

Nonpoint Source Protection Report:

*Approaches for integrating the protection of healthy waters in
nonpoint source management programs*

DRAFT

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Table of Contents

Executive Summary	6
Chapter 1: Introduction	8
Defining Protection	8
The Importance of Protection in Managing NPS Pollution	9
Protection in the National NPS Program	11
Goals of this paper	13
Methods Overview	13
Chapter 2: Prioritizing Watersheds for Protection	16
Chapter Summary	16
Introduction	16
Protection Prioritization Methods and Tools	18
Prioritization Factors	20
Water Quality	22
Watershed Condition	24
Social/Programmatic Factors	30
Chapter 3: Integrating Protection in Watershed Planning	36
Chapter Summary	36
Introduction	37
Using the Watershed Approach to Protect and Restore Waters	37
Review of Protection-Oriented Watershed Plans	40
Integrating Protection in the Watershed Planning Process	44
Step 1: Build Partnerships	44
Step 2: Characterize the Watershed	49
Step 3: Set Goals and Identify Solutions	61
Step 4: Design an Implementation Program	74
Chapter 4: Implementing Protection Projects	78
Chapter Summary	78
Introduction	78
State NPS Program Approaches for Soliciting and Evaluating Protection Projects	79
State NPS Program Protection Projects	84
Land Conservation	86
Local Regulation & Land Use Planning	90

Chapter 5: Tracking Protection Actions and Outcomes	92
Chapter Summary	92
Defining Protection and Protection Goals	93
Tracking Protection in the National NPS program.....	94
State Approaches for Tracking Protection.....	96
Chapter 6: Protection Partnerships and Complementary Programs	103
Chapter Summary	103
EPA Water Programs.....	103
Other Federal Programs.....	106
State Programs.....	108
Local Government Programs	109
Tribal Nations.....	110
Other Key Partners.....	111
Chapter 7: Conclusion	114
References	117
Appendix A. Land Conservation Primer	136
State NPS Program Features	
2.1: Maine – Lake Protection	18
2.2: New Hampshire – Scope of Protection	23
2.3: Maine – Priority Watershed Selection Criteria	27
2.4: New Hampshire – Social and Programmatic Factors	30
2.5: Ohio – High Quality Designations	31
4.1: New Hampshire – BMPs	85
4.2: North Carolina – Review Criteria	86
4.3: Michigan – Conservation Easements	87
4.4: Michigan – Ordinances	90
6.1: Connecticut – Open Space Acquisition	108
6.2: Maine – Lake Association Partnerships	110
Watershed Plan Features	
3.1: Upper Llano River – Acting Before Impairment	41

3.2: Chagrin River – Integrated Protection/Restoration Approach41
3.3: Paw Paw River – Build-Out Analysis52

Resource Features

2.1: EPA Recovery Potential Screening Tool and Watershed Index Online20
2.2: Drinking Water Protection and Land Use26
2.3: Natural Hazard Mitigation29
2.4: Safe Water Conservation Collaborative32
2.5: EPA EnviroAtlas Dataset33
3.1: Finding Local Protection Partners46
3.2: Delaware River Watershed Initiative, Partnerships Central to Water Quality Protection Work47
3.3: EPA Integrated Climate and Land-Use Scenarios Tool53
3.4: Characterizing Lake and Pond Vulnerability to Degradation57
3.5: CWA §303(d) Program Protection Plans59
3.6: Approaches to Identifying Protection Priority Areas (PPAs)69
4.1: Education & Outreach—A Key Component of Protection Projects82
4.2: USDA-NRCS Agricultural Conservation Easement Program87
4.3: Land Conservation to Protect Farmlands and Water Quality88
5.1: National Estuary Program Protection Projects99
6.1: New Hampshire NGOs111

Tables

2.1. State approaches for prioritizing watersheds for protection20
2.2. Indicators used to select priority watersheds for protection21
2.3. CWA §305(b) Integrated Reporting Categories22
3.1. Crosswalk of required elements of WBPs and alternative watershed plans38
3.2. Review of 22 protection-oriented watershed plans (POWPs)42
3.3. Characteristics of the reviewed POWP watersheds43
3.4. Management goals, approaches, and potential challenges.....62
3.5. Ordinance types cited in the reviewed POWPs72

3.6. Interim milestone types cited in the reviewed POWPs75

4.1. New Hampshire evaluation criteria for NPS implementation projects81

4.2. Commonly cited BMPs in GRTS protection projects84

4.3. Land use policy tools that support watershed protection efforts89

5.1. Definition of protection by different EPA water programs92

5.2. Protection-based measures of progress from state NPS program plans95

5.3. Count of habitat protection projects and total acres protected by NEPs, 2010-201899

5.4. Benefits attributed to NEP habitat protection projects100

5.5. Most common lead implementers of NEP habitat protection projects101

Figures

2.1. EPA Healthy Watersheds Assessment Framework25

2.2. Model for assessing watershed vulnerability to climate change28

3.1. General steps for developing and implementing watershed plans40

3.2. Partner types involved in the reviewed POWPs45

3.3. DRWI clusters48

3.4. Annual sediment loads by subwatershed in San Jacinto, CA58

3.5. Watershed classification by protection/disturbance condition61

3.6. Prioritization results from Tyger River’s parcel methodology64

3.7. Expected population growth and land development in Hays County, TX65

3.8. Relationship between pollutant source magnitude and transport potential68

3.9. Hierarchy of stormwater best management practices70

4.1. Protection projects by state, FY2014 – 201983

4.2. Distribution of BMPs implemented in protection projects84

4.3. GRTS projects with conservation easement as a BMP type86

5.1. Four types of protection93

5.2. The 28 National Estuary Programs (NEPs)99

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Executive Summary

To be completed by HQ staff

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Chapter 1: Introduction

Defining Protection

The stated objective of the Clean Water Act (CWA) is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (33 U.S.C. Section 1251(a); CWA Section 101(a)). Much of the focus of EPA’s water programs for the past five decades has been on restoring impaired waters and reducing pollutant levels in waterways. While progress has been made, EPA’s most recent National Water Quality Inventory Report to Congress indicates the extent of ecosystem degradation that still exists across waterbody types. According to this report, the majority of assessed rivers and streams (55%); lakes, ponds and reservoirs (72%); coastal bays and estuaries (77%); and wetlands (53%) are listed as impaired in state Integrated 305(b)/303(d) Reports (USEPA 2017a).

EPA’s National Nonpoint Source (NPS) Program launched the Healthy Watersheds Initiative to place a renewed emphasis on maintaining the integrity of the nation’s healthy waters and to leverage these natural resources to accelerate restoration successes. Whereas restoration aims to improve water quality and ecosystems from a degraded state to a target condition, **the goal of protection is to maintain the integrity of healthy aquatic ecosystems and their watersheds** (USEPA 2012a). Through the Healthy Watersheds Program, EPA has worked over the last decade to better integrate healthy watersheds protection in Clean Water Act programs, assist states and other partners to target protection efforts through [healthy watersheds assessments](#), and accelerate and expand the strategic protection of healthy watersheds across the country through the [Healthy Watersheds Consortium Grant Program](#).

Though not always explicitly distinguished from one another, water quality restoration and protection are frequently dual components of watershed management efforts. For example, the watershed approach serves as a framework for managing water resource quality and quantity in a holistic manner, while actively involving watershed stakeholders in selecting management strategies (USEPA 2008). Both water quality protection and restoration goals can be incorporated in the development of nine element watershed-based plans¹, source water protection plans, and other holistic planning approaches, like integrated water resource management plans. However, as described throughout this report, defining where an effort lies along the protection-restoration gradient is an important part of the decision-making process at both the water program and watershed scales.

A **watershed** is an area of land where precipitation and runoff drain to one common water body, such as a river, stream or lake. **Healthy watersheds** are those in which natural land cover supports dynamic hydrologic and geomorphic processes within their natural range of variation, habitat of sufficient size and connectivity to support native aquatic and riparian species, and physical and chemical water quality conditions able to support healthy biological communities (USEPA 2021b).

¹ EPA’s Clean Water Act section 319 Nonpoint Source Program defines nine element watershed-based plans as those containing the nine elements identified in EPA’s *Handbook for Developing Watershed Plans to Restore and Protect our Waters* (USEPA 2008).

At the state or regional scale, water programs seeking to advance protection work may be newly supporting planning and project work in healthier watersheds that have not been the focus of previous restoration efforts. Within these watersheds, the local partners, community engagement strategies, and management approaches best suited to protect healthy waters may be different than those designed to restore impaired waters (Kwon et al. 2021). For example, healthier, less developed watersheds may present opportunities to work with partners in pursuing large-scale, proactive management strategies such as land conservation and land use planning to meet watershed protection goals. This report aims to serve as a technical and programmatic resource in support of EPA, state, and other partner efforts towards achieving the Clean Water Act objective to maintain the integrity of U.S. waters.

The Importance of Protection in Managing NPS Pollution

Among waterbodies that have been assessed and a possible cause of impairment identified, nonpoint source pollution is the leading cause of water quality impairment in 85 percent of rivers and streams as well as in 80 percent of lakes and reservoirs in the United States (USEPA 2016b). Over the past 25 years, states and partners have made strides in restoring NPS-impaired waters. EPA has published more than 1,300 water quality improvements from all 50 states and the District of Columbia documenting partial/full water quality restoration of NPS-impaired waters.² Despite these successes, the rate at which new waters are being listed for water quality impairments exceeds the pace at which restored waters are being removed from the list (USEPA 2012a). Protection can play a key role in reducing this gap by both preventing new water quality impairments and helping ensure restoration success. Below is an outline of three factors cited by states reviewed for this report, that have motivated their efforts to integrate more protection into their NPS programs.

1. Protecting healthy waters and watersheds can prevent the need for water quality restoration, as well as help ensure restoration success.

Proactive watershed planning and management can prevent or mitigate the need for water quality restoration, which frequently requires significant resource investments and sustained efforts over months or years to achieve success (Meals and Dressing 2008; USEPA 2016b). Healthy, functioning watersheds can also provide the building blocks that anchor water quality restoration efforts (USEPA 2012a). For example, river restoration success, as measured by benthic invertebrate assemblages, has been found to be dependent on the site's proximity to source populations of the desired taxa (Sundermann, Stoll, and Haase 2011). Once an area is restored, ongoing protection work can help maintain water quality and habitat. The Environmental Law Institute's (ELI) *Compendium of State Approaches to Protection* (ELI 2020), a review of the ways that state CWA 303(d) programs have sought to protect healthy waters, refers to "legacy protection" as cases where an existing total maximum daily load (TMDL), developed for an impaired waterbody that has been restored, may continue to provide

²EPA tracks the number of NPS-impaired waters that are partially or fully restored, which is a key measure in the effort to document how NPS restoration efforts are improving water quality across the nation. To qualify as a success story, "a water body must have been listed on the CWA section 303(d) list or on the Integrated Report (IR) as Category 4 or 5 water body during the 1998/2000 listing cycle or subsequent years. Since being listed, water bodies have achieved documented water quality improvements that can be attributed to actual NPS control or restoration efforts." See <https://www.epa.gov/nps/success> for more information.

value as a protection TMDL to help guide efforts to ensure the waterbody does not become impaired again.

Three state NPS programs (AK, NH, and ME) identified the prevalence of unimpaired/high quality waters as a motivating factor for protection. In these states, unimpaired/high quality waters outnumber those with water quality problems (Maine Department of Environmental Protection [ME DEP] 2014; Alaska Department of Environmental Conservation [AK DEC] 2015; New Hampshire Department of Environmental Services [NHDES] 2014). These states have therefore expanded NPS management strategies and resources to proactively protect healthy waters and watersheds from water quality threats.

- **Maine's** NPS program has been motivated to address protection, in part, due to the state's sheer number of unimpaired waters. More than 96% of river and stream miles, 85% of marine waters, and 91% of lake acres and 90% of lakes assessed as part of Maine's 2016 Integrated Report indicate attainment of water quality standards (ME DEP 2019). Protection has been a longstanding objective in Maine, and the state outlines goals for continued protection work in the state NPS management plan (2019). The Maine NPS program plan states "since prevention is far more feasible and less expensive than restoration of an already impaired waterbody, DEP allocates significant program resources for projects that help communities protect waters considered threatened or most at risk" (ME DEP 2019).

2. Protection efforts help maintain healthy watersheds that are resilient to the effects of changes in land use, climate, and other water quality threats.

Watershed condition and water quality are dynamic properties that can change over time due to natural processes and anthropogenic influences. However, natural disturbance regimes have been severely altered in many watersheds by anthropogenic activities like dam construction, fire suppression, surface and ground water withdrawals, and land use change. This can increase a watershed's vulnerability, generally defined as the degree to which a system is susceptible to and/or unable to cope with adverse effects, whether natural or anthropogenic (USEPA 2012a). Vulnerability assessments have helped state NPS programs and partners target protection efforts in watersheds with the highest risk of degradation (USEPA 2021c). Several state NPS programs referenced specific threats, including urbanization and wildfire, as motivating factors for protection. Additionally, several of the protection-oriented watershed plans evaluated future threats, for example through buildout analyses and water quality modeling, to help target management strategies in the most vulnerable parts of the watershed.

- **California's** NPS Program Plan includes a goal of protecting "high priority waters subject to catastrophic fire damage" (CA NPS Program 2015). This goal was in part motivated by water quality issues documented in the Battle Creek Watershed in northern California, which experienced significant increases in sediment loading following a large wildfire in 2012 (Battle Creek Watershed Conservancy 2019). The risk of water quality degradation and related impacts on salmon and steelhead populations following wildfires has prompted efforts to address threats to unimpaired/high quality watersheds using NPS management strategies.
- **Colorado's** 2022 NPS Management Plan includes wetland protection and the prioritization of protection projects to improve climate resiliency to help mitigate climate change impacts and land use changes. Waterbodies prioritized for protection include:
 - Waterbodies with a water quality summary that indicates that the waterbody is or may become threatened by NPS pollution. This includes source water protection areas identified through coordination with Natural Resources Conservation Services and other

NPS partners in the NPS Alliance, a volunteer group that meets to address NPS issues statewide. It also includes subwatersheds prioritized through Colorado State Forest Service's Forest Action Plan to proactively address high wildfire risk areas to prevent cascading impacts to communities post-wildfire;

- High priority watersheds for Aquatic Species of Greatest Conservation Need (SGCN) as identified in Colorado's State Wildlife Action Plan; and
- Waterbodies designated as Outstanding Waters by Colorado's Water Quality Control Commission pursuant to section 31.8(2)(a) in Regulation 31 (The Basic Standards and Methodologies for Surface Water) (CDPHE 2022).

3. Proactive watershed planning and management can help organize partners and gather support in protecting water resources highly valued by communities.

There is an inextricable connection between the health of waters, their surrounding watersheds, and the communities that live in them. Healthy watersheds support healthy waters, which together provide a wide range of ecosystem services necessary for social and economic well-being, including social and health benefits provided by nature-based recreation and reduced costs associated with water treatment and flooding (USEPA 2012b). For this reason, watershed protection efforts are often driven by local communities working together to protect highly valued water resources and the services they provide.

Five states (NH, ME, MI, MN, OH) described stakeholder demand for protecting high value water resources as a motivating factor for integrating protection in their NPS programs. High value aquatic resources included Blue Ribbon trout streams, streams supporting endangered salmonids, National Wild and Scenic Rivers and related state designations, critical sources of clean drinking water, or waters designated as having exceptional biotic habitats. Healthy waters are critical to supporting state and local economies based on water-based tourism, such as fishing, swimming, and boating. Water quality degradation, particularly in lakes, can diminish the property value of surrounding homes while also affecting residents' enjoyment of their locations. In response, groups such as lake and watershed associations have engaged their state governments to support initiatives to maintain the high-quality condition of local waters and prevent or reverse negative trends.

- **Michigan's** stakeholder groups (e.g., lake associations, watershed groups, Trout Unlimited, and watershed councils) have been the primary factor to motivate the adoption and implementation of protection strategies by the Michigan NPS Program. Stakeholder interest in protection has stemmed from various causes, including threats to world-class trout streams and landowner concern over water quality issues near vacation properties. Stakeholders recognize that they can take actions to prevent water quality degradation and impairment and advocate for NPS management in unimpaired/high quality watersheds. The energy and capacity of stakeholder groups have made them key partners for Michigan's NPS program in protection-related efforts, particularly work to protect high quality inland lakes. The commitment to stakeholder partnerships is documented in Michigan's NPS Program Plan, which states that "working in partnership with other stakeholders is a key goal" (Michigan Department of Environmental Quality [MI DEQ] 2015).

Protection in the National NPS Program

The National NPS Program has long recognized water quality protection as a key part of NPS pollution management efforts. Both watershed restoration and protection projects were encouraged and funded

in the early years of the CWA section 319 program during the 1990s. EPA's *Nonpoint Source Program and Grant Guidance for Fiscal Years 1997 and Future Years*, which first introduced the key components of an effective state program, noted that "[w]hile it may take years to remedy waters that are already impaired, it is also important for States to take appropriate steps expeditiously to protect clean waters from reasonably foreseeable degradation. State programs should place a priority on protecting waters from future nonpoint source pollution as soon as possible (generally within 5 years)" (USEPA 1996). EPA maintained a focus on protection of unimpaired waters as a §319-eligible activity in the intervening NPS program and grant guidelines (e.g., USEPA 2003).

The 2013 *NPS Program and Grant Guidelines for States and Territories* emphasize the dual importance of restoring NPS-impaired waters, as well as protecting unimpaired waters from present and reasonably foreseeable future NPS impacts (USEPA 2013b). Per the 2013 guidelines, states may use NPS program funds for protection of unimpaired/high quality waters including healthy watersheds assessments, actions, and leveraging of other sources of funding for watershed protection. Where a state has an updated NPS management program that identifies protection of unimpaired/high quality waters as a priority and describes its process for identifying such waters, the 2013 guidelines provide states flexibility to use a limited amount of watershed project funds for activities to protect identified waters following consultation with EPA through §319 grant work plan negotiations. Per the guidelines, the proportion of §319 watershed project funds allocated to protecting unimpaired/high quality waters could vary depending on the relative priority of restoration and protection activities in the state's NPS management program and the array of projects ready for §319 funding and implementation in that particular year.³

The 2013 §319 guidelines continue to emphasize that effective planning is necessary to guide successful implementation of watershed restoration and protection projects (USEPA 2013b). In most cases, EPA furthers the emphasis on nine element watershed-based plans (WBPs) as the primary planning framework for §319 watershed projects. EPA expects watershed plans to focus not only on the impaired segments within a watershed, but, when possible, to identify currently unimpaired waters where protection and load reduction actions are necessary to ensure that high quality waters do not become impaired, and address conditions that may contribute to impairments downstream (USEPA 2013b). In addition, the 2013 §319 guidelines list a few select cases, including the protection of assessed waters that are largely or fully attaining water quality standards, when alternative plans to a WBP may provide an effective roadmap to achieve the water quality goals of §319-funded efforts. In these watersheds, alternative plans may effectively guide NPS project implementation without addressing all nine planning elements.

Today, the primary focus in the National NPS Program continues to be on planning and implementing management efforts to restore NPS-impaired waters, which account for the majority of water quality impairments nationwide (USEPA 2016b). As described in [Chapter 4: Implementing Protection Projects](#) (see [Figures 4.9](#) and [4.10](#)), protection projects accounted for less than five percent of all NPS projects reported to EPA's Grants Reporting and Tracking System (GRTS) from 2014 to 2019. Given the limited

³Per the 2013 §319 guidelines (USEPA 2013b), **NPS program funds** comprise up to 50% of the total state §319 funding and may be used for the full range of activities to support the goals of the state's approved NPS management program. States must use at least 50% of the annual appropriation of §319 funds (**watershed project funds**) to implement watershed projects guided by nine-element watershed-based plans or acceptable alternative plans.

role of protection in the NPS Program to date, and to help support states interested in integrating protection in their NPS management programs, this report aims to help answer two main questions:

1. How can state NPS programs best target available resources, including 319 funding, to support the protection of unimpaired/high quality waters?
2. Given the central role of watershed planning in the National NPS program, how can states and local NPS partners better integrate protection in these plans to guide protection efforts and help achieve water quality restoration goals?

Goals of this paper

The primary goal of this effort was to compile information on ways in which states have integrated the protection of unimpaired/high quality waters in their NPS management programs. Additionally, given that there is a broader community of practice working to protect healthy waters and watersheds, reviews of state NPS programs and protection-oriented watershed plans were supplemented with targeted reviews of scientific and programmatic literature on the topics covered in this report. This information, including case study feature boxes, are incorporated throughout this report to help inform protection efforts in NPS programs. This report is divided into five main chapters corresponding with key NPS program areas where there is opportunity to integrate protection:

- [Prioritizing Watersheds for Protection \(Chapter 2\)](#) provides an overview of state NPS program approaches for prioritizing healthier watersheds in which to target protection efforts.
- [Integrating Protection in Watershed Planning \(Chapter 3\)](#) outlines opportunities to integrate protection during the four main steps of watershed planning – building partnerships, characterizing the watershed, setting goals, identifying solutions, and designing an implementation program, based primarily on EPA’s review of 22 protection-oriented watershed plans.
- [Implementing Protection Projects \(Chapter 4\)](#) provides an introduction to watershed protection techniques and findings from a review of protection projects reported to EPA’s 319 Grants Reporting and Tracking System (GRTS) from 2014-2019.
- [Tracking Protection Actions and Outcomes \(Chapter 5\)](#) describes EPA’s current approach for tracking protection efforts in the National NPS Program and provides examples of how state NPS programs have adopted water quality-based and other measures to track protection progress.
- [Protection Partnerships and Complementary Programs \(Chapter 6\)](#) provides ‘at-a-glance’ summaries of potential partner programs and organizations whose goals may align with states looking to integrate protection in their NPS management programs.

In general, this report may be of primary interest to state, territory, and tribal NPS program managers and staff looking to explore opportunities to integrate the protection of unimpaired/high quality waters in their programs. This report may also serve as a resource for EPA staff, within the NPS program and other CWA programs, as external program partners interested in coordinating with NPS programs on protection.

Methods Overview

EPA relied on three primary sources of information in developing this report, which together provide a foundation of concepts and approaches to help inform how the protection of unimpaired/high quality waters can be incorporated in state NPS programs and watershed planning efforts:

1. In-depth state NPS program reviews

Beginning in spring 2019, EPA, with contractor support, conducted in-depth reviews of 13 state NPS programs: Alabama, Alaska, California, Colorado, Connecticut, Maine, Maryland, Michigan, Minnesota, New Hampshire, Ohio, Virginia, and West Virginia. EPA HQ staff selected these states, with EPA Regional input, because they represent a sample of states most active to date in integrating protection in their NPS program activities. The review included the most recently available NPS management plan, NPS annual reports, and other NPS program documents, such as State NPS Project Requests for Proposals to catalogue protection-related activities. Information from these state reviews is available in Appendix A to this report.

EPA then conducted phone interviews with NPS program staff from a subset of these states (CA, CT, MD, ME, MI, MN, NH, and OH) in spring 2019. These calls provided an opportunity to hear state perspectives, including successes and challenges, on protection work. These discussions covered topics like: What factors influenced the state NPS program's decision to invest in protection work, and what advice/lessons learned could be shared with other states interested in advancing protection work in their NPS programs?

In addition to the in-depth state NPS program reviews, information from other state NPS programs was included in this report, where other state NPS program protection work was identified through the supporting literature review (see #3 below).

2. Watershed plan reviews

To document the ways in which watershed plans have helped guide water quality protection efforts, in some cases alongside restoration, EPA regional and state NPS program staff conducted an in-depth review of 22 protection-oriented watershed plans. These protection-oriented plans met one of the following criteria: (1) the plan was developed for an unimpaired watershed (15 plans), or (2) the plan was developed for a watershed that includes NPS-impaired waters, but the plan also includes an explicit goal to protect local unimpaired/high quality waters (7 plans).

The 22 plans included in this review were developed for watersheds in eleven states: Alabama, Arkansas, Maine, Michigan, New Jersey, New Hampshire, Oklahoma, South Carolina, Texas, Virginia, and West Virginia. This sample included nine element WBPs, EPA-approved alternative plans to protect unimpaired/high quality waters, and larger-scale protection plans (e.g., basin-wide plans) that may serve as valuable building blocks for a WBP or acceptable alternative plan.

As described in [Chapter 3: Integrating Protection in Watershed Planning](#), a wide range of information from each watershed plan relevant to the four main steps of the watershed planning process was catalogued (see also Appendix B). In addition to the in-depth reviews of these 22 plans, this report also references and incorporates concepts and approaches from other protection-based plans identified through a literature review on the topic (see #3 below), discussions with state NPS programs, etc.

3. Review of scientific and programmatic literature relevant to water quality protection and NPS management

There is a wealth of literature, programs, and initiatives relevant to healthy waters and healthy watersheds protection. While a comprehensive literature review was conducted on the subject was outside the scope of this project, this report does include numerous references to scientific studies, programmatic guidance and other technical literature, and case studies of protection-based efforts from outside the National NPS Program. These references and case studies help to support concepts and approaches described throughout the report. In general, supporting literature was identified through one of the following methods: referenced in state NPS program materials or during conversations with state NPS programs (#1 above), referenced in the protection-oriented watershed plans reviewed for this report (#2 above), or identified through existing EPA Healthy Watersheds Program (HWP) resources (e.g., see <https://www.epa.gov/hwp>) and/or current related HWP projects and activities (e.g., EPA’s Healthy Watersheds Consortium Grant Program has funded 56 projects since 2016, some of which are referenced in this report).

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Chapter 2: Prioritizing Watersheds for Protection

Chapter Summary

- ✓ Given the limited program resources available to protect waters from nonpoint sources in most states, the prioritization of waters and watersheds can help target the protection-based planning and project work needed to help achieve the program’s goals.
- ✓ While state prioritization approaches can vary for specific waterbody type(s) or by watershed scale(s) evaluated, the approaches were aimed at identifying healthier waters and watersheds most vulnerable to degradation.
- ✓ Considering both the waterbodies *and* watershed conditions in prioritization approaches can help identify areas where protection efforts will likely maintain the structure and function necessary to support healthy aquatic ecosystems.
- ✓ Vulnerability assessments can help identify threatened waters/watersheds and aid in considering the design management strategies needed to protect these areas. Components of a vulnerability assessment (i.e., exposure, sensitivity, and adaptive capacity) can be incorporated into state NPS prioritization approaches.

Introduction

Nonpoint source pollution is the leading cause of water quality impairment in the United States. Based on a 2016 analysis of all assessed waterbodies with identified sources of impairment in EPA’s Watershed Assessment, Tracking & Environmental Results System (WATERS), 85 percent of rivers and streams (representing approximately 340,000 river and stream miles) and 80 percent of lakes and reservoirs (6.7 million acres) are polluted by nonpoint sources (USEPA 2016b). Across the country, changing conditions, such as land use development (USEPA 2013a), invasive species (USEPA 2021e), and climate change (U.S. Global Change Research Program 2018), threaten the health of unimpaired/high quality waters and further degrade impaired waters. In general, the resources needed to fully address water quality problems and threats posed by NPS pollution far outweigh those available to state programs. For these reasons, the EPA emphasizes the careful identification and prioritization of state NPS management activities to achieve goals and milestones outlined in the state’s NPS management programs (USEPA 2013b) to help achieve the greatest possible water quality benefit with the limited financial resources available.

EPA’s *Nonpoint Source Program and Grant Guidelines for States and Territories* includes guidance on the key components of an effective state NPS management program, to which states are expected to refer during review and update of their programs (USEPA 2013b). Two of the eight key components address the importance of identifying NPS-impaired, threatened, and high quality waters and watersheds, followed by an emphasis on developing prioritization approaches to target NPS management efforts to achieve program goals:

Key Component #4: *The state program describes how resources will be allocated between (a) abating known water quality impairments from NPS pollution and (b) protecting threatened and high quality waters from significant threats caused by present and future NPS impacts.*

Key Component #5: *The state program identifies waters and watersheds impaired by NPS pollution as well as priority unimpaired waters for protection. The state establishes a process to assign priority and to progressively address identified watersheds by conducting more detailed watershed assessments, developing watershed-based plans and implementing the plans.*

Under Component #4, a state's program describes its approach in setting priorities and aligning resources between protection and restoration based on its water quality challenges and circumstances. Consistent with Component #5, the state then establishes a process to assign priority and progressively address NPS-impaired and threatened waters and watersheds by conducting more detailed watershed assessments, developing watershed-based plans, and implementing those plans. While states are not required to conduct statewide prioritization of waters or watersheds (e.g., some states identify statewide priority pollutants or nonpoint sources while others adopt rotating basin approaches to target NPS efforts), the 2013 NPS guidelines provide example factors states may want to consider during prioritization, such as beneficial water uses, the likelihood of achieving environmental results, and the readiness to proceed among stakeholders and project partners (USEPA 2013b).

Because of the breadth of water quality impairments nationwide and the dominance of NPS pollution as a cause of many of these impairments, EPA's 2013 NPS guidelines maintain the primary focus on utilizing §319 funds to restore impaired waters and meet water quality standards. However, the guidelines provide states flexibility to commit NPS program resources, including a limited amount of §319 watershed project funds, to protect unimpaired/high quality waters. The guidelines offer examples of scenarios states may wish to consider when prioritizing the protection of unimpaired/high quality waters (USEPA 2013b).

Given the limited NPS resources available for protection, states must be deliberate in selecting the waters and watersheds in which to focus their efforts. As described below, several states have developed prioritization frameworks to target protection efforts, including the development and implementation of watershed plans. These states generally included measures of water quality, watershed condition, and social/programmatic factors to identify healthier watersheds most at-risk to degradation. By including prioritization factors that characterize conditions at multiple scales, states can better target protection work. For example, studies demonstrate that evaluating landscape condition at multiple spatial scales (e.g., watershed, catchment, and reach-scale) is critical to understanding stressors and designing management activities that effectively address them (Riato et al. 2020). Prioritization frameworks including proxies of water quality, such as watershed condition metrics, can also help identify unassessed waterbodies likely of higher quality. This chapter describes state NPS program approaches for targeting protection efforts, including the tools and data layers typically used in these assessments.

Protection Prioritization Methods and Tools

Several state NPS programs prioritized waters or watersheds in which to target protection efforts (Table 2.1). Alabama defined protection priorities as all watersheds containing waters known to be attaining all applicable state water quality standards (Alabama Department of Environmental Management [ADEM] 2014). Three states (CT, MI, and NH) applied numeric scoring and ranking systems to identify protection priorities using EPA’s Recovery Potential Screening (RPS) Tool (Connecticut Department of Energy & Environmental Protection [CT DEEP] 2016; Michigan Department of Environmental Quality [MI DEQ] 2015; New Hampshire Department of Environmental Services [NHDES] 2014). Alaska, Maine and Minnesota applied custom tools or frameworks to evaluate and rank protection priorities (Alaska Department of Environmental Conservation [AK DEC] 2016; Maine Department of Environmental Protection [ME DEP] 2014 and 2019; Minnesota Pollution Control Agency [MPCA] 2018).

In some cases, state protection prioritization frameworks differed in the waterbody type targeted as well as the candidate watersheds and watershed scale considered within the prioritization framework:

- **Some states prioritize specific waterbody types for protection.** Maine and Minnesota established prioritization criteria specific to different waterbody types (e.g., rivers/streams, lakes/ponds/reservoirs, and marine waters; ME DEP 2014 and 2019; MPCA 2018). This approach allows for a customizable process that can reflect unique considerations for each waterbody type. Both Maine and Minnesota have concentrated protection efforts toward lakes, ponds, and reservoirs, where lake associations and other local partners with a vested interest in water quality protection are available to help lead planning, project implementation, and community engagement work.

State NPS Program Feature 2.1: Maine – Lake Protection

Maine’s NPS program partners and residents place a high priority on protecting lakes and ponds. Only 21 of Maine’s 5,700 lakes are impaired by NPS pollution, illustrating the importance of protection to address pollution threats posed by phosphorus, sediment, and other pollutants. Maine’s lake protection efforts are advanced in the following ways:

- **Protective state water quality standards.** Maine has a non-degradation standard for lakes, which means that any measured trend of increasing trophic status (e.g., decrease in water clarity, increase in chlorophyll) --even in lakes with high Secchi disc readings—results in a violation of state water quality standards and requires the lake to be listed on the state’s CWA section 303(d) list of impaired waters.
- **A robust lake monitoring program.** The Lake Stewards of Maine (formerly the Maine Volunteer Lake Monitoring Program) is the longest-standing statewide citizen lake monitoring program in the US, currently engaging 1,200 active citizen scientists to monitor more than 500 lakes across the state.
- **A focus on protection-based planning.** Consistent with EPA’s 2013 NPS Program and Grant Guidelines, Maine DEP developed guidance for lake watershed-based protection plans that are alternatives to nine element watershed-based plans (ME DEP 2013a). As of March 2021, Maine has 39 EPA and state-approved alternative watershed-based plans for unimpaired lake/pond watersheds. A building block of Maine’s watershed-based plans are the largely locally funded volunteer lake watershed surveys conducted to identify NPS problem sites and recommend best

management practices. Maine DEP provides guidance on how to conduct watershed surveys (ME DEP 2011) and technical assistance to groups conducting surveys.

- **Community engagement.** Maine’s first Youth Conservation Corps (YCC) was formed in the early 1990s using §319 funds. YCCs are crews of high school students that install buffers, erosion control practices and other conservation practices throughout some of Maine’s most threatened and impaired lake watersheds. Most of the eight communities with YCCs continue to fund the programs with local funding after §319 grant projects end.
- **Investing §319 funds in protection.** Maine typically allocates up to 50% of its §319 project funding for watershed protection projects. These projects typically involve strongly-engaged project partners—including lake associations, municipalities and towns, residents and other stakeholders--working together to facilitate funding and implement NPS control practices throughout the watershed.

- **Some states conduct protection prioritization at a statewide level while others prioritize among a subset of candidate watersheds.** Connecticut, New Hampshire, and Michigan conducted protection prioritization screenings of all watersheds statewide (CT DEEP 2014; MI DEQ 2015; NH DES 2014b). Maine’s NPS priority watersheds list includes a subset of unimpaired streams, lakes and marine waters that are prioritized based on the severity of threats to water quality and other criteria (ME DEP 2019). Alabama considers watersheds with waters assessed as part of the state’s CWA Section 305(b) report. Alaska’s prioritization process begins with waterbodies nominated by the public and partner agencies, which are then reviewed and ranked by the state using water quality, water quantity and habitat criteria. The state then solicits project proposals to protection and maintain priority waterbodies at-risk (AK DEC 2016). Beginning in FY2020, Minnesota targets §319 watershed project funding via its *Small Watersheds Focus Grant Program*, which is aimed at providing sustainable, longer-term funding to a select number of focus watersheds. The state considers unimpaired lake watersheds for selection based on several criteria, including water quality trend information, sensitivity of the waterbody to phosphorus, and the proximity to water quality impairment (MPCA 2018).
- **States vary in the watershed scale considered in protection prioritization frameworks.** Connecticut, Minnesota, and New Hampshire prioritized HUC12 watersheds (CT DEEP 2014, MPCA 2018, NH DES 2014b). Michigan conducted protection prioritization at the HUC10 scale (MI DEQ 2015). Alabama, Alaska, and Maine did not use a standardized watershed scale for prioritization since they rely on partner nominations of various-sized watersheds (AK DEC 2016) or watershed boundaries for unimpaired waterbody segments (ADEM 2014; ME DEP 2014 and 2019).

Table 2.1. Summary of state NPS program approaches for prioritizing waters or watersheds for protection.

State	Protection prioritization by waterbody type?	Candidate watersheds included in prioritization	Waterbody/Watershed Scale	Prioritization Method	Reference
Alabama	No	Watersheds that have been assessed	Waterbody-specific prioritization	All IR Category 1 waters	ADEM 2014
Alaska	No	Watersheds nominated by program partner	Waterbody-specific prioritization	State decision tree	AK DEC 2016
Connecticut	No	All watersheds statewide	HUC12	EPA RPS Tool	CT DEEP 2016
Maine	Yes	Unimpaired watersheds	Waterbody-specific prioritization	State decision tree	ME DEP 2019
Michigan	No	All watersheds statewide	HUC10	EPA RPS Tool	MI DEQ 2015
Minnesota	Yes	Watersheds nominated by program partner	HUC12	State decision tree	MPCA 2018
New Hampshire	No	All watersheds statewide	HUC12	EPA RPS Tool	NH DES 2014b

Resource Feature 2.1: EPA Recovery Potential Screening Tool and Watershed Index Online

Several state NPS programs featured in this report used the EPA's [Recovery Potential Screening \(RPS\) Tool](#) to prioritize watersheds for restoration and protection activities. The RPS Tool is a coded Excel file that allows users to compare and rank a group of watersheds based on user-selected indicators that characterize the ecological, stressor, and social characteristics of each watershed at the HUC12 (or other user-defined) scale. Its embedded indicator data stems from the EPA's Watershed Index Online (WSIO), a data library and watershed assessment tool. The WSIO, which contains 431 HUC12 indicators, can be accessed from the [WSIO website](#) by downloading Excel or geodatabase versions of the HUC12 indicator library, or as a web service.

Prioritization Factors

In general, metrics used in prioritization frameworks fell into three main categories: water quality, watershed condition, and social/programmatic factors. States typically used measures of water quality and watershed condition to identify areas containing unimpaired/high quality waters most vulnerable to degradation. Additionally, state prioritization approaches frequently included social/programmatic factors to identify local areas with organizational presence and capacity to plan and implement projects. See below for a list of the most common indicators cited in state protection prioritization frameworks (Table 2.2) as well as descriptions of these indicator categories.

Table 2.2. Example indicators used to select priority watersheds for protection, based on a review of prioritization methods in state NPS program plans and related documents. A complete list of indicators and document references is provided in Appendix A.

Category	Subcategory	Example Indicators
Water Quality	Water Quality Assessment Status	<ul style="list-style-type: none"> • Presence/absence of impaired waters • Percent stream length supporting aquatic life use • Presence of waters supporting aquatic life and primary contact recreation uses
	Water Quality Trend	<ul style="list-style-type: none"> • Negative water clarity trend • Proximity to numeric water quality criteria
	Biological Condition	<ul style="list-style-type: none"> • Stream miles with healthy benthic community rating • Mean aquatic habitat condition rating in watershed • Count of monitoring stations in watershed with sensitive organisms
Watershed Condition	Natural Land Cover Extent	<ul style="list-style-type: none"> • Percent natural land cover in watershed • Percent natural cover in riparian zone • Percent of wetlands remaining in watershed
	Existing Development	<ul style="list-style-type: none"> • Percent impervious cover in watershed • Percent agricultural cover in watershed • Number road-stream crossings in watershed • Number of combined sewer overflow outfalls
	Hydrology	<ul style="list-style-type: none"> • Miles of free-flowing streams • Number of dams with fishways
	Development Trend	<ul style="list-style-type: none"> • Change in the number of housing units over the last X years • High risk for development due to proximity to highway access • Projected increases in wastewater discharges
Social and Programmatic Factors	High Quality Water Designations	<ul style="list-style-type: none"> • Presence of high quality-designated waters (i.e., Tier 2, 2.5 or 3) • Percent of stream miles within Natural or Scenic Rivers Programs
	Drinking Water Supply	<ul style="list-style-type: none"> • Presence of surface drinking water supply • Number of drinking water intakes
	Recreation Use	<ul style="list-style-type: none"> • Number of recreation areas in watershed • Stream miles with trout stocking
	Protected Lands	<ul style="list-style-type: none"> • Percent of watershed containing protected lands
	Watershed Plans	<ul style="list-style-type: none"> • Presence of watershed-based plan • Percent of stream miles covered by a TMDL
	Planning Complexity	<ul style="list-style-type: none"> • Jurisdictional complexity (number of different counties, cities, towns, etc.) in the watershed

Water Quality

Aquatic ecosystems are affected by their water quality, ambient air quality, surrounding watershed soils, and sediment transported through the aquatic system. In the context of water quality standards, water quality criteria represent the conditions (e.g., concentrations of chemical constituents, such as nutrients and trace metals, or physical parameters, such as water temperature and turbidity) sufficient to protect designated uses. Biological criteria, which are measures of the structure and function of the aquatic community within a specified habitat, also provide a framework for evaluating the health of an aquatic ecosystem (USEPA 2017c). State NPS programs frequently included water quality metrics as part of their protection prioritization frameworks. These metrics generally fell into three categories: water quality assessment status, water quality trend, and biological condition (Table 2.2).

Water Quality Assessment Status

The Clean Water Act requires states to provide a biennial assessment of the quality of all their waters (§305(b)) and a list of impaired or threatened waters (§303(d); Table 2.3). As part of their protection prioritization frameworks, state NPS programs typically incorporated information on water quality assessment status. When prioritizing watersheds for protection, states used water quality assessment status to identify unimpaired watersheds (AL, ME, and MN), or to identify watersheds with relatively fewer impairments expressed, for example, as “% assessed waters fully supporting designated uses,” (AK, CT, MI, and NH).

Table 2.3. Clean Water Act Section 305(b) Integrated Reporting Categories (USEPA 2005b).

Category	Description
1	All designated uses (DUs) are supported, no use is threatened
2	Some, but not all, DUs are supported
3	There is insufficient available data and/or information to make a use support determination
4	<i>Impaired/threatened</i> – TMDL is not needed <ul style="list-style-type: none"> • 4a – TMDL completed • 4b – TMDL alternative • 4c – Non-pollutant causes
5	<i>Impaired/threatened</i> by pollutant – TMDL needed *Also known as the 303(d) list

Nationally, most waterbodies remain unassessed. Based on a 2016 analysis of EPA’s Watershed Assessment, Tracking & Environmental Results System (WATERS), assessed waters represented approximately 31 percent of rivers and streams and 44 percent of lakes, reservoirs, and ponds (USEPA 2016b). In discussions with state NPS programs regarding this report, staff noted the challenge of insufficient monitoring data as data is needed to target protection work and assess the effectiveness of protection activities. In cases when water quality data are not available, indirect measures of water quality may help identify healthier watersheds that contain unimpaired/high quality waters. See the *Watershed Condition* metrics described below for more information on this topic.

State NPS Program Feature 2.2: New Hampshire – Scope of Protection

New Hampshire’s NPS program includes watersheds with varied levels of designated use attainment within their scope of protection. Candidate watersheds for protection include those with waters that are attaining all designated uses, waters with impairments, and waters with unknown impairment status. As noted in the New Hampshire 2014 Program Plan, a waterbody that is “impaired for one parameter or use is eligible for protection activities due to generally high quality for other parameters or uses” (NH DES 2014b). The additional inclusion of waters with unknown impairments status reflects the high proportion of unassessed waters (as of 2018, approximately 58% of lakes and 73% of rivers had insufficient data for assessment of the Aquatic Life Integrity designated use (NH DES 2019) and the generally good condition of the state’s waters. New Hampshire’s inclusive approach to defining their scope of protection offers the potential to protect many more areas relative to waters that are attaining all designated uses.

Water Quality Trend

Maine and Minnesota considered water quality trends when prioritizing lakes for protection. Maine’s NPS program priority list has considered lakes which had either a significant threat to water quality and/or lakes with significant resource value (ME DEP 2014 and 2019). In assessing water quality threats, Maine ran a lake water clarity trend analysis model for lakes with eight or more years of Secchi disk transparency readings. The state evaluated these modeled data along with other historical water quality data to prioritize unimpaired lakes with a significant negative water quality trend indicative of a water quality degradation that is not a result of natural cycles.

As part of Minnesota’s statewide Water Management Framework, HUC8 watershed restoration and protection strategies (WRAPS) were developed on a 10-year recurring cycle to guide local watershed management efforts. The Minnesota Pollution Control Agency published guidance for identifying lakes vulnerable to water quality degradation within a HUC8 watershed and a process for prioritizing those lakes for immediate action (MPCA 2017). The state conducted a risk assessment analysis using water quality and land use/land cover data to provide an initial ranking of each lake’s relative risk of water quality degradation. This information was paired with available water quality trend information to determine the priority order of lakes. Generally, highest priority lakes were large, oligotrophic, vulnerable to phosphorus loading, and near their estimated loading thresholds. In addition, lakes with a declining trend were elevated as higher priority. Beginning in FY2020, MPCA has considered these and other criteria when selecting watersheds for waterbody protection as part of its *Clean Water Act Section 319 Small Watersheds Focus grant program* (MPCA 2018).

Biological Condition

Three states (AK, CT, and VA) included measures of biological condition in their watershed prioritization frameworks. The presence, condition, and assemblage of fish, insects, algae, plants, and other organisms inform the health of aquatic ecosystems. Biological data can be represented as individual metrics (e.g., presence or relative proportion of pollution-sensitive species found at a site) or as biological indices created from multiple metrics to provide a more comprehensive view of an aquatic community (USEPA 2015a). Pairing measures of biological data with the surrounding watershed

condition can provide a more integrated measure of aquatic condition as well as a framework to help link management goals to strategic management actions (Riatio et al. 2020).

There are numerous approaches for assessing biological condition developed at the state, regional, and national scales that may be useful in state NPS program watershed prioritization frameworks. At the state scale, aquatic biological condition assessment frameworks are typically developed and conducted by water quality programs, sometimes in collaboration with natural resources programs like natural heritage programs (Stiles et al. 2013). For example, Virginia’s Interactive Stream Assessment Resource (INSTAR), an integrative, multimetric index to assess stream ecological integrity, has been used to identify and rank healthy streams and watersheds across the state (Virginia Department of Environmental Quality [VA DEQ] 2014). At the regional scale, assessment approaches and tools developed by groups like the National Fish Habitat Partnership (Whelan 2019) and the 22 ecoregion-based Landscape Conservation Cooperatives (LCCs) have incorporated measures of aquatic biological condition. Nationally, EPA’s Biological Condition Gradient model serves as a conceptual, scientific framework that can be used by states to interpret biological responses from the cumulative effects of stressors for various water body types (USEPA 2016a).

Watershed Condition

Given the influence of the surrounding landscape on water quality, state NPS program watershed prioritization approaches typically included measures of watershed condition when targeting protection efforts. These measures can help identify healthier watersheds more likely to support unimpaired/high quality waters. State NPS programs typically paired measures of current condition with future vulnerabilities to target protection efforts in healthier watersheds most at risk to degradation.

Watershed Health

While there are many approaches to defining and evaluating watershed condition, assessments generally center on measuring components of watershed structure and function, which are key to maintaining healthy aquatic ecosystems. These components, such as the extent and configuration of natural land cover, can be assessed individually or included as part of a multimetric index (Flotemersch et al. 2016; Potyondy and Geier 2011; USEPA 2012a). For example, the EPA’s Healthy Watersheds Assessment Framework evaluates six ecological attributes that, together, provide a systems-level measure of watershed health (Figure 2.1; USEPA 2012a).

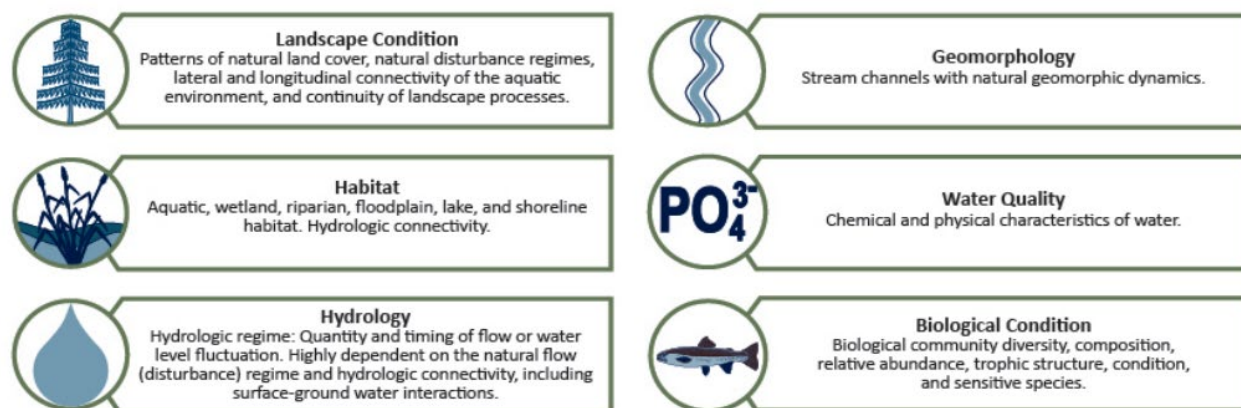


Figure 2.1. EPA Healthy Watersheds Assessment Framework (USEPA 2012a).

Land use and land cover, at both the riparian and watershed scales, exert a strong influence on water quality and aquatic ecosystem health (Błaszczak et al. 2019; Morse et al. 2018; Southerland et al. 2019). Natural vegetative cover stabilizes soil, regulates watershed hydrology, and provides habitat to terrestrial and riparian species. Riparian vegetation regulates temperature, shading, and organic matter input to streams. Conversely, anthropogenic land cover (e.g., agriculture and developed areas) is a primary driver of NPS pollution and can be a reliable indicator of water quality degradation (Schueler et al. 2009). There is wide availability of land use/land cover data; for instance, the National Land Cover Database [NLCD] provides national coverage updated every five years, allowing for estimates of current condition as well as land cover change. States frequently incorporated landscape-based measures when characterizing watershed condition (Table 2.2).

When prioritizing watersheds for protection, measures of landscape condition can also serve as indicators of the relative vulnerability of watersheds to degradation. For example, there is a significant body of research on the relationship between land cover metrics, such as relative proportions of natural and disturbed land cover in a watershed, and water quality (Błaszczak et al. 2019; Booth et al. 2002; Goetz et al. 2003; Morse et al. 2018; Wang et al. 1997). Based on a literature review on impervious cover and water quality, Schueler et al. (2009) expressed shifts in stream quality classification as occurring within “transition bands,” resulting from the interaction of land cover change with other local factors. For example, 5-10% impervious cover may drive a transition from sensitive to impacted water quality. More recent reviews sought to identify transition bands associated with other land cover types, including forest, agriculture, and developed/impervious areas (Morse et al. 2018).

Many examples of watershed assessments apply the concept of transition bands, or land cover thresholds, to characterize relative watershed condition (Barnes et al. 2009; Minnesota Department of Natural Resources [MN DNR] 2020; Zielinski 2002). As part of the *Forests, Water and People* project, the US Forest Service conducted a GIS-based analysis to compare HUC8 watersheds across 20 states in terms of their ability to produce clean water. Based on a literature review of land cover and water quality, the highest quality watersheds were those that met the following criteria: over 75 percent forest land, over 70 percent riparian forest cover, and less than 10 percent agricultural land (Barnes et al. 2009). The Minnesota Watershed Health Assessment Framework assigns a “Least Impacted” condition

to watersheds that contain over 80 percent perennial cover and less than one percent impervious cover (MN DNR 2020). In addition to watershed prioritization frameworks, land cover metrics, like percent forest cover, have frequently been used to quantify protection goals at the watershed scale (Upper Neuse Clean Water Initiative 2015; Daigneault and Strong 2019; Open Space Institute [OSI] et al. 2014; Eddy et al. 2019; Krueger and Jordan 2014). See [Chapter 3: Integrating Protection in Watershed Planning](#) for more information.

Research demonstrates a non-linear, complex relationship between land cover and water quality (Carlisle et al. 2009; Morse et al. 2018). Beyond the relative proportions of land cover type (e.g., natural versus disturbed) in a watershed, the distribution of land cover also influences its relationship with water quality (Blaszczak et al. 2019). Based on a literature review, the Open Space Institute determined the relationship between forest cover and water quality is influenced by the relative extent and distribution of land uses in a watershed, past land use history, and interactions with other local factors, like geology (Morse et al. 2018). At the statewide or regional scale, it is likely difficult to incorporate the full suite of advanced landscape condition metrics in watershed prioritization frameworks. In such cases, pairing broader landscape condition metrics (e.g., those described above and in Table 2.2) with other measures of watershed structure and function can serve as an effective approach to prioritizing watersheds for protection.

Resource Feature 2.2: Drinking Water Protection and Land Use

Understanding land cover thresholds can prove helpful in assessing local ecosystem services, establishing watershed protection goals, and explaining the importance of protection work to potential watershed partners, such as drinking water utilities. For example, studies demonstrate that greater forest cover within a source water drainage area—particularly within a 100-foot buffer—increases water quantity and quality and subsequently decreases water treatment costs (Elias et al. 2013; Ernst 2004; Freeman et al. 2008; Warziniak et al. 2016). Whereas forests provide pollutant capture and filtration, reducing total organic carbon (TOC) and turbidity levels and increasing pH, agricultural and urban land uses tend to increase these parameters, causing poorer water quality and ultimately higher treatment costs. In a study of 37 sites across the U.S., Warziniak et al. (2016) found that water turbidity increased by 3.9 percent for every one percent of forest area converted to developed land use.

The land use-related threats exemplify how source water protection is crucial from both an environmental and economic standpoint. According to Warziniak et al. (2016), “A one percent increase in TOC would increase costs by \$0.28 to \$ 0.68 (+/- 1sd) annually per million gallons treated,” and generally, a 10% conversion of forest area to developed area within their average watershed increased treatment costs from \$2.52 to \$20.48/million gallons treated/year. Elias et al. 2013 estimated the monetary value of forest filtration under various urbanization projections for the Converse Reservoir in Alabama and found the reduction of TOC through forest cover can produce treatment plant savings from \$123.80/ha/year to \$251.90/ha/year.

While research results vary on the level of treatment cost reduction delivered by source water protection efforts, for many states, source waters rank highly among watersheds prioritized for protection.

Watershed Vulnerability

Watershed condition and water quality are dynamic properties that can change over time as a result of natural processes and anthropogenic influences. Vulnerability, defined as the degree to which a system is susceptible to and unable to cope with adverse effects, is driven by dimensions of **exposure**, **sensitivity**, and **adaptive capacity**, which can either be quantitatively measured or qualitatively characterized (Nelitz et al. 2013; Figure 2.2). Assessments typically evaluate vulnerability specific to resource values or organizational goals (Furniss et al. 2013; USEPA 2014). For example, waters targeted for protection in the NPS program may be vulnerable to changes that threaten their unimpaired status, use as a drinking water supply, or critical cold water aquatic habitat.

In assessing both current and projected future conditions, state NPS programs can better target protection efforts (e.g., within watersheds most at risk to degradation) and design management approaches based on watershed-specific vulnerabilities. State NPS programs included the following vulnerability indicators when prioritizing watersheds for protection: measures of existing or future projected anthropogenic land cover (AK, CT, ME, MI, MN, NH, and VA), trends in water quality monitoring data (ME and MN), potential increases in other disturbances, like wastewater discharges (AK), and intrinsic watershed characteristics, like erosion potential (CT). States assessed these vulnerability indicators individually rather than calculating a multimetric index of watershed vulnerability.

State NPS Program Feature 2.3: Maine – Priority Watershed Selection Criteria

Maine's NPS program used a number of criteria to develop their list of priority watersheds for protection. To select priority unimpaired lake watersheds, nine criteria were used, including impacts from agriculture or development, risk of internal loading based on sediment chemistry, and measures of the sensitivity of lakes to increased external phosphorus inputs. Watersheds containing small lakes (less than 50 acres) with limited development were designated as having low vulnerability and were therefore not included. Watersheds with a significant amount of protected land were also considered lower priorities because of the reduced risk for future development in the watershed (ME DEP 2014).

There is a significant body of research, tools, and datasets related to conducting vulnerability assessments in environmental management programs, frequently to evaluate the effects of climate change on ecosystem health to inform adaptation planning (e.g., USEPA 2014). A more specific body of work has applied the climate change vulnerability assessment framework to watershed management (e.g., Furniss et al. 2013; Nelitz et al. 2013; The Resource Innovation Group [TRIG] 2012).

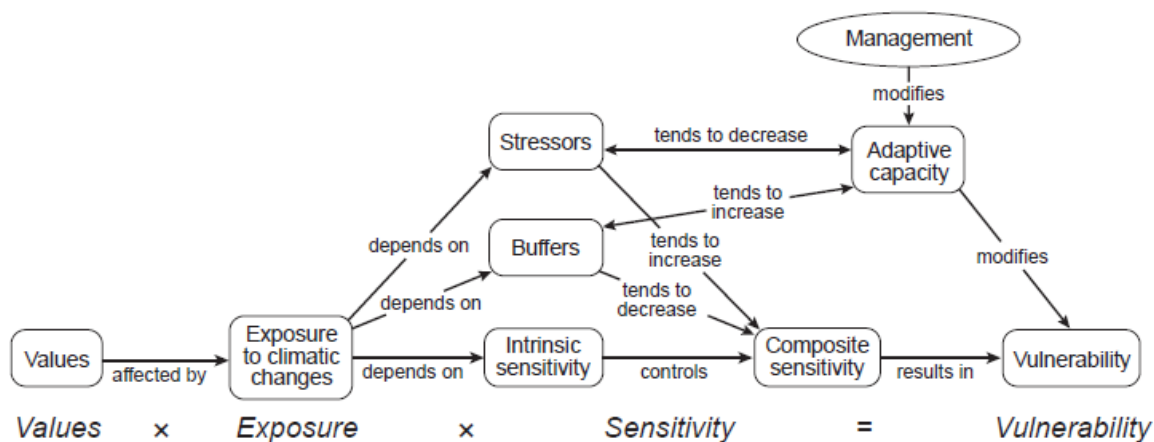


Figure 2.2. Conceptual model for assessing the vulnerability of watersheds to climate change, showing linkages between exposure, resource values, and system condition (sensitivity). The authors separated three components of sensitivity: “buffers” and “stressors” are human-induced, and “intrinsic sensitivity” is based on inherent characteristics independent of human influence (Furniss et al. 2013).

Exposure is a measure of the magnitude, spatial extent, and rate of change in water resources (quality and/or quantity) due to changing conditions. Exposure analyses aim to generate a list of the most important hydrologic changes affecting water resources. For example, exposure indicators may be related to climate (precipitation, air temperature), streamflow (discharge, water level), or water quality (water temperature, nutrients; Furniss et al. 2013; Nelitz et al. 2013).

- *Example data source:* EPA’s EnviroAtlas, developed in partnership with the US Geological Survey, the USDA, and other federal and non-governmental organizations, provides geospatial data, easy-to-use tools, and other resources related to ecosystem services, their stressors, and human health. The EnviroAtlas contains approximately 300 national data layers, many of which are summarized at the HUC12 watershed scale. The EnviroAtlas Change Analysis Tool (ECAT) allows users to compare climate variables (e.g., maximum temperature, minimum temperature, potential evapotranspiration, precipitation) between selected time periods. Explore <https://www.epa.gov/enviroatlas> for more information.
- *Example watershed vulnerability assessment:* The Catawba-Wateree Water Management Group commissioned a study, published in 2019, to assess the relative impacts of climate and land use change on water supply resiliency across the Catawba-Wateree watershed—a 4,750 square mile basin that includes parts of North and South Carolina (Eddy et al. 2019). The study incorporated projections of climate change, land use change, pollutant loading, and water use to identify areas expected to experience the greatest hydrologic and water quality change within the basin. Results from this analysis were used to target land conservation efforts in priority areas to prevent reduced drinking water availability and quality.

Sensitivity is a measure of how a system is likely to respond when exposed to new impacts. Sensitivity can be influenced by intrinsic (e.g., geology) and anthropogenic (e.g., road density and current land cover) attributes of a watershed. Some sensitivity attributes dampen effects (buffers) while others amplify effects (stressors). For example, intact riparian buffers provide shading, dampening the effects of increased temperatures.

- *Example data source:* EPA’s Integrated Climate and Land-Use Scenarios (ICLUS, <https://www.epa.gov/gcx/iclus-downloads>) datasets provide spatially explicit projections of population and land-use based on Intergovernmental Panel on Climate Change (IPCC) projection scenarios. ICLUS data projections are summarized at the HUC12 watershed scale in EPA’s Watershed Index Online (<https://www.epa.gov/wsio>).
- *Example watershed vulnerability assessment:* The Kansas Department of Health and Environment published results from a statewide inventory of candidate reference streams in 2010. As part of this assessment, the authors conducted a qualitative analysis of threats to Kansas’ least disturbed streams, which included several factors such as land use change, introduction/spread of invasive species, mineral resource extraction, dams and reservoirs, and water demand.

Adaptive capacity is a measure of the potential, ability, or opportunities available to decrease the exposure to or sensitivity of a system to stressors (i.e., its ability to adapt; Nelitz et al. 2013). This can refer to the capacity of a watershed to cope with changes (e.g., the capacity to attenuate more frequent flooding events across intact floodplain and wetland areas) or an organizational capacity to respond to stressors (e.g., the ability to commit resources to manage new stressors). Compared to watershed exposure and sensitivity metrics, measures of adaptive capacity will likely be a lower priority for statewide watershed prioritization approaches given they are typically included in more robust, spatially explicit (e.g., a single basin or watershed) vulnerability assessments (Nelitz et al. 2013).

- *Example data source:*
- *Example watershed vulnerability assessment:*

There are multiple approaches to assessing watershed vulnerability that vary in complexity of required input data and level of effort. While states may not have the resources to conduct robust vulnerability assessments as part of NPS prioritization efforts, the approaches and components of watershed vulnerability assessments may be transferrable to state NPS programs. In prioritizing watersheds for protection, state NPS programs frequently considered measures of exposure and sensitivity. For states not currently doing so, the framework and examples provided above may help bolster interest in incorporating measures of watershed vulnerability in prioritization frameworks.

Resource Feature 2.3: Natural Hazard Mitigation

Natural hazard mitigation (NHM) is the act of preventing or dampening the effects of natural disasters in order to protect lives and property from damage. States and cities prepare [FEMA Hazard Mitigation Plans \(HMPs\)](#) with which projects must be consistent to be eligible for [FEMA grants](#). HMPs address all hazards—with a focus on flooding, erosion, and drought—and have two main goals. The first is to identify state-specific natural hazard vulnerabilities (e.g., fire and debris flow threats to drinking water sources) from historical data and models. The second is to propose strategic NHM solutions.

NHM can take the form of nature-based solutions (NBS), such as installing green infrastructure to buffer flooding and increase sediment retention. Because NBS have proven to be cost-effective and promote both community and environmental resiliency, they are often included in HMPs, following the [guidance of FEMA](#) (FEMA 2021). The information from these plans is publicly available and can be incorporated in

watershed prioritization frameworks to emphasize the protection of waters most vulnerable in exposure, sensitivity, and/or adaptive capacity to natural hazards. FEMA’s NHM assistance grants provide local and state entities with an opportunity for funding projects that also provide flood loss benefits through runoff reduction, groundwater recharge, and floodplain restoration. In situations where FEMA and state NPS program watersheds align, resource leveraging between FEMA and EPA programs could be beneficial to everyone. Identifying protection priority areas that have current HMPs or will soon have them could be an impetus for state programs to focus on those watersheds, gaining access to additional funding resources, and providing environmental and social co-benefits to FEMA as well. For more information on FEMA resources, see [Ch. 6: Protection Partnerships](#).

Social/Programmatic Factors

In prioritizing watersheds to support planning and implementation work, state NPS programs aim to identify areas where efforts are most likely to be successful. The success of watershed projects in achieving positive water quality outcomes is dependent on local factors, such as organizational presence and capacity to plan and implement projects and community support. Five state NPS programs (AK, CT, ME, MI, and NH) included social/programmatic factors in watershed prioritization frameworks. As described below, these metrics generally fell into two categories: 1) factors that characterized the resource value of waters and the watershed and 2) factors related to watershed planning. NPS programs included these factors in the prioritization process to select watersheds where successful protection can be sustained with public support, leveraging previous work, and involving an active stakeholder base (Table 2.2). See Appendix A for the full list of metrics.

State NPS Program Feature 2.4: New Hampshire – Social and Programmatic Factors

New Hampshire’s NPS program used four indicators of social and programmatic factors as part of their method to select priority watersheds. These included the number of drinking water intakes in each watershed, the presence of a watershed-based plan, the extent of protected lands, and the number of counties, cities, towns, or other municipalities in a watershed (referred to as jurisdictional complexity). New Hampshire considered watersheds to be higher priorities if they contained greater amounts of protected land. Although these watersheds may be less vulnerable to future development, the existence of land that is already protected through conservation easements or other methods could suggest that the watershed is better prepared for additional action (NHDES 2014b).

Resource Value

Several state NPS programs considered the relative resource value of watersheds, or waters within those watersheds, when targeting protection efforts. Commonly cited **resource value** metrics included the following:

Watersheds containing high quality-designated waters

Designations of high quality waters was used by three of the state NPS programs to define a more narrow and focused scope of protection (ADEM 2014; Maryland Department of the Environment [MD DE] 2016; MI DEQ 2015; Ohio EPA [OH EPA] 2014). Various entities (state,

federal, etc.) may designate waterbodies or watersheds as high quality. State NPS programs included the following designations:

- **Tier 2 or 3-designated waters under Water Quality Standards:** Per the antidegradation requirements in EPA’s water quality standards regulations, states must protect and prevent waters from degradation below their current conditions based on a tiered classification system. High quality waters can refer to those designated as Tier 2 (i.e., waters whose quality exceeds that necessary to support the fishable/swimmable designated uses), Tier 3 (i.e., Outstanding National Resource Waters in which there may be no lowering of water quality), or Tier 2 ½ (i.e., waters receiving a higher level of protection than Tier 2, but without the strict provisions against lowering of water quality found in Tier 3 protection; USEPA 2012c).
- **National Wild & Scenic Rivers:** The federal Wild and Scenic Rivers Act (1968) was created to protect the special characteristics of free-flowing rivers that exhibit outstanding recreational, natural, cultural, or other similar values (Willi and Back 2018). As of April 2019, there are 226 national wild and scenic rivers in 40 states and the Commonwealth of Puerto Rico.
- **Other state-designated waters:** Outside of federally-defined tiers, many states have levels of protection that allow more flexibility when making water quality determinations. For example, Michigan’s Natural Rivers Act (1970) established a system of state-designated “natural rivers” for the purposes of preserving and enhancing the hydrology, ecological and recreational value of these waters (Michigan Department of Natural Resources [MI DNR] 2021). Michigan’s NPS program considers state-designated natural rivers when prioritizing watersheds for protection.

State NPS Program Feature 2.5: Ohio – High Quality Designations

Ohio’s NPS Program Plan highlighted three different sources of high quality designations for identifying watersheds well-suited for protection (OH EPA 2014). The sources included: 1) Wild, Scenic, or Recreational Rivers defined under the Ohio Scenic River Law; 2) stream segments that have been designated as Outstanding State Resource Water or Superior High Quality Waters under the state’s antidegradation rule; or 3) waters that are determined to be attaining Exceptional Warmwater Habitat or Coldwater Habitat aquatic life designated uses. These designations served as the basis for defining a scope of protection that emphasized areas known to possess exceptional water quality.

Watersheds providing drinking water supply

Source water protection can be a significant motivator of watershed protection efforts (Ernst 2004; The Trust for Public Land [TPL] and American Water Works Association [AWWA] 2005). Approximately two-thirds of the US population relies on surface water for drinking; the remaining use groundwater (USEPA 2009). In total, an estimated 53 percent of the water supply in the conterminous US originates on forested land, followed by agriculture (26%), and rangeland (8%; Brown et al. 2008). Source water areas may be vulnerable to changes that threaten their ability to provide clean water. For example, over half of the forested land in the US is privately owned and, thus, may be vulnerable to loss from development pressures (Brown et al. 2008; Mockrin et al. 2014). Source water protection can serve as a unifying watershed goal

among partners and help target protection activities (Upper Neuse Clean Water Initiative 2015; OSI 2017a). Several state NPS programs included drinking water-related criteria in their watershed prioritization frameworks, such as the presence of source waters for drinking water systems (AK, ME) and number of drinking water intakes (NH). See below for a more general discussion of ecosystem services as they relate to prioritization metrics.

Resource Feature 2.4: Safe Water Conservation Collaborative

On January 9, 2014, a tank ruptured at the Charleston, WV Freedom Industries facility, spilling thousands of gallons of crude MCHM, a chemical used in coal processing, into the Elk River. Since the Elk River supplies drinking water to nine counties, approximately 300,000 residents could not use their tap water in any capacity for a minimum of four days. This water crisis led to the passing of West Virginia Senate Bill 373, which went into effect in 2016 and requires community water systems serving more than 25 people create Source Water Protection Plans (SWPPs) and review and update these plans every three years. The West Virginia Rivers Coalition created a program called “Safe Water for West Virginia” to assist water utilities in finding community-based solutions for implementing SWPPs. In the eastern panhandle of West Virginia, this work eventually evolved into the [Safe Water Conservation Collaborative](#). The mission of the Collaborative is “protecting drinking water through land conservation.” Through conservation easements, education & outreach, and conservation practices, Collaborative partners are protecting safe, clean drinking water for eastern panhandle communities.

To prioritize actions, the Collaborative developed a [GIS prioritization tool](#), which assesses regional water quality, programmatic, and geographic indicators. The prioritization model ranks property parcels larger than twenty acres and within drinking water protection areas based on ten categories:

- acres of karst topography (representing landscape vulnerability)
- acres of riparian forest buffers
- linear feet of streams
- projected changes in housing density outside of planned growth areas (i.e. urban sprawl)
- acres of tree canopy
- proximity to protected lands
- presence of civil war battlefields
- percentage of parcel with over 50% qualifying soils (representing prime farmland)
- presence of habitat biodiversity (as designated by the Department of Natural Resources)
- geographic interest (located within one of three prioritized watersheds that encapsulate drinking water sources for local community water systems)

The GIS modeling process was developed directly by members of the Collaborative, with input from local and regional supporters. When prioritizing watersheds, NPS programs should consider social factors such as protected or historical lands and source waters. Pursuing co-benefits attracts greater support, funding, and stakeholder engagement and addresses a wider array of regional stressors.

Watersheds with protected lands

As discussed in [Chapter 4: Implementing Protection Projects](#), land conservation (or land protection) is a broad management strategy that refers to the protection of a range of land use types for one or more purposes. In the context of watershed protection, land conservation can

prevent conversion to land uses that contribute higher pollutant loadings or pose threats to healthy aquatic ecosystems. For this reason, measures of protected lands typically include areas maintained as natural land cover, such as open spaces, nature reserves, and park areas. Four state NPS programs included protected lands metrics in their watershed prioritization frameworks. Three states (CT, MI, NH) prioritized protection efforts in watersheds with greater extents of protected lands. Maine excludes from its list of priority threatened lakes those watersheds where a significant portion is either protected by being part of Acadia National Park or by having other watershed protection because in those places significant threats to water quality are not expected to occur (ME DEP 2019).

Watersheds providing other critical ecosystem services

Ecosystem goods and services, often referred to generally as ecosystem services, are the benefits that humans receive from nature. These services can be organized into four major categories: **provisioning services** (e.g., timber, fisheries), **regulating services** (e.g., water filtration, water flow regulation, habitat preservation), **supporting services** (e.g., nutrient cycling, soil formation) and **cultural services** (e.g., recreation and spiritual benefits; Maryland Department of Natural Resources [MD DNR] 2018; Postel and Thompson 2005). Healthy watersheds provide a number of key ecosystem services that, once lost or altered, can be ecologically infeasible or prohibitively expensive to recreate (Dlugolecki 2012). There are multiple approaches for quantifying and valuing watershed-based ecosystem services to compare multiple watersheds (Barnes et al. 2009) or estimate the total value of services provided within a single watershed (Fletcher and Christin 2015).

In the context of watershed prioritization frameworks, ecosystem services data may help identify watersheds where NPS protection efforts can be leveraged to engage potential partners (e.g., water utilities and outdoor recreation groups). Connecticut's NPS program included several recreation-based metrics, including number of recreational areas and stream miles with trout stocking (CT DEEP 2016). Additionally, Maine's NPS program considered watersheds identified as a priority area by a partner agency (ME DEP 2014).

Resource Feature 2.5: EPA EnviroAtlas Dataset

EPA Office of Research and Development's [EnviroAtlas](#) is an interactive map that displays ecosystem service data through hundreds of layers, seven built-in analysis tools, and at various scales. Its layers cover a wide array of attributes, many of which, fall into one of four categories: ecosystem services and biodiversity (e.g., carbon storage), pollution sources and impacts (e.g., impaired waters), people and built spaces (e.g., housing and schools), and boundaries (e.g., HUCs). Ecosystem services and biodiversity attributes are also assigned to one or more of the following seven benefit categories: 1) clean air, 2) clean and plentiful water, 3) natural hazard mitigation, 4) climate stabilization, 5) recreation, culture, and aesthetics, 6) food, fuel, and materials, and 7) biodiversity conservation. These benefit classifications appear as highlighted icons below an attribute and help users easily identify associated advantages.

Another feature of EnviroAtlas is the [Eco-Health Relationship Browser](#). This provides users with information on the connections between ecosystem services and human health from hundreds of scientific articles. Overall, EnviroAtlas can aid in the difficult task of valuating watersheds based on their ecosystem services for relative prioritization purposes.

Watershed Social Characteristics: Complexity and Evidence of Investment in Planning

As discussed in [Chapter 3](#), watershed planning is a key step in managing NPS pollution to protect and restore waters. By adopting the watershed approach to manage NPS pollution, NPS practitioners can address water quality problems in a holistic manner and actively involve watershed stakeholders in selecting the management strategies to solve these problems. In prioritizing watersheds for protection, state NPS programs may consider where local conditions are likely to support the successful development and implementation of watershed plans. Three state NPS programs (CT, MI, NH) used EPA's Recovery Potential Screening (RPS) Tool to prioritize watersheds for protection. In their prioritization screenings, these states included the following factors related to watershed planning:

Watersheds covered by an existing watershed plan

In 2016, Connecticut's NPS program used EPA's RPS tool to evaluate HUC12 watersheds across the state and address three program priorities: protect watershed health, stormwater management, and nutrients management (CT DEEP 2016). The state then used the priority watershed lists to target watershed planning support over the next six-year period. In its watershed health screening scenario, the state prioritized watersheds where watershed planning had been completed by including the following two social indicators: count of waterbodies with action plans (watershed plans) for each impairment cause and percent watershed stream miles with action plans.

As described in their 2014 NPS management plan, New Hampshire did not have a formal list of high quality waters. Instead, New Hampshire considered waters to be eligible candidates for protection if there was no documented impairment (NHDES 2014b). The state completed a HUC12 prioritization for protection activities using EPA's RPS tool, which included a total of 23 ecological, stressor and social metrics. Within the social metric category, the state prioritized watersheds covered by existing watershed-based plans.

Watersheds containing fewer jurisdictions or landowners

The number of political jurisdictions within a watershed can influence the speed and effectiveness of protection or restoration activities. For example, watersheds with multiple political jurisdictions may require the establishment of a separate group to facilitate planning and consensus-building for environmental initiatives (USEPA 2011a). Likewise, the number and type of landowners in a watershed may influence planning and implementation activities. High numbers of private landowners in a watershed or stream corridor may complicate efforts to protect or restore waters. For example, negotiating management practices, easements, or land purchases becomes complicated in fragmentedly owned watersheds. Single owner-dominated watersheds, particularly where public land ownership is common, may have greater likelihood of protection or restoration success (USEPA 2011b).

Two state NPS programs (MI, NH) included *jurisdictional complexity*, measured as the number of political jurisdictions (e.g., states, counties, and cities) in a watershed, as a social metric in their watershed prioritization frameworks. As described in their 2015 NPS management plan, Michigan’s NPS program used EPA’s RPS tool to conduct a statewide, HUC10 watershed prioritization to prioritize watersheds for both restoration and protection (MI DEQ 2015). The screening included a total of 19 ecological, stressor, and social metrics. Unimpaired watersheds with high ecological and social scores and low stressor scores were prioritized for protection. Within the social metric category, the state considered *jurisdictional complexity of the watershed*. Likewise, New Hampshire included *jurisdictional complexity* as a social metric in their RPS screening to prioritize protection activities (NHDES 2014b).

Conclusion paragraph TBD

Chapter 3: Integrating Protection in Watershed Planning

Chapter Summary

- ✓ **Step 1: Build partnerships.** Partnership-building and community engagement play a critical role in protection-based planning, particularly to garner support and resources for proactive watershed management where the typical drivers of water quality restoration (i.e., impairment listing and TMDL development) may not be present. Planning teams should consider opportunities to engage new partners, including local government planning departments, land conservation organizations, and water utilities, whose goals may be aligned with protecting unimpaired/high quality waters vulnerable to degradation.
- ✓ **Step 2: Characterize the watershed.** As in restoration-based planning, characterizing the watershed and waterbody condition informs watershed planning and implementation work in healthier watersheds. In addition to identifying existing problem areas, protection-oriented plans typically identify areas (e.g., natural areas, unimpaired/high quality waters) where proactive management strategies may be considered during implementation. Protection-oriented plans also typically characterize future conditions to evaluate water quality threats.
- ✓ **Step 3: Set goals and identify solutions.** After decades of experience, EPA’s National NPS Program and the NPS community have refined watershed-based approaches for establishing water quality restoration goals, then designing and targeting NPS management measures in critical source areas. In watersheds where management efforts are driven by the presence of both NPS-impaired waters and unimpaired/high quality waters, protection can be incorporated within these approaches. However, the unimpaired watershed plans also demonstrate the need for NPS technical resources to help practitioners establish protection-based goals, identify protection priority areas, and quantify the water quality benefits of protection-based management practices, like land conservation.
- ✓ **Step 4. Design an implementation program.** Well-articulated watershed goals, objectives and planning targets established under Step 3 lay the important groundwork when designing an implementation program. Under Step 4, interim milestones included in the protection-oriented plans were likely to be most helpful in guiding implementation work when they were geographically targeted, measurable, and incorporated in the plan’s implementation schedule.

Introduction

Using the Watershed Approach to Protect and Restore Waters

Since the inception of the program in 1987, EPA's National Nonpoint Source Program has promoted the *watershed approach* as a coordinating framework for designing and implementing comprehensive, watershed-based efforts to protect and restore water quality (USEPA 1987). In adopting the watershed approach to manage NPS pollution, practitioners can address water quality problems in a holistic manner and actively involve watershed stakeholders in selecting the management strategies that will be implemented to solve these problems. The *watershed planning process* works within this framework by using a series of iterative steps to characterize existing conditions, identify and prioritize problems, define goals, develop management strategies, and implement and adapt selected actions as necessary (USEPA 2008). Watershed plans can guide efforts to restore impaired waters as well as protect unimpaired/high quality waters threatened by NPS pollution.

The 2013 NPS guidelines emphasize that effective planning is necessary to guide successful implementation of watershed restoration and protection projects and requires §319 funded projects be guided by watershed plans (USEPA 2013b). In most cases, EPA continues to emphasize nine element watershed-based plans (WBPs) as the primary planning framework for §319 watershed projects. Based on years of national experience, nine element WBPs are critical components of successfully addressing NPS pollution at the watershed scale. The guidelines note that watershed plans should focus not only on the impaired segments, but, when possible, also identify unimpaired waters where protection and load reduction actions are necessary to ensure high quality waters avoid impairment (USEPA 2013b).⁴ EPA encourages states and others to build on existing planning documents, such as TMDLs and TMDL implementation plans, which may serve as building blocks for a nine element WBP (USEPA 2013b).

The 2013 NPS guidelines include four select cases when alternative plans to a WBP may provide an effective roadmap to achieve water quality goals of §319-funded efforts:⁵

- (1) **When protecting assessed unimpaired/high quality waters.** Where a state has assessed waters that are largely or fully attaining water quality standards and are located in watersheds where only protection actions are needed (i.e., measures to prevent future degradation).
- (2) **When responding to a NPS pollution emergency or urgent NPS public health risk.** In scenarios when the proposed §319 project(s) responds to an urgent, unplanned NPS pollution emergency or urgent NPS public health risk in an area for which a WBP does not exist (e.g., efforts to control erosion and re-establish vegetation in the immediate aftermath of a forest fire or to

⁴Per the §319 guidelines, NPS program funds may also be used to support activities to protect unimpaired/high quality waters including healthy watersheds assessments, actions, and leveraging of other sources of funding for watershed protection. (p. 38)

⁵As stated in the §319 guidelines, "In a few select cases listed below, EPA recognizes that alternative plans to a WBP may provide an effective roadmap to achieve the water quality goals of § 319-funded restoration or protection efforts. In such cases, states must provide the EPA region with justification for why a complete WBP is not necessary and why an alternative plan is sufficient to guide watershed project implementation. This justification may be described through, or included in, the state's § 319 work plan." (USEPA 2013b, p. 35)

reduce pollution affecting drinking water safety), an alternative plan may be developed to ensure the timely, targeted use of watershed project funds.

- (3) **When the impairment is not specific to a pollutant.** Where the impairment is not caused by a pollutant, but rather, by a non-pollutant-based water quality problem (e.g., obstructions for migratory fish or addressing flow regime alterations). In such cases, the state should provide assurance that appropriate watershed analyses were conducted to ascertain the water quality problem will be fully addressed by managing the non-pollutant source of impairment.
- (4) **When addressing an isolated, small-scale water quality problem resulting from one or a few sources of pollution.** An alternative plan may be acceptable when the NPS problem and solution are extremely limited in scope and scale, such that, the water quality problem is caused by one or a very few pollution sources (e.g., a failing septic system). In such cases, the state must demonstrate (through up- and downstream monitoring, watershed characterization studies, etc.) that this impairment is isolated from other potential contributing causes/sources of pollution in the watershed. Additionally, the state must provide assurance that the proposed watershed project will fully address the water quality problem within one grant period.

In these cases, alternative plans may effectively guide NPS project implementation without addressing all nine planning elements. For example, there may be limited value in pollutant load reduction modeling in watersheds with few existing pollutant loads. See Table 3.1 for a crosswalk of the nine elements of a WBP and the elements required in alternative watershed plans. Three of the reviewed states (AK, ME, OR, see Figure 4.13) implemented §319 protection projects in watersheds with EPA-approved alternative plans.

Table 3.1. Crosswalk of required elements of WBPs and alternative watershed plans, as defined in the current §319 guidelines (USEPA 2013b).

Required nine elements of WBPs	Required elements in alternative watershed plans
	Watershed project goal(s) and explanation of how the proposed project(s) will achieve or make advancements towards achieving water quality goals.
Identification of causes and sources of pollution (a)	Identification of the causes or sources of NPS impairment, water quality problem, or threat to unimpaired/high quality waters.
Pollutant loading estimates and expected load reductions needed to meet goals (b)	
Description of management measures that will achieve load reductions and targeted critical areas (c)	Proposed management measures (including a description of operation and maintenance requirements) and explanation of how these measures will effectively address the NPS impairment identified above.
Estimated technical and financial assistance and the relevant authorities needed to implement the plan (d)	

Information/education component (e)	
Project schedule (f)	Schedule and milestones to guide project implementation.
Interim, measurable milestones (g)	
Indicators to measure progress (h)	Water quality results monitoring component, including description of process and measures (e.g., water quality parameters, stream flow metrics, biological indicators) to gauge project success.
Monitoring component (i)	

Because NPS program work primarily focuses on restoring impaired waters, watershed plans are typically designed to identify and manage NPS pollution from critical source areas currently contributing a disproportionately large amount of pollutants in the watershed (USEPA 2008). As described above, the 2013 guidelines acknowledge different planning considerations/needs in healthier watersheds where protection is the primary water quality goal (USEPA 2013b). This chapter provides an overview of planning principles relevant to protection-oriented watershed planning as well as findings from a review of 22 watershed plans developed for unimpaired/high quality watersheds. The chapter is organized into four sections, each corresponding with a major step in the watershed planning process: 1) build partnerships, 2) characterize the watershed, 3) finalize goals and identify solutions, and 4) design an implementation program. Each section provides insights into how the protection of unimpaired/high quality waters can be considered in that step of the watershed planning process (Figure 3.1).

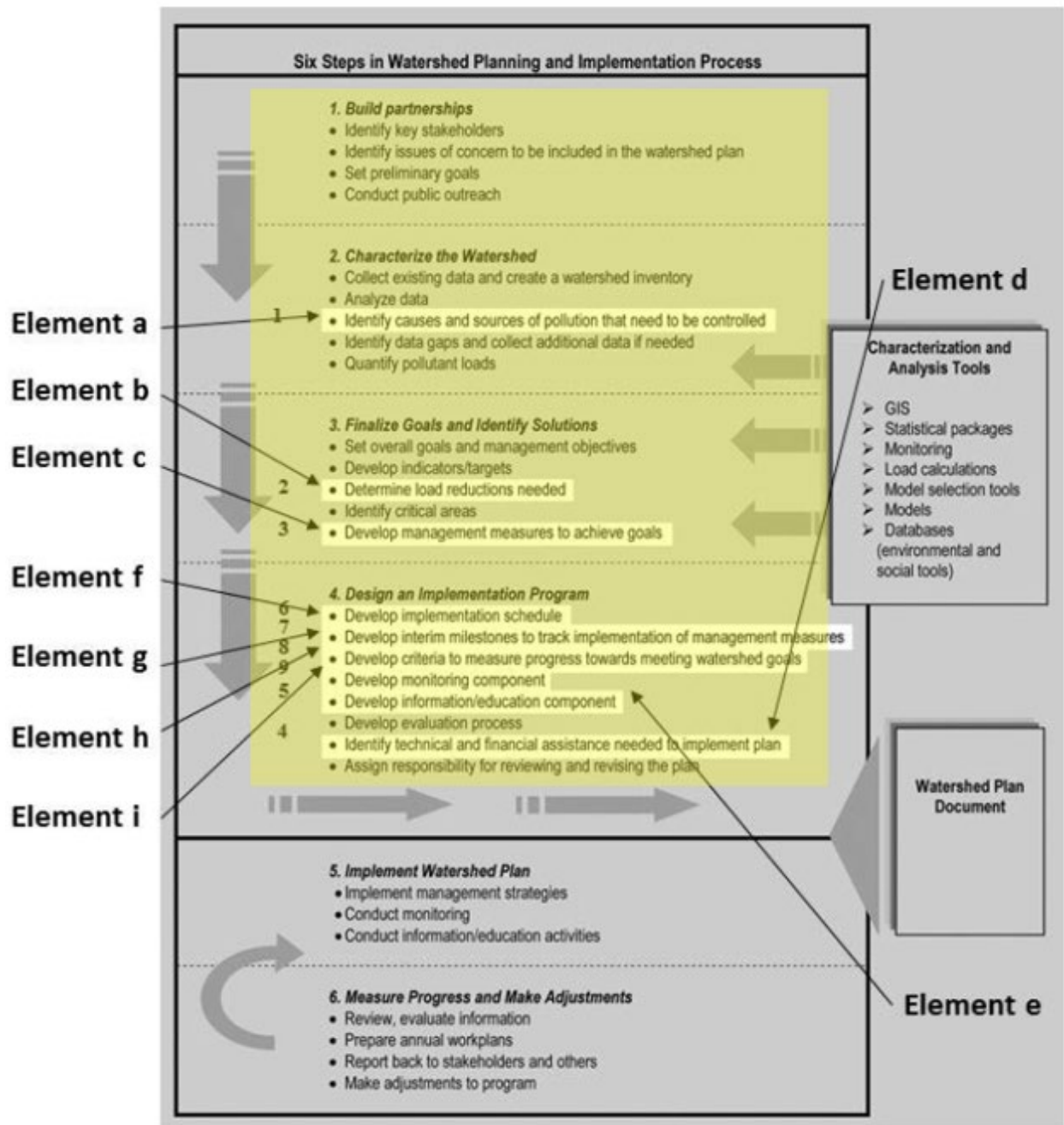


Figure 3.1. An outline of the six general steps guiding the development and implementation of watershed plans, annotated with the EPA’s nine elements corresponding to different planning steps (USEPA 2013a). This chapter provides considerations on how planners can integrate protection in each major step (1-4, highlighted in yellow) of the watershed planning process.

Review of Protection-Oriented Watershed Plans

Twenty-two protection-oriented watershed plans, submitted by EPA regional and state NPS program staff, were reviewed for this report to assess the ways in which these types of plans frame and guide protection efforts (Table 3.2). Specifically, plans met one of the following criteria. Either the plan was

developed for an unimpaired watershed, or the plan was developed for a watershed that includes NPS-impaired waters *and* an explicit goal to protect local unimpaired/high quality waters (Table 3.3). This sample review included nine element WBPs (e.g., Lake Charlevoix, MI 2012), EPA-approved alternative plans (e.g., Woods Pond, ME 2013), and larger-scale protection plans that serve as valuable building blocks for a WBP or acceptable alternative plan (e.g., Chowan River Basin, VA/NC 2014).

The 22 plans included in this review were developed for watersheds in eleven states: Alabama, Arkansas, Maine, Michigan, New Jersey, New Hampshire, Oklahoma, South Carolina, Texas, Virginia, and West Virginia. The watersheds addressed by these plans range in area from five square miles (Woods Pond, ME 2013) to 5,000 square miles (Chowan River Basin, VA/NC 2014). Nine plans primarily focus on lakes, ponds, or reservoirs while 12 plans primarily address streams and rivers. One plan addressed both streams/rivers and a coastal embayment (Weeks Bay, AL 2017).

The review included 15 plans for unimpaired watersheds whose assessed waters were fully attaining water quality standards at the time of plan development. Many of these watersheds contained specially designated waters, such as Tier 3 Outstanding National Resource Waters (Weeks Bay, AL 2017) and Tier 2 High Quality Waters (Pennington Creek, OK 2015) as well as other state-designated high quality waters (Cypress Creek, TX 2014). Plans for unimpaired watersheds typically characterized current water quality condition as vulnerable, threatened, or declining based on water quality monitoring, modeling data, and/or development trends. Some unimpaired watersheds were included on state priority lists because of their vulnerable status.

Watershed Plan Feature 3.1: Upper Llano River – Acting Before Impairment

Developers of watershed plans for unimpaired/high quality watersheds recognize that actions can be taken before water quality is impaired to protect functioning aquatic ecosystems and the services they provide. For example, the *Upper Llano River Watershed Protection Plan* (TX, Upper Llano Watershed Coordination Committee 2016) noted, “[C]urrently, the Upper Llano Watershed does not have any water quality impairments; therefore, this [Watershed Protection Plan] is a proactive approach to watershed management...that focuses on conserving and protecting healthy components of watersheds in an effort to preserve or enhance the ecosystem services provided and to prevent future impairments from land use changes or other perturbations.”

The review also included seven watershed plans that contained impaired waters. These watersheds generally had isolated impairment listings in localized areas of the watershed rather than widespread water quality issues. Impairment causes included excess pathogens, sediment, phosphorus, degraded biological communities, and elevated pH. Despite the presence of impaired segments, these watersheds also contained high quality areas. Plans for impaired watersheds outlined approaches for protecting high quality areas in addition to restoring impaired segments.

Watershed Plan Feature 3.2: Chagrin River – Integrated Protection/Restoration Approach

Watershed plans that describe strategies to both restore impaired segments and protect high quality areas reflect an integrated approach to restoration and protection planning. This concept was

highlighted in the *Chagrin River Watershed Action Plan* (Chagrin River Watershed Partners, Inc. [CRWP] 2011), which stated, “[T]he Chagrin River Watershed is listed on Ohio EPA’s 303(d) list of impaired streams and Ohio EPA completed a TMDL study in 2007...As many streams in the Chagrin River watershed were attaining their designated uses, much of the efforts detailed in this plan are focused on protection activities to maintain the high quality of the Chagrin while also working on improvements in those impaired segments.”

In reviewing each watershed plan, the following information for each step in the watershed planning process was catalogued. Findings from the watershed plan reviews, including excerpts from specific plans, are included throughout this chapter.

Table 3.2. Information collected during reviews of 22 protection-oriented watershed plans.⁶

Watershed Planning Step	Information collected from sample watershed plans
1. Build Partnerships	➤ Partner(s) involved in plan development
2. Characterize the watershed	<ul style="list-style-type: none"> ➤ Watershed Context ➤ Existing water quality condition ➤ Water quality parameter(s) of concern ➤ Watershed threat(s)
3. Set goals and identify solutions	<ul style="list-style-type: none"> ➤ Protection goals ➤ Protection indicators/targets ➤ Protection priority area analysis ➤ Planned management measures
4. Design an implementation program	➤ Implementation milestones

⁶ Information collected during watershed plan reviews is included in Appendix B “Watershed Plan Matrix” Excel file attached to this report.

Table 3.3. Characteristics of the 22 watersheds included in the watershed plan review.

Watershed Name	State(s)	Watershed Area (mi ²)	Water Quality Condition ⁷	Nine-Element Plan? ⁸	Reference
Back Creek	WV, VA	274	Partially Impaired	No	West Virginia Conservation Agency (WVCA) 2014
Chagrin River	OH	267	Partially Impaired	No	Chagrin River Watershed Partners, Inc. (CRWP) 2011
Chowan River	NC, VA	5,000	Unimpaired	No	Virginia Department of Conservation & Recreation (VA DCR) 2014
Cypress Creek	TX	38	Unimpaired	Yes	Texas Commission on Environmental Quality (TX CEQ) 2014
Elk Headwaters	WV	241	Unimpaired	No	West Virginia Department of Environmental Protection (WV DEP) 2012
Hickory Creek	TX	195	Unimpaired	Yes	City of Denton 2008
Lake Charlevoix	MI	330	Unimpaired	Yes	Lake Charlevoix Watershed Advisory Committee (LCWAC) 2012
Lake Winnepesaukee: Meredith, Paugus and Saunders Bay	NH	53	Unimpaired	Yes	Lakes Region Planning Commission (LRPC) 2010
Lee Creek Reservoir and Lee Creek	AR, OK	447	Partially Impaired	Yes	Fort Smith Utility Department (FSUD) 2015a
McGrath Pond Salmon Lake	ME	9	Unimpaired	No	McGrath Pond-Salmon Lake Association 2018
Non-Tidal Raritan River	NJ	830	Partially Impaired	No	New Jersey DEP (NJ DEP) 2018
Panther Pond	ME	12	Unimpaired	No	Panther Pond Association 2015
Paw Paw River	MI	446	Unimpaired	Yes	MI NPS Program 2008
Pennington Creek	OK	93	Unimpaired	Yes	Oklahoma Conservation Commission (OCC) 2015
Salmon Falls Headwater Lakes	NH, ME	26	Unimpaired	Yes	Acton Wakefield Watersheds Alliance (AWWA) 2010
Shaws Creek	SC	85	Partially Impaired	No	City of Aiken 2017
South, Middle, and North Tyger Rivers	SC	345	Partially Impaired	No	South Carolina Department of Health and Environmental Control (SC DHEC) 2018
Upper Frog Bayou	AR	84	Unimpaired	Yes	Fort Smith Utility Department (FSUD) 2015b
Upper Llano River	TX	1,900	Unimpaired	Yes	Upper Llano Watershed Coordination Committee 2016
Upper San Marcos River	TX	95	Unimpaired	Yes	Texas Commission on Environmental Quality (TX CEQ) 2018
Weeks Bay	AL	203	Partially Impaired	Yes	Mobile Bay National Estuary Program (NEP) 2017
Woods Pond	ME	5	Unimpaired	No	Maine Department of Environmental Protection (ME DEP) 2013b

⁷ The presence of designated use impairments at the time of watershed plan publication, as described in the plan document.

⁸ Yes/No flag indicating whether the plan is reported to include EPA's nine elements for watershed planning, as described in the plan document.

Integrating Protection in the Watershed Planning Process

Water quality protection can play an important role in many watershed planning efforts, including alongside restoration goals and in healthy watersheds. In some watersheds, such as those containing both natural and disturbed areas, the planning process may be driven by both protection and restoration water quality goals. This chapter is not intended to provide a comprehensive overview of the watershed planning process, nor does it establish or replace EPA NPS program requirements for watershed planning. Instead, this information supplements existing watershed planning resources (including the 22 reviewed protection-oriented plans as well as programmatic and scientific literature) developed by EPA (e.g., USEPA 2008; USEPA 2013a), state NPS programs, and other watershed-focused researchers and organizations, specifically to highlight opportunities for considering protection during each of the following steps in the watershed planning process.

Step 1: Build Partnerships

Successful development and implementation of a watershed plan depends on the commitment and involvement of community members. Therefore, it is critical to build partnerships with key stakeholders at the outset. Weaving partners into the process can strengthen the end result by welcoming new ideas and input and increasing public understanding of the problems and, more importantly, commitment to the solutions (USEPA 2008; USEPA 2013a).

As depicted in Figure 3.5 (see also [Chapter 4](#), [Figure 4.1](#) and [Table 4.2](#)), watershed context informs all aspects of watershed plan development and implementation, including which partners to include in the process. Protection-based planning may provide opportunities to coordinate with new partners less frequently engaged during restoration work in more disturbed watersheds. By identifying local driving forces motivating development of a watershed plan early in the process, planning teams can find key stakeholders and set goals based on areas of mutual concern (USEPA 2008). Public outreach and engagement can also play a critical role in protection-based planning, particularly in garnering support and understanding for proactive implementation work where water quality problems do not yet exist.

EPA's technical resources outline several key steps to guide partnership-building during watershed plan development (USEPA 2008; USEPA 2013a). Below is a summary of each step, in addition to protection-relevant considerations.

Identify and Engage Stakeholders and Promote Partnerships

People and organizations that have a stake in the outcome of a watershed plan are called stakeholders. Key stakeholders are likely those working on similar issues in the watershed who can provide personnel or resources, such as relationships to landowners, funding support, and technical assistance, to help achieve water quality goals (USEPA 2008; Sustaining Family Forests Initiative [SFFI] 2019). As part of partnership-building, EPA recommends integrating watershed planning efforts with existing programs. EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* includes examples of local (e.g., planning and zoning programs, regional planning councils), state and regional (e.g., source water assessment and protection programs, fish and wildlife programs), and federal (e.g., US Department of Agriculture programs, public lands management) programs particularly relevant to protection-oriented planning (USEPA 2008).

Among the watershed plans reviewed, an average of 11 different partners were involved in each watershed planning team. The most common planning partners were local governments, nonprofit organizations, and state agencies (Figure 3.2). Local governments generally included staff from parks, public health, or environmental services departments of county or city governments as well as representatives from local advisory commissions (e.g., Planning, Conservation, Transportation) and intergovernmental groups (e.g., Council of Governments). Commonly cited nonprofit organizations involved in the planning process included watershed groups, lake or pond associations, and land conservation organizations. Watershed planning teams also frequently included state environmental agency staff from water programs, such as the NPS program, Scenic Rivers, and Healthy Waters programs. Other state agencies involved included natural resource departments, fish and wildlife agencies, and transportation departments. See [Chapter 6](#) for more information about each of these protection partners.

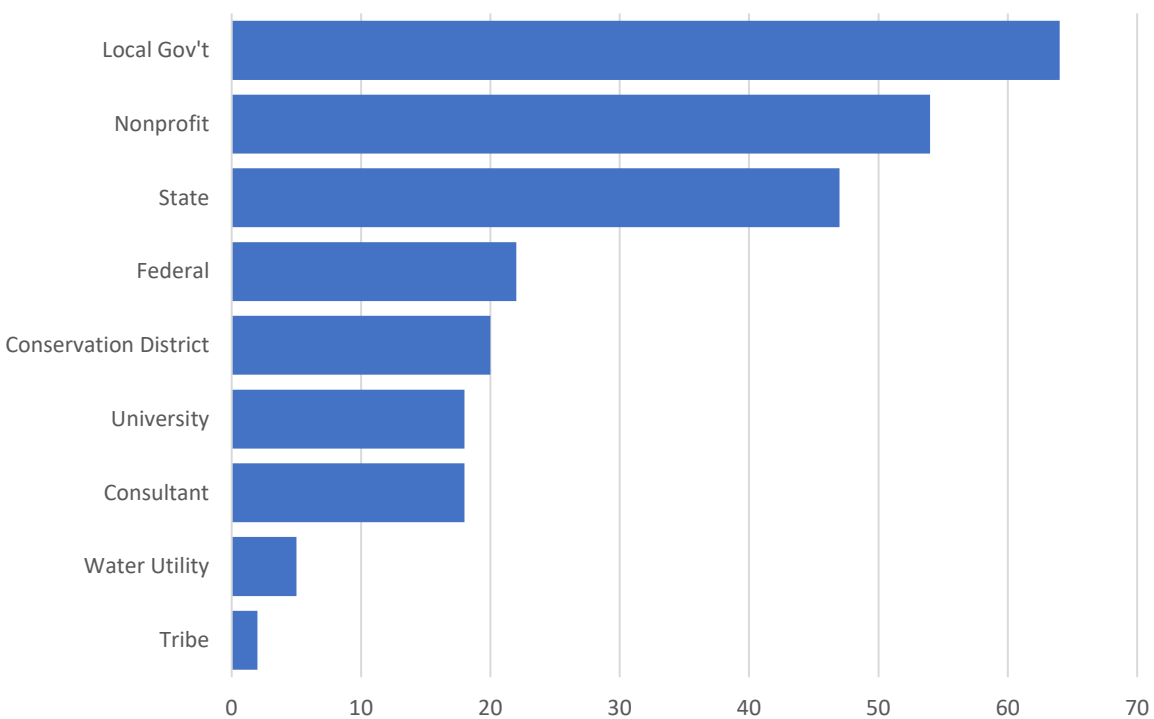


Figure 3.2. Counts of partners, by organization/agency type, involved in the development of 22 watershed plans reviewed for this report.

Not all stakeholders will have equal involvement in the watershed planning process; for example, while some partners will become active members of a watershed planning team, others may be primarily engaged during plan implementation (USEPA 2008). By integrating protection in watershed plans (e.g., identifying areas most critical to protect to achieve water quality goals), these plans may serve as resources for other partners whose complementary work can help achieve protection goals. New Hampshire's NPS program noted that watershed management plans can serve as tools for a variety of partners, including municipal governments, conservation districts, and local watershed groups, to plan for future land use and develop zoning ordinances to protect water quality (NHDES 2010). Watershed

planning teams may also be able to build off existing protection-oriented plans, such as The Nature Conservancy’s Conservation Action Plans (The Nature Conservancy [TNC] 2007).

Resource Feature 3.1: Finding Local Protection Partners

Building partnerships is key to the success of any watershed protection project, but knowing where to start—finding local protection partners—can be a challenge. However, resources for making this task less difficult are expanding.

River Network, a national non-governmental organization (NGO), has an established mission is to “unite and empower a broad range of people, organizations, businesses, and government—to reach common goals and build strength for clean water and healthy rivers.” Inspired by this objective, the River Network developed the [Water Protectors Map](#), an open-access, shareable partner-finding tool. This interactive map displays Wild and Scenic rivers, EPA and USFS regions, HUC6 watershed and forest boundaries, National Park perimeters, and water-protector information within zip codes specified or areas selected by the user. Its database consists of over 6,000 water-oriented organizations, from non-profits to government agencies, and is ever growing.

The Land Trust Alliance, another NGO, offers a similar [tool for finding land conservation partners](#). One can search by state, county, watershed scale (HUC8), or total acres protected to find land trusts and conservancies across the nation. For most of the trusts featured, summary information is provided including the total number of acres protected, a list of protection priorities, and contact information.

Connecting with those who share common goals is crucial to bolstering support, diversifying funding, and expanding project scope and outcomes. Most often, a watershed planner is already aware of local groups interested in preserving the same area or water body. However, utilizing tools developed by organizations like the River Network and Land Trust Alliance can help those new to watershed protection, or those who wish to optimize and/or advertise their partnerships for a more cohesive community and strategic plan.

Articulate Issues of Concern, Preliminary Goals, and Indicators of Progress

In the initial stages of partnership-building, it is important to identify the driving forces for the watershed plan. These issues of concern set the foundation for articulating the plan’s goals and objectives and will help determine the geographic scope of the planning effort (USEPA 2008; USEPA 2013a). As described in [Chapter 2: Prioritizing Watersheds for Protection](#), watershed protection efforts are frequently driven by one or more of the following factors: **water quality** (e.g., presence of unimpaired/high quality waters providing critical cold water aquatic habitat), **watershed condition** (e.g., watersheds with relatively fewer disturbances to landscape condition or hydrology), and **social/programmatic factors** (e.g., presence of high quality-designated waters or waters providing a critical resource value). In addition to considering these factors, state NPS programs typically target protection work in watersheds most vulnerable to changing conditions that threaten water quality.

As a watershed planning team identifies local issues of concern, it may identify new key stakeholders to engage. Protection-oriented planning may include new partners that may or may not have a primary

focus on watershed restoration activities. For example, state natural resources departments and fish and wildlife agencies, frequently cited as partners in the plans, may share a mutual interest in protecting natural areas and wildlife habitat. Land conservation organizations and land use planning authorities may serve as key partners in watersheds facing development pressures. EPA's *Identifying and Protecting Healthy Watersheds: Concepts, Assessments and Management Approaches* (2012) manual includes many examples of national, regional, state, and local partners whose goals may align with healthy watersheds protection (USEPA 2012a).

A fundamental step in the partnership-building process is to solicit stakeholder input on long-term goals for the watershed. These goals are refined throughout the planning process to represent shared goals among the stakeholders. Stakeholders should also be actively involved in selecting indicators that will be used to evaluate progress towards goals (USEPA 2008; USEPA 2013a). Protection-based water quality goals and tracking metrics are discussed later in this chapter as well as in [Chapter 5: Tracking Protection Actions and Outcomes](#).

Resource Feature 3.2: Delaware River Watershed Initiative, Partnerships Central to Water Quality Protection Work

The William Penn Foundation and partner organizations launched the Delaware River Watershed Initiative (DRWI) in 2014 to protect and restore water quality from four primary threats: stormwater and agricultural runoff, forest loss, and groundwater depletion. The 13,500 square mile watershed covers parts of New York, New Jersey, Pennsylvania, and Delaware (Figure 3.3). Approximately half of the water pollution in the watershed is the result of nonpoint sources; land use in the basin includes 19 percent developed areas and 18 percent farms/pasture. The DRWI coordinates and aligns the work of more than 50 partner organizations, with a goal of creating a critical mass of land preservation and restoration work in targeted subwatersheds where they can demonstrate water quality improvements (William Penn Foundation 2021). DRWI funding supports three primary practices: land protection, stormwater management, and agricultural best management practices (4States1Source 2021). The William Penn Foundation has committed more than \$100 million to date to support the Initiative (William Penn Foundation 2021).

Within the basin, the DRWI focuses its efforts in eight clusters of priority HUC12 subwatersheds (avg. cluster area: 817 square miles) where funding could be expected to protect or improve water quality measurably through on-the-ground actions. To select these clusters, partners analyzed land use and land cover, water quality assessment data, and state Natural Heritage Inventory data on areas with habitats or animals of special interest. This process identified either areas where existing higher water quality could be maintained by additional land protection, or areas where agricultural or urban BMPs could lead to water quality improvement. Candidate watersheds were then screened by the Open Space Institute for the presence of established conservation nongovernmental organizations with the capacity and experience to carry out either restoration or protection work (Kroll et al. 2019). Cluster teams, comprised of local and regional land trusts and conservancies, watershed groups, and national conservation groups, were established to guide planning and implementation efforts in the targeted watersheds. Team rosters were tailored to meet the specific water quality goals of each cluster.

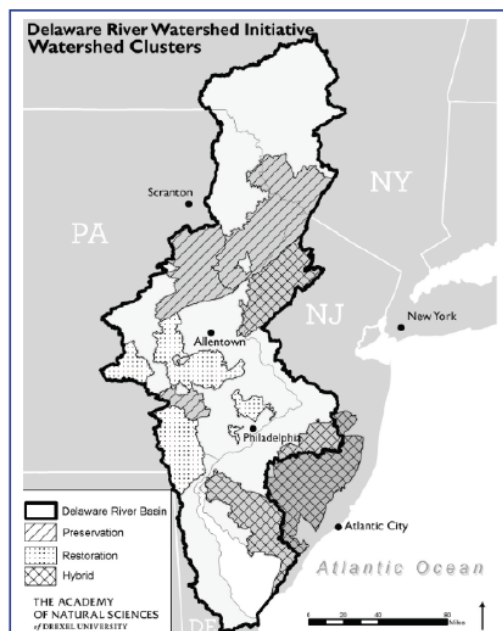


Figure 3.3. DRWI clusters (Collier 2015)

Within each cluster, teams identified smaller focus areas (on average, 16 mi²/cluster) in which to target DRWI funding, which is distributed via two programs: the Delaware River Watershed Protection Fund and the Delaware River Restoration Fund (Kroll et al. 2019). The Protection Fund, managed by the Open Space Institute, provides grant funding for land protection in the five protection-oriented watershed clusters. Across these five clusters, land cover is primarily forest (on average, 59 percent in each cluster) and farmland (21 percent; 4States1Source 2018). Land protection funding is targeted to protect vulnerable sites in healthy watersheds that are critical to protecting high quality surface water and/or recharging groundwater sources and whose conversion from forest cover would likely cause water quality problems (Open Space Institute [OSI] 2017a; OSI 2021).

DRWI protection efforts are tracked via two primary metrics: (1) miles of forested buffer protected through long-term easement or acquisition within focus areas, and

(2) acres of priority forestland protected within focus areas (National Fish and Wildlife Foundation [NFWF] 2021).

Conduct Public Outreach

Information/education activities initiated during watershed planning serve to familiarize potential partners and stakeholders with local water quality issues, outline the watershed planning process, and enlist their participation (USEPA 2013a). During plan implementation, educational outreach is aimed at engaging partners to help achieve plan goals. Thus, successful outreach is dependent on clearly translating these goals into desired actions and targeting messaging to specific audiences (SFFI 2019). There are numerous existing resources, such as EPA's NPS Outreach Toolbox (available at <https://cfpub.epa.gov/npstbx/>), that can help watershed planning teams design effective outreach campaigns.

In healthy watersheds, educational outreach can help local communities understand the importance of early intervention to avoid/mitigate water quality threats. For example, prior to funding the development of lake watershed-based protection plans, Maine's NPS program required local partners complete a watershed survey to identify, document, and prioritize specific NPS problem sites in the watershed. These surveys, frequently conducted by community volunteers, engage local landowners and raise public awareness about the local watershed and water quality concerns (Maine Department of Environmental Protection [ME DEP] 2013; ME DEP 2011).

In some cases, states and partners need to adapt their outreach approaches to effectively engage local communities in protection efforts. As described in the 2013 *Kansas Heritage Streams: Identification and Protection of Healthy Watersheds* report, Kansas' efforts to protect state-designated *heritage streams* were, in some cases, met with resistance from local communities concerned that government-led

initiatives may introduce new limitations on landowners' abilities to use these resources.⁹ For this reason, the report suggests that protection initiatives in Kansas would be more successful if led by local watershed groups or non-governmental organizations, and state agencies can support these efforts through water quality monitoring and public education on the benefits of high quality waters (Stiles et al. 2013).¹⁰

Similarly, social science research on public attitudes towards environmental initiatives may help inform public messaging on protection work. For example, in their study of rural American attitudes towards the environment and conservation, Bonnie et al. (2020) observed a difference in focus group participant opinions of initiatives framed as environmental conservation versus environmental preservation. Whereas some rural participants, particularly those in agriculture and forestry, supported environmental conservation initiatives, they expressed concern towards preservation or protection efforts that may inhibit use of environmental resources critical to their livelihoods. As discussed earlier in this report, water quality protection efforts are frequently motivated by local concern for waters that provide a specific resource value (e.g., drinking water source or critical cold-water fish habitat). This presents the opportunity to emphasize the importance of maintaining healthy waters to sustain the services they provide (MD DNR 2018; Chesapeake Conservation Partnership 2019; Fletcher and Christin 2015; Kittatinny Ridge 2018; USEPA 2012b).

Finally, protection-oriented outreach strategies may differ from restoration work, depending on the local watershed context and the specific management strategies one is working to implement. For example, land conservation may serve as a critical component of watershed protection efforts, particularly in areas facing development pressures. In these cases, community outreach may center on identifying and engaging landowners willing to protect and manage their natural lands (SFFI 2019). Where funding is limited, outreach in these areas may also include engaging local voters to help pass ballot measures to secure funding streams to support conservation efforts (Huron River Watershed Council [HRWC] and Parallel Solutions LLC 2018). As with all watershed efforts, adopting action-oriented outreach is key to effectively engaging the target audience.

Step 2: Characterize the Watershed

The second major step of the watershed planning process is to characterize the watershed to develop an understanding of water quality problems and threats, identify possible causes and sources of pollution, and quantify pollutant loads. This information provides the basis for developing watershed goals and designing management strategies to help achieve these goals. EPA's existing watershed planning resources provide in-depth descriptions of this step (USEPA 2008; USEPA 2013a). Given that protection-oriented planning is frequently driven by concerns of watershed threats, these plans typically characterize both current and projected future conditions. Below is an overview of how the reviewed

⁹Kansas's "heritage streams", as defined in Stiles et al. (2013), refers to high quality waters that met qualifying criteria for designation as either exceptional state waters or outstanding national resource waters under the State's surface water quality standards.

¹⁰The report does note that "public sector initiatives might be successful where the watershed is largely held as public or governmental land, including military reservations or national preserves" (Stiles et al. 2013).

protection-oriented plans characterized watershed condition, assessed waterbody condition, and estimated pollutant loads.

Characterize Watershed Condition

Assessing the condition of a watershed is an important step in the planning process to identify existing problem areas and the pollution sources contributing to these problems, as well as high-quality areas where protection efforts may be needed. Chapter 5 of EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* provides a comprehensive overview of the process for conducting a watershed inventory (USEPA 2008). Although the approach to characterizing watershed condition will be similar in both restoration and protection-based planning efforts, there may be special considerations in healthier watersheds. For example, protection-based watershed plans often include a stronger emphasis on evaluating future conditions, such as land use/land cover change. Three major sources of information based on USEPA 2008 that can be used to characterize watershed condition include: 1) physical and natural features, 2) land use and population characteristics, and 3) pollutant sources.

Physical and natural features

Information on the physical and natural characteristics of a watershed help define the watershed boundary and provide a basic understanding of the local features that can influence pollution sources and pollutant loading. In compiling these data sources for protection-based planning efforts, partners may want to pay special attention to datasets that help identify intact, high-quality areas where protection efforts may be targeted. As outlined in EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*, typical datasets to be considered include those that characterize the hydrology, topography, soils, climate, habitat, fish and wildlife, and/or ecosystems within the planning area (USEPA 2008).

Hydrology

Hydrologic information, including the locations of waterbodies and how they are connected to one another, is an important data source when characterizing and modeling watersheds (USEPA 2008). When selecting hydrologic datasets, watershed planners should consider the relative accuracy of data sources in representing the extent and flow permanence of waterbody networks. For example, smaller streams and tributaries are more likely to be missed in mapping and, as a result, are more likely to be ignored during the planning process (Ernst 2004; Fritz et al. 2013). These omissions may be a notable issue in protection-based watershed planning given the strong influence of small headwater streams and tributaries on the quantity, timing, and quality of streamflow (Ernst 2004; USEPA 2015b). Studies suggest that protecting headwater streams and their riparian zones can have a greater impact on maintaining water quality and quantity than protection of larger tributaries (Ernst 2004; Kaplan et al. 2008).

Ohio's *Chagrin River Watershed Action Plan* (CRWP 2011) covered a 267 square-mile area in the outlying suburbs of Cleveland. Seventy-one miles of the Chagrin River, including headwater portions of the watershed, are designated as a State Scenic River, characterized by exceptional aquatic habitat and adjacent high-quality forests. The plan noted that headwater streams in the watershed are vitally important in providing cold water via springs to support downstream habitat uses. However, much of the watershed faces threats from increasing development pressure. Many headwater reaches are addressed in the *Physical Attributes and Water Quality*

of the Watershed section of the plan, which includes stream reach-specific assessment results for seven HUC12 subwatersheds. The plan also includes headwater-specific numeric targets for several water quality parameters, such as nutrients and total suspended solids.

Topography

Characterizing the topography or natural features of the watershed can help to determine possible sources of pollution. For example, in 2015, the Fort Smith Utility (FSU) Department finalized a nine element WBP for the Upper Frog Bayou Watershed, a 271-square mile HUC8 watershed that drains directly to the Arkansas River in northwest Arkansas (FSUD 2015b). Land use in the watershed is dominated by forest (83 percent of watershed area) and agriculture (11%). Although there were no impaired waters at the time of plan development, FSU was concerned with increasing sediment and nutrient loadings during storm events that threatened the drinking water quality in Lake Fort Smith, a water supply for 200,000 people in Western Arkansas and Eastern Oklahoma. Given the steep topography of the watershed (over half of the area exceeds 16% slope), the plan included a land slope and soils analysis to identify portions of the watershed most vulnerable to erosion and help target management strategies to address sediment loading from unpaved roads and other local sources.

Soils

Information on the distribution of soil types across the watershed can help identify areas with higher runoff potential (e.g., by assessing soil infiltration capacity) as well as areas more susceptible to erosion (e.g., soil erodibility measures). Soils data can help target management strategies. For example, the WBP for South Carolina's South, Middle, and North Tyger HUC10 subwatersheds served as an action plan for protection and restoration activities to address sources of bacteria and sediment pollution (SC DHEC 2018). Land protection was one of the plan's proposed management strategies to protect areas that, if developed, would have the most significant impact on water quality. In their land protection prioritization framework, partners prioritized parcels containing hydric soils, which can provide key services important to protecting water quality, such as groundwater recharge.

Wildlife, Habitats & Ecosystems

In many cases, efforts to protect unimpaired/high quality waters will align with those aimed at protecting wildlife, their habitats, and broader ecosystems. For example, high-quality, contiguous habitats and their buffers, as well as small pockets of critical habitat, can help prevent water quality impairments and provide protection for both terrestrial and aquatic organisms (USEPA 2008). Ecosystem management plans and ecosystem service assessments can serve as building blocks for watershed protection plans and, in some cases, help quantify the financial value of protecting intact ecosystems (Kittatinny Ridge 2018).

The *Meramec River Conservation Action Plan* (TNC 2014) was developed through a collaboration of 29 conservation stakeholders to ensure the sustainability of aquatic resources in the Meramec River Basin. The basin drains 4,000 square miles of east Central Missouri and is among the most biologically significant regions in the United States, containing diverse and rare aquatic and terrestrial plants, animals, and natural communities (TNC 2014). The plan, developed using The Nature Conservancy's Conservation Action Planning Process, identified and prioritized actions in eight conservation target areas to conserve native biodiversity and aquatic resources. The Action Plan contained several elements (e.g., assessment of watershed condition and

potential threats and recommended implementation actions) that can inform NPS watershed planning and implementation work.

Land use and population characteristics

Information on the distribution of land use and population in a watershed provides insights into the potential pollution sources active in the watershed, growth of the area, and changes in land uses and sources (USEPA 2008). The protection-based watershed plans typically included an assessment of current conditions and expected future changes in land use and population. Together, this information can be used to help identify protection priority areas most vulnerable to degradation.

Land Use and Land Cover Data

Land use types (together with other physical features such as soils, vegetative cover, and topography) influence the hydrologic and physical nature of the watershed. In addition, land use distribution is often related to the activities in the watershed and, therefore, provides a basis for identifying and evaluating potential pollution sources (USEPA 2008). As discussed further below in the *Estimate Pollutant Loads* section, land use/land cover data also provide a unit for simulation in watershed models and can be used to estimate future pollutant loads to target protection efforts and set water quality goals.

Eight watershed plans completed a build-out analysis to project future land use/land cover change in the watershed planning area: Lake Charlevoix, Michigan (2012), Cypress Creek, Texas (2014), Hickory Creek, Texas (2008), Upper San Marcos River, Texas (2018), Weeks Bay, Alabama (2017), Paw Paw River, Michigan (2008), Salmon Falls Headwater Lakes, Maine/New Hampshire (2010), and Chagrin River, Ohio (2011). Build-out analyses typically assess the potential for increases in residential, commercial, and/or industrial development, and data inputs usually include current and projected population estimates, present-day land use, development trends, zoning restrictions, and other development constraints such as highly sloped lands. In assessing these data together, build-out analyses can provide both spatial (i.e., portions of a watershed most likely to see land use conversion) and quantitative (i.e., percent of watershed and total areas expected to change) estimates of land use change.

Five plans evaluated build-out within a specified planning horizon, spanning 10-40 years from current conditions. The remaining three plans did not specify an end year for the build-out analysis and instead, evaluated land use change under the assumption of full build-out of all areas that could potentially be developed.

Two plans completed a build-out analysis to gain general insight into future levels and patterns of development within the watershed (i.e., near shoreline areas and river corridors; Lake Charlevoix, MI 2012 and the Chagrin River, OH 2011). These two plans did not explicitly link results of the build-out analysis with other plan components, such as priority areas or recommended management actions.

Watershed Plan Feature 3.3: Paw Paw River – Build-Out Analysis

In Michigan's *Paw Paw River Watershed Management Plan* (MI NPS Program 2008), an empirical build-out model was used to estimate runoff volume, total suspended solids, and phosphorus and nitrogen loads for seventeen predominantly agricultural subwatersheds under four hypothetical urban

development scenarios (25%, 50%, 75%, and 100% impervious coverage or high density residential) as provided by municipal master plans. The build-out model product was a GIS layer comprised of multiple land boundary and characteristic layers, each with associated runoff concentration and management attributes calculated from a Long-term Hydrologic Impact Assessment (L-THIA) model and available pollutant data. The final estimations from the build-out model were then used to prioritize watersheds most at risk for impaired water quality and/or quantity due to increasing urban development. For example, under the 25% scenario, urban subwatersheds will likely experience the greatest increase in nonpoint source pollution; thus, the plan recommends prioritizing these areas for protection.

The second component of the build-out model predicted the effectiveness of five stormwater BMPs (wet retention ponds, dry detention ponds, vegetated swales, rain gardens, and constructed wetlands) in reducing total phosphorous and total suspended solids from runoff within high priority urban subwatersheds over thirty years (the estimated lifespan of retention ponds). While bioswales proved most cost-effective, retention ponds and constructed wetlands displayed the greatest load reductions. However, more information on design parameters and installation feasibility should be considered.

Michigan's build-out model exemplifies how local zoning data can be utilized to estimate loads and predict land use threats to valued waters at the HUC14 scale, ultimately creating an effective analysis for targeting watersheds vulnerable to increased nonpoint source pollution.

Population & Demographic Information

Demographic data include information on the people in the watershed, such as the number of persons or families, commuting patterns, household structure, age, gender, race, economic conditions, employment, and educational information. This information can be used to help design public outreach strategies, identify specific subpopulations to engage with during the implementation phase, or help determine future trends and needs of the populations (USEPA 2008). As described above, population trend data can be used in combination with other datasets to assess future changes within the watershed that pose a risk to water quality, such as land use development. For example, the US Forest Service estimates that over 55 million acres of rural private forest land will experience a substantial increase in housing density from 2000 to 2030. Identifying areas vulnerable to population growth and land use conversion can help target water quality protection strategies, including land conservation and conservation development (Mockrin et al. 2014).

In addition, local information on land ownership can help characterize the watershed as well as target management strategies. Watershed plans frequently included statistics on the proportions of the watershed planning area contained within local jurisdictions, such as counties, municipalities, and townships (e.g., Chagrin River, OH 2011). This information can help identify key entities to engage in the watershed planning process. Land ownership data can also help design management strategies. For example, several of the watershed plans included land conservation as a proposed management strategy to achieve watershed protection goals. Land conservation prioritization frameworks in these plans included factors based on land ownership data, such as parcel size and proximity to existing protected lands (South, Middle, and North Tyger Rivers, SC 2018; Back Creek, WV/VA 2014; Lake Charlevoix, MI 2012).

Resource Feature 3.3: EPA Integrated Climate and Land-Use Scenarios Tool

One of the main threats to unimpaired/high quality waters is increased development driven by population expansion. One approach to prioritizing watersheds for protection is assessing their vulnerability to such threats using resources like the EPA's [Integrated Climate and Land-Use Scenarios \(ICLUS\) tool](#). Since 2009, the EPA has been updating its ICLUS datasets and interactive map with information on projected population and land cover changes. The ICLUS model uses demographic circumstances to predict the fertility, mortality, immigration, and movement of U.S. populations to estimate future demand for residential land. ICLUS Version 1 provides users with regional information on housing density, percentage of impervious surfaces, percentage of impervious stress at the HUC8 level, and county population under four different population growth scenarios. ICLUS Version 2 offers population and land use projections based on the Intergovernmental Panel on Climate Change's shared socio-economic pathways (SSPs) and representative concentration pathways (RCPs). In addition to accessing the ICLUS tool directly, several EPA [Watershed Index Online \(WSIO\)](#) data layers are based on ICLUS data, and ICLUS information can be found through the EPA's [Global Change Explorer \(GCX\)](#). When developing a watershed plan, NPS programs can better target their protection efforts by estimating future NPS threats alongside assessing current concerns.

Land Management Practices

When characterizing the watershed, information on how the land is managed is helpful in identifying current pollution control practices and potential targets for future management. EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* provides examples of both structural practices (e.g., current nonpoint source projects) and existing policies and plans (e.g., local ordinances and master plans) that may be helpful to include in a watershed plan (USEPA 2008). As described in [Chapter 4: Implementing Protection Projects](#), management approaches best suited to protect healthier watersheds may be different than those designed to restore impaired waters (Kwon et al. 2021). For example, there may be larger-scale opportunities for land conservation and land use planning to meet water quality protection goals in healthier, less developed watersheds. In protection-based watershed planning, it can be helpful to inventory these types of land management practices that help address water quality threats.

Watershed plans frequently included information on existing protected lands in addition to local regulations relevant to water quality protection. Protected lands information typically included maps of protected areas (e.g., zoned open spaces, parks, and conservation easements) plus descriptions of the landowners and managers (e.g., Chagrin River, OH 2011). Moreover, several plans included analyses of local regulations relevant to water quality protection (e.g., Lake Charlevoix, MI 2012; Paw Paw River, MI 2008; Weeks Bay, AL 2017). Michigan's *Lake Charlevoix Watershed Management Plan* (LCWAC 2012) included findings from a local ordinance gaps analysis that was conducted to evaluate existing water-related ordinances against what should be in place to best protect water resources. Findings from the analysis also included recommendations to strengthen ordinances to be more protective of water quality.

Pollutant sources

Identifying and characterizing point sources (e.g., existing permitted dischargers) and nonpoint sources (e.g., diffuse sources in agricultural and urban areas) of pollution provides information on the relative magnitude and influence of each source and its impact on water quality conditions. This information helps inform the design of watershed management strategies in latter steps of watershed planning

(USEPA 2008). While there are fewer existing pollution sources in healthier watersheds, conducting an inventory of known pollution sources remains important in protection-based planning. As discussed above, assessment of future pollution sources (e.g., based on projected land use/land cover change) can also be an important component of protection-based plans to help address water quality threats that may arise during plan implementation.

Prior to developing lake watershed-based protection plans, Maine's NPS program required that local partners complete a watershed survey to identify, document, and prioritize specific NPS problem sites in the watershed (ME DEP 2013a). Depending on the watershed area and available resources, these can be conducted by trained volunteers, such as community members from the local lake association. Because of the sensitivity of many of Maine's lakes to phosphorus loading, Maine's Department of Environmental Protection and the Maine Congress of Lake Associations co-published a citizen's guide for conducting a NPS phosphorus survey (ME DEP 2011). According to the guide, conducting a watershed survey helps raise public awareness of the local watershed and water quality concerns, identify existing water quality problems, provide recommendations to landowners about how to fix soil erosion problems and phosphorus runoff from their property, and gather important land use data to inform additional planning and implementation work (ME DEP 2011).

Assess Waterbody Condition

In addition to assessing watershed condition, it is important to evaluate the condition of waterbodies, including whether they meet water quality standards and support designated uses (USEPA 2008). This information provides a general overview of the health of the waterbodies in the watershed and what uses should be supported. This step will also help identify data gaps to determine whether additional water quality sampling is needed. Below, is an overview of three sources of information frequently cited in the protection-oriented watershed plans to characterize local waterbody conditions: 1) presence and condition of unimpaired/high quality-designated waters, 2) water quality assessment status of local waters, and 3) waterbody monitoring data. See [Chapter 2: Prioritizing Watersheds for Protection](#) for additional information about water quality assessments and special designations frequently discussed for unimpaired/high quality waters.

Unimpaired/High Quality-Designated Waters

The presence of unimpaired/high quality-designated waters can often serve as a catalyst for watershed protection efforts. Several watershed plans containing waters recognized by state or federal programs for their high quality condition, including Tier 2 (e.g., Pennington Creek, OK 2015) and Tier 3 (e.g., Weeks Bay, AL 2017) designations as well as other state-designated high quality waters (e.g., Cypress Creek, TX 2014 and Chagrin River, OH 2011), were reviewed for this analysis. When waters with special designations were present, planners typically identified their locations and condition as a part of the watershed planning process.

The *Water Resources* chapter of Ohio's *Chagrin River Watershed Action Plan* (CRWP 2011) included an inventory of use designations/use attainment statuses of waterbodies within the watershed, such as waters designated for Coldwater Habitat, Warmwater Habitat, Exceptional Warmwater Habitat, and having unusual or exceptional assemblages of aquatic organisms including threatened or endangered

species. The plan contained a waterbody-specific list of proposed implementation strategies, which included protection (e.g., acquire riparian conservation easements) and restoration-based (e.g., restore natural flood plain functions) actions to address water quality concerns along Exceptional Warmwater Habitat-designated reaches.

Water Quality Assessment Status

Where waters have been assessed, this information can serve as a basis for setting water quality protection and restoration goals. Of the 22 plans reviewed, 15 covered unimpaired watersheds whose assessed waters were fully attaining water quality standards (WQS) at the time of plan development; seven plans addressed 303(d)-listed impaired waters although typically in localized areas of the watershed. Causes of impairment addressed in these watershed plans included excess pathogens, sediment, phosphorus, degraded biological communities, and elevated pH.

Maine's *McGrath Pond-Salmon Lake Watershed-Based Protection Plan* (McGrath Pond-Salmon Lake Association 2018) was developed to guide NPS pollution management efforts in the 8.7 square-mile watershed surrounding McGrath Pond and the downstream Salmon Lake, which were listed on the Maine Department of Environmental Protection's 2017 Nonpoint Source Priority Watershed List as "Sensitive" and "Watch List", respectively. The plan indicated delivery of nutrient-laden sediment into McGrath Pond and Salmon Lake has resulted in low-levels of dissolved oxygen in deep areas of Salmon Lake, release of phosphorus from bottom sediments into the water column, and algal blooms during the summer months. While neither waterbody was 303(d)-listed at the time of plan development, they flow into an impaired pond and lake. Water quality data and assessment information in the plan served as a basis for proposed management strategies to protect the local waters and contributed to regional efforts to improve downstream water quality.

Waterbody monitoring data

In addition to water quality assessment information (e.g., location of 303(d)-listed waters), monitoring data, including chemical, physical, and biological data, can help characterize waterbody health and the surrounding watershed condition. Long-term datasets can help assess trends in waterbody condition and characterize the risk of water quality degradation in healthy waters. During conversations with state NPS program staff, several states (CA, MN, NH, and OH) noted they sometimes face the challenge of insufficient monitoring data needed to target protection work and assess the effectiveness of protection activities. In cases when local waterbody monitoring data are not available, indirect measures of water quality, such as assessments of landscape condition, may help identify portions of a watershed likely to be high quality and potential targets for protection activities (e.g., Flotemersch et al. 2016; Riato et al. 2020).

The *Stream Ecological Health Assessment for the Chowan River Basin* (VA DCR 2014) was developed to identify ecologically healthy waters and establish a conservation strategy to guide water quality and habitat protection work in the Chowan River Basin, a 5,000 square-mile area covering parts of Virginia and North Carolina. Land use in the basin is 64 percent forest, 28 percent cropland and pasture, and approximately six percent urban. Given the large planning area, partners applied a GIS-based prioritization to identify subwatersheds in which to develop protection-based watershed management plans. The Virginia Watershed Integrity Model (VWIM) was used to identify HUC12 watersheds within

the Chowan Basin most likely to contain healthy streams based on GIS-based measures of aquatic ecosystem (e.g., riparian corridor condition) and watershed condition (e.g., percent undeveloped land). By identifying HUCs with relatively high terrestrial integrity, monitoring staff were able to more effectively leverage the limited resources available for fieldwork to identify healthy waters for conservation and protection activities.

Resource Feature 3.4: Characterizing Lake and Pond Vulnerability to Degradation

Several watershed plans and state NPS programs focus on the protection of unimpaired/high quality lakes and ponds. To guide these protection efforts, programs first assess the vulnerability of lake and pond systems to degradation to identify priority water bodies. For example, Minnesota's lake protection efforts utilized monitoring data to quantify current and potential lake vulnerability (MPCA 2017). Minnesota Pollution Control Agency (MPCA) staff annually updated water quality data (e.g., total phosphorous, chlorophyll a, and Secchi transparency depths) and based data assessments on the most recent 10 years of water quality data. Lakes were then measured against eutrophication criteria in WQS to assess aquatic recreation and aquatic life use goals. Unimpaired lakes were evaluated within a risk assessment approach that helped rank lakes most vulnerable to degradation and target total phosphorous (TP) levels. As of 2016, 60% of Minnesota's lakes were in good to excellent condition. Therefore, large oligotrophic lakes most vulnerable to phosphorous loading, on a declining trend, and/or near loading thresholds were identified as state priorities for consideration in local watershed planning.

New Hampshire used lake assimilative capacity to quantify water quality protection goals and guide watershed planning (NHDES 2010). Antidegradation provisions of NH's WQS required that a minimum of 10% total assimilative capacity of any waterbody be held in reserve. Remaining assimilative capacity determined waterbody classification as either Tier 1 (impaired, no assimilative capacity) or Tier 2 (high quality, remaining assimilative capacity) for each parameter.

Maine employed the Trophic State Index (TSI) to assess overall productivity of a lake (i.e., chlorophyll a, TP, and turbidity). The Maine Lake Sebago report (Daigneault and Strong 2019) compiled information on existing TMDLs for impaired sub-watersheds in the Sebago Lake watershed, including estimates of phosphorous loads exceeding the lake's natural flushing and TP processing rates from three TMDLs that ranged in values from 0.18-0.244 kg P/ha/yr. The authors of the report also acknowledged that tipping points are based on waterbody processing rates, flushing rates, and biogeochemical dynamics, and they sought to answer the question, "At what level of forest loss to development would pollution loading lead to widespread non-attainment of water quality triggering broad-scale need for TMDLs for waterbodies in the watershed?"

TSI measures of condition are often included in other state lake assessments, such as for Upper Frog Bayou, AR (2015), Lake Charlevoix, MI (2012), and McGrath Pond, ME (2018). Maine's *Woods Pond Watershed-Based Protection Plan* (ME DEP 2013b) states, "Maine water quality criteria require that lakes and ponds have a stable or improving trophic state and be free of culturally induced algal blooms." Ultimately, assessing lake and pond productivity is helpful in understanding their sensitivity to degradation and identifying crucial thresholds for targeting protection objectives.

Estimate Pollutant Loads

Characterizing the watershed, water quality problems/threats, and pollutant sources provides the basis for developing effective NPS management strategies to meet water quality goals. This process also helps focus management efforts on the most pressing needs within the watershed (USEPA 2013a). Pollutant loading analysis can be an important part of the watershed planning process, including for protection-oriented plans, in quantifying the relative magnitude, locations, and timing of pollutant loading within the watershed (USEPA 2008). Pollutant load estimates can be derived from water quality monitoring data, literature values (i.e., loading estimates based on published research), or watershed modeling used to forecast or estimate conditions that might occur under various scenarios (USEPA 2013a).

Eight of the 22 plans included numeric pollutant load reduction targets necessary to meet water quality goals. Based on information from these plans and supporting literature on the topic, a summary is provided below on how pollutant loading analysis can be used to 1) evaluate current conditions and 2) forecast future conditions during protection-based watershed planning.

Evaluating current conditions

Since watersheds are frequently comprised of heterogeneous landscapes (e.g., variable land use/land cover, topography, soils) resulting in an uneven distribution of pollution sources, loading analyses can help identify critical source areas contributing disproportionately to water quality problems where management activities are needed (USEPA 2008; USEPA 2013a). Pollutant loading analyses can help quantify existing source loads originating from different categories (e.g., land use types) in the watershed. In protection-based planning, these analyses may also be helpful in identifying areas contributing relatively less pollutant loads, such as existing natural land cover, that may be candidate target areas to protect (Figure 3.4).

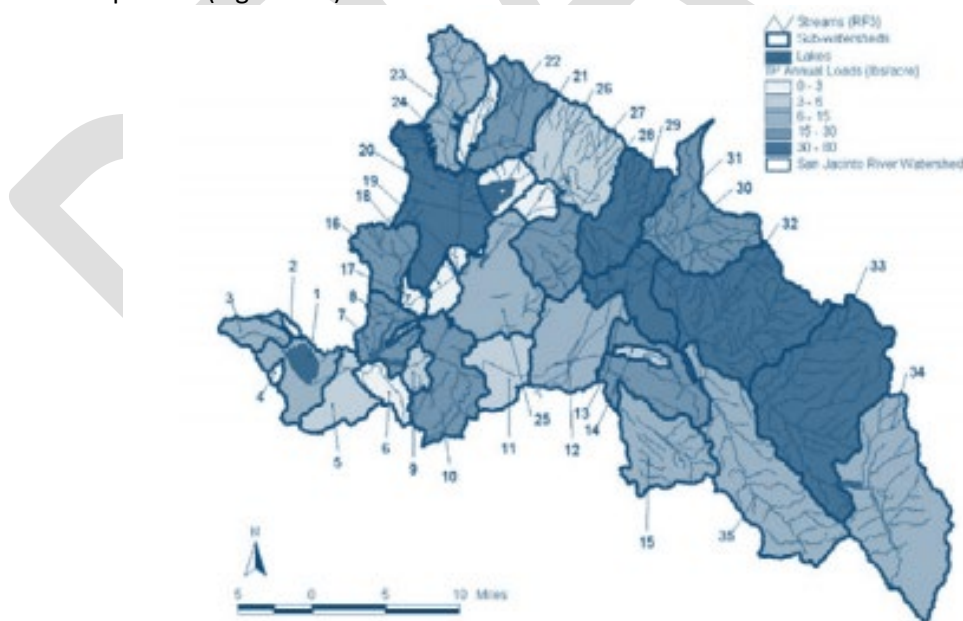


Figure 3.4. Presentation of annual sediment loads (lb/ac) by subwatershed, San Jacinto, California, excerpted from EPA's *Handbook for Developing Watershed Plans to Protect and Restore Waters* (USEPA 2008). In watershed planning efforts focused on water quality restoration, attention is often placed primarily to areas contributing the most pollutant loads, represented as darker areas in the figure. Protection-based plans typically also include information about less-impacted areas (lighter areas in figure) that may be critical to protect to achieve water quality goals, such as avoiding pollutant loads from future development.

When conducting pollutant loading analyses in healthier watersheds, there may be special considerations when selecting modeling tools and input datasets best suited to these settings. For example, pollutant load modeling is based on subdividing a watershed into smaller units whose size is dependent on factors such as land use distribution and diversity. In watersheds with relatively uniform land cover, such as forest, planners may need spatially refined land use datasets to divide the forest to partition source loads. In this case, key land use categories may include various ages of trees (newly established versus mature), logging roads, and small residential areas, which are not likely represented in more generalized land cover datasets typically used in pollutant loading analyses (USEPA 2008).

Protection-based planning efforts may benefit from recent improvements to watershed models that support efforts to identify protection priority areas. For example, an enhanced version of Soil and Water Assessment Tool (SWAT) model, SWAT+, was released in 2017. The enhanced model provides users greater flexibility in the spatial representation and connectivity of processes within a watershed. Whereas previous SWAT models represented only a single main channel within each subbasin, SWAT+ allows multiple channels within each subbasin, each with differing characteristics and connectivity (Bieger et al. 2017; White et al. 2017). This enhancement allows users to more accurately represent different portions of a watershed, including headwater areas known to be important to protecting downstream water quality (Ernst 2004; Kaplan et al. 2008; USEPA 2015b). Quantifying source loads from headwater areas may help increase attention to these areas during watershed planning (USEPA 2019a).

Resource Feature 3.5: CWA §303(d) Program Protection Plans

Protection is one of the six goals under the 303(d) Program Vision. To date, eight state 303(d) programs have done protection work through various 303(d) program activities, including assessments/listings, TMDLs/plans, and collaboration with other programs (Environmental Law Institute [ELI] 2020). As described in EPA's 2008 Watershed Planning Handbook (USEPA 2008), TMDLs can serve as an important component in watershed planning efforts, particularly regarding pollutant loading analysis. Similarly, where state 303(d) programs have developed protection plans, they may serve as a resource in protection-based watershed planning. Under the 303(d) program, protection plans typically contain the following four components (USEPA 2021f, question 8):

- 1) identification of specific waters to be protected and risks to their condition
- 2) activities proposed and/or implemented that are expected to resist degradation or impairment of these waters, or improve water quality (e.g., quantification of loading or assimilative capacity)
- 3) time frames over which a protection target condition is expected to be attained, maintained, or improved
- 4) quantitative and qualitative measures of expected success and planned responses to observed changes in risks or condition.

Currently, only seven states (AK, MA, NJ, NY, TN, TX, and WI) have submitted watershed protection plans under the 303(d) program, but state participation is likely to increase as watershed protection resources become more available and showcased.

Forecasting future conditions

Several protection-oriented plans used pollutant loading modeling to estimate future pollutant loads associated with land use and climatic changes within the watershed. This information can be used to 1) identify areas most vulnerable to change resulting in increased pollutant loading and 2) quantify avoided pollutant loading attributed to activities such as natural land protection (Chesapeake Bay Program Partnership 2017; Chesapeake Bay Program Partnership 2019).

Eight plans included build-out analyses to project future land use/land cover change in the watershed planning area. Six of these plans paired build-out analyses with water quality modeling to project future water quality conditions associated with land use change (Cypress Creek, TX 2014; Hickory Creek, TX 2008; Upper San Marcos River, TX 2018; Weeks Bay, AL 2017; Paw Paw River, MI 2008; Salmon Falls Headwater Lakes, ME/NH 2010). Within these plans, the pollutant loads associated with projected land use change were estimated using a range of analytical methods, from relatively simple (average land use export rates) to highly complex (process-based watershed models such as SWAT). The plans were also used to estimate the potential for BMPs to offset the projected water quality effects of future development. Together, the build-out analysis and follow-up analyses of future water quality effects were completed to determine pollutant load reductions needed to achieve water quality targets, find areas with high pollutant loads that could be priorities for plan implementation, and identify BMP types and quantities that could achieve required load reductions.

- The ***Weeks Bay Watershed Management Plan, Alabama*** (Mobile Bay NEP 2017) included a build-out analysis to project potential land cover changes within the watershed by 2040. Two build-out scenarios were analyzed to address uncertainty in projected conditions: a medium-growth scenario and a high-growth scenario. The analysis mapped changes in land cover types (low, medium, and high density developed, forest, cropland, etc.) based on 2011 land cover, population projections, and a regional transportation planning study. Key findings included an increase in developed land cover from 13% of watershed area in 2011 to 23% in 2040 under the medium growth scenario and 29% under the high growth scenario.

Results of the build-out analysis were used to simulate 2040 water quality conditions throughout the watershed using the Soil and Water Assessment Tool (SWAT) model. Model output offered an estimate of potential concentrations and loads of total nitrogen, total phosphorus, and total suspended solids in streams and rivers under 2040 land cover. Results showed large increases in annual sediment and nitrogen loads in two major rivers in the watershed (Fish River and Magnolia River) but minimal changes in phosphorus loads.

Results of the build-out and modeling analyses were applied to highlight areas of the watershed that could be priorities for NPS management and to support recommended management strategies. Several follow-up analyses were also proposed to further apply SWAT model results to refine the locations and types of NPS management measures that could be implemented to offset the water quality impacts of future development.

The *Weeks Bay Watershed Management Plan* also presented a detailed analysis of the ecological effects of projected sea level rise by simulating habitat changes under alternative magnitudes of sea level rise using the Sea Level Affecting Marshes Model (SLAMM). The analysis documented potential habitats impacts and underscored the importance of management actions outlined in the plan to mitigate the effects of sea level rise.

Step 3: Set Goals and Identify Solutions

After characterizing and quantifying the problems/threats in the watershed, planning teams refine the preliminary goals and develop more detailed objectives, measurable targets, and indicators used to assess progress towards these targets (USEPA 2013a). Below, is an overview of how the reviewed protection-oriented plans approached setting overall goals and management objectives, developing indicators and targets to evaluate management objectives, and identifying protection priority areas in which to target management practices.

Set overall goals and management objectives

As described earlier in this chapter, watershed planning efforts begin with the identification of preliminary watershed goals with input from partners and stakeholders (Step 1: Build Partnerships) followed by characterizing and quantifying the problems and threats in the watershed (Step 2: Characterize the Watershed). During Step 3, watershed planning teams refine their watershed goals and establish more detailed objectives and targets that will guide the development of management strategies to meet these goals (USEPA 2008; USEPA 2013a).

Figure 3.5 and the accompanying Table 3.4 below presents a conceptual framework, adapted from the Minnesota Forest Resources Council (MFRC 2017), of how management goals and strategies may vary depending on current watershed conditions, as measured by percent watershed protected (i.e., natural land that is no longer vulnerable to development) and percent watershed disturbed. In general, watershed goals and candidate management strategies to achieve these goals will vary depending on current and, particularly for protection-oriented planning, projected future watershed conditions.

For example, goals in minimally disturbed watersheds that are largely protected (Zone 1) should center on maintaining these unimpaired/high quality conditions by promoting good stewardship practices and proactively addressing water quality threats. Alternatively, goals in disturbed watersheds with few protected natural areas (Zone 4) are likely to be aimed at reducing and treating polluted runoff by targeting management practices in critical source areas. In watersheds containing both natural and disturbed areas (Zone 2 and 3), implementation efforts may be guided by both water quality protection and restoration goals. Per the *Nonpoint Source Program and Grant Guidelines for States and Territories*, EPA expects watershed plans to focus not only on the impaired segments within a watershed, but, when possible, to identify currently unimpaired waters where protection and load reduction actions are necessary to ensure that high quality waters do not become impaired and to address conditions that may contribute to impairments downstream (USEPA 2013b).

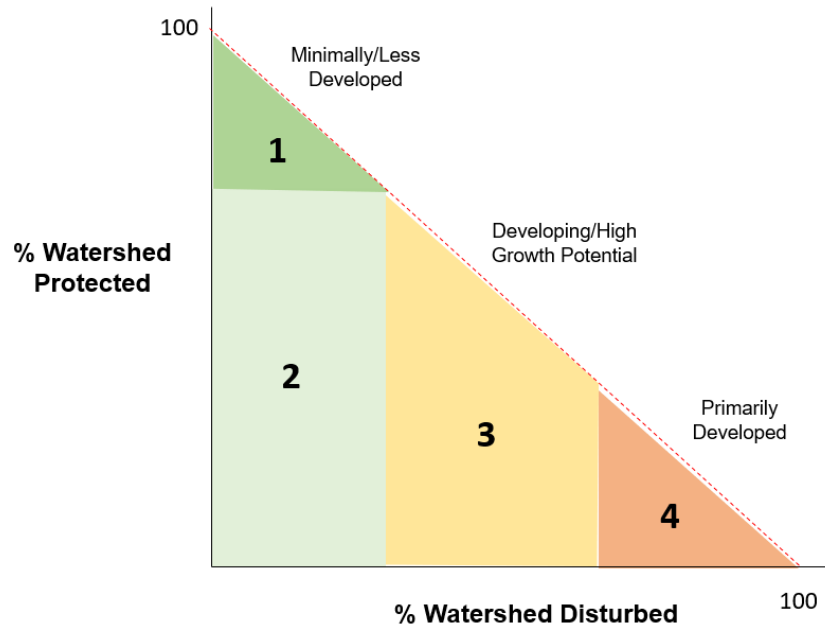


Figure 3.5. Watershed classification by protection/disturbance condition. Watershed goals and management strategies may vary depending on current watershed conditions, as measured by percent watershed protected (i.e., natural land that is no longer vulnerable to development) and percent watershed disturbed. Zone 1: vigilance, Zone 2: Protection, Zone 3 = Full Restoration, Zone 4 = Partial Restoration. (Adapted from Minnesota Forest Resources Council [MFRC] 2017, originally from Jacobson et al. 2016)

Table 3.4. Management goals, approaches, and potential challenges associated with Zones described in Figure 3.5.

Zone/Management Goal	Potential Management Approaches	Potential Challenges
<p>(1) Vigilance Watersheds currently sufficiently protected. Management efforts aimed at maintaining high-quality conditions.</p>	<ul style="list-style-type: none"> • Land protection along riparian corridors and to connect existing protected areas. • Infrastructure BMPs (e.g., culverts, stream crossings, forest roads, septic systems). • Integrate protection goals with local land use and water plans. • Education/outreach on landowner stewardship. 	<ul style="list-style-type: none"> • Absent imminent water quality threats in watershed, may need to find more pressing motivations/incentives to grow public support for protecting water resources (TPL and AWWA 2005, p. 39).
<p>(2) Protection Watersheds with relatively few disturbances, but opportunities to further protect areas.</p>	<ul style="list-style-type: none"> • Large-scale land conservation (e.g., conservation easements, fee title programs). • Land use planning/development management. • Landowner education/outreach to promote stewardship planning, BMPs, etc. • BMPs, such as reforestation and riparian restoration. 	<ul style="list-style-type: none"> • Watersheds likely have near-water development and more intensive recreational uses. Management approaches should balance needs for both watershed protection and near-shore management.

<p>(3) Full Restoration Watersheds with moderate levels of disturbance and realistic chances for full restoration of water quality.</p>	<ul style="list-style-type: none"> • Land use planning/development management. In high growth areas, there is likely to be greater public support for protection measures like restrictive zoning or publicly-financed land acquisition (TPL and AWWA 2005, p. 39). • Targeted land protection on parcels that deliver maximum water quality benefits. • BMPs. • Better site design in developing areas (Kwon et al. 2021). • Erosion/sediment control (Kwon et al. 2021). 	<ul style="list-style-type: none"> • Likely to be high growth areas with near-term threats to water quality. • In more developed watersheds, land values are likely higher resulting in increased costs of land protection.
<p>(4) Partial Restoration Significantly developed (e.g., widespread urban and agricultural land use) watersheds where management efforts are aimed at partial restoration of water quality.</p>	<ul style="list-style-type: none"> • Very strategic land protection projects (e.g., coordinated with wellhead protection efforts). • Agricultural, urban, and other BMPs. • Stormwater BMPs (Kwon et al. 2021). • Watershed stewardship programs (Kwon et al. 2021). 	<ul style="list-style-type: none"> • Watersheds need major landscape policy changes for significant restoration to become viable (MFRC 2017). • Most expensive to restore these watersheds, so may be a lower priority for land protection in the near-term.

The 22 protection-oriented plans generally articulated one or more of the following watershed goals: 1) maintain good water quality condition in unimpaired waters, 2) protect water quality from future increases in NPS loading, and 3) improve water quality by reducing existing NPS pollutant loads. As described earlier in this chapter, these 22 plans included both those developed for partially impaired (seven plans) and unimpaired (15) watersheds (Table 3.3). The watershed goals described in these two groups of plans reflect the local water quality and watershed condition driving management efforts. For example, although all seven plans developed for partially impaired watersheds contained an explicit goal to improve water quality by reducing existing NPS pollutant loads, plans covering unimpaired watersheds more frequently set goals to maintain unimpaired waters (10 plans) and/or address future NPS pollution threats (10 plans), compared with reducing current NPS loads (six plans). In unimpaired watersheds, water quality improvement goals were typically specified when water quality data demonstrated declining water quality, such as conditions near impairment thresholds.

Examples of watershed goals from two plans, one covering a partially impaired watershed (*Watershed Based Plan for the South, Middle, and North Tyger Subwatersheds*, SC; SC DHEC 2018), and one covering an unimpaired watershed (*Cypress Creek Watershed Protection Plan*, TX; TX CEQ 2014), are summarized below.

South, Middle, and North Tyger River Subwatersheds Plan (SC DHEC 2018)

Upstate Forever, a nonprofit conservation organization that protects critical lands and waters, in collaboration with project partners, developed this WBP for three HUC10 subwatersheds in the Tyger

River Basin in northwest South Carolina to “reduce bacteria levels and sediment pollution to meet state water quality standards.” The three subwatersheds comprise approximately 416 stream miles, 2,331 acres of lake, and over 220,900 acres of land, which is primarily forest (44%), agriculture (28%) and developed land (23%). Three drinking water utilities (cited project partners in the plan) have intakes within the planning area, which serve approximately 127,000 residents. At the time of plan development, several tributaries in the planning area were listed as impaired due to high levels of bacteria. Two bacteria TMDLs, approved by EPA in 1999 and 2004, cover waters within the planning area and cite suspected nonpoint sources, including failing septic systems and sewer infrastructure, agriculture, stormwater runoff, and domestic pets and wildlife. Additionally, multiple water quality monitoring stations in the planning area have also been listed as impaired for aquatic life use support criteria. The WBP outlined a 10-year implementation schedule aimed at decreasing bacteria and sediment loads in the subwatersheds. The planning team applied a parcel prioritization methodology to identify priority lands for protection, restoration/enhancement, and/or best management practices (Figure 3.6).

Category	Number of Parcels in Results	Notes
Parcel Analysis Results	65,680	Score results for all parcels that were analyzed for protection or restoration activities
Land Protection	294	High priority parcels that, if developed, would have greatest impact on water quality
Septic System Repair or Replacement	3,226	High priority parcels for septic repair or replacements
Agricultural BMPs	4,057	High priority parcels for agricultural BMPs
Wetland Restoration/Enhancement	184	High priority parcels for wetland restoration/enhancement
Riparian Buffer Restoration/Enhancement	1,232	High priority parcels for riparian buffer restoration or enhancement
Voluntary Dam Removal	18	High priority parcels for Voluntary Dam Removal
Shoreline Management	291	High priority parcels for Shoreline Management restoration/enhancement
Stormwater BMPs	97	High priority parcels for stormwater BMPs, such as detention pond retrofits or rain gardens
Pet Waste Station(s)	53	High priority parcels for Pet Waste Stations

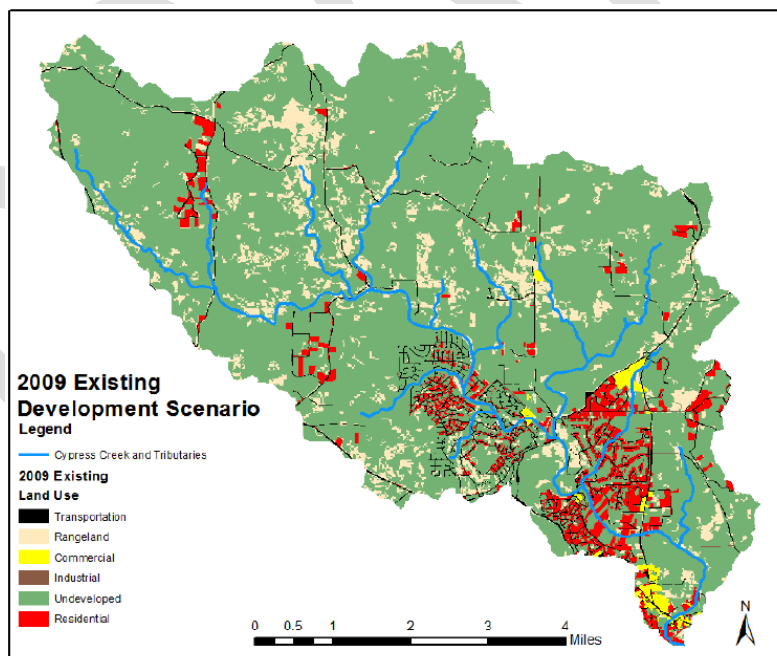
Figure 3.6. Summary of prioritization results from parcel prioritization methodology used in the *Watershed Based Plan for the South, Middle, and North Tyger Subwatersheds* (SC DHEC 2018) to identify priority lands for protection, restoration/enhancement, and/or best management practices. The WBP also includes a series of watershed maps and tables with additional information about priority land areas and proposed management strategies for these parcels.

Cypress Creek Watershed Protection Plan (TX CEQ 2014)

The *Cypress Creek Watershed Protection Plan* (TX CEQ 2014), developed for the Cypress Creek community by Texas State University’s Meadow Center for Water and the Environment, was the result of a six-year collaboration between numerous groups and individuals whose vision was to preserve the

natural beauty and excellent water quality of Cypress Creek for current and future generations. While waters within the planning area were meeting standards during plan development, the Creek had shown signs of water quality degradation. In addition, watershed partners were concerned with water quality threats to surface and groundwater resources from projected population growth and land use development in the 38.3 square-mile watershed (Figure 3.7). The plan articulated a goal “...to ensure that the long-term integrity and sustainability of the Cypress Creek watershed is preserved and that water quality standards are maintained for present and future generations.” To meet this goal, the plan established numeric water quality targets for total nitrogen, total suspended solids, *E. coli*, streamflow, and oil and grease levels. Target values were set to state water quality criteria or to more stringent values based on existing conditions and stakeholder input.

A build-out analysis projecting future land development through 2050 estimated a four-fold increase in residential and commercial development in the watershed. The planning team identified priority subwatersheds in the planning area by pairing the build-out analysis with water quality modeling to identify potential future exceedances of state water quality criteria. Water quality modeling of future scenarios was completed using the Soil and Water Assessment Tool (SWAT) and Event Mean Concentration (EMC) method to evaluate required pollutant load reductions to offset loading from projected growth and achieve numeric targets for stream nitrogen and sediment concentrations. These results were paired with an assessment of current water quality conditions, groundwater recharge potential, and proximity to on-site sewage facilities to identify vulnerable tributaries in which to target management efforts.



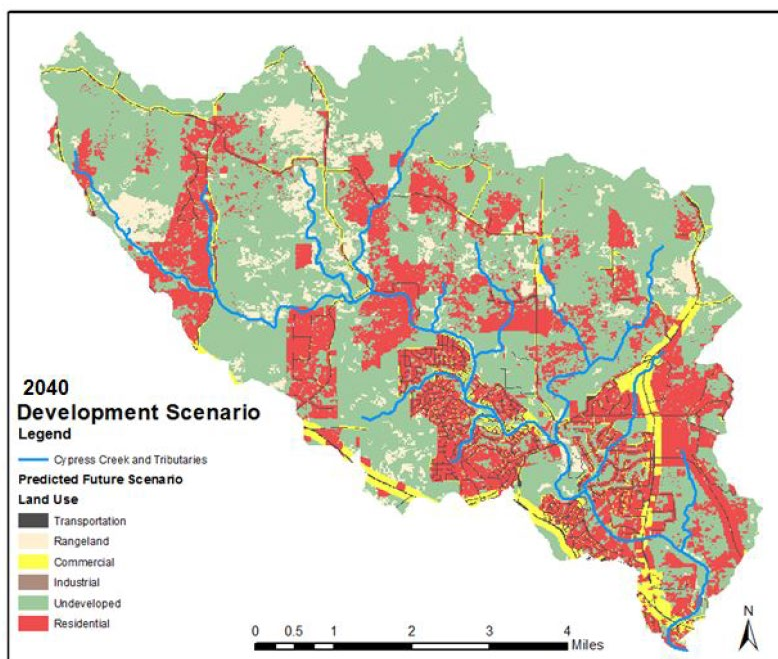


Figure 3.7. One of the drivers in project partners developing the *Cypress Creek Watershed Protection Plan* (TX CEQ 2014) was expected rapid population growth and land development in Hays County between 2009 (above) and 2040 (below). According to the plan, land use change is projected to be predominantly residential, with an increase of 440% in residential area over this time period.

Develop indicators and targets to evaluate management objectives

In the next step of the watershed planning process, indicators and targets to quantitatively measure progress towards meeting watershed goals and management objectives need to be developed. Plans may include environmental, programmatic, and social performance indicators.

Environmental indicators measure the current conditions in the watershed (e.g., number or percentage of river/stream miles that fully meet water quality standards) and help identify stressors and pollutant sources. Environmental indicators are a direct measure of the environmental conditions that plan implementation seeks to achieve.

Social (e.g., rate of participation in targeted education programs) and **programmatic indicators** (e.g., number of management measures implemented in a watershed) can also play an important role in measuring progress towards meeting watershed goals (USEPA 2013a). See Table 3.5 below for examples of social and programmatic indicators cited in plans.

Overall, a greater number of the 22 protection-oriented watershed plans included environmental indicators based on water quality targets (17 plans) rather than pollutant load reduction targets (eight plans). Plans developed for partially impaired watersheds more consistently included both water quality and load reduction targets (five of seven plans) compared with plans covering unimpaired watersheds (three of 15 plans). Although most plans for unimpaired watersheds did include water quality targets (12 of 15 plans) and identified critical areas where management actions would be needed, few of these plans quantified the pollutant load reductions needed to meet water quality targets.

In general, the water quality targets described by the plans reviewed were either equal to state water quality standards, or in some cases, more stringent than state water quality standards. Although each plan has its own unique rationale and approach for target-setting, planners generally considered state water quality criteria, local water quality monitoring data, and stakeholder needs. For example, numeric state water quality criteria served as a basis for nutrient and sediment-based water quality targets in several plans (Chagrin River, OH 2011; Salmon Falls Headwater Lakes, ME/NH 2010; Upper San Marcos River, TX 2018). Additionally, water quality targets were based on water quality standards when limited water quality monitoring data were available in the planning area, or when available monitoring data indicated that existing conditions were near the threshold for impairment listing. In these cases, water quality targets served to guide efforts to protect waters from impairment.

Some plans set water quality targets more stringent than water quality standards such as when monitoring data demonstrated existing high quality conditions, or when stakeholder needs were found to require exceptional water quality (e.g., Upper Frog Bayou, AR 2015). In these cases, water quality targets were set to existing constituent levels observed in the watershed, “reference watershed” values defined in scientific studies, or calculated by applying a percentage adjustment to state water quality standards. As demonstrated in the example below, some plans included a combination of water quality targets based on both state water quality standards and other numeric targets.

- The **Lake Charlevoix Watershed Management Plan** (LCWAC 2012) included both narrative goals and numeric water quality targets for the protection of the unimpaired Lake Charlevoix Watershed in Michigan. Its narrative goals addressed water quality outcomes (“protect and improve the quality of water resources in the Lake Charlevoix Watershed”), the preservation of existing natural areas (“protect valuable lands that are critical to water quality, fisheries, and wildlife”), and specific actions that can be taken to support water quality and preservation outcomes (“promote watershed protection practices, such as permanent land protection and low impact development techniques, to Watershed stakeholders”).

Numeric water quality targets were established for nine parameters of concern, including total nitrogen, total phosphorus, pH, and dissolved oxygen. Targets were based on numeric criteria from Michigan’s water quality standards but were set to either alternative values for parameters that did not have numeric criteria, or to more stringent values when monitoring data showed higher quality conditions were supported within the watershed.

Identify management practices to implement in critical areas

Watershed planners next identify critical areas within the planning area where management practices are needed to meet watershed goals (USEPA 2008, USEPA 2013a). In nine element WBPs, planners incorporate pollutant loading estimates to identify critical source areas, then select management practices based on load reductions needed to meet watershed goals. Together, this information addresses WBP elements (b) and (c). Per EPA’s §319 guidelines, alternative watershed plans are not required to include pollutant loading estimates or calculate pollutant load reductions needed (USEPA 2013b). Instead, alternative plans must demonstrate how the proposed project(s) will achieve or make advancements towards water quality goals and explain how the proposed management measures will effectively address NPS impairments (Table 3.1).

One of the challenges in implementing protection (as cited by state NPS program staff during discussions for this report) is the lack of established methods, relative to restoration-based technical guidance, to quantify the work required to meet watershed protection goals. In many watersheds, the presence of NPS-impaired waters and an associated TMDL, where developed, serves as a primary driving force towards restoration by providing a water quality target and load reductions required to achieve the target condition. Conversely, protection-oriented planning is typically driven by the presence of unimpaired/high quality waters that are threatened by changing conditions. As described above, this can present challenges in setting protection targets (e.g., where the goal is to maintain higher water quality than state water quality standards) and quantifying actions needed to prevent/offset the water quality impacts from projected changes in the watershed. Additionally, EPA's National NPS Program does not currently have established methods for quantifying water quality benefits, such as pollutant load reductions, of protection-based management strategies like land conservation.¹¹

Despite these challenges, several of the protection-oriented plans served as strong examples of how to identify protection priority areas to inform the design of management practices.

Identify Critical Areas

EPA defines critical source areas (CSAs) as smaller areas within a watershed that contribute a disproportionate amount of pollutants of concern or contribute otherwise in a disproportionate manner to the identified water resource problems of concern. CSAs are generally considered to be places where high-level pollutant sources (e.g., resulting from current land management activities) interact with high pollutant transport potential (e.g., areas near waters; Figure 3.8). As part of the watershed approach, planners identify CSAs then target management measures in these areas. Studies demonstrate that these targeted approaches improve efficiency in achieving water quality goals (USEPA 2018a).

¹¹EPA's Spreadsheet Tool for Estimating Pollutant Loads (STEP-L) does not currently include land conservation as a BMP, nor does STEP-L currently allow users to model future conditions. EPA's *Nutrient and Sediment Estimation Tools for Watershed Protection* guide (USEPA 2018b) does provide information on other tools, such as the Region 5 Model, that currently allows users to consider alternative future land-use/cover scenarios, which can support estimates of pollutant load reductions attributed to land conservation.

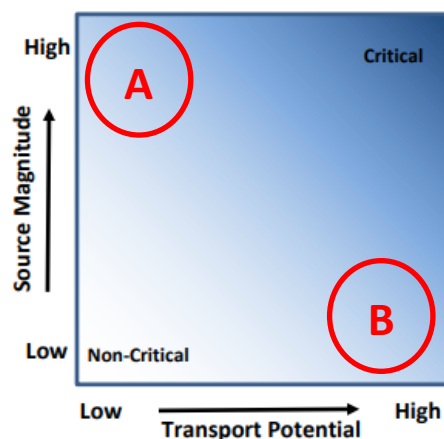


Figure 3.8. Conceptual relationship between pollutant source magnitude and transport potential, adapted from USEPA 2018a. In addition to identifying critical source areas, watershed planning efforts provide an opportunity to identify protection priority areas where proactive management may be critical to achieving and sustaining water quality goals. Protection priority areas include those vulnerable to threats, such as land use change, that may lead them to become new critical areas of high source magnitude (A, such as land use development of upland headwater areas) and/or high transport potential (B, such as areas with highly erodible soils and degradation/loss of intact riparian buffers).

As part of the review of protection-oriented watershed plans, critical source areas were differentiated from *protection priority areas* (PPAs) and defined as high quality portions of a watershed prioritized for protection. PPAs support improved water quality by contributing relatively low levels of pollution, attenuating pollutants from upgradient areas (e.g., riparian buffers), or maintaining other functions that promote aquatic ecosystem health. Most plans included a general description of PPAs as part of a discussion of protection-based management strategies to be implemented. Examples include: “where possible, attaining land or establishing easements in areas critical to the stream (i.e. buffer zones, wetlands, etc.) and maintaining these as green areas should be considered” (Upper Frog Bayou, AR 2015), “encourage landowners to put portions of their property (especially buffers along streams and wetlands) into conservation easements” (Shaws Creek, SC 2017), and “preservation of headwaters via purchase, easement, management activities” (Upper San Marcos River, TX 2018).

Five plans contained a more detailed spatial analysis of PPAs (Lake Charlevoix, MI 2012; South, Middle, and North Tyger Rivers, SC 2018; Back Creek, WV/VA 2014; Paw Paw River, MI 2008; Chagrin River, OH 2011). These plans each included GIS-based parcel-scale analyses to identify areas with favorable characteristics for protection. Parcels typically received priority for protection based on factors like the presence of intact shorelines, riparian buffers, or wetlands, intersection with source water protection areas, and proximity to existing protected lands.

- The ***Back Creek Watershed Protection Plan, West Virginia/Virginia*** (WVCA 2014) included a comprehensive parcel-scale analysis to identify PPAs. Two separate GIS analyses were completed to map high-priority parcels for 1) the protection of intact forest lands and 2) the protection of important aquatic habitat. The forest protection analysis included data that measured attributes such as forest patch size, proximity to rivers and existing protected lands, housing density, and participation in forest stewardship programs. The aquatic habitat protection analysis incorporated data on the location of existing wetlands, wetland corridors,

floodplains, stream reaches containing high-quality aquatic resources, and mapped locations of rare threatened and endangered species. Each analysis resulted in maps of high, medium, and low protection priority parcels to guide where to implement recommended protection measures such as conservation easements.

Resource Feature 3.6: Approaches to Identifying Protection Priority Areas (PPAs)

The [Stream Reach Assessment Tool \(SRAT\)](#) was developed by Drexel University to identify PPAs within eight regions of the Delaware River watershed. Priority catchments are those with the most valuable natural lands (i.e., having the greatest ability to produce clean water), and thus, those that would face the greatest impact if developed. The ability to produce clean and abundant water is calculated by considering the percent forest/wetland, percent riparian natural cover, erosion potential, ground water recharge (inches/year), stream order, and percent base flow of each stream reach. To quantify a catchment's vulnerability, SRAT considers pollutant loading at various scales and outputs, including:

- 1) the mean annual pollutant load of total nitrogen, total phosphorous, and total suspended sediment from major point and nonpoint sources delivered to each stream reach in the Basin from the immediate catchment
- 2) the mean annual in-stream concentration of each pollutant
- 3) the locations and relative impacts of point sources across the Basin.

Combined, these results allow SRAT to function as both a localized system for identifying impaired streams based on nutrient and sediment thresholds and a methodology for prioritizing unimpaired catchments for protection, therefore guiding evaluations of the water quality benefits of protection efforts and informing decision-making.

Similarly, Washington state DOE's Puget Sound watershed assessment (Stanley et al. 2019) incorporates a hydrologic condition index (HCI) that identifies restoration and protection priority areas based on modeled impacts of existing and projected future development on stream flashiness and overall watershed hydrologic condition. This method applies a spatial grid to a watershed (1.8m to 30m resolution) to analyze its land cover, surficial lowland geology, and distance to stream, and from these factors, determine either the Euclidean or natural flow path and likelihood of contributing to stream flashiness. Stream flashiness is dependent on high pulse count (HPC) coefficients, which are derived from hydrologic models run on King County watersheds using decades of precipitation and climate data (King County Department of Natural Resources and Parks 2014). The end HCI score is relative to the worst possible combination of land cover and surficial geology (i.e., 100% impervious). Local governments can use HCI results, along with biological indicators, to systematically design development at the sub-basin scale and minimize watershed degradation within the Puget Sound.

Identify Management Strategies

In general, protection-based strategies are a critical starting point in watershed management. For example, preserving natural areas or establishing vegetated open space is often the first step in a series of stormwater management practices (i.e., "treatment train") aimed at initially maintaining or reducing the amount of runoff generated within a watershed, then treating the remaining runoff to remove the pollutant load (Mid-America Regional Council [MARC] and American Public Works Association [APWA])

2012; Figure 3.9). Undisturbed land or land returned to a natural state through native landscaping enables greater stormwater infiltration which, in turn, minimizes runoff, erosion, and potential for downstream pollution (MARC and APWA 2012).

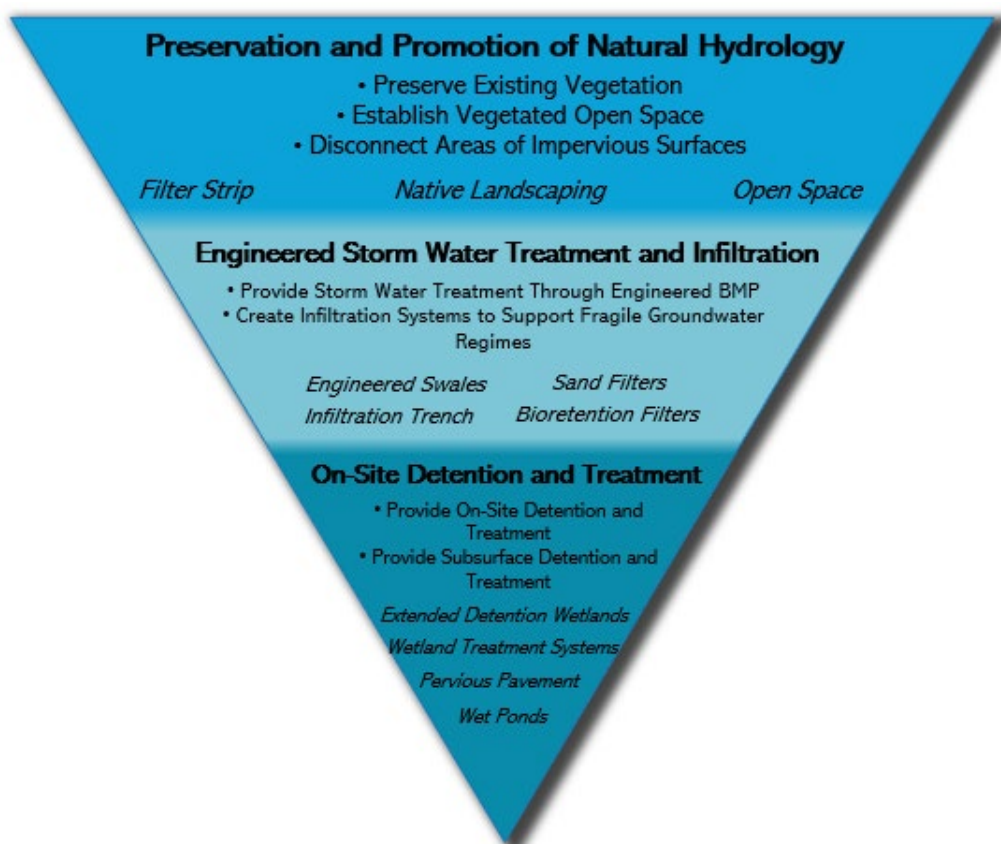


Figure 3.9. Hierarchy of stormwater best management practices. (Adapted from MARC and APWA 2012)

EPA’s *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (2008) recommends that in addition to selecting management practices focused on pollutant load reductions, planning teams consider opportunities to implement practices for “protecting, conserving, and restoring aquatic ecosystems.” The handbook provides examples of protection-oriented measures, such as land conservation (e.g., via fee simple land purchase or conservation easements), local regulations/zoning (e.g., ordinances for protecting habitats and floodplain and riparian zoning), and other related activities (e.g., conservation education; USEPA 2008).

There are numerous tools available to support the screening, selection, and targeting of possible management strategies, including protection-oriented activities as part of the watershed planning process. For example, EPA’s Watershed Management Optimization Support Tool (WMOST) is a decision support tool that facilitates integrated water management at the local or small watershed scale. WMOST models the environmental effects and costs of management decisions in a watershed context, considering both water quality and quantity. WMOST allows users to evaluate a range of management practices, including green stormwater infrastructure, stream restoration, water supply, wastewater, and land conservation (USEPA 2021d).

Almost all the protection-oriented watershed plans included BMPs to reduce existing levels of NPS pollution such as stormwater retention ponds, vegetated buffers, livestock fencing, and no-till management. As described below, most plans also included protection-based management measures. These measures include local ordinances, regulations, codes, or statutes to manage land development (collectively referred to as ordinances in this chapter) and land conservation, primarily aimed at preventing the loss of existing natural areas.

Ordinance development, enhancement, and enforcement. Eighteen watershed plans contained management measures related to ordinance development, enhancement, and/or enforcement (Table 3.4). The ordinances described in the plans take many different approaches to reduce the water quality impacts of future population growth and land development. The most cited ordinances restricted development in or near areas of important water quality functions, such as riparian buffers, shorelines, wetlands, floodplains, or groundwater recharge zones. Ordinances that establish performance standards for stormwater management during and after construction were also frequently discussed as a method for protecting water quality. Broadly, the ordinances can be grouped as 1) those which directly influence the location and design of new development or redevelopment (e.g., impervious cover limits), 2) those that regulate landowner activities that degrade water quality (e.g., fertilizer use), and 3) those that authorize local governments to develop water quality trading or land acquisition programs. Examples are discussed below.

- The ***Upper San Marcos River Watershed Protection Plan, Texas*** (TX CEQ 2018) recommended enhancements to several local ordinances to protect environmentally sensitive areas from development. These included ordinances that restrict development in “stream water quality and buffer zones” and the establishment of “groundwater protection zones” to maintain infiltration and recharge to aquifers that support stream baseflows. The plan also recommended enhancements to ordinances related to the management of post-construction stormwater to augment sediment removal and runoff capture requirements.
- The ***Salmon Falls Headwater Lakes Watershed Management Plan, Maine/New Hampshire*** (AWWA 2010) included recommendations to adopt new ordinances to limit phosphorus inputs from new and existing development. These included ordinances that prohibit the use of phosphate-based detergents and the use of phosphorus lawn fertilizer unless a soil test deems it necessary.
- A major component of the ***Hickory Creek Watershed Protection Plan, Texas*** (City of Denton 2008) was the recommendation to revise local ordinances to implement a system for stormwater credit trading to support protection efforts. The proposed system would establish baseline performance criteria for stormwater management (e.g., minimum levels of pollutant removal or runoff capture) in existing development and new development. Developers could receive credits by designing and maintaining a stormwater management system that performs better than required criteria. Earned credits could then be sold or traded to other developers and therefore represent a market-based incentive to protect water quality through stormwater management.

Table 3.5. Ordinance types cited in protection-oriented watershed plans. In general, these ordinances were described in the plans as being components of management strategies to protect water quality from adverse impacts of development.

Ordinance Category	Description
Development Restrictions	Restrict development in or near riparian buffers, shorelines, wetlands, floodplains, recharge areas, etc.
Construction Stormwater Management	Require stormwater management and erosion and sediment control during construction. Define performance standards for stormwater management and erosion and sediment control during construction.
Post-Construction Stormwater Management	Require stormwater management and erosion and sediment control post-construction for new development and/or redevelopment. Define performance standards for stormwater management and erosion and sediment control during construction new development and/or redevelopment
Conservation Design	Require new development or redevelopment to use principles of conservation design.
Impervious Cover Limits	Limits on impervious cover amounts in new development or redevelopment
Impact Mitigation	Require new development or redevelopment to mitigate impacts to riparian buffers, shorelines, wetlands, floodplains, recharge areas, etc. For example, any loss of riparian buffer is required to be offset by restoring an equivalent amount of riparian buffer in the watershed.
Illicit Discharge Restriction	Restrictions on illicit discharges such as routing home/business sewer pipes into storm drains.
Septic System Performance	Require inspection of septic systems prior to the sale of a property and repair/replacement of septic systems that are no longer functioning as designed.
Fertilizer Use	Restrictions on the application of fertilizer to lawns and/or farmland.
Pet Waste Disposal	Require proper disposal of pet waste.
Water Quality Trading	Allow water quality trading to offset the impacts of development.
Acquisition of Land or Development Rights	Allow a government entity to purchase land or development rights for conservation.

Land conservation. Fifteen watershed plans proposed the use of conservation easements, land purchases, or deed restrictions to protect forests, riparian buffers, wetlands, and other natural areas from development. In some cases, easements and land acquisition were discussed in general terms without reference to specific locations in the watershed that need protection. In contrast, plans with a detailed analysis of protection priority areas identified high-priority areas for acquiring easements or

purchasing land. An additional consideration for land protection is the identification of organizations responsible for negotiating and managing easements and land purchases. The plans included in this review propose a variety of state and local government programs and land trusts for this role. See [Chapter 6: Protection Partnerships and Complementary Programs](#) for further discussion of partner organizations whose goals and resources may help conserve lands.

- The ***Paw Paw River Watershed Management Plan*** (MI NPS Program 2008) was developed to protect the unimpaired Paw Paw River watershed from increasing development pressures throughout southwestern Michigan. The plan highlighted the preservation of the watershed's extensive natural lands as critical to protecting water quality. Plan authors identified specific protection measures to implement, including the protection of intact wetlands, riparian buffers, groundwater recharge zones, and floodplain forests through conservation easements, purchases by partner groups, or donations. Estimated costs associated with land purchases and conservation easements were reported along with target amounts of land to protect over time.

Step 4: Design an Implementation Program

After the processes of stakeholder engagement and partner identification, watershed characterization, and goal setting have occurred, the final step of the watershed planning process is to design a program to guide implementation of the plan (USEPA 2013a). EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (2008) describes components of an effective implementation program, including an information/education component that involves the watershed community, a schedule, and interim milestones to guide implementation, an evaluation framework to assess progress toward meeting watershed goals, and roles/responsibilities for implementing and periodically reviewing the plan (USEPA 2008). Below is a summary of important factors to consider when developing interim milestones and the types of interim milestones included in the protection-oriented watershed plans reviewed for this report.

Identify interim milestones to guide plan implementation

Interim milestones measure the implementation of activities in a watershed plan. EPA recommends developing milestones at relevant time scales, such as short-term (1-2 years), mid-term (2-5 years), and long-term (5-10 years or longer; USEPA 2013a). Evaluating progress towards interim milestones at regular intervals is a key part of adaptive management, providing an opportunity to shift course in implementation work to ensure continued progress. As part of the conservation action planning (CAP) process, The Nature Conservancy recommends that project teams convene at regular intervals (at least once per year) and after critical project milestones or events to analyze progress in CAP implementation. These meetings provide an opportunity to review and document actions taken, compile and assess monitoring results, and then apply lessons learned in setting project implementation and monitoring plans for the coming year (TNC 2007).

All of the watershed plans contained a list of milestones for evaluating progress towards reducing or preventing NPS pollution (Table 3.5). Plans typically included both milestones to track implementation of management measures (i.e., BMP implementation, land protection, ordinance development, and

outreach/education) and support activities critical to sustaining implementation work (i.e., assessment/planning, financing, and organization/program development). Several plans also set interim pollutant load reductions to be achieved during plan implementation.

Consistent with EPA watershed planning guidance (USEPA 2008, 2013a), milestones in these plans were most helpful in guiding implementation when they were geographically targeted, measurable, and specified within an explicit timeframe (e.g., included as a part of the plan's implementation schedule). For instance, the *Watershed Based Plan for the South, Middle, and North Tyger Subwatersheds* (SC DHEC 2018) included short, mid, and long-term land protection milestones targeting high priority parcels identified through GIS parcel prioritization analysis. The planning team also anticipated and included interim milestones for accompanying work to support the land protection goals. As stated in the plan:

As with all voluntary landowner projects, the success of this work is dependent upon landowner participation. Thus, the first step will be to cultivate relationships with local landowners with the assistance of local utilities and organizations to gauge interest in land protection opportunities...For those landowners not interested in conservation easements, it will be important to work with these individuals to identify if there are other, more appealing land protection strategies for their properties.

Additionally, plans with clearly stated watershed goals, objectives, and targets (see Step 3. Set goals and identify solutions) provided a strong foundation for establishing interim milestones to guide implementation work. Clear goals and objectives form an important basis for measuring progress during watershed-based and other conservation planning efforts, including in assessing whether the conservation actions are achieving the desired results (TNC 2007; USEPA 2008). See [Chapter 5: Tracking Protection Actions and Outcomes](#) for additional discussion on this topic.

Conclusion paragraph TBD

Table 3.6. Summary of types of interim milestones cited in 22 protection-oriented watershed plans.

Interim Milestone Type	# Plans	Examples
Best Management Practice Implementation	12	<ul style="list-style-type: none"> • "Reduce current sources of NPS pollution by addressing 51 residential sites, 23 beach and boat-access sites, 13 driveway sites, 11 private-road sites, 7 town, state, municipal/public sites, and 2 other sites identified in the watershed survey report." Plan includes interim targets for BMP implementation, such as address 2 high and medium-priority residential sites in Year 1 of plan implementation. (McGrath Pond Salmon Lake, ME 2018). • Implement management measures on 20% of pastures in WC-1 and LLC-2, two critical subwatersheds in planning area, by August 2021. (Lee Creek Reservoir and Lee Creek, OK/AR 2015)
Land Protection	11	<ul style="list-style-type: none"> • Facilitate the closing of six conservation easements and/or other land protection strategies in Years 2 and 3 of plan implementation (South, Middle, and North Tyger Rivers, SC 2018). • By 2015, protect 120 acres of wetlands in protection priority areas identified within the plan. (Paw Paw River, MI 2008)
Ordinance Development	11	<ul style="list-style-type: none"> • Adopt ordinances in at least 16 jurisdictions for riparian and wetland setbacks, erosion and sediment control, stormwater management, illicit discharge, floodplain management, conservation development, and other best local land use practices. (Chagrin River, OH 2011) • Plan aims to revise pet waste ordinance in Years 4-6 of implementation schedule. Additionally, plan includes ordinance-related measures of success, including # of municipalities that adopt permanent water quality buffers and # of municipalities that adopt pet waste ordinance. (Shaws Creek, SC 2017)
Outreach/Education	11	<ul style="list-style-type: none"> • Plan aims to notify landowners about NPS sites on their properties in 2013-2014. Plan also includes an organizational output to contact all property owners and road associations with sites identified in the watershed survey. (Woods Pond, ME 2013) • During Phase I (2014) of plan implementation, plan aims to conduct landowner outreach to identify willing agricultural producers for implementing BMPs at agricultural stream buffer areas, then to conduct site visits with willing agricultural producers and identify needed BMPs and appropriate funding sources. (Back Creek, WV/VA 2014)
Assessment/Planning	10	<ul style="list-style-type: none"> • In the first two years of plan implementation, establish a water quality monitoring baseline, including compilation of historical data. (Upper Frog Bayou, AR 2015) • In years 1-3 of plan implementation, complete a stormwater assessment to guide selection of BMPs and to assess potential enhancements to water quality ordinances. (Cypress Creek, TX 2014)
Financing	10	<ul style="list-style-type: none"> • During Phase I (2014-2016) of plan implementation, apply for WVDEP Stream Partner Grant to strengthen monitoring program. (Back Creek, WV/VA 2014)

		<ul style="list-style-type: none"> • Completion of City and County bond packages by Year 5 of plan implementation to finance land acquisition (Upper San Marcos River Watershed Plan, TX 2018). • In 2015-2016 (Phase I of plan implementation), Panther Pond Association will apply for EPA 319 grant for Phase III of project to address erosion sites in watershed. (Panther Pond, ME 2015)
Pollutant Load Reductions	5	<ul style="list-style-type: none"> • Plan includes annual target pollutant load reductions for each of the proposed management measures. For example, for the feral hog control management measure “Reducing the feral hog population will reduce bacteria loading to the watershed by 3.23E+14 annually. It will reduce sediment loading by 2.51 tons annually, or 0.6%.” (Upper Llano River, TX 2016)
Organization/Program Development	3	<ul style="list-style-type: none"> • Among community/social milestones, plan includes milestone to implement a town septic system inspection/maintenance program. (Lake Winnepesaukee, NH 2010) • Plan aims to initiate formation of private road associations (2010 and ongoing) to assist in implementation of road-related BMPs. Plan also includes a measure of success for number of new road associations formed. (Salmon Falls Headwater Lakes, ME/NH 2010)

DRAFT

Chapter 4: Implementing Protection Projects

Chapter Summary

- ✓ The context of a given watershed, including current water quality and landscape condition, future water quality threats, and active local partners, helps inform which management approaches are best suited to achieve water quality goals. Land conservation, local regulations, and BMP implementation can be key components of management approaches to protect water quality.
- ✓ **Land conservation** can help achieve water quality goals by preserving natural areas, such as forests, riparian areas, and wetlands, that contribute lower pollutant loads than developed areas and serve as natural filters for contaminants. Additionally, land conservation can prevent conversion to land uses that contribute higher pollutant loadings. Based on a December 2019 analysis of GRTS data, 20 state NPS programs, led by Ohio and Michigan, have reported a total of 134 watershed projects that included conservation easement as a management practice.
- ✓ **Local regulations & land use planning** can support watershed protection by guiding land use development to areas that minimize effects on water resources and open space, as well as ensuring that new and redevelopment sites are designed to reduce runoff volume through on-site stormwater retention. EPA's national NPS program provides [model ordinance language and example ordinances](#) related to natural resource protection. State NPS programs, including Alaska and Michigan, have awarded Section 319 grants to local partners draft ordinances to protect water quality.
- ✓ **Best management practices**, including both structural and nonstructural practices, can play an important role in watershed protection efforts, for example by addressing existing problem areas. Between 2014 and 2019, 27 states reported a total of 131 NPS projects primarily aimed at protecting unimpaired/high quality waters. A total of 81 different BMP types were reported among these projects, most commonly related to agriculture, road/stream crossings, and streambank/stream channel protection.

Introduction

As described in [Chapter 3](#), the watershed planning process help partners articulate watershed goals and management objectives, then design an array of on-the-ground strategies to achieve them. The context of a given watershed, including current water quality and landscape condition, future water quality threats, and active local partners, helps inform which management approaches are best suited to achieve water quality goals (USEPA 2008). Watershed context may also influence the specific role the NPS program, and 319 funds play in supporting NPS management efforts. Past work demonstrates increased likelihood for project success when watershed management efforts are tailored to local conditions through stakeholder engagement, planning, project design, and assessment (Kroll et al. 2019; Open Space Institute [OSI] et al. 2014).

Management approaches best suited to protect healthier watersheds are often different than those designed to restore impaired waters (Kwon et al. 2021). Healthier watersheds tend to be less developed and have a larger proportion of natural land cover, thus they may present larger-scale opportunities like land conservation and land use planning to meet water quality protection goals (Figure 3.5, Table 3.4).

Site-scale stormwater management and instream/riparian restoration practices may be the best options to achieve restoration goals in more developed watersheds with limited options to preserve the natural landscape. Because watersheds are frequently comprised of a mosaic of different land uses and potential pollution sources, management strategies may also vary across a single watershed (Ernst 2004; Trust for Public Land [TPL] and American Water Works Association [AWWA] 2005).

The 2013 NPS guidelines provide states flexibility to direct program resources, including §319 funds, to protect unimpaired/high quality waters where a state has an updated NPS management program that identifies protection of unimpaired/high quality waters as a priority and describes its process for identifying such waters. States may support protection work with NPS program funds, as well as a limited amount of watershed project funds following consultation with EPA through §319 grant work plan negotiations.¹² Per the guidelines, the proportion of §319 watershed project funds allocated to protecting unimpaired/high quality waters could vary depending on the relative priority of restoration and protection activities in the state's NPS management program and the array of projects ready for §319 funding and implementation in that particular year.

This chapter provides an overview of state NPS program approaches for soliciting and evaluating protection projects, then provides a summary of NPS protection projects, including BMPs, land conservation, and local ordinance development aimed at protecting unimpaired/high quality waters, implemented in recent years.

State NPS Program Approaches for Soliciting and Evaluating Protection Projects

Six states (AK, AZ, CO, ME, MI, and NH) have explicitly solicited protection projects in one or more of their Nonpoint Source Project Request for Applications (RFAs). Three of these states (AK, CO, ME) used the same set of criteria to evaluate both protection projects and restoration projects proposals. The remaining states (AZ, MI, and NH) developed protection project-specific evaluation criteria to score and rank these project proposals.

Alaska

Alaska's 2019-2021 RFA solicited water resource protection and restoration activities, including BMP implementation and watershed planning, in nine high priority waters listed in the RFA. Additionally, the state solicited stewardship actions that address broad scale stewardship concerns on high priority waters and/or larger regional areas. The state's 2019-2021 RFA included *Highlight and Protect Healthy Waters* as a stewardship action, under which the state solicited project proposals for low impact development techniques in areas with high environmental value that are at risk from current and past

¹²Per the 2013 NPS guidelines, **NPS program funds** comprise up to 50% of the total state §319 funding and may be used for the full range of activities to support the goals of the state's approved NPS management program. States must use at least 50% of the annual appropriation of §319 funds (**watershed project funds**) to implement watershed projects guided by nine-element watershed-based plans or acceptable alternative plans.

development and proposals to develop draft ordinances to protect water quality for adoption by local governments (AK DEC 2018).

Arizona

In their 2018 project solicitation, the Arizona Department of Environmental Quality solicited Watershed Preservation Grant (WPG) projects aimed at protecting and improving water quality in waters currently meeting water quality standards, but have a documentable NPS pollution concern threatening water quality. According to the solicitation WPG project proposals were evaluated based on the following protection project-specific criteria (Arizona Department of Environmental Quality [AZ DEQ] 2018a; AZ DEQ 2018b):

1. **The waterbody is not listed as impaired for the pollutant of concern in the project** (i.e., listed for *E. coli*, but proposed project focuses on metals).
2. **The pollutant/parameter of concern has an applicable water quality standard or a measurable target number.**
3. **There is a documentable NPS pollution concern threatening water quality.** Proposed projects must identify the specific pollutant of concern and provide documentation supporting the concern. Documentation may include one or more of the following:
 - i. Citation of credible water quality data,
 - ii. Photo-documentation (e.g., signs of erosion),
 - iii. Documentation of threatened biological indicators (e.g., documented loss of sensitive taxa),
 - iv. Specific reference to the waterbody/stream reach being identified in an ADEQ-approved watershed plan, or
 - v. Documentation of recent or pending significant changes in land use that are likely to impact WQ.
4. **Education & outreach** efforts (e.g., workshops, site tours, project signage) must be a component of a WPG project.

Colorado

Since 2018, Colorado's Nonpoint Source Request for Applications included water quality protection projects, defined as projects that implement BMPs identified in nine element watershed-based plans or equivalent water quality management plans in order to protect waterbodies, which may or may not be impaired, from further degradation due to nonpoint sources of pollution.¹³ The state's RFAs in 2018-2020 provided examples of waters that could be a potential focus for protection, such as Integrated Report Category 3a waters that have not been assessed or for which no data exists and Category 3b waters on the state's Monitoring and Evaluation List that lack conclusive evidence regarding attainment of standards (Colorado Department of Public Health & Environment [CDPHE] 2018-2020). Colorado had a waiver of the nine element watershed-based plan or equivalent water quality management plan in

¹³Colorado defines Equivalent Water Quality Management Plan as "A plan that addresses EPA Nine Elements applicable to protection of water quality including watershed characterization information, water quality protection goals and targets, existing and future nonpoint source threats to water quality, prioritized actions to address these threats, resources to complete these actions and measures to track and report effectiveness of meeting the plan's water quality goals and targets." (CDPHE 2018-2022)

place for 2022 protection projects that addressed post-wildfire nonpoint source pollution impacts. Priority points were also offered in the 2021 and 2022 RFAs for protection projects that addressed nonpoint source pollution impacts in disadvantaged communities.

Maine

As part of their RFA for watershed plan implementation projects, Maine has solicited proposals for projects to protect water bodies threatened by NPS pollution. The State's 2018 RFA solicited protection project applications that met both of the following prerequisites: (1) the watershed must be on Maine's NPS priority list of threatened watersheds, defined as unimpaired watersheds that are subject to potential impacts from NPS pollution, and (2) the implementation project must be guided by an active watershed-based plan.¹⁴ Eligible project activities included, but were not limited to: BMP design; BMP construction; technical assistance; cost-sharing construction of BMPs; training and technology transfer; information outreach; project management; and monitoring to evaluate the outcome of the project (Maine Department of Environmental Protection [ME DEP] 2018).

Maine scored NPS implementation project proposals on a 100-point scale using the following seven scoring criteria (ME DEP 2018):

- a. **Applicant Qualifications and Experience (10 points):** Consider the adequacy of applicant qualifications (relevant experience, financial, administrative & technical qualifications, personnel and facilities) to carry out the project within the proposed timeframe, along with any known past performance on relevant projects. If the project plans to issue a subgrant to an eligible recipient, consider the adequacy of the subgrantee's qualifications and relevant past performance. If the project plans to acquire consultant services, consider the adequacy of the qualifications and experience that will be requested in the project's solicitation for services.
- b. **Relative Value of the Waterbody (10 points):** the degree to which the public currently uses and values the waterbody, based on the applicant's description of the availability (access) and extent of use, as well as the uses including, but not limited to: drinking water supply; public recreational opportunities; scenic and aesthetic benefits; aquatic and terrestrial habitat benefits; commercial benefits; and potential for increased public use and improved habitat.
- c. **NPS Pollution Problem/Need (15 points):** the severity of the water quality impairment of the waterbody(s); or the severity of the threats which may cause the waterbody to not attain its water quality standards in the future. Reviewers evaluate the extent to which the work plan exhibits an informed understanding of the nature, extent, and severity of NPS water pollution problems and needs for that watershed.
- d. **Feasibility for Success (25 points):** Likelihood that the project will be successfully completed as proposed and that the waterbody can be successfully restored or protected. Considerations: adequate information and capacity to determine actions needed restore or protect the waterbody; effective well-sequenced tasks; extent to which the work plan and other efforts address the watershed's most critical NPS sources; contribution or participation by appropriate stakeholders and municipal government; leveraged with other previous or concurrent efforts; extent of community support to restore or protect the waterbody.

¹⁴ Active watershed plans (nine-element watershed-based plan or lake watershed-based protection plans) refer to plans less than 10 years old.

- e. **Cost Effectiveness (25 points):** Regarding the grant funds requested and the proposed work, consider the degree to which the project represents a good return for the investment (money, time). Consider whether project work and cost estimates (tasks & budget) are reasonable for the expected outcomes, along with the amount and quality of proposed matching funds or services.
- f. **Maine Business and Economic Impact Consideration (10 points).**
- g. **Comprehensive Plan (5 points):** which towns in the watershed have an adopted Comprehensive Plan that the State has determined is consistent with Maine’s Comprehensive Planning and Land Use Regulation Act?

Michigan

Michigan’s 2018 NPS Program Request for Proposals solicited protection projects aimed at meeting one or more of the following outcomes: (1) result in measurable water quality improvement at NPS-impacted sites in high quality watersheds, (2) achieve or make substantial progress toward achieving the land use protection targets of an approved watershed management plan. Proposed projects were required be within a watershed covered by an approved watershed management plan (note: Michigan’s list of approved plans includes protection plans for watersheds with no impaired designated uses). Eligible project activities included implementing physical BMPs, land protection (e.g., local ordinance development, permanent conservation easements), and education/outreach. Michigan’s RFP outlines specific eligibility criteria for land protection projects (MI DEQ 2017).

Michigan ranks proposed NPS protection and restoration projects into three funding priority tiers. Tier 1 proposals considered first for funding included protection projects that demonstrate the potential for “measurable water quality improvement at NPS-impacted sites in high quality watersheds” or “substantial progress toward achieving the land use protection goals of an approved watershed management plan” in areas located on the state’s Targeted Waterbody List (MI DEQ 2017).

New Hampshire

New Hampshire’s 2019 solicitation for watershed assistance grants included projects to protect high quality waters, defined as projects that will achieve or lead to quantifiable progress toward water quality goals in high quality watersheds (i.e., watersheds without impaired waters). Projects were required to implement one or more components of an existing nine element watershed-based plan or an approved alternative plan. Preference was given to projects in high priority watersheds as defined in the State’s NPS program plan (New Hampshire Department of Environmental Services [NHDES] 2018). New Hampshire applied many of the same criteria for protection and restoration projects but allowed for a higher number of maximum points to be awarded to restoration projects (100 maximum points) relative to protection projects (90 maximum points; NHDES 2018).

Table 4.1. New Hampshire evaluation criteria for NPS implementation projects (NHDES 2018).

Criteria		Max Points
Water Quality Improvement (either/or)	Impaired Waters: Project will achieve or lead to removing an impairment from the 305(b) or 303(d) list, resulting in a 319 Success story (see https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/nonpoint-source-success-stories).	40*
	High Quality Waters: Project will achieve or lead to quantifiable progress toward water quality goals in high quality watershed.	30*
Local Capacity	Commitment of the applicant’s support network, and capacity to complete the proposed project. Ranking will be based upon the grantee’s description and/or demonstration of their team’s ability to successfully complete the proposed project.	25
Relative Value of the Water body	Consider the availability (access), and extent of use of the waterbody. Consider uses including, but not limited to: drinking water supply; public recreational opportunities; aquatic and terrestrial habitat benefits; and potential for increased public use and improved habitat. Consider anticipated cost of corrections relative to their benefit.	15
Priority ranking	Project is located in high or medium priority watersheds as identified in the NHDES Nonpoint Source Management Program Plan.	10
Proposal Thoroughness	General quality and completeness of the application package.	10
	Total possible points for Impaired Waters*	100
	Total possible points for High Quality Waters*	90
*Funding priority is given to restoration of impaired waters. Please see explanation in Section II.		

Resource Feature 4.1: Education & Outreach—A Key Component of Protection Projects

Multiple state NPS programs described the important role that education and outreach efforts play in protection projects. In the absence of a local water quality impairment, which enacts a series of planning actions, often beginning with TMDL development, engaging local landowners can be a critical step in garnering local support for watershed protection. In their solicitation of NPS protection projects, Arizona’s NPS program requires an education/outreach component (AZ DEQ 2018a; AZ DEQ 2018b).

Education/outreach strategies may be different in these unimpaired/high quality watersheds. There are great resources to help guide these efforts. For example, Tools for Engaging Landowners Effectively (TELE) is grounded in social science research and draws on marketing and program planning tools and techniques to develop outreach programs that yield meaningful results on the ground. To date, TELE techniques have been taught at more than 50 workshops to more than 1,400 professionals from 400 organizations. They have worked directly with forestry, wildlife, and conservation organizations throughout the US to improve stewardship on the ground through better landowner engagement (Sustaining Family Forests Initiative [SFFI] 2019).

State NPS Program Protection Projects

Between 2014 and 2019, approximately four percent of all GRTS projects (131 of 3,444 projects) were reported as those aimed primarily at protecting unimpaired/high quality waters.¹⁵ A total of 27 states reported at least one protection project during this time period, with Alaska (24), Maine (21), Michigan (10), and Idaho (10), and Maryland (8) reporting the highest number of protection projects (Figure 4.1).

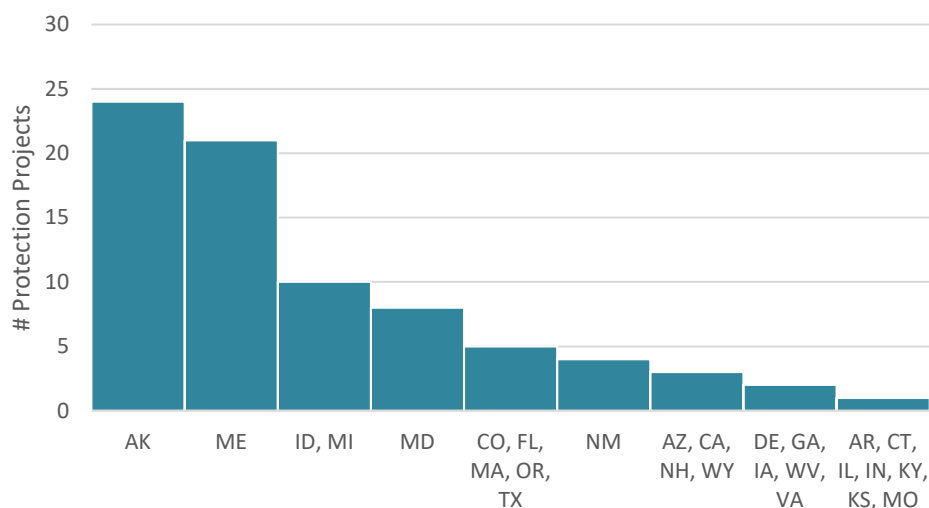


Figure 4.1. Counts of protection projects by state, FY2014 – 2019.

Based on GRTS data:

- **States reported a wide range of BMP types implemented as a part of NPS protection projects.** Of the 131 protection projects reported to GRTS from 2014 to 2019, 76 projects identified 81 different BMPs implemented as part of the project. Most protection project BMPs were related to agriculture (52 protection projects), road/stream crossing (46), streambank/stream channel (46), erosion/sediment control (37), and stormwater (29; Figure 4.2, Table 4.2). On average, four BMPs were implemented as a part of a protection project.
- **Among the 76 protection projects that implemented BMPs, the average total project budget was \$331,000, which included on average \$144,000 in Section 319 grant funds.**
- **Nearly all protection projects (124 of 131) were implemented with 319 funding support.** Among these projects, 319 funding on average comprised 59 percent of the total project budget. Among the 106 protection projects that specified 319 funding type, **most protection projects (85) were supported by watershed project funds.** Twenty protection projects were supported by only 319

¹⁵In 2014, EPA added a new GRTS data field to track protection projects. Within GRTS, protection projects are defined as those in which more than 50 percent of the project budget is used to protect unimpaired/high quality waterbodies. The protection project indicator can be applied to projects supported with §319 NPS program, §319 watershed project funds, or other funding sources (e.g., non-federal match).

program funds, and one project was supported by both 319 program and watershed project funds. Seven protection projects from MI, MO and NM were implemented with only state and local funds.

- Among implementation protection projects that specified watershed plan status (63 total), **most states reported that protection projects implemented part of a nine element watershed-based plan (WBP)** (28 projects from 15 states). Three states (23 projects from ME, AK, and OR) reported protection projects implementing acceptable alternative watershed plans.
- Among the 120 protection projects that specified the waterbody type addressed, **most projects addressed stream/creek/river systems (92), followed by lakes/reservoirs/ponds (37)**. Protection projects were also reported for bays/estuaries, coastal waters, groundwater, and wetlands.
- **Nearly all protection projects (120 of 131) were implemented by a subgrantee**, rather than the state. Non-governmental organizations (27 projects), conservation districts (25), and local governments (20) were the most common subgrantee organization types implementing protection projects.

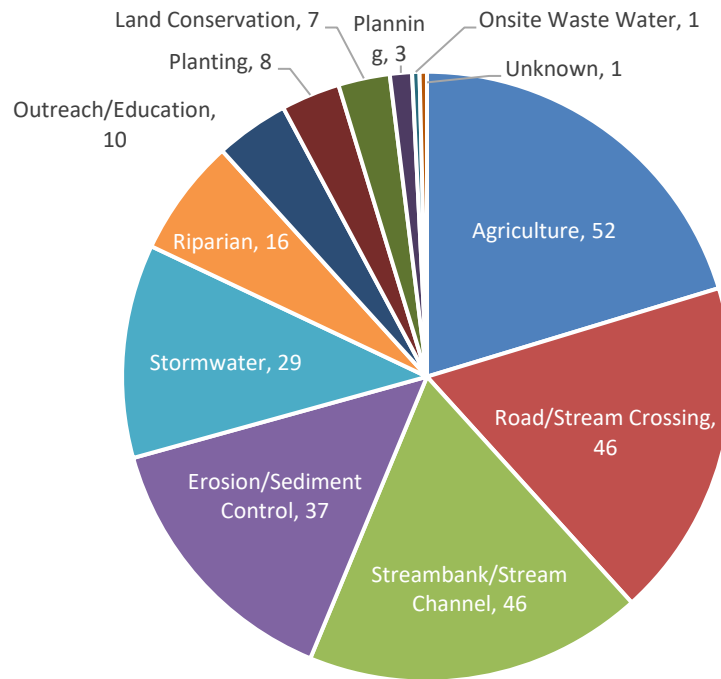


Figure 4.2. Distribution of BMPs implemented in protection projects. Numbers in each BMP category denote the number of protection projects that implemented a BMP in that category. Note that the total count in the pie chart does not equal the number of protection projects, as a single project may include multiple BMPs.

Table 4.2. Commonly cited BMPs in GRTS protection projects.

BMP Category	Most commonly cited practices
Agriculture	Cropland – cover crops, irrigation water management, buffer/filter strips Livestock – fencing, heavy use area protection, grazing management
Road/Stream Crossing	Road ditch creation/improvement, culvert armoring/replacement, water bars

Streambank/Stream Channel	Ditch stabilization, channel restoration or stabilization, stream habitat improvement and management
Erosion/Sediment Control	Mulching, check dam, water diversion, grade stabilization, catch basin
Stormwater	Rain garden/bioretention basin, roof runoff management, porous pavement
Riparian	Channel bank vegetation, riparian forest buffer, riparian herbaceous cover

State NPS Program Feature 4.1: New Hampshire - BMPs

New Hampshire's NPS program has awarded Section 319 funds to support BMP implementation in a number of unimpaired/high quality watersheds throughout the state. In the Newfound Lake Watershed and Salmon Falls Headwaters, Section 319 funds have been used to support reductions in nutrient and sediment loading through outreach, planning, and coordination of conventional BMPs (NHDES 2014a; AWWA 2010). The Newfound Lake Watershed and Salmon Falls Headwaters contain high quality lakes and streams that are at-risk from eutrophication and sedimentation. The BMPs installed in these watersheds capture and treat runoff from rural roads, residential properties, community beach and recreational areas, and youth summer camps. The BMPs are intended to address signs of declining water quality and increase resiliency against future development.

Land Conservation

Land conservation (or land protection) is a broad management strategy that may be aimed at protecting one or more conservation values provided by a property. Land conservation approaches are complex and vary from acquiring partial interest in a property to outright acquisition of the land. The land conservation technique best suited for local conditions depends on a variety of factors including the type of conservation land, landownership, and available resources (TPL and AWWA 2005). Land conservation can help achieve water quality goals by preserving natural areas, such as forests, riparian areas, and wetlands, that contribute relatively lower pollutant loads and serve as natural filters for contaminants (Ernst 2004). Additionally, land conservation can prevent conversion to land uses that contribute higher pollutant loadings. See Appendix A. Land Conservation Primer for more information.

Clean Water Act Section 319(h) funds and non-federal 319 match funds may be used to purchase conservation easements if a purchase is consistent with the implementation of the state's NPS management program. Easements are generally considered to be a type of interest in real property and can be used as in-kind match. See the federal grant regulations in 2 CFR Part 200.306 for specifics on cost-sharing. As with other in-kind contributions, the value of the easement would need to be calculated.

Based on a December 2019 analysis of the EPA 319 Grants Reporting and Tracking Database (GRTS), 20 states reported a total of 134 distinct water quality protection and restoration projects that included conservation easement as a BMP. Most (102) of these projects were implemented with Section 319 grants (Figure 4.3). Based on GRTS data:

- Most conservation easement projects were reported by Ohio (45 projects) and Michigan (42). Both states purchased conservation easements with a combination of Section 319 grant and other funding sources (Michigan Department of Environmental Quality [MI DEQ] 2017; Ohio Environmental Protection Agency [OH EPA] 2018).¹⁶
- The majority of conservation easement projects (111) were implemented to protect or restore streams, creeks or rivers. Conservation easements were most commonly implemented to address agriculture (84 projects), hydromodification (50), and urban runoff/stormwater (48) sources of NPS pollution.
- States reported that conservation easement projects were frequently implemented as part of a local watershed-based plan. Among the conservation easement projects that specified watershed plan status in GRTS (39 total), most projects (34) implemented a watershed-based plan.
- Among projects that specific a primary subgrantee (74 total), conservation easements were most commonly implemented by local governments (31 projects), land conservancies (16 projects), other non-governmental organizations (9), and soil and water conservation districts (9).

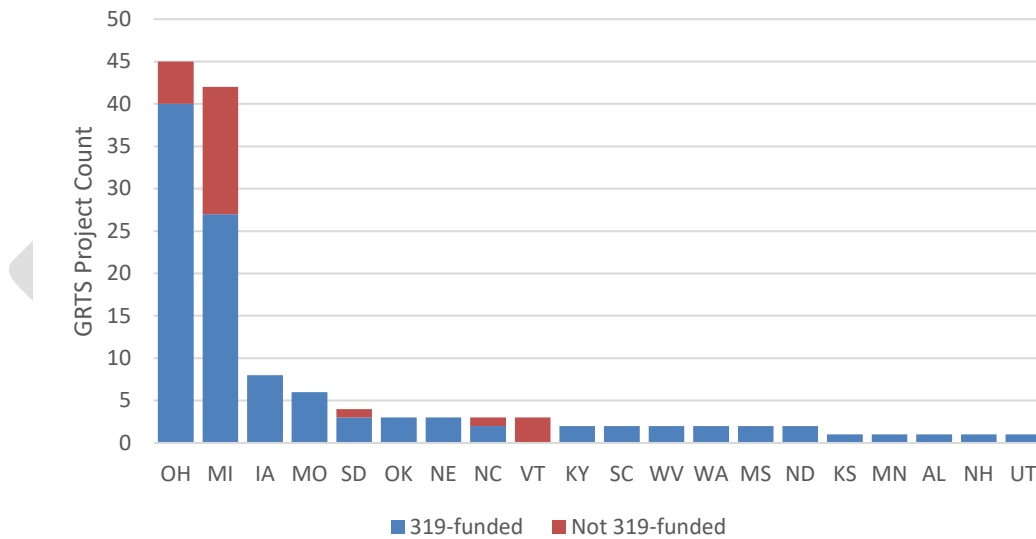


Figure 4.3. Counts of GRTS projects including conservation easement as a BMP type.

¹⁶According to 2018 NPS project request for applications, Ohio’s NPS Program required that wetland restoration projects funded with Section 319 grants include long-term protection of the restored wetland using conservation easements or other protective measures for at least 10 years (OH EPA 2018).

State NPS Program Feature 4.2 North Carolina – Review Criteria

North Carolina Department of Environmental Quality’s FY2020 319 Grant Proposal Review Criteria used to evaluate NPS restoration project proposals considered whether the proposed project was on protected lands. The state awarded up to 10 points, on a 100-point scale, for the “Project Readiness and Permanence” criterion, under which reviewers evaluated several factors, including whether a maintenance agreement and conservation easement was in place at the proposed project site (North Carolina Department of Environmental Quality [NC DEQ] 2019).

State NPS Program Feature 4.3: Michigan – Conservation Easements

Michigan’s NPS program identifies conservation easements as the primary mechanism for long-term protection of the state’s high quality waters (MI DEQ 2018). Section 319 grants have been awarded to support the implementation of over 100 conservation easements protecting thousands of acres of forests, wetlands, riparian buffers, and other natural areas. For example, from 2010 to 2014, four conservation easements were implemented with Section 319 funding in the White River watershed, a designated Natural River by the Michigan Department of Natural Resources. The four easements protected 951 acres of high-quality forests and wetlands and addressed threats related to rising water temperatures, sedimentation, and the loss of river corridor vegetation (MI NPS Program and Land Conservancy of West Michigan [LCWM] 2014).

In 2018, Michigan solicited land protection project proposals, including projects to develop local ordinances and implement conservation easements, in their annual NPS Program Request for Applications (MI DEQ 2018). The State’s RFA specified the following proposal requirements for land protection projects:

- *“Projects must be primarily based on preventing future water quality impacts from NPS but may also consider secondary factors such as endangered species.*
- *Applicants must provide reporting measures directly related to the watershed management plan goals and water quality conditions addressed by the proposal. For example, a proposal intended to address phosphorus and sediment impacts to designated uses must project phosphorus and sediment loads that will be avoided by the proposal.*
- *Proposed conservation easements must be selected based on potential water quality benefits and must permanently protect the proposed area.*
- *NPS Program staff will inspect all proposed easement sites prior to signing a grant contract.*
- *Proposals including conservation easements that will be paid for or used to match NPS Program funds must provide maps and aerial images showing each parcel of interest overlain by a proposed easement boundary.”*

Resource Feature 4.2: USDA-NRCS Agricultural Conservation Easement Program

Over the past 25 years, the Natural Resources Conservation Service (NRCS) has worked with landowners to protect more than 4.4 million acres of wetlands and agricultural lands through voluntary, private lands conservation programs. The 2014 Farm Bill established the USDA Agricultural Conservation Easement Program (ACEP), which provides financial and technical assistance to help conserve agricultural lands and wetlands. ACEP is a merger of three different USDA programs: Grassland Reserve Program, Wetland Reserve Program, and the Farm and Ranchland Protection Program. The 2018 Farm Bill funds ACEP at \$450 million annually. Under ACEP, NRCS provides financial assistance to eligible partners for two different easement types.

- **Agricultural land easements** protect the agricultural use (cropland or grazing lands) and conservation values of eligible lands. NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. Where NRCS determines that grasslands of special environmental significance will be protected, NRCS may contribute up to 75 percent of the fair market value of the agricultural land easement (NRCS 2021). As a condition for participation, NRCS will develop a conservation plan for all Highly Erodible Land.
- **Wetland reserve easements** are available to private landowners to protect, restore, and enhance their land in exchange for retiring eligible land from agriculture. Lands can be protected either via permanent easements (NRCS pays 100 percent of the easement value for the purchase of the easement) or 30-year easements (NRCS pays 50-75 percent of the easement value for the purchase of the easement (NRCS 2021). Through these agreements, NRCS may develop and implement a wetland reserve restoration easement plan.

Resource Feature 4.3: Land Conservation to Protect Farmlands and Water Quality

Although agricultural land uses often pose threats to water resources, efforts to preserve farmland can align with efforts to protect water quality. The Open Space Institute (OSI) Delaware River Watershed Initiative (OSI and William Penn Foundation 2017b) is an example of combining these interests. OSI worked with the New Jersey Conservation Foundation and the New Jersey State Agriculture Development Committee to design a double easement model, which includes both agricultural and conservation easements. This approach was inspired and adopted by a local farmer interested in safeguarding a stream and its buffer within his property. This landowner was selected to pilot the model due to his interest and the decreasing water quality in the stream's headwaters, which bordered impairment and thus made protection of its predominantly forested buffer zone a priority.

As is the case in New Jersey, agricultural easements may not have special provisions or requirements to protect water quality or riparian buffers. State land protection programs aimed at farmland preservation may not be protective of natural areas on a parcel. Thus, OSI and its partners pursued a two-easement program but hope to pilot a single easement model that would install side-by-side easements on a working farm and adjacent stream corridor. There is an incentive to pursue a single easement because few land trusts would be interested in purchasing and monitoring riparian-only easements that could be affected by adjacent farmland activities out of their control. A single easement setup is also more efficient for monitoring.

The National Resources Conservation Service developed a Resource Management Systems plan to establish high environmental standards for the buffer easement. To fully protect streams, future projects should have a rigorous and enforceable farm conservation plan for the riparian buffer *and* working farmland. Including BMPs to further reduce agricultural runoff that may reach a stream can optimize the benefits of integrating the two different forms of land preservation.

Local Regulation & Land Use Planning

Local governments play a central role in watershed protection through local regulations, planning and zoning, which shape land use development and natural resources protection in a jurisdiction. They design and enact most of the land use regulations that dictate how a region can grow and develop (Chesapeake Bay Trust 2017). EPA’s national NPS program provides model ordinance language and example ordinances for several natural resource protections, including aquatic buffers, open space development, and source water protection.¹⁷ Example ordinances include those that restrict development in or near areas that provide important water quality functions, ordinances that establish performance standards for stormwater management during and after construction, and ordinances that establish limits for impervious cover in new development. Alaska and Michigan included ordinance development as an eligible project type in NPS project Request for Proposals (Alaska Department of Environmental Conservation [AK DEC] 2018; MI DEQ 2017). Both states have awarded Section 319 grants to local partners to enhance or adopt ordinances to protect unimpaired/high quality waters.

Table 4.3 below provides an overview of some of the land use policy tools that local governments can use to guide development to areas that minimize effects on sensitive resources and open space, and ensure that new and redevelopment sites are designed to reduce runoff volume through on-site stormwater retention. Jurisdictions can use one or a combination of these planning and development techniques to direct development to areas where development will have fewer impacts on water quality, preserve the integrity of healthy watersheds, and achieve local objectives for infrastructure management and sustainability (USEPA 2010b).

Table 4.3. Land use policy tools that support watershed protection efforts.

Land Use Policy Tool	Description	Source
Comprehensive Plan	High-level policy document that guides future development in a jurisdiction. Comprehensive plans guide a jurisdiction’s decision-making on issues like zoning and subdivision. Jurisdictions can include vision and goal statements that support the preservation of natural lands to protect water quality.	Chesapeake Bay Trust 2017
Zoning Ordinance	A regulatory tool that local governments use to control the physical development of property within their jurisdiction. Zoning ordinances specify the use and density of development permitted on parcels within a	Gilbert et al. 2012; Chesapeake Bay Trust

¹⁷ <https://www.epa.gov/nps/urban-runoff-model-ordinances-prevent-and-control-nonpoint-source-pollution>

	jurisdiction. There are various zoning tools that can help protect water quality, such as cluster development, impervious cover limits, riparian buffer limits, steep slope ordinances, watershed-based zoning, and open space dedications.	2017; TPL and AWWA 2005
Subdivision Ordinance	A regulatory tool that local governments use to control the division, consolidation, boundary change, or development of parcels. While a zoning ordinance governs land-use type (e.g. residential, commercial, industrial) and density, a subdivision ordinance provides details about the division of land and the design of improvements on a given parcel. A subdivision ordinance can be an effective tool for regulating development in a jurisdiction that does not have a zoning ordinance.	Chesapeake Bay Trust 2017
Development Management	A set of regulatory tools designed to reduce the amount of or rate of certain types of development. Development management strategies to protect water quality include infill and community redevelopment, low impact development standards, Transfer of Development Rights, and urban growth boundaries.	Gilbert et al. 2012

State NPS Program Feature 4.4: Michigan - Ordinances

Michigan’s NPS program has awarded several Section 319 grants to projects that involve ordinance development in unimpaired/high quality watersheds. Grant recipients have applied funds to identify gaps in local ordinances, develop recommendations, and hold workshops to educate local governments. Outcomes have included the adoption of ordinances related to stream corridor and shoreline protection, stormwater performance standards, zoning, and residential fertilizer use.

For example, a Section 319 grant for implementation of the Portage Creek Watershed Plan supported the adoption of ordinances in three townships requiring homes to be set back at least 100 feet from lake shorelines and the maintenance of a 25-foot vegetated buffer (MI NPS Program and Huron River Watershed Council [HRWC] 2012). The Michigan NPS program website also includes a [library](#) of toolkits, sample language, and other resources for grant applicants and partners interested using ordinances to protect water quality.

Conclusion paragraph TBD

Chapter 5: Tracking Protection Actions and Outcomes

Chapter Summary

- ✓ In developing protection-based measures of success, it is important to first define protection and establish protection-specific goals against which progress will be measured. Across EPA water programs, protection is generally defined as actions to reduce or eliminate threats to waterbodies and natural habitat to prevent water quality degradation or a decline in condition.
- ✓ Measures of success play an important role in helping states and the public measure the progress and success of NPS management programs. States adopted protection-based measures of success to guide their protection work (e.g., via programmatic, watershed planning, and NPS project implementation measures) before assessing the environmental outcomes of these efforts (e.g., via pollutant load reduction and water quality outcome measures).
- ✓ In general, while a number of states have adopted protection-based measures of success, the state NPS program staff expressed a need for technical guidance to assist in setting quantifiable protection goals, as well as methods to measure progress towards these goals. Specifically, state NPS program staff indicated the need for technical guidance to help: (1) assess water quality conditions corresponding to successful protection (e.g., in cases where current water quality is better than criteria set forth in water quality standards), (2) establish methods to quantify the magnitude of pollutant load reduction or prevention needed to achieve water quality targets, and (3) evaluate the number and type of BMPs or other management practices needed to achieve load reduction or prevention targets.

Defining Protection and Protection Goals

In developing protection-based measures of success, it is important to first define protection and establish protection-specific goals against which progress will be measured. Across EPA water programs, protection is generally defined as, “actions to reduce or eliminate threats to waterbodies and natural habitat, to prevent water quality degradation or prevent a decline in waterbody condition (Table 5.1).” For this reason, protection-based planning typically includes an assessment of future conditions to quantify water quality threats and to determine the management actions needed to offset potential impacts to water quality. These efforts help achieve the Clean Water Act objective to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters” (33 U.S.C. Section 1251(a); CWA Section 101(a)). Programmatic and water quality-based measures of success play an important role in evaluating progress towards achieving the goals outlined in EPA’s Strategic Plan (USEPA 2019c).

Table 5.1. Definition of protection within different EPA water programs.

EPA Program	Program definition of “protection”
Nonpoint Source Program (CWA 319)	“...projects [to] reduce or eliminate current and future threats to unimpaired/high quality waters” ¹⁸ (USEPA 2013b).
Impaired Waters and TMDL Program (CWA 303(d))	“[T]he sustained minimization or avoidance of water quality degradation due to stressors and/or watershed alterations that would present threats to its current condition” (USEPA 2021f).
National Estuary Program (CWA 320)	“Removal of a threat to, or preventing the decline of, habitat conditions. Protection includes mechanisms, such as land acquisition, conservation easements, deed restrictions, or other designation to prevent alteration of the site” ¹⁹ (USEPA 2019b).
EPA Wetlands Program	“Wetlands protection is defined as removing a threat or preventing the decline of wetland conditions” as described under the <i>Voluntary Restoration and Protection</i> element of an effective state and tribal wetlands program (USEPA 2015c).
Source Water Protection Program	“Source water protection includes a wide variety of actions and activities aimed at safeguarding, maintaining, or improving the quality and/or quantity of sources of drinking water and their contributing areas” (USEPA 2021a).

Whereas restoration aims to improve water quality from a degraded state to a target condition, typically reattainment of water quality standards, specific protection goals can vary depending on program

¹⁸EPA’s *Nonpoint Source Program and Grants Guidelines for States and Territories* includes specific examples of scenarios states may wish to consider when prioritizing the protection of unimpaired/high quality waters (e.g., watersheds or portions of watersheds with unique, valuable, or threatened species or critical aquatic habitats of these species; USEPA 2013b).

¹⁹The NEP program defines habitat as “the natural environment of a plant or animal (which includes the total environmental conditions for food, cover, and water within its home range/essential fish habitat)” (USEPA 2019b).

objectives and waterbody context. For example, to date state 303(d) programs have adopted multiple protection approaches across the country, including protecting higher quality waters, protecting waters from impairment, and maintaining restored waters (Figure 5.1). Likewise, states have adopted various definitions of healthy waters and watersheds that provide the basis for measuring progress towards protecting these areas (e.g., WI DNR 2021, Chesapeake Bay Program 2021). Variability in the scope and scale of protection activities emphasizes the need for clear definitions when tracking investment and outcomes from these efforts.

Four Types of Protection

Ways that state CWA 303(d) programs have been approaching protection

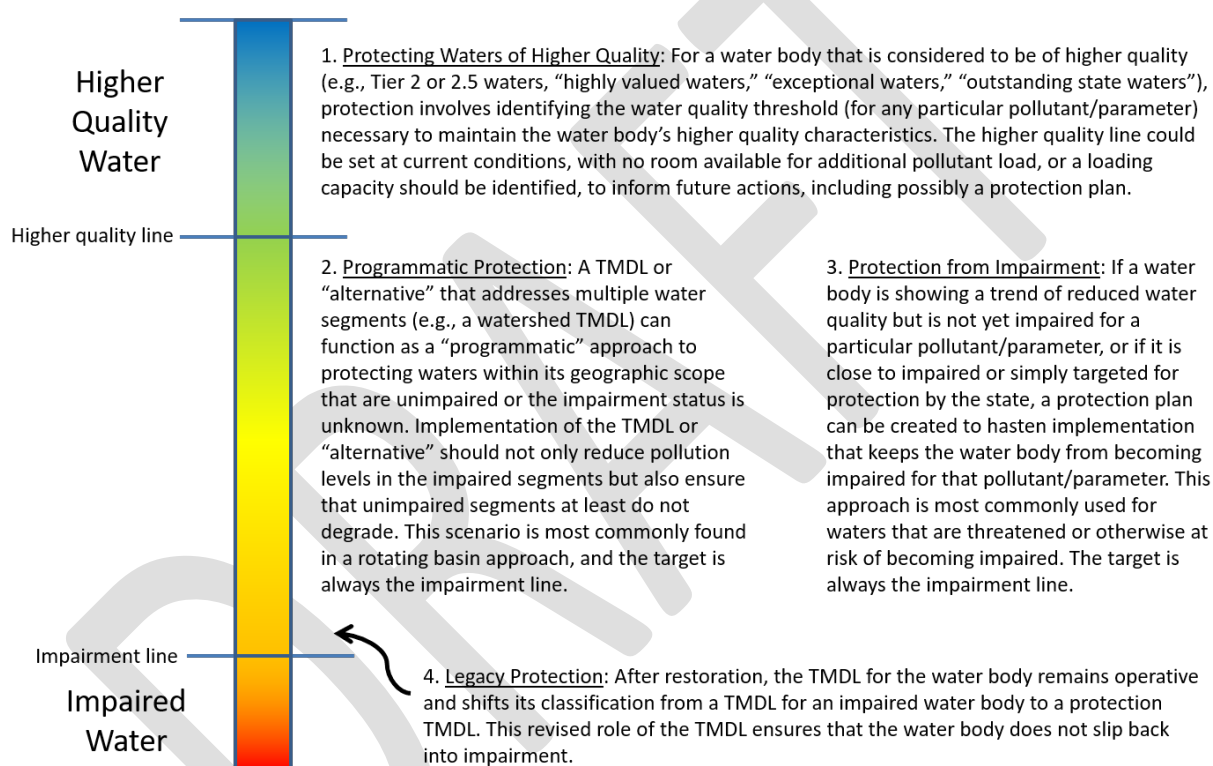


Figure 5.1. Four types of protection, as defined in the Environmental Law Institute’s *Compendium of State Approaches to Protection* (ELI 2020).

Tracking Protection in the National NPS program

As described in EPA’s 2013 NPS guidelines, two of the eight key components of an effective state NPS management program address the importance of setting goals, objectives, and strategies to restore and protect waters, then establishing measures to evaluate progress in meeting these goals and objectives (USEPA 2013b):

Key Component #1: *The state program contains explicit short- and long-term goals, objectives, and strategies to restore and protect surface water and ground water, as appropriate.*

Key Component #8: *The state reviews and evaluates its NPS management program using environmental and functional measures of success and revises its NPS management program at least every five years.*

Under Key Component #8, states establish appropriate measures of progress in meeting programmatic and water quality goals and objectives identified in key component #1. States also describe a monitoring/evaluation strategy and a schedule to measure success in meeting those goals and objectives. This information provides a basis for EPA's review of annual performance and progress determinations under CWA 319 (USEPA 2013b).

EPA currently relies on two national NPS program measures to track progress towards restoring NPS-impaired waters. EPA's NPS [success stories](#) measure tracks the number of NPS impairments eliminated from fully or partially restored waterbodies. Additionally, EPA tracks the estimated annual load reductions of nitrogen, phosphorus, and sediment achieved by NPS projects. EPA recognizes that the national program measures are limited in scope and likely do not capture all state successes supported under §319. For this reason, EPA's 2013 NPS guidelines provide a list of optional measures and indicators that may help states and the public measure the progress and success of their programs, including the following specific to the protection of unimpaired/high quality waters:

- a. *Long-term protection of X acres in priority watersheds by 20XX.*
- b. *Long-term protection projects will prevent X tons of sediment, Y pounds of nitrogen and Z pounds of phosphorus from entering waters of the state by 20XX.*
- c. *No waterbodies or reaches in high quality watersheds will be moved to the nonattainment lists due to NPS causes or pollution.*
- d. *Maintenance of filtration avoidance for certain water supply systems (i.e., no additional treatment or alternative sources of drinking water supply).*
- e. *Specific load reduction or maintenance goals (X lbs. of P per year) in protection-oriented plans covering high value waters.*
- f. *Number or percentage of watersheds that hit their protection-oriented goals each year.*
- g. *Improve trends in water quality of waterbodies that are threatened but not yet impaired so that the waterbodies remain off the nonattainment list.*
- h. *Number and type of BMPs implemented at critical source areas (demonstrating effective targeting).*
- i. *Length and width of improved or protected shoreline or riparian areas along streams.*
- j. *Stable or improving water quality/trophic status in lakes.*
- k. *Increase in the amount of lake shorelands (length and width) protected or maintained in a natural condition.*
- l. *Stable or improving water quality (biocriteria, DO, bacteria) in streams.*

In 2014, EPA added a data field in §319 program's Grants Reporting and Tracking System (GRTS) to track NPS projects according to their primary goal of water quality restoration or protection. Within GRTS, protection projects are defined as those in which more than 50 percent of the project budget is used to protect unimpaired/high quality waterbodies. The protection project indicator can be applied to projects supported with §319 NPS program funds, §319 watershed project funds, or other funding sources (e.g., non-federal match). See [Chapter 4: Implementing Protection Projects](#) for findings from an analysis of NPS protection projects reported in GRTS from 2014-2019.

While EPA has taken steps to support states in tracking protection work in the national NPS program, several state NPS programs engaged during the development of this report indicated the need for technical guidance to help establish targets to guide protection work and assess outcomes. Specifically, state NPS program staff indicated the need for technical guidance to assist in the following areas:

1. **Setting water quality protection goals.** i.e., methods to quantify water quality conditions corresponding to successful protection, particularly in cases where protection is aimed at maintaining/achieving water quality conditions better than what is required under water quality standards.
2. **Quantifying the magnitude of pollutant load reduction or prevention needed to achieve water quality protection goals,** including approaches for quantifying potential water quality impacts of future projected changes within in a watershed (e.g., land use change, climate change) where protection efforts are aimed at addressing these threats.
3. **Quantifying water quality benefits, including pollutant load reductions, associated with protection-based management strategies,** such as land conservation, wetland and riparian protection, and local regulation/land use policies.

To help inform future work on the topic, this chapter provides examples of programmatic and water quality-based measures from state NPS management program plans used to track progress towards protection goals. In addition, see [Chapter 3: Integrating Protection in Watershed Planning](#) for a description of the water quality goals, management objectives, and interim milestones (Table 3.5) included in 22 protection-oriented watershed plans reviewed for this report.

State Approaches for Tracking Protection

Eleven states (AK, CA, CT, ME, MD, MI, MN, NH, OH, VA, WV) included protection-based measures of success in their NPS management program plans. As shown in Table 5.4, these states have adopted various programmatic and water quality-based measures to document progress toward meeting protection-based NPS management goals. The following paragraphs provide additional descriptions and examples of these state-level measures.

Table 5.2. Types and examples of protection-based NPS program annual milestones and measures of success from state NPS program plans.

Measure Type	Example Measures (and State(s))
<p><u>Programmatic</u>: measures of programmatic progress toward advancing protection.</p>	<ul style="list-style-type: none"> • Develop and implement a method to prioritize unimpaired/high quality watersheds for protection (CT). • Develop technical guidance documents to estimate the effectiveness of watershed protection efforts (ME). • Develop methods for assessing watershed/waterbody health to help target protection efforts (e.g., hydrologic, sediment, and nutrient regime of health rivers and streams) (CA, MN, VA). • Develop language to solicit healthy watersheds protection projects, including ordinance development

	<p>and green stormwater infrastructure in state NPS project RFP (AK).</p> <ul style="list-style-type: none"> • Conduct biological monitoring at # sites annually to support implementation of State Antidegradation Policy in areas with pending significant development projects (MD).
<p><u>Watershed Planning</u>: measures of watershed plan development in unimpaired/high quality watersheds.</p>	<ul style="list-style-type: none"> • Number of nine element watershed-based plans developed or updated for protection priority watersheds and approved by the state (NH, OH) • Number of protection-based alternative watershed plans approved by the state (CT, ME, WV).
<p><u>Project Implementation</u>: measures of NPS management practices implemented in unimpaired/high quality watersheds.</p>	<ul style="list-style-type: none"> • Acres of land protected through conservation easements in protection priority watersheds (MI, OH, WV). • Increase local adoption of riparian setback codes and/or rules by X percent during programming period (OH).
<p><u>Pollutant Load</u>: measures of the magnitude of pollutant load reductions or preventions from NPS management actions in unimpaired/high quality watersheds.</p>	<ul style="list-style-type: none"> • Pollutant loads prevented through long-term land protection in high quality watersheds (MI)
<p><u>Water Quality Outcome</u>: measures of water quality outcomes in unimpaired/high quality watersheds.</p>	<ul style="list-style-type: none"> • Demonstrate effective protection of unimpaired, threatened waters, based on WQS and/or water quality trend (ME, NH, CT). • Number of unimpaired waters in healthy watersheds with state-approved watershed management plans moved to 303d list due to NPS causes (target number: 0) (MI).

Programmatic Measures. 10 states included programmatic measures that track NPS program progress toward advancing protection strategies, and this was the most common category of protection measure. The prevalence of programmatic measures could reflect the relatively new nature of initiatives to proactively protect unimpaired/high quality watersheds compared to impaired waters restoration. Programmatic measures offer NPS programs a chance to set clear goals as they define and establish their approach to protection.

Six states adopted programmatic measures to track progress in developing approaches to identify and prioritize unimpaired/high quality watersheds. Example measures include: “conclude an assessment that will result in a statewide ecologically healthy watersheds list” (Virginia Department of Environmental Quality [VA DEQ] 2014), “develop and implement a method to prioritize unimpaired watersheds for protection activities” (Connecticut Department of Energy and Environmental Protection [CT DEEP] 2014), and “identify protection planning priorities and approaches along with schedules to help prevent impairments in healthy waters” (Maryland Department of the Environment [MD DE] 2016).

Four states included measures to track efforts by the NPS program or partner agencies to strengthen water quality protections under federal, state, and local regulations. The regulations addressed by these measures include state antidegradation regulations, state certifications under CWA Section 401, and local ordinances that restrict development in environmentally sensitive areas. For example, New Hampshire's NPS program plan includes a measure to assess whether the state's Alteration of Terrain regulations require revision to better protect water quality (New Hampshire Department of Environmental Services [NHDES] 2014). Ohio's NPS program plan includes a measure to document completion of a model ordinance for riparian protection for use by local governments (Ohio Environmental Protection Agency [OH EPA] 2014). California's NPS program plan includes a measure to demonstrate that CWA Section 401 certifications approved by the state include stringent requirements for wetland and riparian mitigation in approval of federal permits (CA NPS Program 2015).

Other programmatic measures included the inclusion of language in Section 319 grant RFPs to solicit protection-specific projects (Alaska Department of Environmental Conservation [AK DEC] 2015); program support for pilot and demonstration protection projects (MD DE 2016; OH EPA 2014); and the development of technical guidance to evaluate the effectiveness of watershed protection (Maine Department of Environmental Protection [ME DEP] 2014).

Watershed Planning Measures. Five states selected measures to track the development of watershed plans for unimpaired/high quality watersheds (CT DEEP 2014; ME DEP 2014; NHDES 2014b; OH EPA 2014; West Virginia Department of Environmental Protection [WV DEP] 2014). New Hampshire and Ohio measures tracked the development of nine element WBPs in protection priority watersheds. Connecticut, Maine, and West Virginia specified the development of protection-based alternative watershed plans.

Project Implementation Measures. Four states included measures to track NPS project implementation in unimpaired/high quality watersheds (Michigan Department of Environmental Quality [MI DEQ] 2015; NH DES 2014b; OH EPA 2014; WV DEP 2014). Three states tracked specific NPS management practices, including: land conservation; restoration of stream channels, riparian buffers, and wetlands; adoption of riparian setback local ordinances that restrict development in riparian areas; and adoption of local ordinances requiring low impact development (LID) strategies for stormwater management.

Example implementation measures included "protection of 5,000 acres of priority watersheds primarily through conservation easements" (MI DEQ 2015), "fund one project annually that uses bioengineering methods to stabilize 200 linear feet of eroding stream banks in high quality waters" (OH EPA 2014), and "develop two to four conservation easements in the next five years" (WV DEP 2014). State-level BMP implementation measures can be guided by milestones established at the watershed-level. For example, statewide totals for riparian buffer protection could be based on the sum of buffer protection targets defined in watershed plans.

Pollutant Load Measures. All states tracked pollutant load reductions associated with NPS projects. One state (MI) included a protection-specific measure to track the magnitude of pollutant loads reduced or prevented through NPS management in unimpaired/high quality watersheds. Michigan's 2015 NPS plan set a goal to achieve "load reduction targets for sediment (760 tons), nitrogen (14,000 pounds), and

phosphorus (2,300 pounds) from long-term protection projects in priority watersheds” (MI DEQ 2015). Like implementation measures, pollutant load measures can express a numeric target for the magnitude of load reduction or prevention needed for successful protection (e.g., “2,300 pound of phosphorus” in the example above). Numeric targets for state-level pollutant load measures can be guided by load reductions called for in individual watershed plans.

Water Quality Outcome Measures. Four states included measures for tracking successful water quality outcomes in unimpaired/high quality watersheds (CT DEEP 2014; ME DEP 2014; MI DEQ 2015; NH DES 2014b). These measures were expressed as either maintaining the unimpaired status of healthy waters under state 305(b)/303(d) reporting or demonstrating successful protection through project or watershed-specific water quality monitoring and assessment. Analysis of water quality data for trends can be a more robust approach for evaluating protection success relative to impairment listings since water quality degradation might still occur without reaching thresholds for impairment. However, the use of water quality monitoring data requires practitioners to define one or more numeric water quality targets to serve as endpoints for judging the effectiveness for protection. Specific water quality outcome measures were:

- Demonstrate effective protection of unimpaired threatened waterbodies. Evaluated with stream miles classified as high quality waters and water quality trends (CT DEEP 2014).
- Demonstrate effective protection of eight unimpaired threatened waters (ME DEP 2014).
- No waters in healthy watersheds with approved watershed plans moved to the impaired waters list due to NPS causes (MI DEQ 2015).
- No waters moved to the impaired waters list in watersheds with approved watershed plans administered by “very active” watershed groups (MI DEQ 2015).
- Number of waterbodies where the concentration of NPS parameters have been reduced (NH DES 2014b).

Resource Feature 5.1: National Estuary Program Protection Projects

EPA's National Estuary Program (NEP, established as §320 of the Clean Water Act in 1987) is built on four cornerstones: 1) a focus on watersheds as the basic management units, 2) good science to guide sound decision-making, 3) a collaborative approach to problem solving, and 4) the inclusion of the public. Each of the 28 NEPs (Figure 5.2) establish their own Comprehensive Conservation & Management Plan (CCMP) that establishes priorities for activities, research, and funding for the estuary. The CCMP serves as a blueprint to guide future decisions and addresses a wide range of environmental protection issues. Each CCMP is required to include a habitat protection/restoration strategy that identifies habitats and species prioritized for protection and or restoration efforts. In 2006, EPA created the NEP Online Reporting Tool (NEPORT) to track NEP habitat protection and restoration projects, as well as leveraging projects implemented by NEP partners.

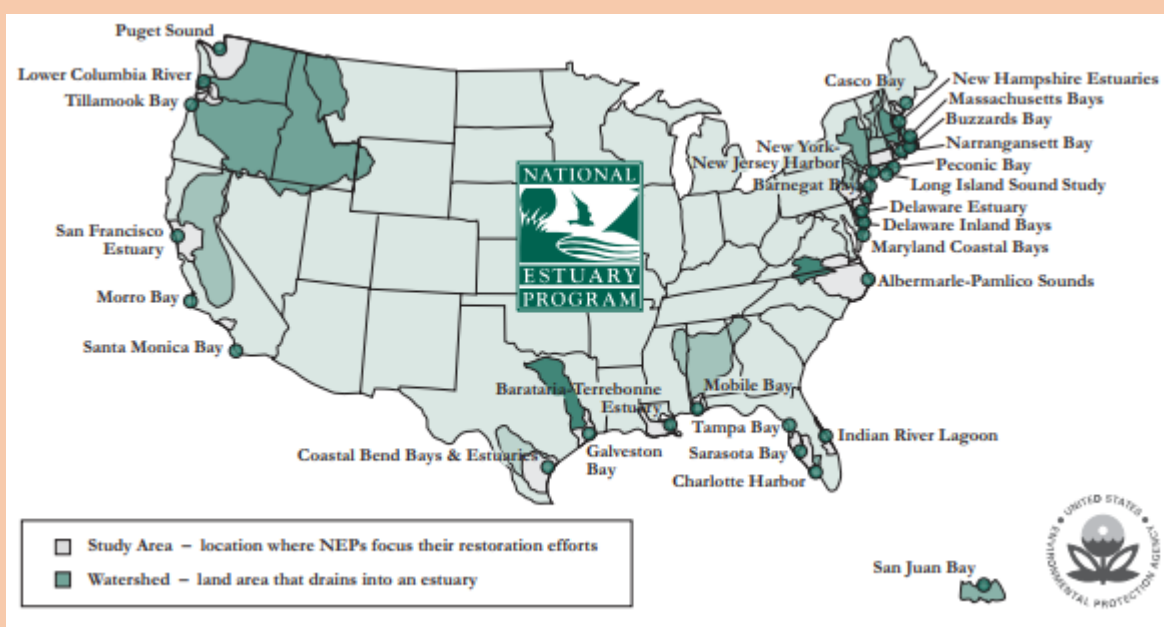


Figure 5.2. The 28 National Estuary Programs, their study areas, and surrounding watersheds (from epa.gov/nep).

Between 2010 and 2018, NEPs implemented a total of 1,749 habitat protection projects, protecting more than 270,000 acres (Table 5.3). Approximately 50 percent of habitat protection projects protected forest/woodland and forested wetlands. Riparian areas, agriculture/ranch land, tidal wetlands, and estuarine shoreline were other frequently cited habitat types targeted in protection projects. Nearly all habitat protection projects were land protection via acquisition (82 percent of projects) or conservation easements (14 percent). In general, similar proportions of habitat types were protected by land acquisition and easements, although agriculture/ranch land was more commonly protected via easements (38 projects) than acquisition (5 projects).

Table 5.3. Count of habitat protection projects and total acres protected by NEPs, 2010-2018.

NEP	# Projects	Acres Protected
Peconic Estuary Program	235	1,756
Delaware Estuary Program	233	18,050
Puget Sound Partnership	230	19,652

Albemarle-Pamlico Estuary Program	188	52,197
Barnegat Bay Estuary Program	136	13,263
Long Island Sound Study	128	5,282
Buzzards Bay National Estuary Program	110	3,667
Charlotte Harbor National Estuary Program	71	37,202
New York-New Jersey Harbor Estuary Program	53	6,438
Mobile Bay Estuary Program	52	9,688
Piscataqua Region Estuaries Partnership	46	8,791
Casco Bay Estuary Partnership	38	6,023
San Francisco Estuary Project	30	26,761
Delaware Inland Bays Estuary Program	28	2,269
Tillamook Estuaries Partnership	24	709
Galveston Bay Estuary Program	21	9,056
Santa Monica Bay Restoration Project	20	29,811
Lower Columbia River Estuary	20	3,863
Indian River Lagoon NEP	19	2,115
Narragansett Bay Estuary Program	15	1,579
Coastal Bend Bays and Estuaries Program	12	6,714
Maryland Coastal Bays Program	11	2,538
Morro Bay Estuary Program	8	1,121
Massachusetts Bays NEP	7	1,933
Sarasota Bay Estuary Program	7	557
Barataria-Terrebonne Estuary Program	6	1,544
Tampa Bay Estuary Program	1	164
Grand Total	272,742	1,749

NEPs reported a range of benefits attributed to habitat protection projects, most commonly protecting open space (80 percent of projects), wildlife habitat (63 percent), bird habitat (54 percent), and protecting or improving water quality (52 percent) (Table 5.4)

Table 5.4. Benefits attributed to habitat protection projects. Note that a single habitat protection project may be associated with one or more project benefits.

Project Benefits	Total
Protect or Preserve Open Space	1,407
Protect/improve/provide habitat for other wildlife	1,107
Protect/improve/provide Habitat for Birds	944
Improve or Protect Water Quality	904
Protect/improve/provide habitat for fish/shellfish	669

Improve/Increase Educational or Recreational Opportunities	439
Increase or Protect Water Quantity	283
Flood Control	99
Climate Change Adaptation	79
Erosion Control	75
Restore Natural Hydrology	54

NEPORT tracks partnership measures with a focus on lead implementers, who are project leads that complete tasks from CCMP Action Plans and NEP Annual Workplans through direct site work, hiring contractor services, negotiating agreements, and providing and/or securing funding. Among funding sources most mentioned (listed in a minimum of seven projects) in the 2010-2018 NEP project analysis, federal and private sources were most cited (203 and 178 projects, respectively). There was a total of 255 lead implementers, 90% of whom responsible for fewer than 10 projects. Those listed in more than 20 projects included towns and NGOs (171 and 160 projects, respectively; Table 5.3).

Table 5.5. Organization type of most common lead implementers of NEP habitat protection projects.

Lead Implementer	Total # of Protection Projects
Town	171
Non-Governmental Organization	160
State	106
Land Trust	93
County	68

With NEPORT as an exemplary system for tracking protection project metrics across programs, NEP is a flagship and potential resource for other EPA programs interested in assessing progress towards protecting valued waters and watersheds.

Conclusion paragraph TBD

Chapter 6: Protection Partnerships and Complementary Programs

Chapter Summary

NPS pollution is a complex and costly problem that cannot be tackled by state NPS resources alone. State NPS programs frequently face resource and capacity limitations that constrain their ability to advance protection work. EPA's *Nonpoint Source Program and Grants Guidelines for States and Territories* (USEPA 2013b) recognizes such barriers and acknowledges that “successfully addressing NPS pollution to achieve water quality standards often requires years of support from a coalition of stakeholders, programs, and funding sources.” This section provides a list of partner programs frequently identified in state NPS program efforts and watershed plans aimed at protecting unimpaired/high quality waters and watersheds.

- ✓ From the local to national scale, partnerships and complementary programs are key in NPS pollution management. In many cases, the partners and funding sources engaged in assessment, planning, and implementation work will be similar in both restoration and protection-based efforts. However, there may be opportunities to foster protection-based partnerships, particularly in healthier watersheds that have not been the focus of past NPS restoration work.
- ✓ At the state, regional, and landscape scales, there may be opportunities for NPS programs to align protection work, such as identifying protection priority watersheds, with partners. In doing so, NPS programs can consider where §319 investment in protection can leverage additional resources (e.g., funding and existing partnership frameworks) towards protection goals.
- ✓ At the watershed scale, the local partners, community engagement strategies, and management approaches best suited to protect healthy waters may be different than those to restore impaired waters. Planning teams should consider opportunities to engage new partners, including local government planning departments, land conservation organizations, and water utilities, whose goals may be aligned with protecting unimpaired/high quality waters vulnerable to degradation.

EPA Water Programs

- **Water Quality Standards, CWA §303(c)**: Water quality standards (WQS) are provisions of state, territorial, authorized tribal, or federal law approved by EPA that describe the desired condition of a water body and the means by which that condition will be protected or achieved. WQS consist of three core components: designated uses of a water body, criteria to protect designated uses, and antidegradation requirements to protect existing uses and high quality/high value waters (Tier 2 and 3 waters). Established WQS form a legal and technical basis for controlling pollutants entering state waters, ultimately protecting human health and aquatic life in these waters.
- **Impaired Waters and TMDL Program, CWA §303(d)**: The Impaired Waters and Total Maximum Daily Load (TMDL) Program is an important component of the CWA's framework to restore and protect U.S. waters. States, tribes, and territories are required to submit the results of their monitoring efforts in two publicly available reports (together, forming an Integrated Report) to EPA. These reports are generally submitted on April 1 of every even-numbered year (i.e., biennially). The first

report is the “305(b) Report,” which should include all the state, tribe, or territory knows about its waters—healthy, threatened, and in poor condition. The second is the “303(d) List,” which should only include threatened or already water quality limited (i.e., not meeting one or more applicable water quality standard). In addition to 305(b) reports and 303(d) lists, states and tribes submit other lists to EPA, such as the 303(e) continuous planning list and toxic hot spots under 304(l). If a water body is added to the 303(d) List, a strategy for meeting WQS is needed. Key elements of a strategy include a Total Maximum Daily Load and a TMDL implementation plan. TMDLs determine what level of pollutant load would be consistent with meeting WQS, allocate acceptable loads among sources of the relevant pollutants, and serve as a starting point or planning tool for restoring water quality.

- **[Healthy Watersheds Program \(HWP\)](#)**: After decades of focusing almost exclusively on restoring impaired waters, the EPA Office of Water created the Healthy Watersheds Program (HWP) to bring more emphasis to protecting high quality waters under the CWA objective, “...to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.” The HWP takes a non-regulatory, collaborative approach to maintaining clean waters by supporting EPA and its partners in assessing and protecting watershed health through CWA programs. Its main efforts involve assessing watershed health and vulnerability, analyzing effective protection policies and approaches, and promoting protection in specific, higher quality watersheds.
- **[Wetlands Program, CWA §104\(b\)\(3\)](#)**: The goals of EPA's wetland program include increasing the quantity and quality of wetlands in the U.S. by conserving and restoring wetland acreage and improving wetland condition. In pursuing these goals, EPA seeks to build the capacity of all levels of government to develop and refine effective, comprehensive programs for wetland protection and management.
- **[National Estuary Program, CWA §320](#)**: The EPA's National Estuary Program (NEP) is a non-regulatory, place-based program that aims to protect and restore the water quality and ecological integrity of estuaries of national significance (currently, 28 located along the Atlantic, Gulf, and Pacific coasts and in Puerto Rico). Each of the 28 NEPs focuses within a study area that includes the estuary and surrounding watershed and develops and implements 5-year Comprehensive Conservation and Management Plans (CCMPs) that contain actions to address water quality and living resource challenges and priorities as determined by the community and other stakeholders.
- **[Clean Water State Revolving Fund, CWA §603](#)**: The Clean Water State Revolving Fund (CWSRF) program is a federal-state partnership that provides communities low-cost financing for a wide range of water quality projects, including those that *protect* water quality (see the ELI's [Opportunities for Funding Water Quality Protection Projects through the Clean Water State Revolving Fund](#) for more information).
- **[Drinking Water State Revolving Fund \(Safe Drinking Water Act\)](#)**: The Drinking Water State Revolving Fund (DWSRF) program is a federal-state partnership to help ensure safe drinking water. Created by the 1996 Amendments to the Safe Drinking Water Act (SDWA), the program provides financial support to water systems and to state safe water programs, which can include source water protection efforts (see EPA's 2019 [Protecting Source Water with the Drinking Water State Revolving Fund Set-Asides](#) and the ELI's [Opportunities for Funding Protection Projects through the Drinking Water State Revolving Fund](#) for more information).
- **[Source Water Protection Program](#)**: The SDWA established state source water assessment programs and required states to assess the source water of all public water systems. There are no additional requirements for source water protection in the SDWA; however, EPA and states strive to protect sources of drinking water by developing tools and supporting voluntary partnerships and

approaches that can protect and prevent contamination of sources of drinking water. Watershed protection groups and source water collaboratives can use EPA's [Drinking Water Mapping Application to Protect Source Waters \(DWMAPS\)](#) to locate drinking water providers, potential sources of contamination, polluted waterways as well as information on protection projects and [Source Water Collaborative \(SWC\)](#) initiatives in their area.

- **Trash Free Waters Program:** EPA's Trash Free Waters program reduces the volume of trash entering U.S. waters by working with partners to implement collaborative solutions that target land-based sources. The program supports and brings together state and local governments, businesses, and concerned citizens to help identify collective actions in communities that enhance trash *prevention*. To further these efforts, Trash Free Waters 1) creates tools that aid in developing litter prevention actions, 2) supports a range of research efforts that assess the impacts of trash on water quality, aquatic habitat, and public health, 3) uses community-based prevention approaches to help facilitate trash prevention programs in other countries, and 4) builds partnerships to stimulate innovative approaches for packaging technology, litter prevention, and material reuse.
- **EPA Geographic Programs:**
 - **Chesapeake Bay Program, Healthy Watersheds Goal Implementation Team:** As a programmatic complement to the "impaired waters" approach, the goal of the Maintain Healthy Watersheds Goal Implementation Team (HWGIT) is to maintain local watersheds at optimal health across a range of landscape contexts, bringing attention to the challenges of protecting healthy streams and watersheds. Specifically, the HWGIT works to: 1) track the health of watersheds and team's effectiveness in protecting them, 2) strengthen local commitment and capacity to protect healthy watersheds, 3) improve protection of state-identified healthy watersheds under federal programs and federal agency decision-making, and 4) support state-based efforts to improve assessment and protection of healthy watersheds.
 - **Gulf of Mexico Division:** EPA's Gulf of Mexico Division (GMD) serves to protect, maintain, and restore the health and productivity of the Gulf of Mexico in ways consistent with the economic well-being of the Gulf region. The GMD's principles include: 1) committing to voluntary, non-regulatory solutions, 2) acting based on sound scientific and technical information working with partners and the public, 3) identifying priority areas and actions through state and coastal community leadership, and 4) providing federal leadership in research, monitoring, scientific analysis, and financial resources to support state and community action. Since its inception in 1988, GMD has developed multiple jurisdictional agreements with federal and state partners as well as international partners. With the cooperation of its partners, the GMD successfully implements and funds projects that lead to a thriving ecosystem.
 - **Great Lakes Restoration Initiative:** The Great Lakes Restoration Initiative (GLRI) accelerates efforts to protect and restore the largest system of fresh surface water in the world – the Great Lakes. Built upon the foundation of the Great Lakes Regional Collaboration Strategy, since 2010, the multi-agency GLRI has provided funding to 16 federal organizations to strategically target the biggest threats to the Great Lakes ecosystem and to accelerate progress toward achieving long-term goals. [GLRI Action Plan III](#) outlines the priorities and goals of the GLRI for fiscal years 2020-2024, which work to accelerate environmental progress in five focus areas: toxic substances and areas of concern, invasive species,

- nonpoint source pollution impacts on nearshore health, habitats and species, and foundations for future restoration actions.
- **[San Francisco Bay Delta Watershed](#)**: EPA's focus on the Sacramento-San Joaquin Delta involves work with federal and state partners to restore aquatic life protection and secure a reliable water supply for agriculture, industry, and municipal uses. In August 2012, EPA published the [San Francisco Bay Delta Action Plan](#), which identified priority activities to advance the protection and restoration of aquatic resources and ensure a reliable water supply in the San Francisco Bay Delta Estuary watershed. EPA also supports water quality monitoring and assessment efforts in the Central Valley and directs the San Francisco Bay Water Quality Improvement Fund, a competitive grant program that provides funding for projects to protect and restore San Francisco Bay and its watershed. Currently, EPA funds 49 grants, involving over 80 partners, to achieve significant environmental improvements related to wetlands, water quality, and green development.
 - **[Puget Sound](#)**: Since 2010, Congress has appropriated over \$350 million in CWA §320 funds for Puget Sound. Under §320, EPA has provided National Estuary Program and Geographic Program funding and support to help communities make on-the-ground improvements for clean and safe water, protected and restored habitat, thriving species, and a vibrant quality of life for all, while supporting local jobs. Currently, EPA helps fund the Puget Sound Partnership's Action Agenda for protecting and restoring Puget Sound, but federal support of Puget Sound recovery also comes from many programs, most of which are administered by NOAA, USDA, DOI, and the U.S. Army Corps of Engineers.

Other Federal Programs

- **[Federal Emergency Management Agency \(FEMA\), Hazard Mitigation Planning](#)**: States and cities prepare FEMA Hazard Mitigation Plans (HMPs) with which projects must be consistent to be eligible for [FEMA grants](#). HMPs address all hazards—including natural hazards such as flooding, erosion, and drought—and have two main goals. The first is to identify state-specific natural hazard vulnerabilities (e.g., fire and debris flow threats to drinking water sources) from historical data and models. The second is to propose strategic natural hazard mitigation solutions, such as protecting landscape buffers.
- Within the U.S. Department of Agriculture (USDA), the following programs are of particular relevance to protection work:
 - **[Natural Resources Conservation Service \(NRCS\)](#)**: NRCS provides U.S. farmers and ranchers with funding and guidance to voluntarily enact conservation practices that not only help the environment, but agricultural operations as well.
 - The NRCS [Agricultural Conservation Easement Program \(ACEP\)](#) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements component, NRCS helps Indian tribes, state and local governments, and non-governmental organizations to protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect, and enhance enrolled wetlands.
 - The NRCS [Healthy Forests Reserve Program \(HFRP\)](#) helps landowners restore, enhance, and protect forestland resources on private lands through easements and

financial assistance. Additionally, HFRP provides landowners with 10-year restoration agreements to aid the recovery of endangered and threatened species under the Endangered Species Act, improve plant and animal biodiversity, and enhance carbon sequestration.

- The NRCS [Regional Conservation Partnership Program \(RCPP\)](#) promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand NRCS' ability to address on-farm, watershed, and regional natural resource concerns. Through RCPP, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.
- The [NRCS National Water Quality Initiative \(NWQI\)](#) provides a way to accelerate voluntary, on-farm conservation investments and focused water quality monitoring and assessment resources where they can deliver the greatest benefits for clean water. Now in its tenth year, NWQI is a partnership among NRCS, state water quality agencies, and EPA to identify and address impaired water bodies through voluntary conservation. NRCS provides targeted funding for financial and technical assistance in small watersheds most in need and where farmers can use conservation practices to make a difference. In FY19, NRCS expanded the scope of NWQI to include source water protection, including both surface and ground water public water systems. NWQI assists partners in adapting and expanding source water protection plans to identify critical source areas needing further treatment related to agricultural land uses. NWQI has also been extended through FY2023 with updates to strengthen program delivery, including a focus on watershed assessment and planning and use of multi-year budgets to demonstrate long-term commitment in assisting water quality efforts.
- [Farm Service Agency \(FSA\), Conservation Reserve Program \(CRP\)](#): CRP is one of the largest private-land conservation programs in the U.S. As part of a 10 to 15-year contract and in exchange for a yearly rental payment, farmers enrolled in the program voluntarily agree to remove environmentally sensitive land from agricultural production and to plant species that will improve environmental health and quality. The long-term goal of the program is to re-establish natural land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.
- [U.S. Forest Service \(USFS\)](#):
 - The USFS [Watershed Program](#) is a network of water and watershed resource specialists who support stewardship efforts at all levels of the organization to promote healthy, sustainable watersheds fundamental to ecosystems and people. Its projects cover numerous focus areas related to watershed condition and water hydrology. For example, the national [Watershed Condition Framework](#) and the accompanying [Watershed Condition Classification Technical Guide](#) establish a consistent, comparable, and credible process for improving the health of watersheds on national forests and grasslands and facilitating new investments in watershed restoration that will provide economic and environmental benefits to local communities.

- The [Forest Legacy Program \(FLP\)](#) is a conservation program administered by the USFS in partnership with state agencies to encourage the protection of privately owned forest lands through conservation easements or land purchases. Protection of private forests through FLP maintains a multitude of public benefits including recreational opportunities, clean drinking water sources, habitat for fish and wildlife, and forest products (e.g., timber).
- [U.S. Department of Defense \(DoD\), Readiness and Environmental Protection Integration \(REPI\) Program](#): The REPI Program is a key tool for combating land-use encroachment that can limit or restrict military training, testing, and operations. The REPI Program preserves and enhances military missions by helping remove or avoid land-use conflicts near installations, ranges, and their associated facilities. A number of these actions preserve surrounding natural land cover, supporting protection efforts.
- [National Wild and Scenic Rivers](#): The National Wild and Scenic Rivers System is implemented by four primary federal agencies (Bureau of Land Management, National Parks Service, U.S. Fish & Wildlife Service, and the U.S. Forest Service). The System's goal is to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Act is notable for safeguarding the special character of these rivers while also recognizing the potential for their appropriate use and development. It encourages river management that crosses political boundaries and promotes public participation in developing goals for river protection.
- [U.S. National Park Service \(NPS\), Land and Water Conservation Fund \(LWCF\)](#): The LWCF was established by Congress to safeguard natural areas, water resources, and cultural heritage and to provide recreation opportunities to all Americans. The fund invests earnings from offshore oil and gas leasing to help strengthen communities, preserve history, and protect national endowment of lands and waters. The LWCF program can be divided into the "[State Side](#)," which provides grants to State and local governments, and the "[Federal Side](#)," which is used to acquire lands, waters, and interests to achieve the natural, cultural, wildlife, and recreation management objectives of federal land management agencies.
- [National Oceanic and Atmospheric Administration \(NOAA\), Office for Coastal Management](#): The Coastal Zone Management Act is the guiding legislation for decisions and actions taken to keep the natural environment, built environment, quality of life, and economic prosperity of coastal areas in balance. NOAA's Office for Coastal Management implements this Act through four major programs: the National Coastal Zone Management Program, National Estuarine Research Reserves, NOAA Coral Reef Conservation Program, and Digital Coast. NOAA also offers Coastal Resilience Grants, which fund projects that help coastal communities and ecosystems prepare for and recover from extreme weather events, climate hazards, and changing ocean conditions.

State Programs

In addition to water quality management programs, state natural resource and fish and wildlife programs may serve as key partners in protection work. EPA maintains a list of [Health and Environmental Agencies of U.S. States and Territories](#).

- **Natural resource agencies** often supervise a multitude of state departments, conservancies, and commissions to implement projects that balance environmental stewardship with the advancement

of governmental priorities and community growth. For example, the [California Natural Resources Agency's mission](#) is “to restore, protect and manage the state's natural, historical and cultural resources for current and future generations using creative approaches and solutions based on science, collaboration, and respect for all the communities and interests involved.”

- **Fish and wildlife agencies** enact and enforce measures (such as hunting/harvesting limits, fish stocking programs, public land access restrictions, etc.) to ensure the conservation and equitable and sustainable management of state fish and wildlife resources. As featured on the [Association of Fish & Wildlife Agencies \(AFWA\)](#) main webpage, “State, provincial, and territorial fish and wildlife agencies in North America have safeguarded fish and wildlife for over 100 years. The public entrusts these agencies with primary stewardship over vital wildlife resources.”
- **Source water protection (SWP) programs** are often housed within a state’s drinking water primacy agency or health department. See the Association of State Drinking Water Administrators (ASDWA) website for a [list of state SWP contacts and their agencies](#).

State NPS Program Feature 6.1: Connecticut – Open Space Acquisition

Connecticut’s Department of Energy and Environmental Protection (CT DEEP) established a goal of protecting 21% of the state’s land area by 2023 as part of its *Comprehensive Open Space Acquisition Strategy* (CT DEEP 2017). Recognizing that this initiative aligns with its own protection goals, the Connecticut NPS program collaborated with two state programs dedicated to implementing the open space strategy: the Recreation and Natural Heritage Trust Program, which purchases properties to contribute to the state’s recreation system, and the Open Space and Watershed Land Acquisition Grant Program, which provides grants to communities looking to acquire open space. Connecticut NPS program staff participated in reviews of grant applications to determine the potential for projects to protect and improve water quality.

Additional partnerships between Connecticut’s NPS program and other state efforts are documented in the *Connecticut Nonpoint Source Management 2018 Annual Report*: “NPS Program Staff continuously review permit applications subject to CT DEEP approval and planning documents developed by CT DEEP and other state agencies with an eye towards water quality protection and improvements. These reviews include but are not limited to water diversion permits, state inland wetland permits, stormwater certifications for state facilities, flood management certification, Section 401 water quality certifications, and projects subject to the Connecticut Environmental Policy Act. In addition, NPS Program Staff review state planning documents such as the state Green Plan, TMDLs, and State Plan of Conservation and Development as part of their ongoing responsibilities” (CT DEEP 2019).

Local Government Programs

- **City/town planning** departments address local zoning and land use plans, which can designate areas of concentrated development to protect valuable undeveloped areas of a watershed.
- **Regional government groups** (e.g., Councils of Governments, COGs) are comprised of local government employees who assist other group members with municipal planning and community development across multiple jurisdictions to better coordinate and manage regional transportation planning, pollution control, resource use, hazard mitigation and emergency planning, and civic data.

A more detailed explanation of COGs may be found at [Western Riverside Council of Governments \(WRCOG\)](#).

- **Public health departments**, which often function at the county or city level, address community health concerns. Thus, the maintenance of high-quality environmental conditions (i.e., clean air, water, and soil) and the prevention of future health risks that may be associated with environmental degradation align with public health department goals to provide residents with safe facilities, drinking water, and food.
- **Environmental services**, sometimes overseen by a state’s department of natural resources or as part of a local health department, monitor and guide local environmental operations such as water and wastewater treatment, solid waste recycling and disposal, dredged material management, hazardous materials clean up, and renewable energy.
- **Soil and water conservation districts** are key partners in nonpoint source agricultural efforts as they coordinate public, private, local, state, and federal resources to address local resource concerns, especially pertaining to farm, ranch, and forestland soil erosion and productivity and water quality and quantity. According to the [National Association of Conservation Districts](#), “Across the United States, nearly 3,000 conservation districts—almost one in every county—work directly with landowners to conserve and promote healthy soils, water, forests and wildlife.”
- **Parks and open spaces** serve not only as important recreational areas but also as beneficial green infrastructure, conserving natural areas and ecosystem functions. At the local scale, these public spaces and facilities are managed by a parks and recreation department within a county/borough, municipal government (e.g., city, town, township, or village), or a special park district/authority, which will work to protect the natural environment while promoting community engagement and health. For more information on the benefits and strategic planning of parks and recreation, visit the [National Recreation and Park Association \(NRPA\)](#).
- **Local advisory commissions/committees (LACs)** consist of knowledgeable, experienced residents, representatives from community organizations, government agencies, and non-governmental organizations (NGOs) who gather pertinent research and residential views to advise legislative bodies on locale-specific projects (e.g., regarding parks and recreation, historical preservation, and waterbody protection) from a wide array of perspectives. To better understand the approach and function of LACs, explore these [Municipal Research and Services Center \(MRSC\)](#) resources.

Tribal Nations

In many states, Tribes are willing partners in protection efforts. There are currently 574 federally recognized American Indian and Alaska Native tribes and villages in the U.S. Approximately 229 of these nations are in Alaska while the other federally recognized tribes are in 35 other states. Additionally, there are state recognized tribes located throughout the nation. Clean Water Act §518 authorizes EPA to treat eligible, federally recognized tribes with reservations in a similar manner to states (TAS) for a variety of purposes, including administering each of the principal CWA regulatory programs and receiving grants under several CWA authorities. There are currently 208 tribes eligible for §319 grant funding under the National NPS Program. Tribal NPS programs develop assessment reports and NPS management program plans to guide water quality protection and restoration efforts on their lands.

Other Key Partners

All state NPS programs value and rely on relationships with local groups and associations to provide support and enhanced capacity. These groups are often the backbone of protection efforts and regularly organize watershed surveys and assessments, prepare watershed plans, develop proposals for §319 or other funding sources, manage on-the-ground efforts to implement watershed protection projects, and conduct post-project monitoring. Local groups have an intimate working knowledge of watershed conditions, resident concerns, and local government initiatives, which can promote progress toward protection-related goals.

- **Watershed organizations** are often built on the hard work and dedication of a few paid staff and volunteers who advocate for the restoration and protection of a specific watershed in the interest of a community. Through implementing projects that improve water quality, habitat conditions, and recreational and educational opportunities, they can emphasize, support, and strive for the protection of unimpaired/high quality waters. To find watershed organizations across the U.S., view the [River Network's "Who Protects Water?" map](#).
- **Community-based associations**, such as lake and road associations, are nonprofit organizations that focus their efforts at a more localized scale and almost entirely rely on the service of volunteers and membership dues to preserve targeted areas for the benefit of the community's health, recreation, and aesthetics (i.e., neighborhood beautification").

State NPS Program Feature 6.2: Maine – Lake Association Partnerships

Partnerships between Maine's NPS program and local lake associations were a critical part of the state's protection-related efforts. A limiting factor for successful protection described by the Maine NPS program and other states was the availability of sufficient funding to develop watershed-based plans. Although §319 funding is available for watershed planning, preference is typically given to plans that focus on restoration of impaired watersheds. The lack of watershed plans for unimpaired/high quality watersheds can act as a bottleneck for funding on-the-ground protection projects, resulting in limited protection progress. Maine overcame this hurdle by empowering its local lake associations to develop watershed plans. To aid local groups in developing watershed plans, Maine's NPS program distributed documents to streamline the process, including *Guidance for Maine Lake Watershed-based Protection Plans* (2013; only applicable for protection of unimpaired lakes, i.e. alternative plans) and *Guidance for Updating Maine Watershed-based Plans* (2017; only applicable when updating a 9-element plan). This framework allowed Maine's state NPS program to allocate §319 dollars to fund protection projects in areas with approved lake watershed-based plans.

- **Land Trusts.** According to the [Land Trust Alliance \(LTA\)](#), there are approximately 1,400 land trusts (also called land conservancies) across the U.S., many of which consider water quality and watershed protection in their work. In fact, "water quality, including wetlands" was cited as the second-leading conservation priority among land trusts in LTA's 2015 National Land Trust Census. During report phone interviews with state NPS program staff, three states (MI, ME, and NH) highlighted the importance of land trust partnerships for protection. Land trust efforts to conserve and steward natural and working lands via the purchase of conservation easements and direct land

acquisition can serve as a key strategy in watershed protection efforts. To find land trusts across the U.S., visit [LTA's "Find a Land Trust" map](#).

- **Landscape conservation networks** (such as the [Network for Landscape Conservation](#), [Center for Large Landscape Conservation](#), and [Highstead](#)) approach protection at a much larger geographic scale, transcending jurisdictional boundaries and expanding the scope of collaborators and preservation to include a myriad of habitats, wildlife, and ecosystem services. Ultimately, this holistic approach is intended to escalate systems-level thinking and embrace both human networking and habitat connectivity.
- **National/regional non-governmental organizations (NGOs)**. State NPS program success often relies heavily on local capacity from watershed groups and lake associations. However, local capacity can be limited in rural watersheds with low populations or in watersheds with predominantly seasonal populations. In these cases, national and regional NGOs, such as [Trout Unlimited](#) or [The Nature Conservancy](#), can act in lieu of a local group to receive grant dollars to plan and implement protection activities.

Resource Feature 6.1: New Hampshire NGOs

New Hampshire boasts over 900 lakes and ponds and 17,000 river and stream miles with the majority of those aquatic resources spread throughout many rural watersheds with limited local capacity to support water quality protection efforts. Statewide and national NGOs including [NH Lakes](#), [New Hampshire Rivers Council](#), [Connecticut River Conservancy](#), and [Trout Unlimited](#) are active in supporting projects in these rural watersheds. Additionally, there are many local NGOs that are the driving force for addressing restoration and protection needs. [The Newfound Lake Region Association](#) (NLRA) is an excellent example of a local watershed association that is serving that purpose. The 63,150-acre Newfound Lake Watershed includes all, or portions of, nine small New Hampshire towns. Newfound Lake is a high quality waterbody with high recreational and socioeconomic importance in the region. Without a motivating and unifying presence in the watershed, water quality protection could be very challenging. To promote and accomplish protection of Newfound Lake, the NLRA completed development of a watershed protection plan in 2014. To date they have also completed three phases of project implementation partnering with the local communities to install various best management practices (BMPs) to control stormwater runoff as were recommended in the plan. The plan development and implementation project work has received support from USEPA Clean Water Act Section 319 Watershed Assistance Grants administered by the New Hampshire Department of Environmental Services Nonpoint Source Management Program. The NLRA also runs a youth conservation corps group that installs residential-scale stormwater BMPs each summer, and continues to work toward achieving the goals outlined in the watershed management plan, including work on a fourth phase of BMP implementation projects. Key project partners have included [NHDES](#); [NH Department of Transportation](#); [NH Fish and Game Department](#); [University of New Hampshire Cooperative Extension](#); [Plymouth State University](#); the Towns of Alexandria, [Bridgewater](#), [Bristol](#), [Groton](#), & [Hebron](#); Sleepy Hollow Association; [The Society for the Protection of New Hampshire Forests](#); Stonegate Acres; Summer Camps [Pasquaney](#), [Mayhew](#), & [Berea](#); numerous private property owners; and, professional project partners Greenfire GIS, [Resilience Planning and Design](#), [Sullivan Creative](#), and Jeffrey H. Taylor and Associates.

Conclusion paragraph TBD

DRAFT

Chapter 7: Conclusion

Intro paragraph to be completed by HQ staff

Chapter 2: Prioritizing Watersheds for Protection

Chapter Summary:

- ✓ Given the limited NPS program resources available in most states for protection, the prioritization of waters/watersheds can help target protection-based planning and project work to help achieve program goals.
- ✓ While state prioritization approaches vary, for example in specific waterbody type(s) considered and watershed scale evaluated, they have generally been aimed at identifying healthier waters and watersheds most vulnerable to degradation.
- ✓ Considering both measures of waterbody and watershed condition in prioritization approaches can help identify areas where protection efforts can help maintain the structure and function necessary to support healthy aquatic ecosystems.
- ✓ Vulnerability assessments can help identify threatened waters/watersheds and design management strategies to protect these areas. Depending on the program need and resources available, components of a vulnerability assessment (i.e., exposure, sensitivity, adaptive capacity) can be incorporated in state NPS prioritization approaches.

Chapter 3: Integrating Protection in Watershed Planning

Chapter Summary:

- ✓ **Step 1: Build partnerships.** Partnership-building and community engagement play a critical role in protection-based planning, particularly to garner support and resources for proactive watershed management where the typical drivers of water quality restoration (i.e., impairment listing and TMDL development) may not be present. Planning teams should consider opportunities to engage new partners, including local government planning departments, land conservation organizations, and water utilities, whose goals may be aligned with protecting unimpaired/high quality waters vulnerable to degradation.
- ✓ **Step 2: Characterize the watershed.** As in restoration-based planning, characterizing the watershed and waterbody condition informs watershed planning and implementation work in healthier watersheds. In addition to identifying existing problem areas, protection-oriented plans typically identify areas (e.g., natural areas, unimpaired/high quality waters) where proactive management strategies may be considered during implementation. Protection-oriented plans also typically characterize future conditions to evaluate water quality threats.
- ✓ **Step 3: Set goals and identify solutions.** After decades of experience, EPA's National NPS Program and the NPS community have refined watershed-based approaches for establishing water quality restoration goals, then designing and targeting NPS management measures in critical source areas. In watersheds where management efforts are driven by the presence of both NPS-impaired waters and unimpaired/high quality waters, protection can be incorporated within these approaches. However, the unimpaired watershed plans also demonstrate the need for NPS technical resources

to help practitioners establish protection-based goals, identify protection priority areas, and quantify the water quality benefits of protection-based management practices, like land conservation.

- ✓ **Step 4. Design an implementation program.** Well-articulated watershed goals, objectives and planning targets established under Step 3 lay the important groundwork when designing an implementation program. Step 4 focused on the interim milestones included in the protection-oriented plans and found that milestones were likely to be most helpful in guiding implementation work when they were geographically targeted, measurable, and incorporated in the plan's implementation schedule.

Chapter 4: Implementing Protection Projects

Chapter Summary:

- ✓ The context of a given watershed, including current water quality and landscape condition, future water quality threats, and active local partners, helps inform which management approaches are best suited to achieve water quality goals. Multiple barrier approaches to NPS management incorporate complementary strategies to prevent, control, and treat polluted runoff. Land conservation, local regulations, and BMP implementation can be key components of such approaches.
- ✓ **Land conservation** can help achieve water quality goals by preserving natural areas, such as forests, riparian areas, and wetlands, that contribute relatively lower pollutant loads and serve as natural filters for contaminants. Additionally, land conservation can prevent conversion to land uses that contribute higher pollutant loadings. Based on a December 2019 analysis of GRTS data, 20 state NPS programs, led by Ohio and Michigan, have reported a total of 135 watershed projects that included conservation easement as a management practice.
- ✓ **Local regulations & zoning** can support watershed protection by guiding land use development to areas that minimize effects on water resources and open space, and ensure that new and redevelopment sites are designed to reduce runoff volume through on-site stormwater retention. Two states, Alaska and Michigan, have awarded Section 319 grants to local partners to enhance or adopt ordinances to protect unimpaired/high quality waters.
- ✓ **Best management practices**, including structural practices and managerial approaches, can play an important role in watershed protection efforts, for example by addressing existing problem areas. Between 2014 and 2019, 27 states reported a total of 131 NPS projects primarily aimed at protecting unimpaired/high quality waters. A total of 81 different BMP types were reported among these projects, most commonly related to agriculture, road/stream crossings, and streambank/stream channel protection.

Chapter 5: Tracking Protection Actions and Outcomes

Chapter Summary:

- ✓ In developing protection-based measures of success, it is important to first define protection and establish protection-specific goals against which progress will be measured. Across EPA water programs, protection is generally defined as actions to reduce or eliminate threats to waterbodies and natural habitat to prevent water quality degradation or a decline in condition.
- ✓ Measures of success play an important role in helping states and the public measure the progress and success NPS management programs. States adopted protection-based measures of success to guide their protection work (e.g., via programmatic, watershed planning, and NPS project

implementation measures), then assess the environmental outcomes of these efforts (e.g., via pollutant load reduction and water quality outcome measures).

- ✓ In general, while numerous states have adopted protection-based measures of success, discussions with state NPS program staff expressed a need for technical guidance to assist in setting quantifiable protection goals, as well as methods to measure progress towards these goals. Specifically, state NPS program staff indicated the need for technical guidance to help: (1) assess water quality conditions corresponding to successful protection (e.g., in cases where current water quality is better than criteria set forth in water quality standards), (2) establish methods to quantify the magnitude of pollutant load reduction or prevention needed to achieve water quality targets, and (3) evaluate the amount of BMPs or other management practices needed achieve load reduction or prevention targets.

Chapter 6: Protection Partnerships and Complementary Programs

Chapter Summary:

- ✓ From the national to local scale, partnerships are a key component in efforts to manage NPS pollution. In many cases, the partners and funding sources engaged in assessment, planning, and implementation work will be similar in both restoration and protection-based efforts. However, there may be opportunities for new protection-based partnerships, particularly in healthier watersheds that have not been the focus of past NPS restoration work.
- ✓ At the state, regional, and landscape scales, there may be opportunities for NPS programs to align protection work, including identifying protection priority watersheds, with partners. In doing so, NPS programs can consider where 319 investments in protection can leverage additional resources (e.g., funding, existing partnership frameworks) towards protection goals.
- ✓ At the watershed scale, the local partners, community engagement strategies, and management approaches best suited to protect healthy waters may be different than those designed to restore impaired waters. Planning teams should consider opportunities to engage new partners, including local government planning departments, land conservation organizations, and water utilities, whose goals may be aligned with protecting unimpaired/high quality waters vulnerable to degradation.

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Appendix A. Land Conservation Primer

Defining Land Conservation

Land conservation (or land protection) is a broad management strategy that may be aimed at protecting one or more conservation values provided by a property (Figure 4.2). Protected lands also vary in terms of the uses permitted on them, the permanence of their protection status, and the entities responsible for management. The Protected Areas Database of the United States (PAD-US), available from the US Geological Survey, includes open space/resource lands owned in fee by agencies and non-profits, as well as conservation easement data from the National Conservation Easement Database (NCED). The database tracks protected lands according to their protection status and management entity. According to PAD-US, protected lands currently comprise approximately 30 percent of land area in the US, though the degree of protection on these lands varies (Table 4.2).

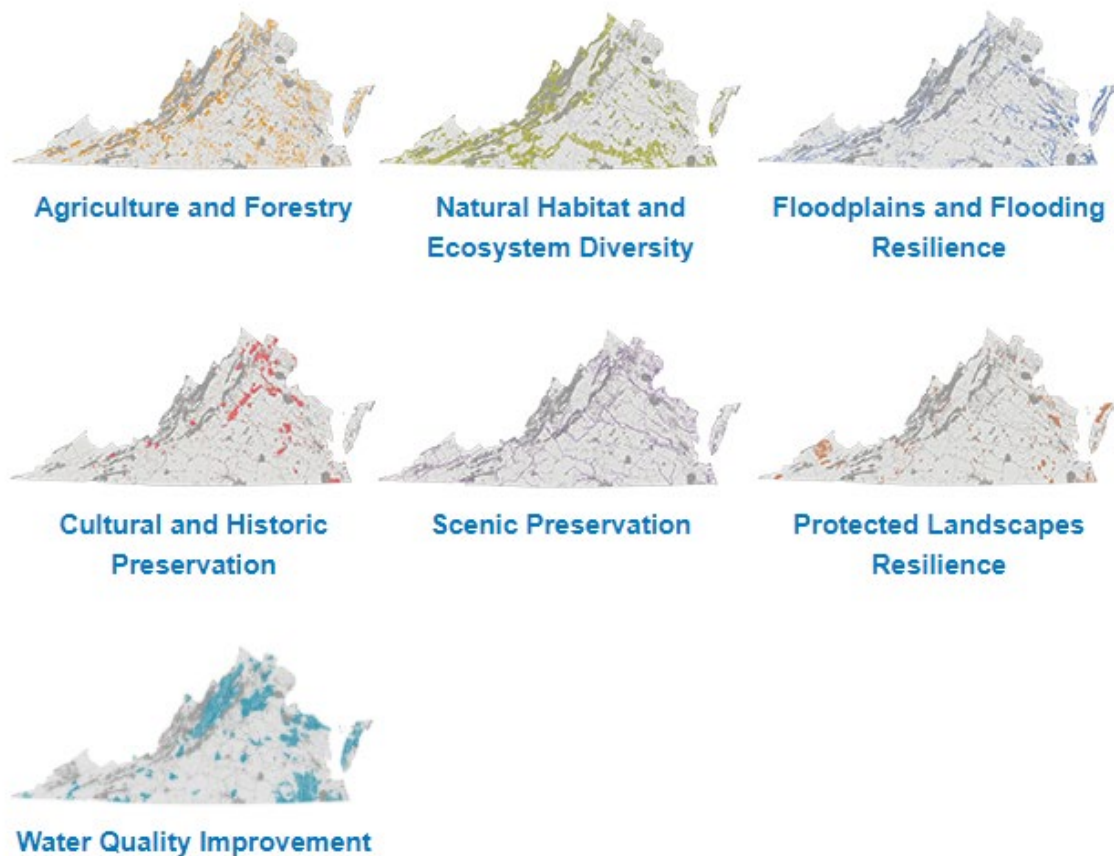


Figure 4.2. Virginia’s *ConserveVirginia* tool identifies highest conservation value lands, based on 19 mapped data inputs, representing top priority conservation values in seven categories, including lands most critical to improving water quality (i.e., lands adjacent to waterbodies in HUC12 watersheds with the highest loadings of nitrogen, phosphorus or sediment, based on statewide assessments; VA DCR 2021).

Table 4.2. Distribution of US land area by protected lands status. Data source: PAD-US Version 1.4 (USGS October 2017). Retrieved from <http://gapanalysis.usgs.gov/PADUS> on February 5, 2020.

GAP Status Code	Definition and Examples	% Total National (US States and Territories) Area	Most Common Land Managers
1	Lands with permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state. <i>e.g., Wilderness Area</i>	8%	US Fish & Wildlife Service (43%), National Park Service (32%), USDA Forest Service (18%), and Bureau of Land Management (4%) collectively manage >95% of GAP Status 1 lands.
2	Lands with permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance. <i>e.g., Conservation Easement, National Park, National Wildlife Refuge, Wild and Scenic River</i>	4%	Bureau of Land Management (27%), USDA Forest Service (14%), State Department of Natural Resources (11%), US Fish & Wildlife Service (11%), and National Park Service (9%) collectively manage >70% of GAP Status 2 lands.
3	An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low intensity type (for example, logging, Off-Highway Vehicle recreation) or localized intense type (for example, mining). <i>e.g., National Public Lands, National Monument, National Forest, Resource Management Area</i>	18%	Bureau of Land Management (50%) and USDA Forest Service (33%) collectively manage >80% of GAP Status 3 lands.
4	There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout or management intent is unknown. <i>e.g., Other Easement (Agricultural), Private Park or Recreation Area, Native American Tribal Land</i>	70%	

Land conservation approaches are complex and vary from acquiring partial interest in a property to outright acquisition of the land. The land conservation technique best suited for local conditions depends on a variety of factors including the type of conservation land, landownership, and available resources (TPL and AWWA 2005). For example, acquiring a partial interest of a property through a conservation easement is usually less expensive than buying the land, and it may be preferable to landowners interested in retaining ownership. Land conservation strategies include the following:

Land Acquisition. The most straightforward approach to permanently protect lands is outright acquisition and management of the land. Acquisition provides full ownership of the land and the

most permanent protection, giving the buyer full rights to the property and the title. The land ownership and management responsibilities may be held by the same entity or shared between multiple parties. For example, in a multi-party management scenario the new landowner may acquire the title to the property then develop a management agreement with an appropriate third party, like a nonprofit land trust (TPL and AWWA 2005).

Acquire partial interest. Land can also be conserved by acquiring, through purchase or donation, some of the property rights. The most well-known means of conveying a partial interest is through a **conservation easement**, which is a voluntary agreement between a landowner and a second party (e.g., unit of government or land trust) to protect specific resources on the land. The landowner retains ownership of the property, but the easement restricts uses or development that would damage those resources. While most conservation easements are permanent, an easement may be granted for a term of years. Easement value is determined through an appraisal of the market value of the property without an easement less the market value with a conservation easement (Chesapeake Bay Trust 2017).

Transfer of Development Rights (TDR). In some parts of the country, it is possible to acquire development rights through government TDR programs (TPL and AWWA 2005). TDR is a zoning technique that conserves land by redirecting development that would otherwise occur on the land to a receiving area suitable for denser development. The technique operates so that owners interested in developing land can be compensated for their redirected development rights (WeConservePA 2021). All TDR programs are voluntary, meaning that both the seller and buyer must choose to participate. The federal government does not expressly authorize TDR programs. States must enact enabling legislation to authorize local governments to create TDR programs. Once the enabling legislation is in place, local jurisdictions can adopt a local ordinance to establish a TDR program (Chesapeake Bay Trust 2017).

Leasing Land.

Targeting Land Conservation to Protect Water Quality

Major sources of NPS pollutant loads are often disproportionately distributed across the landscape, resulting in *critical source areas* where high-level pollutant sources overlap or interact with high pollutant transport potential. The relative contribution of NPS pollutants from different source areas is influenced by a number of factors, including the pollution source magnitude, land cover type and land management practices, pollutant pathways, and transport mechanisms (USEPA 2018a). Land conservation can help achieve water quality goals by preserving natural areas, such as forests, riparian areas, and wetlands, that contribute relatively lower pollutant loads and serve as natural filters for contaminants (Ernst 2004). Additionally, land conservation can prevent conversion to land uses that contribute higher pollutant loadings.

Not all parcels in a watershed have equal impact on water resources. For example, a large and forested parcel that encompasses small streams with steep slopes and highly erosive soils may rank as a higher protection priority than a level parcel with less erosive soils located far from a surface water (Ernst 2004). Natural areas (e.g., forest, wetlands, natural grasslands); lands most prone to erosion, such as

steep slopes and highly erodible soils; and lands close to or encompassing water resources are generally the most important areas to protect for maintaining water quality (TPL and AWWA 2005). By conserving these areas, partners can maintain parts of the landscape currently serving as pollutant sinks and prevent development where it is likely to have the greatest impact on water quality. There are many existing technical resources that can help prioritize and target land conservation in areas most important for water quality. Table 4.3 below provides an overview of some common factors included in land prioritization models developed to target land protection for water quality.

Table 4.3. Important factors when targeting land conservation to protect water quality. Developed with information from the following sources: Upper Neuse Clean Water Initiative 2015; Ernst 2004; Gartner et al. 2013; Krueger and Jordan 2014; TPL and AWWA 2005.

Landscape Characteristic	Why is it important?	Source
Natural land cover	Natural areas (e.g., forests, wetlands, natural grasslands) infiltrate and process pollutants.	Krueger and Jordan 2014; TPL and AWWA 2005; Gartner et al. 2013
Contributing area, Stream order	Contributing area or stream order data layers can be used to identify lands along small upland streams. Land uses in headwater streams have important impacts on downstream water quality.	Upper Neuse Clean Water Initiative 2015; Dodds and Oakes 2008
Proximity to surface waters	Land near or within the riparian area of surface waters has a major influence on streamflow and water quality. Protecting natural lands in the floodplain helps absorb flood waters, thereby mitigating flooding impacts (e.g., property loss).	Upper Neuse Clean Water Initiative 2015; Gartner et al. 2013; Krueger and Jordan 2014; TPL and AWWA 2005
Proximity to groundwater sources	Lands near or above aquifer recharge areas and wellheads are critical to protecting groundwater sources.	Gartner et al. 2013; TPL and AWWA 2005
Proximity to source water protection areas	Land use and human activities within areas draining to drinking water supply intakes pose the greatest threat to source water quality.	TPL and AWWA 2005
Slope	Steep slopes may be less stable and more prone to erosion.	Gartner et al. 2013; Krueger and Jordan 2014; TPL and AWWA 2005
Depth to water table	Lands above shallow water tables may be more prone to overland flow and erosion.	Gartner et al. 2013
Soil permeability	Soil with low infiltration capacity (i.e., lands prone to overland flow and erosion) or high infiltration capacity (i.e., lands with more direct pollutant pathways to groundwater sources) may be key to protecting water quality.	Upper Neuse Clean Water Initiative 2015; Gartner et al. 2013; Krueger

		and Jordan 2014
Soil erodibility	Lands with highly erodible soils, such as silt and clays, are more prone to erosion.	Krueger and Jordan 2014; TPL and AWWA 2005
Development threat	Growth area projections and related datasets can be used to help identify lands most susceptible to development or conversion to a land use with increased pollutant loading potential.	Mockrin et al. 2014
Proximity to protected lands	Landowners adjacent to existing conserved properties may be more willing to learn about opportunities to protect their lands.	Upper Neuse Clean Water Initiative 2015; WeConservePA 2021