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Protecting nature. Preserving life.

April 12, 2019

The Honorable Andrew Wheeler
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Ave. NW
Washington, D.C. 20460

The Honorable R.D. James
Assistant Sec. of the Army for Civil Works
Department of the Army
108 Army Pentagon
Washington, D.C. 20310

RE: Docket ID No. EPA–HQ–OW–2018–0149

Dear Administrator Wheeler and Assistant Secretary James:

Thank you for the opportunity to comment on the definition of "waters of the United States" under the Clean Water Act. The Nature Conservancy (TNC) recognizes the long-standing desire to improve implementation of the Clean Water Act (CWA) by resolving confusion over the definition through the Environmental Protection Agency and U.S. Army Corps of Engineers' (the agencies) rulemaking process.

TNC is a global conservation organization dedicated to conserving the lands and waters on which all life depends. Guided by science, we create innovative, on-the-ground solutions to the world's toughest challenges so that nature and people can thrive together. We are tackling climate change, conserving lands, waters and oceans at unprecedented scale, providing food and water sustainably and helping make cities more sustainable. Working in all 50 states and 72 countries, we use a collaborative approach that engages local communities, governments, the private sector and other partners, including farmers, ranchers and other landowners.

TNC engages in stream and wetland restoration and mitigation projects throughout the United States that often require CWA permits. In addition, as of December 2018, TNC owns more than 2.5 million acres and holds conservation easements covering more than 3.2 million acres in the United States. As a landowner, property manager and regulated entity, the agencies' rulemaking to define CWA jurisdiction has a direct impact on our ability to fulfill our mission.

Enacted in 1972, the goal of the CWA is "to restore and maintain the chemical, physical and biological integrity of the Nation's waters." The CWA represented a major step forward for protecting water quality by prohibiting the discharge of pollutants from point sources into the nation's waters. While the act has been successful in many respects, much work remains to be done. The number of water bodies characterized as impaired by the states has continued to grow, and more than 50% of state-assessed rivers, streams, lakes, ponds and wetlands do not meet their state water quality standards.[1]

[1] U.S.EPA, National Summary of State Information, https://ofmpub.epa.gov/waters10/attains_nation_cy.control#total_assessed_waters accessed March 8, 2019. See also Oliver A. Houck, "The Clean Water Act Returns (Again): Part I, TMDLs and the Chesapeake Bay," *41 Environmental Law Reporter*, 10208, 10212 ("[T]he fact is that impairment is not going down. It is going up. The impaired category for rivers and streams has increased to nearly half a million segments and to almost 50% of all

We are concerned that the agencies' proposed definition of CWA jurisdiction will jeopardize our ability to meet the goal of the act. The proposal:

1. Eliminates federal protections for ephemeral streams and contemplates removing federal protections for intermittent streams. Ephemeral streams can have significant impacts on and contributions to downstream water quality in otherwise jurisdictional waters. Particularly in arid areas in the West where ephemeral streams are common, eliminating federal protections for ephemeral streams will make it difficult if not impossible to ensure that larger rivers and streams can continue to support aquatic life and associated habitats, drinking water supplies and local economies. Eliminating federal protections for intermittent streams will compound this problem.
2. Eliminates federal protections for many important wetlands. By relying on a continuous surface water connection to other jurisdictional waters to establish federal jurisdiction over non-adjacent wetlands, the proposal ignores the myriad ways that wetlands are chemically, physically and biologically connected to other water bodies. As a result, we could lose many wetlands that currently provide extensive water quality, flood risk reduction and ecological benefits.
3. Places new burdens on the states to protect water quality. The agencies make spurious assumptions about the ability of states to fill in the gap left by a reduced federal jurisdiction. State budgets and staffing are already stretched to the limit in most cases, and many states lack the capacity to assume significant new responsibility for water quality protection as proposed by the agencies' draft rule. In addition, the agencies failed to account for many of the costs imposed on the states in their economic analysis of the proposed rule.
4. Ignores the extensive scientific documentation on the connections between hydrologic systems. The Environmental Protection Agency (EPA) and the scientific community validated the importance of ephemeral and intermittent streams as well as floodplain and non-floodplain wetlands in a 2015 report.[2] Unfortunately, the proposal relies on very few of the conclusions presented in the report or the EPA Science Advisory Board's (SAB) review of it.
5. Does not achieve the desired clarity. Because of the definitions used for many of the terms in the proposal, many jurisdictional determinations still will require case-by-case determination. In addition, use of new and untested concepts such as "typical year" introduce new uncertainty into implementation of the CWA.

In the remainder of this comment letter, we describe in detail the concerns listed above and describe the multiple benefits that ephemeral streams and wetlands provide.

1. View of jurisdiction

The appropriate test of jurisdiction should be a scientifically based test focusing on whether the pollution, alteration or filling of particular waters and wetlands would have a meaningful impact on the chemical, physical or biological integrity of downstream waters. Such a test would be directly tied to achieving the purposes of the CWA. Such a focus on key processes is well-grounded in the science

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monitored waters over the past decade. The picture for lakes is even bleaker, rising to 11 million acres and a whopping two-thirds of all lakes measure.").

[2] EPA/600/R-14/475F, Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence, January 2015

summarized in the *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*[3] and was supported by the EPA SAB. This approach is also the foundation TNC uses to protect and restore freshwater systems.[4]

1.1. Science-based rulemaking

Any rule must be grounded in our best scientific understanding of what affects the chemical, physical and biological integrity of various water bodies and accommodate future advances in science. From 2010 to 2015, EPA analyzed the importance of streams and wetlands to downstream waters and produced a robust synopsis of this science in the *Connectivity Report*. The literature review in EPA's *Connectivity Report* cited more than 1,200 peer-reviewed publications, and the report itself was peer reviewed three different times:

- In 2011, 11 scientists from across the government, academic, nonprofit and private sectors reviewed a draft of the report.
- In 2012, an independent review was conducted by 11 scientists.
- From 2013 to 2014, a SAB panel independently reviewed the report. The 27-person panel included professors, hydrologists and researchers and produced a detailed 99-page report summarizing the best thinking in the nation on matters of hydrology, geology and ecology.

Further peer review has only strengthened the conclusions of the *Connectivity Report*. In 2018, the authors of the 2015 *Connectivity Report* submitted an update of the report as six scientific articles to the *Journal of the American Water Resources Association*. These six articles were again reviewed by dozens of external scientists through a peer review process. Once again, the scientific community validated the importance of ephemeral and intermittent streams, as well as floodplain and non-floodplain wetlands. The six articles were published in April of 2018.[5]

The proposal cites the SAB's recommendation that a gradient concept be applied to the idea of connectivity and acknowledges the conclusion that there is "strong scientific support for the conclusion that ephemeral, intermittent and perennial streams exert a strong influence on the character and functioning of downstream waters and that tributary streams are connected to downstream." However, the proposed rule omits the SAB's statement that "relatively low levels of connectivity can be meaningful." The proposed rule concludes that the SAB found perennial and intermittent streams have a greater probability of impacting downstream waters compared with ephemeral streams: "While the SAB stated that 'at sufficiently large spatial and temporal scales, all waters and wetlands are connected,' it found that '[m]ore important are the degree of connection (e.g., frequency, magnitude, timing, duration) and the extent to which those connections affect the chemical, physical and biological integrity of downstream waters.'" Such an argument ignores the unquestionable consequences that would come from removing federal protections from ephemeral channels. While a segment of perennial or intermittent stream may have a higher degree of connection and influence compared with an ephemeral segment of the same length, the lack of jurisdictional protection can produce significant

[3] Ibid.
[4] The Nature Conservancy, 2008. Active River Area: A Conservation Framework for Rivers and Streams
[5] The abstracts of the April 2018 articles in the Journal of the American Water Resources Association can be found at: https://onlinelibrary.wiley.com/toc/17521688/54/2

unmitigated impacts to many ephemeral channels. The cumulative impact may result in the degradation of the chemical, physical and biological integrity of downstream waters.

The proposal omits all reference to the SAB's many statements that wetlands that are connected to other waters through subsurface hydrologic connections and by other means provide numerous important water quality functions. The *Connectivity Report* concluded that "[t]he literature clearly shows that wetlands and open waters in riparian areas and floodplains are physically, chemically, and biologically integrated with rivers via functions that improve downstream water quality." It also concluded that "[w]etlands and open waters in non-floodplain landscape settings provide numerous functions that benefit downstream water integrity."

The proposed rule also points out that the *Connectivity Report* is science and not policy. This statement is used to then make the assertion that the report can therefore not be used to draw the line between federal and state waters. While TNC agrees that the *Connectivity Report* does not prescribe policy, the scientific information within the *Connectivity Report* should inform policy. The proposed rule, on the other hand, treats the science provided in the *Connectivity Report* as irrelevant to the policy being proposed.

1.2. Advance clarity

In justifying an approach that restricts the importance of science, following Justice Antonin Scalia's plurality opinion in *Rapanos*, the notice asserts that the proposed rule will enhance clarity and predictability. Little evidence is offered for this proposition, yet ample evidence exists to the contrary. For example, under the proposed rule, a wetland requires a surface water connection to be jurisdictional. There are numerous wetlands that are directly adjacent to jurisdictional streams that are connected by shallow *sub*surface flow (see TNC's example in section 3.5 and figure 8). It is inaccurate to use the National Wetlands Inventory map and assume wetlands directly adjacent to the United States Geological Survey's (USGS) National Hydrography Dataset (NHD) streams are jurisdictional wetlands because, in reality, these wetlands might lack surface water connections. Even seemingly predictable wetlands require field validation to determine if they have a surface water connection and the size of that surface water connection. Compounding the issue, many wetlands are separated from a stream by a natural or manmade berm or levee, again requiring field work to delineate the hydrology. The agencies have found that "berms and the like are fairly common," affecting, for example, 42% of surveyed wetlands in an area of Oregon and 90% in California's Sacramento-San Joaquin delta.[6] The surface hydrological connection would be established by looking at a "typical year," which under the proposal would require a backward-looking 30-year examination of inundation events affecting the location in question. This individualized calculation would have to be performed quite often and could easily change the size of a jurisdictional wetland, removing any jurisdictional clarity.

[6] USEPA & US Dept. of the Army, Technical Support Document for the Clean Water Rule: Definition of Waters of the United States (May 27, 2015). ("Man-made berms and the like are fairly common along streams and rivers across the United States and often accompany stream channelization. Franklin et al. 2009. One study conducted in Portland, Oregon found that 42% of surveyed wetlands had dams, dikes, or berms. Kentula et al. 2004. Likewise, over 90% of the tidal freshwater wetlands of the Sacramento-San Joaquin Delta have been diked or leveed. Simenstad et al. 1999. At least 40,000 kilometers of levees, floodwalls, embankments, and dikes are estimated across the United States, with approximately 17,000 kilometers of levees in the Upper Mississippi Valley alone. Gergel et al. 2002.")

The same defect is present regarding tributaries and ephemeral water bodies and the definition of "perennial or intermittent." The jurisdictional determination of streams under the proposal will be difficult in the field. Current jurisdictional determinations of streams rely on if the stream has a bed, bank and high-water mark that have been created by a continual pattern of flowing water whether it is from ephemeral, intermittent or perennial flow. The exact point in a continuous stream system where an ephemeral channel becomes intermittent would be difficult to determine in the field and may involve obtaining information from the groundwater table and evaluating stream flow seasonally, after precipitation events and over multiple years for accurate determination.[7] The cost and time required for such a substantial evaluation would be significant and prevent the kind of jurisdictional clarity sought by the proposal.

The proposed rule trades one set of case-by-case judgments for another but by no means eliminates the need for them, nor could that ever be the case given the complexity of water bodies and the science of hydrology. The 2015 rule did reduce the reliance on case-by-case interpretations, and no data is cited in the notice to support the claim that the new proposal would reduce that reliance any further.

1.3. Inclusive of the significant nexus test

Scalia's plurality opinion in *Rapanos* cannot be relied on without Justice Anthony Kennedy's concurring opinion as legal precedent to establish the CWA's jurisdiction. In the 1977 Supreme Court ruling in *Marks v. United States*, the court asserted the proposition that in Supreme Court cases for which no opinion receives a majority, lower courts should follow the "narrowest" opinion that is necessary for the judgment in the case. Here, because of *Marks*, that means that Scalia's words have no lawful value as precedent insofar as they are inconsistent with Kennedy's words. Any new methodology to evaluate the status of a water body must be at least as open to the use of science as the "significant nexus" methodology. TNC believes, therefore, that the "significant nexus" test articulated in *Rapanos* should set the minimum standards for the definition of the waters of the United States.

2. Streams

The degree of connection that ephemeral and intermittent streams have to their downstream perennial waterways is significant. As the SAB concluded, the *Connectivity Report* offers "strong scientific support for the conclusion that ephemeral, intermittent and perennial streams exert a strong influence on the character and functioning of downstream waters and that tributary streams are connected to downstream waters." The *Connectivity Report* found that the degree of connection (e.g., frequency, magnitude, timing and duration) and the extent to which those connections affect the chemical, physical and biological integrity of downstream waters is highly important. These connections have real impacts on the ecosystem services the ephemeral streams provide to their stream networks.

Nearly 60% of the streams in the continental United States are ephemeral or intermittent.[8] While the filling of a single ephemeral channel may not have a significant impact on the ecosystem services

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[7] Vanote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. The river continuum concept. Can. J. Fish. Aquat. Sci. 37: 130-137.

[8] Levick, L., J. Fonseca, D. Goodrich, M. Hernandez, D. Semmens, J. Stromberg, R. Leidy, M. Scianni, D. P. Guertin, M. Tluczek, and W. Kepner. 2008. The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest. U.S. Environmental Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134, ARS/233046, 116 pp.

provided by a stream network, unfettered filling of many stream channels in a single watershed could lead to eventual degradation of the watershed. The significance of ephemeral and intermittent streams should not be examined in isolation, particularly in the arid southwest, because they have significant and varied contributions to the hydrological, biogeochemical and ecological health of a watershed.[9] The ease of alteration to headwater streams and wetlands because of land development, agriculture, mining and other land uses has made these systems highly vulnerable and accentuates the need to create protection for these valuable aquatic resources.[10] Unfortunately, there is not much buffer for such destructive actions, since the EPA reported in a 2017 national water quality inventory that more than 70% of the nation's flowing waters are in either poor or fair biological condition.[11]

2.1. What are ephemeral and intermittent streams?

The defining feature of all intermittent rivers and ephemeral streams is that they cease to flow on the surface at some time. However, many intermittent and ephemeral rivers and streams continue to flow through hyporheic sediments below the streambed even when the surface of the streambed has become dry or is holding pooled water. The proposed rule excludes these subsurface connections for the purposes of determining jurisdiction and excludes ephemeral streams entirely. The proposed rule would include within CWA jurisdiction only a river or stream that "contributes perennial or intermittent flow to a traditional navigable water or territorial sea in a typical year." The proposed rule defines "intermittent" as "surface water flowing continuously during certain times of a typical year, not merely in direct response to precipitation." (We discuss problems with the use of "typical year" below in section 3.1.)

Consideration of subsurface flows is essential to understanding the highly variable flow regimes of intermittent and ephemeral rivers and streams. If dry conditions persist, hyporheic flows may also cease and the streambed dries completely. Consequently, the flow regimes (e.g., frequency, magnitude, duration and timing of flow events) of intermittent rivers and ephemeral streams and the presence of water are typically more variable than in nearby equivalent-sized perennial rivers and streams. This highly variable flow regime, especially intermittence, has major implications for the physiochemistry, biota, ecological processes and management of intermittent rivers and ephemeral streams.

Figure 1 contains a geographic depiction of the location of perennial and intermittent/ephemeral streams utilizing the USGS NHD. Smaller headwater ephemeral and intermittent streams have yet to be mapped sufficiently at the finer spatial scale that would be necessary to document their occurrence.[12] Flow regimes of intermittent rivers and ephemeral streams have been primarily characterized using data from gauging stations, supplemented by diverse methods such as wet-dry mapping, various forms of

[9] Ibid.

[10] Cappiella, K. and L. Fraley-McNeal. 2007. Article 6: The importance of protecting vulnerable streams and wetlands at the local level prepared for the Office of Wetlands, Oceans and Watersheds U.S. Environmental Protection Agency. Center for Watershed Protection. Ellicott City, MD. 36pp.

[11] U.S. Environmental Protection Agency, 2013. Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence. Science Advisory Board.

[12] Colvin, S.A.R., S.M.P. Sullivan, P.D. Shirey, R.W. Colvin, K.O. Winemiller, R.M. Hughes, KD. Fausch, D.M. Infante, J.D. Olden, K.R. Bestgen, R.J. Danehy, L. Eby. 2019. Headwater streams and wetlands are critical for sustaining fish, fisheries, and ecosystem services. Fisheries. Vol. 44 No. 2: 74-91. See also Colson, T., J. Gregory, J. Dorney, and P. Russell. 2008. Topographic and soil maps do not accureately depict headwater stream networks. National Wetlands Newsletter. 30: 25-18.

imagery and modeling. However, many additional advances in technology, such as new water quality and flow sensor technologies, tracer methods, satellite-based remote sensing, drone platforms, low-cost high-resolution automated field photography and advanced isotopic methods, can also be employed to determine connectivity and dramatically enhance our ability to quantify the connectedness of waters at both highly local and watershed-wide spatial scales. Flow data are often summarized as hydrological metrics such as variance in frequency, duration, timing and rate of onset of intermittence that have been used to classify flow regimes of many of the world's rivers. Such classifications reveal that intermittent rivers and ephemeral streams are globally abundant and that intermittence is increasing across much of the world, largely owing to climatic drying and water abstraction.

Headwater streams constitute 79% of our nation's stream networks;[13] however, since NHD does not capture streams that are less than 1 mile in length, the frequency and magnitude of these systems may be grossly underestimated along with the intrinsic values that they provide.[14]

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[13] Colvin, S.A.R., S.M.P. Sullivan, P.D. Shirey, R.W. Colvin, K.O. Winemiller, R.M. Hughes, KD. Fausch, D.M. Infante, J.D. Olden, K.R. Bestgen, R.J. Danehy, L. Eby. 2019. Headwater streams and wetlands are critical for sustaining fish, fisheries, and ecosystem services. Fisheries. Vol. 44 No. 2: 74-91.

[14] Creed, I.F., C.R. Lane, J.N. Serran, LC. Alexander, N.B. Basu, J.J.K. Calhoun, J.R. Christensen, J.J. Cohen, C. Craft, E. D'Amico, E. DeKeyser, L. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirman, M.Land, S.G. Leibowitz, D.B. Lewis, J. Marton, D.L. McLaughlin, H. Raanan-Kiperwas, MC. Rains, K.C. Rains, and L. Smith. 217. Enhancing protection for vulnerable waters. Nature Geoscience. 10: 809-815.

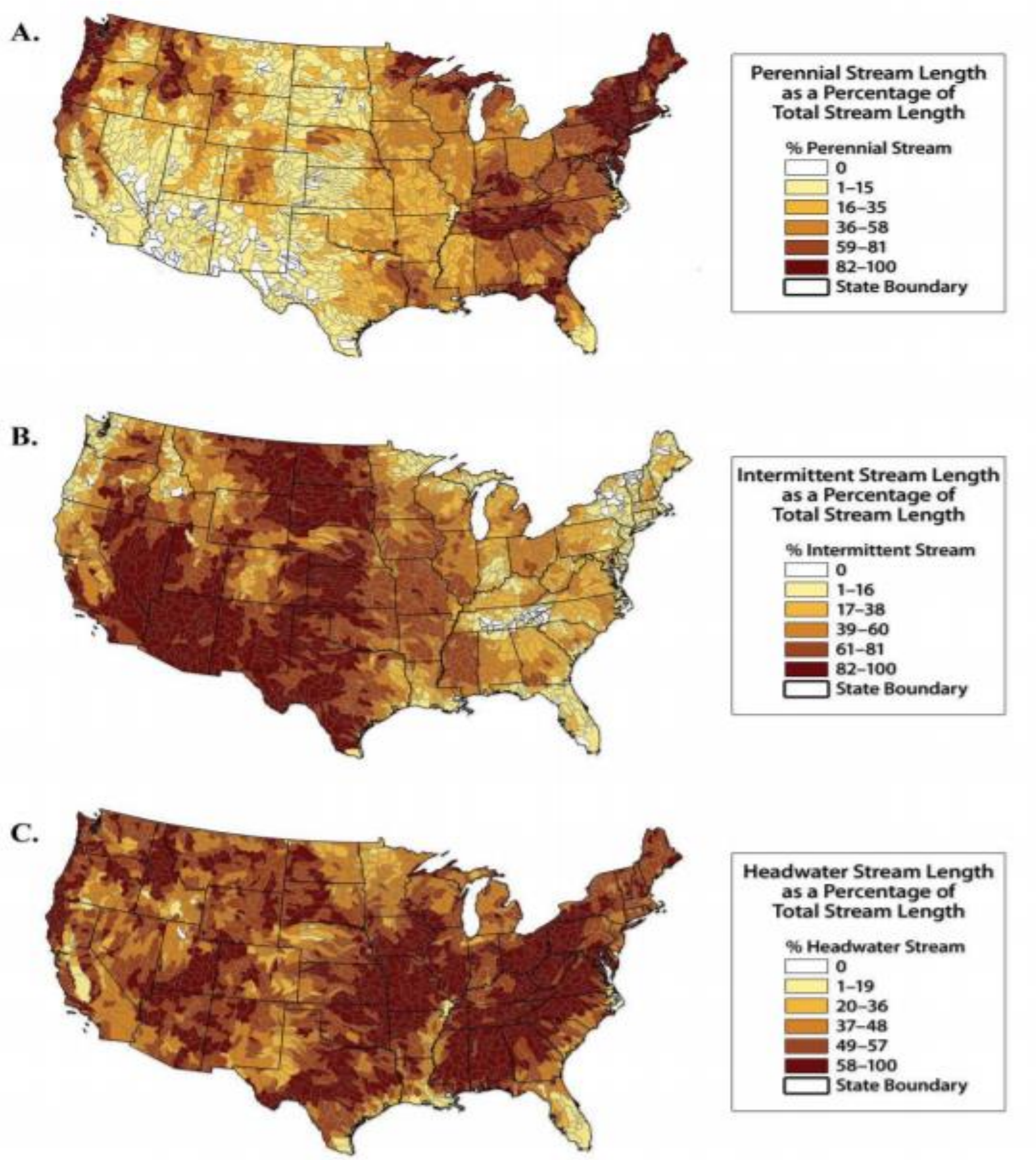

Figure 1. The above figures and associated figure descriptions were obtained from the *Connectivity Report*. "Characteristics of U.S. streams by watershed in terms of percentage of total stream length as (A) perennial (B) intermittent and (C) headwater stream. Data from the National Hydrography Dataset (RAD) v2.0 at 1:100,000 scale using 8-digit HUC (Hydrologic Unit Code) watersheds. Here, 'intermittent' includes streams having intermittent or ephemeral flow. Note that NHD data generally do not capture streams < 1.6 km (1 mile) in length, and ranges of color categories are not consistent across maps."

Ephemeral and intermittent streams occur at different scales and sizes. This is especially evident in the arid southwest. Many of these arid stream systems are larger in size and are considered to have an ephemeral or intermittent flow type. The size of channel that occurs is a direct result of the volume and magnitude of flooding events that occur. Figure 2 shows an example of flow variation and magnitude of flooding.

Dry Rillito River, Tucson, Arizona

Flowing Rillito River, Tucson, Arizona

July 31, 2006, flooding event causing damage to nearby homes in Tucson, Arizona.

July 31, 2006, flooding event causing damage to roads and bridges in Tucson, Arizona.

Figure 2. Photographs obtained from the 2008 report, *The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest*. Top photographs depict the same location on the Rillito River in Tucson, Arizona, on days where the river is dry and flowing water. Bottom photographs depict large flood events from an ephemeral stream in Tucson, Arizona, that resulted in damage to homes, roads and bridges on July 31, 2006.

2.2. Regional differences of ephemeral and intermittent streams

Ephemeral and intermittent streams are the defining characteristics of many watersheds in dry, arid and semi-arid regions and serve a critical role in the protection and maintenance of water resources, human health and the environment. Ephemeral and intermittent streams in arid and semi-arid regions have distinctly different characteristics from perennial streams that are in wetter, more humid (mesic to hydric) environments.

The arid southwestern states have the largest percentage of ephemeral and intermittent streams (figure 3). Arizona has the largest percentage. Ninety-four percent of streams within the state are either ephemeral or intermittent. Ephemeral and intermittent streams are common in non-arid states, too. More than 80% of streams in North Dakota, South Dakota and Kansas are ephemeral or intermittent.[15]

Arizona	94%
Nevada	89%
New Mexico	88%
Utah	79%
Colorado	68%
California	66%

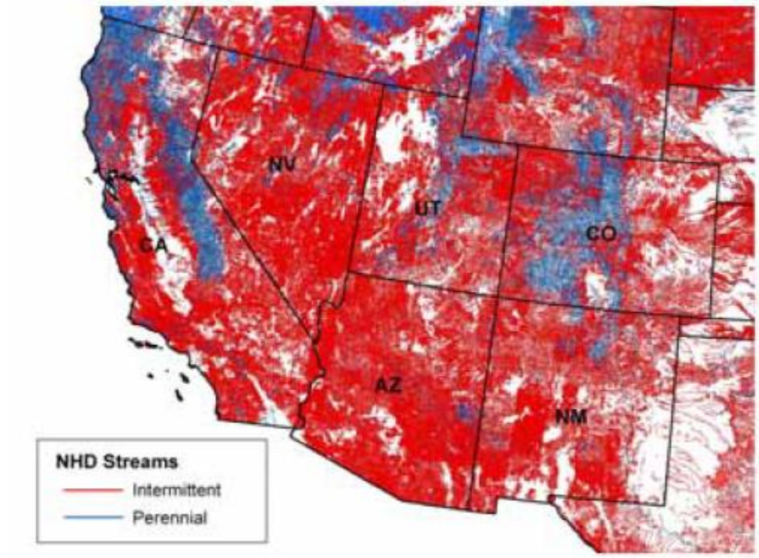

Figure 3. Figures and associated figure description obtained from the Levick et al. 2008 report, *The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest*. "Map of the Southwestern U.S. showing the National Hydrography Dataset (NHD) intermittent/ephemeral (red) and perennial (blue) streams."

In arid and semi-arid settings, ephemeral streams have developed in a climatic regime of wide fluctuations of precipitation, ranging from drought to flood. The variability of flood magnitudes is much greater for ephemeral stream channel flows compared with that of perennial stream systems. For example, in a humid region in Pennsylvania, the 50-year return flood event is roughly 2.5 times the mean annual flow, whereas the 50-year return flow for the Gila River in Arizona is about 280 times the mean annual flow.[16] The associated high-velocity turbulent flash flows contain heavy sediment loads and push large amounts of coarse sediment through the system. In addition, sediment is moved from the uplands and hillslopes into the channels from overland flow. Stormwater is often completely absorbed in the channel network before reaching the outlet. Transmission losses and decreasing discharge in the downstream direction thus promote the stepwise movement, deposition and storage of sediment within ephemeral stream networks.[17]

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[15] Levick, L., J. Fonseca, D. Goodrich, M. Hernandez, D. Semmens, J. Stromberg, R. Leidy, M. Scianni, D. P. Guertin, M. Tluczek, and W. Kepner. 2008. The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest. U.S. Environmental Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134, ARS/233046, 116 pp.

[16] Graf, W.L. 1988. Fluvial Processes in Dryland Rivers. Springer-Verlag, Berlin.

[17] Renard, K.G. 1970. The hydrology of semi-arid rangeland waters. U.S. Department of Agriculture, Agricultural Research Service. Publication ARS 42-162; Renard, K.G. and E.M. Laursen. 1975. Dynamic behavior model of ephemeral stream. Proceedings of the American Society of Civil Engineers. 101: (HY5), Journal of the Hydraulics Division, May 1975; and Levick, L., J. Fonseca, D. Goodrich, M. Hernandez, D. Semmens, J. Stromberg, R. Leidy, M.

The quantity of ephemeral and intermittent streams can differ regionally. In Ohio, 73% of primary headwater streams (less than 1 square mile in drainage area) are intermittent or ephemeral.[18] In the Northeast, small tributaries provide approximately 55% of the mean annual water volume and contribute 40% of the nitrogen mass in larger rivers.[19] Approximately 35% of streams across seven different watersheds in North Carolina are intermittent in nature.[20]

2.3. Functions and benefits of ephemeral and intermittent streams

Ephemeral and intermittent streams provide the same ecological and hydrological functions as perennial streams by moving water, nutrients and sediment throughout the watershed. When functioning properly, these streams provide landscape hydrologic connections; stream energy dissipation during high-water flows to reduce erosion and improve water quality; surface and subsurface water storage and exchange; groundwater recharge and discharge; sediment transport, storage and deposition to aid in floodplain maintenance and development; nutrient storage and cycling; wildlife habitat and migration corridors; support for vegetation communities to help stabilize stream banks and provide wildlife services; and water supply and water quality filtering or cleansing. Arid regions typically produce more runoff and erosion per unit area than in temperate regions for a given intensity of rainfall due to sparse vegetation cover and poorly developed soils with little organic matter.[21]

2.3.1. Physical benefits

Ephemeral streams have unique longitudinal trends of sediment production, transfer and deposition that exist at the landscape scale. Many geomorphological features of intermittent and ephemeral streams tend to be spatially discontinuous because of extended no- or low-flow conditions that are punctuated by high-magnitude flood events. However, the majority of fine particulate organic matter present in large rivers comes from headwater systems in the processing of organic matter and aiding in continual downstream benefits.[22] In southwestern deserts, large amounts of sediment and other particulates are washed into small streams during storms due to compacted soils with low infiltration rates and sparse vegetation in the upland environment.[23] The diversity of geomorphology and sediment

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Scianni, D. P. Guertin, M. Tluczek, and W. Kepner. 2008. The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest. U.S. Environmental Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134, ARS/233046, 116 pp.

[18] Ohio State University. 2001. Headwater rapid assessment study. Report prepared for Ohio EPA, Division of Surface Water by Statistical Consulting Service, Department of Statistics, The Ohio State University, Columbus, Ohio. As referred to in: Ohio EPA. 2012. Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams. Version 3.0. Ohio EPA Division of Surface Water, Columbus, Ohio. 117 pp.

[19] Alexander, R.B., E.W. Boyer, R.A. Smith, G.E. Schwarz, and R.B. Moore. 2007. The Role of Headwater Streams in Downstream Water Quality. Journal of the American Water Resources Association (JAWRA) 43(1):41-59. DOI: 10.1111/j.1752-1688.2007.00005.x

[20] Russell, P.P., S.M. Gale, B. Munoz, J.R. Dorney, and M.J. Rubino. 2015. A Spatially Explicit Model for Mapping Headwater Streams. Journal of the American Water Resources Association (JAWRA) 51(1): 226-239. DOI: 10.1111/jawr.12250.

[21] Thornes, J.B. 1994. Catchment and Channel Hydrology. In: Geomorphology of Desert Environments. A.D. Abrahams and A.J. Parsons, eds. Chapman and Hall, London, p. 257-287.

[22] Vanote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. The river continuum concept. Can. J. Fish. Aquat. Sci. 37: 130-137.

[23] Fisher, S.G. and W.L. Minckley. 1978. Chemical characteristics of a desert stream in flash flood. Journal of Arid Environments, 1:25-33.

regimes in these systems promotes ecological processes and patterns that can be distinct from perennial river systems.[24]

Because headwater, ephemeral and intermittent streams constitute a large percentage of the total watershed channel distance, in combination they may have the capacity to store large amounts of sediment and particulates. Removing federal protections for headwater streams could increase sedimentation rates in downstream channels and in turn alter the dynamic equilibrium of aggradation and degradation that occurs naturally in streams.[25] When small or headwater streams are replaced with paved or lined floodways during development, sediment production may decrease, causing an increase in downstream erosion as sediment-starved waters move through the watershed.

2.3.2. Ecological and biological benefits

Intermittent rivers and ephemeral streams drain more than half the world's land surface.[26] Despite their ubiquity, their ecology and ecosystem services are underappreciated and undervalued. Ephemeral streams provide immense ecosystem services to the ecological integrity of the intermittent, perennial and navigable waters that they feed into. These ecosystem services include improved water quality, maintenance of base flows, nutrient retention and assimilation, temperature regulation, aquatic and amphibian breeding locations (figure 4) and sources of refugia and food for aquatic organisms including fish.[27] All these essential ecosystem functions influence the downstream integrity and quality of waters on which all life depends.

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[24] Jaeger, K.L., J.D. Olden, and N. A. Pelland. 2014. Climate change poised to threaten hydrologic connectivity and endemic fishes in dryland streams. Proceedings of the National Academy of Sciences United States of America. 111: 13894-13899.

[25] Meyer, J.L, and J.B. Wallace. 2001. Lost linkages and lotic ecology: rediscovering small streams. Pages 295-317 in M.C. Press, N.J. Huntly and S. Levin editors. Ecology: achievement and challenge. Blackwell Science, Oxford, UK.

[26] Datry T, Bonada N, Boulton A. 2017. General introduction. In Intermittent rivers and ephemeral streams (eds Datry T, Bonada N, Boulton A), Ch. 1. pp. 1-20. San Diego, CA: Academic Press. https://doi.org/10.1016/B978-0-12-803835-2.00001-2.

[27] Alexander, R.B., E.W. Boyer, R.A. Smith, G.E. Schwarz, and R.B. Moore. 2007. The Role of Headwater Streams in Downstream Water Quality. Journal of the American Water Resources Association (JAWRA) 43(1):41-59. DOI: 10.1111/j.1752-1688.2007.00005.x

Figure 4: Amphibians that breed and reside in ephemeral and intermittent streams, extracted from Levick et al. 2008 "(Clockwise from top left): Canyon tree frog (*Hyla arenicolor*), lowland leopard frog (*Rana yavapaiensis*), red spotted toad (*Bufo punctatus*), egg strand of Sonoran desert toad (photograph: Shea Burns, USDA-Agricultural Research Service) and Sonoran desert toad (*Bufo alvarius*, photograph: Shea Burns, USDA-ARS)".

Several studies find that ephemeral streams are unique systems that support a diverse array of aquatic taxa that cannot be found anywhere else in the watershed. Some streams support levels of aquatic invertebrates comparable to or greater than perennial headwaters.[28] Not only do aquatic invertebrates rely on ephemeral and intermittent streams, many fish occupy these habitats for essential life stages such as breeding and rearing of young.[29] As an example, anadromous Pacific salmon return to spawn in smaller tributaries, providing essential headwater nutrients that benefit the entire watershed by increasing the production of aquatic basal sources, macroinvertebrates and juvenile fish.[30] Furthermore, ephemeral and intermittent streams support highly biodiverse primary producers, including algae and aquatic and riparian plants.

2.3.3. Benefits to drinking water

[28] Progar, R.A., and A.R. Moldenke. 2002. Insect production from temporary and perennially flowing headwater streams in western Oregon. Journal of Freshwater Ecology. 17: 391-407; Price, K., A. Suski, J. McGarvie, B. Beasley, and J.S. Richardson. 2003. Communities of aquatic insects of old-growth and clearcut coastal headwater streams of varying flow persistence. Canadian Journal of Freshwater Ecology. 33: 416-1432; and Colvin, S.A.R., S.M.P. Sullivan, P.D. Shirey, R.W. Colvin, K.O. Winemiller, R.M. Hughes, KD. Fausch, D.M. Infante, J.D. Olden, K.R. Bestgen, R.J. Danehy, L. Eby. 2019. Headwater streams and wetlands are critical for sustaining fish, fisheries, and ecosystem services. Fisheries. Vol. 44 No. 2: 74-91.

[29] Faush, K.D., C.E. Torgersen, C.V. Baxter, and H.W. Li. 2002. Landscapes to riverscapes: bridging the gap between research and conservation of stream fishes. BioScience 52: 483-498.

[30] Zhang, Y.X., J.N. Negishi, J.S. Richardson, and R. Kolodziejczyk. 2003. Impacts of marine-derived nutrients on stream ecosystem functioning. Proceedings of the Royal Society B-Biological Sciences. 270: 2117-21263.

Watersheds with intact ephemeral stream networks also provide ecosystem services essential to human health and well-being. These ecosystem services include transportation of water, flood control, fresh and plentiful drinking water, groundwater recharge, movement of necessary sediment and organic materials, irrigation, nutrient cycling and fish for recreation and consumption. "[T]hese and other functions of headwater streams make them economically vital, with recent estimates at $15.7 trillion US dollars/year in ecosystem services for the conterminous USA and Hawaii."[31] In addition, more than one-third of the U.S. population—117 million Americans—receives drinking water from headwater systems.[32] As an example, figure 5 depicts regional patterns of intermittent, ephemeral and headwater streams that provide surface drinking water in Pennsylvania.[33]

There are downstream ramifications when headwater streams become polluted and nutrient laden. Hypoxia in the Gulf of Mexico is an example of cumulative downstream impacts of pollution and excess nutrient loading flowing from the Mississippi River watershed into the Gulf of Mexico. This hypoxic area creates a dead zone that has reduced biodiversity and commercial fisheries with major economic and social consequences.[34] Water pollution in headwater systems can exacerbate harmful algal blooms, causing fish kills, toxic water leading to domestic animal and human death and economic damage.[35] This has been especially true in Toledo, Ohio, which sources its water from Lake Erie. Excess nutrient loading causes algal blooms in the western Lake Erin basin, contaminating the Toledo water system with cyanobacteria, or blue-green algae, known to cause liver and kidney damage (figure 6). These algal blooms affect approximately 400,000 residents of Ohio and southeastern Michigan, depriving them of municipal drinking water. Furthermore, the 2014 algal bloom cost the local economy approximately $65 million because of the loss of tourism and tax revenue.[36]

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[31] Colvin, S.A.R., S.M.P. Sullivan, P.D. Shirey, R.W. Colvin, K.O. Winemiller, R.M. Hughes, KD. Fausch, D.M. Infante, J.D. Olden, K.R. Bestgen, R.J. Danehy, L. Eby. 2019. Headwater streams and wetlands are critical for sustaining fish, fisheries, and ecosystem services. Fisheries. Vol. 44 No. 2: 74-91. See also Colson, T., J. Gregory, J. Dorney, and P. Russell. 2008. Topographic and soil maps do not accureately depict headwater stream networks. National Wetlands Newsletter. 30: 25-18.

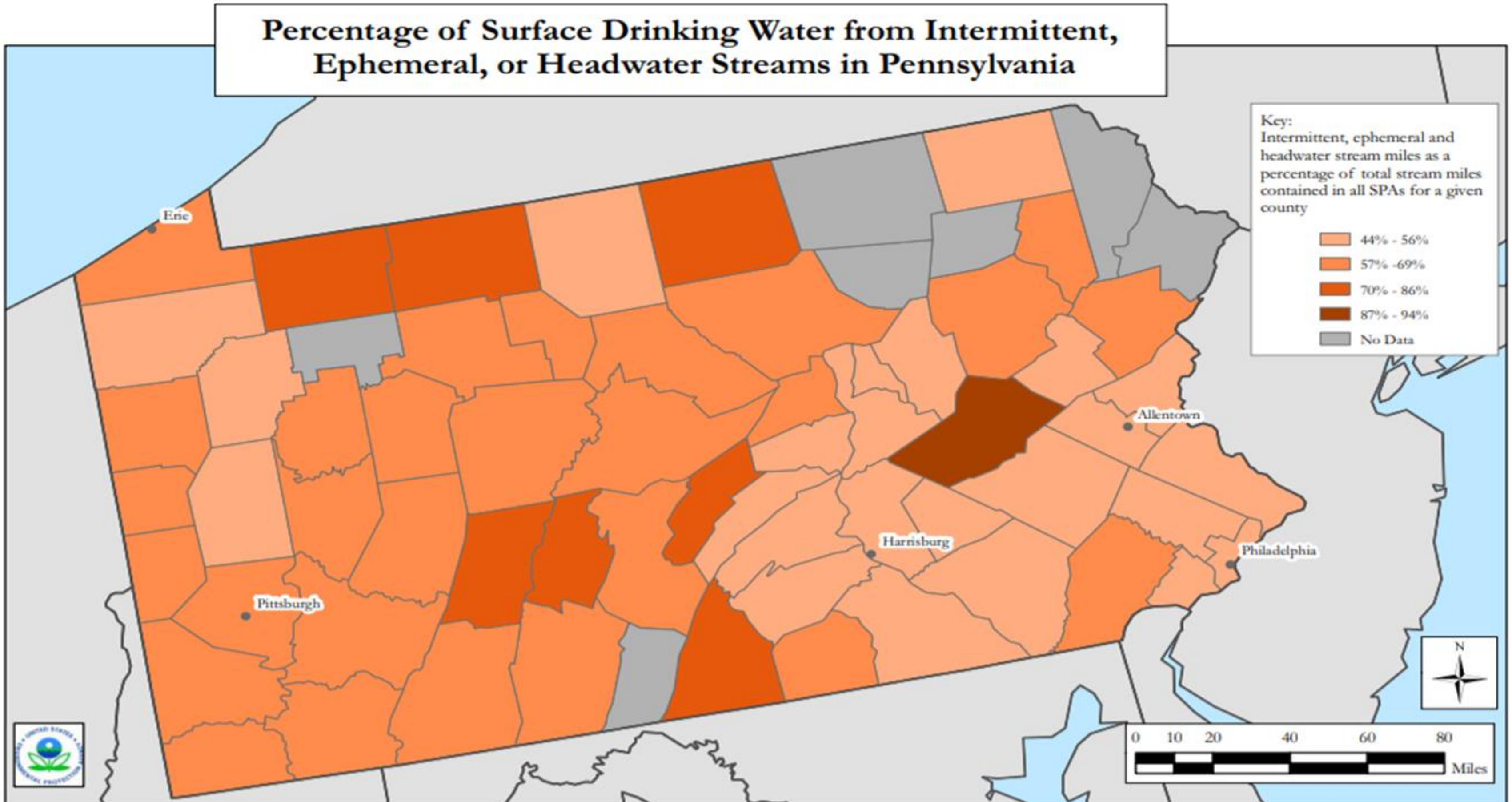
[32] USEPA (U.S. Environmental Protection Agency). 2009. Section 404 of the Clean Water Act. Geographic information systems analysis of the surface drinking water provided by intermittent, ephemeral, and headwater streams in the U.S. United States Environmental Protection Agency, Washington D.C.

[33] Ibid.

[34] Rabotyagov, S.S., C.L. Kling, P.W. Gassman, N.N. Rabalais, and R.E. Turner. 2014. The economics of dead zones: causes impactes, policy challenges, and a model of the Gulf of Mexico hypoxic zone. Review of Environmental Economics and Policy 8(1): 58-79.

[35] Tango, P. 2008. Cyanotoxins in tidal waters of Chesapeake Bay. Northeastern Naturalist. 15: 403-416.

[36] Malewitz. J. 2018. Lake Erie's algae bloom is growing again after paralyzing Toledo water system, August 22, 2018 report. Bridge: Michigan Environmental Watch. Available at https://www.bridgemi.com/michigan-environment-watch/lake-eries-algae-bloom-growing-again-after-paralyzing-toledo-water-system.



Legend: This map highlights regional patterns of dependence on intermittent, ephemeral, and headwater streams for surface drinking water in Pennsylvania. In Pennsylvania, 18,604 total miles of streams provide water for surface water intakes supplying public drinking water systems; of this, 10,720 miles, or 58%, are intermittent, ephemeral, or headwater streams. Over 8 million people in Pennsylvania receive drinking water from public drinking water systems that rely at least in part on intermittent, ephemeral, or headwater streams. This analysis compared the stream length of intermittent, ephemeral, and headwater streams to total stream length within all mapped Source Protection Areas (SPAs) for each county. A SPA is an area upstream from a drinking water source or intake that contributes surface water flow to the drinking water intake during a 24-hour period. This is based on data that generally do not include streams less than one mile in length. Intermittent streams are streams containing water for only part of the year. Ephemeral streams flow in response to precipitation events. First-order streams have been used to represent headwater streams.
Data Sources: National Hydrography Dataset Plus at medium resolution; Federal Safe Drinking Water Information System 4th Quarter 2006 Data.

Figure 5. Geographic depiction of surface drinking water that relies upon intermittent, ephemeral or headwater streams in Pennsylvania (USEPA 2009).

Figure 6. Satellite view of the August 2014 western Lake Erie basin algal bloom that resulted in the suspension of municipal drinking water for the city of Toledo, Ohio (NASA photo courtesy Jeff Schmaltz, LANCE/EOSDIS MODIS Rapid Response Team).

2.3.4. Benefits to flood risk reduction

These streams also help protect communities from the risks of flooding. Ephemeral and intermittent streams reduce the burdens of high-water events placed on bridges, culverts and other drainage infrastructure. Changes in the natural flow regimes of headwater streams can increase the intensity and frequency of downstream flooding.[37] High-intensity flows exacerbate the problems of streambed scour near bridge piers and abutments, which causes more bridge failures than all other causes.[38]

2.3.5. Benefits to recreation

Ephemeral and intermittent streams also provide many recreational benefits to people, including swimming, boating, fishing and tourism. Recreational and commercial fisheries supported 1.62 million jobs in the United States in 2015, resulting in a $208 billion economy with more than 12 million people participating in recreational fishing alone.[39]

2.4. TNC impact: Patagonia-Sonoita Creek Preserve (Arizona)—Home to one of Arizona's few permanently flowing streams, endangered fish, butterflies and birds

In a verdant floodplain valley between the Patagonia and Santa Rita Mountains of southeastern Arizona, within the watershed of Sonoita Creek, lies some of the richest of the remaining riparian (streamside) habitat in the region. One of only a few remaining permanent streams, Sonoita Creek provides for a wide array of diverse species from endangered fishes to butterflies and birds. TNC's Arizona chapter was

[37] Colvin, S.A.R., S.M.P. Sullivan, P.D. Shirey, R.W. Colvin, K.O. Winemiller, R.M. Hughes, KD. Fausch, D.M. Infante, J.D. Olden, K.R. Bestgen, R.J. Danehy, L. Eby. 2019. Headwater streams and wetlands are critical for sustaining fish, fisheries, and ecosystem services. Fisheries. Vol. 44 No. 2: 74-91.
[38] U.S. Geological Survey, 2000. "National Bridge Scour Program: Measuring Scour of the Streambed at Highway Bridges." Available at https://pubs.usgs.gov/fs/2000/0107/report.pdf.
[39] National Marine Fisheries Service, 2015. Fisheries economics of the Unites States, 2015. Government Printing Office, Washington, D.C.; and U.S. Fish and Wildlife Service, 2012. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. U.S. Department of the Interior, Washington, D.C.

founded with the establishment of the Patagonia-Sonoita Creek Preserve in this area in 1966. The Patagonia-Sonoita Creek Preserve contains the first 2 miles of permanent flow of Sonoita Creek and the floodplains adjacent to the stream. The site's high biodiversity value stems primarily from the riparian habitats along Sonoita Creek. The watershed is mostly undeveloped, and the natural processes of the floodplain are mostly intact and functioning.

The 873-acre preserve protects an example of the rare Fremont cottonwood-Goodding willow riparian forest. Some of the trees are among the largest (more than 100 feet tall) and oldest (130 years old) Fremont cottonwood trees in the country. The preserve is one of the few remaining sites in Arizona where this once-common forest type persists. Arizona black walnut, velvet mesquite, velvet ash, netleaf hackberry and various willows are found in other habitats throughout the preserve.

The preserve also has remnant wetlands, or cienegas, a once-common feature of the Sonoita Creek floodplain and the most endangered natural community in Arizona. A significant number of rare and sensitive plant species are found in the Sonoita Creek watershed, including Huachuca water umbel, Santa Cruz striped agave and the Santa Cruz beehive cactus.

Every year, thousands of people visit the preserve to see and experience the many facets of its rich natural diversity. The preserve has actively supported hydrologic research and monitoring and is the site of some of the first community-based activities to build understanding and support for conservation in southern Arizona. It has been a platform for promoting the work of TNC and home to several innovative environmental education initiatives.

Unfortunately, the preserve is at risk from construction upstream in an ephemeral portion of Sonoita Creek.

The Rosemont Copper Company (Rosemont) plans to develop a copper mine in the nearby Coronado National Forest in the Cienega Creek watershed. Rosemont has received a CWA section 404 dredge-and-fill permit for the project and developed a proposed habitat mitigation and monitoring plan (mitigation plan). A core component of the proposed mitigation plan is restoration of Sonoita Creek as compensatory mitigation for the project's filling in of certain channels in the Cienega Creek watershed. The location of the restoration project at Sonoita Creek is directly upstream of the Patagonia-Sonoita Creek Preserve.

The restoration actions included in the proposed mitigation plan will have significant adverse impacts on TNC's Patagonia-Sonoita Creek Preserve, including to species listed under the Endangered Species Act. Specifically, implementation of the mitigation plan would accelerate transport of sediment downstream. We share the opinion of the EPA that excavating a new channel with an unnaturally high degree of sinuosity, given the context within which it is located, would likely result in subsequent erosion, channel straightening and sediment delivery to downstream locations, including our preserve. This outcome is also predicted by Rosemont in the mitigation plan. The proposed mitigation plan would accelerate the transport of coarse and fine sediment downstream for many years, likely decades, until a new equilibrium is reached in the channel, depending upon the timing, duration and magnitude of future flood events.

The accelerated transport of fine sediments would negatively affect the conservation values of our property, including the aquatic and riparian communities that support rare, threatened and endangered species, along 3 miles of Sonoita Creek that has been managed for over half a century as a nature preserve. The Patagonia-Sonoita Creek Preserve has an intact, fully functioning riparian corridor that reduces flood velocities, enabling depositional processes that in an undisturbed system promote conditions essential for riparian recruitment. However, a large increase in fine sediment delivery due to the size of the proposed mitigation project upstream has the potential to result in unprecedented volumes of deposition, potentially filling the active stream channel and reducing the presence of surface water, as well as eliminating aquatic habitat required for fish. The preserve currently supports three native fish species: speckled dace *(Rhinichthys osculus)*, longfin dace *(Agosia chrysogaster)* and desert sucker *(Catastomus clarki)*. Deposition of fine sediments can eliminate the specific habitat needs for several fish species present on our preserve, including speckled dace, which requires gravel stream beds for spawning and uses riffle habitat throughout its life cycle.

We are also concerned about the potential impacts of the proposed mitigation project on the Huachuca water umbel, an endangered plant species. It has designated critical habitat, which includes 1.25 miles of Sonoita Creek near Cottonwood Spring near the town of Sonoita, upstream from the mitigation project site. A historic population from Monkey Spring, 7.5 miles from the preserve, appears to be extirpated. Our staff have confirmed two populations of Huachuca water umbel on our Patagonia-Sonoita Creek Preserve. As with fish, the predicted bed and bank mobilization of the overly sinuous new channel will lead to substantial deposition of fine sediment on the preserve, which could bury these populations of small statured plants.

TNC also shares EPA's concern about potential loss of the existing sacaton riparian grasslands. Research by our staff shows that community type is rare in the ecoregion, has been reduced to less than 5% of its original distribution and is largely unprotected.[40] The proposed mitigation plan reached the conclusion that "there is a well-developed and diverse community present along the current channel." It noted significant cover of sacaton *(Sporobolus airoides* or *Sporobolus wrightii)* in every reach and terrace sampled. The proposed mitigation project would place large volumes of excavated soil associated with new channel construction on top of existing high-quality sacaton grassland and mesquite woodland riparian/floodplain habitat, causing a net loss of these very valuable, existing plant and wildlife communities.

TNC met with Rosemont twice to express our concerns and offer alternative design concepts, including discussion of a less-sinuous channel and beneficial enhancement of the existing creek channel. At our second meeting Rosemont offered to forward any data or modeling it had that would address our concerns regarding sediment transport. As of December 20, 2018, TNC had not received any materials from Rosemont, leading us to believe that impacts on our preserve have not been fully evaluated. TNC also communicated our concerns to Brigadier General D. Peter Helmlinger, commander of the South Pacific Division of the U.S. Army Corps of Engineers (Corps), which has responsibility for approving the CWA section 404 dredge-and-fill permit for the project as well as the section 404 dredge-and-fill permit associated with the compensatory mitigation project on Sonoita Creek.

In March 2019, the Corps issued Rosemont the necessary permit. TNC is grateful there was a process associated with the permit. Since the mitigation actions are proposed for an ephemeral reach of Sonoita

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[40] Enquist, Carolyn and Gori, D. (2008). Application of an Expert System Approach for Assessing Grassland Status in the U.S.- Mexico Borderlands: Implications for Conservation and Management. Natural Areas Journal. 28. 414-428.

Creek, under the proposed definition of CWA jurisdiction Rosemont would not have needed a separate dredge-and-fill permit for the mitigation plan, limiting our ability to protect our property at the Patagonia-Sonoita Creek Preserve. Because the permitting process allowed us review and evaluate the impact of the mitigation plan on the preserve, we can adjust the monitoring and management at the site to minimize the harm to the conservation investments we have made there.

3. Wetlands

Water quality improvement is the core reason for wetland protection under the CWA because wetlands offer many benefits to water quality. They provide numerous other benefits, too. Wetlands do the work of water treatment plants by removing sediments and contaminants, provide habitat for economically important fish and waterfowl species, attenuate floodwaters, protect shorelines from erosion and storm surge and sequester carbon. EPA's SAB recognized that wetlands' influence on downstream waters is not based on one physical line but rather a connectivity gradient. A connectivity gradient recognizes variation in the frequency, duration, magnitude, predictability and consequences of the physical, chemical and biological connections between wetlands and downstream navigable waters.

If CWA jurisdiction relies on a relatively permanent surface water connection alone—which is just one aspect of how wetlands are connected to downstream waters—many critical wetlands will lose federal protection. Even obvious riparian wetlands that are directly adjacent to jurisdictional waters can lack a surface water connection (see the North Carolina case study in section 3.5 and figure 8 below) and instead be strongly connected to the stream through shallow subsurface flow. Losing federal protection for our most obvious wetlands, let alone other critical wetlands, directly jeopardizes the health of our downstream communities and water supplies.

3.1. Typical year

Wetlands will also lose federal protection through the use of the "typical year" concept, which the agencies propose to use to define whether a river, stream, lake or pond is jurisdictional. Jurisdiction would be conferred only if there is a "direct hydrologic surface connection to other 'waters of the United States' in a typical year." Reliance on the notion of a "typical year" of precipitation is indefensible at a time when variability, not typicality, is the defining characteristic of rainfall, snowfall, drought and other weather events affecting surface waters and groundwater. This variability is expected to continue with near scientific certainty.[41] In contrast, the agencies assert that water bodies' connectivity and importance can be determined by looking back three decades, defining a typical year as meaning "within the normal range of precipitation over a rolling thirty-year period for a particular geographic area." A year would be considered "typical" when "the observed rainfall from the previous three months falls within the 30th and 70th percentiles established by a 30-year rainfall average generated at [National Oceanic and Atmospheric Administration] weather stations." Yet the very idea of a "normal range of precipitation" in any area is without foundation.[42]

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[41] Milly PC, Betancourt J, Falkenmark M, Hirsch RM, Kundzewicz ZW, Lettenmaier DP, Stouffer RJ. 2008. Climate change – Stationarity is dead: Whither water management? Science 319(5863):573-574. DOI: 10.1126/science.1151915

[42] See, for example, NOAA's "U.S. Selected Significant Climate Anomalies and Events for 2016" (available at https://www.ncdc.noaa.gov/sotc/global/201613) and "U.S. Selected Significant Climate Anomalies and Events for 2015" (available at https://www.ncdc.noaa.gov/sotc/national/201513).

The agencies state that the definition of a "typical year" is designed "to convey that times of drought or extreme floods would not be a factor" in determining which waters are jurisdictional even though precipitation extremes are becoming more common.[43] In addition, the 30-year look-back period may not capture current precipitation patterns because precipitation has increased by more than 50% in a large portion of the country since 1996.[44] Lastly, since precipitation variability is occurring not only from year to year and place to place but also within each year, tying the definition of "typical year" to "the observed rainfall from the previous three months" can mischaracterize current on-the-ground conditions.

If the agencies decide to retain the "typical year" concept, the agencies should conduct an in-depth analysis, including through the SAB, of the impacts and utility of the concept on implementation of the CWA on a regional basis. The "typical year" concept represents a new and significant departure from current practice. For example, the look-back period focuses only on precipitation patterns and not on broader hydrologic connections or chemical and physical factors, as would be relevant to the goals of the CWA. The analysis should include consideration of modeling and other predictors of future precipitation, flow and inundation patterns, including measurements from tide gauges and models of sea level rise.

3.2. Benefits of wetlands

All wetlands provide an array of ecosystem services, but the number, type and degree of services provided by individual wetlands varies based on factors such as watershed position, wetland type, landscape context and interaction with waterflow paths.[45,46] Together, these factors constitute a watershed approach, recognized and required by EPA and the Corps for siting wetland compensatory mitigation under the 2008 mitigation rule (33 CFR 332). Because the proposal uses two watershed approach factors to define protection status—watershed position and interaction with waterflow paths—certain wetland services are at greater risk of being reduced or lost. For example, headwater wetlands—positioned at the top of watersheds and associated with low-order streams—may not be protected under the proposal. These wetlands discharge groundwater and help to maintain cold water temperatures and streamflow during periods of drought and seasonal low flow, supporting aquatic life and sportfishing opportunities. Internally drained wetland basins, which lack a surface connection to streams, are important in many landscapes for storing floodwaters. In the absence of regulatory protection, these wetlands may be artificially connected to stream systems to enhance drainage, which would contribute to flooding problems downstream and potentially impair water quality of regulated waters.

3.2.1. Ecological and biological benefits

[43] "Extreme Precipitation Events Have Risen Sharply in Northeastern U.S. Since 1996," Yale Environment 360, May 24, 2017.
[44] Ibid.
[45] Zedler, J. B. 2003. Wetlands at your service: Reducing impacts of agriculture at the watershed scale. Frontiers in Ecology and Environment 1:65-72.
[46] National Research Council (NRC). 2001. Compensating for wetland losses under the Clean Water Act. National Academy Press. Washington, DC.

The conterminous 48 U.S. states have lost approximately 53% of their original, pre-settlement wetland area, from an estimated 221 million acres in the 1780s to 104 million acres in the 1980s.[47] This equates to only 5.5% of the total land area in the United States remaining as wetland habitat. However, a disproportionate number of federally imperiled species rely on wetland habitat for at least a portion of their lives. According to EPA's *EnviroAtlas*, in 1991, 43% of the 595 federally endangered or threatened plant and animal species in the United States were wetland dependent.[48] Of the 1,900 species of birds in North America, approximately one-third require the use of wetlands for significant aspects of their life cycle, and 80% of the endangered or threatened bird species are wetland dependent.[49]

3.2.2. Benefits to human health and well-being

The EPA recognizes the importance of wetlands, as demonstrated by the agency's website titled, "Why are Wetlands Important." It states, "Wetlands are important features in the landscape that provide numerous beneficial services for people and for fish and wildlife. Some of these services, or functions, include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters and maintaining surface water flow during dry periods."[50] The Corps also recognizes the functions and values that wetlands provide, as evidenced by the creation of *The Highway Methodology Workbook Supplement: Wetland Functions and Values, A Descriptive Approach*.[51] The Corps understood that wetland functions and values are an important part of section 404 permit decisions and developed a methodology to evaluate the 13 different functions and values that wetlands provide.

Wetlands act as sponges that trap and slowly release water over time. Wetland vegetation in floodplains slows floodwaters and allows the energy to dissipate over a larger area, thereby reducing the velocity and depth of flow and risks to downstream infrastructure and communities.[52] During flood events, the same wetlands are filtering sediments, absorbing nutrients and chemicals and trapping other toxicants and pathogens, doing the work of wastewater treatment plants and keeping our water clean for drinking water as well as for fish and wildlife.

3.3. Regional differences

Wetlands are diverse ecosystems that vary greatly across the United States and across the world. While wetlands are found throughout the country, the characteristics of those wetlands and the functions and values that they provide are vastly different depending on their geographical location. The bottomland forests of the southeastern United States are different from the prairie potholes of the upper Midwest. Domed bogs in the Northeast are different from slope wetlands of the western mountains. The Corps

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[47] Dahl, T.E. 1990. Wetlands Losses in the United States, 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service. Washington, D.C. 13pp.

[48] EPA's *EnviroAtlas* fact sheet, "Total Number of At-Risk Wetland Species." Available at https://enviroatlas.epa.gov/enviroatlas/DataFactSheets/pdf/ESN/Totalnumberofatriskwetlandspecies.pdf. See also Flynn, K. 1996. Understanding wetlands and endangered species: Definitions and relationships. Extension Publication ANR-979, Alabama Cooperative Extension System.

[49] Kusler, Jon. 2004. COMMON QUESTIONS: WETLAND CONSERVATION AND THE PROTECTION OF MIGRATORY BIRDS. Association of State Wetland Managers. 13 pp.

[50] "Why are Wetlands Important" https://www.epa.gov/wetlands/why-are-wetlands-important

[51] U.S. Army Corps of Engineers. 1995. The Highway Methodology Workbook Supplement. Wetland Functions and Values: A Descriptive Approach. U.S. Army Corps of Engineers, New England Division. NENEP-360-1-30a. 32 pp.

[52] Keddy, P.A. 2010. Wetland Ecology, Principles and Conservation, Second Edition. Cambridge University Press, Cambridge, United Kingdom.

develops regional supplements to the Corps' *Wetlands Delineation Manual* to address differences in regional wetland characteristics.[53]

Below we provide specific examples of the geographic variability of wetlands throughout the country and how these examples will be affected by the proposed rule.

3.3.1. Western and arid landscapes

In Western arid environments, groundwater plays a critical role in the interconnectedness of wetlands and streams. Permanent surface water connections are not common in the West, and most wetland resources are connected to each other, or to streams and other navigable waters, through groundwater. Under the current proposal, this groundwater connection would not be enough to provide jurisdictional protection to these wetlands, yet the wetlands clearly serve to protect the physical, chemical and biological integrity of downstream waters. A spatial analysis conducted by Saint Mary's University, using GIS data from three different watersheds in Minnesota, Colorado and northeastern New Mexico, indicated that limiting CWA jurisdiction to only those wetlands that are adjacent to perennial and intermittent streams (and not ephemeral streams) would result in significantly fewer jurisdictional wetland acres in each watershed.[54] This difference is particularly pronounced in the arid southwest where estimates are that upwards of 90% of streams are ephemeral in nature.

For example, consider the headwater slope wetlands of the mountains of New Mexico. These wetlands, which are in higher-elevation areas, capture winter snow melt in the spring and hold it through the drier summer months. The soils in the wetlands have high organic matter content and can hold more water than mineral soils; therefore, the wetlands act like a sponge, holding water and slowly releasing it over time.[55] These wetlands are connected to lower-order streams through groundwater or by narrow, grassed-over channels that would generally be considered ephemeral streams. Under the proposed rule, these wetlands would no longer be protected by the CWA. The slope wetlands provide consistent water for high elevation grazing and are the primary water source for downstream agriculture. Impacts to these wetlands can reduce the water storage capacity of the landscape, and without the flood attenuation provided by the wetlands, storms and snow melt can lead to flash flood conditions downstream, which can cause property and crop damage. These wetlands currently store and release water over a long period of time, providing a dependable water source for downstream users (primarily agriculture) while also attenuating flood conditions.[56] While the state of New Mexico is in the process of developing a wetlands program plan, currently wetland impact permits are issued by the Corps;[57]

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[53] Wakeley, J. S. 2002. "Developing a 'Regionalized' Version of the Corps of Engineers Wetlands Delineation Manual: Issues and Recommendations," ERDC/EL TR-02-20, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

[54] Meyer, R. and A. Robertson. 2019. Clean Water Rule spatial analysis: A GIS-based scenario model for comparative analysis of the potential spatial extent of jurisdictional and non-jurisdictional wetlands. Saint Mary's University of Minnesota, Winona, Minnesota.

[55] Zeedyk, W.D., M. Walton, T. Gadzia. 2014. "Characterization and Restoration of Slope Wetlands in New Mexico: A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options." Quivira Coalition. Sante Fe, NM.

[56] Amigos Bravos. On-The-Ground Restoration. Carson National Forest Wetland Jewels Story Map. Taos, NM. Available at: https://amigosbravos.org/on-the-ground-restoration#WetlandGem

[57] Wetlands Program Plan for New Mexico, 2017. New Mexico Environment Department, Surface Water Quality Bureau. Updated February 20, 2017.

therefore, reducing or eliminating federal protection of these slope wetlands will put them at risk and has the potential to greatly affect downstream communities.

Similarly, in Arizona and New Mexico, groundwater-dependent and spring-fed wetlands known as cienegas play an important role in arid southwest ecosystems. Cienegas are freshwater or alkaline wet meadow wetlands with a shallow gradient that are often found in headwater areas alongside stream systems but are not directly connected to them. These wetlands consist of permanently saturated, organic soils and slow-moving water and are often associated with shallow headwater streams.[58] These wetlands provide important ecological value, including as habitat for rare, threatened and endangered plant and animal species, but also provide functions of flood control, nutrient filtration and groundwater recharge.[59] However, these wetlands are often not connected to associated stream systems by a "direct hydrologic surface connection," although they are certainly connected via groundwater interchange. Cienegas provide ecological services that directly affect the physical, chemical and biological integrity of downstream waters while also providing public health and safety functions to people throughout the southwest. The proposed rule would remove protections for these incredibly important wetland systems and open them up to even further degradation.

3.3.2. Prairie potholes

The western states are not the only parts of the country that will see significant and high-value wetlands lose protection under the proposed rule. Prairie potholes are a complex of glacially formed wetlands, usually occurring in depressions that lack permanent natural outlets, that are found from central Iowa through western Minnesota, Montana, eastern South Dakota and North Dakota. One of their most significant functions is floodwater abatement. Prairie potholes accumulate and retain water effectively and store water for long periods of time, thereby reducing flows to downstream waters. These wetlands also provide nutrient removal and transformation, effectively maintaining the chemical and biological integrity of downstream waters. Prairie potholes also provide high-value wildlife habitat. The region provides stopover habitat for 36 of the 50 shorebird species that regularly occur in the United States, provides habitat for at least 40 species of waterfowl such as terns and gulls and in a typical year is believed to sustain up to 10 million ducks.[60] However, prairie potholes are usually not connected to downstream waters by a direct hydrologic surface connection. Instead, they are connected to the stream network and other prairie potholes via shallow subsurface connections or intermittent and ephemeral surface connections. More than half of the wetlands in the prairie pothole region have already been lost, primarily by conversion to agriculture.[61] Continued loss of these valuable wetland resources, which is likely to occur under the proposed rule, would significantly impact ecosystem services and wildlife not just in the immediate region but also further afield. Flood storage and nutrient removal services affect the entire Mississippi River valley and migratory waterfowl travel throughout North America, affecting ecosystems and recreational hunting across the country.

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[58] Hendrickson, D.A., and W.L. Minckley. 1985. "Cienegas: Vanishing Climax Communities of the American Southwest." *Desert Plants.* 6(3).
[59] Cole, A.T. and C. Cole. 2015. "An Overview of Aridland Cienagas, with Proposals for Their Classification, Restoration, and Preservation." *The New Mexico Botanist.* Special Issue, No. 4.
[60] Fields, S.P., Ed. 2017. 2017 Prairie Pothole Joint Venture Implementation Plan. Prairie Pothole Joint Venture, March 2017.
[61] Ibid.

3.3.3. Carolina bays

Carolina bays are ponded depressional wetlands that are most abundant in North Carolina and South Carolina. Most bays receive water through precipitation, lose water through evapotranspiration and lack a direct hydrologic surface connection to other waters. Carolina bays typically are in proximity to each other or to streams, with hydrologic connections to each other and to downstream waters provided via overland flow during heavy rain events or by shallow subsurface connections. Historic human ditching of the bays is widespread and creates some surface connections to other waters, including to tributaries and estuaries. Carolina bays provide valuable ecological functions, including nutrient and sediment removal, as well as flood control. Bays also provide valuable wildlife habitat that is used extensively by a variety of waterfowl and wading birds. Similar to vernal pools, the lack of permanent hydrology, as well as the lack of a permanent hydrologic connection to other waters, means these wetlands are often devoid of predatory fish species, thereby providing valuable breeding habitat to amphibians, reptiles and aquatic invertebrates.[62] As described above for prairie potholes, under the current proposal, most Carolina bays would no longer be considered jurisdictional due to the lack of a direct hydrologic surface connection to other waters. A loss of federal protections to these wetlands would leave them vulnerable to impacts and development, which would have significant impacts on the natural and human communities of the region.

3.4. States' ability to protect wetlands

The proposed rule contends that loss of federal protection under the CWA will be replaced by state governments. However, current state-level wetlands protections provide little evidence to support this contention. State protection for wetlands is often much less than that provided by CWA regulations. Even states that have wetlands protections as strong as or stronger than the CWA would have difficulty trying to enforce them because they lack the staff and funding necessary, as described further in section 4.1.

Below we describe the potential impacts of the proposal on Ohio and Nevada.

3.4.1. Ohio

Ohio has lost 90% of its original wetlands.[63] However, it is considered by the Association of State Wetland Managers and others to have a robust wetland program compared with most other states.[64] In 1998 the state incorporated wetland water quality standards and a wetland antidegradation rule into administrative rules. The rules guide the regulation of federally jurisdictional wetlands in the state, which, at that time, were all the wetlands in the state.

The wetland antidegradation rule assigns wetlands into three categories with varying levels of protection depending on the quality/functional level of a wetland. While low- to good-quality wetlands (categories 1 and 2) can receive permits for development, there must be a demonstration of avoidance

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[62] Sharitz, R.R. 2003. "Carolina Bay Wetlands: Unique Habitats of the Southeastern United States." *Wetlands*. 23: 550-562.

[63] Dahl, T.E. 1990. Wetlands Losses in the United States, 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service. Washington, D.C. 13pp.

[64] Association of State Wetland Managers (ASWM). 2015. Status and Trends Report on State Wetland Programs in the United States.

of impacts as well as a justified need for category 2 wetlands. Lost wetlands require replacement at acreage ratios ranging from 1.5:1 to 2.5:1. Superior-quality wetlands (category 3) receive high levels of protection and can only be impacted for projects that clearly satisfy public need on a statewide basis. Replacement acreage ratios for category 3 wetlands range from 2.5:1 to 3:1.

Ohio has 15 FTEs working in its section 401 Water Quality Certification and Isolated Wetland Permit programs and has a robust monitoring and assessment program. In 2001 after the Supreme Court's *Solid Waste Agency of Northern Cook County* decision, the state legislature approved the Isolated Wetland Statute. While capturing an estimated 40% of Ohio's remaining wetlands, the Isolated Wetland Statute greatly reduced the amount of protections for wetlands compared with those afforded to federally regulated wetlands.

Staffing levels have remained unchanged, and the Corps continues to review all wetland delineations and determine which wetlands are federally jurisdictional and which fall under the state's Isolated Wetland Statute. Under the agencies' proposal, a greater percentage of wetlands would fall under the state-only jurisdiction of the Isolated Wetland Statute, which provides a much lower level of protections. The new level of demands on the state wetland permitting program could exceed the ability of the current staff to effectively review and administer all permit applications, and the state does not have an identified source of funding to hire additional staff. Even in a state like Ohio with a robust wetland program, the agencies' proposal will reduce the level of wetland protection.

3.4.2. Nevada

While Nevada has a state wetland program plan approved by EPA,[65] it has less than one FTE assigned to its wetland program. The state relies solely on section 401 certification, conducts no joint permitting with the Corps and for compensatory wetland delineation, defers to the Corps. The state has not adopted a goal of no net loss, nor does it have wetland-specific water quality standards. It acknowledges that "the level of protection afforded wetlands is greater on public land than on non-federal land," due in part to CWA safeguards.[66] Therefore, it is unlikely that Nevada, which is 86% federal land, will fill the gap left by reduced federal jurisdiction. Nevada has already lost 52% of its original wetlands[67] and potentially could lose much of the remaining wetlands under the proposed rule.

Overall, very few states are prepared to take over the wetland protection work that is currently being performed by the larger, highly qualified and experienced staff within the Corps and EPA. Idaho, Kansas, Montana, Nebraska, New Mexico, Oklahoma, Utah and Wyoming all have fewer than one FTE assigned to conducting wetland regulation duties. The only exceptions are Michigan and New Jersey, which have assumed the section 404 program in their states. Even states with strong wetland programs will be overwhelmed by the amount of work that would be transferred from the Corps and EPA to them. Almost all states would be hesitant to take on the new responsibilities, due to a lack of funding and other missing resources. If some did decide to take over the additional regulatory burden, it would not

[65] Nevada Natural Heritage Program. 2016. State of Nevada Wetland Program Plan 2017-2022. Carson City: NNHP. 17 p. Available at http://heritage.nv.gov/node/310.

[66] Nevada Wetlands Priority Conservation Plan. 2006. Ed Skudlarek, Editor. Nevada Natural Heritage Program. Available at http://heritage.nv.gov/sites/default/files/library/wetplan2006.pdf.

[67] Dahl, T.E. 1990. Wetlands Losses in the United States, 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service. Washington, D.C. 13pp.

happen overnight. Rather, it would likely take several years to develop the funding sources and institutional knowledge needed to run a comprehensive wetland program that has the staff, legal support, facilities and equipment required to perform the necessary tasks effectively.

3.5. Case studies

3.5.1. North Carolina and the importance of wetland protections for extreme weather events

North Carolina has now experienced multiple 500-year storms within the last two decades. Hurricane Floyd (1999) decimated eastern North Carolina, causing $6.5 billion of damage. Hurricane Matthew (2016) brought as much as 18 inches of rain, flooding homes, damaging infrastructure and causing $1.9 billion of damage. Hurricane Florence (2018) and Tropical Storm Michael (2018) hit North Carolina within one month of each other, shattering previous rainfall and flooding records across the state. Florence dumped up to 35 inches of rain and caused an estimated $17 billion of damage in North Carolina alone.[68] Michael dumped another 6 inches to 10 inches of rain on the already-waterlogged state.

These storms put both people and infrastructure in harm's way. Hurricane Florence impacts in North Carolina included the following:

- Loss of life of more than 40 people.
- Numerous wastewater failures throughout the state. The North Carolina Department of Environmental Quality estimates 61 different wastewater treatment plants sent 66.8 million gallons of untreated sewage into waters and 516 sanitary sewer overflows released 54.9 million gallons of wastewater.[69]
- Statewide, more than 2,000 roads closed, including sections of I-40 and I-95.
- An estimated 3.4 million dead poultry and 5,500 dead hogs from flooded animal houses.
- Breaches and/or overflows of more than 30 concentrated animal feeding operation waste lagoons.[70]
- An estimated $17 billion of total damage to North Carolina, including municipal and personal property damage.[71]

In addition, Hurricane Florence caused significant water quality issues in multiple rivers throughout the state. There was an oxygen dead zone in the Cape Fear River that lasted 10 days and killed numerous fish, including endangered Atlantic sturgeon.[72] Reports from the Waccamaw River estimated 100,000 dead fish. State agencies are still assessing the long-term damage from the storm.

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[68] Feaster, T.D., Weaver, J.C., Gotvald, A.J., and Kolb, K.R., 2018, Preliminary peak stage and streamflow data at selected U.S. Geological Survey streamgaging stations in North and South Carolina for flooding following Hurricane Florence, September 2018: U.S. Geological Survey Open-File Report 2018–1172, 36 p., https://doi.org/10.3133/ofr20181172.

[69] Data is collected from the North Carolina Department of Environmental Quality (NC DEQ) and can be accessed at https://edocs.deq.nc.gov/WaterResources/Browse.aspx?dbid=0&startid=753849&cr=1.

[70] Data collected by the NC DEQ and can be accessed at https://deq.nc.gov/news/deq-dashboard#animal-operations---swine-lagoon-facilities.

[71] Estimate from the NC Governor's office: https://governor.nc.gov/news/updated-estimates-show-florence-caused-17-billion-damage.

[72] Data tracked by the NC Wildlife Resources Commission and NC DEQ. For fish related info, see: http://ncwrc.maps.arcgis.com/apps/StoryMapBasic/index.html?appid=ad8a80a017604669ac2b6a83a5738ffd,

Both the state of North Carolina and federal agencies are putting extensive time and resources into determining how to reduce the impacts of big storms. The North Carolina General Assembly has already appropriated $700 million to Hurricane Florence impacts, and it is likely to appropriate another $90 million.[73] The recently proposed disaster package in the U.S. Senate contained $13 billion for states and territories recently impacted by hurricanes, wildfires, earthquakes and other natural hazards.

Nevertheless, North Carolina will have many communities that remain at significant risk of flooding. TNC analyzed municipal boundaries using a spatial data layer called the Active River Area that approximates areas likely to flood in large storms.[74] For the Neuse and the Cape Fear river basins, both of which experienced flooding in hurricanes Matthew and Florence (figure 7), TNC found that 116 municipalities (63%) have at least 10% of their land areas in locations prone to flooding. Of these, 16 municipalities have greater than 50% of their municipal boundaries in flood-prone locations. Within just the Cape Fear River basin, there were 53 wastewater treatment plants and 200 public drinking supply wells in the flood-prone locations.

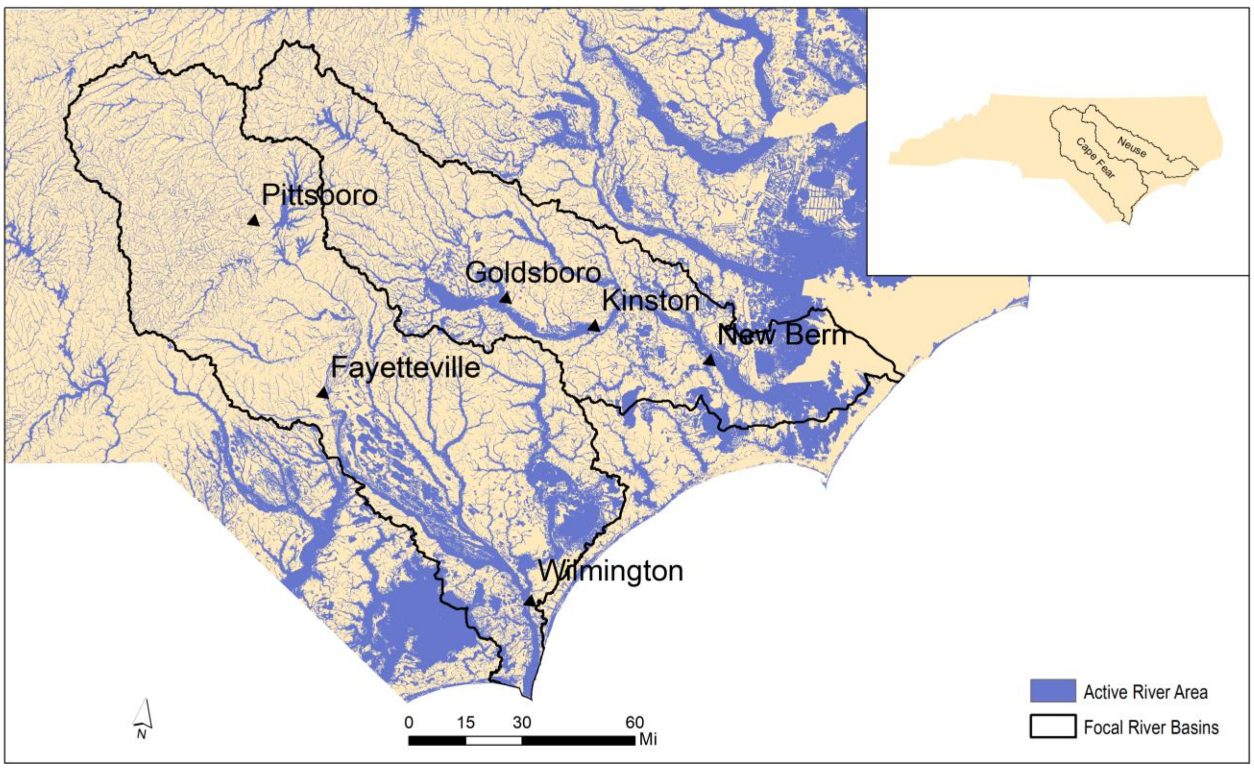

Figure 7. Flood-prone areas for the Cape Fear and Neuse river basins in North Carolina.

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https://www.ncwildlife.org/News/wildlife-commission-biologists-investigate-widespread-fish-kills-after-hurricane-florence, and https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/nc-fish-kill-activity/fish-kill-events.

[73] Fain, Travis. "Cooper signs $800M Florence relief package into law." WRAL, October 15, 2018. Available at https://www.wral.com/legislature-approving-800-million-in-florence-relief/17918141/

[74] For documentation about the Active River Area data layer, to download the free data, and to see published reports about the Active River Area, visit The Nature Conservancy's Conservation Gateway at https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/freshwater/floodplains/Pages/default.aspx

By requiring a visible surface hydrological connection, many types of wetlands, including wetlands that are directly adjacent to jurisdictional streams, will lose federal protection. For example, the picture in figure 8 depicts a stream in the Piedmont of North Carolina in a river basin that experienced multiple hurricanes. The stream is intermittent but contains water the majority of the year and is considered a jurisdictional stream under the 1986 definition of CWA jurisdiction. The areas alongside the stream contain hydric soils, wetland vegetation and high-water marks from floods, clearly representing a riparian wetland. Yet this riparian wetland does not have a visible surface water connection except in large storms. TNC does not think this will be jurisdictional under the proposal, meaning this wetland no longer requires a federal permit to develop on it.

Figure 8. A riparian wetland in the Piedmont of North Carolina in the Neuse River basin, which experienced multiple hurricanes. This riparian wetland only has a visible surface water connection during high-water events. Otherwise, the hydrology consists of shallow, subsurface flow and likely does not meet the newly proposed definition of federal waters.

If development were to happen on this wetland, permeable soils that can absorb floodwaters are turned into impervious surfaces, such as roads and pavement, that send more water to the downstream environment. The downstream environment also will receive more pollution due to the lost nutrient processing and pollution retention capacities of the degraded wetland. This wetland alone cannot stop huge storms, but it can reduce the impacts on the downstream environment. Wetlands collectively help buffer people and infrastructure from damage.

The agencies' economic analysis categorizes North Carolina multiple times as a state that is "likely to provide partial regulatory coverage of waters that would no longer be 'waters of the United States' and may continue baseline regulatory practices." North Carolina does have state protections on wetlands, but these protections were put into place prior to 2010. Since 2010, the North Carolina General Assembly has systematically rolled back protections on state definitions of wetlands and buffers.[75] In several specific water basins, the state has mandated that local regulation cannot be more stringent than the state's definition.[76] In the foreseeable timeframe, it is unlikely that the state of North Carolina will increase protections on wetlands and buffers if federal protections were to loosen.

The federal definition of waters and wetlands is important to North Carolina as big storms are becoming a more frequent occurrence. Significant state and federal funds are going toward buying people out of flood zones and creating healthy wetlands that can absorb floodwaters. Yet this can all be undone quickly if development can occur with no permit that requires accounting for downstream impacts. As with previous TNC comments, TNC encourages the EPA to consider the physical, biological and chemical connections when determining the definition of waters. That ensures the most critical waters and wetlands are jurisdictional, which in turn helps governments deal with large storms and floods.

3.5.2. Wisconsin

Saint Mary's University assessed the potential ecosystem service impacts of narrowing CWA jurisdiction in three western U.S. watersheds.[77,78] Here, we build from the Saint Mary's approach to explore impacts and uncertainties of the agencies' proposal on the waters of Wisconsin at a statewide scale and in a set of watersheds that are the focus of significant conservation investments by EPA, TNC, state agencies and many other partners. Our analysis also relies on a decision support tool called *Wetlands by Design: A Watershed Approach for Wisconsin*[79] that prioritizes Wisconsin's wetland protection and restoration opportunities according to ecosystem service returns, including flood abatement, water quality improvement (sediment retention and nutrient transformation) and stream base flow maintenance, that TNC and partners developed in 2018.

While the Wisconsin and Saint Mary's approaches are similar in how wetland ecosystem services were assessed, they differ in the determination of what would be federally protected versus unprotected under the agencies' proposal. The Wisconsin approach uses the building blocks of ecosystem service assessments—such as wetland hydrologic inputs and outputs and association with water bodies and water flow paths—to determine proposed CWA jurisdiction. Specifically, using an approach known as

[75] Wittenberg, Ariel. "WOTUS rollback seen as death blow for 'very unique habitat'." E&E News, October 2, 2017. Available at https://www.eenews.net/stories/1060062183.
[76] There are several legislative examples, including the NC General Assembly 2017-2018 session Senate Bill 434 which prevents local governments from enacting stricter buffer rules than state law: https://lrs.sog.unc.edu/bill-summaries-lookup/S/434/2017-2018%20Session/S434.
[77] Meyer, R., and A. Robertson. 2019. Clean Water Rule spatial analysis: A GIS-based scenario model for comparative analysis of the potential spatial extent of jurisdictional and non-jurisdictional wetlands. Saint Mary's University of Minnesota, Winona, Minnesota.
[78] http://smumn.maps.arcgis.com/apps/Cascade/index.html?appid=f3de6b30c0454c15ac9d3d881f18ae33
[79] www.WetlandsByDesign.org

NWI Plus[80,81] we considered the relationship of wetland characteristics (landscape position, landform, associated water body type and waterflow path) to assign individual sites to three categories of federal protection under the new proposal: protected, unprotected and uncertain (Table 1).

Table 1. NWI Plus modifiers used to approximate federal protection status for Wisconsin wetlands under proposed changes to CWA jurisdiction.

Wetland Modifier	***Protection Status***	***Description***
Landscape Position		**The relation of the wetland to a water body**
Terrene	unprotected	Not influenced by hydrologic inputs from a stream, river or lake
Landform		**The physical shape/location of the wetland**
Fringe	protected	Occurs in the shallow water zone of a permanent stream, river or lake
Floodplain	uncertain	Occurs on an active alluvial plain along a river or stream
Floodplain Fringe	protected	Encompasses elements of both Fringe and Floodplain
Waterflow Path		**Water flow path relative to the wetland**
No surface connection	unprotected	Wetland has no surface water connection to other wetlands and waters
Inflow	uncertain	Receives concentrated surface water with no outflow
Outflow	protected	Surface water outflow via natural channels; no channelized inflow
Outflow Intermittent	unprotected	Surface water outflow via intermittent channels; no channelized inflow
Outflow Artificial	uncertain	Surface water outflow via artificially manipulated or created channels; no channelized inflow
Throughflow	protected	Surface water inflow and outflow via natural channels
Throughflow Intermittent	unprotected	Surface water inflow and outflow via intermittent channels
Throughflow Artificial	uncertain	Surface water inflow and outflow via artificially straightened or created channels
Bidirectional	protected	Adjacent to lake; wetland hydrology influenced by changing lake levels
Connection Intermittent	unprotected	Intermittent unmapped surface connection to a stream, river or lake

3.5.2.1. Impacts of the proposal on the areal extent of Wisconsin wetlands

Historically, Wisconsin's wetlands covered approximately 11 million acres,[82] or 26% of the state's total land area. Due to surface drainage, subsurface drainage and filling to convert wetlands to other land uses, that number has declined by 41% to approximately 6.4 million acres, or 15% of the state (figure 9a). According to our assessment, the proposed changes would remove federal protection from an

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[80] Tiner, R.W. 2003. Correlating Enhanced National Wetlands Inventory Data with Wetland Functions for Watershed Assessments: A Rationale for Northeastern U.S. Wetlands. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Region 5, Hadley, MA. 26 pp.

[81] Tiner, R.W. 2005. Assessing cumulative loss of wetland functions in the Nanticoke River Watershed using enhanced National Wetlands Inventory data. Wetlands 25(2).

[82] Conservatively estimated, based on current wetland maps (Wisconsin Wetland Inventory) and mapping of likely previously converted wetlands (Wisconsin's Potentially Restorable Wetland data, version 3.1).

estimated additional 4.2 million to 4.5 million acres (66% to 71%) of Wisconsin's remaining wetlands (figure 9b).

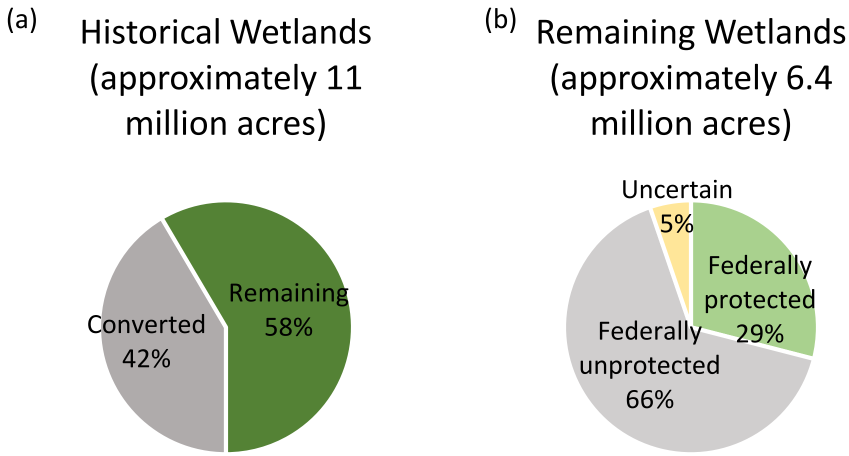

Figure 9. Proportion of Wisconsin's historical wetlands that have been converted and are remaining (a), and proportion of Wisconsin's remaining wetlands that would be protected or unprotected or are of uncertain status under the agencies' proposal (b).

3.5.2.2. Lack of clarity in the agencies' proposal

The uncertain status of wetlands shown in figure 9b can be attributed to lack of clarity in the agencies' proposal around which wetland hydrologies would be protected or unprotected. In particular, we discuss hyporheic flow associated with floodplain wetlands and artificial surface flow associated with ditches.

Hyporheic flow (floodplain wetlands)

As discussed in the case study on the importance of North Carolina wetlands in mitigating extreme events (section 3.5.1), floodplain wetlands provide many ecosystem services, including playing important roles in maintaining stream flow and desynchronizing floods by supporting subsurface hyporheic flow, which is adjacent to the stream channel and contributes to stream flow.

The Wisconsin assessment supports the assertions in section 3.5.1 regarding the values of floodplains for people and communities. In our analysis, floodplain wetlands (as distinguished from Floodplain-Fringe, which is more likely to exhibit standing water and was assigned to the protected category) cover approximately 230,000 acres in Wisconsin, accounting for approximately 3.5% of Wisconsin's remaining wetlands. However, these wetlands deliver a disproportionate share of ecosystem services: They provide 5% of Wisconsin wetlands' flood abatement potential, 8% of wetlands' surface water supply potential (i.e., stream base flow support), 6% of wetland sediment and sediment-bound phosphorus capture potential and 5% of wetland nutrient transformation potential.

Artificial surface flow (ditches)

The proposal relies on surface hydrological connections for federal jurisdiction but lacks clarity on the status of wetlands supplied by and associated with artificial drainage, or ditches. The hydrologies of wetlands designated in our assessment as throughflow artificial have been altered via ditching. In combination with sites assessed as inflow (i.e., receiving surface inputs but exhibiting no outflow via surface channels to streams or rivers), the status of which is also ambiguous in the proposal, these wetlands account for approximately 100,000 acres, or 1.5% of Wisconsin's remaining wetlands. At a statewide scale, these figures may seem relatively small. However, these ambiguities would be very problematic in making jurisdictional determinations in certain portions of the landscape, such as the central part of Wisconsin where ditching is prevalent (figure 10). Further, ditches are notoriously difficult to map comprehensively and likely would require site-by-site determinations to achieve jurisdictional certainty. Subsurface drainage (e.g., drainage tile) is even more difficult to map.

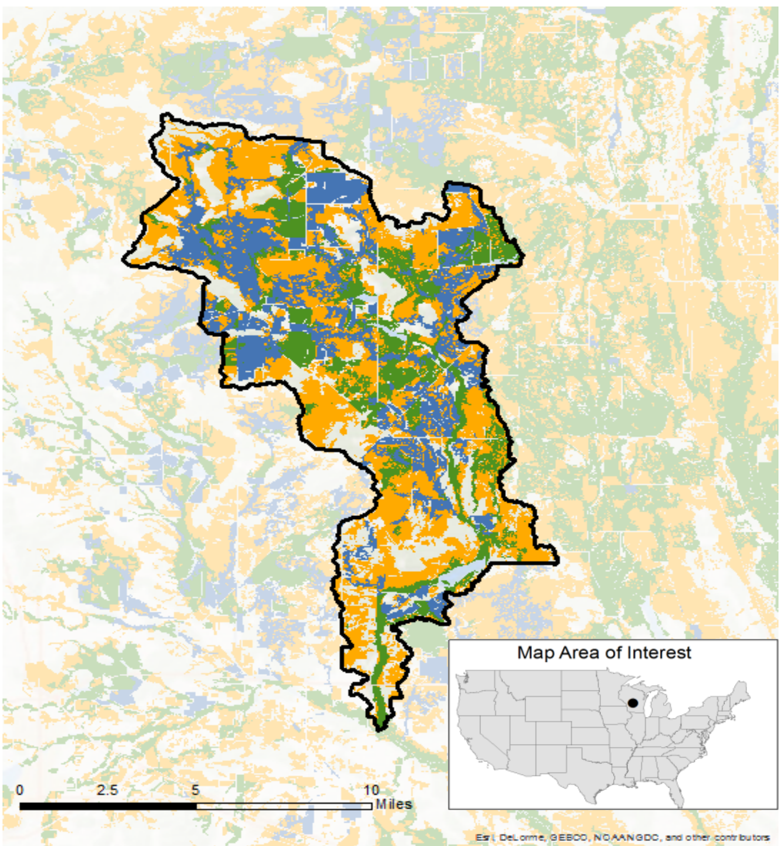

Figure 10. Beaver Creek watershed of central Wisconsin, showing likely protected wetlands (green), likely unprotected wetlands (orange) and wetlands of uncertain protection status due to ambiguity in the proposed rule (blue).

3.5.2.3. Impacts of the proposal on Wisconsin's water quality

In Wisconsin, sediments suspended in streamflow, along with the phosphorus bound to sediments,[83] are of particular concern for water quality of streams and lakes. Wetlands improve water quality by

[83] Wisconsin Department of Natural Resources and UW-Extension. 2013. Wisconsin's Nutrient Reduction Strategy. https://dnr.wi.gov/topic/SurfaceWater/nutrient/combined_draft.pdf

transforming harmful nitrates to harmless gas, capturing phosphorus that would otherwise contribute to lake hypoxia, trapping sediments and slowing flows at the watershed scale to reduce erosion during events. These services help to maintain drinking water standards, improve habitat for aquatic biodiversity, benefit fishing industries, increase tourism and water-based recreation opportunities and maintain waterfront property values.

While the agencies' proposal would leave 66% of Wisconsin's wetlands without federal protection, statewide the impact on wetlands' potential to address the state's sediment and phosphorous problems would be more extensive. The proposal would remove federal protections from 86% of Wisconsin wetland potential to provide sediment and phosphorus reduction. Further, 92% of wetland potential to remove sediments and phosphorus would be at risk if federal protections are also removed from floodplain wetlands.

To illustrate the impacts of the proposed changes on Wisconsin's waters, we provide an example from the lower Fox River watershed and its contributions to a hypoxic zone in the Bay of Green Bay in northeastern Wisconsin. With economies, livelihoods, public health and biodiversity at risk, this area—designated a Great Lakes Area of Concern by EPA—focuses the efforts and resources of a large coalition of partners including EPA, U.S. Fish and Wildlife Service, Wisconsin Department of Natural Resources, TNC, the city of Green Bay's water utility, the Oneida Nation, county governments, local land trusts and others.

Historical wetland losses, primarily due to conversion to cropland through surface and subsurface drainage, have dramatically compromised the potential for wetlands to maintain water quality in the lower Fox River and the Bay of Green Bay. Two of the subwatersheds contributing particularly high amounts of sediment and phosphorus to the system—Kankapot Creek and Plum Creek[84]—in combination have lost 88% of their historical wetland distribution. Of the 12% of wetlands that remain, 63% would be removed from federal protection due to the proposed changes, which would put at risk 78% of the remaining potential for Plum-Kankapot wetlands to address phosphorus and sediment issues in the lower Fox/Green Bay Area of Concern. These watersheds are no longer equipped with the natural infrastructure needed to address elevated phosphorus and sediment loads.

[84] The Cadmus Group, Inc. 2012. Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended Solids in the Lower Fox River Basin and Lower Green Bay. https://dnr.wi.gov/topic/TMDLs/documents/lowerfox/LowerFoxRiverTMDLReport2012.pdf

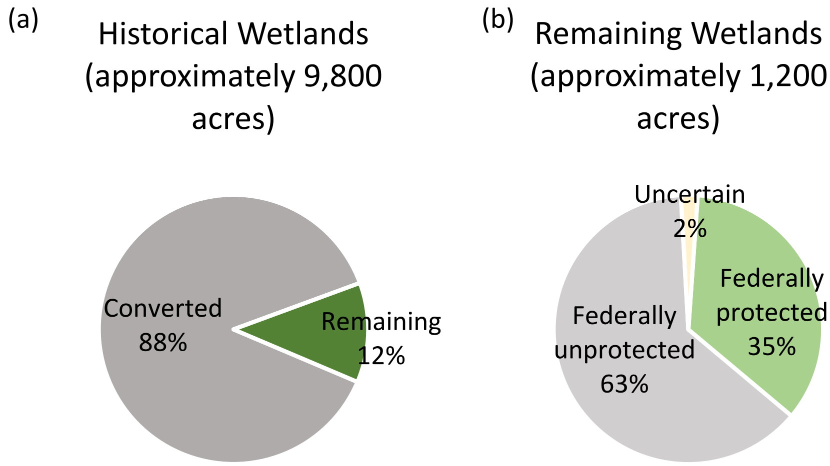

Figure 11. Proportion of historical wetlands in the Plum-Kankapot watersheds that have been converted and are remaining (a) and proportion of remaining wetlands in the Plum-Kankapot watershed that would be protected, unprotected or of uncertain status (e.g., floodplain wetlands) under the agencies' proposal (b). Loss of federal protections would put at risk 78% of the remaining phosphorus and sediment reduction potential of wetlands in the watershed (up to 82% if floodplains are also unprotected).

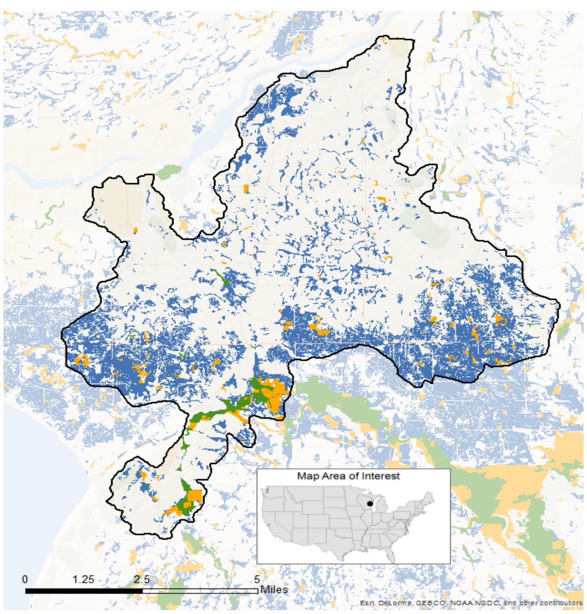

Figure 12. Plum-Kankapot watershed of northeastern Wisconsin, a major contributor of sediment and phosphorus to the Bay of Green Bay's hypoxic zone. Historical wetlands that have been drained and converted to upland land uses are shown in blue, remaining wetlands likely to be protected under the proposed definitions are shown in green, and remaining wetlands likely to be unprotected are shown in orange. Watersheds with very high historical loss of wetlands may be disproportionately impacted by the proposal relative to watersheds with more intact wetland networks.

It is crucial to protect remaining wetlands in the Plum-Kankapot watershed to abate water quality issues, and this lesson may be extended to other areas: Watersheds that have already been compromised by historical wetland losses will be affected disproportionately relative to watersheds with a greater portion of their historic wetland distribution intact.

Further, it is important to note that wetland restoration and creation is a key strategy of the array of partners addressing water quality in the lower Fox River/Green Bay system. A reduction in federal wetland protections would run counter to cleanup efforts by federal agencies and other partners, including EPA, offsetting water quality gains and undermining public and private conservation investments.

3.5.2.4. Additional data, modeling and analysis needs

While the Wisconsin assessment provides a high-level overview of potential issues with the proposal, it was constrained to the 60-day comment period. Additional time would be required to more thoroughly and accurately model and examine implications of the proposal on waters, wildlife and human health and well-being in Wisconsin. Substantial additional time would be required to conduct the assessment at a national level. We recommend that the agencies conduct modeling to further explore impacts of the proposal across the nation or in comprehensively representative basins. Further, we recommend that all modeling incorporate a field component for model validation and improvement.

Models can and should be used to explore the potential impacts of redefining CWA jurisdiction. However, due to data limitations, modeling assumptions and uncertainty in results, models should never be used to make jurisdictional determinations. The production of reliable jurisdictional maps using spatial data and modeling alone is not possible. While the proposed changes aim to streamline jurisdictional determinations, they do not obviate the need for field-based assessments and jurisdictional determinations.

3.6. TNC impact: Chesapeake Bay—Securing clean water and protecting critical habitats in our nation's largest estuary

The Chesapeake Bay is the nation's largest estuary, stretching more than 200 miles in length and covering 64,000 square miles of streams, rivers, forests, farms and cities in six states and the District of Columbia. The bay's health and its ability to meet society's many needs depend on clean water. Yet the bay is polluted with nitrogen, phosphorus and sediment from agricultural operations, urban and suburban runoff, wastewater, airborne contaminants and other sources. The excess nutrients and sediment lead to murky water and algal blooms, which block sunlight from reaching and sustaining underwater bay grasses. Murky water and algal blooms also create low levels of oxygen for aquatic life, such as fish, crabs and oysters.[85]

Despite extensive restoration efforts since the 1980s and prompted by insufficient restoration progress and poor water quality in the Chesapeake Bay and its tidal tributaries, on December 29, 2010, the EPA established the Chesapeake Bay total maximum daily load (TMDL). A TMDL is the calculation of the maximum amount of pollution a body of water can receive and still meet state water quality standards to support aquatic life. When the Chesapeake Bay TMDL was established, monitoring data continued to

[85] This description draws from the EPA's Chesapeake Bay TMDL fact sheet available at https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-fact-sheet. Last accessed on March 6, 2019.

show that the bay had poor water quality, degraded habitats and low populations of many species of fish and shellfish.

Actions taken under the TMDL, which to date include restoring more than 9,000 acres of wetlands and 9,000 miles of forests along streams and rivers, will have significant benefits far beyond the Chesapeake Bay itself. Benefits include helping to clean rivers and other waterways that support local economies and recreational pursuits, such as fishing and swimming, and serve as drinking water sources.

Since establishment of the TMDL, TNC has led a coordinated program to support the clean water goals identified in the TMDL. Our work focuses on using nature and natural filters such as forests and wetlands to help reduce pollution in the streams and rivers that flow into the Chesapeake Bay. In our program, we work with farmers to increase their crop yields while reducing polluted runoff, help cities reduce their water treatment costs by restoring nature and help rebuild the bay's natural infrastructure such as oyster reefs.

Here are three examples of TNC's conservation work in the bay:

- **Protecting land to secure habitat, clean water and our investments in restoration.** TNC helped secure more than 3,000 acres of habitat in Maryland over the past few years, including 1,000 acres of wetland protection on the Eastern Shore, 650 acres added to Pocomoke River State Forest and 300 acres protected by a conservation easement in the Nanticoke Rural Legacy Area. In Virginia, we helped create and direct funding to a pilot project demonstrating that nearly 3 million pounds of new pollution could be avoided and more than $120 million could be saved in the Rappahannock River basin alone if additional provisions to protect forests are put in place. The project is now in its second phase and is working directly with local government officials to develop tools they can use to more effectively conserve forests.
- **Accelerating wetland restoration.** In Maryland, we worked with partners to implement the largest wetland restoration project in the state's history along the Pocomoke River. The project encompasses roughly 4,000 acres of floodplain along 9 miles of the river. We also created a living laboratory in a headwaters of a priority tributary to the Chesapeake Bay where restoration of nearly 350 acres of marginal farmland and enhancement of an additional 350 acres of existing forest will reduce nutrients and sediment to the Chesapeake Bay and showcase a diversity of techniques to inspire other landowners to perform restoration. In Pennsylvania, we are restoring the natural channel and stream flow of a half-mile segment of Tom's Run, improving water quality, fish habitat and recreation opportunities in a high-quality trout stream.
- **Reducing stormwater runoff and pollution in Washington, D.C.** Stormwater runoff is the fastest-growing source of water pollution in the Chesapeake Bay, making it a top priority for us. In 2018, we replaced approximately 18,000 square feet of impervious surface with rain gardens in the initial phase of a two-phased project at historic Mount Olivet Cemetery in Washington, D.C. The first-of-its-kind green infrastructure project is expected to prevent the runoff of millions of gallons of stormwater into the nearby Anacostia River, while also serving as a model for other cities around the country. Our financial partners on this project helped demonstrate a new way to use investor capital to drive conservation, and they are seeing a profitable return.

TNC's success in the Chesapeake Bay is possible because we raised and invested millions of dollars of private funds to support and leverage federal and state government funding, fill gaps in other government efforts and represent the commitment of thousands of citizens to clean water. The proposed rule change threatens investments that TNC and others have made and the cleaner water communities are enjoying as a result. Communities whose livelihoods depend on clean water are most at risk. Watermen, who harvest crabs, oysters and fish and live along the bay's shores, would bear disproportionate impacts of this proposed change, as progress toward clean water could reverse.

Wetlands provide many benefits to society including replenishing water supply, providing nurseries for fish, protecting shorelines, providing habitat for plants and animals and reducing flooding. Specific to meeting the TMDL targets, wetlands are an effective way to remove excess nutrients, too. There are 1.5 million acres of wetlands in the Chesapeake Bay watershed. This is half of what existed historically. The 1.5 million acres we have lost in the watershed had the capacity to remove 50 million pounds of nutrient pollution every year. Achieving the same amount of water treatment would cost $500 million. Accelerating the loss of wetlands in the watershed will also place additional demands on efforts to restore wetlands, already a challenging area to meet our goals. Continuing wetlands loss deprives the watershed of critical water filtration capacity, resulting in greater flood risks and dirtier water.

Meeting the TMDL targets is already a challenging goal. Losing the water quality benefits of wetlands by changing CWA jurisdiction as proposed would be a step in the wrong direction, increasing the demands and costs on those working to restore the Chesapeake Bay.

4. Economic analysis

In the agencies' economic analysis, the agencies estimate the costs and benefits of the proposed revision in a two-step process. First, the agencies estimate the costs and benefits of moving from the current definition of waters of the United States, which was enacted in 2015, to the pre-2015 rule. This is referred to as the stage 1 analyses. Second, the agencies estimate the costs and benefits of moving from the pre-2015 rule to the currently proposed rule. This is referred to as the stage 2 analyses.

In each of these analyses, the agencies estimate the costs of the change in each stage, referred to as the foregone benefits, as the loss in value of ecosystem services that would occur as the result of the proposed change. Most notably, these foregone benefits include the loss in ecosystem service value that would occur if certain wetlands are no longer required to be protected. Ecosystem services provided by wetlands are varied and include improving water quality, providing flood protection, enhancing recreational opportunity, providing habitat for wildlife, serving as breeding grounds for fish and other aquatic life and enhancing scenic value.

In each of these analyses, the agencies also estimate the benefits of the change, referred to as the avoided costs. These avoided costs include cost savings from a reduction in permit applications and a reduction in costs associated with replacing wetland habitat impacted by development that would occur as the result of the proposed change. To assess the benefits, the EPA estimates the number of permit applications that would no longer be necessary under the proposed rule, the cost of those permit applications and any relevant wetland habitat offset that would no longer be required.

Throughout the agencies' economic analysis, they assume that state, tribal or local programs are able to effectively regulate waters under their own programs. Specifically, the agencies note that "[c]hanging the definition of 'Waters of the United States' in a way that reduces the amount of aquatic resources under federal jurisdiction effectively hands sole regulatory authority of those resources to the states and tribes." The agencies go on to note that states and tribes may choose to respond to the proposed rule by maintaining or increasing their current state regulations to regulate waters that would no longer be jurisdictional under the proposed rule. Effectively, this assumption means that the agencies exclude the costs and benefits from states who will continue a dredge or fill permitting practice and/or who will at least partially regulate waters that would no longer be regulated as a result of the proposed rule. In practice, the agencies exclude the costs and benefits from 23 states under the section 402 (National Pollutant Discharge Elimination System permitting) analysis and 21 states under the section 404 (Dredged and Fill Materials, Wetlands) analyses in their primary calculations (referred to as Scenario 1).

Below we address three important potential impacts of the proposed rule that are not accounted for within the agencies' economic analysis. These include the following:

- Capacity gaps in many states and tribes limit their ability to effectively regulate their waters in the absence of federal regulations. These states and tribes may face either regulatory barriers and/or funding or staff capacity barriers.
- Cross-jurisdictional costs and benefits are not currently accounted for in the agencies' analysis. Watersheds that cross state and tribal boundaries with differing regulations may create costs and benefits that are not accounted for in the agencies' economic analysis.
- The agencies do not account for, or significantly underestimate, several important costs of the proposed rule. For example, the agencies' economic analysis does not account for the lost water quality benefits that would result from the proposed rule, and it significantly underestimates costs associated with flood impacts.

4.1. State and tribal capacity gaps

The proposed rule reduces the type of waters that would be covered by the waters of the United States definition. For a reduction in the type of waters that are federally regulated to be beneficial, states must be able to implement and fund their own state water programs on the federally excluded waters when necessary. However, 36 states have laws that restrict their ability to regulate waters that are not regulated by waters of the United States.[86] For example, the Arizona Department of Environmental Quality cannot enact any regulations that are more stringent than the EPA's enforcement of waters of the United States.[87] These regulatory barriers mean if a rule is enacted reducing the area of waters of the United States that are regulated federally, some states will be required to reduce the areas regulated at the state level as well. Moreover, states that the agencies have identified as maintaining regulations on some waters that would no longer be regulated under the proposed rule may still lack capacity or current regulations to maintain these regulations going forward. For instance, North Carolina has been identified as "likely to provide partial regulatory coverage of waters that would no longer be 'Waters of the United States' and may continue baseline regulatory practices." North Carolina, however, has systematically been removing state protections of wetlands since 2010.

In addition, even states that may legally be able to regulate waters left non-jurisdictional by waters of the United States may not be able to effectively regulate these waters due to capacity constraints. As of

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[86] State Constraints: State-Imposed Limitations on the Authority of Agencies to Regulate Waters Beyond the Scope of the Federal Clean Water Act, 2013 Environmental Law Institute, Washington, D.C.
[87] See Arizona Revised Statute 49-255.01, Subpart B.

2014, the Association of State Wetland Managers reported that nine states have fewer than one FTE overseeing all wetland regulatory work. In addition, seven states do not provide staff time for wetland monitoring and assessment, and 20 states do not provide staff time for wetlands water quality.[88] The proposed rule would shift the burden of implementation and monitoring to states, especially for states that choose to regulate waters no longer regulated at the federal level. These states would inevitably see a large increase in permit applications. In many instances the costs to states of implementing their own regulatory program for waters not covered by waters of the United States could be prohibitive, both in terms of regulatory hurdles and staff capacity constraints.

Additionally, state laws imposing limitations on the authority of state agencies, and to some extent municipalities, to protect aquatic resources are commonplace. Although these laws vary significantly in their scope and application, they can constrain, and in some cases eliminate, the ability of state regulators to protect waters no longer covered by the federal CWA. For instance, 19 states are mandated not to regulate waters more rigorously than required by the CWA, and 36 states have laws that could restrict the authority of the state agencies or localities to regulate waters left unprotected by the federal CWA.[89] Since these laws are statutory, they do not affect the ability of state legislatures to alter them or to enact additional water protections. However, the prevalence of these state constraints across the country, together with the reality that only half of all states already protect waters more strongly than what is required by federal law, suggest that states are not currently filling the gap left by U.S. Supreme Court rulings limiting the CWA and face significant obstacles to doing so.

Most states do not have the capacity or funding to implement new laws or protections. This inability and lack of will to take over jurisdiction of waters means most of the states are predisposed to let the federal government protect these waters and decide which wetlands and streams get protected.

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[88] See Association of State Wetland Managers, 2015. Status and Trends Report on State Wetland Programs in the United States. Most states do not have viable, stand-alone programs that could quickly be adapted to fill the gaps left by the large reduction of federal jurisdiction. For instance:

- Of the 29 states that have considered assumption of the 404 Program, only two—Michigan and New Jersey—have assumed that task.
- Only 26 states have a “no net loss” or a “net increase” of wetlands goal.
- Number of Full Time Employees (FTEs) working in wetland regulation:
    - 1 state has no staff
    - 9 states have <1 FTE
    - 11 states have 1-4 FTEs
    - 7 states have 5-9 FTEs
    - 4 states have 10-19 FTEs
    - 10 states have >20 FTEs
    - 9 states provided no info on FTEs
- EPA has only approved the wetland programs in 25 states. 10 states are working on approval and the other 15 states have no plans for having an approvable wetland program.
- 31 states rely on the Corps for administration and enforcement of their State Programmatic General Permits.
- Only 23 states have their own dredge and fill permits.
- Since the SWANCC decision in 2001, only five states have developed a program to protect the large number of wetlands that fell out of federal jurisdiction.

[89] State Constraints: State-Imposed Limitations on the Authority of Agencies to Regulate Waters Beyond the Scope of the Federal Clean Water Act, 2013 Environmental Law Institute, Washington, D.C.

4.2. Cross-jurisdictional costs and benefits

The sum of estimated state-level costs and benefits do not sufficiently account for the full impacts of the proposed rule. In its primary analysis, the agencies exclude the costs and benefits of more than 20 states that are presumed to have state-level regulations that would regulate waters above and beyond those that would be regulated under the proposed rule. The agencies' exclusion of these states effectively assumes that they would not be affected by the rule and would bear no costs or benefits from the change. Water bodies in the United States are not contained within state lines and, as such, it is inaccurate to assume that one state will not be affected by the regulations that occur in another state, particularly a neighboring state. For example, a state with a high level of state regulations could still see added costs from the proposed rule if it experiences a decline in water quality flowing into the state from a neighboring state that follows federal guidelines. That is, the whole effects of the proposed rule are greater than the sum of their parts. The agencies note this potential cross-jurisdictional effect, which they call trans-boundary benefits, as a caveat to their analysis but fail to account for it in any way.

Ongoing and past experience provides a preview into some of the cross-jurisdictional challenges that may result from the proposed rule. For example, the EPA has traditionally left non-point source pollution regulation to the states. The Chesapeake Bay, a roughly 64,000-square mile estuary, collects water from more than 150 streams and has a drainage basin that covers parts of Delaware, Maryland, New York, Pennsylvania, the District of Columbia, Virginia and West Virginia. By 2011, more than half of its tributaries were in poor or very poor condition, primarily from nitrogen, phosphorous and sediment runoff from agricultural lands, which are non-point source pollutants.[90] Years of plans and promises at the state level failed to make meaningful reductions in phosphorous and nitrogen loads entering the bay, eventually causing federal authorities to intervene. In 2009, the federal government assumed control of the cleanup, including an EPA-led plan that allocated nutrient and sediment load reductions to the individual states. This case shows how the involvement of federal regulators can be critical when managing waters that cross state jurisdictional lines.

In addition, pollution discharges can cross state lines and potentially affect large portions of the country and interstate commerce. For example, southern California identified widespread water contamination from perchlorate in 1997.[91] The source of the contamination was a now-closed rocket fuel plant in Henderson, Nevada. The perchlorate contamination seeped into the Las Vegas Wash, emptied into Lake Mead and eventually drained into California via the Colorado River. A pollution discharge in Nevada ended up affecting municipal water users hundreds of miles away in cities such as San Diego and Los Angeles. In addition, more than 1 million acres of farmland that supply more than 90% of the country's fresh lettuce during the winter are irrigated with Colorado River water. Consequently, this one isolated source of water pollution in Nevada potentially exposed hundreds of millions of Americans to perchlorate.

[90] Houck, Oliver. (2011). "The Clean Water Act Returns (Again): Part I, TMDLs and the Chesapeake Bay." *Environmental Law Reporter*: 10208-10228.

[91] Bustillo, Miguel, "Colorado River Taint Worries Some Officials," Los Angeles Times, February 2, 2003. Available at https://www.latimes.com/archives/la-xpm-2003-feb-02-me-perc2-story.html.

4.3. Other missing costs

The agencies' economic analysis fails to explicitly include, or to accurately estimate, several important costs of the proposed rule, such as benefits from flood risk reduction and cross-jurisdictional water quality.

4.3.1. Flood risk reduction

The agencies' economic analysis fails to fully incorporate the extent of flood mitigation that would be lost with the proposed rule. While it is true that a number of the studies cited in the estimation of the costs related to wetland mitigation include flood protection benefits, these flood risk reduction benefits were estimated using survey data from surveys administered to local populations.[92] In general, individual survey responses will underestimate the full value of wetlands for flood risk reduction. This underestimation is because individuals tend to underestimate the risk of flooding and natural hazards if they have not previously experienced a natural hazard.[93] Thus, individuals surveyed in these studies that have not experienced flooding events are likely to have underestimated the true benefits of wetlands as a source of flood risk reduction.

Scientists at TNC have applied alternative methods of estimating the flood protection benefits of wetlands that capture these benefits in a more scientifically accurate way. These alternative methods use geographically specific infrastructure values and complex flood risk modeling techniques, such as those used in the insurance industry, to estimate the value of assets protected by wetlands from a storm event. In one such study, TNC, working with catastrophe modeling firm Risk Management Solutions and others, used high-resolution flood and loss models to quantify the value of coastal wetlands in the northeastern United States for reducing damage to properties from hurricanes. This study concluded that wetlands avoided $625 million in direct flood damages during Hurricane Sandy.[94] In another example of avoided property damage, Otter Creek in Vermont, a 36-mile river with roughly 18,000 acres of wetlands, prevented on average as much as $450,000 per year in damage from flooding in Middlebury, Vermont, over 10 different storm events.[95] In 2011 during Hurricane Irene, Otter Creek prevented as much as $1 million in damage to Middlebury. The town of Middlebury has a population of roughly 6,500, which means that the average annual flood risk reduction benefits from the wetlands on Otter Creek are equivalent to roughly $68 per year.

4.3.2.Water quality

The agencies' economic analysis does not estimate any national-level costs related to water quality that would result from the proposed rule. Numerous academic studies cited above have shown that the

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[92] See "Worksheet_Meta_Data_(8_17_17).xlsx" provided by the EPA as a supplementary data file. For example, Blomquist and Whitehead (1998) mention flood control as one of the services provided by wetlands and Mullarkey and Bishop (1999) mention flood flow alteration.
[93] For a review on the literature in this topic. See: Wachinger, G., et al., (2013). "The Risk Perception Paradox – Implications for Governance and Communications of Natural Hazards." *Risk Analysis* (Vol. 33., No. 6): 1049-1065.
[94] Narayan, S. et al. (2017). "The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern, USA." *Scientific Reports* 7, Article Number 9463 (2017).
[95] Watson, K. et al. (2016). "Quantifying Flood Mitigation Services: The Economic Value of Otter Creek Wetlands and Floodplains to Middlebury, VT." *Ecological Economics* (Vol. 130): 16-24.

interactions between streams, wetlands and groundwater are complex. Therefore, impacts to ephemeral and intermittent streams and wetlands could directly impact the water quality of surface water and indirectly impact the water quality of groundwater systems, groundwater recharge and total water levels.

The agencies rely on the results of three localized case studies to make the claim that the proposed rule would have no significant impact on water quality treatment in the United States. To predict the degree to which the proposed rule would impact water quality treatment costs, the agencies use the soil and water assessment tool (SWAT). Based on five years of permit applications from 2011 to 2015, the agencies estimate the number of section 404 permits that would no longer require compensatory mitigation and the associated reduction in wetland acres within the specified watershed. The agencies then run the SWAT model to estimate the change in daily suspended sediment concentration that would result from the proposed change. The output of the model is presented across four-digit hydrologic unit codes (HUCs), or subregions, of which there are 221 in the United States.

SWAT is a well-respected model to test the impacts of land-use change scenarios on communities. SWAT has been peer reviewed, and many scholars use it for scientific inquiry. Yet, as with all models, even good models are only as accurate as the information that is input. TNC found several flaws with how the agencies used the SWAT model to estimate the water quality benefits in two of the three case studies[96] and makes two recommendations:

- Preliminary review suggests that the agencies did not select the most representative watersheds for the three case studies. The agencies state that they prioritized selected watersheds for the three case studies where “non-permanent streams represent a relatively large fraction of waters located within the state, as mapped by the high-resolution NHD.” The agencies’ proposal acknowledges, however, that they have not mapped ephemeral waters with equivalent detail across the United States. Thus, the selection of watersheds themselves might not represent their goal.
- Preliminary review of the Ohio River case study reveals inaccurate classification of ephemeral streams. In the Ohio River case study, the agencies specify that the NHD data layer only classifies 2 miles of river as ephemeral. The agencies state that “the small number of miles of ephemeral streams within the two watersheds (none in HUC 0510 and two miles in HUC 0509) is due to the lack of specific flow regime categorization in the high resolution NHD data rather than the absence of such streams.” This categorization is problematic because either current streams are ephemeral and have not been characterized that way, thus making SWAT underestimate impacts to removing jurisdictional waters, or there are additional ephemeral streams that are not mapped, also not giving a full picture of the watershed and potential impacts of the proposed rule.
- Preliminary review of the Ohio River case study suggests that the agencies drastically underestimated the number of wetlands that would lose protection under the proposed rule. In the Ohio River case study, the agencies assume that the proposed rule would only impact wetlands that are abutting ephemeral streams, which are a small percentage of total land. Because of this assumption, the agencies conclude that the proposed rule has no significant

[96] The EPA did not use the SWAT model in its analysis of the Rio Grand River Basin, the third case study. See EPA Economic Analysis of Proposed Rule, pages 196-197.

impact on downstream water quality. However, as mentioned above, the agencies do not accurately map ephemeral streams in the Ohio River case study. Additionally, TNC has identified cases of wetlands abutting a jurisdictional water without a visible surface water connection; therefore, they do not fit the EPA's proposed definition of an impacted water (see section 3.5.1). Thus, the agencies are currently excluding the impacts on these wetlands from their analysis.

- The agencies should make public the assumptions and details of the SWAT model used in the analysis. Any SWAT model and the assumptions therein should be peer reviewed by the academic community. SWAT has many customizable features, and experts should evaluate if the agencies are answering the question they set out to model.
- The agencies should present model outputs for more localized regions immediately downstream of impacted areas. The agencies modeled the effect of wetland changes at a 12-digit HUC sub-watershed level, of which there are approximately 160,000 in the United States. As noted above, however, the output of the model is presented at the four-digit HUC level, a much larger geographic hydrologic unit. The agencies' analysis should present localized results of the model output at more geographically specific areas as we would expect to see the greatest impacts of any estimated land-use changes immediately downstream of the impact.

More broadly, using three case study watersheds, as the agencies have done for the economic analysis, cannot give a full understanding of the potential impacts to the entire country. In order for the results of the three case studies to be generalizable across the country, the proposed rule's estimated impact to land use in each of these watersheds would have to mirror the proposed rule's estimated impact to land use across the country.

As such, the three localized case studies do not provide sufficient justification to omit the estimation of the potential costs of the proposed rule to drinking water, both in terms of water quality treatment costs and water availability. The impacts of the proposed rule to drinking water quality and availability could be large. In the United States, 66% of the population relies on surface water for drinking water, and 56 of the 64 public water systems serving populations of more than 500,000 rely on surface water.[97] Most importantly, 117 million people get a portion of their drinking water from small streams. In addition, more than 13 million households rely on private wells for drinking water, which are not protected by the Safe Drinking Water Act.[98] Any adverse impacts to groundwater that result from the agencies' proposed rule will directly impact the health and livelihoods of these households. Finally, the loss of small wetlands may also impact total water available in some places in the United States through its impact on groundwater recharge.[99]

5. Conclusion

If finalized as it is, the agencies' proposed definition of CWA jurisdiction will reverse many of the hard-fought water quality gains we have made in recent decades and make it less likely that the agencies can

[97] Based on review of the Safe Drinking Water Information System database. Available at https://ofmpub.epa.gov/apex/sfdw/f?p=108:200.
[98] EPA. "Private Drinking Water Wells." Available at https://www.epa.gov/privatewells. Last accessed March 4, 2019.
[99] Gerla, Philip. (1992). "The Relationship of Water-Table Changes to the Capillary Fringe, Evapotranspiration, and Precipitation in Intermittent Wetlands." *Wetlands* (vol. 12., no. 2): 91-98.

achieve the objectives of the act. We urge the agencies to reconsider the approach taken in the proposal and further analyze the impacts of redefining CWA jurisdiction prior to taking any final regulatory action.

Thank you for the opportunity to comment on your revised definition of Clean Water Act jurisdiction.

Sincerely,

Lynn Scarlett