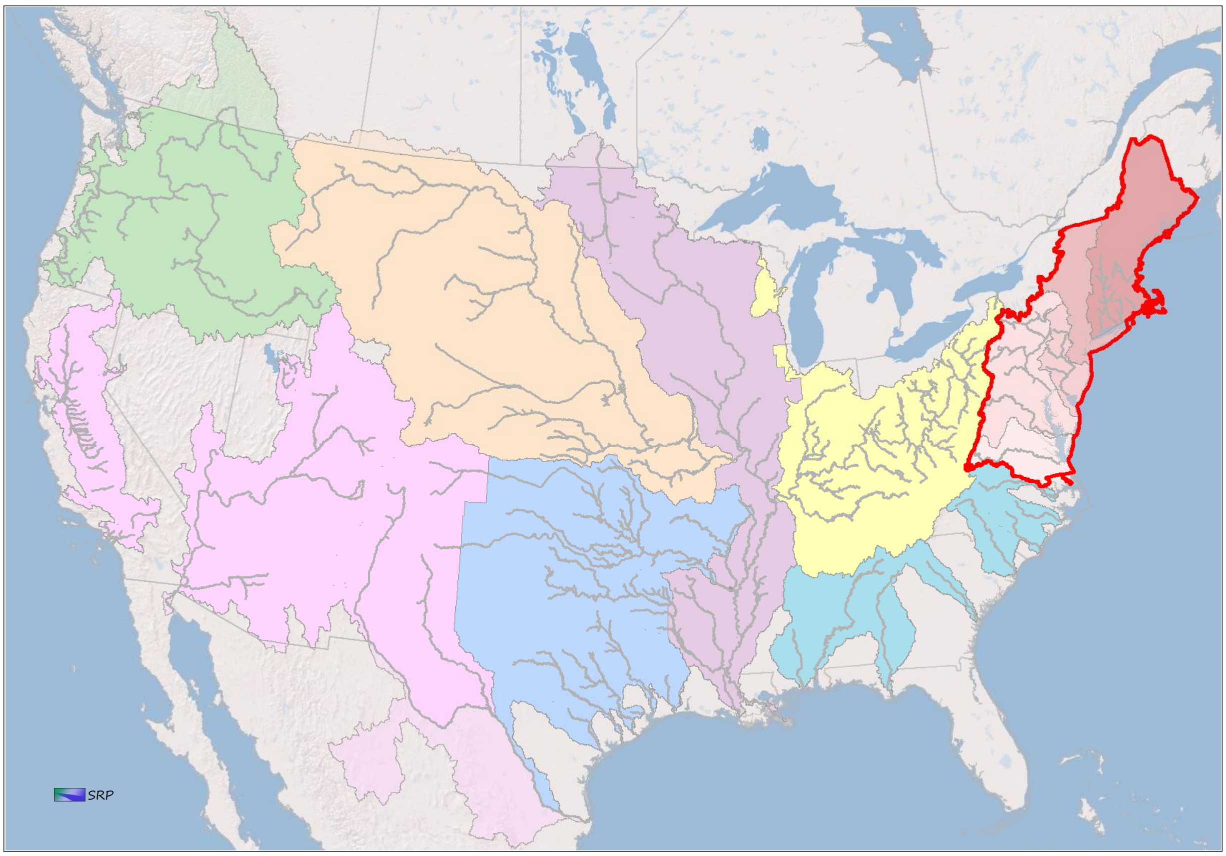
Sustainable Rivers Program

# Environmental Opportunities for Rivers and Reservoirs in the North Atlantic




Regional Operations and Water Management Meeting

Web-based activity and collaboration

January 12th, 2022

## Executive Summary

The North Atlantic Operations and Water Management Meeting was conducted virtually, October 6-7, 2021. The purpose of the meeting was to identify environmental opportunities at reservoirs and related Civil Works water resources infrastructure in the North Atlantic region that are feasible to implement with compelling potential benefits. This report documents the meeting and the discussions held in plenary and breakout sessions. This is not a decision document; no specific recommendations are made. However, this report is intended for use by district and regional Corps staff considering opportunities and priorities for environmental improvement at water resources infrastructure in the North Atlantic region.

The North Atlantic region is defined as the geographic areas of 5 Corps Districts within North Atlantic Division (NAD): Baltimore (NAB), New England (NAE), New York (NAN), Norfolk (NAO), and Philadelphia (NAP). New York District participation was done separately because the relevant portfolio of infrastructure within that district's area of responsibility consists of only one facility. Districts are responsible for Corps Civil Works water resource projects within a geographic area that encompasses major river basins to include the Connecticut River, Merrimack, Housatonic, Thames, Blackstone, Delaware, Susquehanna, Potomac, and James Rivers. Additional responsibilities include a lock and dam (NAN), Charles River Natural Valley Storage Area (NAE), hurricane protection barriers, and several miles of the Intracoastal Waterway along the Atlantic Seaboard (Figure 1). 54 reservoirs, affecting flows for 3,049 river miles within the region, were considered.

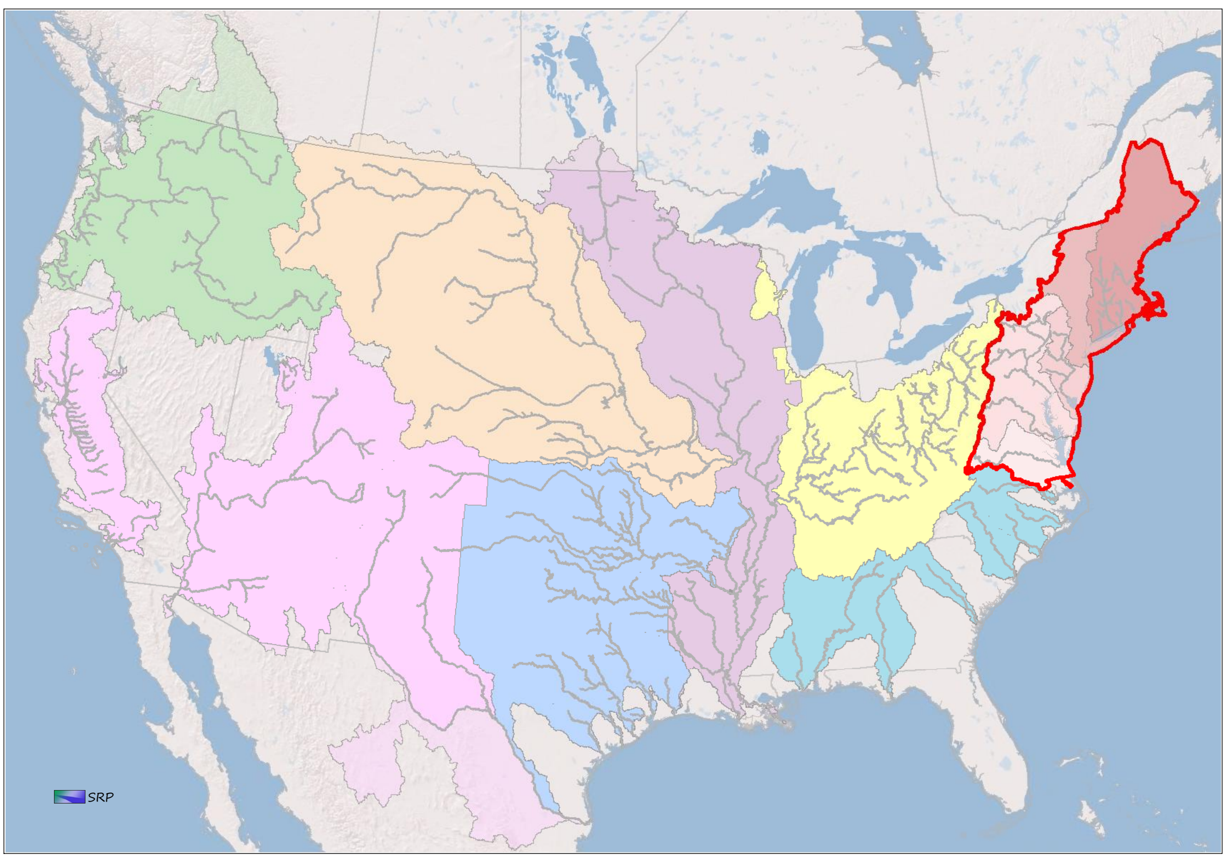



Figure 1. Geographic scope of the North Atlantic Regional Meeting

In formulating and evaluating environmental opportunities, location-based teams followed these steps:

1) list possible environmental actions associated with reservoirs;
2) rate environmental potential of each action;
3) rate degree to which each action has been implemented;
4) select environmental actions with unrealized implementation; and,
5) rank reservoirs according to which are most promising for operational changes related to selected actions.

Identified actionable ideas, or combinations of environmental action and candidate reservoir, are highlighted in the report and summarized in table 1.

Table 1. Priority actionable ideas, North Atlantic region.

| **Location-based team** | **Environmental Action** | **Reservoir(s)** |
|---|---|---|
| Baltimore | Environmental flows | Jennings Randolph, Raystown, Tioga-Hammond Lakes |
| Baltimore | Support water level mgmt. for fisheries | Raystown, Tioga-Hammond Lakes, Foster J. Sayers |
| Baltimore | Support water level management for vegetation (wetlands and riparian and suppress) | Tioga-Hammond Lakes, Raystown, Alvin R. Bush |
| Baltimore | Physical habitat – wetland creation (WQ / habitat improvements) | Arkport Dam, Indian Rock Dam |
| New England | Environmental flows for life stage support | Surry Mountain, Otter Brook |
| New England | Invasive species control – native plant establishment | Hopkinton, Buffumville, East Brimfield, Knightville |
| New England | Water quality – management of harmful algal blooms | Hopkinton, Tully |
| New England | Sediment management | Townsend, Northfield Brook |
| New York | Connect up and down: fish passage | Troy Lock and Dam |
| Norfolk | Environmental flows for water quality | Gathright Dam |
| Norfolk | Water level management for vegetation | Dismal Swamp |
| Norfolk | Water quality – management of harmful algal blooms | Gathright Dam |
| Philadelphia | Riparian management for habitat conditions | Gen. Edgar Jadwin Dam |
| Philadelphia | Physical habitat: riffle creation or restoration | Gen. Edgar Jadwin Dam |
| Philadelphia | Recreation | Gen. Edgar Jadwin Dam |
| Philadelphia | Suppress – level management for vegetation | Francis E. Walter, Blue Marsh |
| Philadelphia | Environmental flows for fisheries | Francis E. Walter |
| Philadelphia | Level management for mussels | Beltzville Dam, Blue Marsh Lake |

| | | |
|---|---|---|
| Philadelphia | Suppress – level management for overwintering biota | Francis E. Walter, Blue Marsh Lake |
| Philadelphia | Sediment management | Francis E. Walter, Blue Marsh Lake |
| Philadelphia | Water quality – management of harmful algal blooms | Blue Marsh Lake |

Meeting participants (appendix A) were comprised of staff from the U.S. Army Corps of Engineers (Corps), including representatives of NAD and the five districts, and The Nature Conservancy (TNC).

This report details content of the meeting and is structured to follow the meeting agenda (appendix B).

**Introduction and Objective**

The goal of the North Atlantic Operations and Water Management meeting was to identify environmental opportunities at Corps-involved reservoirs that are feasible to implement with compelling potential benefits.

By many measures (e.g., number of reservoirs, total storage, geographic distribution), the Corps is the largest water management organization in the nation. A reservoir survey completed in 2013 identified 465 reservoirs with federally authorized flood storage. The majority (356) of these reservoirs were owned and operated by the Corps. Additionally, the Corps has approximately 180 Corps lock and dam reservoirs. Considering environmental opportunities for all of these reservoirs is daunting given their diversity of size, location, and purpose.

Contemplating opportunities at finer spatial scales becomes more practical as similarities in hydrology, landscape, reservoirs, and water resources management create a common context for sharing experiences and formulating alternative management strategies. Environmental opportunities and challenges also trend regionally, as considerations begin to focus on shared ecological community types, flyways, and habitats. The North Atlantic Operations and Water Management meeting was convened with this premise – that regional characteristics of water and ecological systems can underpin a productive dialogue about reservoir operations for environmental benefits.

Meeting participants provided expertise in reservoir operations, water management, water quality, natural resources management, environmental planning, and ecology. Collectively, the group began the formulation process by listing key environmental actions associated with reservoirs. Participants then split into location-based teams (based on geographical areas of responsibility of the four participating Corps districts and experience). Each team scored the potential benefits and current implementation level of each environmental action (for all reservoirs, collectively). Teams then selected specific actions with unrealized environmental benefits and ranked the reservoirs within their area, individually, according to which were the most promising candidates for operational changes related to each selected action.

**Sustainable Rivers Program**

The Sustainable Rivers Program (SRP) is a national partnership between the Corps and TNC. The mission of SRP is to improve the health and life of rivers by changing dam operations to restore and protect ecosystems, while maintaining or enhancing other project benefits.

SRP began in 1998 with an initial collaboration to improve the ecological condition of Green River, Kentucky. The Program was formally established in 2002 and involved 8 river systems. SRP now (2021) involves work on 89 Corps reservoirs in 40 river systems and 10,953 river miles (Figure 2). It is the largest scale and most comprehensive program for implementing environmental flows below Corps reservoirs.

Environmental flows are defined as the quantity, timing, and quality of water flows required to sustain ecosystems. For reservoir operators, environmental flows manifest as management decisions that manipulate water and land-water interactions to achieve ecological or environmental goals. The SRP process for environmental flows has three phases: (1) advance; (2) implement; and (3) incorporate. Advancing e-flows involves engaging stakeholders in a science-based process to define the flow needs of riverine ecosystems. Implementation involves testing the effectiveness and feasibility of the defined flows. Incorporation involves including environmental flow strategies in reservoir operations policy such as water control manuals. Environmental flows were the founding objective of SRP and remain the key focus. In recent years, the Program began exploring other reservoir-oriented actions with potential to produce environmental benefits.

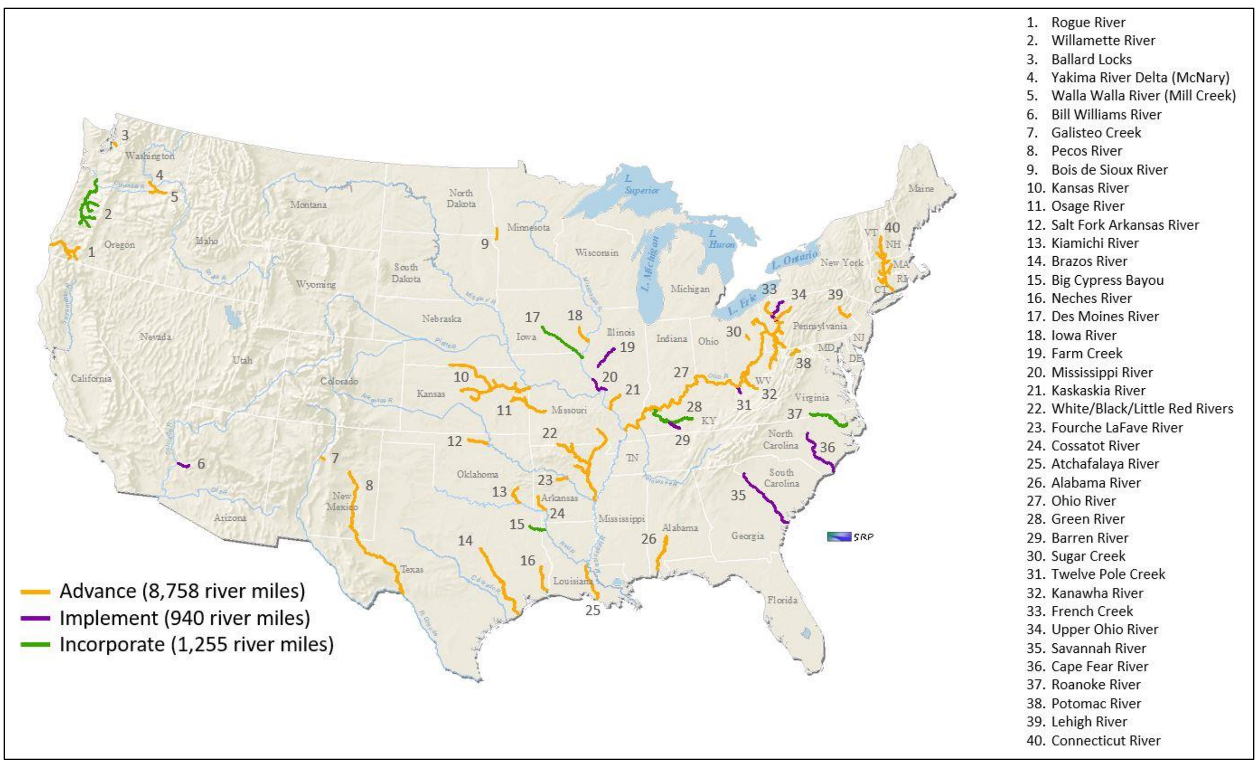



Figure 2. Status of rivers engaged in the Sustainable Rivers Program, 2021.

Importantly, this report and associated meeting are not about SRP. SRP has promoted the concept of regional meetings for several years with the intent of providing a venue for broad consideration of environmental actions at rivers and reservoirs. The North Atlantic meeting was the fourth in a series of regional Operations and Water Management meetings sponsored by the Sustainable Rivers Program. Previous regional meetings were conducted in the Upper Midwest (involving Kansas City, Omaha, Rock Island, St. Paul, and St. Louis districts) in September 2019, South (involving New Orleans, Memphis, Vicksburg, Galveston, Little Rock, Fort Worth, and Tulsa districts) in September 2020, and Pacific Northwest (involving Seattle, Portland, and Walla Walla districts) in November 2020.

**North Atlantic Regional Rivers and Reservoirs**

For the purposes of this meeting, the North Atlantic region is comprised of the geographic areas of 5 Corps Districts, Baltimore (NAB), New England (NAE), New York (NAN), Norfolk (NAO), and Philadelphia (NAP), which are parts of the Corps' North Atlantic Division (NAD). Collectively, those districts are involved with 54 reservoirs with federally authorized flood space. Almost all (52) of these reservoirs are owned and operated by the Corps. The others (2) are owned and operated by entities other than the Corps, with the Corps prescribing guidance for the management of the federal authorized flood space (Figure 3). These reservoirs are often referred to as Section 7 reservoirs in reference to the portion of the Flood Control Act of 1944 that authorized the Corps to prescribe regulations for the use of reservoir storage dedicated to flood risk management for all facilities constructed wholly or in part with federal funds. Nine of the Corps reservoirs are dry dams. Dry dams are typically smaller and more single-purpose than other reservoirs with federally authorized flood space. Most were constructed solely for flood risk management and many release water passively, storing water only when inflows exceed the physical capacity of always open outlets.

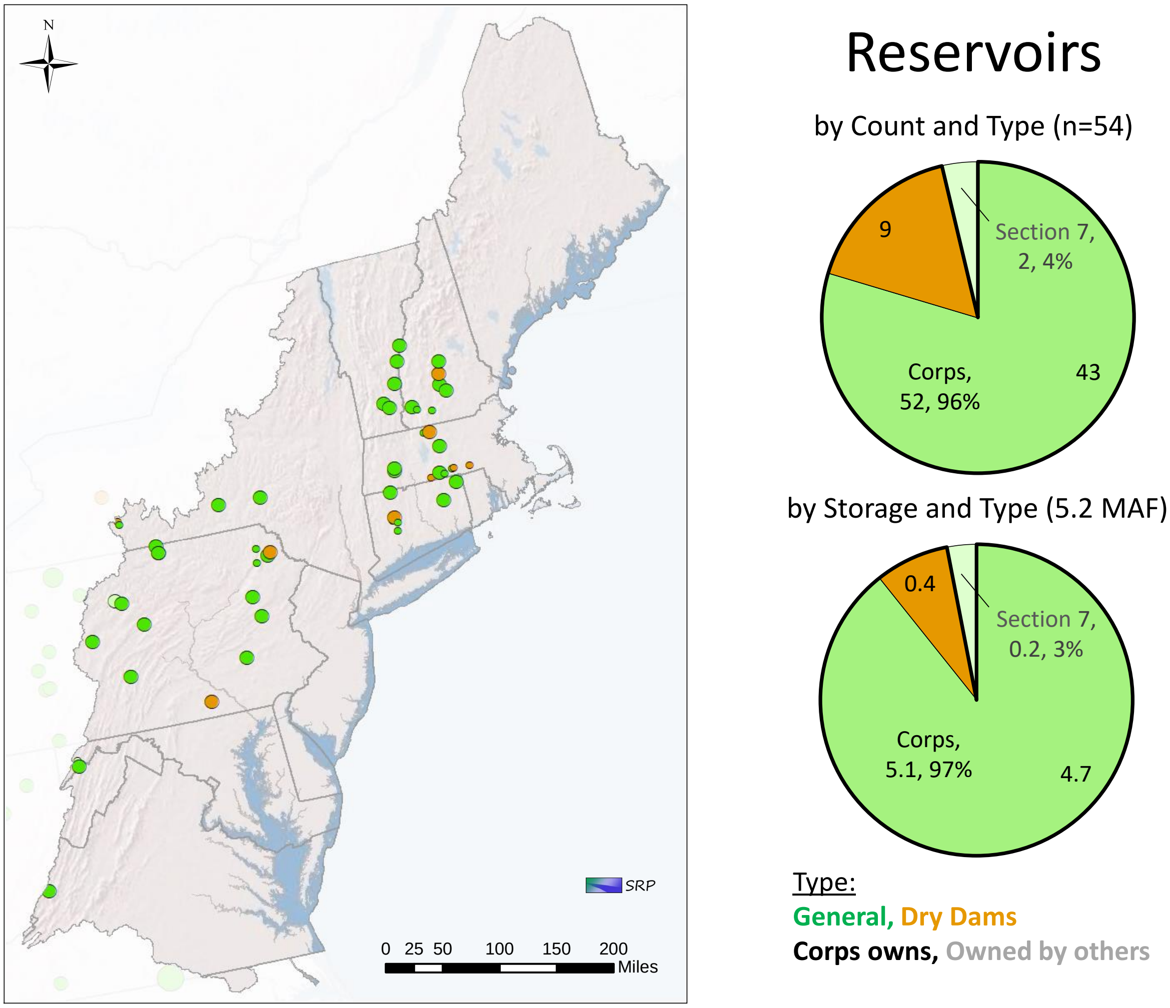


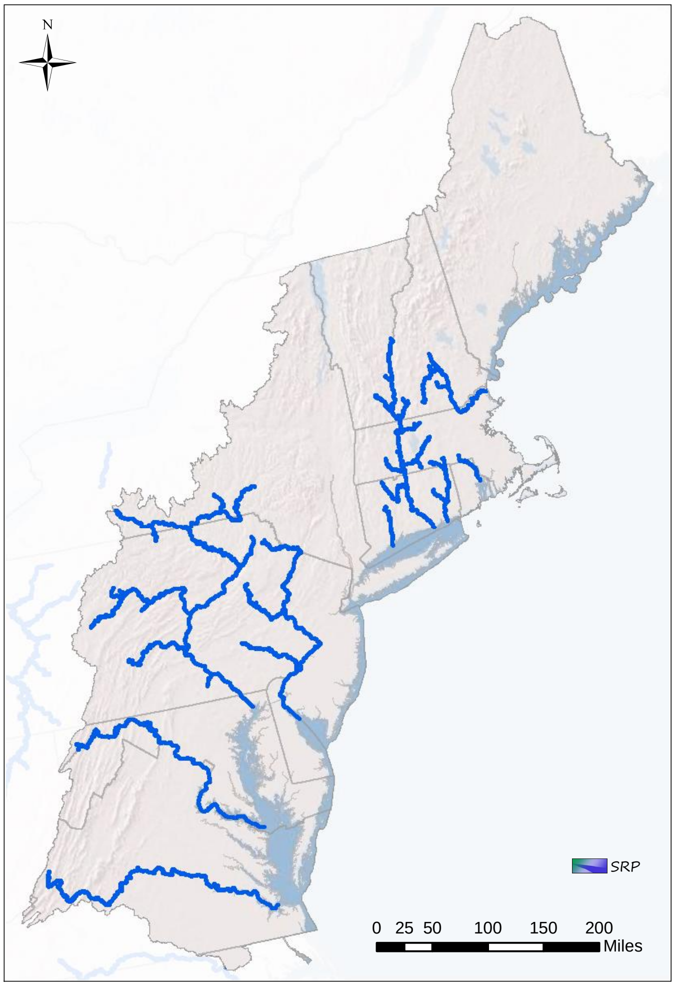

Figure 3. Corps-involved reservoirs in the North Atlantic region. Excludes Corps locks and dams.

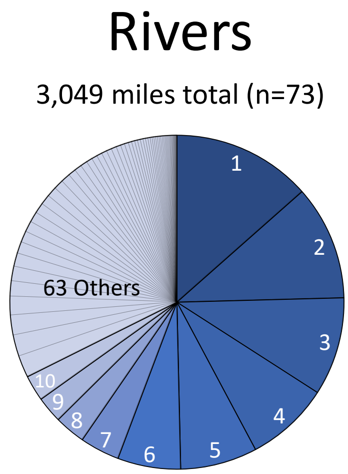
Based on the National Inventory of Dams (NID 2016), Corps involved dams contain 5.2 MAF of storage, which is 18% of all surface water reservoir storage in the region. Table 2 provides a summary of the reservoirs. There are no reservoirs in New York District with federally authorized flood space. Therefore, the NID count of 1,456 and combined storage of 7.2 MAF in New York District are omitted from the table.

Table 2. North Atlantic region reservoir count and storage. Corps locks and dams are excluded from the "Corps - Count" and "Corps - Storage" tallies. Reservoirs in New York District excluded from "NID - Count" and "NID - Storage" tallies.

| | Count | | | | | Storage (millions of acre-feet; MAF) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Corps | | Section 7 | | NID (all) | Corps | | Section 7 | | NID (all) |
| | General | Dry dams | General | Dry dams | | General | Dry dams | General | Dry dams | |
| NAB | 13 | 2 | 2 | - | 1,716 | 2.2 | 0.06 | 0.2 | - | 5.5 |
| NAE | 25 | 6 | - | - | 3,706 | 1.5 | 0.29 | - | - | 17.3 |
| NAO | 1 | - | - | - | 1,859 | 0.4 | - | - | - | 3.0 |
| NAP | 4 | 1 | - | - | 1,167 | 0.5 | 0.05 | - | - | 3.1 |
| Total | 43 | 9 | 2 | - | 8,448 | 4.7 | 0.4 | 0.2 | - | 28.9 |

The river network below the Corps involved reservoirs consists of 73 different named rivers. The Susquehanna is the longest with a total of 411 river miles from the Ouleout Creek confluence, roughly 5 miles below East Sidney Dam in New York State, to the Chesapeake Bay northeast of Baltimore, Maryland. The James has the second longest length within the region with the Potomac, Delaware, Connecticut, West Branch Susquehanna, Merrimack, Juniata, Lehigh, and Schuylkill completing the list of top ten longest rivers (Figure 4).




| # | Name | Miles |
|---|---|---|
| 1 | Susquehanna River | 411 |
| 2 | James River | 339 |
| 3 | Potomac River | 290 |
| 4 | Delaware River | 247 |
| 5 | Connecticut River | 227 |
| 6 | W. Branch Susq. River | 186 |
| 7 | Merrimack River | 117 |
| 8 | Juniata River | 91 |
| 9 | Lehigh River | 78 |
| 10 | Schuylkill River | 76 |
| 11… | 63 Others | 987 |
| Total | | 3,049 |

Figure 4. Rivers below Corps-involved reservoirs in the North Atlantic region.

The total number of river miles in the region below Corps involved dams is 3,049. Of these, 2,438 river miles are below Corps dams, 25 are below Section 7 dams, and 586 are below a combination of both Corps and Section 7 dams. Most of the total (1,786 river miles) are below reservoirs that have an authorized purpose related to the environment (fish and wildlife, water quality, or recreation). Table 3 provides a summary of the rivers.

Table 3. River miles below Corps involved dams. Tallies provided per ownership type and purpose.

| | River Miles by Ownership | | | River Miles by Purpose | | | | |
|---|---|---|---|---|---|---|---|---|
| | Corps | Section 7 | Both | Enviro | Hydro | Both | Neither | Total |
| NAB | 691 | 25 | 586 | 823 | 0 | 186 | 294 | 1,302 |
| NAE | 917 | 0 | 0 | 0 | 276 | 115 | 526 | 917 |
| NAO | 382 | 0 | 0 | 382 | 0 | 0 | 0 | 382 |
| NAP | 448 | 0 | 0 | 281 | 0 | 0 | 167 | 448 |
| Total | 2,438 | 25 | 586 | 1,485 | 276 | 301 | 987 | 3,049 |

**Reservoir-centric Environmental Efforts within the NAD Region**

Corps reservoirs and locks are operated in accordance with water control manuals. Deviations to water control plans must be approved by the division after district study. Deviations to operating plans are only allowed for authorized purposes. Changes for other purposes can be studied and incorporated into the water control manuals but cannot be tested without an approved water control plan. This section provides a summary of presentations from the four participating districts about ongoing reservoir-centric environmental efforts in the region.

<u>Baltimore District</u>

The Baltimore District area of responsibility for reservoir regulation follows the Civil Works boundaries for the Baltimore District and includes two main watersheds – the Susquehanna River Basin and the Potomac River Basin. Figure 5 illustrates the watershed boundaries for these two river basins. These watersheds include parts of New York, Pennsylvania, Maryland, Virginia and West Virginia and cover about 42,000 sq miles (27,500 squares miles for the Susquehanna River Basin and 14,700 square miles for the Potomac River Basin).

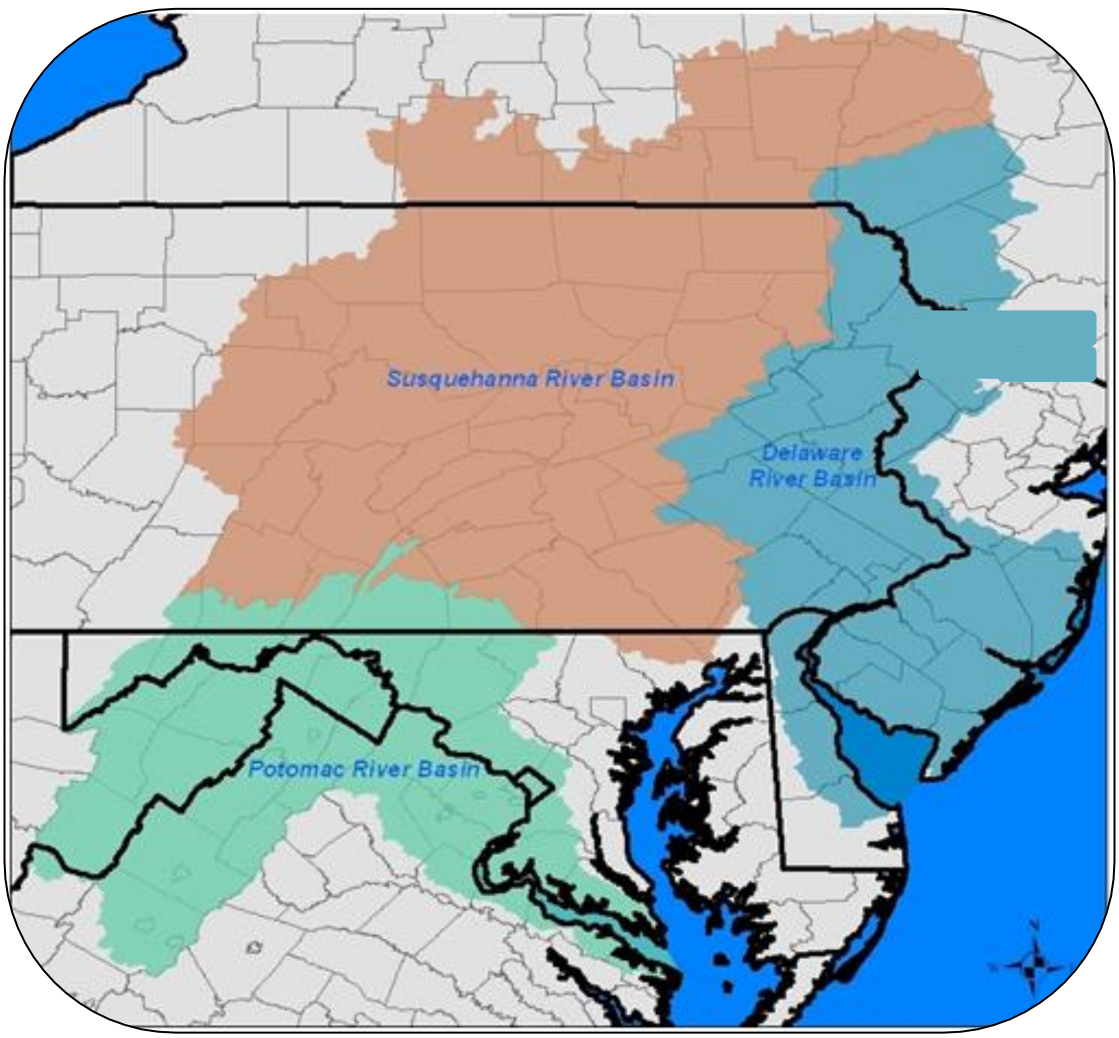



Figure 5. Baltimore District watershed boundaries.

Figure 6 shows the location of the flood risk management projects within the Baltimore District. Black triangles represent the dams and reservoir projects, and red circles represent local flood protection projects. From a reservoir regulation standpoint, the Baltimore District regulates a total of 16 reservoir projects - 14 Federal and 2 non-Federal. All these reservoir projects are headwater dams and none are in series.

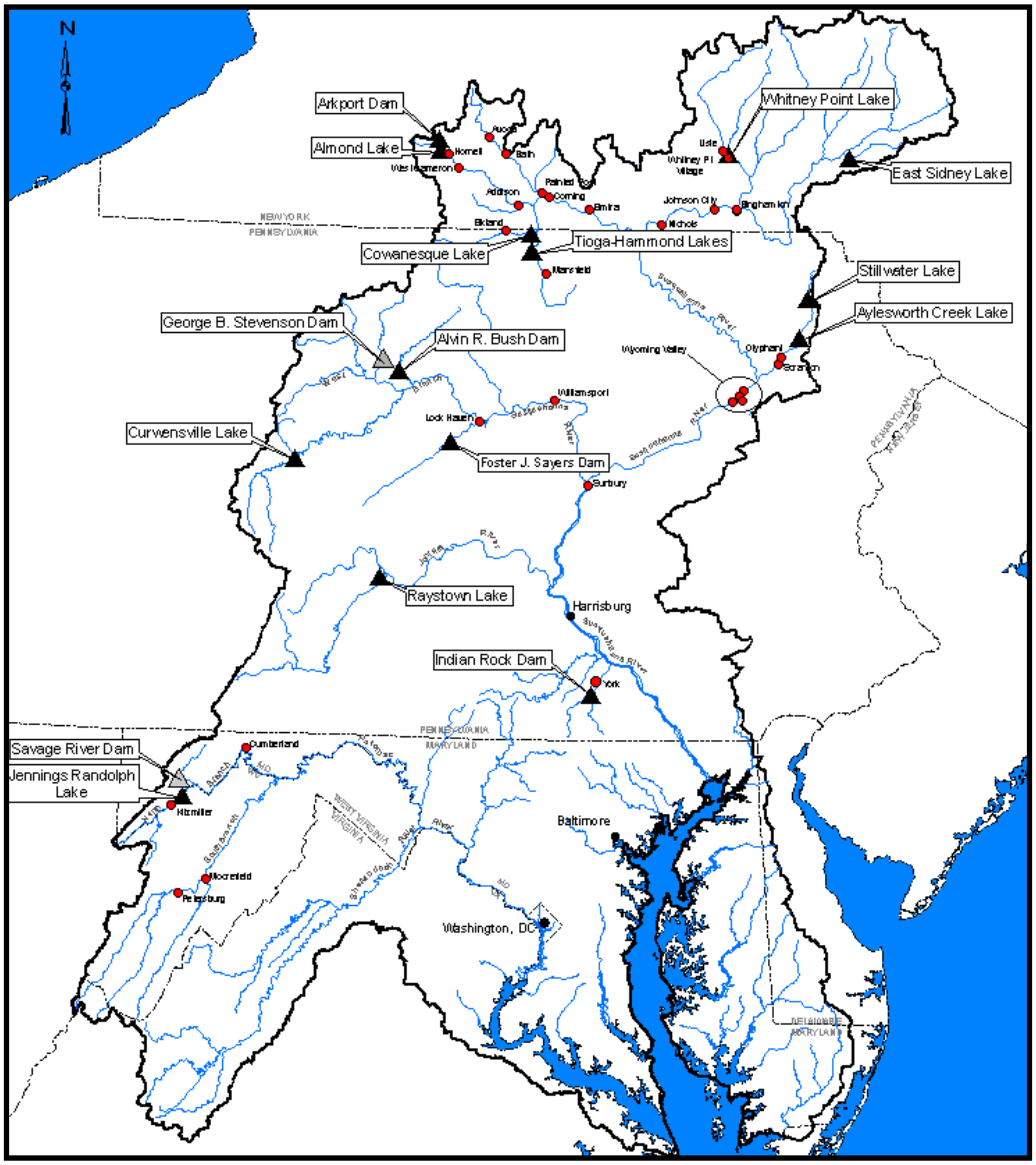



Figure 6. Location of flood risk management projects in Baltimore District.

The water control mission for these projects is to regulate the storage and release of water from the reservoirs in accordance with each project's authorized purposes to provide both in-lake and downstream benefits. All NAB reservoirs are authorized for flood risk management which is the primary purpose. Most projects operate for water quality in some way whether directly or indirectly and could include regulating for water chemistry, flow augmentation, and fish and wildlife enhancements, for example. Some projects were specifically designed with selective withdrawal capabilities as well. Other authorized purposes for Baltimore District reservoirs include recreation, water supply (for municipal and industrial use) and hydropower (non-Federal) and vary from project to project.

Some of the existing environmental efforts being accomplished by Baltimore District at reservoirs follow:

*Susquehanna River Basin*

Nearly all projects have an established minimum release. Baltimore District is currently working to evaluate minimum releases in coordination with the Susquehanna River Basin Commission.

Several projects have some type of selective withdrawal capability or outlet configuration that allows for some regulation of water quality parameters such as water temperature and pH, including Cowanesque Lake, Tioga-Hammond Lakes, Raystown Lake, Alvin R. Bush dam, and Curwensville Lake.

As a result of a completed Section 1135 study, the regulation plan for Whitney Point was modified to remove a seasonal drawdown and established a low flow augmentation plan where a specific amount of the conservation storage can be released based on downstream flow triggers.

Tioga-Hammond is a uniquely designed project where there are two separate dams and two separate lakes which are connected by a channel. Flows can be regulated from Hammond Lake, which has basic pH levels, into Tioga Lake, which historically has acidic pH levels, to neutralize the pH of Tioga Lake. The outlet works also have selective withdraw capabilities to further blend releases for water quality.

*North Branch Potomac River Basin*

The North Branch Potomac River has a history of water quality concerns. Jennings Randolph and Savage River Dam have been regulated for water quality as an authorized purpose. Originally, water quality concerns centered around acid mine drainage and industrial pollutants in the watershed. Jennings Randolph Lake was devoid of fish and it was deemed that there never could or would be a fishery in the lake. At that time reservoir strategies at Jennings Randolph Lake included utilizing the selective withdraw capability of the outlet works to regulate for pH, conductance, and dissolved oxygen. In addition, the release plan reflected some of the “solution to pollution is dilution” philosophy. During extended late summer and fall periods of low releases and downstream flows, sediment and precipitates from industrial effluent and acid mine drainage would settle out in the downstream river channel creating a smothering effect. To help minimize these adverse effects, Artificially Varied Flow or AVF releases were initiated as a regulation strategy for removing accumulated organic sediments to improve the downstream aquatic environment. Typically, two AVF releases are made in the late summer/early fall timeframe as triggered by an extended period of constant low flow releases with no significant runoff. Generally, a release of about 1,000 cfs for 24 to 48 hours is effective in removing the accumulated organic sediments.

Over the years since Jennings Randolph Lake was constructed, the overall condition of the watershed improved as various remediation efforts were implemented between treatment of acid mine drainage and stricter environmental rules on industrial effluents. In-lake and downstream fisheries began to thrive. A thriving cold-water fishery developed downstream of Jennings Randolph and Savage which has led to a significant increase in fishing interests and growing recreation businesses. Currently, the main water quality concern is the downstream cold-water fishery and the ability of Jennings Randolph and

Savage to provide the requisite cold-water releases. Accordingly, management strategies have shifted away from releasing as much water as possible to being more conservative while trying to maintain downstream temperatures and desired flows for the downstream fishery.

Over the years, regulation of Jennings Randolph for flood risk management and water supply has not changed much. However, due to the shift in improved water quality within the watershed, there has been a corresponding shift in how Jennings Randolph is regulated for water quality. Along with the improved water quality came interest in downstream recreation and associated economic implications. The combination of these two changes for water quality and recreation have led to many questions about how water quality storage within the reservoir is utilized; the interest of conserving cold water within the reservoir so that cold water releases can extend into the summer and fall; and questioning the necessity of AVF releases and whether there are better ways to utilize the water resource.

The long and varied water management history of the Potomac River led to involvement with the Sustainable Rivers Program in 2021. The original proposal and scope focused on the application of AVF releases. During the scope development process, it was determined to broaden the scope while keeping the water quality aspect engaged because it is integral to reservoir regulation for Jennings Randolph.

New England District

New England District manages five river basins, Thames (which includes the Blackstone & Charles River Basins), Merrimack, Housatonic (Naugatuck), Upper Connecticut, and Lower Connecticut, within five states, Massachusetts, Rhode Island, New Hampshire, Connecticut, and Vermont (Figure 7). In total, NAE is responsible for 32 flood risk management dams and reservoirs, three hurricane protection barriers, a canal, and a unique natural flood storage area known as the Charles River Natural Valley Storage Area.

New England has always been susceptible to flooding from many sources such as hurricanes in the late summer and early fall, snowmelt in winter and spring and coastal storms that occur year-round. As a result of catastrophic floods in 1936 and 1938, the Corps was called upon to undertake a comprehensive flood risk management program. In addition to flood risk management, the reservoirs offer recreation and environmental stewardship activities.

NAE dams and reservoirs are operated in accordance with water control manuals and outflow guidance. Outflow guidance at NAE reservoirs include operating for aquatic base flow (ABF) during normal operations. ABF suggests minimum outflow and incremental gate changes as needed to closely mimic run-of-river flow conditions.

Two reservoirs in the Thames River Basin, Buffumville and East Brimfield Lakes, have integrated annual winter drawdowns of the pool to combat aquatic invasive plants species such as Eurasian/Variable Milfoil and Fanwort, in combination with annual chemical treatments. There is significant potential for expanding this method at other NAE reservoirs to reduce the dependance on chemical treatment as the sole means for invasive control. Additionally, Hopkinton Lake has been coordinating with the New Hampshire State Department of Environmental Services to do trials of a low dose experimental chemical treatment called Procellor. Procellor, had shown to be just as effective as traditional treatments while using less chemicals (Figure 8).

Harmful algal blooms (HAB) have also been a focus of the district in recent years, as lake and beach closures have become a recurring issue. The Water Quality Team proposed a treatment utilizing Copper

Sulfate to combat the issue at Tully Lake (Figure 9). So far, these treatments seem to be working, but cost and the desire to be less reliant on chemicals, makes this a less than desirable candidate and the need for further research on potential sources and alternative treatments.

Lastly, sedimentation has been a problem for some of our reservoirs. Townshend Lake, which was temporarily closed due to damage from sedimentation from Hurricane Irene in 2011, receiving congressional attention. The reservoir area around the swim beach at Townshend was dredged in 2013 and 2017, and future dredging is planned for 2023. However, deposition during nearly annual high flows has replaced most of the material that was removed, and a long-term solution is needed. Other reservoirs within NAE, such as Northfield Brook Lake, has faced similar issues with sediment accumulating within the reservoir areas. Ongoing sedimentation and water quality issues caused the Northfield Brook Lake swim beach to be closed in 2013. A study was conducted to evaluate potential alternatives, including reverting the reservoir area to a dry-bed thereby encouraging sediments to be conveyed downstream (Figure 10).

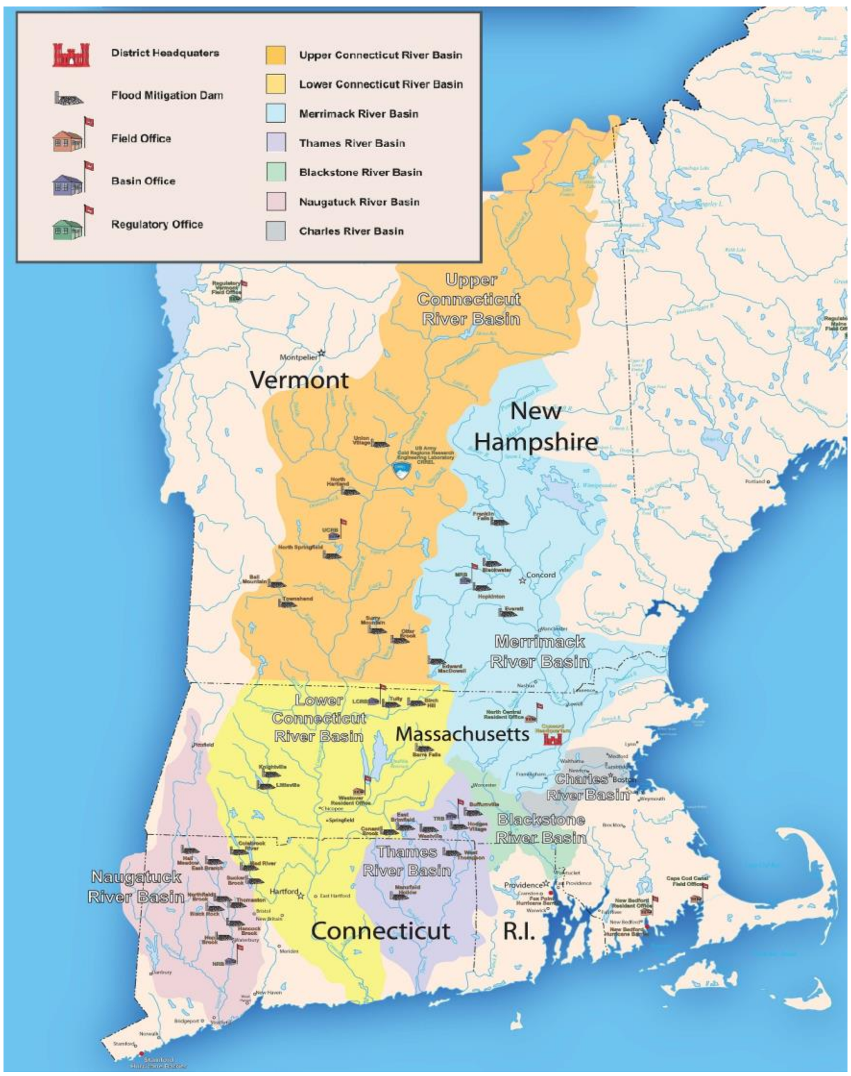


Figure 7. New England District river basins and associated water control facilities.

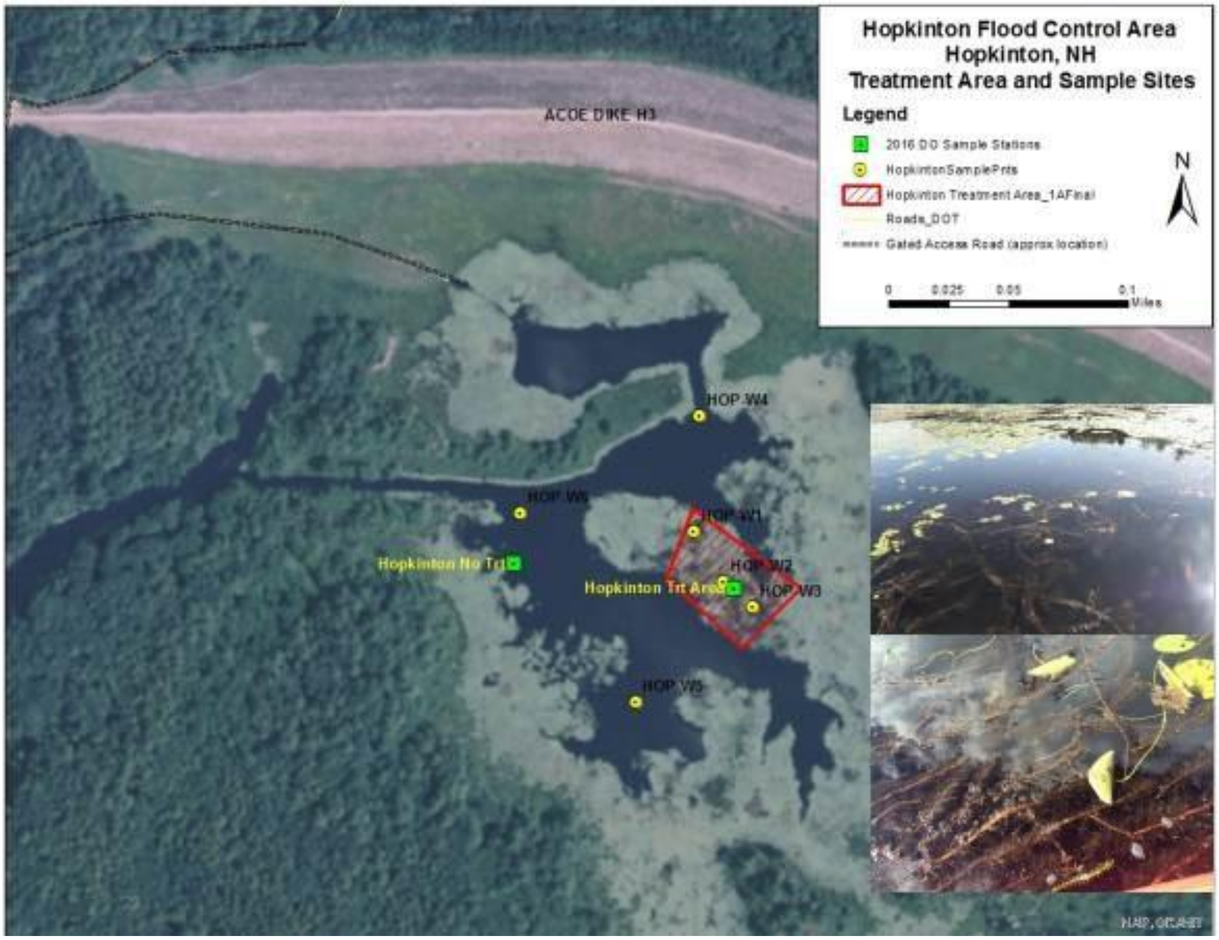


Figure 8. Procellor treatment area at Hopkinton Reservoir.


Figure 9. Copper sulfate treatment at Tully Lake (USACE photo).

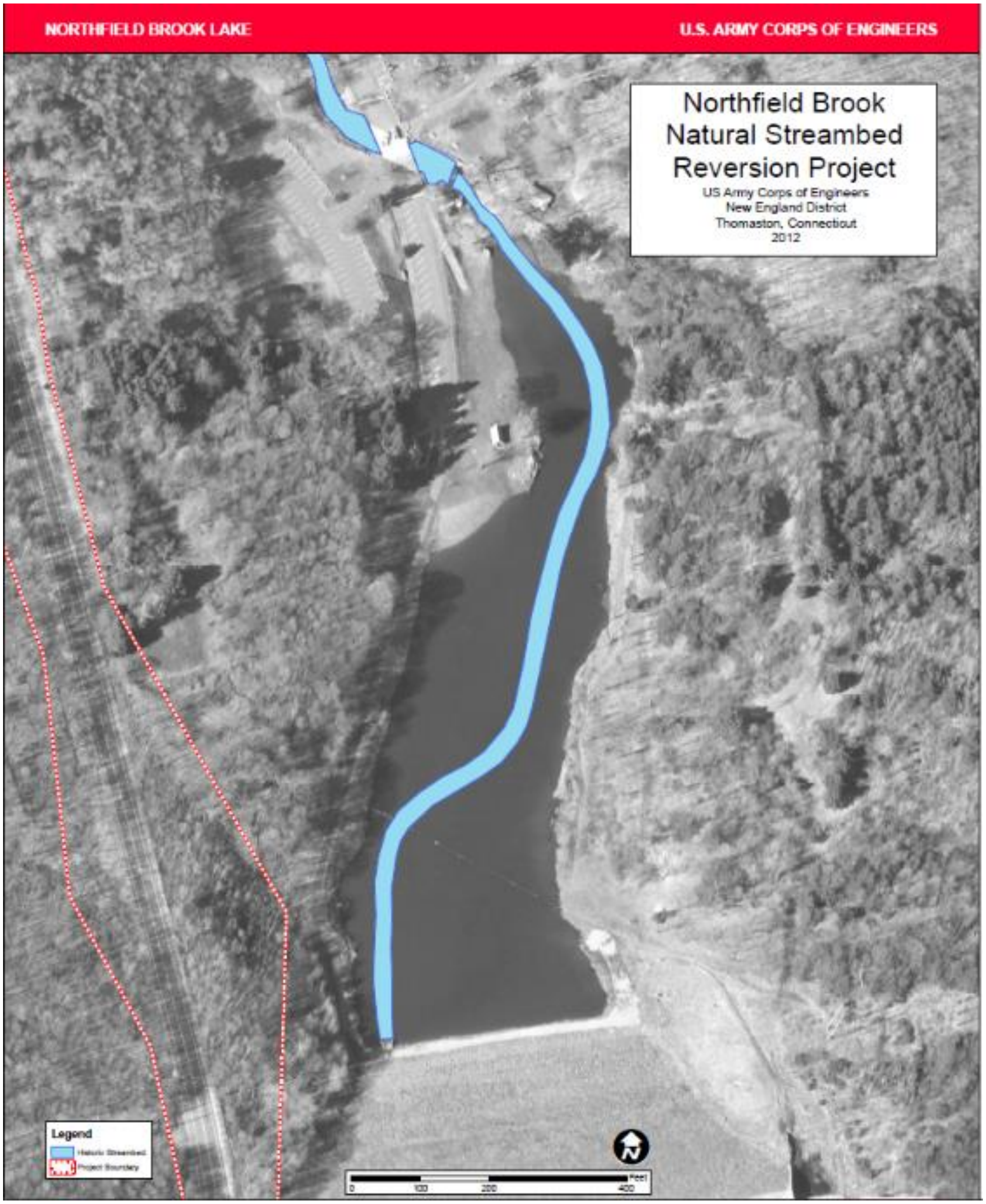



Figure 10. Northfield Brook Lake Natural Streambed Reversion Project.

New York District

The New York District (NAN) did not participate at the two-day regional meeting due to only having one structure for consideration, Troy Lock and Dam. Two separate meetings were conducted with NAN and the SRP team to discuss regional meeting themes.

Troy Lock and Dam (Figure 11) is located on the Hudson River in Troy, New York. It is one of the oldest in the Nation, providing navigation on the Hudson River for commercial and recreational traffic accessing the New York State Canal System from May 1st – November 30th every year. The canal system spans 524 miles, linking the Hudson River with the Great Lakes and includes a series of 56 locks with Troy Lock and Dam being the only federal lock and dam in the navigation system. The remaining 55 locks are operated by the Canal Corporation.

Troy Lock and Dam has a lock chamber, main spillway, auxiliary spillway, support pier, ice pass spillway and a headgate bulkhead. A non-federal hydropower facility, The Green Island Project, is located along the right descending bank of the structure. The navigation pool level behind Troy Lock and Dam can be manipulated two feet with use of an inflatable rubber bladder that rest on top of the main spillway. Bladder operations and pool levels are the responsibility of the non-federal hydropower facility.

The Hudson River has been identified as important spawning grounds for alewife, blueback herring, shad, sturgeon, and other fish. Fish lockage was adopted at Troy Lock and Dam to facilitate movement of these important sea run migratory fishes. The Corps will initiate fish lockage at the request of New York State officials and will act unsolicited whenever fish are seen residing adjacent to the lock chamber. It is also worth noting that a fish passage structure is currently being planned as part of the relicensing process to increase power generation at the non-federal hydropower facility located at Troy Lock and Dam.

Figure 11. Troy Lock and Dam (USACE photo).

Norfolk District

The Norfolk District (NAO) provided an overview of projects within the district's area of responsibility. NAO has two civil works Water Resource Projects to consider for Environmental Opportunity: 1) Gathright Dam and Lake Moomaw; and 2) Atlantic Intracoastal Waterway.

The Gathright Dam and Lake Moomaw Project provides flood risk management for industrial, commercial, and residential properties along the Jackson and James rivers with immediate impact on Covington, Virginia. Congress authorized construction of the dam and reservoir in the Flood Control Act of 1946. The dam is a rolled-rock fill embankment with a compacted earthen-clay core, outlet works, and an emergency spillway is located at the right abutment. The embankment is 1,310 feet long with a height of 257 feet. The width is 32 feet at the top of the dam with a maximum width of 1,000 feet at its base. Dam construction began in 1974 and was completed in 1979. Water impoundment began in December 1979 and was completed in April 1982.

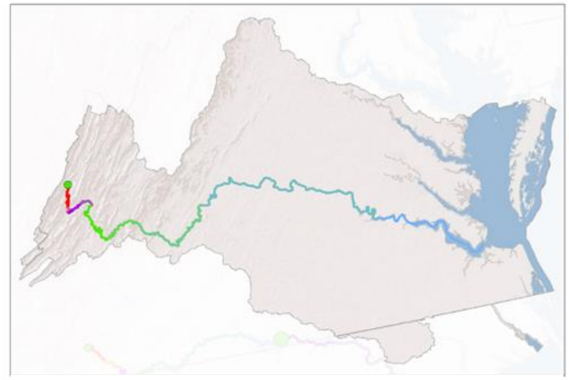


Figure 12. Norfolk District Boundary.

Figure 13. Gathright Dam intake tower (USACE photo).

Figure 14. Gathright Dam project (USACE photo).

Figure 15. Jackson River before and after flow pulse (USACE photos).

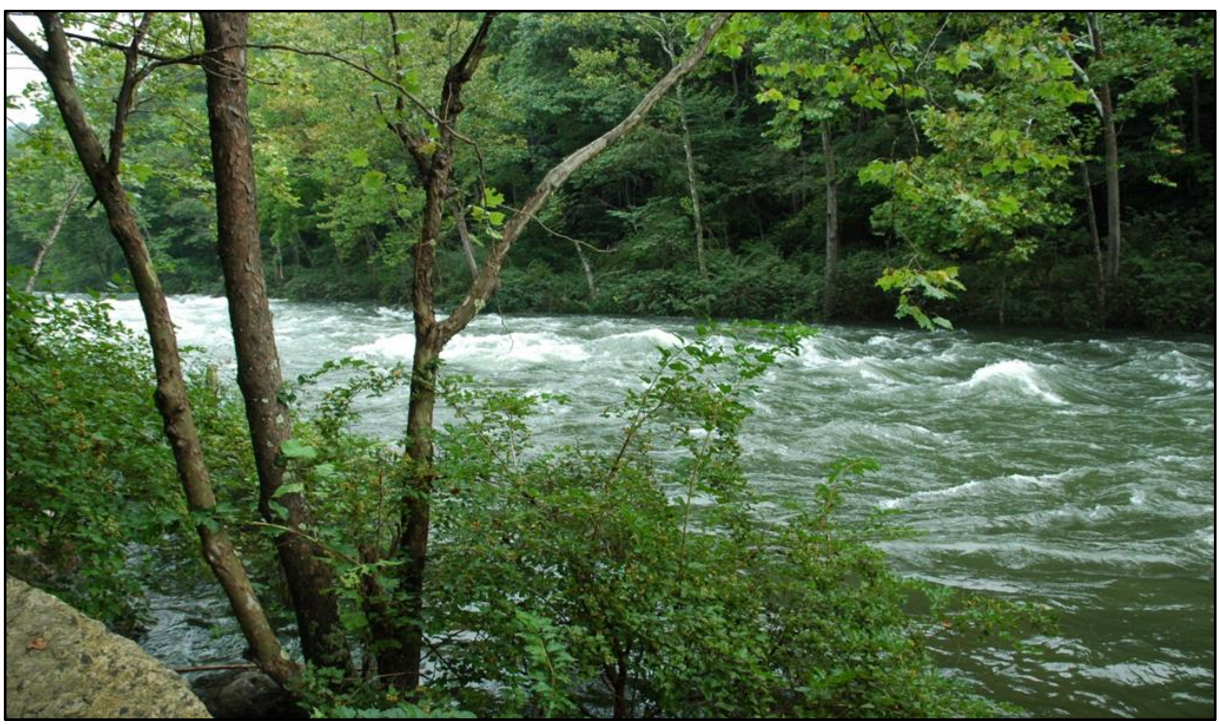


Figure 16. Jackson River conditions during pulse (USACE photo).

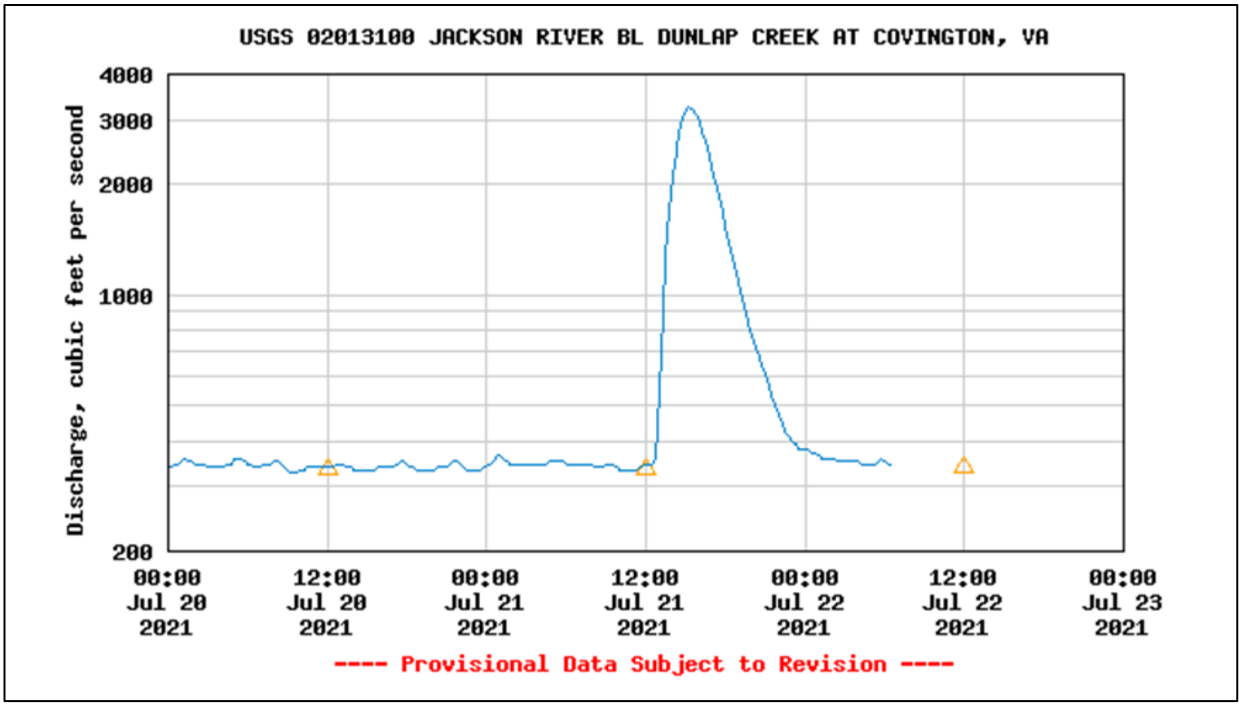
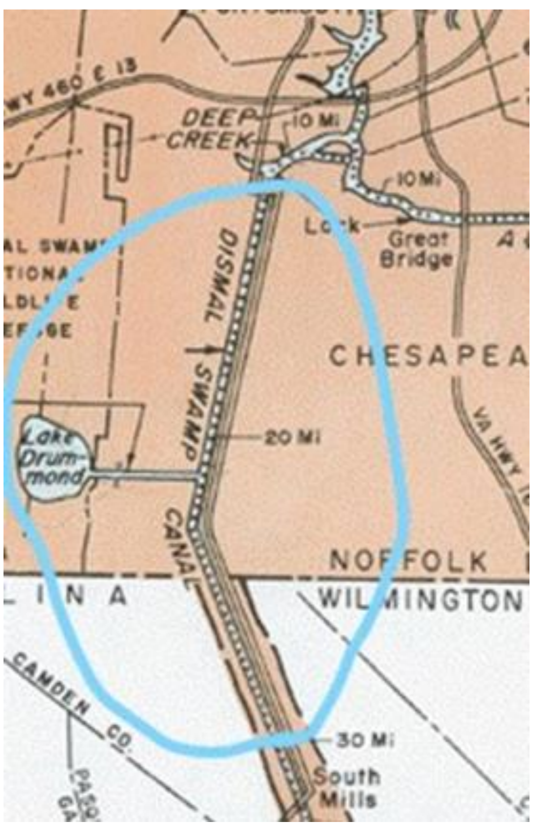



Figure 17. Jackson River flow during pulse.




### Dismal Swamp Canal

Maintained by Norfolk District, the Dismal Swamp Canal (DSC) and Albemarle and Chesapeake Canal (ACC) form alternative routes along the Atlantic Intracoastal Waterway (AIWW) between the Chesapeake Bay and Albemarle Sound.

These canals are part of the greater Atlantic Intracoastal Waterway, which stretches from Norfolk, Virginia, to Miami and offers recreational boaters and commercial shippers a protected inland channel.

While there were no environmental improvement opportunities noted on the ACC, the NAO team identified potential for exploration of environmental benefits related to duckweed mitigation.

The District supports a navigation project on the AIWW that also maintains water levels in Lake Drummond and Dismal Swamp National Wildlife Area.

Figure 18. Map of Dismal Swamp Canal.

Philadelphia District

Established in 1866, the Philadelphia District manages water resources of the Delaware River basin; builds facilities for the Army and Air Force; and provides engineering and environmental services for other agencies.  The Philadelphia District serves more than nine million people across portions of Delaware, Maryland, New Jersey, New York, and Pennsylvania.  Five earthfill dams in eastern Pennsylvania protects communities in the Delaware River Basin from flooding while providing water supply and enhancing both water quality and recreation: Blue Marsh Lake near Reading; Beltzville Lake and Francis E. Walter Dam in the Poconos; and Prompton Lake and Jadwin Dam in the northeastern corner of the state.

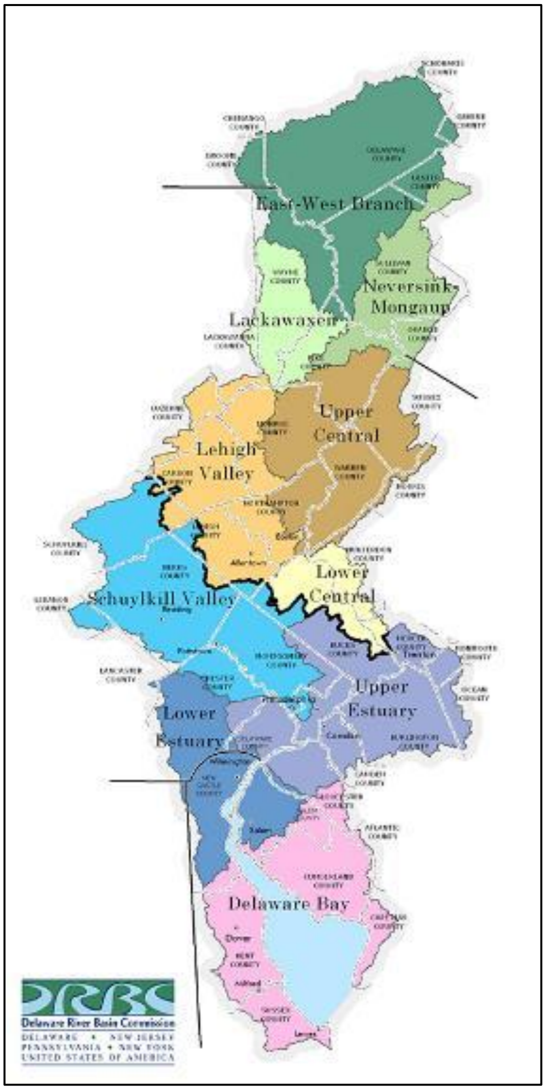



Figure 19. NAP Watersheds

## Philadelphia District Water Management

Civil Work Projects in three sub basins within the Delaware River Basin:

Lackawaxen River Basin
- Prompton Dam
- Jadwin Dam

Lehigh River Basin
- Francis E. Walter Dam
- Beltzville Dam

Schuylkill River Basin
- Blue Marsh Lake

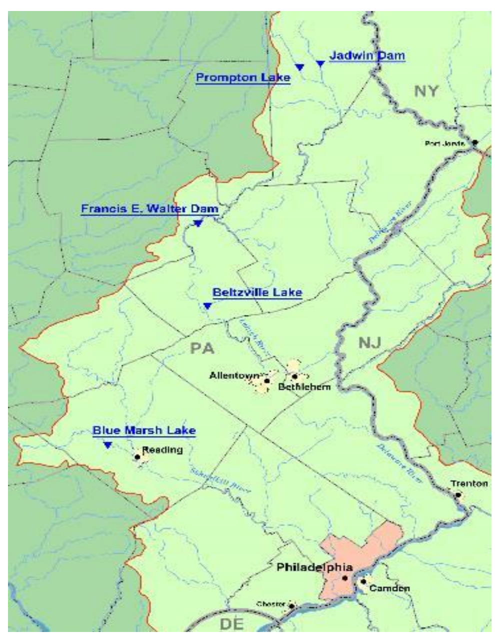



Figure 20. NAP Project Map

*Blue Marsh Lake*

The Blue Marsh Lake and Dam (Figure 21) is located on Tulpehocken Creek, a tributary of the Schuylkill River, approximately 6.4 miles upstream of Reading in Berks County, Pennsylvania. The project location is shown on figures 19 and 20. The Tulpehocken Creek flows into the Schuylkill River at approximately river mile 76.1 as established by the United States Geological Survey for the Delaware River Basin Commission. The Blue Marsh Lake and Dam is an integral part of the Schuylkill River Flood Control Program. This project, in addition to aiding in flood control along the Tulpehocken Creek and the Schuylkill River, will operate for water supply, water quality control and low flow augmentation in the Schuylkill River and salinity repulsion in the Delaware River Estuary. Authorized by the Flood Control Act of 1962, purposes of this project are flood control, water supply and low flow augmentation. Secondary purposes are recreation and water quality control.

Figure 21. Blue Marsh Lake and Dam (USACE photos).

- Recreation Impact: Over one million visitors in 2020, $9.44 million in visitor spending
- Sustainability Program: Geothermal in Visitor Center, Electric Vehicles, LED lighting, HVAC upgrades
- Environmental Stewardship Program: Shoreline Restoration ongoing, Water Quality-HABS, Habitat creation in lake and downstream.
- Invasive Species Program: Spotted Lanternfly
- Downstream temperature management for Cold Water Trout Stocked Fishery
- Water Supply Intake upgraded to direct tower withdrawal
- Instream Flow Incremental Methodology (IFIM) used in the past to guide flow regulation during critical times of year for the aquatic community downstream
- Selective withdrawal capabilities in control tower

*Francis E. Walter Dam*

The Francis E. Walter Reservoir Project (formerly Bear Creek Reservoir) is located on the Lehigh River, approximately 77 miles above the confluence with the Delaware River, 5 miles above White Haven, PA. Project location is shown on figures 19 and 20. Authorized by the Flood Control Act of 1946, the Francis E. Walter Reservoir Project (Figure 22) is an integral part of the Lehigh River Flood Control Program. This project, in addition to aiding in flood control along the Lehigh River, will regulate for recreation. Originally the only authorized purpose of this project was flood control. Public Law 100-676, Section 6, dated November 17, 1988 authorized recreation to include whitewater rafting activities.


Figure 22.  Whitewater boating on the Lehigh River and Francis E. Walters Dam (USACE photos).

- Recreation Impact: Large stakeholder interest in recreation releases for fishing and whitewater boating.
- Environmental Stewardship Program: Borrow area revitalization and habitat creation, Partnership with Pheasants Afield, Pheasants Forever, Forest Habitat Program (timber management).
- Invasive Species Program: Gypsy moth, Japanese Knotweed
- Annual Recreational and Fishery releases critical to local and regional economy and benefits the river ecosystem
- USACE, Agencies and Public engagement and interest became elevated from approximately 2000 to Present
- Lehigh River Sustainable Rivers study completed in 2017.  Currently undergoing a Re-evaluation Study authorized under Section 216 of the Flood Control Act of 1970
- Minimal selective tower control

*General Edgar Jadwin Dam (Dry Dam)*

The Jadwin Reservoir Project is located on the Dyberry Creek, a tributary of the Lackawaxen River, approximately 2.9 miles upstream of Honesdale, PA. The project location is shown on figures 19 and 20. The project is 30.1 miles above the confluence of the Lackawaxen River with the Delaware River at Lackawaxen, PA.  Authorized by the Flood Control Act of 1948, the Jadwin Reservoir project (Figure 23) is part of an integrated reservoir flood control system. In conjunction with Prompton Reservoir, Jadwin provides flood control protection in varying degrees, to the Boroughs of Honesdale and Hawley and to smaller communities along the Lackawaxen. Flood control is the only authorized purpose for this project.

Figure 23. General Edgar Jadwin Dry Dam (USACE photo).

- Recreation Benefit: Area is open to hunting, fishing, and hiking.
- Environmental Stewardship Program: Reforestation, Invasive Species Program
- Conduit controlled outflow

*Beltzville Dam*

The Beltzville Lake and Dam Project is located on the Pohopoco Creek (Class A Trout Fishery), a tributary of the Lehigh River, approximately 5.2 miles above the confluence with the Lehigh River in Carbon and Monroe counties in northeastern Pennsylvania. Project location is shown on figures 19 and 20. The Pohopoco Creek flows into the Lehigh River at approximately river mile 41.1 as established by the United States Geological Survey for the Delaware River Basin Commission. Authorized by the Flood Control Act of 1962, the Beltzville Lake and Dam Project (Figure 24) is an integral part of the Lehigh River Flood Control Program. This project, in addition to aiding in flood control along the Pohopoco Creek and the Lehigh River, will operate for water supply, water quality control, low flow augmentation in the Lehigh River and lower Delaware River and salinity repulsion in the Delaware River Estuary. Authorized purposes of this project are flood control, water supply and low flow augmentation. Secondary purposes are recreation and water quality control.

Figure 24. Beltzville Dam (USACE photo).

- Additional Benefits: Water Quality, Environmental Stewardship and Recreation.
- Sustainability Program**:** Solar panel array to supplement control tower electric needs.
- Invasive Species Program: Aquatic Hitchhikers, Hydrilla, Zebra Mussels, boat wash station, Spotted Lanternfly.
- Environmental Stewardship Program: Habitat creation in lake and downstream, Selective control tower, Downstream temperature management for cold water trout fishery
- Operates with FE Walter Dam as system for the Lehigh River

*Prompton Lake*

Prompton Reservoir is located on the West Branch of the Lackawaxen River, approximately 0.5 miles upstream of Prompton, PA, 4.7 miles upstream of Honesdale, PA, and 31 miles upstream of the confluence of the Lackawaxen River and the Delaware River at Lackawaxen, PA. Project location is shown on figures 19 and 20. Authorized by the Flood Control Act of 1948, Prompton Reservoir (Figure 25) is part of an integrated reservoir flood control system. In conjunction with General Edgar Jadwin Reservoir, it provides flood control protection in varying degrees for Prompton, Honesdale, Hawley and smaller communities along the Lackawaxen River. Flood control is the only authorized purpose for this project. The project also includes recreational public use facilities.

Figure 25. Prompton Lake and Dam Project (USACE photos).

- Recreation Impact: Fishing, boating, hiking
- Environmental Stewardship Program: Reforestation, Habitat creation for pollinators to reduce mowing, Invasive Species Program
- No Selective withdrawal capabilities available, outflow is controlled by conduit size.

**Environmental Opportunity Matrix and Ongoing Environmental Work**

The Environmental Opportunity Matrix was initially developed for use in the Upper Midwest Regional Operations and Water Management meeting. Its intended use is to help identify priority environmental actions and opportunities effectively and comprehensively for the region. The matrix evolved through the subsequent South and Pacific Northwest and now North Atlantic regional meetings. Meeting participants were provided a copy of the matrix prior to the meeting and asked to review the list of potential environmental actions and objectives, particularly with a view toward adding any unlisted actions pertinent to reservoir projects in the North Atlantic region. At the end of the first plenary session, the matrix was reviewed again by the entire group.

During the first breakout session, each team was asked to use the matrix to consider environmental actions associated with Corps water resource infrastructure in their respective areas of responsibility. Each action was scored based on potential and implementation. Scores are per team; values reflect status for each team's entire portfolio of projects (per reservoir type).

Potential ("Pot.") is a measure of the degree to which an action is likely to produce benefits. Implementation ("Imp.") is a measure of how much of that potential has already been realized. Both measures are reported as either: 0 (none), 1 (low), 2 (moderate), or 3 (high). For potential, a "0" ranking is an activity that has no potential for providing environmental benefits even if it were implemented. For implementation, a "0" ranking means there has been no implementation. In interpreting the scoring, a "3-2" would be a very promising action with moderate fulfillment; a "1-3" would characterize an action with limited possibilities that has already been highly achieved. An implementation value less than 3 indicates that there are unrealized environmental benefits.

Table 4a addresses environmental opportunity at general reservoirs with multiple purpose storage while Table 4b addresses lock and dam and dry dam reservoirs. Green highlighting identifies actions selected by each team for consideration during the next breakout session.

Table 4a. Potential and implementation of environmental actions per location-based team (general reservoirs).

**Potential (Pot.)**: a measure of the degree to which an action is likely to produce benefits
**Implementation (Imp.)**: a measure of how much of that potential has already been realized
Both measures are reported as either: 0 (none), 1 (low), 2 (medium), 3 (high), or not applicable (n.a.)

[yellow] Denotes environmental flow actions and objectives--traditional focus of SRP
[green] Denotes environmental actions selected by location-based teams for per project consideration

| Reservoir Project Types | | Environmental Action/Objectives | NAB | | NAE | | NAN | | NAO | | NAP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. |
| General | In pool | Support - Water Level management for fisheries | 3 | 2 | 2 | 1 | n.a. | n.a. | 2 | 2 | 3 | 2 |
| | | Support - Water level management for mussels | 1 | 0 | 2 | 0 | n.a. | n.a. | 0 | 0 | 2 | 0 |
| | | Support - Water level management for overwinter biota | 2 | 1 | 1 | 0 | n.a. | n.a. | 0 | 0 | 1 | 0 |
| | | Support - Water level management for vegetation (riparian) | 3 | 1 | 1 | 0 | n.a. | n.a. | 0 | 0 | 3 | 1 |
| | | Support - Water level management for vegetation (wetlands) | 3 | 1 | 1 | 0 | n.a. | n.a. | 0 | 0 | 3 | 1 |
| | | Support - Water level management for waterfowl | 3 | 1 | 1 | 0 | n.a. | n.a. | 0 | 0 | 0 | 0 |
| | | Support - Water level management for shorebirds, gulls, other migrants | 1 | 1 | 1 | 0 | n.a. | n.a. | 0 | 0 | 0 | 0 |
| | | Suppress - Level management for fisheries | 0 | 0 | 0 | 0 | n.a. | n.a. | 0 | 0 | 3 | 2 |
| | | Suppress - Level management for mussels | 2 | 0 | 0 | 0 | n.a. | n.a. | 0 | 0 | 1 | 0 |
| | | Suppress - Level management for overwinter biota | 0 | 0 | 1 | 0 | n.a. | n.a. | 0 | 0 | 2 | 0 |
| | | Suppress - Level management for vegetation | 3 | 0 | 3 | 1 | n.a. | n.a. | 0 | 0 | 3 | 0 |
| | | Suppress - Level management for waterfowl | 0 | 0 | 0 | 0 | n.a. | n.a. | 0 | 0 | 1 | 0 |
| | | Suppress - Water level management for shorebirds, gulls, other migrants | 0 | 0 | 0 | 0 | n.a. | n.a. | 0 | 0 | 1 | 0 |
| | | Pool rate of change management for bank integrity (WQ considerations) | 2 | 2 | 1 | 0 | n.a. | n.a. | 0 | 0 | 0 | 0 |
| | | Water Quality - Pathogens | 1 | 0 | 2 | 1 | n.a. | n.a. | 2 | 2 | 2 | 1 |
| | | Water Quality - Nutrients | 1 | 0 | 2 | 1 | n.a. | n.a. | 2 | 2 | 3 | 2 |
| | | Water Quality - Temperature | 2 | 1 | 1 | 0 | n.a. | n.a. | 2 | 2 | 3 | 2 |
| | | Water Quality - Management of harmful algal blooms | 1 | 0 | 2 | 1 | n.a. | n.a. | 2 | 1 | 3 | 2 |
| | Connect up and down | Manage distribution of depositing sediments (encourage sediment flux) | 1 | 0 | 3 | 1 | n.a. | n.a. | 0 | 0 | 3 | 1 |
| | | Reallocations | 2 | 1 | 1 | 0 | n.a. | n.a. | 0 | 0 | 3 | 1 |
| | | Sediment management - bed and bank | 1 | 0 | 3 | 1 | n.a. | n.a. | 0 | 0 | 3 | 1 |
| | | Restrict passage of invasives | 3 | 3 | 2 | 0 | n.a. | n.a. | 0 | 0 | 1 | 0 |
| | | Debris management | 1 | 1 | 2 | 2 | n.a. | n.a. | 0 | 0 | 2 | 1 |
| | **Downstream** | | | | | | n.a. | n.a. | | | | |
| | *Ecological flow targets* | Geomorphic process support | 1 | 1 | 1 | 1 | n.a. | n.a. | 1 | 1 | 3 | 2 |
| | . | Floodplain connectivity | 2 | 1 | 1 | 1 | n.a. | n.a. | 1 | 1 | 3 | 2 |
| | | Riparian management | 2 | 1 | 1 | 1 | n.a. | n.a. | 1 | 1 | 3 | 2 |
| | . | Wetland management | 2 | 1 | 1 | 1 | n.a. | n.a. | 1 | 1 | 3 | 2 |
| | . | Life stage support - Fisheries | 3 | 2 | 1 | 1 | n.a. | n.a. | 2 | 2 | 3 | 0 |
| | . | Life stage support - Mussels | 1 | 1 | 1 | 1 | n.a. | n.a. | 1 | 1 | 3 | 1 |
| | . | Life stage support - Waterfowl | 2 | 1 | 0 | 0 | n.a. | n.a. | 2 | 2 | 3 | 2 |
| | . | Life stage support - Shorebirds, Gulls, other migrants | 1 | 1 | 0 | 0 | n.a. | n.a. | 2 | 2 | 3 | 2 |
| | *Ecological flow targets* | Life stage support - Herps | 1 | 1 | 1 | 1 | n.a. | n.a. | 2 | 2 | 3 | 2 |
| | | Rate of change management for bank integrity (WQ considerations) | 1 | 0 | 2 | 2 | n.a. | n.a. | 2 | 2 | 1 | 0 |
| | | Physical habitat creation (use of dredged material, oxbows/floodplain restoration) | 1 | 0 | 1 | 0 | n.a. | n.a. | 0 | 0 | 0 | 0 |
| | | Recreation | 2 | 2 | 2 | 2 | n.a. | n.a. | 2 | 1 | 3 | 2 |
| | | Water Quality - Dissolved Gas (Management of gas bubble trauma) | 2 | 1 | 1 | 0 | n.a. | n.a. | 2 | 2 | 0 | 0 |
| | | Water Quality - Nutrients | 1 | 0 | 1 | 0 | n.a. | n.a. | 2 | 2 | 2 | 2 |
| | | Water Quality - Temperature | 2 | 2 | 2 | 1 | n.a. | n.a. | 2 | 2 | 1 | 2 |
| | | Water Quality - Turbidity | 1 | 0 | 1 | 0 | n.a. | n.a. | 2 | 2 | 0 | 0 |

Table 4b. Potential and implementation of environmental actions per location-based team (lock and dam and dry dam reservoirs).

**Potential (Pot.)**: a measure of the degree to which an action is likely to produce benefits
**Implementation (Imp.)**: a measure of how much of that potential has already been realized
Both measures are reported as either: 0 (none), 1 (low), 2 (medium), 3 (high), or not applicable (n.a.)

[green] Denotes environmental actions selected by location-based teams for per project consideration

| Reservoir Project Types | | Environmental Action/Objectives | NAB | | NAE | | NAN | | NAO | | NAP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. |
| L&D | In pool | Level management for vegetation (riparian, woody, pioneer trees) | n.a. | n.a. | n.a. | n.a. | 1 | 0 | 2 | 0 | n.a. | n.a. |
| | | Level management for veg (wetland emergent) | n.a. | n.a. | n.a. | n.a. | 1 | 0 | 2 | 0 | n.a. | n.a. |
| | | Level management for waterfowl | n.a. | n.a. | n.a. | n.a. | 1 | 0 | 1 | 0 | n.a. | n.a. |
| | | Level management for shorebirds, gulls, other migrants | n.a. | n.a. | n.a. | n.a. | 1 | 0 | 1 | 0 | n.a. | n.a. |
| | | Water Quality - Nutrients | n.a. | n.a. | n.a. | n.a. | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Water Quality - Temperature | n.a. | n.a. | n.a. | n.a. | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Water Quality - Total Dissolved Gas | n.a. | n.a. | n.a. | n.a. | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Water Quality - Turbidity | n.a. | n.a. | n.a. | n.a. | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Fish Passage Operations | n.a. | n.a. | n.a. | n.a. | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Managing Sediment | n.a. | n.a. | n.a. | n.a. | 1 | 1 | 0 | 0 | n.a. | n.a. |
| | | Debris management | n.a. | n.a. | n.a. | n.a. | 1 | 1 | 1 | 1 | n.a. | n.a. |
| | Connect up and down | Fish Passage | n.a. | n.a. | n.a. | n.a. | 1.5 | 1 | 0 | 0 | n.a. | n.a. |
| | | Sediment management - bed and bank | n.a. | n.a. | n.a. | n.a. | 1 | 1 | 1 | 1 | n.a. | n.a. |
| Dry Dams | In pool | Physical habitat - Subimpoundment creation or restoration (ponds work) | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Physical habitat - Riffle creation or restoration (stream work) | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 3 | 0 |
| | | Physical habitat - Permanent wetland creation (water quality / habitat improvements) | 2 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Physical habitat - Seasonal wetland creation (vernal pools / seasonal wetlands) | 2 | 0 | 2 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Invasive species control - native plant establishments | 1 | 0 | 3 | 2 | n.a. | n.a | n.a. | n.a. | 2 | 3 |
| | | Support - Water level management for amphibians | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Support - Water level management for fisheries | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Support - Water level management for water birds | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Support - Water level management for vegetation | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Suppress - Water level management for vegetation | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Recreation | 1 | 2 | 2 | 2 | n.a. | n.a | n.a. | n.a. | 3 | 2 |
| | Connect Up and Down | Upstream sediment management partnerships | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Manage distribution of depositing sediments | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Sediment management - bed and banks | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Debris management | 1 | 0 | 2 | 2 | n.a. | n.a | n.a. | n.a. | 3 | 3 |
| | | Fish Passage | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Groundwater recharge for downstream ecological benefits | 0 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | Downstream | Riparian management for habitat conditions | 1 | 0 | 0 | 0 | n.a. | n.a | n.a. | n.a. | 2 | 0 |
| | | Subimpoundment creation or restoration (ponds work) | 1 | 0 | 0 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Riffle creation or restoration (stream work) | 1 | 0 | 0 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Permanent wetland creation - water quality / habitat improvements | 1 | 0 | 0 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Seasonal wetland creation - vernal pools / seasonal wetlands** | 1 | 0 | 0 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Ecological flow targets (especially herps and vegetation) | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |
| | | Water quality for ecological purposes | 1 | 0 | 1 | 0 | n.a. | n.a | n.a. | n.a. | 0 | 0 |

**Illustration of Reservoir Review**

As background and information for the next focus session, a national review of environmental flow potential for reservoirs was presented. The review involved three questions, with each culminating in rankings of all 465 reservoirs with federally authorized flood space. The three questions were: 1) how influential could the reservoir be, 2) in terms of hydrologic alteration, what is the reservoir actually doing, and 3) what is the reservoir able to do? Each of these questions involved a different assessment. All were designed to sort the whole portfolio of reservoirs according to their relative promise as a candidate for environmental flow operations. Tioga-Hammond was treated as a single reservoir for each assessment.

The "potential to influence" investigation involved a GIS exercise based on the storage volume of each reservoir and its corresponding mean annual flow at the dam and at points placed along the stream network below the dam. A value of storage divided by mean annual flow was computed at each point. Computed values decreased with distance from dam because the corresponding watershed area and associated mean annual flows increased. Computed values were multiplied by corresponding river reach lengths and summed for the full flow path, from dam to receiving lentic water body. Summed values were then sorted, ranked, and categorized as high, middle, and lower thirds within the region for display purposes (Figure 26).

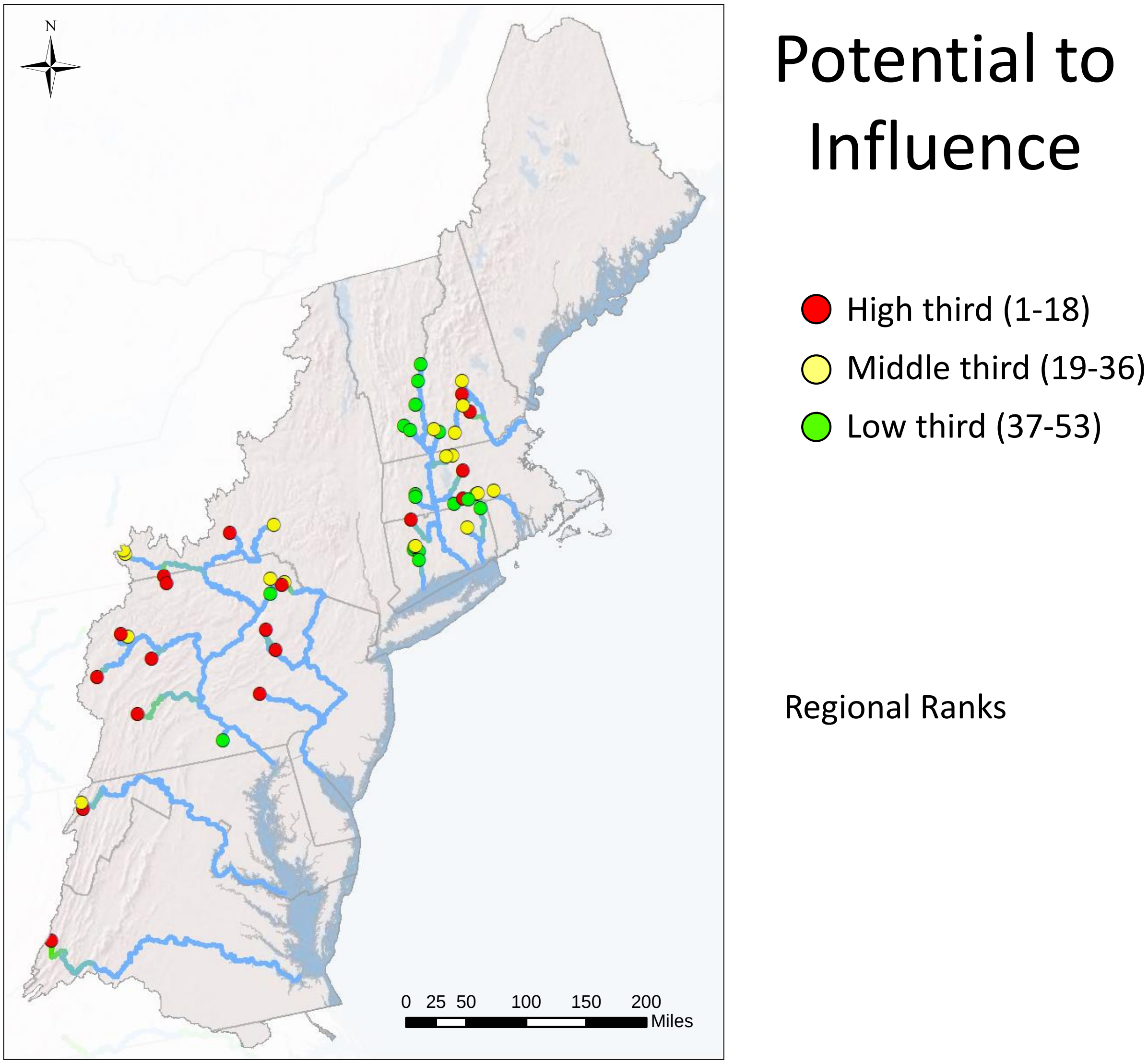



Figure 26. Results of the potential to influence assessment for the North Atlantic region. Categories are based on regional rankings.

The "hydrologic alteration" assessment involved a statistical comparison of reservoir inflows and outflows. Differences in low flows, high flows, monthly volumes, and variability were all computed, expressed as a scale between 0 and 10 and then summed for the four metrics. The resulting sums were sorted, ranked, and categorized as high, middle, and lower thirds for display purposes (Figure 27).

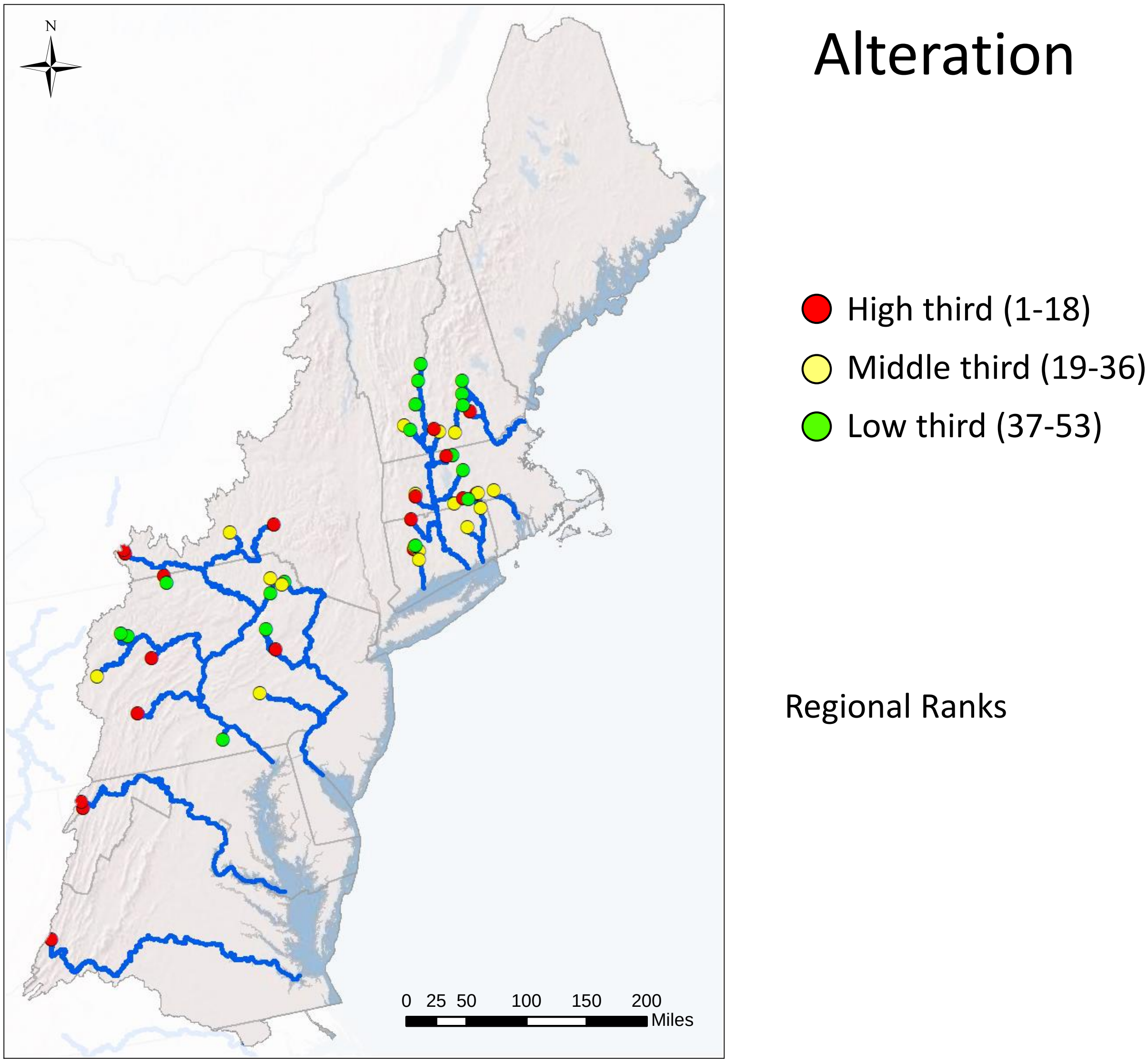



Figure 27. Results of the hydrologic alteration assessment for the North Atlantic Region. Categories are based on regional rankings.

The "characteristics" assessment considered each reservoir's authorities, operational flexibility, temperature management, fish passage, and channel condition. Reservoirs with federally authorized flood space have an average of 4 and as many as 8 authorized purposes per reservoir. Each authority accrued points for the reservoir (fish and wildlife +5, water quality +2.5, recreation +2.5, and all others -2 each). The total of the points was used as the score for the authorities portion of the assessment. Operational flexibility was estimated by computing the percentage of each reservoirs outflow that occurred between 0 and 20% of flood space encroached and then placing the percentage for each reservoir on a 0 to 10 scale. A reservoir's ability to manage outflow temperatures was scored on a scale from 0 to 10 with 0 being no ability, 5 being limited ability, and 10 being able to operate for water temperature with no expressed limitations. A reservoir's ability to pass fish was scored on a scale from

0 to 10 based on reported effectiveness, with 10 being free passage. Channel condition involved a comparison of a reservoir's objective flow (high flow limit) and its maximum non-damaging flow. When objective flow was equal to the maximum non-damaging flow a score of 0 was assigned. When objective flow was less than the maximum non-damaging flow the percent difference between the two values increased to a maximum of 10 when maximum non-damaging flow doubled the objective flow (differences greater than double were capped at a score of 10). When objective flow was greater than the maximum non-damaging flow the percent difference between the two values decreased to 0 as the maximum non-damaging flow decreased to 0. Scores for each of the five metrics were summed. Scores for the authorities and operational flexibility metrics were judged to be more important than the other metrics and given two shares each (added twice). The resulting sums were sorted, ranked, and categorized as high, middle, and lower thirds for display purposes (Figure 28).

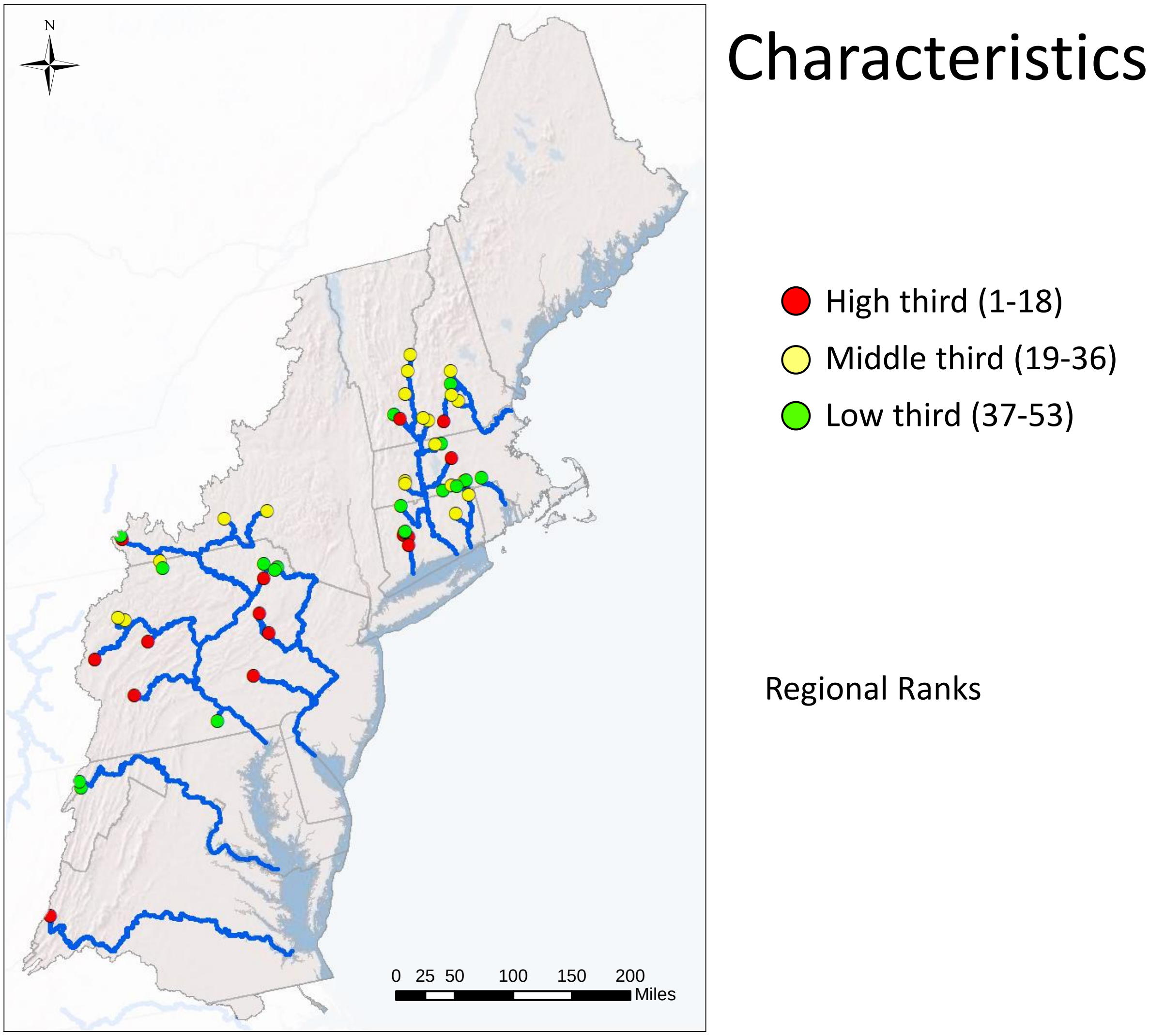



Figure 28. Results of the characteristics assessment for the North Atlantic region. Categories are based on regional rankings.

**Prioritization of Reservoirs**

Location-based teams were provided with information from the national review of environmental flow potential and tasked with prioritizing infrastructure within their area of responsibility. Each team selected 3 to 4 environmental actions from Table 4a and 4b, including "General (Reservoirs) – Downstream – Ecological flows", which is a focus of SRP and was required. Other environmental actions were selected by the teams that have unrealized environmental benefits (i.e., implementation values less than 3).

Teams were tasked with prioritizing reservoirs within their area of responsibility for each selected environmental action. Results for each team are detailed below. Green highlighting shows the priority actionable ideas that are summarized in Table 1.

Baltimore District

The following environmental actions were selected for prioritization:

1. Ecological flows (for multiple communities): (Pot. 3 to 1; Imp. 2 to 1)
2. Water level management for fisheries: (Pot. 3; Imp. 2)
3. Water level management for vegetation (wetlands, riparian vegetation, and vegetation suppression): (Pot. 3; Imp. 1 to 0)
4. Physical habitat- wetland creation (dry dams): (Pot. 2; Imp. 0)

Reservoirs were prioritized for each of these actions based on a combination of restoration need and potential ecological benefit (Table 5). Note that NAB generalized e-flows for multiple species and is meant to represent the multiple rows of life stage support listed in Table 4a.

Table 5. Baltimore District prioritization.

| Baltimore District | Selected "Actionable" Environmental Opportunities | | | |
|---|---|---|---|---|
| | E-Flows (multiple communities) (Pot. 3 to 1; Imp. 2 to 1) | Support - WLM for fisheries (Pot. 3; Imp. 2) | Support - WLM for vegetation (wetlands and rip and suppress) (Pot. 3; Imp. 1 to 0) | Physical habitat - Wetland creation (WQ / habitat improvements) (Pot. 2; Imp. 0) |
| | Ranking | Ranking | Ranking | Ranking |
| **General Reservoirs** | | | | |
| **Susquehanna** | | | | |
| Almond Lake | 11 | 11 | 11 | |
| Cowanesque Lake | 5 | 4 | 5 | |
| Tioga-Hammond Lakes | 3 | 2 | 1 | |
| East Sidney Lake | 9 | 10 | 10 | |
| Whitney Point Lake | 7 | 7 | 4 | |
| Stillwater | 10 | 9 | 7 | |
| Aylesworth | 12 | 12 | 12 | |
| Curwensville | 6 | 6 | 6 | |
| Alvin R. Bush | 8 | 8 | 3 | |
| Foster J. Sayers | 4 | 3 | 9 | |
| Raystown | 2 | 1 | 2 | |
| George B. Stevenson (Section 7 | 8b | 8b | 3b | |
| **Potomac** | | | | |
| Jennings Randolph | 1 | 5 | 8 | |
| Savage River Dam (Section 7) | 9b | 9b | 8b | |
| **Dry Dams** | | | | |
| Arkport Dam (Susq. Basin) | | | | 1 |
| Indian Rock Dam (Susq. Basin) | | | | 2 |
| **Other** | | | | |
| Aqueduct? | | | | |
| | | | | |

<u>New England District</u>

The following environmental actions were selected for prioritization:

1. Ecological flows for life stage support: (Pot. 1; Imp. 1)
2. Invasive species control – native plant establishments: (Pot. 3; Imp. 2)
3. Water quality – management of harmful algal blooms: (Pot. 2; Imp. 1)
4. Sediment management: (Pot. 3; Imp. 1)

Table 6 presents a summary of the results of analysis conducted by the NAE team. Note that NAE carried forward "E-flows for life stage support" and was meant to represent the multiple rows of life stage support listed in the EOM. Due to the large number of reservoirs managed by New England District and limited time for discussion, only the reservoirs with the most potential for the environmental impact were considered during prioritization.

Table 6.  New England District prioritization.

| New England District | Selected "Actionable" Environmental Opportunities | | | |
|---|---|---|---|---|
| | E-flows for life stage support (Pot. 1; Imp. 1) | Invasive species control - native plant establishments (Pot. 3; Imp. 2) | Water Quality - Management of harmful algal blooms (Pot. 2: Imp. 1) | Sediment Management (Pot. 3; Imp. 1) |
| | Ranking | Ranking | Ranking | Ranking |
| **General Reservoirs** | | | | |
| **Upper Connecticut River Basin** | | | | |
| North Hartland | | • | | |
| North Springfield | | 3 | | |
| Ball Mountain | 4 | | | |
| Townshend | 3 | | | 1 |
| Otter Brook | 2 | | 3 | 4 |
| Surry Mountain | 1 | | | 3 |
| **Lower Connecticut River Basin** | | | | |
| Tully | | | 2 | |
| Littleville | | | | |
| Colebrook | | | | |
| **Merrimack River Basin** | | | | |
| Ed. Macdowell | | | | |
| Hopkinton | | 1 | 1 | |
| Everett | | | | |
| **Housatonic River Basin** | | | | |
| Northfield Brook | | | | 2 |
| Black Rock | | | | |
| Hancock Brook | | | | |
| Hop Brook | | | | |
| **Thames River Basin** | | | | |
| Buffumville | | 1 | 4 | |
| East Brimfield | | 1 | | |
| Westville | | | | |
| West Thompson | | 4 | | |
| Mansfield Hollow | | • | | |
| **Blackstone River Basin** | | | | |
| Woonsocket Falls | | | | |
| | | | | |
| **Dry Dams** | | | | |
| Barre Falls - (Connecticut Basin) | | | | |
| Birch Hill - (Connecticut Basin) | | • | | |
| Conant Brook - (Connecticut Basin) | | | | |
| Knightville - (Connecticut Basin) | | 2 | | |
| Union Village - (Connecticut Basin) | | | | |
| Blackwater - (Merrimack Basin) | | | | |
| Franklin Falls - (Merrimack Basin | | • | | |
| Thomaston - (Housatonic Basin) | | | | |
| Hodges Village - (Thames Basin) | | 5 | | |
| West Hill - (Blackstone Basin) | | | | |
| | | | | |
| **Other** | | | | |
| Sucker Brook (Connecticut Basin) | | | | |
| Mad River Dam (Connecticut Basin) | | | | |
| East Branch Dam (Housatonic Basin) | | | | |
| Hall Meadow Dam (Housatonic Basin) | | | | |
| | | | | |
| **Charles River Natural Valley Storage Area?** | | | | |
| **3 Hurricane protection barriers? FRM primary** | | | | |
| **Local Protection Projects?** | | | | |
| **Cape Cod Canals? Fed Nav Project** | | | | |
| | | | | |

New York District

The following environmental actions were selected for prioritization:

1. Fish passage: (Pot. 1.5; Imp. 1)

Table 7. New York District prioritization

| Project name | Selected "Actionable" Environmental Opportunities |
| --- | --- |
| | Connect Up and Down: Fish Passage (Pot. 1.5; Imp. 1) |
| | Ranking |
| **Locks and Dams** | |
| **Hudson River** | |
| Troy Lock & Dam | 1 |
| | |

Norfolk District

The following environmental actions were selected for prioritization:

1. Environmental flows - water quality: (Pot. 2; Imp. 2)
2. Pool level management for vegetation: (Pot. 2; Imp. 0)
3. Management of harmful algal blooms: (Pot. 2; Imp. 1)

Table 8. Norfolk District prioritization.

| Norfolk District | Selected "Actionable" Environmental Opportunities | | |
| --- | --- | --- | --- |
| | Environmental Flows: Water Quality (Pot. 2; Imp. 2) | Pool Level Management for Vegetation (Pot. 2; Imp. 0) | Management of Harmful Algal Blooms (Pot. 2; Imp. 1) |
| | Ranking | Ranking | Ranking |
| **General Reservoirs** | | | |
| **James River Basin** | | | |
| Gathright Dam | 1 | | 1 |
| | | | |
| **Other** | | | |
| Albermarle and Chesapeake Canal | | | |
| Dismal Swamp | | 1 | |
| | | | |

Philadelphia District

The following environmental actions were selected for prioritization:

1. Riparian management for habitat conditions: (Pot. 2; Imp. 0)
2. Physical habitat – riffle creation or restoration: (Pot. 3; Imp. 0)
3. Recreation: (Pot. 3; Imp. 2)
4. Suppress – level management for veg: (Pot. 3; Imp. 0)
5. E-flows for fisheries: (Pot. 3; Imp. 0)
6. Level management for mussels: (Pot. 2; Imp. 0)
7. Suppress – level management for overwintering biota: (Pot. 3; Imp. 1)
8. Sediment management: (Pot. 3; Imp. 1)
9. Water quality – management of HAB's: (Pot. 3; Imp. 2)

Table 9. Philadelphia District prioritization.

| Project name | Selected "Actionable" Environmental Opportunities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Riparian Management for Habitat Conditions (Pot. 2; Imp. 0) | Physical habitat: Riffle Creation or Restoration (Pot. 3; Imp. 0) | Recreation (Pot. 3; Imp. 2) | Suppress: Level Management for Veg (Pot. 3; Imp. 0) | E-flows Fisheries (Pot. 3; Imp. 0) | Level Management for Mussels, (Pot. 2; Imp 0) | Suppress: Level Mgmt. for Overwintering Biota (Pot. 2; Imp. 0) | Sediment Management (Pot. 3; Imp. 1) | Water Quality: Management of HABs (Pot. 3; Imp. 2) |
| | Ranking | Ranking | Ranking | Ranking | Ranking | Ranking | Ranking | Ranking | Ranking |
| **General Reservoirs** | | | | | | | | | |
| **Delaware River Basin** | | | | | | | | | |
| Prompton Dam | 2 | 2 | 2 | 4 | | 4 | 4 | | |
| Francis E. Walter Dam | | | | 1 | 1 | 3 | 1 | 2 | |
| Beltzville Dam | | | | 3 | | 1 | 3 | 3 | |
| Blue Marsh Lake | | | | 2 | | 2 | 2 | 1 | 1 |
| | | | | | | | | | |
| **Dry Dams** | | | | | | | | | |
| Gen. Edgar Jadwin Dam | 1 | 1 | 1 | | | | | | |
| | | | | | | | | | |

**Parallel Sessions: Dry Dams**

Plenary Session #4 was originally scheduled to include parallel sessions for participants to choose between two nominated topics related to environmental opportunities at Corps water resources infrastructure. The session was scheduled in recognition that different regions of the country have different hydrology, ecosystems, and infrastructure. Participants are provided an opportunity to identify a topic of general interest and explore it in more detail.

Environmental Opportunities at Dry Dams was the single topic identified for discussion. The SRP Management team provided an overview of the ongoing national initiative to investigate and implement environmental actions at dry dams. Out of a total of 50 projects in the Corps' national portfolio of dry dams, 9 are located in NAD, including:

- 6 dry dams in New England District (NAE recognizes an additional 4 that are not included in the national portfolio).
- 2 dry dams in Baltimore District.

- 1 dry dam in Philadelphia District.

Dry dams are characterized as projects in which the reservoir remains empty most of the time. The reservoirs are filled only during flood events with stored water quickly released downstream following the event. Some dry dams have controlled outlet works while others are passive release without controllable gates. Most Corps dry dams are authorized for single purpose flood risk management, although some are also authorized for other purposes including Recreation, Fish and Wildlife, and conservation storage. Some dry dams have small year-round or seasonal conservation storage pools.

Since FY 20, it has been an objective of SRP to expand both the geographic scope of environmental improvement projects in SRP, as well as to increase activity at different types of Corps infrastructure – to include Section 7 projects, lock and dam projects and dry dams. An overview was provided of the four dry dam projects currently in SRP, including: Farmdale Dam on Farm Creek in Illinois (Rock Island District); Galisteo Dam on Galisteo Creek in New Mexico (Albuquerque District); Union City Dam on French Creek in Pennsylvania (Pittsburgh District); and Beach City Dam on Sugar Creek in Ohio (Huntington District).

Dry dams are viewed as providing special opportunity for environmental improvement. Water is a scarce and valuable resource everywhere but particularly in arid climates where many Corps dry dams are located. The existence of a Federal water resource infrastructure combined with public land and water resource management at those projects creates opportunity for environmental improvements that are consistent with SRP and other Corps missions and authorities.

The traditional "wheelhouse" of SRP has been to achieve ecological benefits through identification and implementation of environmental flows or "e-flows" downstream of general multiple-purpose storage reservoirs. While e-flows may not be feasible for dry dams, SRP projects at dry dams can consider management decisions that more broadly manipulate land/water interactions to achieve ecological goals. Examples include:

- Physical habitat creation (sub-impoundments, riffles, vernal pools, season wetlands, etc.)
- Pool level management (timing storage volumes and release of flood waters) for habitat improvement and/or suppression.
- Fish passage or other habitat connectivity improvement
- Invasive species control (plant and animal)
- Sediment management
- Debris management
- Riparian zone management
- Groundwater recharge
- Food cover crops
- Reservoir area land use changes

Location-based teams representing the districts in NAD were encouraged to consider and prioritize environmental actions at their respective dry dams during breakout sessions.

**Actionable Ideas and Discussion**

In the final breakout session, teams reconvened to further refine their prioritization of reservoirs. Each location-based team identified actionable ideas. An actionable idea is the pairing of a selected **environmental action** and **reservoir(s)** deemed to be compelling in accordance with potential environmental benefits and feasible to implement. This section details actionable ideas for each team.

Baltimore District

**Ecological flows**. **Jennings Randolph Lake** (Potomac Basin) was identified as the best actionable candidate reservoir for e-flows. Flows have historically been managed using established minimum flow releases as well as techniques such as AVF due to historical poor water quality conditions in the watershed from acid mine drainage and industrial uses. Water quality and other watershed conditions have improved since Jennings Randolph was constructed, which suggests that re-evaluating how the reservoir is regulated may provide insight into additional operational changes that could further benefit the system.

**Raystown** ranked second – it is the largest and perhaps most influential reservoir in NAB's portfolio.

**Tioga-Hammond Lakes** ranked third. Ongoing water quality improvement of in-flows may allow for opportunities to evaluate ecological flows for downstream improvements.

**Foster Joseph Sayers** was also viewed as a good candidate for e-flows through a recent continuing authorities program study (1135) revealed feasibility challenges that make implementation of e-flows difficult.

**In-pool water level management for fisheries**. No projects were determined to be actionable. Many projects in Pennsylvania are stocked with fish by Pennsylvania resource agencies and many in-pool habitat structures have been installed. Examples may be found at Raystown, Foster Joseph Sayers, and others. However more investigation is needed to find out if additional water management actions would be beneficial and appropriate at any project.

**In-pool water level management vegetation**. **Tioga-Hammond Lakes** ranked first because the upstream pool areas have a large cattail wetland and there is potential for action at the project, likely in Hammond more so than Tioga. **Alvin R. Bush** ranked third and was the only other project selected as "actionable". Upstream lands have wetland characteristics and there may be opportunities for wetland creation and enhancement.

The NAB SRP Team identified some gaps in their knowledge and expertise that would help determine potential, feasibility, and potential opportunities. They recommend that next steps may include reaching out to project staff, outgranted recreation areas, and other partners that may be able to fill in these gaps (for example, elevations/topography, federal/state prioritized species lists, vegetation, geographical focus areas to maximize return on investment, and partnering to leverage resources, increase capacity, and maximize benefits) to refine potential opportunities and impact existing habitat by working with others.

**Physical habitat – wetland creation (water quality and habitat improvements)**

**Arkport** was ranked above **Indian Rock** for wetland creation. Arkport's pool area may also allow for contouring for wetland creation. Indian Rock's existing gates may allow holding water for wetland creation and enhancement within the pool area. However, in-flow water quality at Indian Rock is poor due to upstream industry. Arkport and Indian Rock are both dry dams.

New England District

**Ecological flows for life stage support.** **Surry Mountain Lake** ranked highest for implementation of e-flows due to the identification of the ESA listed species, Dwarf Wedge Mussel, downstream. A 2002 biological opinion from the USFWS identified take from a sudden reduction in flows for non-flood control events, and subsequent requirements for maintaining 15 cfs during non-emergency periodic and conduit inspections and various monitoring requirements. A stress study is scheduled to be conducted in FY22. **Otter Brook Lake** ranked second for e-flows as it operates in conjunction with SML.

**Invasive species control – native plant establishments.** **Hopkinton-Everett**, **Buffumville**, and **East Brimfield Lakes** ranked highest because they have the greatest potential for invasive species control of Eurasian/Variable Milfoil through continued use of winter pool drawdowns in combination with chemical treatments. Additional studies of non-chemical and low dose alternatives for reduction of invasive aquatic species should be explored.

**Knightville Dam** ranked next highest due to the substantial spread of Japanese Knotweed throughout the dry-bed reservoir area. A bio-control study with the University of Massachusetts, Amherst is being considered.

**Water quality – management of harmful algal blooms (HAB)**. **Hopkinton-Everett** ranked highest again due to the multiple beach closures over the last recreation season which has put a focus on identifying potential sources of HABs in that reservoir. It has been suggested that there may be a connection between the HAB occurrences and chemical milfoil treatments. Hopkinton-Everett has great potential for exploring the use of Copper Sulfate to reduce HAB occurrences with continued observation to determine if there is a link between milfoil treatments and HABs.

**Tully Lake** ranked second for potential in the management of HABs as project personnel have already been implementing Copper Sulfate treatments. Treatments have kept cell counts within Massachusetts state limits for safe bathing/swimming, but longer-term solutions are sought as cell counts continue to rise and costs for treatments could become prohibitive. Additionally, high phosphorous in tributaries has been identified as a source of HABs in this reservoir.

Otter Brook Lake and Buffumville ranked third and fourth as both projects have also had HAB occurrences though none were identified in 2020-2021 and no treatments have been conducted at these sites previously.

**Sediment management.** Management for sedimentation in the reservoir is of greatest concern at **Townshend Lake**. Chronic sedimentation has been impacting the swim beach, which has gained Congressional attention in recent years. Dredging has been done to remove material from the reservoir, but this is a short-term solution. Studies for alternative actions should be sought.

**Northfield Brook Lake** has had similar sedimentation issues within the reservoir, impacting its swim beach and the water quality, so much so that the beach has been closed since 2013. While there is documented sedimentation from an abutting private housing development onto project lands, a single source has not been identified for the sedimentation in the reservoir. Sedimentation may be resulting from increased development along the watershed, including stormwater discharges. Additional sedimentation has been deposited from the numerous storms in 2021. Studies and surveys, including an Environmental Assessment, were conducted from 2000 to 2015 to determine feasibility of reverting the reservoir back to dry bed and other alternatives to address sedimentation and water quality issues. The project was put on hold indefinitely and a FONSI was never issued for the Environmental Assessment when the dry-bed reversion was determined to be contrary to the project's authorized purpose.

Management of the sediment at Otter Brook and Surry Mountain Lakes should also be considered due to the low regeneration rate of the sedimentation layer within the Ashuelot River floodplain.

New York District

**Connect Up and Down: Fish Passage**. **Troy Lock and Dam** is the only infrastructure in New York District that was evaluated for environmental actions. New York District identified fish passage as the action with the greatest potential for environmental benefits. Other items that were considered but not carried forward due to low potential included pool level management for multiple environmental benefits, sediment management and debris management.

Fish passage during early months of the year was identified as an environmental action with higher potential than current implementation. Troy Lock and Dam currently locks sea migrating fish through the lock chamber during normal operating months (May-November). Lock operations at Troy cease during winter months (December – April) with the chambers closed to prevent unauthorized vessel use and to prevent debris and ice from entering the chamber. Maintenance operations resume in early to mid-April with vessel movement beginning May 1st but may preclude fish that migrate February through April. Troy Lock and Dam has a conduit in the lock chamber that may allow some fish movement during winter months, but it's use by fish is largely unknown. Discussions included the possibility of leaving the lock chamber open throughout the winter or begin operating in February and March to allow fish passage earlier in the year.

Norfolk District

**Ecological flows. Gathright Dam and Lake Moomaw** was the only project identified as actionable for ecological flows. An initial step would be to explore improvements to water quality downstream of the Gathright Dam project within the Jackson River. Gathright, in coordination with the Virginia Department of Environmental Quality (VADEQ), releases six pulsed outflows during spring and summer months. The water control plan for Gathright includes these releases as part of the low flow augmentation authorized purpose. The VADEQ is the lead agency for water quality in the Jackson River. To date, the VADEQ has not requested USACE explore further changes to environmental flows to enhance water quality.

**Harmful algal blooms (HABs).** HABs are an emerging issue at **Gathright Dam and Lake Moomaw**. In June 2021 a small bloom of cyanobacteria was identified along the north shore of Lake Moomaw in the vicinity of the Gathright Dam. Project staff prepared to sample the water in the vicinity of the algal bloom, in coordination with District environmental scientists. However, upon their return to the site the following day, the bloom had dissipated. Such cyanobacteria growth has not been seen on Lake Moomaw prior to 2021. The NAO team identified this new aspect as a candidate for investigation to determine the potential sources of and opportunities to mitigate future growth of HABs.

**Level management of vegetation.** The **Dismal Swamp Canal (DSC)** was the only site deemed actionable for level management of vegetation. Duckweed growth in the **DSC** has been an ongoing concern for navigation interests. The DSC primarily serves the recreational boating community and is a major route for boats travelling up and down the east coast each year. Duckweed causes problems with the cooling systems on boats, limits visibility in the canal for identification of floating hazards, and at times duckweed density in the canal can be so high as to inhibit a vessels' ability to transit the canal. While the environmental impacts, whether beneficial or harmful, are not clear to the NAO team, there is a potential to investigate the duckweed situation.

Philadelphia District

The team identified **Francis E. Walter (Walter) Dam** as the NAP project with the highest flexibility for additional environmental action. The four actionable ideas associated with **Walter** are **Ecological Flows for Fisheries, Pool Level Management for Mussels, Vegetation and Overwintering Biota**, and **Sediment Management**. The current operation plan stores 18,700 acre-feet of water in the spring which is used for recreation, ecological flows, and pulse releases.

**Ecological flows for fisheries**. In a 2017 SRP study of Walter and Beltzville Dams, The Nature Conservancy (TNC) identified potential flow needs for the Lehigh River. There is an opportunity to explore modifications to the existing operating plan to incorporate suggestions from the 2017 study. Additionally, recent concern over tributary surface flow disconnection from the mainstem Lehigh River downstream of Walter Dam and under low flow release operations will be evaluated in partnership with the State of Pennsylvania and other interests as identified.

**Level management for vegetation, overwintering biota and management for mussels**. The drop in seasonal pool level exposes soil and sediment, decreases the in-lake habitat availability and prevents the establishment of a vegetated littoral zone. NAP proposes to evaluate operations and opportunities as they relate to seasonal and flood control operations and the exposure of unvegetated sediments and loss of habitats. This would include surveys of existing mussel populations and locations. Since the type and number of mussel species in the reservoir are unknown, an opportunity exists to gather that data and determine if further study could determine if level management could be used to support existing mussel populations. Because the pool fluctuates 70 feet during the summer recreation season, a change in the timing and magnitude of the pool change could improve aquatic habitats in the reservoir. An investigation of the current management of upstream pockets of Japanese knotweed will also be considered as it relates to current operations and management efforts.

**Sediment management**. Immediately downstream of the dam, there is a lack of vegetation to stabilize the right embankment. During high flows the right embankment erodes and has created a large sandbar downstream of the outlet works. There are also large boulders that have changed the flow pattern in the outlet works. The embankment may be close to stabilizing as bedrock is being exposed, however there is an opportunity to explore sediment management at this project. In addition, the drop in seasonal pool level exposes soil and sediment upstream and decreases the in-lake habitat availability and increases erosion potential. NAP proposes to evaluate operations and opportunities as they relate to seasonal drawdown, flood control operations and exposure of unvegetated sediments.

Philadelphia District identified actionable ideas at the **Blue Marsh Dam and Reservoir** including the **manipulation of seasonal pool operations** (support native riparian vegetation, bank stability, and in lake fishery habitat), **harmful algal bloom management** opportunities, and **in-lake bank stabilization and erosion control** efforts.

**Level management for vegetation, overwintering biota, management for mussels, and sediment management** - The drop in winter pool level exposes soil and sediment, decreases the in-lake habitat availability and increases erosion potential. NAP proposes to evaluate operations and opportunities as they relate to seasonal drawdown flood control operations, exposure of unvegetated sediments and loss of habitats. This would include surveys of existing mussel populations and locations.

**Management of harmful algal blooms (HABs)** have become a public safety, ecological and operational concern at Blue Marsh Dam and Reservoir. NAP is working closely with the other USACE districts in Pennsylvania, the Pennsylvania Department of Environmental Protection, and local interests to develop operating procedures and response plans. As part of the Sustainable Rivers Program, NAP proposes to study what operational opportunities might exist at Blue Marsh Dam and Reservoir to manage high risk HAB events.

**Sediment management** -The Philadelphia District is actively involved in shoreline restoration projects along the reservoir rim working with state, local and NGO partners. As part of the SRP, NAP proposes to continue these partnerships and to research best management practices to harden the shoreline to prevent or lessen erosion caused by wave action which leads to sedimentation in the lake.

Philadelphia District identified actionable ideas at the **Beltzville Dam and Reservoir** to include **Level management for mussels.**

**Level management for mussels -** Native mussels are known to exist at Beltzville, but number of species, abundance, and location are largely unknown. A survey of existing mussel populations, to include consideration of appropriate management efforts, is needed.

Philadelphia District identified actionable ideas at the **General Edgar Jadwin Dam** including the **restoration of instream aquatic habitats** within the flood management area, **improvements in riparian buffer habitats** downstream of the dam structure, and enhancement of public onsite **environmental education** (Figure 29). General Edgar Jadwin Dam is a dry dam with perennial stream flow.

**Physical habitat: Riffle Creation or Restoration**. During dam construction, Dyberry Creek upstream of the dam was channelized for approximately 1000 feet. This reach lacks near bank overhead cover and is devoid of instream aquatic habitats. NAP proposes to restore in stream structure and native riparian habitats throughout this reach.

**Riparian management for habitat conditions.** The riparian area along the west bank of Dyberry Creek downstream of Jadwin Dam for approximately 800 feet does not adequately provide an effective riparian corridor to include benefits to instream temperature and water quality. NAP proposes to increase the riparian width of this reach utilizing native riparian tree and shrub species.

**Recreation.** Primary public access to the project area is along a decommissioned road upstream of the dam. Philadelphia District proposes to provide public environmental, and project related educational signage along this 0.75-mile access road. In addition, educational signage would be placed along existing trail systems throughout the project.

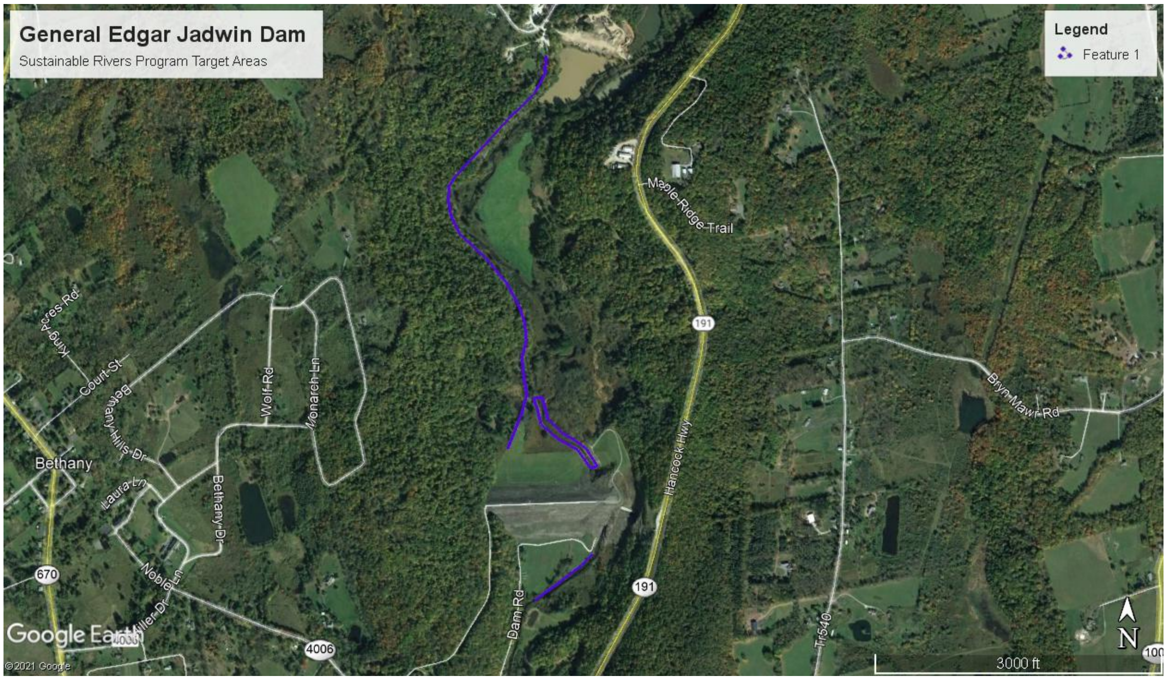



Figure 29. General Edgar Jadwin target areas for actionable ideas.

**Conclusion**

The North Atlantic Operations and Water Management Meeting was held virtually October 6-7, 2021. The North Atlantic region is defined as the geographic areas of 5 Corps Districts within North Atlantic Division (NAD): Baltimore (NAB), New England (NAE), New York (NAN), Norfolk (NAO), and Philadelphia (NAP). Teams for each area collaborated to determine environmental opportunities at reservoirs that are feasible to implement with compelling potential benefits. More than 54 reservoirs, affecting flows for over 3,049 river miles within the region, were considered.

In formulating and evaluating environmental opportunities, location-based teams followed these steps:

1. list possible environmental actions associated with reservoirs;
2. rate environmental potential of each action;
3. rate degree to which each action has been implemented;
4. select environmental actions with potential and unrealized implementation; and,
5. rank reservoirs according to which are most promising for operational changes related to selected actions.

A key outcome of the meeting is the list of “actionable ideas”, each of which is a pairing of an environmental action with unrealized implementation and a reservoir with potential for related operational changes. There were 38 actionable ideas identified during the workshop involving 16 environmental actions, 21 Corps reservoirs, 1 Corps lock and dam, and one “other category” (Dismal Swamp) (Table 1).

This tally is worthy of reflection. In a day and a half, 37 participants identified 38 actionable ideas. In other words, table 1 includes 38 ways to get more environmental benefits from already built, public, water resources infrastructure - just do more of this (action) at this location (reservoir). It does not mean making the changes would be easy or always generate the anticipated benefits. However, it does clearly connect water resources management to ecosystem management and illustrate the unrealized potential of reservoirs to be used as tools in the restoration and management of ecosystems.

It is hoped that the meeting outcomes can be used by district and North Atlantic regional partners to initiate implementation of as many of the identified measures as possible using the suite of environmental restoration and management tools and authorities at their disposal, including the Sustainable Rivers Program.

This was the fourth regional meeting supported by Sustainable Rivers. From a Program perspective, the meeting was done to 1) identify environmental opportunities at reservoirs in the North Atlantic region and 2) cultivate a forum about environmental considerations at reservoirs. The Corps has several recurring meetings that focus on water management and involve multiple Districts. To the knowledge of SRP, none are specific to environment considerations. Sustainable Rivers will continue to advance these regional meetings and help implement the resulting ideas with the overall goal of incorporating environmental strategies into the operations of Corps reservoirs.

# Appendix A - Participants

| Name | Org | Location-based Team |
|---|---|---|
| Andrew Hofmann | Corps | Baltimore |
| Andrew Roach | Corps | Baltimore |
| John Hickey | Corps | Baltimore |
| Julie Fritz | Corps | Baltimore |
| Kathy Anderson | Corps | Baltimore |
| Lacy Evans | Corps | Baltimore |
| Laura Felter | Corps | Baltimore |
| Phil Cwiek | Corps | Baltimore |
| Steven Brown | Corps | Baltimore |
| Vanessa Campbell | Corps | Baltimore |
| Adam Durando | Corps | New England |
| Christopher Hatfield | Corps | New England |
| Hugh Howe | Corps | New England |
| Jack Keenan | Corps | New England |
| Jeffrey Mangum | Corps | New England |
| Katie Kennedy | TNC | New England |
| Kim Russell | Corps | New England |
| Laura Fraser | Corps | New England |
| Meg Burke | Corps | New England |
| Natalie McCormack | Corps | New England |
| Stephanie Morrison | Corps | New England |
| Yixian Zhang | Corps | New England |
| Reggie Eakins | Corps | New York (met separately to evaluate NAN opportunities) |
| Lesley Dobbins-Noble | Corps | Norfolk |
| Matthew Rea | Corps | Norfolk |
| Megan Wood | Corps | Norfolk |
| Robin Williams | Corps | Norfolk |
| Scott Titus | Corps | Norfolk |
| Zachary Hill | Corps | Norfolk |
| Adrian Leary | Corps | Philadelphia |
| Christine Lewis-Coker | Corps | Philadelphia |
| Dave Williams NAP | Corps | Philadelphia |
| Gregory Wacik | Corps | Philadelphia |
| Jim Howe | TNC | Philadelphia |
| Laura Bittner | Corps | Philadelphia |
| Michelle Mattson | Corps | Philadelphia |
| Scott Sunderland | Corps | Philadelphia |
| Javier Jimenez-Vargas | Corps | Multiple |

# Appendix B

## AGENDA

## NORTH ATLANTIC REGION - OPERATIONS AND WATER MANAGEMENT MEETING

KEY EVENT DATES

JULY - SEPTEMBER
COORDINATION WITH PARTICIPANTS

SEPTEMBER
PREPARE MEETING MATERIALS

OCTOBER 6-7
OPERATIONS AND WATER MANAGEMENT MEETING

## OCTOBER 6-7, 2021

# NORTH ATLANTIC REGION - OPERATIONS AND WATER MANAGEMENT MEETING

Meeting goal is to identify environmental opportunities at water infrastructure that are feasible to implement with compelling potential benefits. Participants provide expertise in reservoir operations, water management, water quality, natural resources management, environmental planning, and ecology. Meeting provides a venue for consideration of environmental actions at rivers and water infrastructure of the North Atlantic Region.

MEETING LOCATION:

https://usace1.webex.com/meet/hugh.d.howe

US Army Corps of Engineers® Rock Island District

Sustainable Rivers Program

The Nature Conservancy
Protecting nature. Preserving life.™

# OPERATIONS AND WATER MANAGEMENT MEETING - NORTH ATLANTIC REGION

## Day 1 (times are in EST)

**9:00 am - 9:30 am:**

Introductions and Meeting Objectives. Session includes welcome, introductions, meeting overview, and meeting objectives. – Hugh Howe and John Hickey

**9:30 am - 10:00 am:**

SRP Brief. History and status of the Sustainable Rivers Program (SRP). As of 2021, SRP has engaged 40 river systems and 89 Corps reservoirs. SRP focuses on environmental flows (e-flows), including a process for advancing, implementing, and incorporating e-flows into reservoir operations, while exploring a broader set of strategies about environmental opportunities at water infrastructure. – Jim Howe

**10:00 am - 10:30 am:**

Regional Rivers and Reservoirs. Results from ongoing GIS analyses are used to summarize rivers and reservoir systems of the North Atlantic Region. Details include number, volume, purposes, and potential influence of Corps reservoirs in region. – John Hickey

**10:30 am - 10:45 am: Break**

**10:45 am - 11:30 am:**

"Water Infrastructure"-centric Environmental Efforts within Region. SRP efforts in the North Atlantic Region include work on the Connecticut, Lehigh, Susquehanna, and Potomac Rivers. Session includes presentations about SRP and other environmental projects within region (perspectives from NAE, NAB, NAP and NAO – 10 minutes each).

**11:30 am – 12:00 pm:**

Environmental Opportunity Matrix. Review matrix, incorporate any revisions, and provide instructions and goals for breakout session – Michelle Mattson.

**12:00 pm - 12:30 pm: Lunch**

**12:30 pm - 2:00 pm: Breakout session #1**

Focus Session: Ongoing Environmental Work at Water Infrastructure Projects within Region. Interactive group exercise (with reporting to conclude session) related to current environmental activities. Three topics or questions will be explored:

1) Identify environmental opportunities at reservoirs. Define potential and implementation per office.
2) What opportunities are underrepresented and feasible?
3) What are limitations to implementation?

**2:00 pm - 2:30 pm: Plenary session**

National Reservoir Review. Review of project authorizations and basic capabilities of Corps reservoirs to operate for environmental purposes, including which reservoirs have fish and wildlife, water quality, and/or recreation as an authorized purpose. – John Hickey

**2:30 pm - 4:00 pm: Breakout session #2**

Focus Session: Prioritization of Water Infrastructure Projects within Region. Location-based teams will be provided with information from a national reservoir review and tasked with prioritizing candidate infrastructure projects within their area of interest/expertise. Prioritizations will be done for environmental flow potential and two or three of the most promising environmental activities identified in the morning session. Teams will also develop ideas about how data provided might be applied differently in support of environmental activities.

**4:00 pm - 4:15 pm: Plenary session**

Wrap for day and details about tomorrow.

## Day 2

**9:00 am - 9:15 am: Plenary session**

Greeting and Revisit of Meeting Objectives. Session describes meeting goals and activities for the day. – Hugh Howe

**9:15 am – 9:45 am: Parallel Session**

Different regions of the country have different hydrology, ecosystems, and infrastructure. This session offers participants a chance to identify a topic of general interest and delve into it in more detail.

Environmental Opportunities at Dry Dams. Session will highlight environmental actions taken at dry dams across the country through the Sustainable Rivers Program. Due to the number of dry dams in NAD, this session is intended to offer districts a chance to place additional focus on this type of infrastructure. Approaches at dry dams have transferability to other types of infrastructure and will be informative to all participants. – Matt Rea

Other Nominated Topic – Day one discussion may prompt questions and discussion about other related environmental actions at Corps infrastructure. This space is reserved for any potential topics nominated during the meeting.

**9:45 am - 10:00 am:**

Review of Yesterday. Brief retrospective about yesterday's focus sessions for 1) environmental activities at water infrastructure projects and 2) project prioritizations. – John Hickey

**10:00 am – 10:15 am: Break**

**10:15 am - 12:00 pm: Breakout session #3**

Strategy Session to Integrate Information. Location-based teams reconvene to complete project prioritizations, finalize thoughts and materials for report out, and document results.

**12:00 pm - 1:00 pm: Lunch**

**1:00 pm - 2:00 pm: Plenary session**

Reports from Location-based Teams. Teams will report to group on identified environmental opportunities and candidate infrastructure projects. Actionable ideas will be highlighted. (15 minutes each)

**2:00 pm - 2:30 pm:**

Group discussion. Open discussion about meeting products and actionable ideas. Follow-up tasks. Concluding thoughts.

**2:30 pm - 3:00 pm:**

Review Regional Meeting Concept. This is the fourth regional meeting done via the Sustainable Rivers Program. Review overall agenda and revisit key components to discuss effectiveness and generate ideas for future meetings. Ideas about meeting goals, construct, and potential would be welcome. – John Hickey

**3:00 pm - Meeting Adjourned**