

Preliminary Individual Comments from Dr. Lucinda Johnson and Dr. Maurice Valett on the Scientific and Technical Basis of the Proposed Rule Titled ‘Definition of ‘Waters of the United States’ Under the Clean Water Act’

(as of August 18, 2014)

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Dr. Lucinda Johnson

Lucinda Johnson comments to Draft Rule

I wish to commend the authors of the proposed rule for drafting a document that largely reflects the existing science and do not expand the regulatory authority of the EPA unnecessarily. The proposed rule protects precious aquatic resources and acknowledges the important ecosystem services that are provided by waters, alone or in aggregate. One of the important features of the rule is the definition the term “significant nexus”, and the acknowledgement that a connection can exist along a gradient. (*“The relationship that waters can have to each other and connections downstream that affect the chemical, physical, or biological integrity of traditional navigable waters, interstate waters, or the territorial seas is not an all or nothing situation. The existence of a connection, a nexus, does not by itself establish that it is a “significant nexus.” **There is a gradient in the relation of waters to each other, and this is documented in the Report.**”*) The existence of a gradient is an important component of the SAB panel’s findings.

Questions

1. The proposed rule has defined Waters of the U.S. under the jurisdiction of the Clean Water Act to mean all tributaries of a traditional navigable water, interstate water, the territorial seas, or impoundment. This definition is based on the conclusion that a significant nexus exists between tributaries (as defined in the proposed rule) and the traditional navigable waters, interstate waters, and the territorial seas into which they flow. Please comment on the adequacy of the scientific and technical basis of this proposed definition. (*lead discussants are: Drs. Emma Rosi-Marshall and Jennifer Tank*)

This definition is completely consistent with the science, the conclusions of the draft report and the SAB panel findings. It is significant that this definition includes wetlands, natural, man-altered, or man-made waters that contribute flow to “water of the U.S.” and that breaks such as bridges, culverts, pipes and dams) do not change the status of those waters. Streams that disappear underground as a function of human alteration or natural geology must retain their protection as they clearly contribute to the integrity of the tributaries to which they connect above-ground, and to the integrity of the downstream waters.

As noted in the SAB review report, the scale of maps used to define tributaries is a critical consideration, as the vast majority of ephemeral streams that meet the criteria of having a bed and bank and ordinary high water mark may not be depicted on most existing maps. It is critical that the appropriate agencies continue to invest in high-resolution mapping products that will facilitate the identification of these waters without on-site inspection.

Regarding the exclusion of two types of ditches: Exclusion of “Ditches that are excavated wholly in uplands, drain only uplands, and have less than perennial flow”, may be problematic because many such ditches now drain areas that previously would have qualified as wetlands under the Cowardin system (e.g., Midwestern U.S.). Such ditches now drain uplands, and may not experience perennial flow, but rather, may pond water without flow except under

heavy precipitation events or during snowmelt, or may contain water and flow only during wet conditions. Because such ditches exist in heavily agricultural areas which are subject to runoff containing high concentrations of sediments, nutrients, and pesticides, these features may be important for certain ecosystem services such as attenuation nonpoint source pollution. It may be necessary to define a category of ditch that is embedded in a landscape that was previously flooded, but is now considered upland. Historical evidence of “upland” status should include historic reconstructions from surveyor’s notes.

Exclusion of ephemeral features located on agricultural land that do not possess a bed and bank due to past farming practices seem to grant an unnecessary and potentially harmful exclusion and should be reconsidered. Because of the relative ease in which tile drains can now be installed, ephemeral channels without a bed and bank could easily be eliminated from jurisdiction. When ephemeral channels within farm fields are tiled, these waters deliver nutrient and pesticide-laden waters directly to downstream waters and increase flashy flows by reducing infiltration potential. Increased flows increase erosion and along with increased nutrients and pesticides, degrade water and habitat quality and biotic integrity of downstream waters.

The science, the EPA report, and the SAB panel all support the definition of headwater wetlands as jurisdictional, whether they are regarded as a tributary or under the definition of adjacent waters. To provide clarity for the definition, the inclusion of such wetlands as jurisdictional under the definition of “adjacent” waters seems the most practical, while still affording the protection necessary for these features. To further clarify this definition and afford protection to the full population of wetlands in this category, the definition of such wetlands should be based on the Cowardin classification rather than necessitating the presence of all three components of the Cowardin definition. If the agency is not able to apply this expanded definition to this class of wetland, it should maintain the current definition of headwater wetlands as tributaries, which entails defining such water bodies through their location in the network, rather than through their physical structure as possessing a bed and bank and OHWM. That said, the presence of extensive biological connections between these headwater wetlands and downstream jurisdictional waters should be sufficient to establish a “significant nexus”. As discussed extensively by the EPA’s SAB panel, the presence of biological connections should be considered equivalent to hydrologic connections. Such biological connections can be direct, e.g., through movement along corridors connection the wetlands to downstream flowing waters; they also can be more indirect, through microbial processes that alter nutrients, thereby sequestering them in sediments or in the food chain, or converting them to alternate forms.

2. The proposed rule has defined Waters of the U.S. under the jurisdiction of the Clean Water Act to mean all waters, including wetlands, adjacent to a traditional navigable water, interstate water, the territorial seas, impoundment, or tributary. This definition is based on the conclusion that a significant nexus exists between adjacent water bodies (as defined in the proposed rule) and traditional navigable waters, interstate waters, and the territorial seas. Please comment on the adequacy of the scientific and technical basis of this proposed definition. (*lead discussants are: Drs. Siobhan Fennessy and Mazeika Sullivan*)

See comments on headwater wetlands above.

This definition is well supported by the science, the EPA report and the SAB’s panel review. In particular it should be noted that the vast majority of waters that are adjacent to jurisdictional waters

have with a shallow subsurface connection, or a biological connection that would qualify as a “significant nexus”. I did not see the term “shallow subsurface” defined in the rule document. This should be added to the set of definitions to ensure consistent application of this concept.

The agency is requesting comments regarding options for providing clarity for connections through confined surface or subsurface hydrology. “Options could include:

1. asserting jurisdiction over all waters connected through a shallow subsurface hydrologic connection or confined surface hydrologic connection regardless of distance;
2. asserting jurisdiction over adjacent waters only if they are located in the floodplain or riparian zone of a jurisdictional water;
3. considering only confined surface connections but not shallow subsurface connections for purposes of determining adjacency;
4. establishing specific geographic limits for using shallow subsurface or confined surface hydrological connections as basis for determining adjacency, including, for example, distance limitations based on ratios compared to the bank-to-bank width of the water to which the water is adjacent.”

I feel that the only practical, and scientifically valid choice is # 1. The science supports the contention that waters outside the riparian zone and floodplain connected via shallow groundwater connections OR biological connections can be significant, thus # 2 is not a reasonable option. (Note the references contained in the SAB panel report for support of the biological connection argument.) Similarly, the science strongly supports the contention that shallow subsurface connections are important to the chemical and physical integrity of downstream waters by contributing to baseflow, influencing chemical and biological processes. There is a vast scientific literature on the hyporheic zone on this topic. Finally, geographic limits do not seem like a practical option since the importance of these is likely to vary seasonally and over periods of low to high moisture regimes. Furthermore, the distance criterion would not account for differences in permeability and hydraulic gradient between the channel and source areas. Highly permeable sediment may contribute flow over longer distances than nearby areas with less permeable sediments.

Tools that can be used to quantify the contributions (or at minimum the presence of connections) between areas with shallow subsurface flows include chemical analysis of ions or isotopes to assess chemical signatures of the two water bodies. Since biological connections are not addressed in this portion of the rule, but are deemed important by the SAB panel, these connections also should be considered. Analysis of the biological communities and food webs (with appropriate genetic markers) may reveal the extent of biological connections.

Consideration of connectivity via the definition of adjacency through a shallow subsurface connection appears to contradict the statement “Waters located near an adjacent water but which are not themselves (independently) adjacent to an (a)(1)through (a)(5) water would, under the proposed rule, not be regulated under(a)(6). However, waters, including wetlands, that are adjacent to a wetland that meets the definition of a tributary would be considered adjacent waters.” This condition must be examined through the lens of the presence or absence of a shallow subsurface connection for this determination to be made. In the absence of a shallow subsurface connection, a biological connection should be considered as per the SAB panel recommendations. As the SAB panel has noted, biological connections contribute in many significant ways to the integrity of downstream waters through transport of energy, nutrients, introduction of disease vectors, and provision of habitat for biota (“...the bulk exchange of materials via biota, e.g., energy (Lowe et al. 2005; Norlin 1967; Mason and MacDonald 1982; Polis et al. 1997; Sabo and Power 2002; Baxter et al. 2005; Spinola et al. 2008; Pearse et al. 2011); the movement of nutrients by biota (McCull and Burger 1976; Johnston and Naiman 1987; Davis 2003; Vrtiska and Sullivan 2009); the introduction of disease vectors (Blanchong et al. 2006); and the provisioning of habitat essential for biological integrity and completion of life cycles of downstream species (Brooks et al. 1998; Miyazano et al. 2010; Julian et al. 2013).” Pg 53 SAB panel report.

Similarly, the statement “It is the presence of this hydrologic connection which provides the opportunity for neighboring waters to influence the chemical, physical, or biological integrity of (a)(1) through (a)(5) waters.” Does not account for the possibility of significant biological connections, whose importance and existence is noted above.

3. The proposed rule has defined Waters of the U.S. under the jurisdiction of the Clean Water Act to mean, on a case-specific basis, other waters including wetlands, provided that those waters alone, or in combination with other similarly situated waters, including wetlands, located in the same region, have a significant nexus to a traditional navigable water, interstate water, or the territorial seas. Please comment on the adequacy of the scientific and technical basis of this proposed definition. (*lead discussants are: Drs. Emily Bernhardt and Michael Gooseff*)

“Other Waters”

Based on the science and the SAB’s panel findings, consideration must be given to both the presence and the absence of a significant hydrologic connection; furthermore, biological connections must also be considered in the criteria to establish a “significant nexus” (see comments and citations for CQ2). Biological factors that might be added to the potential criteria (i.e., increasing size and decreasing distance, increased density of the “other water” in similarly situated areas) might include evidence of genetic similarity in key biotic assemblages; evidence of transfer of biotic materials (e.g., propagules, disease vectors) among “other waters, similarly situated), evidence of biota (that contribute to biological integrity of downstream waters) that require the downstream waters to complete their life cycle (life cycle dependency). The science suggests that some non-resident migratory species may significantly influence downstream waters (a)(1)-(a)(3) waters through a significant transfer of disease vectors, nutrients or biomass (e.g., energy (Lowe et al. 2005; Norlin 1967; Mason and MacDonald 1982; Polis et al. 1997; Sabo and Power 2002; Baxter et al. 2005; Spinola et al. 2008; Pearse et al. 2011); the movement of nutrients by biota (McColl and Burger 1976; Johnston and Naiman 1987; Davis 2003; Vrtiska and Sullivan 2009); the introduction of disease vectors (Blanchong et al. 2006); and the provisioning of habitat essential for biological integrity and completion of life cycles of downstream species (Brooks et al. 1998; Miyazano et al. 2010; Julian et al. 2013).” Pg 53 SAB panel report) in addition to the examples listed.

It is exactly true that the determination of these waters may be resource-intensive. Thus it would behoove the agencies to establish a set of baseline criteria that would enable a hierarchically structured decision framework that would first establish the potential for hydrologic connections via surface, shallow subsurface, or groundwater flowpaths. The SAB panel recognized that such connections occur across a gradient that varies through time. Yet hydrologic modeling and / or spatial modeling in conjunction with satellite remote sensing and aerial photography may provide the basis for determining the presence of physical connections over time frames that include long duration wet regimes (c.f. Winter and Rosenberry 1998). Such an empirical depiction of “connected” landscapes could form the starting point for further assessments that would be followed by more rigorous analyses of subsurface flow paths, and subsequently biological studies that would establish whether the observed connections meet the standard of a “significant nexus”. While the SAB panel recognized that over space and time most water bodies are connect, they acknowledged that such connections may not significantly affect the integrity of jurisdictional waters (a)(1) – (a)(3) and thus would not meet the standard of a “significant nexus”.

Determine by rule that “other waters” are similarly situated in certain areas of the country.

Response: Ecoregions are not appropriate spatial units over which to determine the issues of whether or not a region is deemed to be “similar”. Ecoregions were mainly developed based on terrestrial vegetation communities, in combination with soils and climate. These units are not

meant to reflect hydrologic regions. The SAB panel recommended the use of Hydrologic Landscape Regions as a more appropriate base from which to delineate similar regions.

Determine by rule that certain additional subcategories of waters would be jurisdictional rather than addressed with a case-specific analysis, and that other subcategories of waters would be non-jurisdictional.

Response: Some specific wetland types and regions have been sufficiently well-studied to determine that they should be considered jurisdictional, e.g., Prairie Potholes, Carolina bays, coastal prairie wetlands. The agency should accelerate efforts to further establish the basis for such determinations for other classes of waters. I especially suggest that in addition to western vernal ponds, that vernal ponds on the east coast and the upper Midwest be considered. Recent efforts to map vernal pools in northern Minnesota reveal that the density far exceeds previous estimates.

I do not support the proposal that remaining “other waters” automatically be classified as non-jurisdictional; rather, there should be an established protocol that establish the decision framework for such a decision. The more structured and spatially-relevant this decision framework can be, the fewer resources each case by case determination will require.

4. The proposed rule defines other terms and excludes specified waters and features from the definition of Waters of the U.S. Please comment on the adequacy of the scientific and technical basis of the other definitions and exclusions. (*lead discussants are: Drs. David Allan and Mark Rains*)

I have some concern about the blanket exclusion of the “prior converted cropland” exclusion due to the fact that there is not timeframe defining the term “prior”, and it is unclear how the EPA would operationalize this definition. The US has lost millions of acres of wetlands to cropland conversion, and losses continue as the technology for installing drain tiles has made it increasingly easy for individual land owners to install drain tiles. Wetlands perform clearly documented roles in holding flood waters, recharging water tables, removing sediments and nutrients, and providing essential habitat for biota that contribute to the integrity of downstream waters. These water bodies perform functions that benefit society at large, and not just the landowner. The collective loss of wetlands has resulted in millions of dollars of direct and indirect economic losses.

Comments repeated from response to CQ 1 above.

Regarding the exclusion of two types of ditches: Exclusion of “Ditches that are excavated wholly in uplands, drain only uplands, and have less than perennial flow”, may be problematic because many such ditches now drain areas that previously would have qualified as wetlands under the Cowardin system (e.g., Midwestern U.S.). Such ditches now drain uplands, and may not experience perennial flow, but rather, may pond water without flow except under heavy precipitation events or during snowmelt, or may contain water and flow only during wet conditions. Because such ditches exist in heavily agricultural areas which are subject to runoff containing high concentrations of sediments, nutrients, and pesticides, these features may be important for certain ecosystem services such as attenuation nonpoint source pollution. It may be necessary to define a category of ditch that is embedded in a landscape that was previously flooded, but is now considered upland. Historical evidence of “upland” status should include historic reconstructions from surveyor’s notes.

5. If you have any other comments about the adequacy of the scientific and technical basis of the proposed rule, please provide them as well.

Dr. Maurice Valett

Proposed Rule for Definition of Waters of the United States Under the Clean Water Act:
Comments from HM Valett

Proposed Rule for Definition of Waters of the United States Under the Clean Water Act:

I. General Info

none

II. Background

22195: use of the term ‘significant’- The text on this page indicates that ‘significant is not a scientific term’. It would be better to state that ‘significant’ is not meant to be used in a scientific manner at this point (i.e., refer to Kennedy’s intent, as employed on page 22196; ...more than speculative or insubstantial). I make this point because ‘significant’ is indeed a scientific term with implications of the probability of quantitative relationships among statistical estimates to effectively reflect reality (i.e., P values, etc).

III. Proposed definition of Waters of the United States

22204: proposed definition of ‘tributary’ - OHWM and semi-arid channels - Central to the proposed definition is the notion of the existence of an ‘ordinary high water mark’ (OHWM) and indirect or direct linkage to jurisdictional water. Recognition of both direct and indirect (i.e., through an additional entity that connects directly to the jurisdictional water) appropriately employs a ‘systems’ approach as emphasized in the *Rapanos* case (547 US 1t 781-782). This is a great strength of the definition.

Reliance on the OHWM to distinguish ‘streams’ from gullies or rills is perfectly appropriate in environments where climatic conditions result in fluvial geomorphic features that are formed by perennial flows and effectively represent ‘permanent’ waters. The science behind perspectives addressing where ‘streams’ start and the progression of hydrologic and geomorphic character, however, is hugely biased towards perennial systems. Other work (has emphasized environments and biomes where flow is not ‘ordinary’ and the concept of OHWM just doesn’t work well. In truth, the transition from terrestrial to aquatic is a continuum and while I recognize the need for distinction, care must be taken to incorporate channels in semi-arid environments where flows occur uncommonly but are critical to the ‘aquatic system’. Accordingly, I am worried about how this definition will be employed (or not) in semi-arid (i.e., desert) biomes where water issues are likely to first become apparent.

On the bottom of the first column on page #22202 the text reads ‘The flow in a tributary may be ephemeral, intermittent, or perennial...’ but on page #22203 in the middle column, half way down the page, the text reads ‘The scientific concept of perennial flow is a widely accepted and well understood hydrologic characteristic of tributaries’. Written in that manner, it would suggest that perennial flow is a ‘necessary’ component for a channel to qualify as a tributary. This seems inconsistent. The

inconsistency continues as the text on page #22205, middle column near top, reads that 'Sediment transport is also provided by ephemeral streams', provided as part of a description of how tributaries have significant nexus with jurisdictional waters. This sort of statement suggests that 'ephemeral' systems qualify first as streams and second as tributaries. My concern is that the terminology used here (ephemeral, intermittent, perennial) must be clearly identified and quantifiable. Determining a 'sig nexus' for the headwater (i.e., intermittent) streams of semi-arid landscapes will be greatly complicated by the 'atypical' geomorphology of these systems. Without the OHWM these channels may be categorized as 'other waters' and, therefore, will require establishment of a significant nexus to be categorized as 'adjacent' or 'neighboring'.

22205: significant nexus for tributaries - Biological linkage is argued to occur among tributaries and the text here emphasizes anadromous fishes. This is accurate and appropriate, but these fishes are rare at a national scale. Benthic insects, however, are robustly common and integrate streams and tributaries through drift and upstream flight (i.e., Colonization Cycle, Muller, K. 1982. The **colonization cycle** of freshwater insects. *Oecologia* 52:202-207.)

22206: exclusion of wetlands as 'tributaries', middle column - I agree with the agencies recognition that wetlands may play critical roles linked to lotic systems, but I feel it is best not to incorporate them in the more robust definition of tributary contributed by the proposed rule. Inclusion will dilute the clarity intended and promote confusion. It is far better to rely on 'adjacent' or 'neighboring' status to link wetlands to jurisdictional waters.

22208 & 22209: clarification on waters with 'these types of connections' - This portion of the proposed rule addresses waters that are 'neighboring' or 'adjacent' and how 'waters with these types of connections' may be identified via 'reasonable options for providing clarity'.

Two responses come to mind in regard to this issue, 1) there is no simple way to address the existence of a significant nexus....the concept is the correct one and addressing the existence of the nexus will be the burden of the agencies as recognized, and 2) claiming the 'floodplain' waters as adjacent is theoretically sound but operationally problematic. In studies of larger river systems, it is clear that current climatic conditions may support flooding and inundation of a given frequency, but its occurrence may be eliminated by modifications to stream banks (e.g., levees) and flow regimes (e.g., extractions, impoundments). Flood recurrence intervals are logical for 'connected' floodplains but there will be a need to establish new flow assessment to determine how a given magnitude will translate to 'connection' and influence nexus. The ultimate issue is one of connection and distinction as 'riparian' may or may not correspond to 'floodplain' landscape position. I do believe that the agencies are correct to claim the floodplain waters as 'adjacent' but the 'riparian' definition suggests that 'surface or subsurface hydrology' influences these environments. First of all, 'hydrology' is the study of water movements and distribution. That's not really the correction term to use in the riparian definition. I will admit that the term is commonly used (in peer-reviewed literature) to mean the movement and distribution of water, but the definition fails to link 'riparian' environments to the lotic systems of concern. The floodplain definition takes care of this issue.

Regarding how to approach designation, there isn't a 'desktop' version available. Floodplains and their surrounding environments are linked over vastly differing spatial and temporal scale and I don't believe that the agencies are going to be able to 'categorize' without due diligence. Costly, but accurate.

22211: 'other waters' and case-specific assessment - I think the agencies have it right here. There is a clear need to address on a 'case-specific' basis the status of a water body designated as 'other'. In fact on page #22211, right column, 'other waters' are specifically defined as those that require assessment of a 'case-specific significant nexus determination'. The agencies clarify that they will remove an old list of 'others' to eliminate confusion (i.e., the mistaken notion that the list was exhaustive).

The larger issue is whether 'similarly situated' water bodies need to be addressed individually or can be assessed as a 'landscape unit' (see page #22213, left column) in a cumulative context. This language appropriately embraces the cumulative effects of 'neighboring' waters, characteristic of dendritic drainages and 'watersheds' as a whole. I really like the use of 'landscape unit' as it suggests integrated function. The request to employ a 'landscape unit' approach is a tricky one, but one that seems like it can be operationalized (i.e., aggregation on a 'local' basis to establish the landscape unit).

22212-22213: 'in the region' and 'similarly situated' - The agencies have correctly engaged in addressing this issue by clarifying their position on Justice Kennedy's use of 'in the region' and 'similarly situated'. With their approach, 'region' becomes synonymous with watershed (really catchment is the correct term). Later there appears to be recognition that 'regions' are larger things. Their interpretation does, however, keep the hydrologic linkage (i.e., and evident nexus) at the core of the distinction and that is a strength of the approach. Use of the NHD and HUC-10 tools are appropriate for designation as they are based on the same notion of 'watershed' delineation.

The definition employed for 'similarly situated' waters is nicely rooted in function and appropriately employs the 'landscape unit' concept. While geographic proximity can be misleading (i.e., some things nearby may be disconnected while others afar remain fully integrated), it needs to be included in the use of the term as geographic proximity is the basis of the 'region' notion above and the notion of similarity employed here....even given the clear focus on function. Note, however, when the definition of 'similarly situated' is addressed (left column, bottom, 22213), it is rooted in characteristics of the terrestrial environment (soils, vegetation, landform). Given the emphasis that the SAB has placed on a 'flowpath' conceptual basis for the Water Body Connectivity report, I find it strange that 'hydrologic connectivity to each other or a jurisdictional water' arrives as a caveat...almost an afterthought. I would propose elevating it to the same level of importance as the terrestrial characteristics.

At the same time, the use of 'relatively homogenous soils, vegetation and landform' is a vague distinction. Soils and vegetation are notoriously heterogeneous at different scales. I'm not sure if this notion helps aggregate at all.

22214: use of the term 'report' – In the left column, top of page, the text reads 'For example, a report that reviewed the results....'. The use of the term 'report' is misleading. The citation provided indicates a

peer-reviewed publication and the product should be named as such. There are no standards for reports that cross agencies and institutions.

22214: clarifying chemical nexus – Mid-point of left column the text argues that landscape position influences the strength of connection to the nearest water of the US. This may be a true statement, but it is not specific to chemical nexus and seems out of place.

22214: regional and national studies and ‘desktop evaluation’ – Despite the very specific definition of region and the efforts to consider ‘similarly situated’, the agencies now suggest that ‘national’ scale assessments are applicable. Moreover, they make the statement that ‘desktop’ assessment will be appropriate if ‘sufficient’ information exists. Without any protocol established a priori, this statement is arrogant and borders on inflammatory. Is it their intent to say that they don't have to do field work when it isn't necessary? Again, without established protocol to address, this statement should be seriously reconsidered.

22214: ‘additional scientific research and data that might further inform decisions about other waters’ – The rule to be promulgated addresses specific relationships among water bodies across multiple scales. It is clear that the agencies are concerned about ‘resources’ for case-specific assessment. I suggest that a series of specific RFPs address these needs in the future to focus research on just these issues. Back-fitting research originally addressing a different question will only go so far in this sense.

22215-22216: request for comment on ‘these alternative approaches’ – Determining by rule that ‘other waters are similarly situated’ in certain areas is proposed to be applicable by recognition of the idea that streams/waters within a ‘ecoregion’ behave similarly. The ecoregions addressed by the agencies are thought to have similar ecosystems and resources. Omernik's work comes from a geography background (Omernik, J.M. 1987. Ecoregions of the conterminous United States. *Annals of the Association of American Geographers*. 77:118-125). This (and the list of Level III ecoregions) compiles associations based again on terrestrial entities. What about HUC-10 or aggregation based on flow characteristics (Poff, N. L., and J. V. Ward. 1989. Implications of streamflow variability and predictability for lotic community structure: A regional analysis of streamflow patterns. *Canadian Journal of Fisheries and Aquatic Sciences* 46:1805-1818.)? While the focus is on Waters of the United States, there seems to be tie to terrestrial geography here at the expense of ‘water-based’ categorization. Result may be similar or not but the focus should be on distribution and flow of water within ‘regions’ directly assessed rather than inferred from terrestrial association. A comparison of the two (terrestrial vs. aquatic) should yield insight.

Such an approach would ‘group’ streams as similar in the context of their flow characteristics and derive a geographic association simultaneously. The issue of whether those streams within a ‘region’ are ‘similarly situated’ remains unsolved. Position along the flow continuum and discontinuities associated with different processing domains (Montgomery, D. R. 199. Process domains and the river continuum. *Journal of the American Water Resources Association* 35:397-410.) will be important in determining ‘landscape position’ and addressing the question of ‘similarly situated’.

22217: general tendencies – Middle column half way down – I’m not sure it make any sense to telegraph the interpretation of aggregation at this point. This may raise the ire and appears to be pre-judging the issue of aggregation. How does including this help with clarity?

2217 & 2218: agriculture and the CWA – While this is not the task of the SAB, the agencies and the US as a whole need to start thinking about the logic of regulating all but the largest polluters of its waters.

IV. Related Acts of Congress, Executive Orders, and Agency Initiatives

none

Appendix A: Scientific Evidence

Part I: synthesis of peer-reviewed literature

22222: upper right column, bidirectional vs. unidirectional – These terms continue to hang around even as we have clearly deemed them confusing and inappropriate. I expect they will be eliminated from future versions?

Part II: additional scientific support

Under section ‘i. tributaries’ the outline form breaks down with the following errors:

i. tributaries					
	A. tribs have nexus				
	B. tribs affect physical integrity				
	C. tribs affect chemical integrity				
mistake	C. tribs affect biological integrity				
mistake	D. headwater tribs influence phys, chem, biol				
	F. non-permanent streams via phys, chem, biol				
mistake	E. Trib lake, pponds, wetlands				
mistake	F. man-made tirbs				