



THE ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

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Peter S. Thorne, Ph.D.  
Chairman  
Science Advisory Board  
Amanda D. Rodewald, Ph.D.  
Chairwoman  
Science Advisory Panel for the Review  
of the EPA Water Body Connectivity Report  
U.S. Environmental Protection Agency  
1200 Pennsylvania Avenue, NW  
Washington, D.C. 20460

Dear Dr. Thorne and Dr. Rodewald:

I thank you for the detailed and thorough review of the U.S. Environmental Protection Agency's draft report, *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*. The Science Advisory Board's review of the connectivity report, SAB report EPA-SAB-15-001, provided comments that our scientists used to strengthen the science presented in the report. Our response to SAB comments was provided along with the release of the final connectivity report in January 2015. In the following I have highlighted the major changes represented in the final connectivity report.

The SAB commented that throughout the report the connectivity of waters is sometimes referred to as a binary property (connected versus not connected). This was not our intent, and we have responded by clarifying the report text and adding a major conclusion to indicate that the connectivity of waters occurs along a gradient and can be described in terms of frequency, duration, magnitude, timing and rate of change. The final report also provides additional examples of connections that vary in their relative frequencies, durations, magnitudes and timing and an expanded discussion of the consequences of different types and degrees of connectivity in terms of functions and effects on downstream waters. The SAB recommended that the EPA provide an overview of approaches to measuring connectivity. In response, we added a summary of the literature on metrics and approaches for measuring connectivity. Based upon our review of the literature, we have included a brief discussion of the dimensions of connectivity that could be most appropriately quantified, ways to construct connectivity metrics and methodological advances needed.

The development of a conceptual framework describing the hydrologic elements of waters and the connections between those elements was a major part of the draft provided to the SAB and remains a major component of the final report. We were grateful that the SAB found that the literature supporting our conceptual framework was technically accurate and clearly presented.

In response to SAB suggestions we revised the graphical framework to represent continuous hydrologic, chemical and biological flowpaths that included both surface water and groundwater connecting

different components of watersheds and landscapes. This framework was added to the report's introduction and is linked to subsequent chapters to clarify that stream, wetland and open-water systems are not discrete systems. As part of the framework, we have strengthened discussion of those factors that influence surface and subsurface hydrologic flowpaths.

We agree with the SAB's comments concerning the importance of cumulative and aggregate effects of streams, groundwater systems and wetlands on downstream waters. This is something that is fundamental to the nature of river networks and watersheds. We have added in the introduction of the final report an overview of the literature on cumulative and aggregate effects of streams, wetlands and associated groundwater systems and have incorporated in other chapters additional summaries of peer-reviewed literature describing aggregate and cumulative effects of headwater streams and wetlands. The importance of cumulative effects has been highlighted as a major conclusion of the report.

In response to the SAB comment that our use of the terms "unidirectional" and "bidirectional" to describe the connectivity of wetlands did not adequately describe the four-dimensional – longitudinal, lateral, vertical and temporal – nature of connectivity, we have replaced these terms and now use the more commonly understood terms "non-floodplain" and "riparian/floodplain" to describe wetlands throughout the final report.

The SAB provided several very supportive comments concerning the comprehensiveness of our literature review and our accurate interpretation of that literature. The EPA continued to review relevant literature, and the final report reflects that process and the literature suggested by the SAB. The SAB suggested that the EPA more clearly describe the approach used to screen, compile and synthesize information. In response, we expanded our description of the process used to screen, compile and synthesize information used in the report.

We were pleased to see that the SAB supported our conclusion that the scientific literature showed that ephemeral, intermittent and perennial streams exert a strong influence on the integrity of downstream waters. In response to the SAB suggestions we expanded the text on hydrologic exchanges between main channels and off-channel surface and shallow subsurface waters located at channel margins. We also added additional discussion and examples of biogeochemical transformations, other than nitrate removal, that affect the mobility of dissolved chemicals.

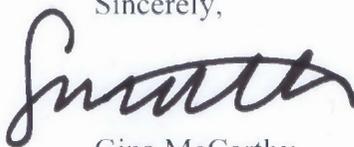
We were also pleased to see that the SAB supported our conclusion concerning the connectivity of waters and wetlands in floodplain settings. In response to the SAB suggestions we have expanded the overview of floodplains and riparian areas in the report.

Finally, the SAB disagreed with our conclusion that the scientific literature did not provide sufficient information to generalize about the degree of connectivity of wetlands in non-floodplain landscape settings. We note that establishing connectivity for these wetlands is difficult because the peer-reviewed literature infrequently examines the frequency, duration, magnitude, timing and rate of change of such connections. In response to SAB comments we included additional discussion of functions of non-floodplain wetlands that could sustain the physical, chemical and/or biological integrity of downstream waters. We also make recommendations in the final report for studies concerning data gaps and uncertainties in the available literature.

The SAB's comments and suggestions and its review of the public comments received on the draft connectivity report have greatly informed the EPA's revisions and improved our synthesis of the state-of-the-science represented in the final report. I appreciate the hard work of the members of the chartered SAB and the ad hoc panel assembled for the review of this important report. Your thoughtful

contributions help to ensure that the EPA's decisions on protecting human health and the environment are based on strong, defensible and unbiased science.

Sincerely,

A handwritten signature in black ink, appearing to read 'Gina McCarthy', written in a cursive style.

Gina McCarthy