



Urban Wetlands Protection and Restoration Guide

A resource to support efforts to restore and protect urban wetlands for economic, ecological, and social benefits

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wetlands for economic, ecological, and social benefits*

The Association of State Wetland Managers, Inc.

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Introduction

This guide summarizes the findings of a two-year project carried out by the Association of State Wetland Managers (ASWM) with assistance from a national interdisciplinary workgroup of experts to identify ways to enhance, protect, and restore wetlands within and surrounding urban areas to maximize economic, ecological, and social benefits for urban communities.

Wetlands help make urban areas more livable by lessening the impacts of flooding, diminishing the urban heat island effect, filtering stormwater, replenishing groundwater, improving air quality, and providing green spaces needed by people and wildlife alike in areas often dominated by development and impervious surfaces. Yet local community leaders are often unaware of the benefits urban wetlands currently provide or could provide, and state wetland managers frequently view them as being too degraded or facing too many stressors to be prioritized for restoration or protection under programs with limited resources. As a result, these critical resources are often neglected or in-filled for development, limiting the benefits they provide to urban communities.

This guide provides a road map for future efforts to improve policies, programs, and actions that restore and protect urban wetlands. While being of greatest use to individuals at the local government level who are just beginning to consider urban wetland management, information contained within will also benefit more advanced local planners and provide recommendations to state and federal agencies on how they can better support local wetland partners.

After an opening discussion on the benefits and challenges facing urban wetlands, this guide presents a high-level overview on three topic areas that are important to improving urban wetland management: mapping, assessment, and prioritization; policy tools; and funding and financing mechanisms. Under each of these topics the authors highlight important opportunities and barriers to consider through informative examples and useful resources. Each chapter concludes with a list of recommendations that the user should be mindful of while working on an urban wetland project.

The topic areas have generally been organized in a way that will make sense for those looking to develop a long-term sustainable urban wetland program but is by no means meant to represent a definitive stepwise plan for building an urban wetlands program. Each user's needs will vary based their specific circumstances and desired outcomes. The guide also does not provide information on methods or best practices for conducting urban wetland restoration, although more information is needed on this topic given the many unique challenges urban wetlands face. This guide focuses on the planning, protection, and funding that often precipitates restoration activities. For information on wetland restoration best practices, we direct the user to ASWM's white paper, [*Wetland Restoration: Contemporary Issues and Lessons Learned*](#), as much of the information contained within is useful and relevant to urban settings, such as setting realistic, measurable goals and planning with a wider watershed focus.

CHAPTER 1: Urban Wetlands Overview

Defining Urban Wetland and Other Key Terms

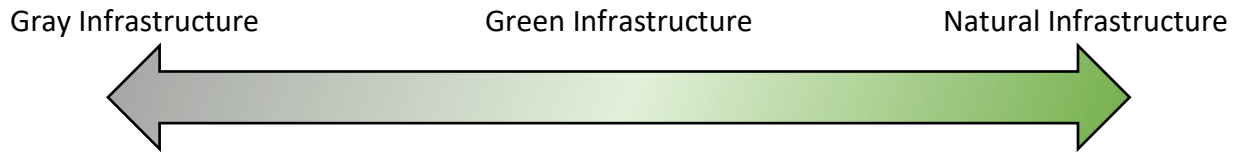
Setting a firm definition of what does and does not constitute an urban wetland at the outset of a guide designed to aid in the management of urban wetlands would seem like a logical place to start. But, as any wetland manager can attest, defining wetlands can get complicated. Scientific definitions of wetlands frequently do not align with regulatory definitions of wetlands and regulatory definitions of wetlands can vary from state to state, between state and federal agencies, and can change over time based on U.S. Supreme Court decisions (e.g., the [SWANCC](#) and [Rapanos](#) decisions in 2001 and 2006 respectively). This inconsistency of language can become a significant barrier to wetland management as it creates uncertainty around what is and is not regulated and can make it difficult to integrate wetland management goals across programs that should otherwise be compatible.

Likewise, defining what does and does not constitute an urban area can be challenging. Should it be based on population size or density, degree of disturbance, amount of impervious cover, or some other factor? No matter how you answer this question, lines will be drawn that are, to some extent, arbitrary. Other key terms used throughout the document, such as green infrastructure and natural infrastructure, present similar issues. For example, is a wetland created specifically for stormwater management defined as natural infrastructure or green infrastructure? The answer could depend on who created the wetland, why they created the wetland, where the wetland is sited, whether the wetland is able to maintain a natural ecosystem balance on its own or requires maintenance, and other variables.

Considering these challenges, we present the below key terms and descriptions as a general guide for how the terminology is used throughout this document rather than strict definitions.

Urban Wetlands: Key Terms and Descriptions
<ul style="list-style-type: none">• Gray Infrastructure – Human engineered and constructed systems that are typically designed to provide one specific function. Examples include wastewater facilities, detention ponds, and piping.• Green Infrastructure – Intentionally designed systems that mimic natural functions to achieve specific desired outcomes but may provide co-benefits. Examples include green roofs, rain gardens, bioswales, and rainwater harvesting systems.• Living Shoreline - A protected, stabilized coastal or other surface water edge made of natural materials or a combination of natural and human-made materials that provide co-benefits such as storm surge protection and habitat.• Natural Infrastructure – Natural ecosystems, such as wetlands and floodplains, that provide desirable outcomes, including floodwater attenuation, storm surge protection, nutrient reduction, or increased natural habitat and provide multiple co-benefits.• Nature Based Project – A project that focuses on the restoration, protection, and management of naturally occurring systems such as wetlands or floodplains to achieve desirable outcomes.• Urban Wetland – Wetlands within and immediately adjacent to populated areas, including cities and towns, that provide economic, ecological, and social benefits for those communities. Urban wetlands may be naturally occurring or created.

When it comes to the differences between green and natural infrastructure, users may find it easier to visualize these categories as existing on a spectrum with traditional gray infrastructure at one end, green infrastructure in the middle, and natural infrastructure at the far end. Many urban projects will not fit neatly into any one category but will instead fall somewhere in between depending on context. Application and understanding of these terms are somewhat flexible and we encourage the end user to think on how they apply to their unique situation.



Value of Urban Wetlands

Wetlands in and around urban spaces play an important role in making cities and towns more livable. They help clean water, reduce flood risk, filter stormwater, replenish groundwater supplies, reduce the urban heat island effect, offer habitat to important plant and animal species, and provide critical access to green spaces in areas that are often dominated by the built environment. These services translate into tangible ecological, social, and economic benefits for surrounding communities.

One of the most important services that wetlands provide in the urban context is hazard mitigation. By spreading and slowing water during peak rainfall events, dissipating energy from storm surge, and retaining water through dry periods wetlands can help mitigate numerous forms of natural hazards. A study of regional flood damages resulting from Hurricane Sandy found that coastal wetlands located in the northeastern United States prevented \$625,000,000 in flood damages. Despite low contributions to risk reduction relative to overall damage incurred, the few wetlands that protect highly urbanized areas such as New York City were shown to have high absolute values due to the significant amount of built infrastructure and human life resources they protect (Narayan et al, 2017). Natural infrastructure and nature-based solutions have been found to be equally or more effective than conventional structural approaches at achieving hazard mitigation goals and are often more cost effective when considering long-term maintenance and the co-benefits that they provide (Glick et al, 2020). As climate change advances and urban communities experience extreme weather events with greater frequency, the role that wetlands play in providing climate resiliency and hazard mitigation will become more significant.

Urban wetlands also play a critical role in managing and filtering stormwater and wastewater, and in doing so provide valuable water quality benefits. As demonstrated throughout this guide, many cities and towns across America are already recognizing and utilizing natural and created wetlands to support their urban water infrastructure. North Carolina's Charlotte-Mecklenburg Storm Water Services has developed a robust stream and wetland restoration program to support their water quality and water quantity goals. And in Phoenix, Arizona, the Tres Rios constructed treatment wetland provides an excellent example of how wetlands can support wastewater management goals while creating excellent habitat for plants and animals

and opportunities for outdoor education and birdwatching. An analysis of studies on the Tres Rios Environmental Restoration Project found that it would cost roughly \$5 billion to remove the same quantity of nitrogen from wastewater that the wetland is currently removing for the city of Phoenix, AZ (Childers, 2020). By recognizing and harnessing the benefits of wetlands, these programs reduce the need for additional gray infrastructure, reduce strain on existing infrastructure, extend their effective life, and gain additional co-benefits that wetlands provide.

Providing a point of access to nature for people and wildlife is another important service that urban wetlands offer. Wetlands are among the most productive ecosystems in the world, being home to an immense variety of plants, insects, amphibians, reptiles, fish, shellfish, and mammals, many of whom are uniquely adapted to these aquatic environments. Wetlands serve as important resource of food and water for non-aquatic species, vital stopping places for migratory birds, and critical reproductive habitat for many fish. In otherwise developed environments urban wetlands can represent critical natural resources to resident plant and animal species.

Human communities also benefit from access to natural spaces. A wide array of scientific literature exists supporting the links between mental health benefits and interaction with nature. Green spaces alleviate mental fatigue, provide a place for outdoor activity, encourage learning, create opportunities for outdoor education, and allow us to disconnect from the stressors of our daily lives. And by making urban spaces more desirable to live through restoration and protection of natural spaces communities can often see real economic benefits. A report examining the economic implications of urban floodplain restoration found an increase in property value, high value development outside of the floodplain, jobs and economic activity, business and employee attraction and retention, and tax revenue (Parsons et al, 2020).

Challenges Facing Urban Wetlands

Despite the benefits that urban wetlands provide, restoration and protection of these spaces occur less often and face greater barriers when compared to rural wetlands. At the state level, this is primarily a result of limited resources and programmatic priorities. Every state wetland program is unique and is designed to meet diverse state goals. However, they are all generally designed to either restore or protect wetlands that have high scores for condition already or have the potential for meeting high performance outcomes associated with wetlands of the same type and located in the same region (aka, reference wetlands). Urban wetlands will almost never meet the same level of condition or function as those that are located in more rural settings and that face fewer stressors. Due to the developed nature of the landscape surrounding urban wetlands, they are often small, hydrologically isolated, polluted, overrun with invasive species, contain legacy pollutants and/or have to handle stressors associated with

TRES RIOS WETLANDS

The Tres Rios Environmental Restoration project involves the rehabilitation of nearly 700 acres in and around the Salt River, restoring a vital wetland and riparian habitat. Reclaimed water from the wastewater treatment plant is pumped over to the wetlands, and the plants and animals take what they need before it is discharged back into the river. Tres Rios is now home to more than 150 different species of birds and animals like muskrats, raccoons, skunks, coyotes, bobcats, and beavers.

current land use practices either on or surrounding the site. As a result, urban wetlands frequently get lower rankings under state wetland monitoring and assessment programs, are assumed to have little chance of regaining ecological performance outcomes and receive lower prioritization when it comes to funding and state programmatic efforts.

Similar issues exist between federal wetland programs and urban wetlands. Section 404 of the Clean Water Act requires compensatory mitigation for actions impacting a federally protected wetland. Permittees can fulfill this requirement by purchasing credits from a mitigation bank, paying in to an in-lieu fee program, or through permittee responsible mitigation. Challenges associated with cost of land, land availability, and attaining ecological performance outcomes can result in compensatory mitigation for urban wetland impacts to be transferred outside of the urban area.

At the local level, the primary barrier is understanding. Many people are not aware of the benefits that wetlands provide, never mind urban wetlands specifically. A study of ecosystem service awareness demonstrated that ecosystem services were consistently under-recognized and this failure to recognize ecosystem services was greatest for the benefits provided by wetlands (McInnes, 2014). Even when local decision makers are aware of wetland benefits, there can be an expectation that all wetlands are already regulated or protected under state or federal programs and therefore do not require additional local attention. And in circumstances where neither of those factors are relevant, urban land managers are often just as limited with resources as state wetland managers, preventing them from taking a more active role in wetland restoration and protection. The cumulative impact of these circumstances is that urban communities are more likely to lose their wetland resources and the benefits they provide due to development or degradation while rural wetlands are more likely to be protected and restored. Given that urban counties are predominantly non-white and rural counties are predominately white (Parker et al, 2018), this issue highlights concerns around environmental justice and equitable allocation of state and federal resources and efforts in relation to urban areas and people of color.

Moving Forward

How do we move forward from here to improve outcomes for urban wetlands? At a fundamental level, we need to reassess why we pursue ecological restoration and protection of wetlands. Generally, restoration actions occur to regain lost wetland acreage and functions and to return those places to what ecological conditions would have been prior to anthropogenic impacts or as close to those conditions as can be reasonably expected. This is unquestionably a good goal, but it is not always a realistic one, especially in urban areas with high human populations and that face multiple stressors and can result in a disproportionate allocation of resources and efforts as discussed above.

Urban ecosystems are unique, not an ecological lost cause, and as such offer unique opportunities for biodiversity conservation (Lambert, Donihue, 2020). In an ideal urban setting, the human element is not an external force on ecological systems that needs to be managed, nor are natural systems pockets of nature in an otherwise human environment. The two

elements are integrated as part of a holistic social/environmental ecosystem. This distinctive urban social/environmental relationship can benefit from more realistic recognition of both benefits and limitations of management. At the state and federal level, this could present itself as providing greater restoration and protection resources based on potential functional uplift and relative functional value despite current or expected ecological condition. Doing so would help elevate urban wetland priorities in these larger programs and provide more flexibility for support even when ecological conditions do not or cannot match reference site conditions or be restored back to some level of historical pristine condition.

Even with wider adoption of this approach, the value of small, isolated urban wetland has the potential to be lost by state and federal programs which focus on a much larger geographic scale. For this reason, local or regional stakeholders are often better suited to facilitate restoration and protection of urban wetlands since they are more likely to recognize and directly benefit from the services they provide.

This guide aims to support this need by facilitating greater activity from local communities in the restoration and protection of urban wetland resources. In doing so it presents information and recommendations on three key topic areas that can help achieve this goal. Mapping, assessment, and prioritization tools can play a significant role in supporting urban land management. Policy mechanisms can help protect existing resources and incentivize restoration activity based on desired ecological, economic, and social goals. And identifying, accessing, and/or developing the right funding can help kick start an urban wetland project or maintain a broader, self-sufficient urban wetland program.

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CHAPTER 2: Wetland Mapping, Assessment, and Prioritization

The Basics

Wetland **mapping** at its most basic level involves the identification of existing wetland resources through remote sensing techniques such as aerial photography, lidar, or satellite imagery. A wetland inventory with no additional data beyond likely locations of existing wetlands can be used to help urban land managers highlight areas that may require permits for development activities and sites best suited for restoration and protection efforts, whether voluntary or required by wetland compensatory mitigation requirements.

Wetland **assessment** is the evaluation of wetlands for indicators of wetland ecological condition and/or function. Assessments generally require analyzing data on wetland plant and animal life, water quality, soil health, hydrologic connectivity, and/or surrounding land use practices. Assessments can be performed remotely or in the field. While remote assessments are naturally faster and less intensive to perform if the data and technical expertise are available, they are not a one-for-one replacement for field assessments. Instead, remote assessments provide an additional layer of information that informs decision making and improves efficiency around site identification and selection.

Prioritization uses the information from assessments to rank wetlands based on their ability or potential ability to help achieve desired goals or meet identified needs. Goals that shape prioritization plans are often ecologically driven, focusing on the need to preserve rare plants and animals and hard to replace ecosystems, but can also be shaped by the wetland's ability to provide ecosystem services that more directly benefit human health and well-being, such as reducing flood risk and urban heat island effects, or providing access to green space.

When data on wetland condition, function, and prioritization are built into publicly accessible geographic information systems (GIS), they can become powerful tools in the development and implementation of any wetland program but are especially impactful in the urban context to support sustainable development decisions and improve understanding of wetland presence and value. It is important to note, however, that these tools have limitations. For example, wetland identification through remote sensing should not be used to determine jurisdiction for regulatory purposes. These are first and foremost planning level tools that can provide a picture of where there is opportunity, but subsequent action is needed to build on the initial identification of location, size and type.

Data Scale and Complexity

Federal

Many wetland mapping tools exist throughout the United States at different spatial scales and with varying degrees of accuracy and complexity. The most broadly accessible wetland mapping tool is the U.S. Fish and Wildlife National Wetlands Inventory (NWI) Wetland Mapper. NWI provides information on wetland location, type, and size nationwide (at time of publication some portions of Alaska were not mapped). This tool is free to use and is easily accessible via a

web-based application but does have limitations, primarily the coarse scale at which the data has been collected, the variability in data accuracy due to when data collection occurred, and the lack of information on condition or function.

Because of the national focus, data for NWI is collected at a coarse resolution, meaning that it frequently fails to identify smaller wetlands common in urban areas. Additionally, some of the data collection used to support NWI occurred in the 1980s and 1990s and has not been updated since. This means that for parts of the country, NWI's maps are well out of date and have the potential to be inaccurate. Finally, most of NWI's wetland polygons include no information on wetland condition or function, providing only estimates of wetland type based on photo interpretation. Numerous states and tribes have taken the initiative to update all or sections of the NWI data for their program area and can provide a more accurate, higher quality product. As a result, limitations on data scale, accuracy, and complexity are variable from state to state within the Wetland Mapper and data accuracy should be assessed at the local level. Despite limitations, NWI is a useful resource for planning purposes, especially in states where data updates have occurred. NWI will not be able to provide all the detail and information that locally derived data can, but it is a good first step in developing an awareness of where wetlands may be located in an area and can benefit urban planning.

Other national level tools that can be beneficial in the urban context are the Community Rating System Explorer, which identifies areas eligible for Open Space Preservation credits under the Federal Emergency Management Administration (FEMA) Community Rating System (CRS), and the EPA's Environmental Justice Screening and Mapping Tool (EJSCREEN), which provides a national dataset for combining environmental and demographic indicators. Other federal datasets which can support wetland decision making as well as the development of localized tools include, among others, the USGS National Hydrography dataset, NRCS soils data, and USFS National Riparian Area dataset.

State

Some states have taken an additional step and developed state specific tools that provide more accurate and detailed information than NWI to support decision making. Examples of such state tools and brief descriptions are included below:

Nevada's Wetland Analysis Toolbar (WetBar): WetBar was developed along with the statewide Wetland Map of Nevada. Incorporated into the Wetland Map of Nevada, WetBar provides users with various information on wetland sites including hydrologic, climate, land ownership, and wetland type and links in real time to Google Earth Engine. WetBar was developed by the Nevada Natural Heritage Program and the Desert Research Institute to support wetland assessments.

Virginia's Wetland Condition Assessment Tool (WetCAT): WetCAT is a GIS tool that provides functional assessment information on Virginia's non-tidal wetlands, focusing on their ability to enhance or protect water quality and provide habitat for numerous species. The tool is intended to support Virginia's Department of Environmental Quality (DEQ) regulatory decision-making process, allow reporting of wetland condition, and

support wetland related policy development. Development of WetCAT is done collaboratively between DEQ and the Virginia Institute of Marine Science.

Wisconsin's Wetlands by Design: Wetlands by Design was designed to support a watershed approach for wetland compensatory mitigation decisions and inform and enhance siting decisions for watershed planning. The tool ranks nested watersheds by the level of wetland service loss that they have experienced. For each individual Wisconsin Wetland Inventory (WWI) polygon and Potentially Restorable Wetland (PRW) polygon, the tool lists the modeled services including flood abatement, fish and aquatic habitat, phosphorus retention, sediment retention, nitrogen reduction, surface water supply, shoreline protection, carbon storage, and floristic integrity. This tool was developed by the Wisconsin Department of Natural Resources and The Nature Conservancy.

These tools represent improvements over NWI for local land managers in the states where they are available, but data scale at the state level is often still too coarse to be ideally suited for local decision making and priority functions selected by the state do not always align with local needs. Similarly, many states have developed wetland rating systems that can be utilized at the local level to support prioritization but as discussed in Chapter 1, these tools are often primarily focused on providing scores for ecological condition and function and are not ideally suited for urban wetland contexts. However, two examples with interesting potential applications in the urban context are found in Ohio and Washington:

Ohio's Rapid Assessment Method for Wetlands (ORAM): ORAM categorizes wetlands based on their ecological quality and level of function. Wetlands receive differing levels of protection based on how they are categorized. Category 1 wetlands correspond to low quality while category 2 and 3 wetlands correspond to medium, and high quality, respectively. Within category 2 there is an implied fourth category for wetlands which are degraded but have a reasonable potential for reestablishing lost wetland functions. The inclusion of a subcategory within category 2 wetlands has potential for elevating urban wetlands given their significant potential for functional uplift. If restoration goals are firmly aimed at attaining category 3 status though, urban wetlands will remain under protected because of their landscape driven limitations.

Washington State Wetland Rating System: The Wetland Rating System groups wetlands into four categories based on their sensitivity to disturbance, rarity, ability to replace them, and ability to provide functions. The system also includes consideration for the ability of the wetland to provide value (flood protection, habitat, nutrient reduction, etc.) as well as the ability of the surrounding landscape to support a value (hydrologic functions, water quality, habitat, etc.). For example, a wetland may have the ability to remove a significant amount of nutrient pollution but if the surrounding landscape does not have nutrient pollution run off then the landscape potential would be low. Washington's factoring of ability to provide a value and landscape ability to support a value could elevate urban wetlands when one considers their outsized ability to provide social and economic value through services like flood mitigation and access to outdoor education and recreation due to their proximity to population centers and

infrastructure. Also, wetland assessments aimed at identifying and elevating for protection wetlands that are rare or difficult to replace are generally focused on ecological factors. For example, forested wetlands often receive additional protections because of the long timeframe required to achieve restoration or mitigation goals. If this idea of elevating protection and restoration for difficult to replace wetlands was considered, not just for ecological reasons, but based on challenges in siting within the same local watershed or challenges in replacing lost social value, urban wetlands could receive greater protection due to the difficulty of siting and achieving wetland restoration or creation within urban areas.

Local

Locally developed data and tools provide the best resources to support local planning and local needs. Functions vary throughout the watershed and available functions do not always correlate to need so the more localized the data the better it will represent desired ecosystem services and functional uplift. Examples of regional and local mapping and prioritization tools with brief descriptions are presented below to highlight this point.

White Oak Bayou Watershed: In 2016 the city of Maumelle, Arkansas completed a wetland priority map of the 42 square mile White Oak Bayou Watershed, which falls within portions of the cities of Maumelle and North Little Rock. The priority map was completed after years of wetland mapping efforts, wetland assessment development, and data collection. Wetlands were categorized into high, medium, and low priority areas. Wetlands categorized as high receive priority for preservation, restoration, or enhancement under USACE mitigation requirements. Categorization was determined based on the score of seven ecological and socio-economic factors which were identified and selected by local stakeholders. As of 2018, approximately 375 acres of wetlands and an additional 45 acres of protected wetland buffer were protected under USACE conservation easements as part of compensatory mitigation for wetland impacts in the White Oak Bayou watershed.

Superior Special Area Management Plan: In 1996 the city of Superior, Wisconsin adopted a Special Area Management Plan (SAMP) as a means of simultaneously improving wetland permitting efficiency and protecting high value wetlands. Through SAMP, the city of Superior can issue general permits for activities requiring Clean Water Act section 404 permitting and Wisconsin Water Quality Certification, with oversight from state and federal partners. As part of this program, Superior has mapped all wetlands in the city and assessed them for ecological condition and function and the city only allows wetlands with severely degraded ecological conditions to be available under the SAMP general permit. Since the SAMP general permit administered by the city is significantly faster to obtain, developers are incentivized to focus their impacts on the low-quality wetlands while avoiding the high-quality wetlands.

Bellingham Washington CityIQ: The city of Bellingham, Washington has developed a robust, publicly accessible GIS mapping tool which includes data on wetlands within the city as well other many other attributes. Wetland data has been developed with periodic updates as well as with requirements that permit applicants provide wetland

delineation data in GIS format. Wetland data incorporated into the tool can be overlaid and reviewed with other related city projects or programs such as the Frequently Flooded Areas Assessment and planning information layers. This enables the city to make informed development decisions, comply with local ordinances, and identify restoration and preservation areas. The city has also developed a Habitat Restoration Technical Assessment which prioritizes different habitat sites, including wetlands, by the potential for uplift compared within the urban project area, not to full functioning ecosystems outside the city.

Lake County Potentially Restorable Wetlands Layer: In 2020 the Lake County, Illinois Stormwater Management Commission made public the Potentially Restorable Wetlands data layer to provide potential wetland function information for all existing and historic wetlands across the county to support protection and restoration efforts. The tool built on the previously completed Lake County Wetland Inventory (LCWI) utilizing aerial imagery, lidar mapping, NRCS soil surveys, NWI data, and field surveys to update LCWI polygons to reflect changes that have occurred since the LCWI was last updated and to assess the wetlands for thirteen key functions. The tool was finalized and rolled out for public use in 2020 and has already been used to identify a potential project location and obtain Clean Water Act section 319 funding for wetland restoration and is being used by mitigation bankers to select project sites.

These examples demonstrate how localized wetland mapping and prioritization can be successfully implemented to achieve desired outcomes. The cities of Maumelle, AR and Superior, WI have both used their mapping and prioritization to drive desirable development decisions and preferred restoration and protection site selection. Bellingham, WA and Lake County, IL have utilized their tools to integrate wetland management into a broader array of city initiatives (planning, flood reduction, stormwater management, and habitat restoration). And in each case, the local entity was at least aware of the benefits that wetland management would provide to local communities, if not specifically accounting for them, as well as the limitations of restoration and protection of wetlands inherent to the built environment.

These outcomes were made possible because localized data on wetland condition, function, and ranking were built into publicly accessible mapping resources that provide a powerful tool for education, land use decisions, and efficient implementation of resources. **Table 1** summarizes some of the benefits of utilizing local wetland mapping and/or prioritization tools and highlights the added benefits when these two tools are combined and made available to the public.

Local Wetland Mapping and Prioritization Tools			
Potential Benefits	Mapping	Prioritization	Combined
Educate community on wetland presence	✓	X	✓
Educate community on wetland value	X	X	✓
Inform land use decisions	✓	✓	✓✓
Facilitate permitting process	✓	✓	✓✓
Improve restoration/protection site selection	✓	✓	✓✓
Improve wetland management outcomes	✓	✓	✓✓
Increase opportunity for integration	✓	✓	✓✓
More efficient and accurate cost-benefit analysis	X	✓	✓

Table 1: Benefits of Local Wetland Mapping and Prioritization Tools. X indicates the benefit is not provided. ✓ indicates the benefit is provided. ✓✓ indicates benefits are improved through combination.

Recommendations

The following recommendations are intended to provide ideas for state, tribal, regional, and local agencies to consider when developing a wetland mapping or prioritization program that can support better urban wetland management. These recommendations may not be immediately possible for many agencies due to resource constraints and should be seen as potential goals to consider. They are not weighted or presented in any specific order as needs will vary, so we leave it up to the user of this guide to assess which are appropriate for their circumstance.

Recommendations to Local Agencies

- Work with community stakeholders and partners to determine priority functions, services, and uses for a geospatial mapping and prioritization tool.
- Determine if existing resources, such as the National Wetland Inventory or a state tool, can meet desired needs.
- Consider upkeep costs and strategies. Bellingham’s example of requiring permit applicants to provide GIS data for wetland delineations is one option to consider.
- Work directly with federal and state partners for technical and funding support.

- *Integrate mapping initiatives with other programs that could benefit from such an effort, including stormwater management, flood management, and planning and development.*
- *Integrate wetland prioritization with social goals and values such as environmental justice. This is particularly important for urban wetlands given proximity to social environments and populations centers.*
- *Focus on goals associated with human health and safety. These can be easier to get support for than purely ecological goals and are particularly important in urban areas.*
- *Leverage the human capital in urban areas through citizen science initiatives or private-public partnerships to support monitoring and assessment and strengthen community buy-in.*
- *Use mapping to select restoration sites within the context of local watersheds, not municipal boundaries, to derive the best benefit.*
- *Remember the limitations of the mapping tools. They are primarily planning tools and do not replace field delineations or assessments. Wetland maps are merely regulatory boundary approximations and should not be used to determine jurisdiction alone.*

Recommendations to State Agencies

- *Make state developed mapping and assessment resources, methodology, and data available to local agencies and the public when possible to support greater use of the information and increase opportunities for partnerships and integration.*
- *Provide financial and/or technical support when possible to local stakeholders interested conducting monitoring and assessment programs.*
- *Engage communities when developing or updating mapping initiatives. Do not embark on mapping efforts without seeking local input on focus and direction.*
- *Coordinate efforts among various local agencies to support information sharing and resource support.*
- *Incorporate goals for local inventories or mapping initiatives into your Wetland Program Plan.*
- *Elevate the importance of functional assessment and functional uplift as criteria for prioritization, particularly with functions associated with human health and well-being.*

Section Resources

Bellingham City IQ and Habitat Restoration Technical Assessment

<https://maps.cob.org/geviewer/Html5Viewer/Index.html?viewer=cityiq>

<https://cob.org/services/environment/restoration/restoration-plan>

Community Rating System Explorer

<https://coastalresilience.org/project/community-rating-system-explorer/>

EPA's Environmental Justice Screening and Mapping Tool

<https://enviroatlas.epa.gov/enviroatlas/DataFactSheets/pdf/Supplemental/EstimatedFloodplains.pdf>

Lake County Potentially Restorable Wetland Layer

<https://www.lakecountyil.gov/2531/Wetland-Restoration-Preservation-Plan>

<https://eri.iu.edu/erit/case-studies/lake-county-wetlands-tool.html>

Environmental Law Institute Citizen Science Programs at Environmental Programs: Case Studies.
<https://www.eli.org/sites/default/files/eli-pubs/eli-citizen-science-case-study-report.pdf>

Nevada's Wetland Analysis Toolbar
<https://www.dri.edu/project/wetland-mapnvnew/>

Ohio Rapid Assessment Method for Wetlands
<https://www.epa.ohio.gov/Portals/35/401/ORAM%20Manual%205.0.pdf>

Superior Special Area Management Plan
<https://www.ci.superior.wi.us/565/Special-Area-Management-Plan-SAMP>

U.S. Fish and Wildlife National Wetlands Inventory Wetland Mapper
<https://www.fws.gov/wetlands/data/mapper.html>

Virginia's Wetland Condition Assessment Tool
<https://www.deq.virginia.gov/water/wetlands-streams/wetcat>

Washington State Wetland Rating System
<https://apps.ecology.wa.gov/publications/documents/1406030.pdf>
<https://apps.ecology.wa.gov/publications/documents/1406029.pdf>

White Oak Bayou Wetland Management Plan
http://www.whiteoakbayou.com/media/WOB-WMP-Jan_2018rev2.pdf

Wisconsin's Wetlands by Design
https://dnr.wi.gov/topic/Wetlands/documents/reports/3_Wetlands_by_Design.pdf

CHAPTER 3: Policy Tools for Restoration and Protection

This chapter presents a range of policy tools as options for local governments to improve urban wetland management. Some will likely be familiar, such as local ordinances, while others may be less so, such as mitigation banks or market mechanisms. Each section includes a high-level summary of what the tool is, the different forms it can take, how it has or could be used to support urban wetlands, and limitations or challenges. Whenever possible, real world examples have been used to demonstrate their application in a wetland context. This guide does not get into detailed recommendations around the development or implementation of the various tools. Instead, our goal is to present overviews of available options for further consideration and to share resources at the end of the chapter that go into greater detail for those interested in learning more about specific options.

Wetland Ordinances

One of the best ways for local governments to enhance wetland protection and restoration is by adopting local wetland ordinances. Wetland ordinances can be designed to be stand-alone regulations, focusing on the protection of wetlands solely for the services and values they provide, or as a component of larger programs such as shoreline management, stormwater management, flood risk reduction, water quality protection, or general comprehensive

Transfer/Purchase of Development Rights

Transfer or purchase of development rights (TDR and PDR respectively) are one possible option for wider community planning approaches that wetland protection can be built into. TDR programs are designed to allow landowners to sell development rights on their land (sending land) to developers. Developers use those rights to build elsewhere in a location determined to be desirable for development by the community (receiving land). The selling land property becomes protected by a conservation easement, but the property owner retains all other rights to the land. PDR works under the same principle but with the government acting as an intermediary by purchasing and selling the development rights. This can be an effective tool for growing cities looking to preserve larger areas of open space while encouraging focused development. Although not a wetland specific tool, its potential for general conservation, including wetlands, is significant in the right context. An example of a TDR program can be found in [Mequon Wisconsin](#).

planning. Typically, wetland ordinances require permitting for impacts in wetlands and wetland buffers, utilize zoning restrictions to discourage development in or near wetlands, and stipulate mitigation requirements for unavoidable wetland impacts. These processes result in greater oversight of wetland impacts, help to reduce wetland loss, and sometimes strive to achieve net wetland gains.

Several states have developed regulations requiring local or regional governments to develop local wetland protections or implement state programs. Washington state's Growth Management Act (GMA) requires all cities and counties in the state to adopt development regulations known as Critical Area Ordinances (CAOs) that protect five categories of critical areas, including wetlands. The city of Bellingham, WA for example has developed a CAO that regulates most activities in a wetland and wetland buffer, requires a permit for regulated

activities to occur, and creates civil and criminal penalties for violations of the CAO. Permit applicants are expected to avoid, minimize, and restore all adverse impacts to critical areas.

Massachusetts' Wetland Protection Act requires local conservation commissions to implement the state regulations, which require review and permitting for actions that may alter wetlands and other aquatic resources. Although not required to adopt local ordinances, most communities in Massachusetts have voluntarily chosen to provide additional protections above and beyond those offered by state and federal regulations. Other states that require local wetland regulatory activity include Connecticut, Florida, Maine, Maryland, Minnesota, and Wisconsin.

Most states however do not require local wetland regulatory protections. In these cases, cities and towns that are interested in developing wetland ordinances need to first determine whether they have the authority to do so. Local governing authority varies from state to state, with some local governments having broad authority provided in their state constitution, while others have limited authority, dependent on the state granting authority for certain actions through statute. Boulder Colorado's Stream, Wetlands, and Water Body Protection Regulations is one example of a local developed wetland regulation ordinance. The program is designed to preserve, protect, restore, and enhance the quality and diversity of wetlands and water bodies and it accomplishes this through permitting and mitigation requirements for impacts within wetlands and wetland buffers.

In some communities, lack of appropriate authority to enact wetland ordinances will be the biggest and only barrier to adoption. Where this is not the case, one common challenge is confusion surrounding state and federal wetland jurisdiction. Many communities have a perception that all wetlands are protected by state and federal regulations and therefore don't require additional protection. Another major barrier relates to developing and implementing clear and effective wetland regulations. Both barriers can be addressed with greater outreach, communication, and partnership with federal, state, and local partners.

Buy-out Programs

Buy-out programs are used to reduce flood risk by purchasing properties in flood prone areas, demolishing existing infrastructure, restoring the site to more natural conditions, and maintaining the property as open space. In many cases, buy-out programs occur in response to flood events where damages were incurred. In these instances, private property owners are given the opportunity to accept pre-disaster fair market value for their property and relocate out of the floodplain and away from flood risk. Less common are programs that are pre-emptive to flood mitigation, but the same principles apply with property owners having the option to accept market value for their property and relocate out of the floodplain. In both cases, flood risk is reduced directly through the removal of infrastructure and human life from a flood prone area and indirectly with other properties in the area benefiting from the presence of open space for floodwaters to spread into. They also offer the potential bonus to local communities of reducing flood insurance premiums through the Federal Emergency Management Administration's (FEMA) Community Rating System, which credits communities

for taking actions to reduce flood risk, including acquisition and relocation of infrastructure in floodplains. Although not specifically targeting wetlands, buy-out programs often result in wetland restoration and protection since wetlands are frequently found in the floodplain. Buy-out programs can be particularly advantageous to pursue in the urban context because they address one of the most significant challenges facing urban wetland restoration, lack of publicly held land, by creating a viable way to incentivize voluntary transfer of privately held land to public control.

A significant barrier to implementation of buy-out programs is access to the funding required to purchase properties and perform demolition and restoration. Federal programs, including FEMA's Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Building Resilient Infrastructure and Communities (BRIC), as well as the U.S. Department of Housing and Urban Development's (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) funds, are frequently used to support buy-out programs. However, access to funding can be dependent on major disaster declaration and funding allocation from Congress, as is the case with HMGP and CDBG-DR, and can entail difficult application and administrative requirements such as detailed cost-benefit analysis of planned projects and cost share.

Many states operate their own buy-out programs or other flood risk reduction initiatives that include buy-outs as one possible option. State program funding varies, with some almost exclusively relying on the above federal programs to support buy-outs, while others allocate significant state funding to support their program. State programs also vary widely on funding eligibility, application requirements, and cost share requirements. For example, Washington state's Floodplain by Design program has a 20 percent matching funds requirement, which can be waived for qualifying economically distressed communities, while Wisconsin's Municipal Flood Control Grant program requires grantees to meet 50 percent cost share. Given the competitive nature of these grant programs, whether at the state or federal level, and the broad geographic area that they cover, local communities may find it challenging to fully meet their flood risk reduction and open space conservation goals through these programs alone.

Charlotte-Mecklenburg Storm Water Services' (CMSS) Floodplain Buy-out (Acquisition) Program is one example of a local/regional entity that has taken steps to fill this gap. In 1999, CMSS established a floodplain buy-out program to address challenges resulting from multiple flood events. Much of the early work accomplished under the program was funded with FEMA Mitigation Grant programs, however CMSS also instituted a Major System Storm Water Fee that established a "rainy day fund" for the purchase of damaged or distressed properties after a damaging flood event. This "rainy day fund" has provided funding for 68 acquisitions since 2003. Since 2012, CMSS has funded all costs associated for most buy-outs, which have been prioritized and selected based on local risks and needs with CMSS money from stormwater fees and other partners. Through this program, CMSS has acquired 185 acres of properties which has avoided an estimated \$25 million in losses.

Mitigation Banks

Wetland mitigation banking is a system that generates mitigation credits through wetland restoration and protection activities which can then be sold to developers to meet regulatory requirements of compensatory mitigation. The U.S. Army Corps of Engineers [2008 Mitigation Rule](#) outlines the requirements for mitigation banking and a preferred hierarchy of mitigation options: 1) mitigation banking, 2) in lieu fee, and 3) permittee responsible. Overall, wetland mitigation banks are generally desirable for three reasons. First, mitigation banks invest in restoration before impacts occur – so there is no temporal loss of wetland functions as is typically the case with permittee responsible or in lieu fee mitigation. Second, mitigation bank practitioners are almost always more experienced at performing restoration than the entity (developer or otherwise) who has to mitigate for impacts and the mitigation bank has a monetary incentive in reaching required ecological metrics in a timely manner in order to receive payment for their mitigation credits. And third, mitigation banking makes permitting easier and more reliable for development since the permittees no longer have to perform the mitigation activities themselves or contract another company to perform it.

From an urban specific context, locally controlled mitigation banks offer two additional benefits. First, is that it can prevent wetland mitigation from being transferred outside of the urban area as discussed in Chapter 1 since local entities can control where the wetland restoration will occur. Second, when local governments operate a mitigation bank, the price of credits can be adjusted depending on local goals. Communities can keep the cost of credits low by setting the price at or near production costs to benefit the development community and incentivize them to work with the local mitigation program instead of pursuing other mitigation options; or communities can sell credits at a profit to help fund other wetland other restoration and protection goals. Challenges from urban wetland mitigation banks include the sizable upfront investment required to get through planning and restoration activities before credits can be sold and the significant barriers to achieving required ecological outcomes in urban areas due to land availability, current and past land use practices, and local stressors to wetland condition.

One example of an urban wetland mitigation bank is New York City's (NYC) Saw Mill Creek (SMC) wetland mitigation bank. NYC Economic Development Corporation (EDC) decided to establish a wetland mitigation bank within NYC in response to infrastructure projects in the city facing costly and unpredictable permitting timelines. EDC worked with their local Interagency Review Team, state partners, and other local NYC agencies to identify a suitable site, negotiate number of credits, and develop a restoration plan for the site. All costs incurred during the multi-year planning process for the project were paid for by EDC. Once restoration began, challenges from soil contamination, historic dumping, and invasive species significantly increased costs and time to perform adequate restoration. In the fall of 2019, after nearly 10 years of planning and restoration, phase 1 of the project was completed with 54 acres of wetlands restored on Staten Island generating just under 13 credits. Credits are being sold for \$1.5 million, which represents a significant cost savings to development interests compared to the cost of mitigation before the bank was established. Given the sizable investment that EDC invested into the planning and restoration activities of this project, the process implemented

may not be ideally suited for transferability to other municipalities. Other large, highly developed cities like New York will likely face similar challenges in establishing mitigation banks. For this reason, this policy tool may be more appropriately implemented in smaller municipalities where site selection and restoration will not be as challenging to overcome.

Market Mechanisms

Market mechanisms are policy tools that are typically used to incentivize voluntary implementation of green infrastructure (GI) projects to help achieve desired water quality or water quantity outcomes. Market mechanisms are dependent on the presence of regulatory requirements for private property owners to manage water resources in some capacity. Typically, this requirement is fulfilled by regulations that stipulate certain levels of onsite stormwater retention or nutrient reduction. When a market is established, property owners within the given area can voluntarily implement an approved GI project. If the GI project exceeds the requirement of the site, the additional capacity of the project generates credits which can then be sold to other property owners to help them meet their regulatory requirements. Market mechanisms have primarily been used to support stormwater management and nutrient reduction programs, however examples of temperature credit trading programs also exist. The main benefits of credit trading programs are that they

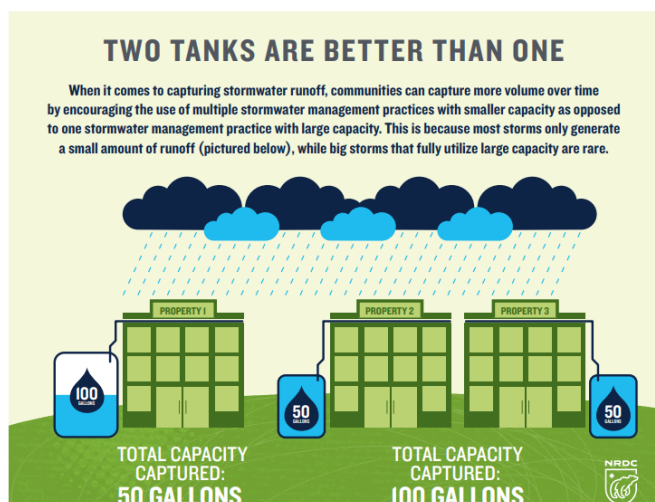


Figure 1 Two Tanks are Better Than One. (NRDC, 2016).

incentivize voluntary implementation of GI on private property and result in broader implementation of smaller GI projects. As we have mentioned previously, lack of public land that wetland restoration, or in this case GI implementation, can occur on is one of the most significant limiting factors in the urban context. By creating a monetary incentive for implementation of GI on private property, water resource managers can vastly increase the potential space for beneficial infrastructure projects. Furthermore, wider adoption of smaller GI projects can be more impactful than fewer large projects because there is less wasted potential during smaller rain events. This

principle is demonstrated in **Figure 1**. Although targeting GI development, most markets reviewed as part of this project include wetland restoration, enhancement, and/or creation as an approved option for generating credits. That being said, wetlands may not always be well-suited for widespread adoption in these programs due to challenges with space and private property owners' desire for efficiency (as described below).

Washington D.C.'s Stormwater Retention Credit Trading (SRC) Program is an ideal example to highlight limitations on the applicability of market mechanisms for urban wetland restoration and to manage expectations pertaining to this option. Although D.C.'s SRC program does

identify wetland restoration, enhancement, and creation as a possible option to generate credits, wetlands have never been employed to generate credits in the 8 years that the program has been operating. The two primary reasons for that is that land is at a premium in the District and wetlands are not the most space efficient way to generate retention credits. Project developers prefer options that require less space and generate more credits, like bioswales. Although wetlands provide more co-benefits than traditional GI options, those co-benefits that are difficult to quantify (i.e., public goods such as improved mental health by living near open space, habitat for species, etc.) are typically not monetized and therefore do not directly benefit the individual generating credits. These barriers will likely be consistent in any city where space is limited. In cities and towns that are still growing however, there is potential for this mechanism to be useful, especially if protection of existing resources can be used to generate credits.

Governments can also consider reimbursing individuals or providing tax or fee credits for individuals who protect or restore wetlands on their property to further incentivize voluntary action on private property or as a standalone program. This option would require less oversight and administration to establish and operate but likely would not provide the same level of incentive that a strong credit trading market can provide.

Recommendations

The following recommendations are intended to provide ideas for state, tribal, regional, and local agencies to consider when looking to improve urban wetland management through policy mechanisms. These recommendations will not be possible or desirable in all situations. Users are encouraged to consider which options may work best for them given their needs and circumstance. Recommendations are not weighted or presented in any specific order as needs will vary.

Recommendations to Local Agencies

- *Seek input from local stakeholders to determine why wetland protection is important for your community. Select and tailor chosen policy options accordingly.*
- *Keep regulatory language short and understandable.*
- *Look for opportunity to integrate wetland management with other programs like stormwater management, floodplain management, or urban planning.*
- *If utilizing a buy-out program, try to group properties or prioritize those already near open space to improve benefits.*

Recommendations to State Agencies

- *Develop and share educational material on the value of local wetland protection.*
- *Develop and share educational material on the limitations of state and federal wetland regulations.*
- *Lower the barrier to implementation of wetland ordinances, local buy-out programs, mitigation banks, and market mechanisms with guidance documents and/or training materials.*

- *Create or highlight incentives for communities that adopt local controls or buy-out programs, such as lower flood insurance premiums through the Community Rating System.*
- *Encourage local controls that are at least as stringent as state and federal protections.*

Section Resources

Building Community Resilience With Nature-Based Solutions: A Guide for Local Communities.
https://www.fema.gov/sites/default/files/2020-08/fema_riskmap_nature-based-solutions-guide_2020.pdf

Building Demand in US Water Quality Trading Markets.
<https://www.conservationfinancenetwork.org/2019/09/25/building-demand-in-us-water-quality-trading-markets>

Charlotte-Mecklenburg Storm Water Services Floodplain Buyout (Acquisition) Program
<https://charlottenc.gov/StormWater/Flooding/Pages/FloodplainBuy-outProgram.aspx>

Coastal Restoration Toolkit
<https://restoreyourcoast.org/>

Community Development Block Grant – Disaster Recovery Toolkit
<https://www.hudexchange.info/programs/cdbg-dr/toolkits/>

Community Rating System: A Local Official’s Guide to Saving Lives, Preventing Property Damage, and Reducing the Cost of Flood Insurance.
https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_local-guide-flood-insurance-2018.pdf

Establishing a Stormwater Volume Credit Trading Program.
https://www.americanrivers.org/wp-content/uploads/2019/09/AR_StormwaterVolumeCreditTrading_Final.pdf

Floodplains by Design
<http://www.floodplainsbydesign.org/>

Green Infrastructure Effectiveness Database
<https://coast.noaa.gov/digitalcoast/training/gi-database.html>

How to: Stormwater Credit Trading Programs.
<https://www.nrdc.org/sites/default/files/stormwater-credit-trading-programs-ib.pdf>

Model Ordinances for Regulating Wetlands; Riparian Habitats; Stream Buffers
https://www.aswm.org/pdf/lib/model_ordinance_1209.pdf

Model Wetland Conservation Ordinance: A policy Development Tool for Wisconsin Counties, Cities, Villages, Towns, and Tribes.
<http://wisconsinwetlands.org/wp-content/uploads/2016/10/MWCO.pdf>

New York State Wetland and Water Course Protection Measures

https://www.dos.ny.gov/opd/programs/resilience/2_Wetland%20and%20Watercourse%20Protection_Measures_All.pdf

Planner's Guide to Wetland Buffers for Local Governments

https://www.eli.org/sites/default/files/eli-pubs/d18_01.pdf

Tackling Barriers to Green Infrastructure An Audit of Local Codes and Ordinances.

<https://www.seagrant.wisc.edu/wp-content/uploads/2018/09/GIAT.pdf>

Understanding and Managing Flood Risk: A Guide for Elected Officials

<https://www.floodsciencecenter.org/products/elected-officials-flood-risk-guide/>

CHAPTER 4: Funding and Financing Mechanisms

Funding is one of the biggest obstacles to greater local involvement in wetland management. Staff and administrative needs, site identification, land acquisition, restoration, and maintenance activities all require sizable financial investment. The ideal outcome from this section of the guide is that more local communities will develop long-term sustainable funding to support local wetland management. To that end, we start this chapter off by presenting various options to consider for providing ongoing local funding for wetland management and highlight communities that have already implemented that approach. However, in some circumstances a sustainable funding mechanism is not a realistic near-term option, and even when it is, additional funding is usually required to support those activities. Therefore, we also present mechanisms that can be used to support urban wetland projects (sustainable or otherwise) and share examples of common and alternative ways that they can be leveraged.

Sustainable Local Wetland Funding

Integrate with Existing Program

One way to produce long-term support for urban wetlands is by incorporating their management into an existing program such as planning and urban development, public works, stormwater, or parks. Wetland management does not need to be the sole or primary focus of a public program to produce better urban wetland management outcomes. One of the best things local communities can do is provide dedicated staff time to wetland management, even if that is only part of their assigned responsibilities. Taking this approach may require an increase in staff capacity, but elements of wetland management can also provide new revenue to support additional staff through wetland permit fees, mitigation bank credits, or in-lieu fee programs.

Many of the example communities we have already highlighted throughout the guide have taken this approach. Superior, Wisconsin's Special Area Management Plan, for example, is housed within its Public Works Administration and is funded by a city managed mitigation bank and wetland permit fee. Charlotte-Mecklenburg Stormwater Services in North Carolina funds much of its buyout and restoration activity through a stormwater fee. And Lake County Stormwater Commission in Illinois supports its wetland work, in part, with a wetland restoration in-lieu fee fund. One example that has not been presented yet but will be discussed more later in this chapter is the wetland work performed by Cleveland Metropolitan Parks (MetroParks). MetroParks has been involved in numerous wetland restoration projects in the Cleveland metropolitan area providing excellent opportunity for access to green space for those communities. MetroParks accomplishes this work primarily with outside funding sources but is also able to provide staff capacity through its budget to support project management, pursue funding options, and execute some field work.

Dedicated Wetland or Natural Resource Program

Another way to approach urban wetlands is with a program specifically dedicated to their management or natural resource management more generally. Bellingham, Washington's Natural Resources division of Public Works has developed a robust restoration and protection

program which it is able to tie into multiple programs and city initiatives including environmental education, stormwater management, sustainable development, water quality, and fish and wildlife habitat. The origins of this program unfortunately stem from an incident in 1999 where a ruptured gasoline pipeline resulted in a large explosion and killed 3 people. As a result, the city received a sizable compensation payment through the Natural Resource Damage Assessment process and created widespread political will to support broader environmental protections. This funding source and political backing provided Bellingham with the initial support it needed to get its program started and the benefits the program has provided has allowed it to continue doing that work. Currently, staff is funded through the city budget while projects rely on a mix of funds including grants, loans, and stormwater fees.

A different approach to dedicated program funding can be found in the San Francisco Bay Restoration Authority (the Authority) and the resulting parcel tax. The Authority was created in 2008 by the California state legislature as a regional body designed to identify new, local funding to support projects that protect, restore, and enhance San Francisco Bay. The Authority utilized significant outreach and communication efforts to identify what issues people in the region cared most about, how best to structure a local funding source, and determine when they had the necessary support to move forward. In 2016, ballot Measure AA was passed which instituted a 20-year, \$12 parcel tax in the nine county San Francisco Bay area generating approximately \$25 million annually to fund restoration projects in the region. Funding has been used to support a wide range of projects throughout the region that benefit habitat restoration, flood protection, shoreline access, economically disadvantaged communities, and natural resource education.

In both examples, widespread community support for environmental restoration was necessary before either program could be started. In Bellingham, it was unfortunately a tragic event that brought the community together around this issue and in San Francisco Bay it was the product of strategic polling and an aggressive advertising campaign. Both programs also required sizable financial resources to build the program in to what it has become. For Bellingham, it was the compensation received through the Natural Resource Damage Assessment process that provided this resource. For the Authority, it was a combination of grants, loans, and other similar resources that allowed the program to develop over the course of eight years before Measure AA was passed. These two elements, community support and a substantial funding source, are likely essential for most local governments looking to develop a dedicated restoration and protection program. Once a program is established and communities begin to see tangible ecological, social, and economic benefits, a successful program will typically generate greater public and private support and sustained funding.

As noted earlier though, sustainable funding mechanisms are not always realistic near-term options. Many local or regional bodies cannot just adopt wetland goals or protections into existing programs or develop dedicated programs. A significant investment in planning and preparation typically lead up to these actions and it may be necessary to demonstrate wetland value through pilot projects to garner necessary support. For these needs, one-off funding options like grants, loans, bonds, and private-public partnerships might be the best fit.

Grants

Grants can be a great way to support an existing project or program or get one started as there are a wide array of funding opportunities based on project needs or desired outcomes. However, grants can also present certain challenges including difficult application and management requirements, cost share, and identifying the right grant based on needs. To assist with this challenge, we present below some of the recurring or otherwise noteworthy federal grant programs identified during this project that can be used to support urban wetland projects. This is by no means meant to be a comprehensive list. Many other grant opportunities exist beyond the ones listed below. Users of the guide are strongly encouraged to consider regional, state, and foundation grant options in addition to other federal programs.

[Five Star and Urban Waters Restoration Grant Program:](#)

The U.S. Environmental Protection Agency's (EPA) Five Star and Urban Waters Restoration Grant Program provides supports for projects that focus on habitat restoration with strong elements of outreach, education, and community partnerships. The program requires projects to provide quantifiable results as well as a plan for sustained support beyond the grant period. Grants range from \$20 thousand to \$50 thousand, and recipients are required to meet or exceed a 1:1 match ratio.

[Community-Based Habitat Restoration Program](#)

The National Oceanic and Atmospheric Administration's Community-Based Restoration Program supports restoration projects that use a habitat-based approach to rebuild productive and sustainable fisheries, contribute to the recovery and conservation of protected resources, promote healthy ecosystems, and yield community and economic benefits. Although not required, applicants are encouraged to demonstrate a 1:1 cost share match.

[Wetland Program Development Grants :](#)

The EPA's Wetland Program Development Grants (WPDG) are best suited for entities looking to develop or build wetland program capacity by focusing on one or more of the Core Element Framework components. WPDGs assist state, tribal, local government agencies and interstate/intertribal entities in building programs to protect, manage and restore wetlands. States, tribes, local governments, interstate associations, and intertribal consortia are eligible to apply for the Regional WPDG Request for Proposals. However, WPDGs are capacity building grants and cannot be used for project implementation activities. WPDGs have a minimum 25% cost share/matching funds requirement.

[Building Resilient Infrastructure and Communities:](#)

The Federal Emergency Management Agency's (FEMA) Building Resilient Infrastructure and Communities program (BRIC) funding supports large hazard mitigation projects that can include elements of nature-based solutions. BRIC would be best suited for urban wetland projects that are designed to address hazard risk reduction such as property acquisition or floodplain restoration. Applicants are required to conduct a benefit-cost analysis as part of the application

process and must use FEMA approved tools to demonstrate cost-effectiveness. BRIC replaced FEMA's Pre-Disaster Mitigation program in 2020.

[Section 319 Grant Program](#)

Under Section 319, states, territories and tribes with approved nonpoint source management programs receive grant money that supports a wide variety of activities related to improving water quality through better non-point source pollution management. Section 319 funding decisions are made by the states and each state program varies but 319 grant funding was seen as a support across multiple urban wetlands example projects in this effort and should be considered by local entities as one possible option.

[Brownfield Grant Program](#)

The EPA's Brownfields program is best suited for restoration projects which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Brownfield grants can be used to support site assessments, clean up, and job training activities. Brownfields grants are particularly useful in urban projects due to problems associated with historic pollution and/or more recent illegal dumping in wetland areas.

[Bonds and Loans](#)

Bonds and loans are two funding mechanisms already used by many municipalities that can be employed more broadly to support urban wetland projects. As with grants, these mechanisms can support an existing project or program or get one started. However, there are a few additional elements that separate them from grants that need to be considered. First, the government entity, whether the city government or a specific department, must have the authority to take on a bond or loan. Second, the borrower must have a reliable funding source that can be allocated for repayment. For a city this could be general funds, for a stormwater agency it might be permit or stormwater fees. Third, bonds and loans are most efficient when they are large due to the administrative costs associated with accessing them. One way to approach for this urban wetland projects is by incorporating them into larger traditional bond and loan initiatives, such as those associated with large infrastructure improvements. Walnut Creek Wetland Park in Raleigh, North Carolina for example, benefited from over \$2 million for wetland restoration and development of an education center when the Parks and Greenway Bond passed in 2003, and Walnut Creek has continued to receive bond funding for various improvements since then.

A different kind of bond that can be used to support urban wetlands are Environmental Impact Bonds (EIBs). EIBs are a form of performance-based financing, where investors pay upfront costs for deploying environmental solutions and the "payor" (public or private entity that benefits) repays investors an amount linked to the achievement of agreed upon outcomes following project completion and evaluation. This is known as a "pay-for-success" model. EIBs have been adopted in Washington D.C., Hampton, Virginia, Buffalo, New York, and Atlanta, Georgia to address issues related to flooding and stormwater management. Atlanta's EIB was a \$14 million-dollar municipal bond aimed at providing funding for green infrastructure solutions

(including wetland restoration) to reduce flooding and water quality issues and improve quality of life in the Proctor Creek Watershed.

For loans, Clean Water State Revolving Funds (SRF) offer a perhaps under leveraged funding opportunity for natural infrastructure projects. Under the SRF program, EPA provides states with grant funding for a wide range of water infrastructure projects such as planning and construction of wastewater treatment facilities. States then provide those funds as low interest rate loans for eligible projects. As funds are repaid to the state, they go back into the SRF and become available for future projects. States are responsible for managing their SRF program and are given flexibility to support a range of projects including green infrastructure projects and projects that reduce non-point source pollution.

Some states have developed unique programs within their SRF to specifically fund habitat restoration and protection. For example, Ohio's Water Resources Restoration Sponsor Program (WRRSP), funds projects that result in the full protection and/or restoration of aquatic resources that either already meet or will meet Ohio's Water Quality Standards for streams or the highest level of the Ohio's Rapid Assessment Method for wetlands. Under the program, recipients of Ohio's SRF loans may voluntarily agree to sponsor a WRRSP project as part of their loan by entering into a formal sponsorship agreement with the WRRSP project implementer. The sponsor receives an interest rate discount of up to 0.1% on their SRF loan and the remaining interest from the WPCLF project is used to fund the sponsored WRRSP project. The principal loan amount is paid back into the SRF program for future loans as usually occurs in the SRF model. WRRSP funding is provided to implementors with no cost share requirement and no ceiling on the amount of the request. This funding mechanism has helped support numerous restoration and protection projects in Ohio including MetroParks' restoration of the former Acacia County Club, now the Acacia Reservation. WRRSP's requirement that restoration projects achieve high ecological outcomes does create barriers to using the tool in an urban context but the structure in general is one that could provide significant financial support for more projects if it were adopted more broadly.

Private-Public Partnerships

Private-public partnerships are partnerships between government and private entities to achieve desirable outcomes for both parties in a cost-effective way. Given the wide array of available partners and opportunities for collaboration, private-public partnerships can be an especially effective tool in the urban environment. Many of the examples already discussed in this guide have relied on partnerships to some extent but we present two new examples below where partnerships were fundamental to the project.

In South Portland, Maine, when EPA exercised its Residual Designation Authority (RDA) under the Clean Water Act to address water quality concerns resulting from urbanization in the Long Creek Watershed, local governments, private landowners, and others joined together to develop the Long Creek Watershed Management District (LCWMD). Through the LCWMD, participating entities coordinate water quality improvement efforts under a general stormwater permit. LCWMD projects cover a range of approaches including retrofits to existing stormwater

infrastructure, stream restoration, gravel wetlands, and porous pavement. LCWMD also provides other services to improve water quality such as street sweeping and catch basin cleaning. Activity by the LCWMD is funded by the annual fees paid by participating entities based on amount of impervious cover they operate. Participating entities include 88 private landowners, 3 municipalities, Maine Department of Transportation, Maine Turnpike Authority, and another quasi-public entity, ECO Maine. Regulated parties in the watershed were highly motivated to pursue this option as the alternative would have required each entity to obtain individual permits and perform site specific retrofitting projects at significantly greater costs than the anticipated costs under the watershed management district's coordinated program.

In a similar situation, private and public entities located on Money Point in Chesapeake, Virginia worked together to address site contamination issues and avoid EPA Superfund designation. Money Point is a stretch of primarily industrial properties along the South Branch of the Elizabeth River that, until recently, was one of the most contaminated areas of the river. These conditions created two notable issues. First, the presence of such contamination was an economic liability and hindered resale value. Second, the level of contamination present meant that the site was on EPA's radar as a potential Superfund location. Area community members were concerned that a Superfund designation would further negatively impact the perception of Money Point and would ultimately be less cost effective and less responsive to community needs in addressing environmental issues than a voluntary approach.

Under the coordination of the Elizabeth River Project (ERP), a community based non-profit organization, private and public partners completed a wide range of projects to improve the ecological health of Money Point. The primary effort was the dredging of over 80,000 cubic yards of contaminated sediment from hot spots in the river and restoring the sites to include new oyster reef, tidal marsh, and forested shore. Supporting activities from both private and public partners included upland site remediation, improved stormwater management through both green and gray infrastructure approaches, and conservation and restoration of other wildlife habitat areas and buffer zones.

Part of the motivation for the private industries to provide these voluntary measures came from the potential threat of Superfund designation. However, ERP also provides incentive through their River Star program. The program offers free technical assistance and public documentation for significant results in environmental stewardship. These partnerships typically result in measurable environmental benefits while benefiting the organization and community through reduced costs and positive public recognition.

Recommendations to Local Agencies

- Consider incorporating wetland management into existing programs by identifying priority ecosystem functions and how they can help achieve program goals.
- Consider pursuing grant options that focus on human health and well-being, not just ecological restoration.
- Incorporate wetland restoration and protection into larger loan or bond initiatives.

- Look to leverage private-public partnerships to access greater revenue sources and opportunities to conduct restoration on privately held land.

Recommendations to State Agencies

- Coordinate efforts among local agencies to support a watershed approach and pooled resources.
- Develop educational material on funding opportunities.
- Provide more flexible funding opportunities for wetland restoration that does not require achieving reference standard conditions.
- Design your Section 319 grant program and SRF program to be more supportive of restoration initiatives. For example, Ohio's SRF sponsorship program is a good model for other states to build from.

Section Resources

Bellingham Washington Natural Resources and Environment

<https://cob.org/services/environment>

Clean Water State Revolving Fund

<https://www.epa.gov/cwsrf>

Cleveland MetroParks

<https://www.clevelandmetroparks.com/about/conservation/natural-resources/resource-management>

Fact Sheet: Federal Resources for Nature-Based Solutions to Climate Change.

https://www.eesi.org/files/FactSheet_Nature-Based_Solutions_Funding.pdf

Long Creek Watershed Management District

<https://www.restorelongcreek.org/>

Money Point Revitalization

<https://elizabethriver.org/money-point-revitalization>

Ohio Environmental Protection Agency Water Resource Restoration Sponsor Program

<https://epa.ohio.gov/defa/wrrsp>

San Francisco Bay Restoration Authority

<http://sfbayrestore.org/>

Sharing Risk, Rewarding Outcomes: The Environmental Impact Bond

<https://www.quantifiedventures.com/blog/what-is-an-environmental-impact-bond>

Using State Revolving Funds for Land Conservation.

<https://www.conservationfinancenetwork.org/2018/05/21/using-state-revolving-funds-for-land-conservation>

Walnut Creek Wetland Park

<https://raleighnc.gov/places/walnut-creek-wetland-park>

CHAPTER 5: Conclusion

Urban wetlands provide tremendous value to local communities, but historically, restoration and protection of these resources has not been highly prioritized. Local governments are often best suited to fill this management gap because urban wetland benefits are best recognized at the local community level. However, confusion around existing regulatory protections, data gaps regarding wetland functions, and resource constraints make it challenging for local agencies to do more. Federal and state partners can play a critical role in supporting local governments by coordinating efforts among local organizations, involving local partners more substantially in state wetland program planning and implementation, and by providing educational material and technical support. Federal and state agencies can also support urban wetland programs by recognizing ecological limitations to restoration in urban environments and by providing greater flexibility in funding and regulatory programs to support restoration and protection of wetlands based on social and economic value, relative functional value, and potential functional uplift instead of focusing primarily on wetland extent and ecological condition as has been standard practice to date. When local governments do take on urban wetland management, mapping and prioritization tools help land managers better identify and quantify existing and potentially restorable wetlands, which strengthens decision making processes. Policy mechanisms such as local wetland ordinances and buy-out programs increase restoration and protection, especially when incorporated into broader community planning initiatives. And integrating wetland management programs and/or activities into existing city or town departments that benefit from wetland ecological services is a relatively easy way to support long-term, sustainable wetland program funding support. Below we summarize some of the reoccurring and most important recommendations throughout the guide.

Local Recommendations

- *Work with community stakeholders and partners to determine priority functions and ecosystem services. Projects are more likely to succeed when they are designed to address local community needs and interests.*
- *Consider benefits of wetland management to support social initiatives such as environmental justice. This is particularly important for urban wetlands given their often close proximity to underserved populations and should be accounted for whenever possible.*
- *Focus on benefits of wetland management associated with human health and safety. These can be easier to get support for than purely ecological goals.*
- *Consider integrating wetland management with related programs such as flood risk reduction, water quality management, stormwater management, planning and economic development, and parks and recreation.*
- *Work directly with federal and state partners for technical and funding support.*
- *Leverage the human capital in urban areas through citizen science initiatives or private-public partnerships to support monitoring and assessment and strengthen community buy-in.*

- *Select restoration sites within the context of local watersheds, not municipal boundaries, to derive the best possible outcomes.*
- *Set realistic expectations around ecological outcomes of restoration in the urban setting. Focus on functional uplift and improving desired ecosystem services.*

State Recommendations

- *Elevate the importance of functional assessment and functional uplift as criteria for prioritization, particularly with functions associated with human health and well-being.*
- *Engage communities when developing or updating wetland program plans or other large wetland initiatives such as mapping or development of wetland monitoring and assessment practices.*
- *Coordinate efforts among various local agencies to support information and resource sharing.*
- *Incorporate goals for greater local involvement in each core element included in your state Wetland Program Plan.*
- *Make state developed mapping and assessment methodology and data available to the public whenever possible to support greater use of the resources and increase opportunities for partnerships and integration.*
- *Provide technical support and training materials to local stakeholders interested in supporting wetland program goals.*
- *Develop and share educational material on the value of local wetland protection.*
- *Develop and share educational material on the limitations of state and federal wetland regulations.*
- *Create or highlight incentives for communities to become more involved in wetland management.*

Appendices

Appendix A: List of Urban Wetland Workgroup Members

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- Camille Beasley, Florida Department of Environmental Protection
- Todd Bridges, U.S. Army Corps of Engineers
- Jennifer Dietzen, Washington D.C., Department of Energy & Environment
- Sarah Edwards, The Pew Charitable Trusts
- Dave Fowler, Association of State Floodplain Managers
- Laurie Gilligan, Colorado Natural Heritage Program
- Letitia Grenier, San Francisco Estuary Institute
- Simeon Hahn, National Oceanic and Atmospheric Administration
- Melissa Harrison, Pennsylvania Department of Environmental Protection
- Stephanie Hayes Schlea, Association of Metropolitan Water Agencies
- Jasper Hobbs, Association of Clean Water Administrators
- Petra Hurtado, American Planning Association
- Nausheen Iqbal, U.S. Forest Service
- Kyle Magyera, Wisconsin Wetlands Association
- Linda Merchant-Masonbrink, Ohio Environmental Protection Agency
- Jeff Odefey, American Rivers
- Jamie Piziali, U.S. Environmental Protection Agency
- Tim Rach, Florida Department of Environmental Protection
- Myra Price, U.S. Environmental Protection Agency
- Andy Robertson, Saint Mary's University of Minnesota
- David Rouse, David Rouse Consulting
- Alex Schaefer, The Trust For Public Land
- Martha Shiels, University of Southern Maine
- Matt Stahman, Resource Environmental Solutions
- Marla Stelk, Association of State Wetland Managers
- Brian Watts, The Pew Charitable Trusts
- Lauren Williams, The Nature Conservancy

Recommended Enhancements to the Core Elements Framework to Increase Restoration and Protection of Urban Wetlands under State and Tribal Wetland Program Plans

INTRODUCTION

Wetlands in and around urban spaces play an important role in making cities and towns more livable. They help clean water, reduce flood risk, attenuate stormwater, provide storm surge protection, replenish groundwater supplies, reduce the urban heat island effect, provide habitat to important plant and animal species, and provide critical access to green spaces in areas that are often dominated by the built environment. These services translate into tangible ecological, social, and economic benefits for surrounding communities.

Despite these benefits, urban wetlands are often viewed by the public as wastelands to be infilled for development and too degraded to be worthy of protection or restoration by wetland managers with limited budgets. Additionally, regulatory requirements for mitigation from impacts to wetlands frequently allow mitigation to occur outside of the urban area because of challenges such as cost or availability of land, current or historic land use practices, and fragmented hydrology. As a result, urban wetlands are more prone to being developed and impacts that are allowed are often transferred outside of the urban area where the impact occurred, reducing the benefits the wetlands provide to the local communities.

One way to address this issue is through the Environmental Protection Agency's (EPA) Core Elements Framework (CEF). The CEF, drafted in 2008 is part of EPA's Enhancing State and Tribal Programs (ESTP) initiative, which was designed to lay out critical components of a state or tribal Wetland Program Plan (WPP). The CEF provides a menu of program-building activities available to states and tribes interested in developing or improving a WPP. The four Core Elements are:

- Monitoring and Assessment
- Regulation
- Voluntary Restoration and Protection
- Water Quality Standards for Wetlands

With strategic updates to the CEF, the EPA can help states and tribes develop WPP's that better recognize the valuable functions that urban wetlands provide, resulting in more equitable distribution of restoration and protection resources between rural and urban locations. To this end, an interdisciplinary workgroup of experts involved in various aspects of urban aquatic health collaborated to identify ways in which WPPs have been or can be used to support urban wetland protection and restoration and to turn those findings into recommendations for potential enhancements to the CEF. Recommendations are listed below with supporting evidence to provide context as to why the workgroup determined them to be important.

RECOMMENDATIONS FOR POTENTIAL ENHANCEMENTS TO THE CORE ELEMENTS FRAMEWORK

RECOMMENDATION 1: Update the CEF to more strongly encourage states and tribes to assess wetland functions and ecosystem services directly and to consider a wider suite of services including those that benefit human health and wellbeing.

The first core element identified in the CEF is the development of a monitoring and assessment program. Monitoring is the systematic observation and recording of current and changing conditions and assessment is the use of that data to evaluate or appraise wetlands. The CEF encourages states and tribes to develop a monitoring and assessment strategy consistent with *Elements of a State Water Monitoring and Assessment Program for Wetlands* (EPA, 2006). This resource states that “the condition of wetlands affects their capacity to support a beneficial use (e.g., aquatic life use support, including wildlife habitat)” and advises states and tribes to select indicators for their monitoring and assessment program that reflect wetland ecological health (hydrology, soil, and biota). Most state and tribal monitoring and assessment programs have followed this structure, assessing wetland condition with indicators such as presence of pollutants, occurrence of native versus invasive species, surrounding land use practices, and soil assessments. This data is then used by states and tribes to indicate a wetlands ability to support restoration efforts, meet regulatory goals and requirements, inform planning and prioritization, and integrate wetland management with other related programs.

Urban wetlands generally do not measure well when assessed based on indicators of ecological health since they are frequently small, hydrologically isolated, and face numerous stressors including current and historic pollution, detrimental land use practices in the surrounding area, high occurrence of invasive species, illegal dumping, etc. As a result, urban wetlands with low condition assessments are assumed to have a lower capacity to reach their full ecological potential and often receive lower prioritization when it comes to state programmatic restoration and protection efforts. However, although wetlands with impaired ecological conditions may be less able to reach their full ecological potential, they still provide critical ecosystem services and benefits for surrounding communities such as storm surge protection, stormwater attenuation, and access to green spaces for local communities.

States and tribes can capture a wider array of ecosystem services and benefits that urban wetlands provide local communities by adopting functional assessment procedures. Functional assessments measure the capacity of a particular wetland to provide a broad range of ecosystem services and benefits that can then be translated into indicators of value for social and economic benefits such as public health, increased property values, recreational benefits, and more. Doing so will result in higher prioritization of urban ecosystems and in turn greater restoration and protection of those areas. Additionally, functional assessment data can help states and tribes integrate wetland protection into a broader range of related policy areas (such as environmental justice, hazard mitigation, and resiliency), and can provide data for cost-benefit analysis of natural infrastructure projects.

To accomplish this, EPA should update the CEF to more strongly and directly encourage states and tribes to adopt functional assessment procedures in addition to condition assessments,

particularly with a focus on functions that impact human health and well-being. Although the CEF already recommends developing functional assessment procedures, EPA can update the language and messaging of the CEF to reflect the importance of functional assessments to developing a more balanced monitoring and assessment program, particularly for urban and suburban contexts. EPA should also consider revising *Elements of a State Water Monitoring and Assessment Program for Wetlands* (EPA, 2006) to reflect the same changes.

Finally, EPA should update the CEF to reflect advancements in Level 1 or landscape scale functional assessments. Currently, the CEF states that Level 1 assessments can provide a coarse gauge of wetland condition within a watershed, however remote sensing technologies and analysis techniques have seen significant development since the CEF was drafted, providing users with the ability to acquire relatively affordable landscape scale functional assessment data.

RECOMMENDATION 2: *Encourage states and tribes to consider supporting the adoption of wetland protection controls by local or regional governments.*

Even with wider adoption of functional assessments into state and tribal wetland programs, urban wetland values may still be lost at the landscape scale that these programs are typically focused on. This does not mean that urban wetland benefits are unimportant but that their benefits are sometimes better recognized at the local level. For this reason, local or regional governments are better suited in certain respects to manage these natural areas since they are more likely to directly benefit from the services they provide. However, they also often lack the necessary resources or regulatory mechanisms to take on this additional responsibility.

To lower these barriers and make it easier for local governments to adopt their own wetland protection controls, some states have adopted programs that either encourage or mandate that local governments develop wetland protection controls. Washington State's Growth Management Act in part requires all cities and counties in the state to adopt ordinances that protect critical areas including wetlands, areas critical for recharging aquifers, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas (WA Ecology). In Massachusetts, local conservation commissions are tasked with implementing regulations under the state's Wetland Protection Act while the state develops regulations and policies, provides technical training to commissions, and hears appeals of commission decisions (MA DEP). Additionally, over 100 Massachusetts communities have adopted local bylaws in addition to state and federal regulations. And state's such as Wisconsin and New York have either directly developed or supported the development of guides that help local governments adopt local controls and provide model ordinances (Magyera et al., 2016; NY DOS, 2019).

By adopting similar measures or providing similar resources, state agencies create an opportunity to educate local government officials on the benefits provided by their natural resources and increase the likelihood that local partners will adopt controls, effectively expanding and strengthening state wetland programs. Given these benefits, the CEF should be updated to encourage state and tribal wetland programs to support the adoption of wetland protection controls by local or regional entities. These updates should suggest that local controls be written so that they are at least as stringent as state and federal programs. They

should also note that state mandates to develop local controls will likely face significant challenge in terms of getting local support. Instead, states and tribes should consider developing model ordinances that the local/regional entities can build on, provide training on implementing local controls, or give local/regional entities the option to adopt controls or implement state regulatory programs. States and tribes may be able to encourage voluntary adoption by providing or highlighting incentives that could come with such a program like benefits under the Community Rating System, access to natural infrastructure geared funding sources, or tie-ins to existing state managed programs like the National Pollution Discharge Elimination System (NPDES).

RECOMMENDATION 3: *Encourage states and tribes to consider implementing market-based mechanisms such as nutrient trading, stormwater trading, or temperature trading to incentivize voluntary restoration and protection.*

One of the biggest limiting factors to performing wetland restoration or creation in the urban environment is land availability since most of the land area is privately owned. And when urban property does become available, public entities can find it challenging to make a strong cost-benefit argument for purchasing and performing environmental restoration due to the high cost of acquiring the land. One way that some state, local, and regional governments have attempted to address this barrier is through market mechanisms.

Market mechanisms are designed around existing regulatory or statutory programs that impose requirements on private entities, such as NPDES or stormwater management. Under these markets, private entities have the option to offset a part of their requirements by purchasing credits from others who have voluntarily implemented an approved green infrastructure (GI) project that achieves a desired effect like nutrient reduction or stormwater attenuation. Examples of GI that generate credits often include but are not limited to bioswales, rain gardens, and wetland restoration or creation. Well-designed market-mechanisms benefit everyone, giving permittees a more affordable way to meet their regulatory requirements while creating an incentive for private parties to develop GI on private property resulting in greater implementation and distribution of GI. Once matured, GI provide benefits beyond the specific desired benefit. For example, Charlotte-Mecklenburg Stormwater Services in North Carolina has instituted a successful stream and wetland restoration program as a means to improve water quality and manage stormwater. Between 2003 and 2016 Charlotte-Mecklenburg Storm Water Services improved approximately 30 miles of streams and either improved or preserved 18 acres of wetlands throughout Charlotte and Mecklenburg County. These efforts in combination with other water quality programs have helped increase the number of creeks and streams safe for human contact in the county from 25% in 1998 to 98% in 2018 (Charlotte-Mecklenburg Stormwater Services).

Market mechanisms are not the right solution in every scenario, but they are a tool that have been used very successfully in some cases. Despite this fact, the CEF does not currently mention market-based systems as an available tool to support state and tribal programs. To remedy this, the CEF should be updated to encourage states and tribes to consider market-based mechanisms such as nutrient trading, stormwater trading, or temperature trading to incentivize voluntary wetland restoration, protection, and creation.

RECOMMENDATION 4: Include stronger language around why developing partnerships is important to the overall success of a wetland program and provide more specific examples as to how states and tribes should consider developing and utilizing those partnerships.

Developing and leveraging partnerships is an essential part of any successful state or tribal wetland program. By partnering with other agencies and organizations, wetland managers can identify common goals, pool resources, and accomplish more together than they ever could alone. This is especially true and important in urban areas where potential partnerships with private, public, and non-profit entities abound. State and tribal goals can be integrated with local or regional entities (like stormwater programs) to enhance restoration and protection activity. Non-profits, land trusts, and community organizations offer great opportunities for collaboration on restoration initiatives or monitoring and assessment programs. And partnerships with private entities looking to meet other regulatory requirements or support their local community present the potential to leverage untapped financial resources.

The CEF does currently identify partnership building as an important element of a successful wetland program. However, coordination to often stops at the state/federal level before reaching local partners or presents itself in a one-way relationship with states sharing goals and priorities instead of working with partners to find common goals and develop priorities. This may be in part because of the language EPA has chosen throughout the CEF. For example, in the **Program Building Activities Menu** under the Voluntary Restoration and Protection core element, the EPA advises states and tribes share protection and restoration priorities with partners to establish partnerships. This suggests a scenario where partners were not involved in the development of those priorities and are merely being informed of them. A more effective way to develop partnerships and create potential for future cooperation and support is to work with local partners to identify restoration and protection priorities either during program development or program updates. In 2015, the Department of Interior published a “How-to-Guide for the Co-Production of Actionable Science” that speaks to the benefits of co-producing data, analyses, etc. with stakeholders for improved outcomes (Beier P., et al., 2015).

Other examples of CEF updates that the EPA could consider implementing to encourage more and stronger partnerships with local groups include;

- Identify the potential for citizen science initiatives to support monitoring and assessment programs. For example, Hennepin and Dakota Counties in the urban area of Minneapolis have operated the Wetland Health Evaluation Program (WHEP) for over 20 years. WHEP is an initiative that utilizes volunteer citizen scientists to conduct wetland evaluations for various reasons with the support of state and local entities (Moodley, K., & Wyeth, G., 2020).
- Provide examples of the types of local programs and organizations that states and tribes should consider partnering with, such as stormwater programs, NPDES/MS4 programs, parks programs, hazard mitigation programs, land trusts, and other non-governmental organizations focused on water quality, wildlife, outdoor education, or environmental justice.

- Encourage states and tribes to consider the ability to provide training on monitoring and assessment protocols and geospatial wetland mapping tools to non-state entities. Doing so makes it easier for interested parties to participate in state/tribal initiatives and expands the use of tools that the state spent valuable time and resources developing. For example, the Washington Department of Ecology provides training to wetland regulators and consultants on use of the state wetland rating system, resources on responsible wetland stewardship for landowners, and educational material on wetlands to the general public.
- Recommend that states and tribes develop outreach and educational material specifically on the value of urban wetlands. Ecological value of larger, healthy wetlands is more often understood and appreciated but social value of urban wetlands is not. If state and tribal programs provide data on the benefits to human health and well-being provided by urban wetlands local leaders will be more likely to seek partnerships with wetland program managers to enhance and protect these valuable community assets.

RECOMMENDATION 5: Encourage state and tribal programs to identify ongoing funding sources for monitoring, maintenance, or enforcement of wetland restoration, enhancement, or creation efforts.

Just as urban wetlands play an important role in making cities more livable, they also generally need greater monitoring and maintenance due to all the stressors of an urban environment as discussed earlier. Undesirable effects of unhealthy, unmaintained or poorly maintained urban wetlands can have real or perceived negative impacts on the surrounding population. For example, one study found that urban wetlands that were drained during certain parts of the year to reduce the abundance of invasive fish and refilled at other times to provide habitat for a threatened frog species, yielded significantly more mosquito larvae than undrained wetlands (Hanford, J. K., et al., 2020). Given the public exposure urban wetlands receive, ensuring that wetland restoration, enhancement, or creation efforts in urban areas are being executed properly and maintained is of critical importance to fostering and preserving positive public perceptions of these areas. Currently, the CEF does not specify this step in any of the Core Elements' Menu of Program Development Activities. To address this issue, the CEF should be updated to encourage state and tribal programs to identify an ongoing funding source for monitoring, maintenance, or enforcement of wetland restoration, enhancement, or creation efforts as part of either a monitoring and assessment program, or a regulatory program.

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