Table 8C will be included in our deliberations. However, the BMPs developed for Jefferson County should be based on the conditions and needs of Jefferson County and not on conditions existing in King County and other highly urbanized areas.

7.2 Site-specific wetland and buffer management plans

We concur with Dr. Brooks that site-specific buffer plans can provide a tailored approach that takes into account detailed site parameters. However, utilizing such an approach can result in less predictability for land-owners, is expensive to implement and leads to conflicts. It is a high-cost approach with a low-certainty of outcome. That said, the County could include an option for a Rural Stewardship Plan, such as King County did, to provide rural landowners who are not engaged in commercial agriculture with an opportunity to develop more site-specific management approaches that may result in reduced buffers.

Response. Ecology provides no evidence substantiating any of its assertions in this paragraph. Site specific management plans are provided as an option in Brooks (2007). For some Americans, the cost of Ecology's overly burdensome regulatory program is far greater than the cost of developing a site specific management plan. In any case, residents should be provided with this option.

8.0 Voluntary programs

Dr. Brooks addresses the benefits of utilizing a voluntary stewardship approach in order to get restoration and enhancement of critical areas. We concur that this is a preferred approach for making environmental improvements with regard to existing land uses. Ecology supports the use of BMPs, farm plans, landowner incentives and voluntary programs for existing, ongoing commercial agriculture and Rural Stewardship Plans, landowner incentives and voluntary programs for existing rural and non-commercial agricultural land uses. The types of voluntary projects described by Dr. Brooks for Chimacum Creek and on his farm are commendable and should be supported.

Response. Agreed.

However, we believe that new development should be subject to adequate regulations

to ensure that critical area functions and values are protected. Landowner incentive programs can augment regulations but cannot adequately protect critical area functions and values by themselves. Dr. Brooks has proposed a combination of minimum buffers and voluntary measures to address new development. We do not agree that his proposed buffers will provide adequate protection, even with voluntary measures. For new development, we believe buffers that ensure no more than a moderate risk of degradation of functions and values are needed. The minimum buffers proposed by Dr. Brooks will pose a high risk that wetland functions and values will be degraded by new development.

Response. Disagree. See previous comments regarding Ecology's need to provide evidence showing that the buffers are inadequate. In addition, Ecology then needs to show why buffers in some other rural jurisdictions, like Island County, are much smaller and yet have been allowed. Lastly, Ecology and/or WDFW have not provided any evidence showing that the existing buffers provided in Jefferson County's current CAO have damaged wildlife in the county. No harm – no penalty. This is fundamental to the concept of a *Shared Onus.*

We agree with Dr. Brooks that Jefferson County should provide a balanced approach to critical area protection. However, we disagree on what constitutes "balance". We suggest that a balanced approach includes largely voluntary measures to address existing land uses and adequate regulations to address new development.

Response. Disagree. What Ecology is saying that if rural landowners want to voluntarily enhance existing conditions that is OK, but if new residents want to voluntarily manage their property in accordance with an approved management plan, that is unacceptable. As previously noted, based on my 25 years of experience in resource management, I believe that the overly zealous regulatory approach promoted by Ecology will result in land-owner resentment and that resentment will diminish rural residents' commitment to wildlife. In other words Ecology's approach is socially unsustainable; will be counterproductive; and will result in a further loss of the agency's perceived legitimacy and the legitimacy of Jefferson County government.

In closing, we appreciate the opportunity to provide this review and assistance to Jefferson County. The Department of Ecology supports the County in its ongoing efforts to develop a Critical Areas Ordinance that will "protect and enhance wetlands in all their functions" (Jefferson County Comprehensive Plan, Goal ENG 14.0). We also acknowledge the concern and considerable efforts of the Critical Areas Committee. As described and explained throughout our analysis document, we believe that Dr. Brooks' work has applicability as the County develops strategies to manage the effects of existing and ongoing agriculture on wetlands. However, his approach, when applied to development other than existing agriculture, would not adequately protect all wetland functions and values. We believe Dr. Brooks' recommendations constitute a significant departure from the best available science and are inconsistent with the guidance recommended by Ecology and Fish and Wildlife.

Response. Jefferson County's Critical Area Ordinance Review Committee has asked for and not received any opportunity for direct interaction with knowledgeable agency staff. The recommendations of this committee are based on what we believe is a rational approach to resource management in rural Jefferson County that is sustainable because it creates a partnership focusing on stewardship between rural residents and governments. I have personally requested such interaction from the Director of the Southwest Region. Ecology has not responded to these requests. Instead, Ecology has refused to facilitate this process by provided requested references and this critique by the agency shows an almost total lack of understanding of the environmental and social conditions in the county or of the county's existing zoning.

In preparing this response, it has been necessary to retrieve and review another 181 pages of peer reviewed documents in an effort to understand Ecology's assertions made in Chapter 4 and 5 of Sheldon *et al.* (2005) regarding amphibians and birds. Rather than helping me understand Ecology's conclusions, that review has demonstrated that the agency has abused that literature and that the authors either didn't critically review the documents they cited or they misinterpreted what they read. In any case, the examination of additional documents regarding buffer requirements to protect hydrologic function and water quality and the papers reviewed dealing with wildlife buffers suggests that there are significant omissions and flaws in Sheldon *et al.* (2005) and that it does not provide a rigorous scientific basis for the recommendations made in Volume 2 by Granger *et al.* (2005). All of this has been a significant disappointment to this author as it was my sincere belief that the innovative approach recommended in Brooks (2007) would provide a more protective and less polemic path toward sustainability.

Given the omissions and flaws in the analysis of Sheldon *et al.* (2005), it is strongly recommended that Washington State form a panel of truly independent experts, with a referee acceptable to all constituents, to evaluate Ecology's BAS. It may be that the hydrology, water quality, amphibian and bird sections reviewed by Brooks (2007) are exceptions and that the remainder of the BAS is acceptable. However, the review to date is not encouraging.

Appendix A – Ecology's Comments on Dr. Brook's Draft CAO:

We are not providing detailed comments on every section and subsection of the proposed CAO in Appendix 3. Our comments below are directed at the portions of the CAO where we have the greatest concern.

As detailed earlier in this document, the prescribed buffer widths in the CAO would not adequately protect wetland functions and values, especially in regards to the function of wildlife habitat. Another major issue with the draft is that it bases the buffers for all the wetlands with special characteristics on their scores for the functions. The reason these wetlands are separated in Ecology's guidance documents is because the scores for the functions for these wetlands are not representative of the buffers they need. Thus, the buffer strategy in Brooks (2007) for bogs, natural heritage sites, coastal lagoons etc. is not based on BAS. The rationale for requiring buffers other than those based on functions in wetlands with special characteristics is provided in Appendix 8-E (Vol. 2 Guidance).

Response. Basing buffer widths on the Rating Scores is an approach designed to take a step toward site specific management plans by tailoring buffer requirements to specific functional values associated with a wetland and the hazards posed by development. Ecology simply applies large buffers to wetlands having designated attributes. There is no BAS supporting the arbitrary buffer widths prescribed by Ecology.

Section C (p. 52 of Brooks (2007), of the draft ordinance exempts isolated Category III wetlands less than 2,500 square feet in area and isolated Category IV wetlands less than 7,500 square feet in area. This approach is not supported by the scientific literature.

Response. I cannot respond to all of the 900+ citations in Sheldon *et al.* (2005) because this is a purely voluntary effort. However, the review of a subsections of those citations now included in the *Supplemental BAS* suggests that at least for amphibians and birds, Ecology's assertions are not substantiated by their own citations. In fact, in some cases the citations are contradictory to Ecology's assertions. The smallest wetlands included in the papers that were reviewed were 0.20 hectares (ca. 0.5 acres) and none of Ecology's citations examined buffer distances required by amphibians or birds. One could assume that scientists didn't study smaller wetlands because of their limited value. However, I won't make that assumption. Rather, I will refer to Table 3 in this response. The Committee's recommendation that Category III wetlands not be regulated when they cover <2,500 ft^2 and that Category IV wetlands not be regulated when they cover <10,000 ft^2 is very consistent with the exclusions found in other rural county CAO's. No support was found for regulating small wetlands (<0.5 acres) in the literature reviewed for the *Supplemental* BAS. Ecology makes many assertions in their flawed BAS that have so far been found to not be supported by the literature. Given the

It is not possible to conclude from size alone what functions and values a particular wetland is providing. Sections 5.3.3 and 5.3.4 of Volume 1 BAS emphasize that small

wetlands and isolated wetlands provide many important functions. Many of these small and/or isolated wetlands are biologically unique systems that are critically important to amphibians. Jefferson County contains at least 12 species of native amphibians. The loss of small wetlands results in increased fragmentation of habitat and greater distances between wetland patches (See Chapter 4 of Volume 1). This can have a significant effect on the ability of a landscape to support viable populations of wetland-dependent wildlife. However, we recognize that many jurisdictions desire to place size thresholds on wetlands that are to be regulated, in order to focus staff time and attention on the most important natural resources. In order to assist jurisdictions in addressing this administrative need, while minimizing the impact on wetland functions, Ecology has developed a strategy for exempting small wetlands that incorporates appropriate science-based criteria. Example language for the exemption language in a CAO is as follows:

Response. As shown in Brooks (2007) Ecology's assertions regarding the importance of fragmentation is based on theory that is not substantiated by the empirical evidence. This assertion by Hruby *et al.* (2007) is strongly contradicted by the authors cited in Sheldon *et al.* (2005).

1. Exempt wetlands that are isolated and less than 1,000 s.f. in area where it has been shown by the applicant that they are not associated with a riparian corridor, they are not part of a wetland mosaic and do not contain habitat identified as essential for local populations of priority species identified by Washington Department of Fish and Wildlife.
2. The requirement to avoid impacts may be dropped for Category 3 and 4 wetlands between 1,000 and 4,000 s.f. that meet all of the following criteria:
    a. Wetland is not associated with a riparian corridor and
    b. Wetland is not part of a wetland mosaic and
    c. Wetland does not score 20 points or greater for habitat in the 2004 WesternWashington Rating System and
    d. Wetland does not contain habitat identified as essential for local populations of priority species identified by Washington Department of Fish and Wildlife.

3. Impacts allowed under this provision to these wetlands will be fully mitigated as required in mitigation section.

We note that a recent Growth Management Hearings Board decision on this same issue determined that Kitsap County was erroneous in exempting wetlands in the way proposed by Brooks (2007).

The GMHB decision includes the following text: "Kitsap County has not expanded its small wetlands exemption; in fact, the exemption has been somewhat narrowed. But there is no evidence in the record of the likely number of exempt wetlands, no cumulative impacts assessment or adaptive management, and no monitoring program to assure no net loss. In light of the Court's guidance in *Clallam County*, which the Board finds controlling, the Board is persuaded that a mistake has been made;

Kitsap's wetlands exemption is **clearly erroneous."**

Response. Urban Kitsap County is heard by the Central Board – not the Western Board, which rules on issues involving rural counties in Western Washington. Ecology makes a significant error in applying decisions regarding highly urbanized areas to rural areas. Note in the Rural zone of Island County, Category I and II wetlands (Class A) are excluded when then cover <2,500 ft^2 and Category III and IV wetlands (Class B) are excluded when they cover < one acre! The Committee's recommendation is consistent with all of the other counties listed in Table 3. Ecology's BAS needs to depend on quantitative empirical data describing the various restrictions on property associated with Buffers. If Ecology continues this dialogue, I hope they will be more rigorous in their approach and supply specific data from specific studies supporting their recommendations.

Additional areas where the draft CAO is inconsistent with BAS include the following:

p. 52 D. This section contains provisions that are inconsistent with the guidance on applying the state rating system.

Response. I'm not sure what specifically is being referred to in this statement. It is too vague.

p. 56 2nd bullet allows for the development of a habitat management plan, which can supersede buffer requirements, that appears to only require that water quality and sediment quality standards are not exceeded. No analysis of habitat appears to be required by the habitat management plan.

Response. This section of the report simply identifies the option of preparing a site and hazard specific habitat management plan. There are, to the best of my knowledge, no codified performance standards for wildlife or habitat. There are for sediment and water quality (WAC 173-201 and 173-204). That is why these performance standards are specifically mentioned. If Hruby *et al.* are aware of codified wildlife and/or habitat performance standards, please forward those and the Committee will incorporate them. Requirements for mitigation and habitat management planning are presented together at the end of the proposal. The author would be pleased to work with Ecology to develop specifics describing the contents of Habitat Management Plans. However, one of the goals of the Committee was to write a CAO that was as flexible as possible. In this case, the Committee has confidence that habitat planners considered competent by Jefferson County can and will consider all of the functions and values associated with a wetland in developing a habitat management plan. If the planner does not, then the county would not have to accept the plan.

pp. 58-63. The mitigation provisions in the draft CAO are incomplete and inadequate to ensure no net loss of wetland functions and values when unavoidable impacts occur. For recommended language on mitigation, see Appendix 8B of *Volume 2, Guidance.*

Response. Ecology's recommendations are prescriptive, burdensome, unnecessary, and they stifle the imagination of anyone attempting imagination. No rigorously defined basis is presented for Ecology's recommendations. This is especially true for the exaggerated mitigation ratios. In contrast, the mitigation requirements in the recommendations of Brooks (2007) are performance based and the ratios are based on the assessed potential for success. That is a judgment made by the planner who actually has experience and who has done this type of work. Ecology's reliance on prescriptive mitigation ratios appears to be another instance of lack of agency confidence in professionals working in this field. The reasons for Ecology's attitudes are unknown.

Appendix B How to think about Wetland Buffers

Wetland Buffers

Buffers are by far the most difficult and contentious issue for local governments to address in developing protection measures for wetlands (and streams). Requiring buffers means requiring landowners to set aside land that may otherwise be developable. Thus, establishing required buffer widths should be done with care and with a clearly stated purpose. Ecology's recommendations on how to establish reasonable, defensible buffers are based on three primary factors:

1. What the science says about the range of buffers needed to protect functions and values;
2. Other protection programs and measures to be implemented (i.e., how much are buffers relied upon to provide protection of wetland functions and values in a jurisdiction?); and
3. An appropriate level of risk that wetland functions and values will degrade.

Response. The *Supplemental BAS* provided by Brooks (2007) has examined to specific areas of Ecology's BAS.

Ecology's BAS is one dimensional and incomplete. In the case of water quality and hydrologic functions, Sheldon *et al.* (2005) was incomplete in that it ignored a body of literature indicating that much shorter buffers can, in most cases, protect hydrologic and water quality functions. Ecology's misapplication of the paper by Young *et al.* (1980) suggests that their BAS is one dimensional in that it focused on highlighting the largest buffers that could be documented.

Ecology's BAS is inaccurate. Examination of the citations provided by Ecology dealing with the issue of the effects of habitat fragmentation on amphibians and birds indicates the results of the 13 studies reviewed, in depth, by Brooks (2007) do not support Ecology's conclusions and in many cases they contradict those conclusions.

Examining these issues in depth is a tedious and time consuming task and it is beyond the scope of this voluntary effort to review all sections of Sheldon *et al.* (2005). However, the results of reviewing two areas suggests that there are serious flaws in this document. Furthermore, this review suggests that the entire document requires review, not by wetland biologists selected by the authors, but by scientists familiar with the subject matter **who do not share Ecology's viewpoint that has resulted in the agency requiring large prescriptive buffers.**

Below, we describe briefly how each of these factors should be addressed.

1. The scientific literature is unequivocal that buffers are necessary to protect

wetland functions and values (a list of the most important scientific documents related to buffers is provided in an attachment). The literature consistently reports that the primary factors to evaluate in determining appropriate buffer widths are: 1) the wetland type and functions needing protection; 2) the types of adjacent land use and their expected impacts; 3) the characteristics of the buffer area (slope, soils, vegetation); and 4) the functions the buffer must perform (filtering sediment, nutrients, or toxics; screening noise and light; providing forage, nesting, or resting habitat for wetland dependent species; etc.).

Response. The literature reviewed to date does not support Hruby *et al.*'s assertion that, "the scientific literature is unequivocal that buffers are necessary to protect wetland functions and values." Other than the five page paper by Lande (1988), none of the citations provided in the appendix are published in the peer reviewed literature. I don't disagree with points one through four in the above statement. However, these points are not demonstrably supported in the reviewed literature. The observation that buffers may be required for some wetland types and functions for protection from some adjacent land uses does not mean that buffers are the only form of protection or that they are even necessary. To gain additional perspective on the inappropriateness of the statement above, the reader is encouraged to read the entire review of Brooks (2007) by Easter (2007).

The widths of buffers needed vary widely, depending on these four factors. For example, providing filtration of coarse sediment from residential development next to a low-quality wetland would require only a relatively flat buffer of dense grasses or forest/shrub vegetation in the range of 20 to 30 feet. However, providing forage and nesting habitat for common wetland dependent species such as waterfowl, herons, or amphibians in a high quality wetland adjacent to residential development would require a buffer vegetated with trees and shrubs in the range of 200 to 300 feet. This illustrates the necessity of using a buffer approach that incorporates wetland type and functions (based on an appropriate rating system), types of land use, and buffer characteristics. [For more on the science of buffers, see chapter 5 of *Wetlands in Washington State - Volume 1: A Synthesis of the Science* (Sheldon et al., March 2005)]

Response. The reader is referred to Brooks (2007) and Figure 5-1 in Sheldon *et al.* (2005) to see the inappropriateness of Hruby *et al.'s* assertion that "providing filtration of coarse sediment from residential development next to a low-quality wetland would require only a relatively flat buffer of dense grasses or forest/shrub vegetation in the range of 20 to 30 feet." The literature clearly demonstrates that in the case described, buffers of only a few feet would be adequate. Furthermore, the literature reviewed in Brooks (2007) clearly demonstrates the relative ineffectiveness of forest-shrub buffers for removing suspended solids from stormwater. The review of literature cited by Ecology in Sections 4 of Sheldon *et al.* (2005) in Brooks (2007) does don't substantiate the need for significant buffers – except perhaps in highly urbanized landscapes that are not allowed by zoning in rural Jefferson County. My point is that Ecology has made many assertions that are not

substantiated by their own BAS and are certainly not substantiated by the additional citations reviewed in Brooks (2007)

2. Wetland regulations are one tool that local governments can use to protect wetland functions and values, and buffers are one part of wetland regulations. While necessary and important, buffers are not the "be all and end all" of wetland protection. In the absence of other protection measures, buffers become more important and, thus, larger buffers are more necessary. However, we believe it is possible—and consistent with BAS—to rely less heavily upon buffers and regulations in general if other protection measures are used. These include watershed- or landscape-scale assessment and protection and non-regulatory approaches such as public preservation and restoration and the use of landowner incentives. We believe that the development of a more comprehensive, robust program of wetland protection can allow a jurisdiction to rely less upon regulations in general, and buffers in particular. Conversely, if the County is going to rely largely upon its CAO as the means of protecting wetland functions and values, then larger buffers are necessary.

Response. The outcome of this dialogue would have been very different if Ecology had agreed to sit down with the Committee and discuss these ideas in an interactive way to explore how Jefferson County could refine its stewardship approach to critical area protection with the aid of education and incentives provided by Washington State. Instead, Ecology has assaulted the recommendations of Brooks (2007) with rigor, when in fact, those recommendations are very similar to the discussion above. It almost seems like the paragraph above was written by someone who did not participate in writing most of the Hruby *et al.* (2007) critique.

3. Finally, we believe that risk management is a critical factor in deciding what buffers (and regulatory standards in general) are needed. The best available science currently does not, and probably never will, provide absolute quantitative information on what is needed to protect wetland functions and values. However, the best available science can help us understand the relative level of risk to wetland functions and values based on a proposed level of protection. Thus, while the scientific literature on buffers provides information in terms of ranges of widths based on the factors described in factor #1 above, one can reasonably estimate the level of risk posed to wetland functions and values from a proposed buffer width on a certain type of wetland.

For example, Ecology has developed three approaches to determining wetland buffer widths based on the factors described above. In selecting our recommended widths, Ecology assumed that a moderate level of risk was appropriate. We thought it was inappropriate to recommend buffer widths at the low end of the range reported in the scientific literature. It would pose a high risk of degradation of wetland functions and values to adopt such buffers, especially in the absence of other, complementary wetland protection

measures. Likewise, we thought it would be unreasonable (given the need to balance protection with private property rights) to recommend buffer widths at the high end of the range, even though this would pose a low risk of degradation of wetland functions and values. Thus, our recommended buffer widths fall in the mid-range of what the scientific literature suggests is needed.

Response. The concept presented above is reasonable. However, Ecology has demonstrated that their prescribed buffers represent any particular level of risk. For instance, the assertion that the prescribed buffers are in the "mid-range" of the distances at which wildlife responds to human activity or at which species have been observed from their core habitats is meaningless. For wildlife, consider the conceptual representation of upland buffer habitat needs for population viability in Figure 2. In reality there is a family of curves. However, only three are shown. The dashed blue line is appropriate for species that have minimal habitat needs outside the core area. No buffers, or upland buffers of only a few feet may meet all of the population's needs. The exponentially increasing solid black line represents a population that is partially dependent on uplands, but whose core reproductive potential is maintained by small buffers. Ecology's approach of assuming a linear response curve and choosing median values is represented by the solid red line. The fact is that individual taxa likely have different response curves and we don't know what those curves are. There is no basis in the literature for Ecology's choice of median values. My own professional experience suggests that for aquatic invertebrates, the exponential increase is more likely to represent many species and some species are primarily dependent on a core habitat, such as open water, and have a need for minimum upland buffers.

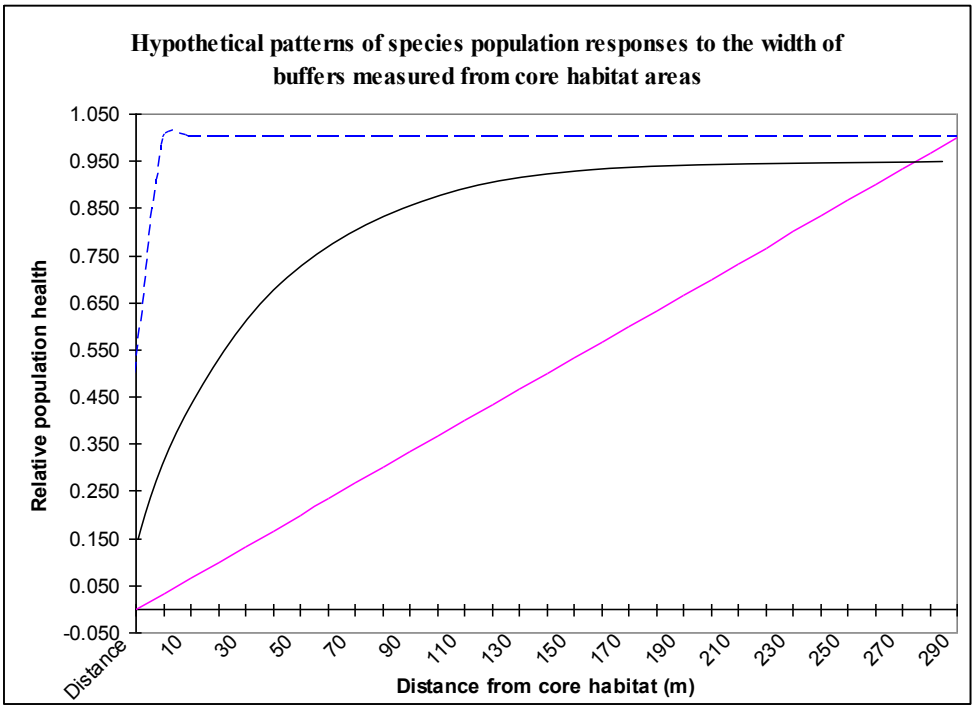

Figure 2. Conceptual response of a species of animals to the amount of upland habitat (buffer) available adjacent to their core habitat. A value of one on the Y-axis indicates that buffer width per se no longer affects the viability of the population.

Each species has specific habitat needs. What is missing in this discussion is any attempt to specify a constitutionally acceptable level of protection for wildlife. That decision is not a matter of science, but rather a matter for elected representatives and constitutional law to decide. To date, it is unclear if Washington State has constitutional authority to impose restrictions on private property for the general protection of wildlife. Sheldon *et al.* (2005) does not provide the kind of analysis required for a quantitative determination of habitat requirements. The concept of a *Shared Onus* demands that government demonstrate that there is a specifically identified and quantify, with empirical evidence, a level of harm associated with an activity on private or public property. It is then the task of elected representatives and the courts to determine what constitutes an acceptable level of risk for the species of concern.

There is good precedent for the approach recommended above. The Sediment Management Unit of the Department of Ecology has developed the Sediment Quality Criteria defined in WAC 173-204. Those criteria are based on *Apparent Effects Thresholds* that clearly define the level of effect allowed. Empirical evidence supporting development of the SQC is available in the form of suites of sediment bioassay results for the contaminants in question and macrobenthic data describing the response of communities of benthic organisms. Hruby *et al.'s* assertion that this task is to difficult and complex when applied to wildlife is an unacceptable excuse.

An example of how other jurisdictions have approached this issue is provided in Figure 3 taken from Brooks and Mahnken 2003). In British Columbia the macrobenthic performance standard applied to the Marine Netpen Waste Regulation is based on an allowable 50% reduction in species richness found at local reference locations. A similar biological performance standard based on macrobenthic abundance is codified in Washington State (WAC 173-204-320 (3) Biological effects criteria.

"(c) Benthic abundance: The test sediment has less than fifty percent of the reference sediment mean abundance of any one of the following major taxa: Crustacea, Mollusca or Polychaeta, and the test sediment abundance is statistically different (t test, $p \leq 0.05$) from the reference sediment abundance."

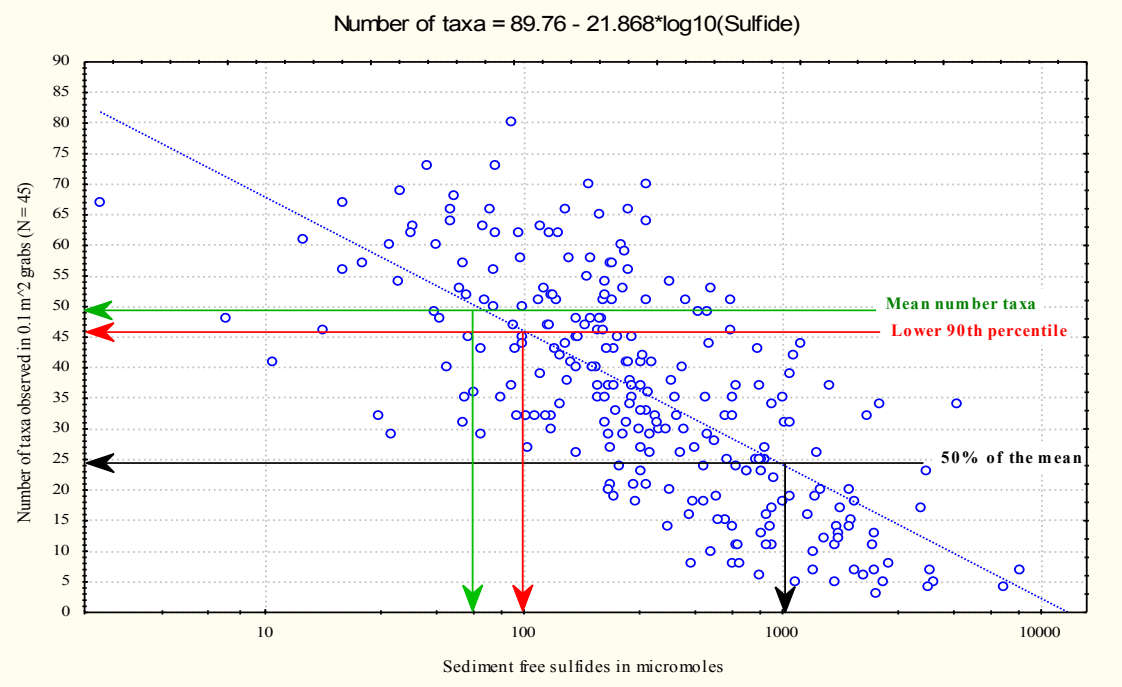

Figure 3. Number of macrobenthic taxa observed in marine sediments as a function of the concentration of free sulfides in micromoles.

The point is that Hruby *et al.*'s excuse that the task of coupling wildlife needs for upland buffers demonstrated by empirical evidence with allowable affects determined by the legislature or other elected body is not acceptable. Ecology has taken the more rigorous approach discussed above in dealing with other anthropogenic effects and in the absence of this type of rigorous approach demonstrating a demonstrable effect (harm) coupled with an allowable level of effect, the prescriptive buffers recommended by Ecology are not justifiable.

The Endangered Species Act requires this approach and Jefferson County's Critical Area Review Committee's recommendations for designation of species of local concern and wildlife corridors requires a process including these considerations. Those processes anchor requirements for restrictions on private and public lands in fact and not in opinion as appear to be the case with Ecology's recommendations for prescriptive wildlife buffers that do not identify the species being protected or their specific habitat needs.

Appendix C Ecology guidance on existing, on-going agriculture

In Section 8.3.3.7 of Volume 2 Guidance we state:

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

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

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

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

There are two basic approaches that local governments should consider:

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

Response. This is the successful approach that Conservation Districts, NRCS and the Extension Service have been taking for over 60 years. Jefferson County has had a water quality monitoring program ongoing since at 1985 and that monitoring has clearly demonstrated the effectiveness of their voluntary BMP programs. It is curious why WDFW and Ecology would recommend these proven approaches rather than acknowledge that they are 60 years behind time in supporting the concept. They should have simply acknowledged that federal, state and local agencies (three of the Conservation District supervisors are elected by residents of their counties)

have been proactively and successfully addressing these issues for decades. Ecology and WDFW deserve no credit for those successes.

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

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

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

Response. Hruby *et al.* do not understand that the history of non-point source pollution abatement clearly demonstrates that without expenditure of enormous amounts of money for enforcement, regulations provide little actual certainty. That is why **successful** non-point source programs have relied on education and incentives to gain the **understanding and cooperation of all landowners – not just agricultural producers.**

REFERENCES

Desbonnet, A., P. Pogue, V. Lee and N. Wolff. 1994. Vegetated Buffers in the Coastal Zone – A Summary Review and Bibliography. Coastal Resources Center Technical Report NO. 2064. University of Rhode Island Graduate School of Oceanography, Narragansett, RI 02882. 72pp.

Franklin, I.R. 1980. *Evolutionary change in small populations.* in Conservation Biology, an evolutionary-ecological perspective. M.E. Soule and B.A. Wilcox eds. Sinauer Assoc, Sunderland MA.

Johnson, D.H. and T.A. O'Neil (eds). 2001. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis.

Lande, R. 1988. *Genetics and demography in biological conservation.* Science 241:1455- 1460.

Larsen, E. M., J. M. Azerrad, and N. Nordstrom, eds. 2004. Management Recommendations for Washington's Priority Species, Volume IV: Birds. Washington Department of Fish and Wildlife, Olympia. 268pp.

Stebbins, Robert C. *Western Reptiles and Amphibians (third edition).* Houghton Mifflin Company, 2003.

References not cited in Brooks (2007)

1. Brooks, K.M. 2000. Literature review and model evaluation describing the environmental effects and carrying capacity associated with the intensive culture of mussels (*Mytilus edulis galloprovincialis*). Technical appendix for an Environmental Impact Statement prepared for Taylor Resources, Southeast 130 Lynch Road, Shelton, WA 98584. 129 pp.

2. Brooks, K.M. 2006. Supplemental study of dissolved nutrients and particulate organic matter in waters near the proposed mussel farm in North Totten Inlet, Washington State, USA. Technical report prepared for Taylor Resources, Southeast 130 Lynch Road, Shelton, WA 98584. 48 pp.

3. Hicks, M. 1998a. Evaluating Standards for Protecting Aquatic Life In Washington's Surface Water Quality Standards Temperature Criteria. Sponsored by the Washington State Department of Ecology Water Quality Program Watershed Management Section, Olympia, Washington 98504-7710.

4. Hicks, M. 1998b. Water Quality Antidegradation Implementation Plan. Example of Possible Rule Language to Replace Chapter 173-201A-070 WAC. Sponsored by the Washington State Department of Ecology Water Quality Program Watershed Management Section, Olympia, Washington 98504-7710.