WETLANDS & WATERSHEDS

The Importance of Protecting Vulnerable Streams and Wetlands at the Local Level

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Center for Watershed Protection

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Wetlands & Watersheds Article #6

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Executive Summary

This article makes the case for expanded state and local protection of vulnerable streams and wetlands. Vulnerable streams and wetlands include the very smallest streams and wetlands that do not have a permanent surface water connection to larger waterbodies, yet are still vital parts of the ecosystem. The exact extent of these resources across the nation is unknown. Some preliminary estimates find that, in the contiguous U.S., headwater streams comprise 53% to 59% of the stream network, while 20% to 30% of wetlands could be considered isolated, making them vulnerable to direct impacts. Headwater streams and isolated wetlands provide a host of benefits that are just beginning to be documented, including: ecological linkages to downstream receiving waters; capacity to store floodwaters and recharge groundwater supplies; removal of excess nutrients and sediment; and exceptional biodiversity, supporting habitat for many threatened or endangered species.

The primary federal authority protecting streams and wetlands is the Clean Water Act. Recent Supreme Court decisions such as SWANCC and Rapanos have potentially restricted the scope of the Clean Water Act, making headwater streams and isolated wetlands vulnerable. Furthermore, the federal program does not regulate impacts to streams and wetlands resulting from activities within their drainage areas. Numerous studies have documented how these indirect impacts from land development significantly alter the hydrology of streams and wetlands, and have secondary effects on water quality, habitat and biodiversity. Headwater streams and isolated wetlands are extremely vulnerable to direct and indirect impacts because they are typically present at low points that receive stormwater runoff, are relatively easy to fill or relocate, and are often unmapped. As urban areas across the country continue to expand, loss of important functions provided by these streams and wetlands is inevitable.

Most states, tribes, and local governments do not currently have the regulatory tools in place needed to protect headwater streams and isolated wetlands. For example, 21 states rely solely on the Clean Water Act Section 401 water quality certification to protect their local wetland resources and therefore lack the authority to protect any waters not covered under the federal program. State and local governments can improve both their regulatory and non-regulatory programs to provide expanded protection for vulnerable streams and wetlands.

A few states, such as Ohio, Wisconsin, Indiana, and North Carolina, have recently adopted new regulations to fill the gaps in federal protection. An added benefit of this approach is that states

can choose to regulate a broader range of activities and water resource types than the federal program. Local governments can help fill the gaps by quantifying the extent of headwater streams and isolated wetlands in their jurisdictions and documenting the important connections between these waters and those that are protected under the Clean Water Act. Local governments can also use special protection ordinance or zoning to regulate activities in or around vulnerable streams and wetlands, and encourage voluntary stream and wetland protection.

About the Wetlands & Watersheds Article Series

The Wetlands & Watersheds article series was developed by the Center for Watershed Protection (CWP) in cooperation with the United States Environmental Protection Agency (USEPA). Funding for this project was provided by USEPA under cooperative agreements number CD-83192901-0 and WD-83264101-0.

Collectively, wetlands provide many watershed benefits, including pollutant removal, flood storage, wildlife habitat, groundwater recharge, and erosion control. While watersheds and wetlands are interconnected systems, their management is often segregated along regulatory and jurisdictional lines. Recent initiatives, such as the National Wetlands Mitigation Action Plan, provide a potential framework to integrate wetland protection in the context of larger local and state watershed planning efforts. However, no specific guidance exists for managing wetlands in the context of local watershed plans, and local governments often lack the tools and knowledge to effectively protect critical wetlands. This project was designed to fill this gap by expanding CWP's current watershed protection guidance, tools, and resources to integrate wetlands into larger watershed protection efforts. A key message conveyed in this new guidance is that wetlands should not be managed separately from other water resources because they are integral to water resource management.

This project included *research* on urban wetlands and local protection tools, *synthesis* of the research into a series of articles, and *transfer* of wetland protection tools and resources to wetland and watershed professionals across the country. The audience for the articles includes local natural resources managers and land planners who would benefit from guidance on local tools for protecting wetlands. The Wetlands & Watersheds article series includes the following:

Article 1: Direct and Indirect Impacts of Land Development on Wetland Quality
This article reviews the direct and indirect impacts of urbanization on wetlands, and describes the benefits wetlands provide at the watershed scale.

Article 2: Using Local Watershed Plans to Protect Wetlands
This article presents detailed methods for integrating wetland management into the local watershed planning process.

Article 3: Adapting Watershed Tools to Protect Wetlands
This article describes 37 techniques for protecting wetlands through local programs and ordinances.

Article 4: A Local Ordinance to Protect Wetland Functions
This article outlines the key elements of an effective ordinance to protect wetlands from the indirect impacts of land development, and provides adaptable model ordinance language.

Article 5: The Next Generation of Stormwater Wetlands
This article revisits the design of stormwater wetland systems based on lessons learned from the field, and presents new concepts and design objectives for stormwater wetlands.

Article 6: The Importance of Protecting Vulnerable Streams and Wetlands at the Local Level

This article makes the case for expanded local protection of vulnerable streams and wetlands that may not be fully protected by state or federal law due to their perceived isolation from perennial or navigable waters. This article summarizes state and local approaches to closing this gap.

Other wetland-related products of this project include wetland slideshows, an annotated bibliography of wetland research, a listing of key wetland web resources, and more products available on the newly expanded CWP wetlands website at www.cwp.org/wetlands/index.htm.

The CWP project team included:

- Karen Cappiella
- Lisa Fraley-McNeal
- Anne Kitchell

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Introduction

Over the past 30 years, the primary authority protecting our nation's water bodies from being filled, polluted, or otherwise degraded has been the federal Clean Water Act (CWA). Many states, tribes, and local governments rely solely on this federal authority to protect their local wetland resources. Over the past six years, controversial court decisions have eroded this federal authority, potentially restricting the scope of the CWA by significantly reducing the types of streams and wetlands that can now be federally regulated. This includes the very smallest streams and wetlands that do not have a permanent surface water connection to larger waterbodies, yet are still vital parts of the ecosystem. To fill these gaps, states, tribes, and local governments, particularly in areas with extensive vulnerable streams and wetlands, will need to improve their regulatory and non-regulatory efforts.

This article makes the case for why expanded state and local protection of vulnerable streams and wetlands is critical to maintain the important ecologic, hydrologic, water quality and biodiversity functions that our small streams and wetlands provide. It first defines and examines the extent of vulnerable streams and wetlands across the country, and summarizes research on the benefits they provide. Next, it evaluates what makes these streams and wetlands vulnerable – specifically, erosion of federal protection due to recent court rulings, and threats and impacts from land development. Finally, it summarizes the various approaches states are taking to enhance protection and outlines some local strategies for protection of these resources. Articles 2, 3, and 4 of this series provide additional tools that local governments can use to protect all types of wetlands from the impacts of land development in their watersheds.

Defining Vulnerable Streams and Wetlands

The term "**vulnerable streams and wetlands**" broadly refers to all those streams and wetlands that may no longer be protected under the CWA due to their periodic dryness, isolation or non-navigability. These may include very small perennial, intermittent, and ephemeral streams as well as geographically isolated wetlands, although the exact stream and wetland types that are vulnerable is the subject of intense debate. Each of these terms is defined in Box 1.

Box 1. Stream and Wetland Terminology

Perennial stream – streams that have flowing water year-round.

Intermittent stream – streams that have sporadic flow, usually in response to seasonal rainfall patterns. For example, these streams may be wet primarily in the spring when groundwater tables rise in response to snowmelt. In dry years, these streams may not have any water. Intermittent streams are fed by both surface water and groundwater sources.

Ephemeral stream – streams that only have flow periodically, in response to storm events. These are sometimes referred to as dry washes or swales in arid regions. Groundwater is not a water source for ephemeral streams.

Geographically isolated wetland – wetlands that are completely surrounded by upland (Tiner et al., 2002). While many geographically isolated wetlands have no apparent surface water connection to perennial rivers and streams, lakes, estuaries or the ocean, these wetlands are rarely hydrologically isolated in the strictest sense, because most wetlands also have important groundwater connections.

Because **"headwater streams"** are generally defined as the uppermost streams in the stream order system, we use this term throughout this article to refer streams that may no longer be protected under the CWA. Similarly, we use the term **"isolated wetlands"** in this article to broadly refer to wetlands that may be unprotected under the CWA. Headwater streams as defined here can be intermittent, ephemeral or perennial and may or may not have well defined channels. In human-altered watersheds, headwater streams have often been channelized or replaced by drainage ditches, constructed swales, or stormwater drainage pipes. Figures 1-7 illustrate both natural and human-altered versions of the streams and wetlands described in Box 1.

Figure 1. This natural stream channel (left) and channelized stream (right) are perennial or permanently wet. Photo on right courtesy of U.S. Fish and Wildlife Service.

Figure 2. This natural stream channel (left) and constructed drainage ditch (right) both have intermittent flow, meaning they are seasonally wet.

Figure 3. This natural stream channel (left) and constructed drainage swale (right) both have ephemeral flow, meaning they flow only in response to rainfall. Photo on left courtesy of USGS.

Figure 4. Several types of isolated wetlands are common in arid or semi-arid regions, including west coast vernal pools (left) and desert spring wetlands (right). Photo on left by Paul Sesser. Photo on right from Tiner et al. (2002).

Figure 5. Isolated depressional wetland in Michigan. Photo courtesy of Annis Water Resources Institute.

Figure 6. Isolated wetlands in Virginia include forested wetlands (left) and coastal plain ponds (right). Photo on left by Gary P. Fleming. Photo on right by Irvine Wilson.

Figure 7. Prairie potholes (left) are common in the upper Great Plains region, as shown by the aerial view (right). Photos by Don Poggensee, USDA NRCS.

Scale plays a key role in defining headwater streams, since stream ordering is often done based on mapping rather than field assessments. Figure 8a depicts the stream network taken from

1:24,000 scale USGS quad sheets for the Watts Branch watershed near Rockville, Maryland. The 1st order stream shown in Figure 8a is designated as a third order stream in Figure 8b, where you can see the smaller headwater streams that drain to it. Figure 8b was created using more detailed stream data for the same watershed. It is these very small streams (and even smaller ones not mapped) that are impacted the most by land use alterations, yet are afforded the least protections.

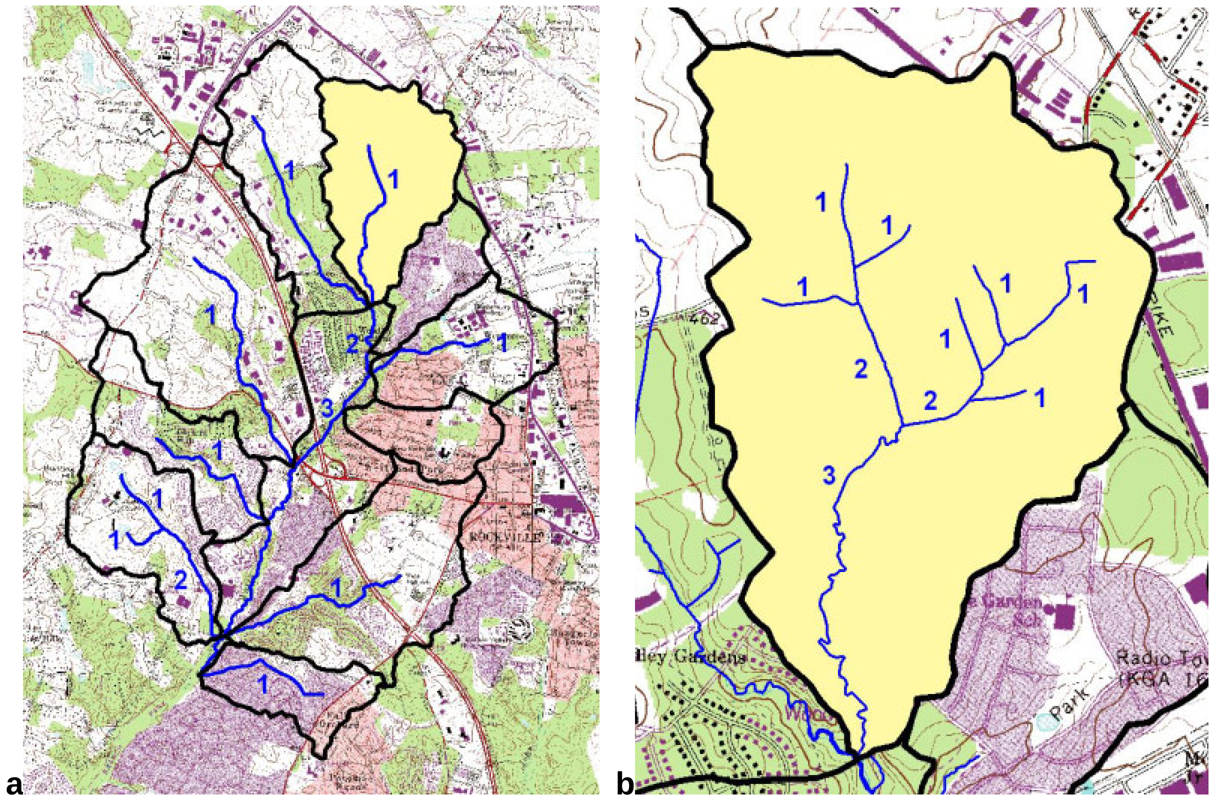

Figure 8. Scale effects on stream ordering

Figure 9 is a map of the drainage network for a portion of the Kingston Lake Watershed in South Carolina. The stream network is shown in green (mainstem) and blue (tributaries), while all the drainage ditches are shown in red. The extensive network of ditches comprises the majority of the drainage network; however, ditches are not afforded the same protection as streams in most watersheds. Although they may not provide the quality of habitat that natural streams do, artificial drainage networks are important because they directly contribute to the quality of the receiving waters into which they flow.

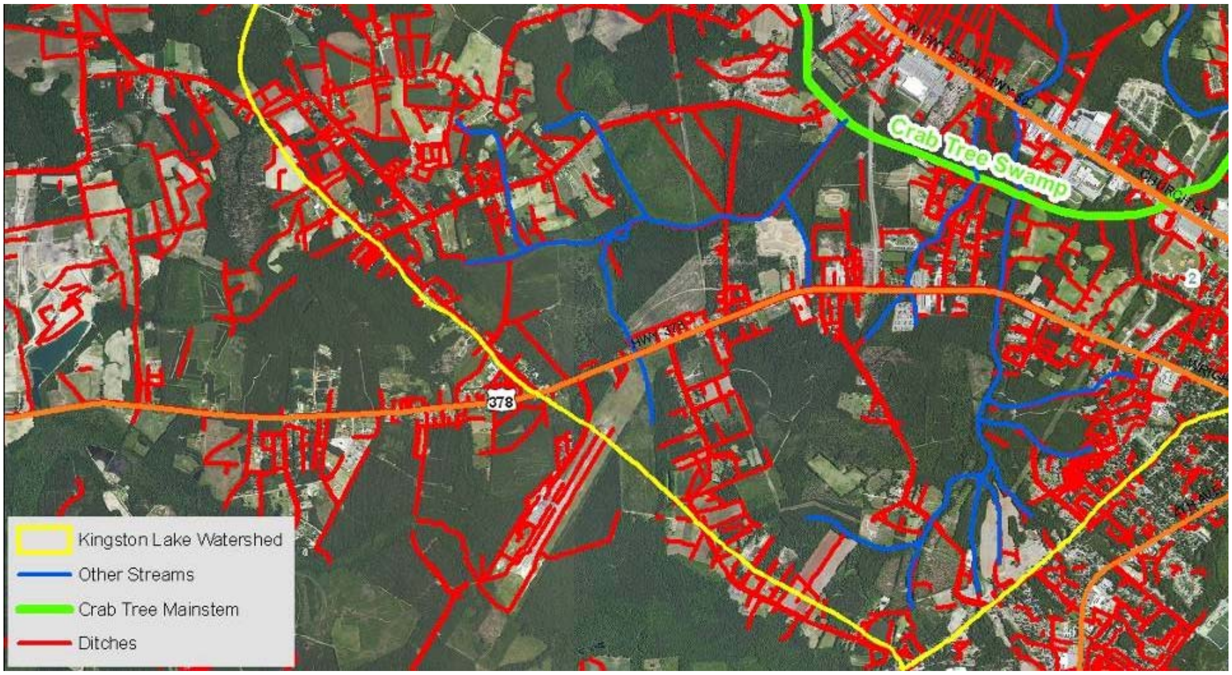

Figure 9. Drainage network in Kingston Lake, South Carolina (Source: Waccamaw Watershed Academy)

The Extent of Headwater Streams and Isolated Wetlands

Although individual headwater streams are small, their aggregate length in any river system is significant. Isolated wetlands, also typically small, make up a significant proportion of wetlands in some watersheds. However, no one knows for sure how many miles of stream and acres of wetlands are at risk nationally because there are currently no formal legal or scientific definitions for terms such as "isolated" that can be called upon to make these estimates. Estimating the extent of potential loss is crucial not only to convince lawmakers and watershed citizens that the loss of these resources should be prevented, but also to identify areas of greatest risk.

Preliminary estimates of the extent of headwater streams and isolated wetlands nationally are summarized below. These estimates are considered preliminary since no national dataset exists that provides an appropriate scale for identifying headwater streams and isolated wetlands, and because there is no standard method for defining isolated wetlands. Individual state estimates of the extent of vulnerable streams and wetlands are summarized in the Clean Water Network document *How Much of Your State's Waters May Not Be Protected by the Clean Water Act* at: http://www.cleanwaternetwork.org//issues/scope/factsheets/.

Headwater Streams

EPA estimates that the percentage of stream miles in the contiguous U.S that can be considered headwaters (including intermittent and ephemeral streams and streams with no mapped tributaries) ranges from 53% to 59% (Grumbles, 2005; Nadeau and Rains, 2007). Figure 10 depicts the extent of intermittent/ephemeral streams in the U.S. based on the EPA study. Due to the limitations of scale discussed on page 5 and described further in Nadeau and Rains (2007), these national estimates are likely to significantly underestimate the extent of headwater streams.

The data show that at least half the streams in twenty-two states in the contiguous U.S. are ephemeral or intermittent (Nadeau and Rains, 2007). The highest proportion of intermittent/ephemeral streams is found in the arid southwest and midwest portions of the country. Arizona alone has more than 95% of its streams as intermittent (Kusler, 2004). These areas may be at greatest risk if they are no longer protected under the CWA and adequate state or local regulations are not in place.

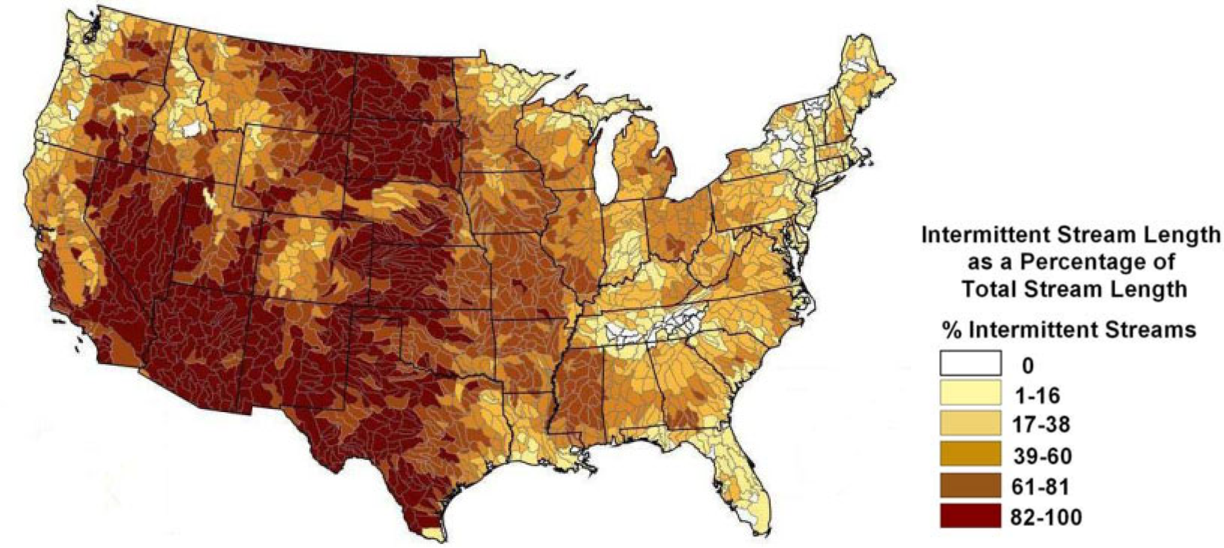

Figure 10. Intermittent/Ephemeral Streams in U.S. Watersheds, by Percent of Total Stream Miles (based on a 2004 analysis of the National Hydrography Dataset summarized in Nadeau and Rains, 2007. Graphic source: ASWM, no date)

Isolated Wetlands

Estimates made by EPA, the Natural Resources Defense Council and National Wildlife Federation state that approximately 20% to 30% of the wetland acreage in the contiguous U.S. (equivalent to 20 million acres) could be considered "isolated," depending on how the term is defined (Meyer et al., 2003; Kusler, 2004). A recent study by Comer et al. (2005) supports this estimate by stating that 29% of the wetland and riparian ecological systems described in a national database of natural heritage data met their (project-specific) definition of "isolated." The data used in the Comer study is not a complete inventory of all wetlands but is the most comprehensive data source of its type.

In terms of geographic distribution of isolated wetlands among states, the Comer et al. (2005) study found that the South Atlantic and Gulf coastal plain had the greatest diversity of isolated wetland *types*. However, the highest *proportions* of isolated wetlands when viewed as a percent of total wetlands (Figure 11) were found in the upper Great Lakes, north-central interior and Great Plains regions (Comer et al., 2005). Most of the isolated wetlands in this study (77%) were depressional wetlands, with the remainder split between slope and flat wetlands.

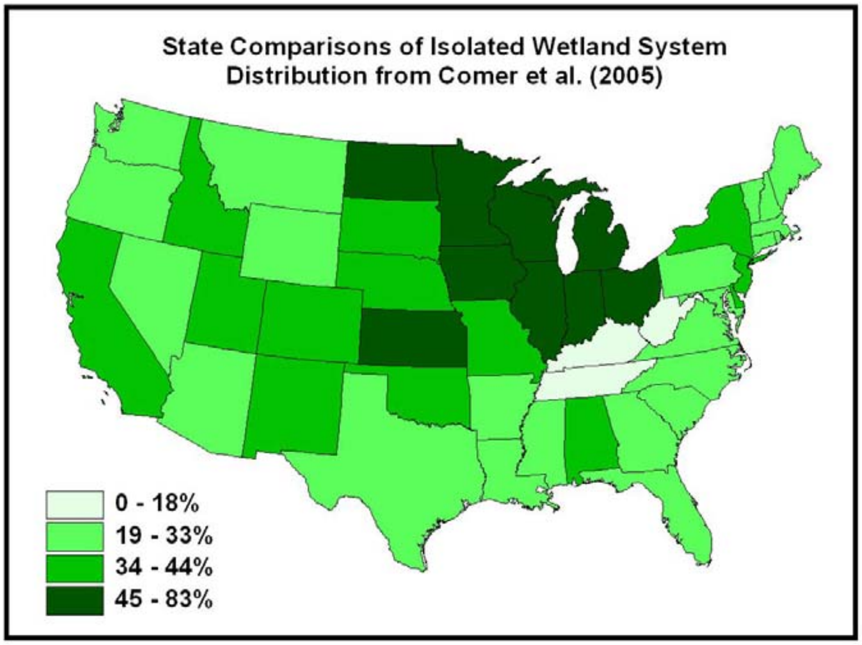

Figure 11. Proportion of wetland systems evaluated meeting the definition of "isolated" used by Comer at al. (2005)

Tiner's (2003a) study of the extent of geographically isolated wetlands in selected areas of the U.S. found that isolated wetlands constitute a significant proportion of the wetland resource in arid and semi-arid to subhumid regions and in karst topography. Table 1 lists 19 of the isolated wetland types identified by Tiner (2003b) and the areas where they are commonly found. These areas (as well as others that have not yet been studied) may be at greatest risk if they are no longer protected under the CWA and adequate state or local regulations are not in place.

Table 1. Location of Geographically Isolated Wetlands in the U.S. (Source: Tiner, 2003b)

Isolated Wetland Type	State or Region Found
Prairie potholes	Upper Midwest
Playas	Southwest
Rainwater basin wetlands	South-central Nebraska
Sandhills wetlands	North-central Nebraska
Salt flats and salt lake wetlands	Great Basin
Channeled scablands wetlands	Eastern Washington
Desert spring wetlands	Arid West and Southwest
Kettle hole wetlands	Glaciated regions
Delmarva pothole wetlands	Delmarva Peninsula
Coastal plain ponds	Atlantic-Gulf coastal plain
Gum ponds	Southeast
Carolina Bay wetlands	South Atlantic coastal plain
Pocosin wetlands	
Cypress domes	Florida
Sinkhole wetlands	Karst regions
West Coast vernal pools	West coast
Woodland vernal pools	Forested regions
Interdunal and intradunal wetlands	Coastal areas
Alvar wetlands	Great Lakes shoreline

Why Headwater Streams and Isolated Wetlands are Important

Organic matter processing, plant and animal habitat, and maintenance of downstream water supply and water quality are just a few of the functions provided by headwater streams and isolated wetlands. These systems have not been as well-studied as larger perennial systems; therefore, the extent of their benefits may not yet be fully discovered. A summary of the ecological, hydrologic, water quality and biological benefits of these streams and wetlands is provided below. Note that the studies below focused primarily on ephemeral and intermittent streams. Artificial channels or ditches may not provide all of these same benefits, although they should be afforded some level of protection because they directly contribute to the quality of downstream waters.

Ecological Linkages

Perhaps the most important function of headwater streams is their role as the primary collectors and processors of organic matter that is ultimately transported to downstream systems. Organic matter entering headwater systems consists of leaves, woody debris, detritus, and waste products of plants and animals. Microorganisms living in the stream use this material for food, transforming the organic matter from an unusable form (inorganic carbon) into food for other organisms (organic carbon). This process is the basis of the food web in freshwater ecosystems.

Headwater systems are significantly more efficient at retaining and transforming organic matter than larger streams because debris dams and lower or infrequent flows prevent the downstream movement of larger materials. The storage and transformation of organic matter in headwaters is important because it prevents downstream water quality degradation due to excess organic matter. It also affects the survival and condition of organisms that depend on this food source, both in the headwater areas and downstream.

Storage and Recharge Capacity

Headwater streams and many isolated wetlands play a critical role in the hydrology of downstream receiving waters by moderating downstream flooding during periods of high flow, and by maintaining flow during dry weather. These functions are possibly due to the significant storage and recharge capacity of these systems. Headwater systems provide the greatest opportunity for groundwater recharge because of the large surface area of soil in contact with available water (Meyer et al., 2003). During high flows, water enters the groundwater through the channel bed, reducing the volume that travels downstream. During dry periods, the opposite occurs, with groundwater replenishing flow in the stream. Even in arid regions, water infiltrated from headwater streams supports springs, streamflow, isolated wetlands, or native vegetation far from the recharge areas (Izbicki, 2007).

Most isolated wetlands do not have an obvious surface water connection, but they store and slowly release water into groundwater, aquifers and surface waters. The surface water storage capacity of isolated wetlands can be enormous. For example, South Carolina's geographically isolated wetlands are estimated to store 4.58 billion gallons of water (SELC, 2004). The cost to construct stormwater management facilities to detain this volume of water is estimated at more than $200 million (based on an equation from Brown and Schueler, 1997). The recharge and discharge capacity of isolated wetlands is also important for receiving waters that are connected to the wetlands by groundwater. Weller (1981) found that small isolated wetlands have a high perimeter to volume ratio, which gives them a greater capacity to recharge groundwater.

Water Quality Improvement

The water quality of receiving waters is strongly influenced by the quality of water coming from the headwater streams and wetlands that feed into them. These headwater systems retain and process excess nutrients, such as nitrogen and phosphorus, and prevent them from traveling further downstream by transforming them into biologically useful forms. Peterson et al. (2001) found that despite their small dimensions, headwater streams play a disproportionately large role in nitrogen transformations on the landscape. They typically retain and transform more than 50% of the inputs from their watersheds. This important role is possible due to the high land/water exchange in these systems, which provides a much greater opportunity for nutrient removal.

Wetlands also act as nutrient sinks, and several studies have found that wetlands associated with the smallest streams provide the most nutrient removal (Meyer et al., 2003). The North Carolina Division of Water Quality found that wetlands associated with headwater streams are improving water quality in the state by significantly reducing the levels of sediment and other pollutants that flow into first order streams (NCDWQ, 2006). Another water quality benefit of headwater streams and isolated wetlands is that they trap and retain much of the sediment that washes into them, preventing excess sediment accumulation downstream. This is possible due to natural obstructions, such as rocks and downed logs, and low-lying topography, both of which cause water to slow down and allow sediment to settle out of the water column (Meyer et al., 2003; Tiner et al., 2002).

Biodiversity

Headwater streams are unique and diverse habitats that can support hundreds to thousands of species, including bacteria, fungi, algae, higher plants, invertebrates, fish, amphibians, birds, and mammals. Some of these species are headwater specialists, meaning they are abundant in or restricted to headwaters, and sometimes extend over only a short distance along the length of the stream. These specialists often have small geographic ranges and many are imperiled, including a few dozen listed under the U.S. Endangered Species Act and hundreds of others rare enough to be considered for listing (Meyer et al., 2003).

Many other organisms use headwater streams on a seasonal basis or for a portion of their life cycle. These streams are important as spawning and nursery habitats, seasonal feeding areas, refuge from predators and competitors, thermal refuge, and travel corridors (Meyer et al., 2007). Other species, such as birds, do not actually live in these small streams, but depend on headwaters for food, water, habitat, or movement corridors. In general, biodiversity is higher in perennial streams, but the unique conditions in headwater streams make them vitally important for the unique species that are specifically adapted to their conditions.

Isolated wetlands are among the country's most significant resources in terms of biological diversity (Figure 12). A single isolated wetland can support more than 100 species of aquatic insects, and species richness in small isolated wetlands has been shown to be comparable or possibly higher than estimates for much larger wetlands (SELC, 2004; Semlitsch, 2000). A 50-state investigation by Comer et al. (2005) demonstrated the exceptional biodiversity value of isolated wetlands. Isolated wetlands in the study supported 274 at-risk plant and animal species, 86 of which were covered by the U.S. Endangered Species Act. The investigators also documented 279 at-risk vegetation associations as being characteristic of isolated wetlands (Comer et al., 2005). One reason these wetlands support so many at-risk species is that isolation often leads to the development of endemic species.

Figure 12. Isolated prairie pothole wetlands support habitat for wildlife such as the green heron and Wilson's phalathrope. Photo on left by Dennis Larson, photo on right by Don Poggensee, both photos from NRCS Photo Gallery.

Isolated wetlands are used by a wide variety of species during different portions of their life cycle, and their unique characteristics make them critical for certain species (NWF and NRDC, 2002). For example, isolated wetlands provide refuge due to their lack of certain predators that might otherwise dominate food webs and depress diversity (Leibowitz, 2003). Vulnerable amphibian populations use areas abundant with small, isolated wetlands as "stepping stones" to aid in dispersal and recolonization of suitable habitats (Tiner et al., 2002). One South Carolina study estimated that 20 species of amphibians would become extinct if all of the State's isolated wetlands were lost (SELC, 2004). Upland wildlife also depend on isolated wetlands as sources of drinking water, since they would otherwise be restricted to the margins of permanent waters (Moler, 2003).

Why Isolated Wetlands and Headwater Streams are Vulnerable

Headwater streams and isolated wetlands have always been more vulnerable than their larger counterparts due to their small size and ease of alteration. Headwater stream and wetland modification results from activities such as land development, drainage for agriculture, logging and mining. Past alterations due to agriculture have been especially significant; however, federal disincentives and reduced demand for new cropland has greatly curtailed these impacts over the past few decades. More recently, the threats are from land development and uncertainty surrounding federal protection for these resources. These threats and impacts to headwater streams and isolated wetlands and the implications of their loss are discussed below.

Potential Loss of Federal Protection

Most states, tribes, and local governments rely solely on federal regulations to protect local wetland resources. The primary federal authority used for wetland and stream protection is Section 404 of the CWA, which is administered by the U.S. Army Corps of Engineers (Corps) and EPA or, in some cases, a delegated state agency. CWA Section 404 regulates the discharge of dredged or fill material into waters of the U.S., including wetlands. A Section 404 permit must be secured from the Corps or delegated state agency before these activities can be undertaken. The applicant must demonstrate steps have been taken to avoid impacts to regulated waters, minimize any potential impacts, and perform mitigation to compensate for any unavoidable impacts, to the maximum extent practicable.

Recent court rulings have muddied the definition of the streams and wetlands that are considered 'jurisdictional' or protected under the CWA. Box 2 summarizes both the *SWANNC* and *Rapanos* cases, and is followed by a discussion of the impact of these rulings on the scope of waters protected under the CWA. For a primer on the CWA, see Killam et al. (2005).

Box 2. Summary of SWANCC and Rapanos Supreme Court Rulings

In 2001, a U. S. Supreme Court ruling, Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, 531 U.S. 159 (2001) (SWANCC), determined that isolated, non-navigable and intrastate waters were no longer protected under CWA Section 404 based solely on their use by migratory birds. This case potentially reduced the acreage of wetlands subject to Section 404 permits by a significant but unmeasured amount. The SWANCC case involved an appeal of the Corp's denial of a Section 404 permit to fill an abandoned sand and gravel pit in Illinois that had turned into a wetland and was being used by migratory birds. The U.S. Supreme Court ruled that the Corps could not deny a Section 404 permit to alter isolated wetlands and other waters based on use by migratory waterfowl alone. Because the Supreme Court did not clearly define "isolated" waters, it was left to individual lower courts to decide which isolated wetlands are still subject to the Section 404 permit program. "Isolated" is a relative term and wetlands may be considered isolated from a geographic, hydrologic or ecological standpoint, and is best viewed along a continuum (Tiner et al., 2002).

In June 2006, another Supreme Court ruling resulted in additional confusion and potential vulnerability for streams and wetlands nationwide. In the consolidated cases Rapanos v. United States and Carabell v. United States Army Corps of Engineers, 126 S. Ct. 2208 (2006) (Rapanos), the Supreme Court vacated judgments against K. Carabell and J. Rapanos, two Michigan property owners who wanted to fill (or had already filled) wetlands on their respective properties. The court issued five separate decisions, agreeing only that the lower court decisions did not perform a rigorous enough test to determine whether the wetlands in question were subject to CWA jurisdiction. Justice Scalia concluded that "the waters of the U.S." included only relatively permanent bodies of water connected to traditional interstate navigable waters, and for wetlands to be jurisdictional they must have a continuous surface connection with these waters. Justice Kennedy concluded that waters are regulated under the CWA if they have a "significant nexus" to navigable waters, and this nexus must be assessed in terms of the goals of the CWA: "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

In June 2007, EPA and the Corps released guidance to provide consistency in identifying waters subject to CWA jurisdiction; this guidance focuses only on issues raised in Rapanos (EPA and USACE, 2007b). The guidance states that CWA jurisdiction is upheld over "relatively permanent" tributaries of navigable waters and wetlands with a continuous surface connection with such tributaries. The agencies will generally not assert jurisdiction over ditches in/draining upland areas, and swales or erosional features. Kennedy's significant nexus test applies for adjacent wetlands and non-navigable tributaries that are not relatively permanent. Determination of a significant nexus will be based on an evaluation of whether the water is likely to have an effect that is "more than speculative or insubstantial on the chemical, physical, and biological integrity of a traditional navigable water (EPA and USACE, 2007a)."

EPA and the Corps are concurrently providing a six-month public comment period to solicit input on early experience with implementing the guidance and will either reissue, revise, or suspend the guidance after considering the public comments received. Comments are due on or before December 5, 2007 and can be submitted through www.regulations.gov. EPA and the Corps also intend to clarify and define key terminology (such as 'relatively permanent') used in their recent guidance through rulemaking or other appropriate policy process (EPA and USACE, 2007a).

The Environmental Law Institute recently developed a set of checklists for use in determining whether a particular stream or wetland is covered under the CWA. These checklists reflect the recent EPA/Corps guidance and are provided in Tables 2 and 3. As illustrated in these checklists, the ability to protect vulnerable streams and wetlands at the federal level relies on the existence of strong scientific evidence that these waters have an important connection to the chemical, physical, and/or biological integrity of traditional navigable waters. Headwater streams and their associated wetlands could lose federal protection under the act depending on how the guidance is applied. A summary of scientific and legal information that can be used to determine if a particular waterbody passes the "significant nexus test" is provided in ELI (2007).

This debate over exactly what streams and wetlands are considered "waters of the U.S." is critical because it affects all CWA programs, not just Section 404 (Downing et al., 2003). This includes Section 402 National Pollutant Discharge Elimination System permits, Section 401 water quality certification, Section 301 water quality standards, and oil and hazardous spill prevention and cleanup under Section 311 (Nadeau and Rains, 2007). These programs are administered by EPA and operate under the same definition of "waters of the U.S." Many state wetland programs are also tied to the federal definitions and authority.

Table 2. Wetlands Checklist for Clean Water Act Coverage (Adapted from ELI, 2007)
A "yes" response to any question indicates Clean Water Act (CWA) coverage for the wetland.
Be sure to consult the Explanatory Notes in Attachment A.

Question	Legal Rule or Test
1. Does the wetland cross state lines?	Interstate Waters
2. Is the wetland a traditional navigable water?	Traditional Navigable Waters
3. Is the wetland adjacent to traditional navigable waters?	Adjacency Rule
4. Does the wetland, either alone or in combination with similarly situated lands in the region, significantly affect the (A) chemical integrity, or (B) physical integrity, or (C) biological integrity, of any traditional navigable waters?	Significant Nexus Test
5. Is the wetland adjacent to, and does it have a continuous surface connection with a relatively permanent, standing or continuously flowing body of water that is connected to traditional interstate navigable waters?	Adjacency + Continuous Surface Connection Test
6. Could the degradation or destruction of the wetland affect interstate or foreign commerce? Includes any wetland: (A) that is or could be used by interstate or foreign travelers for recreational or other purposes; or (B) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (C) that is or could be used for industrial purpose by industries in interstate commerce?	Affecting Interstate or Foreign Commerce Test

Table 3. Streams Checklist for Clean Water Act Coverage (Adapted from ELI, 2007)
A "yes" response to any question indicates Clean Water Act (CWA) coverage for the stream.
Be sure to consult the Explanatory Notes in Attachment A.

Question	Legal Rule or Test
1. Does the stream cross state lines?	Interstate Waters
2. Is the stream a traditional navigable water?	Traditional Navigable Waters
3. Is the stream a continuously flowing or relatively permanent body of water that flows into traditional interstate navigable waters?	Adjacency Rule
4. Does the stream (whether continuously flowing or not) significantly affect the (A) chemical integrity, or (B) physical integrity, or (C) biological integrity of any traditional navigable waters?	Significant Nexus Test
5. Could the degradation or destruction of the stream affect interstate or foreign commerce? Includes any stream: (A) that is or could be used by interstate or foreign travelers for recreational or other purposes; or (B) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (C) that is or could be used for industrial purpose by industries in interstate commerce?	Adjacency + Continuous Surface Connection Test

Threats and Impacts from Land Development

Another piece of the puzzle in evaluating the potential vulnerability of headwater streams and isolated wetlands is to determine where land development is likely to occur, and what impacts will result. In many areas of the country, development is occurring at a fast pace. The National Resources Conservation Service estimates that between 1992 and 1997, developed land in the contiguous U.S. increased by more than 11 million acres (USDA NRCS, 2000). Much of this growth occurred in and around our cities, but a significant portion (34%) took place in counties that are considered non-metropolitan by the U.S. Census Bureau (USDA NRCS, 2000).

In addition, the rate of land development was **twice as high** as the rate of population growth (Figure 13). The disproportionately high rates of land development indicate a decline in development density, which is ultimately driven by a demand for larger lots in rural/suburban areas where land values are lower than in urban areas. If this trend in sprawl development continues, the U.S. will have another 68 million developed acres by 2025, and a greater number of our water resources will be impacted by new development (Beach, 2002).

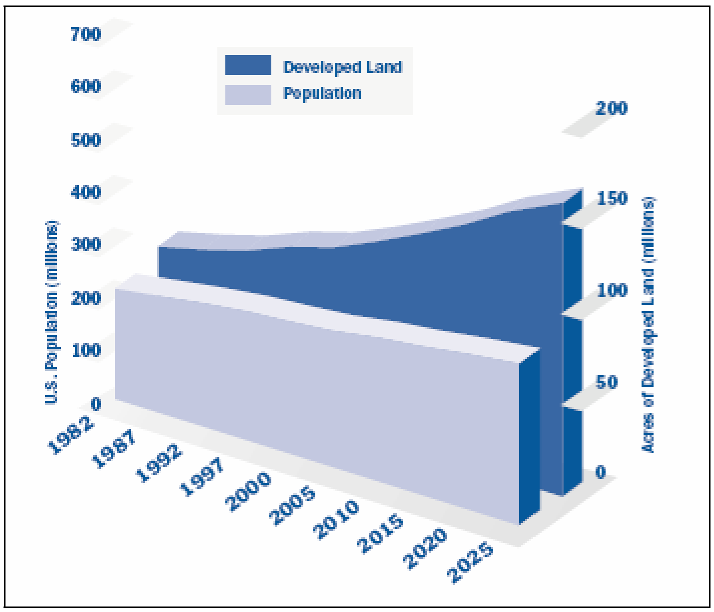

Figure 13. Population growth compared to land development rate, 1982-2025 (Source: Beach, 2002, data and extrapolations from USDA NRCS, 2000; U.S. Census Bureau, 2000)

The most extreme impact from land development is total loss of streams and wetlands. Dahl (2006) estimated that 61% of wetland losses from 1998-2004 were due to urban and rural land development. Streams and wetlands that are not directly destroyed through the construction process may be indirectly impacted by development because they are located at topographic lows and are receiving points for stormwater runoff. They may also be recipients of point source discharges. An analysis of all point source discharges permitted under the CWA (and having locational data) showed that 40% of these discharges are located on intermittent, ephemeral, or very small perennial streams (Grumbles, 2005). These include various types of wastewater and industrial discharges.

Three main processes associated with land development significantly alter the hydrology of streams and wetlands. First, native vegetation that once intercepted rainfall is removed and soils are compacted. Second, impervious cover is created when roads, rooftops, and parking lots are constructed. Lastly, efficient storm drainage systems are installed to quickly convey runoff to downstream waters. In many cases, the aquatic network of streams and wetlands is actually replaced by a complex arrangement of underground pipes and drains in an attempt to manage storm flows. These changes result in an increase in both the rate and volume of stormwater runoff delivered to receiving waters following storms. In highly urban areas, this problem is compounded by the fact that the piped water does not undergo the same processes of water quality improvement that would occur in a naturally flowing system.

The impacts of these landscape changes on stream condition are well-documented by CWP (2003) in a literature review of 225 studies. These studies support the Impervious Cover Model (ICM), which predicts that when impervious cover in a watershed exceeds 10%, stream quality indicators decline; beyond 25%, more severe degradation is expected (CWP, 2003). Since this comprehensive review was published, several major stream research studies have reinforced the ICM as it is applied to first to third order streams (Cianfrani et al., 2006; Coles et al., 2004; Deacon et al., 2005; Fitzpatrick et al., 2005; King et al., 2005; Urban et al., 2006). A recent California study indicates that so-called "zero-order streams" may be more susceptible to the impacts of upstream development than first and second order streams, with as little as 3% impervious cover causing channel enlargement (Coleman et al., 2005).

Article 1 of this article series includes a literature review of more than 100 studies on the indirect impacts of land development on wetlands. Box 3 summarizes findings from both CWP (2003) and Article 1.

Box 3. Impacts of Urbanization on Streams and Wetlands

Impacts on Streams:

- Increased runoff volume, peak discharge rate, and bankfull (channel-forming) flow
- Decreased baseflow
- Stream channel enlargement
- Stream temperature increase
- Loss of large woody debris
- Increased bank erosion
- Increased embeddedness
- More frequent stream channel alterations (crossings, dams) and barriers to fish migration
- Increased inputs of sediment, nutrients, metals, hydrocarbons, bacteria, pathogens, organic carbon, MTBE, pesticides and deicers
- Reduced abundance and diversity of aquatic insects, fish, and amphibians

Impacts on Wetlands:

- Increased ponding and water level fluctuation
- Downstream flow constrictions from road crossings with undersized culverts
- Decreased groundwater recharge and hydrologic drought (in floodplain wetlands)
- Sediment deposition
- Pollutant accumulation in wetland sediments
- Nutrient enrichment
- Increased chloride inputs from road salt application
- Reduced abundance and diversity of wetland plants, aquatic insects, amphibians and birds

Sources: CWP (2003), Article 1

In light of this connection between impervious cover and stream and wetland health, the National Oceanic and Atmospheric Administration conducted a study to quantify the amount of impervious cover on a national basis. The study estimated impervious surface area for the contiguous U.S. to be 43,480 square miles, almost the size of Ohio (Elvidge et al., 2004). Figure 14 shows the resulting impervious surface map. Elvidge et al. (2004) predict that impervious cover will continue to increase since the national population is increasing by 3 million people per year, prompting the construction of 1 million new single family homes and over 10,000 miles of new roads per year.

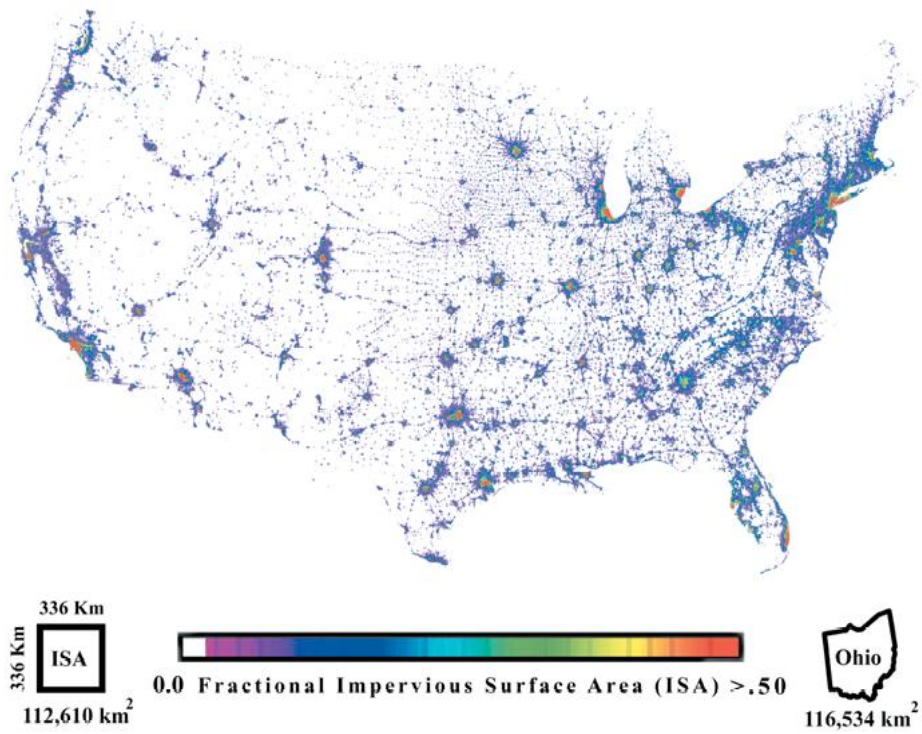

Figure 14. Impervious surface area (percent) in the lower 48 states (Source: Elvidge et al., 2004)

Headwater streams and isolated wetlands are extremely vulnerable to the direct and indirect impacts of land development for several reasons:

1. Headwater streams and many types of isolated wetlands typically have very small drainage areas and therefore are significantly and rapidly affected by land alterations in their watersheds. In comparison, larger waterbodies with large drainage areas can take months or even years to show the effects of land alterations that occur far upstream.

2. Headwater streams make up a significant majority of stream miles nationally, so the likelihood of their presence on an individual development site is high.

3. Headwater streams and isolated wetlands are relatively easy to fill or relocate compared to larger waterbodies because of their small size and, in some cases, occasional dryness (Figure 15).

4. Headwater streams and isolated wetlands are often unnamed, rarely appear on maps, and are not always wet. Therefore, they are not always recognized as streams or wetlands and are consequently not afforded adequate protection during development.

5. Headwater streams and isolated wetlands are less likely to be afforded protection from direct and indirect impacts by federal, state, tribal, and local regulations.

Figure 15. This small headwater stream in Conway, SC (left) once flowed through the middle of this recently graded development site. The stream was recently "relocated" to the property boundary, as evidenced by the remaining wetland plants (like the wetland rush shown in the photo on the right) emerging from the bulldozed earth.

The combination of headwater stream and isolated wetland vulnerability, their extensive geographic coverage in some regions, and the high rate of land consumption may ultimately result in: water quality decline from increases in nutrients, sediment and other pollutants; loss of hydrologic and ecologic connectivity between headwater and downstream waters; or complete loss of species that depend on headwater streams, as well as the species that prey on them (Freeman et al., 2007; Wipfli et al., 2007). Loss of these resources can even affect public health. For example, EPA estimates that 90% of source water protection areas in the contiguous U.S. contain headwater areas, and that public drinking water systems using the associated intakes supply drinking water to more than 110 million people (Grumbles, 2005). If we lose or pollute these areas, the nation's drinking water supply could be seriously threatened, or the cost to treat drinking water may go up exponentially. States and local governments can reduce this risk by improving their programs to strengthen protection for headwater streams and isolated wetlands.

State Efforts to Protect Vulnerable Streams and Wetlands

States currently pursue a variety of strategies for protecting streams and wetlands, some of which partially fill the gaps left by the federal program. Most states could greatly improve their programs to enhance protection for vulnerable streams and wetlands. This decision will be driven by the type, number, percentage, and social and economic importance of vulnerable waters, as well as the associated costs of protection. Some states may be uncertain about what action to take because the federal government has not yet clarified how to apply the terms "navigable," "tributary," "adjacent," and "significant nexus" in defining CWA jurisdiction (Christie and Hausmann, 2003). States must also determine how to effectively implement the regulations in order for protection efforts to be successful. A summary of the status of state protection for headwater streams and isolated wetlands follows.

State Protection of Isolated Wetlands

The CWA gives states the authority to establish their own regulatory programs for wetlands. States can adopt more stringent criteria than those established under the federal program. States also utilize restoration, education and outreach, and other non-regulatory mechanisms for protection and restoration of wetlands (ELI, 2005).

Twenty states currently have independent permitting programs for wetlands, while nine states have regulatory programs for wetlands in coastal areas only (Figure 16). The remaining 21 states that do not have wetland regulatory programs must rely on Section 401 certification of federal permits to protect wetlands (Christie and Kusler, 2006). The Section 401 water quality approach allows states to condition federal permits, such as Section 404 permits, in accordance with state water quality standards. Utilization of Section 401 water quality certification to protect wetlands varies greatly among states and can be weak to fairly aggressive.

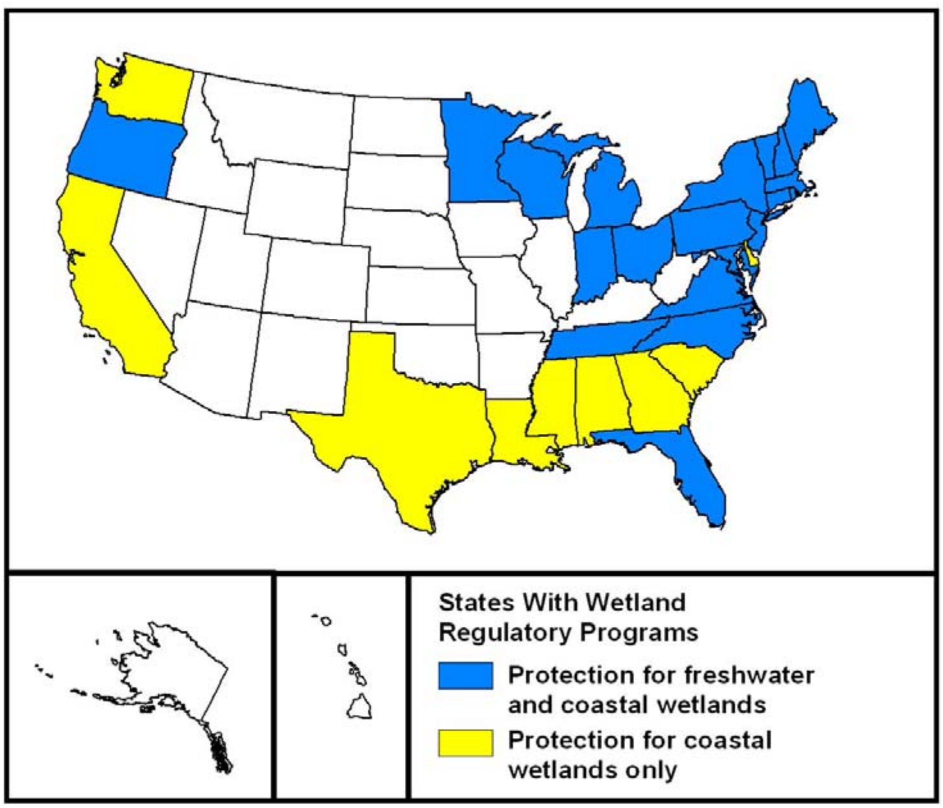

Figure 16. Status of state wetland regulatory programs (Source: Jeanne Christie, ASWM)

States with regulatory programs also vary greatly in the extent of protection provided for wetlands. For example, Texas's wetland program only applies to wetlands on state lands in coastal areas (ELI, 2006). This means Texas must rely on Section 401 as the regulatory means to protect all other wetlands in the state.

In terms of protection for isolated wetlands, states approaches are, again, variable. States with wetland regulatory programs have the ability to issue permits for activities in or adjacent to wetlands. Most permitting programs will protect isolated wetlands to some extent, depending on the definition of "waters of the state" and the activities regulated under their programs. For example, some state definitions of "waters of the state" include certain types of isolated wetlands (e.g., vernal pools) or isolated wetlands above a certain size. Other states include all wetlands, including isolated ones, in their definition of "waters of the state," but do not have the authority to regulate activities in these wetlands if the Corps determines they are non-jurisdictional.

Four states clearly stand out as leaders in isolated wetland protection, as they have tried to close the gaps created by SWANCC. Wisconsin, Ohio and Indiana have adopted legislation that requires a standalone state permit for dredge and fill activities in waters of the state when the Corps determines a federal permit is not required (Kusler and Christie, 2006). North Carolina has essentially achieved the same results by adopting isolated wetland rules rather than legislation (ELI, 2005). Box 4 summarizes the new legislation adopted by Wisconsin to protect isolated wetlands.

Box 4. Wisconsin's Protection for Isolated Wetlands

The State of Wisconsin enacted new legislation in May 2001 to extend its pre-existing Section 401 water quality certification program to "non-federal wetlands." Wisconsin has had a strong wetlands permitting program for some time. This program is based on state water quality standards for wetlands and the Section 401 water quality certification authority. As a result of the SWANCC decision, the Corps no longer required Section 404 permits in non-navigable, isolated, intrastate waters, preventing the State from exercising its Section 401 certification authority to protect these wetlands. Wisconsin' s new law extends the state's certification authority to "non-federal wetlands," and requires an applicant wishing to alter a non-federal wetland to receive an individual water quality certification. "Non-federal wetlands" are defined as those wetlands over which the Corps no longer takes Section 404 jurisdiction based on the SWANCC decision. Because the definition of non-federal wetlands is so broad, this new act essentially protects all wetlands in the state.

Source: NWF (2001), Wisconsin Administrative Code (2001)

To date, there has been no comprehensive summary of the extent of protection provided for isolated wetlands under state regulatory programs. However, Kusler and Christie (2006) estimate that state regulation of isolated freshwater wetlands is weakest in much of the Midwest, the inland portion of the West, and the South (Kusler and Christie, 2006). Also of note is that states with some of the largest isolated wetland acreages, such as Alaska, Louisiana, North Dakota, South Dakota, Georgia, Kansas, and Mississippi, provide little or no state-level protection for freshwater wetlands (Kusler, 2004).

State Protection of Headwater Streams

While no state programs exist specifically to regulate headwater streams, states can use Section 401 water quality certification to protect these areas since they are covered under the Section 404 program. States and tribes are required under the CWA to develop and adopt water quality standards, which includes designating uses for state waterbodies; setting water quality criteria to protect designated uses; and protecting water quality through antidegradation provisions. States may designate uses specific to headwater streams, which may make conditioning of federal permits more defensible. Most states, with the exception of Ohio (Box 5), have not designated uses for ephemeral and intermittent streams as part of their water quality standards. It is not known how often this approach is used to protect headwater streams.

Box 5. Protection of Primary Headwater Habitat in Ohio

A headwater stream is currently defined by Ohio water quality standards as a stream with a watershed less than or equal to 20 mi^2 (OhioEPA, 2005). About 78% of the streams flowing in Ohio are comprised of these small headwater streams. The Ohio EPA uses an Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) to characterize larger streams (Blau, 2002). However, these methods do not accurately reflect the low level of fish species richness that naturally occurs in the smallest headwater streams (< 1mi^2). Nor are they appropriate biological assessment tools for the extreme headwater habitats of watersheds (OhioEPA, 2005).

Between 1999 and 2002, the Ohio EPA surveyed over 300 of the smallest headwater streams in various ecoregions of Ohio and verified the importance of protecting small headwater stream habitat. These streams were previously not defined or assigned beneficial uses in Ohio's water quality standards. However, they now are known as "primary headwater habitat" (PHWH) streams. The survey distinguished three distinct types of biological communities present within the spatial scale of the primary headwater habitat. Class I PHWH-streams are channels that are completely separated from groundwater aquifers and only maintain water during or shortly after precipitation events. Class II streams are hydrologically connected to perched groundwater and tend to be warmer in summer months. Class III streams are connected to deep, cold, and perennial groundwater flow. The classification also includes a separate category for headwater habitat streams that have been channelized or otherwise altered. The survey concluded that water quality and land management approaches previously applied to all aquatic resources would not adequately characterize the diverse network of biological communities present at drainage areas less than 1 mi^2 (OhioEPA, 2005).

In order to provide protection for these primary headwater habitat streams, the Ohio EPA has applied the PHWH stream classification system in the Section 401 water quality certification program. It helps to determine the "existing aquatic life use" for PHWH streams that are proposed to be modified under an Army Corps of Engineers Section 404 permit. The classification is also being used in a Summit County zoning law that requires riparian protection for all PHWH streams (OhioEPA, 2005).

In light of SWANCC and Rapanos, the states that rely on Section 401 water quality certification to protect isolated wetlands and headwater streams may no longer be able to protect these resources. If the Corps determines that a stream or wetland is not jurisdictional under the CWA, there is no federal permit for states to condition. The Association of State Wetland Managers (ASWM) recommends that states take the following actions to evaluate and reduce the extent of potential vulnerability to these resources (adapted from Christie and Kusler, 2006):

- Monitor Corps determinations to evaluate the extent of reductions in CWA jurisdiction
- Document any associated loss of wetland benefits and services
- Work with the Corps and EPA to determine "significant nexus" guidance
- Provide clarifying information to the public regarding regulated waters
- Expand state permitting programs or water quality statutes to provide protection for vulnerable streams and wetlands. ASWM provides a model statute on their website for states

that wish to improve protection for isolated wetlands: http://www.aswm.org/swp/model-leg.pdf.

States can also submit comments on the EPA/Corps post-Rapanos guidance by December 5, 2007, encourage local governments to take action, and ensure that municipalities have adequate authority to provide effective local protection for headwater streams and isolated wetlands.

Local Government Role in Protecting Vulnerable Streams and Wetlands

Local governments play a key role in filling the gaps in stream and wetland protection, because they have primary responsibility for local land use management. Local action is particularly critical in states that do not have comprehensive wetland protection programs and adequate protection for headwater streams. A review of options for local governments is provided below. In the absence of expanded state regulations or federal legislation to protect vulnerable streams and wetlands, local governments can utilize regulatory and non-regulatory approaches. Ideally, a combination of approaches will be used.

Non-regulatory approaches include quantifying the extent and value of vulnerable streams and wetlands locally, and encouraging voluntary protection of headwater streams and isolated wetlands. Regulatory approaches include use of special protection ordinances and zoning regulations. The regulatory approach to protecting small streams and wetlands may not be as attractive to some local governments because of the effort involved in developing and administering the programs. However, this is generally the most effective protection method and allows local governments to protect a wider range of resources (e.g., all types and sizes of wetlands) and regulate a wider range of activities (e.g., drainage, fills, clearing) than federal or state programs. Each strategy is described in more detail below.

Quantify the Extent and Value of Vulnerable Streams and Wetlands Locally

In the absence of state-level studies, local governments can take on the task of quantifying the extent and value of headwater streams and isolated wetlands in their jurisdictions. Quantifying the acres of wetlands or miles of stream that can potentially be lost because of inadequate protection can be a very powerful mechanism to get support for expanded local protection. Local governments can also take this information to the states and to EPA in support of regulations to ensure these resources are not degraded.

Quantifying the extent of vulnerable streams and wetlands involves determining which types of waters may be vulnerable based on current regulations, and identifying these resources on maps and/or in the field. This can be challenging because the federal regulations do not clearly specify which waters are unprotected, and because there are no consistent definitions or a standard methodology for identifying potentially vulnerable waters such as “isolated wetlands.” Other limitations include the ability to use mapping to identify hydrologic connections between wetlands and other waters through underground pipes, culverts, or ditches, or to identify intermittent and ephemeral streams in the field. Some combination of state/local regulation evaluation, mapping, and field assessments will likely be needed to complete this analysis. The following tools may assist local governments in this task:

- EPA's *Field Operations Manual for Assessing the Hydrologic Permanence and Ecological Condition of Headwater Streams*: http://www.epa.gov/eerd/manual/HISSmanual_full.pdf
- North Carolina Division of Water Quality's proposed method for distinguishing between ephemeral and intermittent streams in the field: http://h2o.enr.state.nc.us/ncwetlands/strmman.rtf
- The Association of State Wetland Managers' proposed consistent method for identifying isolated wetlands using mapping: http://www.aswm.org/fwp/swancc/gis-swan.htm
- The Center for Watershed Protection's Wetland Impacts assessment (Article 2) evaluates hydrologic connections between wetlands and other waters through pipes, culverts, and outfalls in urban areas: http://www.cwp.org/wetlands/articles.htm

In addition to mapping the extent of vulnerable streams and wetlands, assessments that quantify the benefits provided by these resources should also be undertaken to give scientific weight to the argument for their protection. For example, a community could estimate the relative contribution of headwater streams to watershed loads of nutrients and sediment, and estimate how these loads might increase if these resources were lost. The state of North Carolina recently conducted an assessment of the extent and benefits of headwater streams and wetlands across the state; results are summarized in Box 6. Information on benefits provided by specific streams and wetlands can be useful to document a "significant nexus" in the context of Section 404 permits.

Box 6. The Extent and Value of Headwater Streams and Wetlands in North Carolina

The North Carolina Department of Environment and Natural Resources conducted a multi-year research study to examine the water quality and aquatic life values of headwater streams and wetlands across the state. The study concluded that first and second order streams make up the majority (75%) of streams across all three physiographic regions in the state: coastal plain (71%), piedmont (58%) and mountains (37%). These headwater streams were also inaccurately depicted on USGS topographic maps.

Researchers determined that headwater streams provide significant reductions in nutrients and sediment across the state and also provide a significant source of organic matter for downstream ecosystems. Intermittent streams were found to have one-half the aquatic life of downstream perennial streams, while the mean watershed area for intermittent spring-fed streams was only 4.2 acres.

This study also found that headwater wetlands (wetlands associated with first and second order streams) significantly reduced sediment, nutrients and heavy metals in the piedmont region. They also provide important habitat for amphibians such as salamanders. The research findings show that proper protection and management of headwater streams and wetlands is critical to protect downstream water quality and aquatic life in the state. Results of the study were summarized in a publicly available two-page fact sheet, and serve as an outreach tool to make the case for protection of these vulnerable resources.

Sources: Dorney (2006) and NCDWQ (2006)

Encourage Voluntary Stream and Wetland Protection

Local governments can encourage landowners to voluntarily conserve or protect their vulnerable resources. This is not limited to direct land conservation, but includes actions that may reduce stormwater runoff and pollutants entering downstream receiving waters. Local governments can provide tax incentives to landowners for wetland conservation; provide stormwater credits to developers for conserving natural areas and reducing impervious cover; develop local recognition programs for green businesses and schools; or provide free or subsidized materials and training for tree planting, composting, yard waste collection, hazardous materials collection, rain barrels and rain gardens. CWP (1998) and Article 3 in this series provide further information on stream and wetland protection techniques that local governments can encourage through incentives and other instruments.

Use Special Protection Ordinances to Regulate Vulnerable Streams and Wetlands

Special protection ordinances provide a local government with regulatory power to protect natural resources outside of zoning by directly regulating activities in and around wetlands, streams, buffers, floodplains, or other natural resources. Some states require local governments to adopt and implement special protection ordinances. Special protection ordinances require some administration on the part of the local government, and may cause controversy over perceived ‘takings’ of land. The use of local buffer and wetland protection ordinances to protect headwater streams and isolated wetlands is described below.

Stream and Wetland Buffer Ordinances

Local stream and wetland buffer ordinances are excellent tools for protecting vulnerable streams and wetlands. Many local governments have already adopted stream buffer ordinances; however, these regulations typically apply only to perennial streams. In an extensive review of scientific literature on buffer functions, Wenger (1999) determined that buffers are most effective when applied to all streams, including small ones. Wenger and Fowler (2000) recommend that, at a minimum, all perennial and intermittent streams be buffered, and all ephemeral streams should have vegetated banks. A minimum base buffer width of 50 to 100 feet is recommended to provide adequate stream protection (Wenger and Fowler, 2000; Schueler, 2000).

Existing stream buffer ordinances can be modified to protect all streams and their associated floodplains and wetlands by clearly specifying in the ordinance definition that “streams” refer to both perennial and non-perennial streams. The ordinance should state that no fill or discharges are allowed in the protected buffer area. Since many headwater streams are not shown on USGS topographic maps, the ordinance language should also state that unmapped streams identified in the field are also subject to the buffer requirement (Wenger and Fowler, 2000). If local maps are referenced by the ordinance, the most detailed ones available (e.g., NRCS soil survey maps) should be used (Figure 17).

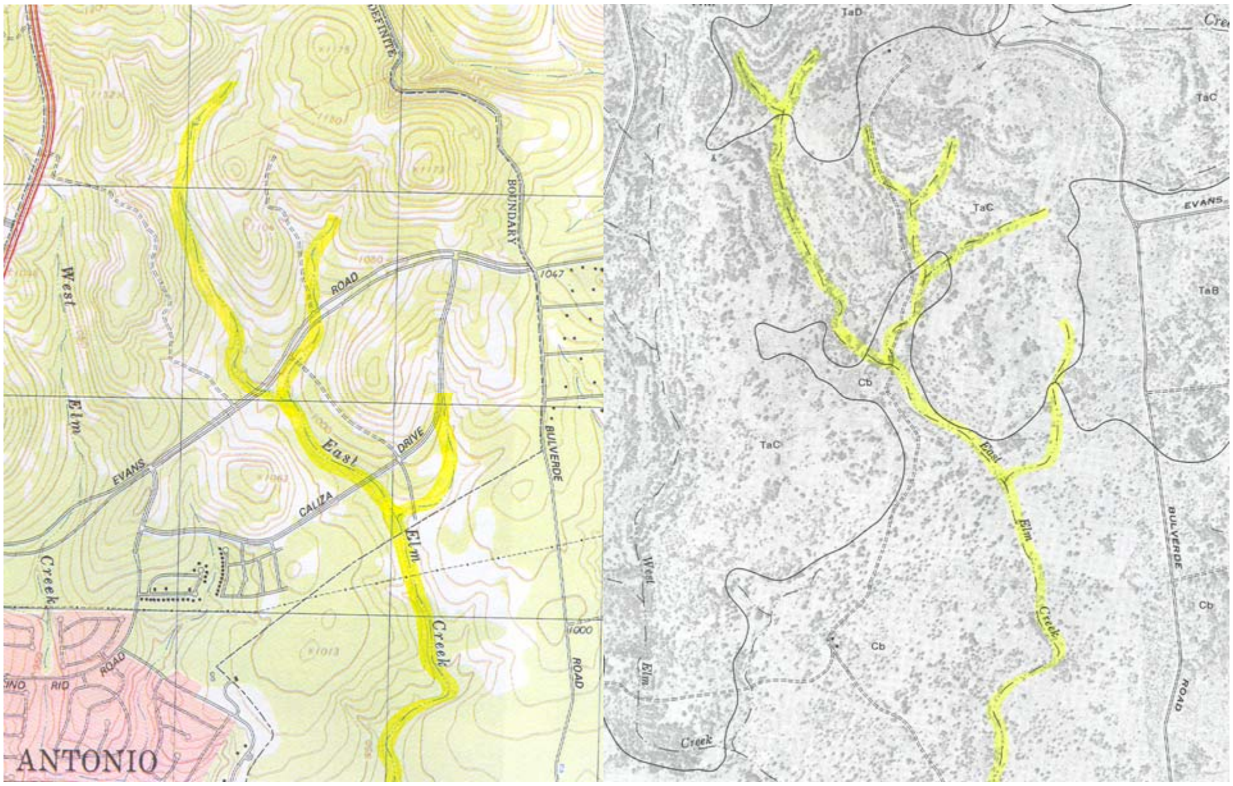

Figure 17. The stream network on USGS topographic maps (left) is often less detailed than on local soil surveys (right)

The stream buffer approach is effective because it keeps the stream corridor from being disturbed without the burden and cost of administering a permit process. Potential problems with requiring stream buffers on intermittent and ephemeral streams include identification of these streams in the field, and an increase in local program resources to enforce the regulations. Box 7 summarizes approaches taken by two Virginia counties to protect intermittent streams using buffers. Schueler (2000) provides guidance on the design and enforcement of urban stream buffers, and a model ordinance is provided at: www.stormwatercenter.net.

Wetland buffers can be required through a local wetland buffer ordinance or by expanding the stream buffer ordinance to include nearby wetlands. To protect isolated wetlands, the buffer ordinance definition of "wetlands" should include all wetland types, regardless of size or isolation. Buffer widths of 50 to 100 feet are typically recommended to protect wetland water quality, while buffer widths of 100 to 300 feet or more are recommended for wetlands with important wildlife functions (EOR, 2001, Chase et al., 1997; Castelle et al., 1992). Box 8 summarizes the status of protection for isolated wetlands and their buffers in Massachusetts. Article 3 in this series provides guidance on local wetland buffer ordinances.

Box 7. Protecting Intermittent Streams in Two Virginia Counties

Stream buffers are required in Albemarle County, Virginia for the purposes of retarding runoff, preventing erosion, filtering non point source pollution from runoff, moderating stream temperature, and providing for the ecological integrity of stream corridors and networks. The county takes a varied approach to stream buffer extent, with different buffer width requirements for different areas of the county. This approach recognizes that headwater streams and wetlands have value in protecting drinking water supply, and requires a 100-foot buffer along all perennial and intermittent streams within designated water supply protection areas. Nontidal wetlands contiguous to these streams and floodplains must also have a 100-foot buffer, and the buffer must extend to the limits of the floodplain.

In James City County, Virginia, a rapidly expanding county near Williamsburg, the Board of Supervisors recently adopted revisions to two watershed management plans that will require a 50-foot buffer along intermittent streams and wetlands not regulated by the state (this typically includes isolated wetlands). These revisions currently affect only those properties with rezoning or special use permit applications within the Powhatan Creek and Yarmouth Creek Watersheds, but the county plans to extend the revisions to all future development plans. In addition to protecting intermittent streams, the buffer requirements include a 3-zone buffer system that, in total, can be as wide as 300 feet, depending on site characteristics.

Sources: ACAO (2006), Freedland (2006), and James City County Board of Supervisors (2006)

Box 8. Protecting Isolated Wetlands and Their Buffers in Massachusetts

Massachusetts state wetlands regulations extend to wetlands that are adjacent to other waters, and do not extend to isolated wetlands. However, this does not preclude local governments from extending protection to isolated wetlands. The Pioneer Institute for Public Policy Research conducted a survey of municipalities in eastern Massachusetts to find out just how many local jurisdictions regulated isolated wetlands. Of the 131 jurisdictions with local wetland ordinances, 113 of them extended protection to isolated wetlands, and most protected a 100-foot buffer around these wetlands (Dain, 2006). The minimum size of wetlands regulated ranged from 500 ft^2 to 5,000 ft^2 (Dain, 2006).

Ordinance language used by Massachusetts communities to protect isolated wetlands was variable. As an example, the Town of Groton Wetlands Protection Bylaw applies to “any freshwater wetland, marsh, wet meadow, bog, swamp, vernal pool, creek, beach or bank, reservoir, lake, pond of any size, land under any water body or within 100 feet of any of the aforesaid resource areas; any river or stream, including land within 200 feet of same; or any land subject to flooding or inundation by stormwater, groundwater or surface water (Town of Groton, 2003).” The Town of Groton bylaw defines freshwater wetlands as “all wetlands whether or not they border on a water body” (Town of Groton, 2003).

While buffers are simple in concept, buffer requirements can be difficult to implement, due to shortages of enforcement staff and other resources. Therefore, it is important that local program staff have the necessary enforcement authority, resources, and training to ensure effective implementation of the regulation. Figure 18 presents an example from North Carolina of the importance of implementation.

Figure 18. While some impacts to this wetland in the Neuse River Basin, NC were permitted, the local regulations require proper erosion and sediment controls to protect streams and wetlands from excessive sedimentation. The silt fence shown in these photos has not been properly maintained and allows discharges of sediment into the stream and wetland. Better enforcement and inspections might have prevented this situation.

Wetland Protection Ordinances

Local governments can modify their existing local wetland protection ordinances to include isolated wetlands. Ordinance amendment may involve revising the definition of "wetlands" (Box 9), listing the specific types of wetlands protected, and/or updating relevant maps. Fills and discharges should be prohibited (at a minimum) in these areas, but other activities, such as drainage, may also be prohibited. Alternatively, local governments can adopt new wetland protection ordinances to fill the gap in federal and state regulation, if one does not currently exist. Box 10 summarizes this approach in one New York town. Additional information on local wetland protection ordinances is provided in Article 3 and in Kusler and Opheim (1996).

Box 9. Expanded Local Protection for Isolated Wetlands in Lake County, Illinois

Lake County, Illinois' Watershed Development Ordinance (WDO) establishes countywide standards for runoff maintenance, detention sites, erosion control, water quality, wetlands and floodplains. In order to "fill the gap" created by SWANCC, Lake County amended the WDO in 2001. The amendments require the applicant to first submit a jurisdictional determination request to the U.S. Army Corps of Engineers (Corps). The Corps will decide whether the wetland in question is jurisdictional under the Clean Water Act, or isolated by nature of the SWANCC Supreme Court Decision. The amended WDO contains three (3) modified definitions related to the isolated wetland program: The most significant new definition is for "Isolated Waters of Lake County" (IWCS). The new definition encompasses areas that meet the Corps definition of a wetland, but that are not under Federal jurisdiction.

Source: LCSMC (2006)

Box 10. Expanded Local Protection for Wetlands in the Town of Wappinger, New York

In July 2005, the Town of Wappinger, New York adopted a new wetlands protection law that closes the gap in state and federal wetland regulations. The current state wetland laws only protect wetlands that are 12.4 acres or larger. The new local regulation applies to all wetlands, regardless of size, and also regulates a broader range of activities that may occur in and around wetlands. The new town law regulates the following activities that occur within 100 feet of wetlands: construction, dumping, excavating, grading, clear cutting and other activities that impair wetland functions. In addition, the Town Board adopted a resolution that requests the state to pass the Clean Water Protection/Flood Prevention Act to require state protection of all wetlands one acre or larger.

Source: Town of Wappinger (2006)

Regulate Vulnerable Streams and Wetlands Through Zoning

Zoning regulations can be used to protect sensitive areas, such as stream corridors, shoreland zones, or wetlands, in the form of a resource protection zone. The use of zoning to protect natural resources generally includes mapping the areas to be protected, adopting the map as part of local zoning, and adopting written regulations that set forth permitted and prohibited uses for that zone (Kusler, 2006). Resource protection zones directly limit or prohibit incompatible development within these zones. Very low-intensity uses are usually authorized, while other types of uses are outright prohibited. Additional activities may be allowed under a conditional use permit, which may require mitigation for impacts.

Local governments can protect headwater streams and isolated wetlands using the zoning approach described above. This requires adoption of a map showing the location of the resources to be protected. Map layers that may be used to generate the resource protection zone map include wetlands, hydric soils, 100-year floodplains, streams, and topography. In order to capture the smallest streams and wetlands, the most detailed data available should be used. Actual boundaries may need to be verified in the field during administration of the zoning ordinance.

Summary

Recent Supreme Court rulings have muddied the waters regarding federal protection of isolated wetlands and headwater streams; however, it is clear is that most states, tribes, and local governments do not currently have the regulatory tools in place needed to protect these water resources. This is of particular concern in those states and local watersheds where a large percentage of streams are intermittent or ephemeral; a large proportion of wetlands are considered isolated; increasing development pressure further threatens the health of these waters; and state/local protection of streams and wetlands relies on the federal permitting program. The loss of headwater streams and isolated wetlands would mean the loss of the important ecological, hydrologic, water quality, and habitat benefits that they provide to the entire aquatic ecosystem. State and local governments must take action to ensure that this does not happen.

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Attachment A: Explanatory Notes for Tables 2 and 3

Source: ELI (2007). For a complete discussion of these explanatory notes and associated citations, consult ELI (2007). Available online for free download at: www.eli.org

Traditional Navigable Waters
A body of water that is currently used, or was used in the past, or is susceptible to use in the future, in interstate or foreign commerce. Includes all waters that are subject to the ebb and flow of the tide.

Adjacency Rule as Applied to Non-Navigable Tributaries
A wetland is jurisdictional based solely on its adjacency to a non-navigable tributary if *either* the answer to Question No. 5 on the Wetlands Checklist for Clean Water Act Coverage (Table 2) is "yes," *or* if the wetland is adjacent to a tributary coming within a category of non-navigable tributaries that the Corps has identified as significant.

Relatively Permanent Bodies of Water
Relatively permanent bodies of water include some rivers characterized as "seasonal" that have continuous flow during some months of the year but no flow during dry months, as well as waters that might dry up in extraordinary circumstances, such as drought.

Man-Made Dikes or Barriers, Natural River Berms, and Beach Dunes
The presence of a man-made or natural barrier between a wetland and traditional navigable waters (or their tributaries) is not a bar to Clean Water Act jurisdiction.

Prior Converted Cropland
The Clean Water Act does not cover prior converted cropland, an issue that arises most often in the Section 404 program.

Use of Aggregation for Streams
Under current law, it is uncertain whether the significant nexus test, as applied to a stream, allows for the stream to be combined with similarly situated lands (or streams) in the region for purposes of assessing its effects—as may be done with wetlands.

Impoundments
Impoundments of waters that are "waters of the United States" are covered by the Clean Water Act

Physical Boundaries of Jurisdiction
Corps regulations fix the precise limits of its jurisdiction over both *tidal waters* and *non-tidal waters*, respectively.