

## CONNECTIVITY OF STREAMS AND WETLANDS TO DOWNSTREAM WATERS: A REVIEW AND SYNTHESIS OF THE SCIENTIFIC EVIDENCE

### General Information

The Environmental Protection Agency's (EPA) Office of Research and Development (ORD) has finalized the science report, *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*.

The purpose of this report is to summarize the current scientific understanding about the connectivity and mechanisms by which streams and wetlands, singly or in aggregate, affect the physical, chemical, and biological integrity of downstream waters. EPA has conducted a thorough review of the literature regarding the effects that streams, nontidal wetlands, and open waters have on larger downstream waters such as rivers, lakes, estuaries, and oceans. The report addresses three main questions related to connectivity:

- (1) What are the physical, chemical, and biological connections to, and effects of, *ephemeral, intermittent, and perennial stream* on downstream waters?
- (2) What are the physical, chemical, and biological connections to, and effects of, *riparian or floodplain wetlands and open waters* on downstream waters?
- (3) What are the physical, chemical, and biological connections to, and effects of, *wetlands and open waters in non-floodplain settings* on downstream waters?

### Summary of Findings and Conclusions

Based on a review of more than 1,200 publications from the peer-reviewed scientific literature, this final report reviews and summarizes the scientific



evidence regarding the effects that streams, nontidal wetlands and open waters have on larger downstream waters such as rivers, lakes, estuaries, and oceans. The final report contains 5 major conclusions:

- The scientific literature unequivocally demonstrates that *streams*, regardless of their size or frequency of flow, are connected to downstream waters and strongly influence their function.
- The scientific literature clearly shows that *wetlands and open waters in riparian areas* (transitional areas between terrestrial and aquatic ecosystems) and *floodplains* are physically, chemically, and biologically integrated with rivers via functions that improve downstream water quality. These systems act as effective buffers to protect downstream waters from pollution and are essential components of river food webs.
- There is ample evidence that many *wetlands and open waters located outside of riparian areas and floodplains*, even when lacking surface water connections, provide physical, chemical, and biological functions that could affect the integrity of downstream waters. Some potential benefits of these wetlands are due to their isolation rather than their connectivity.

Evaluations of the connectivity and effects of individual wetlands or groups of wetlands are possible through case-by-case analysis.

- Variations in the degree of connectivity are determined by the physical, chemical and biological environment, and by human activities. These variations support a range of stream and wetland functions that affect the integrity and sustainability of downstream waters.
- The literature strongly supports the conclusion that the incremental contributions of individual streams and wetlands are cumulative across entire watersheds, and their effects on downstream waters should be evaluated within the context of other streams and wetlands in that watershed.

### Next Steps

Now final, this scientific report can be used to inform future policy and regulatory decisions, including the proposed Clean Water Rule being developed by EPA's Office of Water and the U.S. Army Corps of Engineers.

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