EPA
United States
Environmental Protection
Agency

EPA Draft Report EPA/600/R-11/098B

Connectivity of Streams and Wetlands to Downstream Waters

Science Advisory Board Review, December 16-18, 2013

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Summary

- Report provides a review and synthesis of the peer reviewed scientific literature on the relationships of streams and wetlands to downstream water bodies – the “connectivity” of waters.

- Synthesis provides a scientific foundation for EPA and Army Corps of Engineers rulemaking to clarify jurisdiction under the Clean Water Act (CWA).

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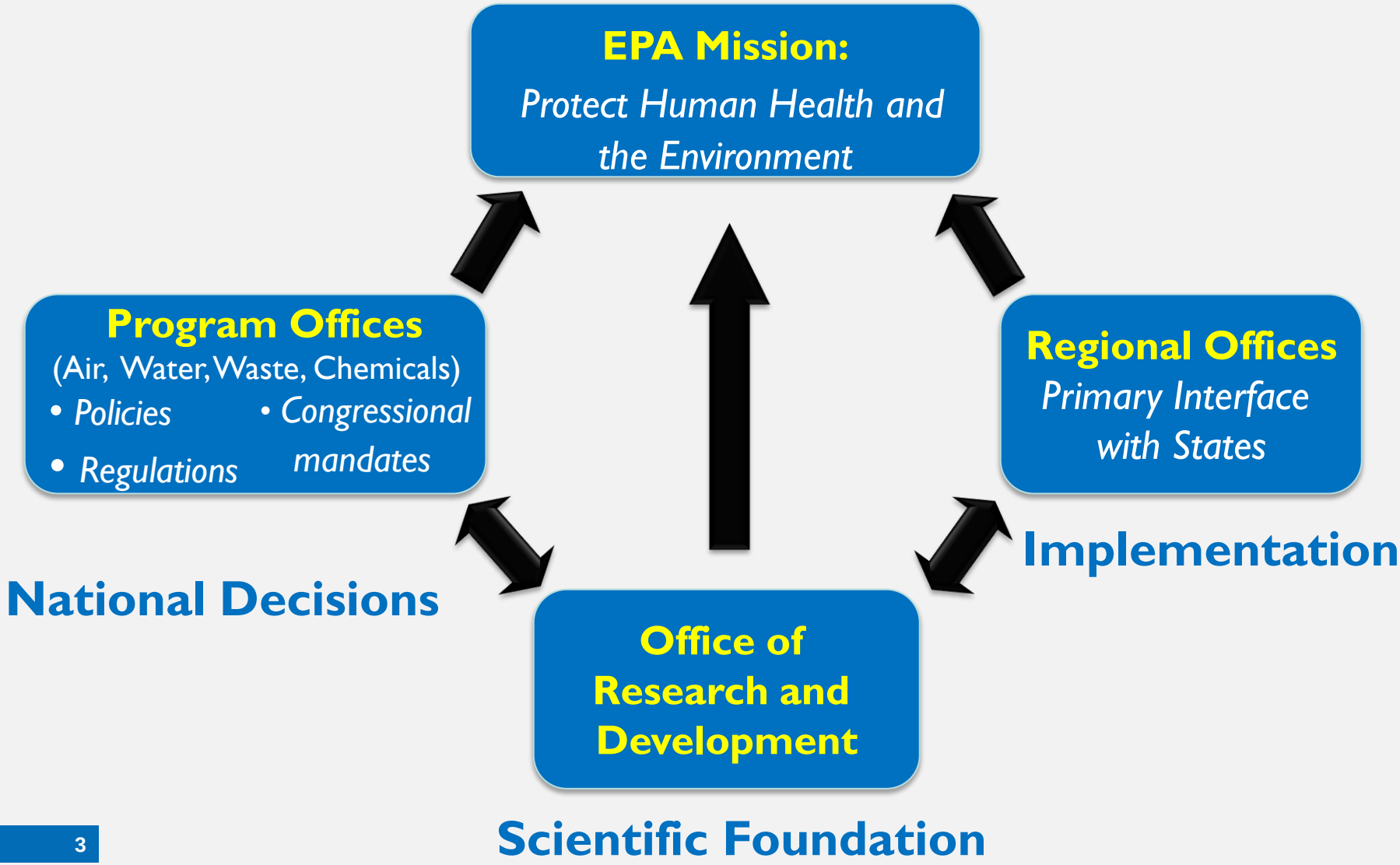
Report Background

- EPA's **Office of Water** requested the **Office of Research and Development** to conduct a review and synthesis of the literature on the connectivity of waters.
- The review and the development of this report was conducted as part of ORD's **Safe and Sustainable Waters Research Program (SSWRP)**.
- Report based on published, peer reviewed literature. Over 1000 publications reviewed.
- No new original research projects were conducted to inform the development of this report.

Coordination within EPA



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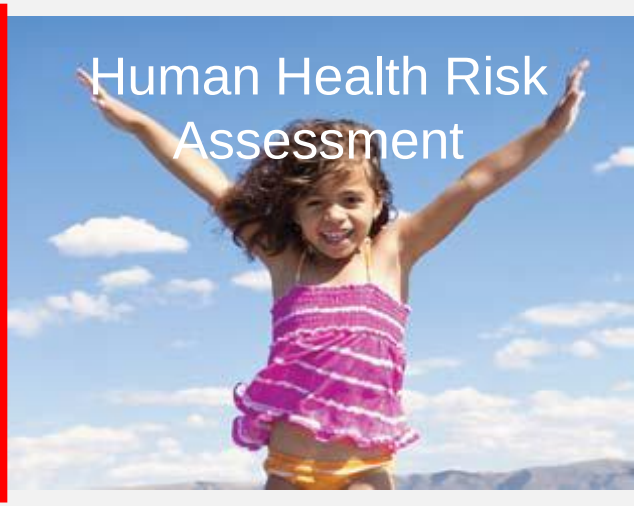
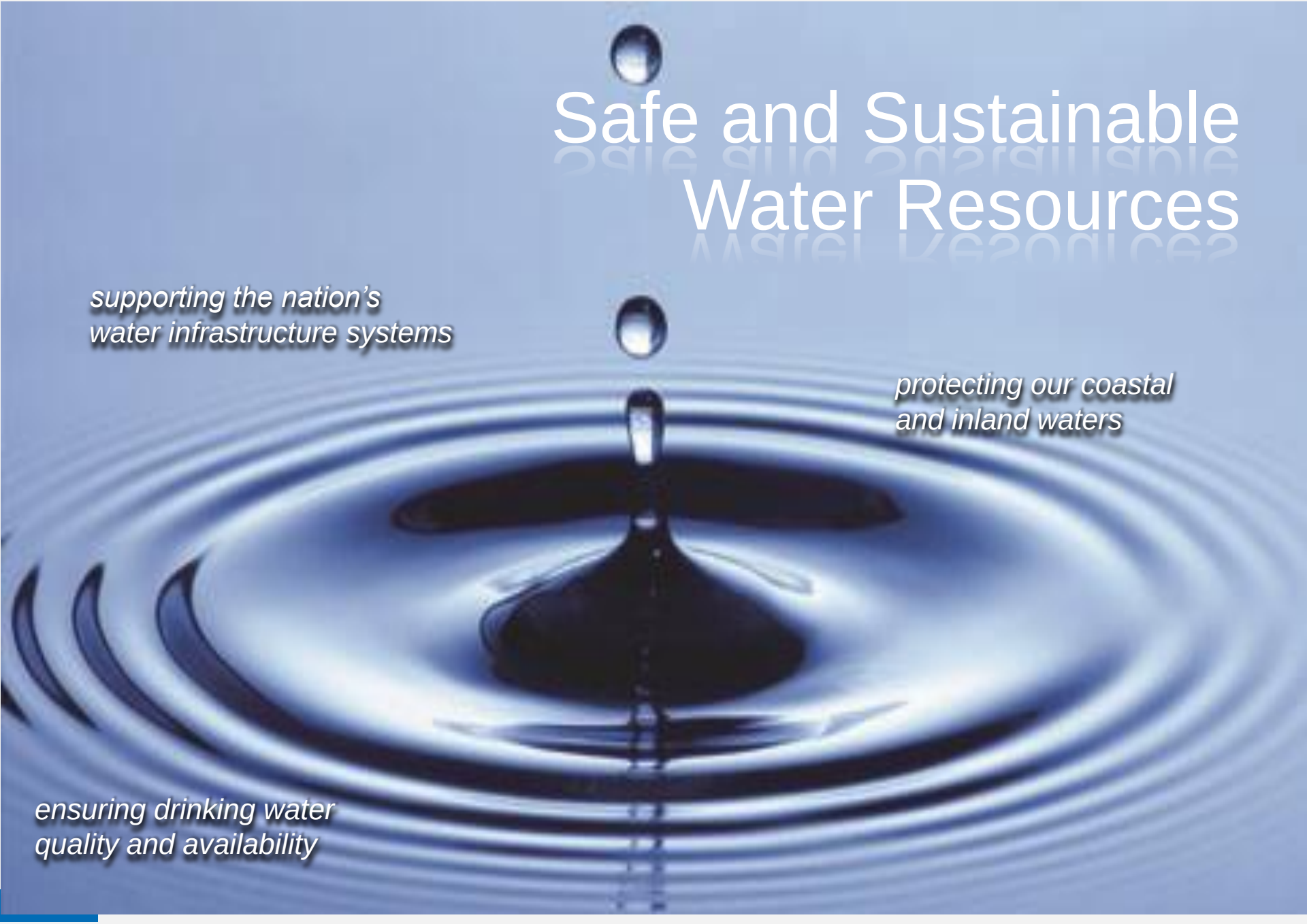
ORD Research Programs




Safe and Sustainable Water Resources
supporting the nation's water infrastructure systems
protecting our coastal and inland waters
ensuring drinking water quality and availability

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Report Purpose

- The purpose of this report is to summarize current scientific understanding of the **connectivity** and **downstream effects** of streams, wetlands, and open waters on the physical, chemical, or biological integrity of larger water bodies, including rivers, lakes, coastal bays, and oceans.

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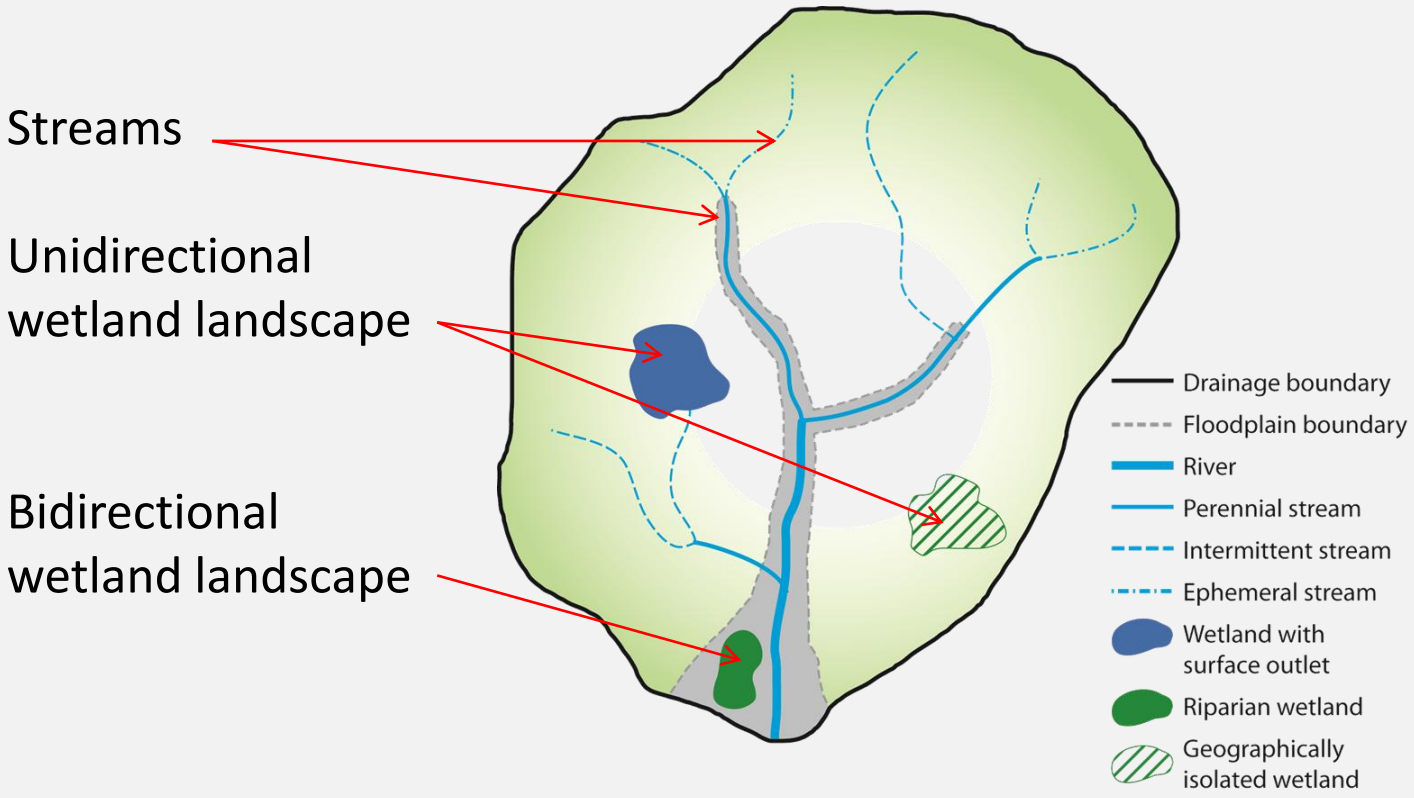
Topics Covered in the Report

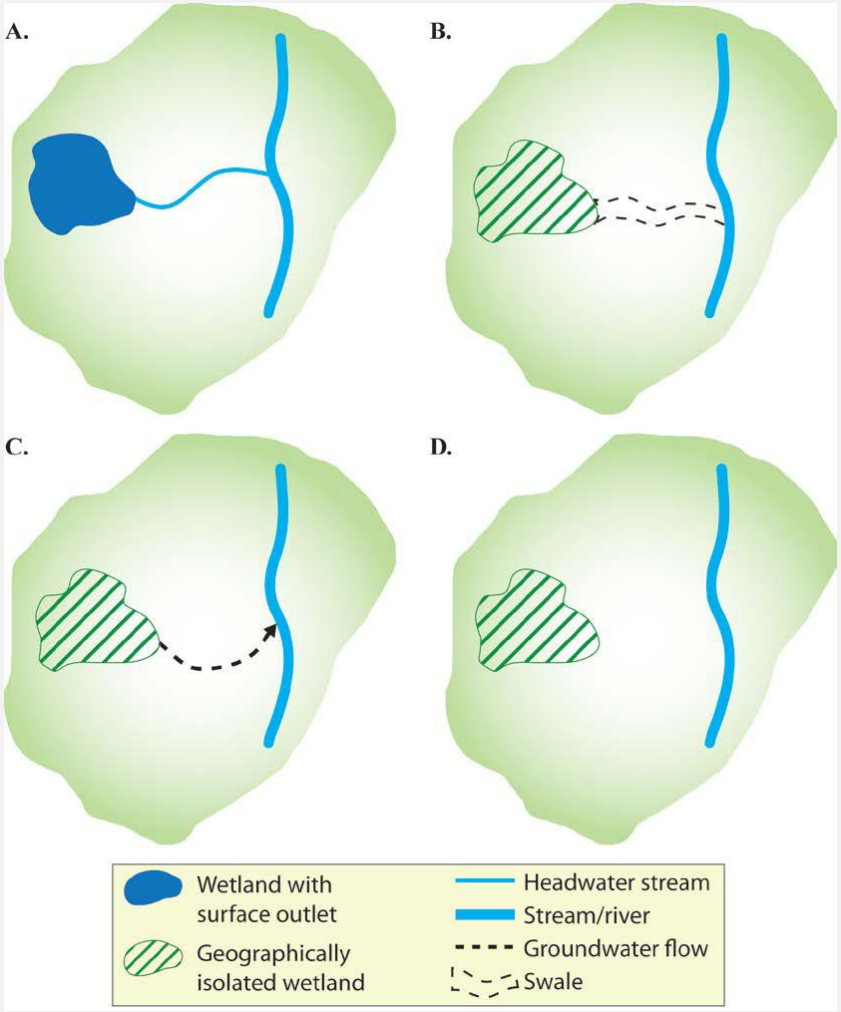
- A conceptual framework for understanding watershed connectivity: A systems perspective.
- Scientific evidence pertaining to connectivity or isolation of:
  - Non-tidal streams.
  - Wetlands and certain open waters in riparian zones and floodplains.
  - Wetlands outside riparian zones and floodplains, including "geographically isolated wetlands."
- Mechanisms by which these types of waters can alter the condition or function of downstream ecosystems.
- Landscape and climate factors that influence connectivity .
- This report is not a policy document and does not outline policy options.

Conceptual Framework

- Conceptual framework presented for understanding the hydrologic components of a watershed and the types of linkages among them.



Types of hydrologic connectivity between unidirectional wetlands and downstream waters



(A) Flow through a headwater stream channel.

(B) Surface flow through a nonchannelized swale.

(C) Groundwater flow (flowpath may be local, intermediate, or regional).

(D) A wetland that is hydrologically isolated from a river.

Note that in A–C, flows connecting the wetland and river may be perennial, intermittent, or ephemeral.

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Summary of draft results

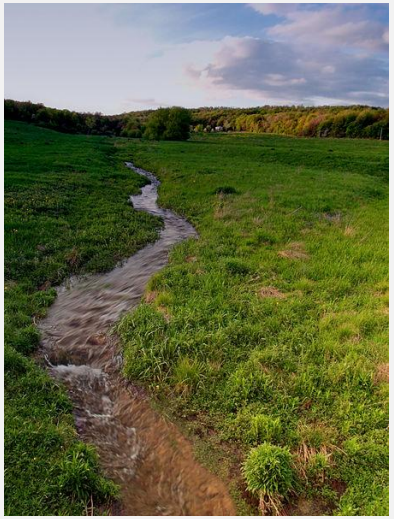
Three major conclusions:

1. All tributaries, regardless of size or flow duration class (ephemeral, intermittent, perennial), are connected to and have important effects on downstream waters.
2. Wetlands and open waters in riparian areas and floodplains are integrated with river networks via bidirectional exchange of water, materials, organisms.
3. Current literature is insufficient to generalize about the connectivity or downstream effects of waters in unidirectional landscape settings (often referred to as “geographically isolated” wetlands).

Findings for conclusion #1

Strong evidence for downstream connectivity and effects of streams of all sizes and flow classes

- Streams are “hydraulic highways” transporting materials, chemicals, organisms.
- Streams are the dominant source of water in most rivers.
- Ephemeral/intermittent streams shape river channels by gradually or episodically releasing sediment.
- Material transformations (e.g., nutrient processing) in small streams have large effects on downstream water quality.



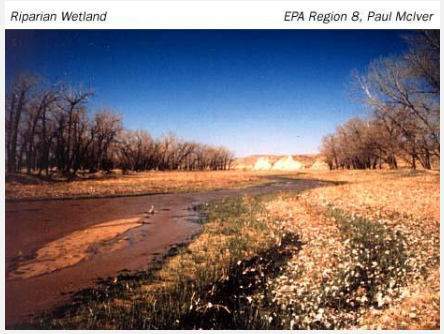
Headwater of the Allegheny River

http://commons.wikimedia.org/wiki/File:Headwater_Stream_(1).jpg

Findings for conclusion #2

Strong evidence that wetlands and open waters (e.g., oxbow lakes) within riparian areas and floodplains of streams, rivers, lakes, bays ..

- Attenuate flooding
- Export food resources
- Trap and transport sediments
- Store and modify potential pollutants
- Provide refuge and habitat for riverine plants and animals



.. thereby sustaining water quality and productivity of downstream rivers, lakes and estuaries .

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Findings for conclusion #3

Current literature is insufficient to generalize about the connectivity or downstream effects of waters in unidirectional landscape settings (often referred to as "geographically isolated wetlands")

- These wetlands and open waters exist along a connectivity/isolation gradient.
- Connectivity varies within a watershed and over time, and within wetland classes.
- Additional information could allow identification of classes based on connectivity and effect on downstream waters.

Findings for conclusion #3 (cont)

Aggregating wetlands to determine magnitude of downstream effects

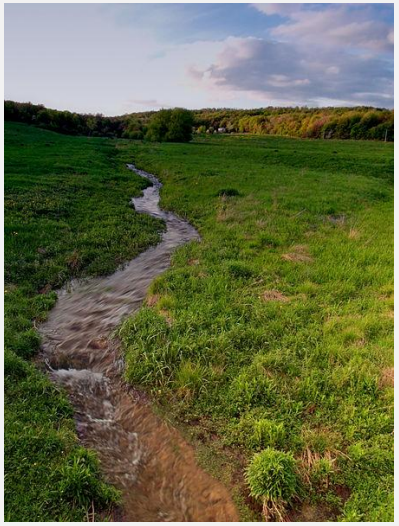
- Strong scientific support for case-by-case analysis on groups of wetlands that perform similar functions, in the same watershed.
- Individual effect might be small, but combined effect can be great.

Report History

- July 2010 – Request from Office of Water
- February 2011 – Internal Review Draft
  - Peer consultation of preliminary draft by 11 reviewers from federal agencies (USGS, USDA, Army Corps of Engineers), academia, consulting groups
  - Internal review by EPA Office of Water (OW)
- January 2012 - External Peer Review Draft
  - Independent contractor-led panel review by 11 experts
- Revised report in response to January 2012 peer review panel comments
- Revised draft report released September 17, 2013
  - Public comment period prior to SAB panel meeting
- SAB public peer review panel meeting December 16-18.

Intended Use

- This report provides technical information that informs development of rulemaking intending to clarify Clean Water Act (CWA) jurisdiction.
- As a scientific review, it does not consider or make judgments regarding legal standards for CWA jurisdiction.
- It is written for general audiences; terms are used in accordance with standard scientific meanings and definitions in the report glossary.



Headwater of the Allegheny River

http://commons.wikimedia.org/wiki/File:Headwater_Stream_(1).jpg

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Charge to the SAB Panel

Charge to SAB Panel

Overall Clarity and Technical Accuracy of the Draft Report

Charge Question 1. Please provide your overall impressions of the clarity and technical accuracy of the draft EPA Report, *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*.

Charge to SAB Panel (continued)

Conceptual Framework: An Integrated, Systems Perspective of Watershed Structure and Function

Charge Question 2. Chapter 3 of the draft Report presents the conceptual basis for describing the hydrologic elements of a watershed; the types of physical, chemical, and biological connections that link these elements, and watershed climatic factors that influence connectivity at various temporal and spatial scales.

Please comment on the clarity and technical accuracy of this chapter and its usefulness in providing context for interpreting the evidence about individual watershed components presented in the Report.

Charge to SAB Panel (continued)

Lotic Systems: Ephemeral, Intermittent, and Perennial Streams

Charge Question 3(a) Chapter 4 of the Report reviews the literature on the *directional* (*downstream) connectivity and effects* of ephemeral, intermittent, and perennial streams (including flow-through wetlands).

Please comment on whether the Report includes the most relevant published peer reviewed literature with respect to these types of streams.

Please also comment on whether the literature has been correctly summarized.

Charge to SAB Panel (continued)

Lotic Systems: Ephemeral, Intermittent, and Perennial Streams

Charge Question 3(a) continued

Please identify any published peer reviewed studies that should be added to the Report, any cited literature that is not relevant to the review objectives of the Report, and any corrections that may be needed in the characterization of the literature.

Charge to SAB Panel (continued)

Lotic Systems: Ephemeral, Intermittent, and Perennial Streams

Charge Question 3(b) Conclusion (1) in section 1.4.1 of the Report Executive Summary discusses major findings and conclusions from the literature referenced in Charge Question 3(a) above.

Please comment on whether the conclusions and findings in section 1.4.1 are supported by the available science.

Please suggest alternative wording for any conclusions and findings that are not fully supported.

Charge to SAB Panel (continued)

Lentic Systems: Wetlands and Open Waters with the Potential for Non-tidal, Bidirectional Hydrologic Flows with Rivers and Lakes

Charge Question 4(a) Section 5.3 of the Report reviews the literature on the *directional (downstream) connectivity and effects* of wetlands and certain open waters subject to non-tidal, bidirectional hydrologic flows with rivers and lakes.

Please comment on whether the Report includes the most relevant published peer reviewed literature with respect to these types of wetlands and open waters.

Charge to SAB Panel (continued)

Lentic Systems: Wetlands and Open Waters with the Potential for Non-tidal, Bidirectional Hydrologic Flows with Rivers and Lakes

Charge Question 4(a) continued

Please also comment on whether the literature has been correctly summarized. Please identify any published peer reviewed studies that should be added to the Report, any cited literature that is not relevant to the review objectives of the Report, and any corrections that may be needed in the characterization of the literature.

Charge to SAB Panel (continued)

Lentic Systems: Wetlands and Open Waters with the Potential for Non-tidal, Bidirectional Hydrologic Flows with Rivers and Lakes

Charge Question 4(b) Conclusion (2) in section 1.4.2 of the Report Executive Summary discusses major findings and conclusions from the literature referenced in Charge Question 4(a) above.

Please comment on whether the conclusions and findings in section 1.4.2 are supported by the available science.

Please suggest alternative wording for any conclusions and findings that are not fully supported.

Charge to SAB Panel (continued)

Lentic systems: Wetlands and Open Waters with Potential for Unidirectional Hydrologic Flows to Rivers and Lakes, Including "Geographically Isolated Wetlands"

Charge Question 5(a) Section 5.4 of the draft Report reviews the literature on the directional (downstream) connectivity and effects of wetlands and certain open waters, including "geographically isolated wetlands," with potential for unidirectional hydrologic flows to rivers and lakes. Please comment on whether the Report includes the most relevant published peer reviewed literature with respect to these types of wetlands and open waters.

Charge to SAB Panel (continued)

Lentic systems: Wetlands and Open Waters with Potential for Unidirectional Hydrologic Flows to Rivers and Lakes, Including "Geographically Isolated Wetlands"

Charge Question 5(a) continued

Please also comment on whether the literature has been correctly summarized. Please identify any published peer reviewed studies that should be added to the Report, any cited literature that is not relevant to the review objectives of the Report, and any corrections that may be needed in the characterization of the literature.

Charge to SAB Panel (continued)

Lentic systems: Wetlands and Open Waters with Potential for Unidirectional Hydrologic Flows to Rivers and Lakes, Including "Geographically Isolated Wetlands"

Charge Question 5(b) Conclusion (3) in section 1.4.3 of the Report Executive Summary discusses major findings and conclusions from the literature referenced in Charge Question 5(a) above.

Please comment on whether the conclusions and findings in section 1.4.3 are supported by the available science. Please suggest alternative wording for any conclusions and findings that are not fully supported.