



# Sustainable Rivers Program

In Progress Review

FY 2021



US Army Corps  
of Engineers®

The Nature  
Conservancy 

1/21/2022

Prepared for U.S. Army Corps of Engineers, The Nature Conservancy,  
and other organizations involved with Sustainable Rivers

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## Overview

The Sustainable Rivers Program (SRP) is a national partnership between the U.S. Army Corps of Engineers (Corps) and The Nature Conservancy (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 authorized uses and 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. At the end of FY 2021, SRP involved work in 23 Corps Districts and 7 Divisions. Individual projects affect 89 Corps reservoirs in 40 river systems affecting approximately 10,953 river miles (Figure 1). It is the largest scale and most comprehensive program for implementing e-flows below Corps reservoirs and is growing. Sixteen new rivers were engaged in FY 2021.

Environmental flows (e-flows) are defined as the quantity, timing, and quality of water flows required to sustain ecosystems. For reservoir operators, e-flows manifest as management decisions that manipulate water and land-water interactions to achieve ecological or environmental goals.

SRP process for e-flows has three phases: “advance, implement and 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 e-flow strategies in reservoir operations policy such as water control manuals. Searching for e-flow opportunities at General multiple purpose reservoirs with storage space for flood risk management and other conservation purposes was the founding objective of SRP and remains the key focus. In recent years, the Program began exploring other reservoir-oriented actions with potential to produce environmental benefits. Initiatives have been undertaken to explore opportunities for pool level management and related environmental improvements strategies at lock and dam projects, and for actions to modify the land/water interface at dry dam projects to provide environmental benefits.

As in previous years, SRP funds will be used to accomplish a combination of programmatic and site work in accordance with the following principles: 1) build capacity within the water management community to implement environmental strategies with little or no direct funding from SRP; 2) engage partners to focus on sustainability and avoid conflict; and 3) advance innovative efforts to implement environmental strategies.

In broad terms, programmatic work focuses on how best to generate more environmental benefits from water resources infrastructure and location-based work focuses on advancing, implementing, and incorporating environmental strategies at specific facilities. The two are complementary with each generating new ideas, honing SRP methods, and demonstrating the benefits of environmental actions. Individual pieces of programmatic and location-based work are characterized by the leads for those efforts per the task categories described above for organizational and communications purposes.

Ideas for programmatic work originate from and are shaped by several influences; Regional and National SRP meetings, other USACE programs, strategic directions of SRP’s governmental and non-governmental partners, and especially interactions with and commonalities amongst location-based teams are all important sources. Ideas are refined by staff involved with SRP programmatic support and initiated as Program capacity allows.

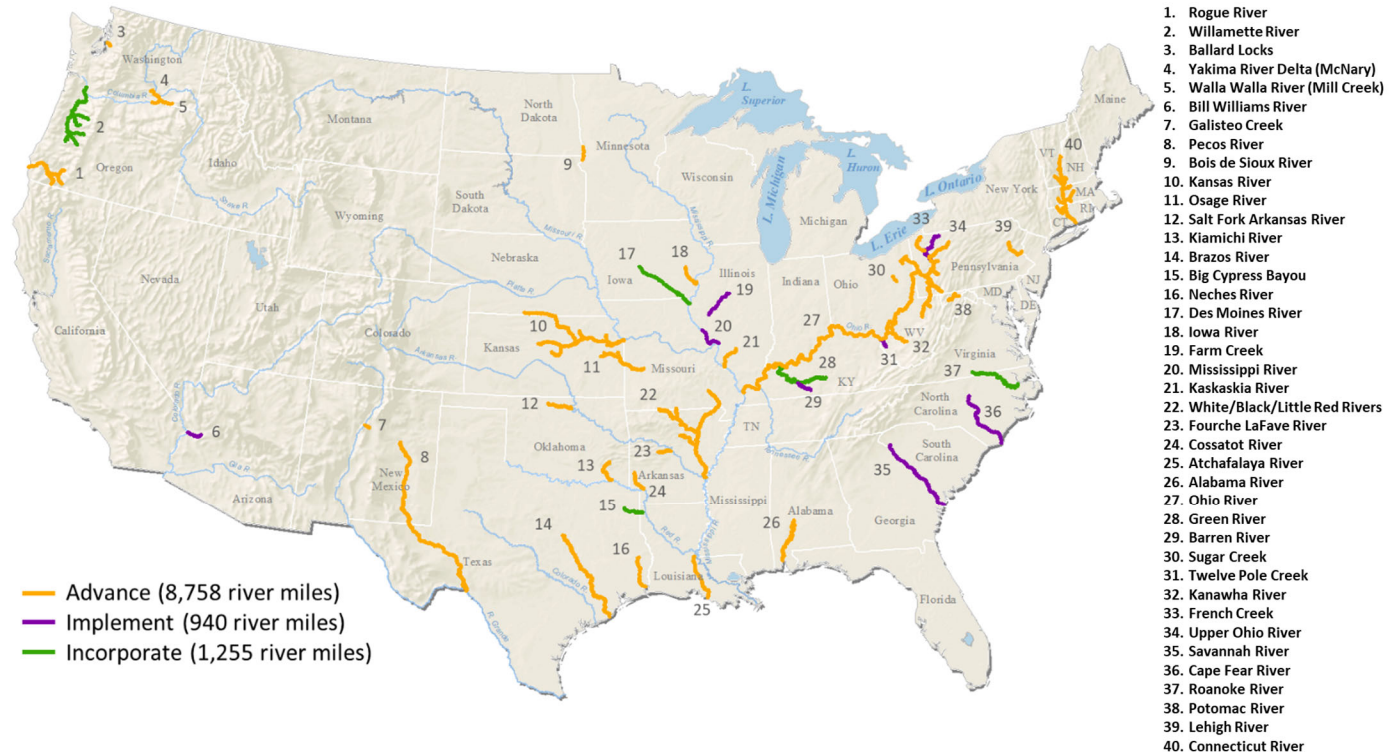


Figure 1. Status of rivers engaged in the Sustainable Rivers Program at end of 2021.

This document details SRP programmatic and location-based status and provides short backgrounds, FY 2021 progress, proposed FY 2022 work, and future visions of active SRP projects. For example, in this report you will find descriptions of several projects implementing e-flow prescriptions, including by Rock Island District in the Des Moines River. This year they conducted field surveys on fourteen occasions during the Lake Red Rock summer '21 pool drawdown which proved to be successful at supporting approximately 36,000 total shore birds, water birds (excluding over 76,000 White Pelicans), and their allies of 49 species. Saint Louis District used SRP funding to obtain satellite imagery taken during summer drawdown for Carlyle, Shelbyville, and Kaskaskia reservoirs. The team is using that imagery to delineate acres of exposed habitat shoreline habitat. SRP added 17 new rivers to the program in FY 2021 that began compiling literature in preparation of state of the science reports, building stakeholder working groups, executing stakeholder meetings and either prepare for, or hosting e-flow workshops. SRP has moved into new areas such as funding the Rivercane Restoration Alliance formed by TNTCX to facilitate a Rivercane Restoration Workshop. The workshop was attended by 187 participants, including 50 Tribal Nation representatives from 17 tribes. Rivercane is a critically endangered ecosystem and a cultural keystone species, and the tribes were asked to share Traditional Ecological Knowledge (TEK) along with scientific ecological knowledge to identify approaches to rivercane recovery. In addition, in this report you will find that the four SRP-Science projects are highlighted as a distinct category of SRP Programmatic Work.

The following project updates were compiled through meetings with District SRP Teams in November 2021 and supporting information can be found in the Deliverables and Milestones Spreadsheet (Appendix A) and SRP Tasks and Status Spreadsheet (publicly available; "Sustainable Rivers - Tasks - 2021-12-14.xlsx"). Appendix B provides a summary of funding and expenditures for FY 2021.

## Programmatic Work

Programmatic work planned for FY 2021-2024 is comprised mainly of program support, technologies, and validation of environmental strategies. Between 4 and 5 new or continuations of ongoing programmatic efforts per year are expected, FY 2021-2024 (e.g., national informational resources, regional meetings, national meetings, technologies, and validation).

### Program Support

Program support includes costs to administer the Program, engage partners, capacity building, and assistance for location-based efforts (outreach, implementation, and innovation). Program support is key to understanding and communicating the portfolio of structures involved (distribution and relevant characteristics of structures) and the spectrum of possible environmental actions (enabling setting and other considerations). Programmatic work undertaken in support of the different types of structures, includes organizing regional Operations and Water Management Meetings as well as the following type-specific activities (see pages 6-7 in PMP). In FY 2021 SRP organized two regional meetings to support Corps Districts in identifying potential environmental opportunities that could be pursued through SRP, the Corps Planning and Environmental Program, or another federal program. The first regional meeting was about dry dams, which are reservoirs that typically do not store water except during high flows. The dry dams meeting was held in September and October 2020 and engaged staff representing South Pacific Division (SPD) and Albuquerque (SPA), Sacramento (SPK) and Los Angeles (SPL) districts to discuss environmental opportunities at dry dam reservoirs. The second regional meeting was called the North Atlantic Operations and Water Management Meeting and was held in October 2021 and resulted in 38 actionable ideas. A meeting about environmental operations at Locks and Dams was delayed due to Covid and is now planned for early 2022.

### Technologies

Technologies includes investments in ecological and water resource software applied broadly within Sustainable Rivers as well as technical support for software applications led by location-based teams (technology and innovation). Ongoing technologies efforts include software development related to ecological time series analyses, formulation of river management alternatives, and spatial habitat mapping.

### Science (Validation)

From a purely ecological perspective, success of SRP is a function of improvements in river health which are therefore of key importance to gage. Unfortunately, the health of a natural system is very difficult to measure due to uncertainties in ecology understanding, changing influences of water management, and time required for ecological responses to become measurable. Through SRP-Science, SRP seeks to cultivate scientific understanding of the connections between reservoir operations and ecosystem responses for select rivers in unique ecoregions around the United States. Development of scientific knowledge is leveraged through implementation of e-flow prescriptions at reservoirs, which alters land-water interactions thereby stimulating ecosystem responses that can be studied and quantified using field monitoring protocols and analysis. If operational changes are studied, resulting knowledge can be used to improve prescriptions and perpetuate a culture of adaptive management. Monitoring does not need to be exhaustive to be effective and requires constructive, informative, and timely guidance from scientists in the field to dam operators.

SRP-Science was initiated in FY 2020 with four regional efforts intended to promote implementation of environmental strategies at reservoirs by: 1) reducing uncertainties about flow-ecology responses and

2) quantifying and communicating benefits of e-flows. These regional efforts include scientific work for the Des Moines River, North Carolina Rivers (Cape Fear and Roanoke), Upper Ohio (Allegheny River), and Willamette River.

*Des Moines River, IA – (SRP-Science)*

SRP-Science activities on the Des Moines River include agreements with the USGS Cooperative Research Unit at Iowa State University. Field work began in 2021 to evaluate how dam operations can influence fish recruitment below the Red Rock Dam. The effort created momentum with partnering agencies and resulted in the Iowa Department of Natural Resources to also conduct fish recruitment studies on the lower Des Moines River that focus largely on sturgeon spawning. Shovelnose Sturgeon are long-lived, slow-growing fish; do not spawn annually, but are especially susceptible to population declines due to overharvest and habitat modifications. Hydrologic conditions were favorable for a spring pulse in May 2021. MVR SRP staff conducted necessary coordination between Iowa State University, Iowa DNR fisheries, MVR Operations, and the MVR Water Control Center. Two pulses were passed through the dam resulting in larval sturgeon being captured a few days later. The “normal,” run of the river mode during the unusually dry period otherwise did not prompt fish to spawn. Laboratory analysis will continue into winter months and a report of findings anticipated.

SRP-Science efforts for the Des Moines River focus on better understanding the effects of e-flows on fish and mussel dynamics. The most recent includes a two-year field study on mussel assemblages and impacts from the dam. Available funds at the time required the scope of work to be reduced. As a result, the final lab analysis and reporting were removed. Field work is expected to reconvene in spring 2022.

*North Carolina Rivers, VA and NC – (SRP-Science)*

The Wilmington District (SAW) in North Carolina has two rivers in the SRP, the Roanoke and the Cape Fear Rivers. The Roanoke River is one of the original 8 rivers in SRP and is in the “incorporate” phase of the process. In 2016, the water control manual was amended to allow for quasi-run-of-river when the Corps enters flood operations. Building on the momentum of the Roanoke, the Cape Fear River was added to SRP in 2016/17. The Cape Fear is in the “implement” phase of the SRP process, actively conducting e-flow releases.

The Wilmington District (SAW) in North Carolina has two rivers in the SRP, the Roanoke and the Cape Fear Rivers. The Roanoke River is one of the original 8 rivers in SRP and is in the “incorporate” phase of the process. In 2016, the water control manual was amended to allow for quasi-run-of-river when the Corps enters flood operations. Building on the momentum of the Roanoke, the Cape Fear River was added to SRP in 2016/17. The Cape Fear is in the “implement” phase of the SRP process, actively conducting e-flow releases.

Being in different stages of the SRP process and with semblance to other Atlantic coastal plain rivers make the Roanoke and Cape Fear compelling candidates for scientific attention. SRP-Science in these two rivers entails formal work with the USGS across three topics: (1) creating a long-term adaptive management plan for both rivers, (2) learning about bank stability after high flows on the Roanoke to learn how to reduce the stress on the system with the new operational flexibility, (3) studying algal blooms and water quality in relation to flows using advanced technologies and techniques. The adaptive management plan was initiated in 2020 with a structured decision-making analysis. Field work for water

quality started in 2020 with USGS adding new sensors to their existing gages as well as running the autonomous underwater vehicle (AUV). The water quality work was expanded in the spring/summer of 2021 to include additional water quality sensors and 5 additional runs of the AUV in varying flow and pulse conditions. USGS, TNC, and US Fish and Wildlife Service (USFWS) created a plan to study bank stability that included a light detection and ranging (LIDAR) analysis complemented by field work utilizing “structure for motion”, which is planned for January 2022.

As part of the adaptive management work, TNC and USGS embarked on an effort to study how inflows are changing into reservoirs using the period of record data. This led to more questions about changing weather patterns in the basin, which is primed for 2022 work. The 2022 efforts will continue the adaptive management framework, the bank stability, the water quality, and analysis of climate change.

#### Upper Ohio River, PA – (SRP-Science)

Environmental flow efforts for the Upper Ohio River basin and supported by SRP began in 2014. After flow targets were defined focus shifted to translating basin-wide e-flow recommendations into operating recommendations at reservoirs within the region.

In 2020, the SRP team held the Kinzua Dam provisional ecosystem flow recommendations (PEFRs) workshop in September that was attended by forty river scientists and Corps staff. The SRP team prepared an Adaptive Management and Monitoring Plan (AMMP) for implementation of PEFRs at Kinzua Dam, including summaries of the biological surveys conducted in the Allegheny and knowledge gaps that limit implementation.

The SRP-Science team will continue in FY 2022 to refine the environmental prescriptions on the Allegheny and transfer lessons learned to Mahoning River and Little Beaver Creek within the Upper Ohio River system. Additionally, LRP will investigate impacts of climate change on the system and how it may influence the ability to implement e-flow changes at the Allegheny and other basins in the Upper Ohio.

#### Willamette River, OR – (SRP-Science)

Through SRP, the Corps and TNC have worked together since 2006 to determine e-flow requirements downstream of dams on the Willamette River Basin and identified opportunities to restore key aspects of the flow regime. The work reached a pivotal milestone in 2015 when a Memorandum for the Record was signed thereby incorporating e-flows into the operational guidance for several basin reservoirs.

In 2020, SRP-Science efforts were initiated to assess implementation of e-flow targets in the Willamette River Basin, evaluate ecological implications of flow objectives and develop communication products that can support the implementation and adaptive refinement of prescriptions for the basin and other watersheds. Results of this SRP-Science work will eventually be used by Corps water management and natural resources management staff, in conjunction with other co-managers and stakeholders, to determine if e-flow prescriptions can or should be adaptively revised to meet ecological requirements.

In 2021, SRP-Science efforts focused on development of a simple, streamlined process for annually reporting SRP implementation, describing which targets were met, the context for those targets, ecological benefits, lessons learned and recommendations for future monitoring and adaptive management. A pilot invertebrate sampling effort model informed data analyses was completed. From 2022 through 2024, the team proposes to develop models for Willamette Basin taxa, complete additional invertebrate sampling, assess variability of model performance and evaluate scenarios.



## Location-based Work

With increasing success of individual SRP projects and expanded awareness of the Program, SRP funding grew from \$500K to \$5M in FY 2020. The Program budget held at \$5M FY 2021. In FY 2021, three SRP Request for Proposals (RFPs) were announced; General, Locks and Dams, and Dry Dams. SRP program and leadership teams reviewed and prioritized 83 proposals on behalf of 38 rivers were received for FY 2021, including 24 new rivers. Requests totaled to \$5.6M.

SRP identifies and executes location-based work via the following process: 1) evaluate program objectives and topics of interest to determine if adjustments are needed, 2) highlight objectives and topics as part of a RFP, 3) compile and prioritize responses, 4) scope priority tasks, 5) arrange funding and other logistics, and 6) perform work. In FY 2020, 65 tasks totaling \$4.7M were proposed. Of those, 43 tasks for 17 rivers and \$2.4M were scoped and funded. The first In-Progress Review (IPR) summarizing status, including work completed in FY 2020 and anticipated work in FY 2021 is available at <https://www.hec.usace.army.mil/sustainableivers/>. In FY 2021 a total of 83 tasks totaling \$5.6M were proposed. This report summarizes status, including work completed in FY 2021 and anticipated work in FY 2022 and beyond. Infrastructure type(s) - “Gen” for general multi-purpose reservoirs, “LD” for locks and dams, and “DD” for dry dams - and pertinent state abbreviations acknowledged as part of the section header for each river. This section is organized alphabetically as shown in Table 1.

Table 1. FY 2021 Location-Based Efforts

<u>SRP Supported Rivers (Structures) - FY 2021</u>	<u>District Name</u>
Alabama River (Claiborne and Millers Ferry) *	Mobile District (SAM)
Salt Fork Arkansas River (Great Salt Plains) *	Tulsa District (SWT)
Big Cypress Bayou - Caddo Lake (Lake O' the Pines)	Fort Worth District (SWF)
Bois de Sioux River (Lake Traverse and Mud Lake) *	St. Paul District (MVP)
Brazos River (Whitney)*	Fort Worth District (SWF)
Cape Fear River (Jordan Dam)	Wilmington District (SAW)
Cossatot River (Gillham Lake)	Little Rock District (SWL)
Des Moines River (Saylorville and Lake Red Rock)	Rock Island District (MVR)
Farm Creek (Farmdale Reservoir)	Rock Island District (MVR)
Fourche LaFave River (Nimrod)*	Little Rock District (SWL)
French Creek West Branch (Union City Reservoir) *	Pittsburgh District (LRP)
Galisteo Creek (Galisteo)*	Albuquerque District (SPA)
Iowa River (Coralville Lake)	Rock Island District (MVR)
Kanawha River (London Lock and Dam) *	Huntington District (LRH)
Kansas River (multiple reservoirs)	Kansas District (NWK)
Kaskaskia River (Carlyle, Shelbyville and Kaskaskia Lock & Dam)	St. Louis District (MVS)
Kiamichi River (Sardis Lake)	Tulsa District (SWT)
Lake Washington Ship Canal (Ballard Locks) *	Seattle District (NWS)
Mill Creek (Mill Creek Flood Control Project) *	Walla Walla District (NWW)
Mississippi River *	St. Louis District (MVS)
	St. Paul District (MVP)
	Rock Island (MVR)
Neches River (Sam Rayburn and Town Bluff) *	Fort Worth District (SWF)
Ohio River (multiple Locks & Dams)	Huntington District (LRH)
	Pittsburgh District (LRP)

Osage River (multiple reservoirs)	Louisville District (LRL)
Pecos River (Santa Rosa, Sumner, and Brantley)	Kansas District (NWK)
Potomac River (Jennings Randolph Lake) *	Albuquerque District (SPA)
Roanoke River (John H. Kerr Dam)	Baltimore District (NAB)
Rogue River (Lost Creek and Applegate) *	Wilmington District (SAW)
Sugar Creek (Beach City) *	Portland District (NWP)
Willamette River (multiple reservoirs)	Huntington District (LRH)
Yakima River Delta (McNary Lock and Dam) *	Portland District (NWP)
TNTCX Rivercane Restoration*	Walla Walla District (NWW)
	Multiple Districts

\*New River or SRP Project in FY 2021

### Alabama River (Claiborne and Millers Ferry), AL – SAM (LD)

Claiborne and Millers Ferry Locks and Dams are the lowermost dams on the Alabama River and have authorized purposes of navigation, recreation, and fish and wildlife conservation.

Claiborne and Millers Ferry were identified for study because pools have low commercial navigation traffic and limit fish passage for migratory fishes within the Mobile River Basin. Claiborne and Millers Ferry are characterized by good water quality, connection to riffle/run/pool habitat, and presence of multiple threatened and endangered fish and freshwater mussel species. The District has assembled an inter-disciplinary team from Corps Planning, Operations, Inland Environment Team, and other federal state, and non-government entities to study operational alternatives related to conservation locking of fish. FY 2021 was the first year of SRP involvement for Claiborne and Millers Ferry.

#### Status of 2021 work

The SAM team proposed a multi-year project spanning the end of FY 2021 through FY 2023 beginning with coordinating with their partners to initiate work early in FY 2022 with carry-in funding from FY 2021. FY 2021 work consisted of working with the SRP administrative team to scope future work and secure funding.

#### Anticipated 2022 work

In FY 2022 and FY 2023, the SAM team plans to gather and assess baseline fisheries data under current conservation locking schedules, methodology and determine structure operating flexibility. The team will determine acceptable or adverse impacts that could occur as a part of operational changes, coordinate with external agencies, modify existing hydropower license agreements if warranted, and formulate a test proposal for the following SRP cycle.

#### Future Vision

The team envisions modifying existing hydropower license agreements if warranted and formulating new operational practices in the Alabama River basin if the studies demonstrate beneficial environmental outcomes.

### Salt Fork Arkansas River (Great Salt Plains Lake), OK – SWT (Gen)

Great Salt Plains Lake is located on the Salt Fork of the Arkansas River approximately eight miles northeast of Jet, Oklahoma, and 12 miles east of Cherokee within the Tulsa District (SWT). The lake

consists of 8,700 surface acres and sits in a basin bordered by salt plains on the west with red shale bluffs and sandy beaches on the south. The 32,000-acre Great Salt Plains National Wildlife Refuge borders the lake on its upper end and provides habitat for approximately 300 species of birds and 30 species of mammals. Winter wildlife include ducks, geese, crane, and bald eagles. Summer wildlife include egrets, herons, pelicans, and endangered least terns among others.

The Great Salt Plains Dam and Lake has congressionally authorized purposes of flood control and conservation, including recreation and fish and wildlife. Three ungated, concrete weirs are in the spillway channel and crest elevations are spaced so that the drop between the maximum pool elevation and tailwater elevation is made in three equal stages. The elevation of the conservation pool is fixed by the elevation of the crest of the intermediate weir; the pool level automatically returns to that elevation following floods. Two 36-inch-diameter motorized; gated bypasses provide control for small releases.

Great Salt Plains Lake was identified in the 2020 South Region Operations and Water Management Workshop as a potential candidate for environmental enhancement. The 2010 Disposition Study conducted by the SWT determined Great Salt Plains is unable to continue to fully meet all authorized project purposes based on current operational practices. SWT identified 103 miles of river, extending downstream of Great Salt Plains Lake to the confluence of the Salt Fork of the Arkansas River and the Arkansas River that may realize ecological benefits through operational adjustments. Potential partner organizations include TNC, USFWS, and the Oklahoma Department of Wildlife Conservation.

#### Status of 2021 work

In FY 2020, SWT proposed to identify key local, state, federal, tribal, and NGO stakeholders within the Salt Fork of the Arkansas River Basin and conduct outreach meetings to identify constraints, problems and opportunities, and data availability. Proposed tasks included conducting a literature search to identify existing land topography and stream imagery/LiDAR during various flow conditions, previous biological and hydrological studies, water rights issues and concerns, identification of species of concern, and identification of flora and fauna critical life history needs not currently being met; review and update existing hydrologic data and RAS and RiverWare models; evaluation of sedimentation process within the lake that may affect in situ and downstream resources; begin preliminary e-flow/reservoir reoperation alternative formulation; and engage with interested stakeholders. The SWT team was able to execute an IPA fulfilling some of their proposed FY 2020 work effort and move close to completing the hydrology report. The team was unable to move forward on FY 2021 work due to staffing limitations. The remaining work was carried into FY 2021 and further into FY 2022.

#### Anticipated 2022 work

The SWT team plans to complete the FY 2020 and 2021 planned work in FY 2022 using carry-in funds. Delays are due to previous staffing limitations that are being resolved in early 2022. The plan is to complete literature review by January 2022 and the white paper in Spring 2022. This work is critical to moving into an e-flow reservoir reoperation workshop to assess the potential to reimagine how Great Salt Plains Lake can sustainably continue to meet all authorized project purposes in future by testing reoperation strategies associated with modifications in reservoir operations and the current water control plan. If tasks are completed, the project would be well positioned for additional SRP support in FY 2023.

#### Future Vision

Reoperation of the facility to improve sedimentation in downstream stream reaches for native fisheries and exposure of additional flats for bird species within the pond.

## Big Cypress Bayou – Caddo Lake (Lake O' the Pines), TX – SWF (Gen)

The Big Cypress Creek and Bayou SRP project is focused on Caddo Lake, located in North East Texas on the border of Texas and Louisiana, its tributaries, and associated wetlands. The watershed is approximately 2,970 square miles, about a third of which is regulated by Lake o' the Pines and other upstream reservoirs. Lake O' the Pines is a Corps Reservoir administrated by the Fort Worth District (SWF), for the primary purpose of flood control and secondary purposes of water supply, recreation, and fish and wildlife conservation.

Flow recommendations developed through the SRP process have been implemented since 2012 on a voluntary basis. The water control manual has been updated with language for several flow components and, in cooperation of the North East Texas Municipal Water District, has allowed for waters held temporarily in the pool to be released as prescribed pulses to meet the average and dry base e-flow recommendations. There is still limited operational flexibility for the management of the flood control pool and uncommitted water in the reservoir conservation pool. Considering increasing water demands, new strategies will be needed to continue e-flows over the long-term. The most promising strategy to date is to maintain storage in the lake at the current summer pool level (rather than drawing down in the winter). The technical challenge is to weigh the cost (potential reduced flood protection) with the environmental benefits.

### Status of 2021 work

The SWF team has proposed a stepwise approach to address the challenge (weighing the risk of potential reduced flood protection) with the environmental benefits of maintaining storage in the lake at summer pool (rather that drawing down in the winter). In addition to the legal constraints on the operation of the conservation pool, this yield analysis may also consider operation constraints including the location of intake structures to better inform the regional water supplier (NETMWD) and the customer how reservoir operation decisions may affect water supply. The team updated the period of record (POR) to include all available data for gages in the basin and incorporated the POR in the RiverWare analysis to develop stage/discharge data for existing conditions. The existing conditions task was completed.

The team then utilized the RiverWare existing conditions POR data to develop an unsteady model for the Cypress system below Lake O' the Pines and above Caddo Lake to generate input data for the HEC-EFM model. The development of the unsteady HEC-RAS model has been completed. The HEC-EFM model was run utilizing ecological conditions developed for the adjacent Sulphur River Basin. Existing habitat conditions from the EFM model was compared against existing vegetation community spatial data to validate the EFM results.

### Anticipated Work in 2022

A workshop with stakeholders is being scheduled to develop flow and management strategies to test using the validated HEC-EFM model. The results will be incorporated into a final report for this activity.

### Future Vision

The team would seek to incorporate the results into a demonstration project and monitor the results to determine the efficacy of the new flow management guidelines.

### Bois de Sioux River (Traverse and Mud Lakes), MN and SD - MVP (Gen)

The primary purposes for the Lake Traverse Flood Control are for flood control benefits along the Bois de Sioux River and lower Red River valley, as well as water conservation. White Rock Dam, which forms Mud Lake, is located at the extreme north end of the site and controls water flowing north on the Bois de Sioux River.

The purpose of the SRP effort is to conduct scoping for late summer drawdowns and minimum releases at Mud Lake. Scoping involves engaging partner agencies, developing potential alternatives, and engaging the affected public to gauge acceptability and potential adverse effects. Partner agencies had requested that minimum releases be provided from Mud Lake to the Bois de Sioux River. Also, Mud Lake provides low quality habitat now, as it is very shallow, windswept, and nearly devoid of vegetation. A growing season drawdown in the early 2000s resulted in a vegetation response, but the response was short-lived as much of the vegetation is killed due to holding floodwaters. However, during the drawdown shorebirds used Mud Lake in high numbers. It may be possible to conduct such a drawdown annually, provide good shorebird habitat, and provide minimum releases downstream. One obstacle though, is high sulfate concentration in Mud Lake's releases, which impacts use in a downstream community and needs to be assessed.

The desired outcome would be implementing the annual drawdown and minimum release. Doing so will depend on an evaluation of the effects of the plan, and on effective community engagement. Drawdown scoping builds on SRP supported MVP workshops initiated in FY 2020.

#### Status of 2021 work

Much of the science needed to complete the FY 2021 work is already developed. Shorebird data was available in a certified shorebird model developed in MVP, and some modeling to characterize drawdowns might perform. Much of the work in FY 2021 focused on outreach, developing and engaging an interagency team to assist in developing a plan, and engaging the public and downstream communities to identify potential adverse effects and ways to mitigate them. Agency partners included the Minnesota Department of Natural Resources, the South Dakota Game, Fish and Parks, and the U.S. Fish and Wildlife Service (USFWS).

The team completed scoping opportunities and considerations for spring and early summer drawdowns, minimum releases, and fall flooding at Mud Lake. The Corps team found that the potential for shorebird habitat, waterfowl habitat, and native vegetation establishment is substantial enough to warrant future action.

#### Anticipated 2022 work

Building upon the recommendation of the SRP funded FY21 "Mud Lake Drawdown Scoping," the team plans to move forward into final development of e-flow prescriptions, evaluation, and environmental compliance documentation to implement an annual drawdown, fall flood, and minimum release of Mud Lake. The District would complete an environmental assessment and a drawdown report for implementation during FY 2022 and 2023. The team plans to complete the study and environmental assessment in time for a 2022 summer drawdown. The drawdown would initially be implemented through a deviation to the 1994 Lake Traverse Water Control Manual, pending approval by MVD, and then included in the next version of the manual.

#### Future Vision

Changing operations would require both informal and formal consultation with state, federal, and Tribal agencies, as appropriate. If successful in identifying appropriate e-flow prescriptions, the MVP team would request a deviation from the 1994 Water Control Manual from the Corps' Mississippi Valley Division (MVD) for a drawdown, fall flooding, and minimum releases at Mud Lake.

### Brazos River, TX – SWF (Gen)

The headwaters of the Brazos River start near the Texas-New Mexico border north and west of Lubbock, Texas and flow 1,280 miles to the Gulf of Mexico near the city of Freeport. The Brazos River basin encompasses approximately 16-percent of the land area of Texas, including all or part of 70 counties, stretching across more than 42,000 square miles. The Brazos River proper begins at the confluence of the Salt Fork and Double Mountain Fork and major tributaries include the Clear Fork of the Brazos, the Paluxy River, the Bosque River, the Little River, Yegua Creek, the Nolan River, the Leon River, the San Gabriel River, the Lampasas River, and the Navasota River.

Twelve reservoirs are located within the Brazos River basin, three of which are located on the main stem of the river: Possum Kingdom, Lake Granbury, and Lake Whitney. The multipurpose uses of the reservoirs include flood control, water supply, and recreation. Each reservoir is guided by project specific Water Control Manuals to ensure project compliance with congressionally approved operating purposes. The Brazos River also supports many endangered and threatened species fishes, salamanders, and mussels and a robust recreational fishery.

Near the Gulf of Mexico, the river passes through bottomland hardwood systems in the San Bernard National Wildlife Refuge (NWR), the MidCoast NWR Complex, Justin Hurst Wildlife Management Area (WMA), the Nannie M. Stringfellow WMA, and Brazos Bend State Park. Potential SRP actions could benefit these areas as well as aquatic, floodplain, and riparian habitats throughout the basin.

#### Status of 2021 work

The SWF and TNC coordinated a workshop with the Brazos River Authority, natural resource agencies, academia, and other scientific experts and environmental practitioners. The goal of the workshop was to bring stakeholders together to identify ecosystem problems and opportunities, including those that could be addressed by SRP. The workshop was held on 8 September 2021 and identified existing data and data gaps for the identified problem/opportunity. The workshop identified flow-related elements of resources in Brazos River Basin, opportunities to benefit those resources, and the challenges facing changes in the system. The draft workshop report has been prepared and summarizes the workshop including a prioritized list of potential ecosystem projects, research, and studies to inform two SRP proposals for FY 2022.

Many of the workshop participants viewed the effort as an opportunity to connect agencies, academia, and NGOs in an overall framework or team to meet and discuss the changing needs of the Brazos River Basin. Many noted that this was the first-time stakeholders were together to discuss the River and recommended that the group continue to meet about any SRP and other actions in the Basin.

#### Anticipated 2022 work

The Brazos River SRP Team submitted two proposals for SRP consideration in FY 2022: a proposal for data collection and a Brazos River system analysis. These proposals have multi-agency support, a clear path forward, and in-kind and financial support to augment the funding of the SRP actions.

### Future Vision

The benefits of this workshop reached beyond its original intent and the Brazos SRP team plans to continue to meet on SRP and other related issues into the future.

### Cape Fear River (Jordan Dam), NC – SAW (Gen and LD)

In North Carolina, the Cape Fear River serves people and wildlife, making its water quality and water quantity of utmost importance to the region. The Corps' management on the Cape Fear River includes B. Everett Jordan Dam and Lake, three locks and dams and dredging operations. These facilities are collectively managed for a diverse set of purposes including water supply, flood risk management, water quality, navigation, recreation and fish and wildlife conservation. These same structures are barriers to diadromous fish; and NOAA estimates that commercial fish landings have decreased 87% in two centuries.

SRP work on the Cape Fear River began in FY 2017 by engaging and convening stakeholder groups to develop a conceptual framework of environmental opportunities to improve habitat for diadromous fish and potentially managing water quality issues. Eager partners worked together to develop the State of the Science Report on the ecology and hydrology of the Cape Fear system in preparation of the e-flows workshop held in Fall 2019. Together the Corps and regional river experts developed flow regimes for consideration at Cape Fear River dams to improve conditions for diadromous fishes and potentially diffuse algal blooms before they become hazardous. Summer flow demonstrations began in 2020 and will provide the initial glimpse into the value of changes for fish and water quality. These demonstrations and extensive monitoring will continue for all the seasonal flow components to refine the e-flow prescriptions for the Cape Fear River.

Additionally, models were run to determine the spring hydrological conditions that enable pulses of 20,000 cfs at the downstream locks and dams, with the goal to better support spawning by shad, sturgeon and other diadromous fish. SAW and TNC analyzed the enabling hydrological conditions for late summer flow pulses that reduced the chances for algal blooms.

### Status of 2021 work

SRP funds arrived in April 2021, after the spawn in North Carolina was underway. Yet, the excitement from basin partners and researchers as well as trust built between TNC/Corps and partners mobilized an extensive fish monitoring effort ahead of the spawn. TNC organized the NC Division of Marine Fisheries to contribute 15 telemetry receivers to put on the upstream and downstream sides of the lock and dams. Similarly, TNC was able to capitalize on an effort by Clemson University to put 25 fine-movement telemetry receivers on lock and dam #1. TNC and the Corps engaged the NC Wildlife Resources Commission in several ways. First, they enlisted an eDNA specialist and field sampler to take weekly eDNA samples during the time of the spawn. Second, they worked with the electrofishing field colleague to ensure sampling around the locks and dams was done at key times. Next, TNC engaged UNC-Wilmington researchers to collect eDNA samples around known sturgeon populations. These same researchers also worked with Clemson to install the telemetry receivers. Clemson researchers tagged shad and some sturgeon. UNC-W researchers tagged sturgeon. Clemson researchers checked telemetry equipment at the locks and dams throughout summer. The weather was conducive to accomplish one large pulse out of Jordan Dam in March to assist the fish over the locks and dams. From the early data results and on-the-ground observations, it was determined that fish were not able to migrate the 50 river miles to clear all three locks and dams. The fish often made it over one barrier but not all three.

This was an important observation for proposed FY 2022 work. Starting in late March, the basin went into abnormally dry or moderate drought conditions and no more fish pulses could be implemented. The team received reports of extensive populations of shad stuck behind the locks and dams.

Dry conditions in the middle and late summer made the river basin more susceptible to river temperature stratification and potential algal blooms. Equipment was set up at multiple points in the river, including real-time sensors, satellite technology, and temperature thermistors throughout the water column. Despite funding delays, researchers collected samples from June through late October. TNC and USGS ran the autonomous underwater vehicle four different times in two locations throughout the river. The team studied baseflow contributions from tributaries and the dam (Jordan Dam supplementing water downstream vs. heavy rains creating natural pulses). Due to the dry conditions, the team relied on “natural pulses”. The Corps did open and close the gates at Jordan Dam to study water quality conditions with sprigs of water. The Corps was prepared to submit a deviation to send a pulse of water if algal blooms were reported. Initial data indicates the river stratified during the warm months but there were no recorded algal blooms. The momentum on the Cape Fear is palpable by all research teams and partners. Drinking water utilities are sending TNC their data to help validate the satellite and local sensor technologies.

#### Anticipated Work in 2022

The Cape Fear team would like to continue to build upon monitoring efforts to gain more information about the influence of flow pulses on the desired ecology, including fish and water quality. For example, the team would like to assess how long fish will wait behind a lock and dam, assess flow velocities suitable for fish to swim upstream, and utilize this data to further refine spring pulses. This requires tagging additional fish and tracking new and existing tags for a longer duration. The team would continue efforts around sturgeon since they were recorded at the first lock and dam in 2021. Efforts would include monitoring sturgeon movement and eDNA sampling and analysis. With respect to water quality, deviations from the Corps’ operating procedures would be implemented if an algal bloom occurs during a drought. Additional water quality data is essential for demonstrating that pulses and mixing water reduces the likelihood of algal blooms. The Corps and TNC plan to reconvene basin stakeholders to review pulses, evaluate lessons learned, and identify any needed information to move Cape Fear River into the “incorporate” stage of the SRP process. Within the next year, the team plans to identify the necessary steps to get effective e-flow prescriptions incorporated into the Corps’ operating principles.

#### Future Vision

The Corps operates four dams in the system and plans to continue implementation of the Cape Fear e-flow prescription. Assessment and adaptation of these flows will focus on the movement of diadromous fish, connection of river flows with off-channel floodplain habitat, and summer flow conditions that support juvenile fish movement and potential dispersal of algal blooms. Additional environmental actions will be based on outcomes associated with testing e-flows. The team’s overarching goal is to incorporate effective e-flows into the Corps’ operating principles.

### Cossatot River (Gillham Lake), AR – SWL (Gen)

The Cossatot River is a 90 square mile basin in the Ouachita Mountains of western Arkansas. The river flows into the Little River and then to the Red River (of the South). Vegetation is dominated by southeastern mixed forest with shortleaf and some loblolly pine plus hardwood species of oak and



hickory. Floodplain species are dominated by alder, sycamore, and river birch. The basin is 99.5% forested and primarily managed by the US Forest Service for timber harvest and recreation. The Caney Creek Wilderness Area was established within the basin in 1975 and the river is designated a Wild and Scenic River.

Natural resources stakeholders are interested in a multi-year study to establish e-flows for the river below the Gillham Dam to benefit one of the southernmost populations of smallmouth bass, 10 mussel and 3 fish species of greatest conservation need, 3 federally listed threatened or endangered mussel species, and could eventually lead to future repatriation of the federally threatened Leopard Darter into a portion of its former range. These e-flows could also increase recreational boating and fishing opportunities in the lower Cossatot River. Additional connections are being made between other connected watersheds between the Little Rock and Tulsa Districts to consider systemic river needs.

This multi-year study was kicked off in FY 2020 by establishing a steering committee with experts from Arkansas agencies, Corps, U.S. Geological Survey (USGS), USFWS, TNC and academia. A series of facilitated meetings were conducted to review scientific information and a draft State of the Science Report was completed in FY 2021 but is being updated with temperature data. This project is estimated to continue through FY 2023.

#### Status of 2021 work

This information is critical to understanding the potential e-flows needs for the Cossatot River. The facilitator of these meetings was the Arkansas Game and Fish Commission. TNC coordinated meetings with stakeholders and experts. Sponsors that contributed to the report also includes the AR Heritage Commission. The draft State of the Science report was completed and will be updated with an assessment of temperature using CE-QUAL-W2 to model scenarios with different releases from Gillham.

The team has been preparing for an e-flows workshop through collaboration with other SRP teams, coordinating with federal and state liaisons, locating a meeting space and compiling a list of participants.

#### Anticipated Work in 2022

The team will continue the planned work of completing the State of the Science Report and will circulate it for review and comments by SRP and stakeholders. An e-flow workshop will be coordinated and is planned to occur in April 2022 and a workshop summary report by June 2022.

#### Future Vision

Long-term implementation of e-flows from Gillham Dam to benefit flora and fauna of the River and repatriation of the federally threatened Leopard Darter into a portion of its former range.

### **Des Moines River (Saylorville and Lake Red Rock), IA – MVR (Gen and Science)**

The Des Moines River watershed drains about 1,350 square miles (3,496 km<sup>2</sup>) of agricultural land that once was glaciated prairies in Minnesota and Iowa. Along the river, Saylorville Dam and Reservoir operationalized in 1977 is located upstream from the City of Des Moines and Lake Red Rock Reservoir operationalized in 1969 is located approximately 50 miles downstream of the City of Des Moines. The Corps dams are operated for flood risk management as well as recreation, water supply, drought management, and fish and wildlife.

Des Moines River dam operations altered river flow by increasing summer flows, lowering spring flows, reducing peak flows, and substantially reducing connectivity to floodplain features like oxbow lakes.

River scientists documented the changes to the river from impoundments and were looking for options to improve conditions for fish and wildlife habitat. Around 2015, the MVR began the process of updating the Water Control Manual (WCM) at both dams, which provided the opportunity to evaluate and add environmental considerations. SRP helped support the Corps and stakeholders include improved e-flows in the WCM update. The manual now includes seasonal conservation bands for the reservoir that will support aspects of the natural flow regime to benefit several ancient river fishes, such as paddlefish, shovelnose and lake sturgeon, as well as floodplain plant communities and terrestrial wildlife.

Since SRP partnered with MVR, the team completed the Agricultural Conservation Planning Framework for all 33 HUC 12 watersheds surrounding Saylorville Lake and Lake Red Rock. In addition, an e-flows workshop was held in 2016 resulting in a summary report that identified several suggested river flows and reservoir level management practices to improve conditions for aquatic biota, terrestrial habitats, and water quality. In 2019, measures were incorporated into the Des Moines River Water Control Plan (WCP) that introduced flexibilities to allow implementation of e-flows and water level management practices to maximize the environmental benefits. In 2020, SRP-Science invested in efforts that gauge the effectiveness of e-flows for fish and water level management strategies to improve waterbird habitat and denitrification potential. In addition, The Des Moines River SRP continues to pursue collaborative efforts with NRCS and others, to reduce nutrient inputs to the Des Moines River system.

#### Status of 2021 work

Des Moines River SRP efforts began in 2015 and has completed the process to advance, implement, and incorporate e-flows. Work now includes location-based work and SRP Science efforts to better understand ecological responses to operations, including outflows and pool level management for ecological benefits. The Rock Island District has coordinated multiple activities between researchers, COE staff and other agencies to implement e-flow prescriptions through dam releases or environmental water level management within the lake.

Two Cooperative Ecosystem Studies Unit (CESU) contracts were awarded. One is for an Iowa State University researcher to evaluate waterbird use, feeding, and resting in the vast reservoir delta as water levels are slowly lowered during peak migration. This is the first of a two-year contract. The researcher conducted field surveys on fourteen occasions during the Lake Red Rock summer '21 pool drawdown. The Summer 2021 field season proved to be excellent with a count of approximately 36,000 total shore birds, water birds (excluding over 76,000 White Pelicans), and their allies of 49 species. Sixty Least Sandpipers were captured, and transmitters attached to aid in determining aspects of stopover ecology of the Red Rock Delta for residency time and influence on bird condition. The field biologist also conducted vegetation sampling of the delta to document the diversity and relative abundance of the plant species, which can be useful food sources for the migrating shorebirds, as well as later waterfowl migration when the pool is raised, and vegetation is flooded.

The second CESU contract is in the first year of a study to conduct literature review of denitrification of water within the reservoir's delta area and delineation of Red Rock's delta using geospatial information systems. The study also includes elements of field work to collect sediment samples and perform water quality analysis, funded by another Corps program, Engineering with Nature. The project will characterize the geomorphology of the delta. Once these processes are determined, the application of knowledge gained can advance and implement similar pool management practices elsewhere, and hopefully reduce the nitrate load in the reservoirs, rivers, and eventually to the hypoxia zone of the Gulf of Mexico.

Outcomes of 2020 videography work on the Des Moines were outstanding! 2021 efforts include re-establishing a photo point utilized in 2020, plus a new location on the opposite side of the reservoir to capture bird behavior and migration from the middle of July to present. This coincides with the slight summer drawdown of conservation band to expose invertebrate-rich mudflats. Cameras have been placed at Lake Red Rock and Saylorville Lake. For videography, we seek to continue to document bird activity in the delta. Cameras are now capturing fall waterfowl migration, as the conservation band slowly creeps upward to flood natural food sources that are relished by waterfowl. Post-season processing will occur in the winter months.

Workshop planning has been initiated with NRCS for inter-agency evaluation of best management practices for reservoir watersheds. The workshop will include presenters on Agricultural Conservation Planning Framework and soil health. "Soil health" is a new emphasis on agricultural land use that is much friendlier to the environment, enhances soil organic community and potentially reduces nutrient losses to rivers and streams. We will adapt workshop strategies to a different challenge: a comprehensive and reflective land management analysis of ourselves and land-managing partners. This model has good potential for transferability to other projects and agencies. However, due to agency restrictions in response to the COVID pandemic, in-person trainings and workshops have been prohibited. It is anticipated that "normal" conditions will prevail after the start of 2022, with tentative workshop date being planned for February.

#### Anticipated 2022 work

The accomplishments of 2021 generated excitement and enthusiasm for the Sustainable River Program in the Rock Island District. Continuation of multi-year efforts to capture the next phases of observations and data fuels eager anticipation of what can be learned.

On the CESU contracts, the second season of waterbird field studies will be conducted. A field technician is needed to assist the primary field biologist (monitoring, data collection, tagging, nets, water safety, etc.). The ephemeral data opportunity, both avian and terrestrial, can be most efficiently collected by two field people.

For the next phases of the denitrification study, instrumentation is needed to measure continuous changes in nitrate concentration in three regions of the reservoir. This is unfunded, but an important research of denitrification of water in reservoir delta.

The Des Moines River team submitted a proposal that will tell the story about SRP generally, and MVR successes, to an audience that seeks information about the program. The MVR SRP projects have helped answer questions to problems with reservoir operations or have advanced scientific understanding of these processes. Considerable interest has generated among COE professionals, scientific experts, communities, and agency partners. This will include efforts to tell the SRP story through print, web-based and promotional video productions with time-lapse cameras and drones. SRP information will be presented to the public with interpretive signage at the Lake Red Rock Visitor Center.

#### Future Vision

The Rock Island District SRP program was initially concerned with how dam and reservoir operations can be managed to minimize negative ecological consequences and maximize positive flow and pool benefits. The product of an E-Flows workshop with scientific experts and resource professionals provided the flexible framework for a versatile Adaptive Management and Monitoring Plan. This alignment of academics, field personnel, reservoir operators and hydrologists has already yielded outstanding environmental benefits and scientific knowledge. This collaboration has not occurred to

this extent before on the Des Moines River. The Des Moines River team seeks to continue the dialogue between agencies and scientists to affect the most benefit from operations. As we learn, more questions arise. By seeing the waters of Iowa as a life sustaining resource, rather than simply landscape overflow and drainage, we find the riverine ecology responding in-kind.

### Farm Creek (Farmdale Reservoir), IL – MVR (DD)

Farm Creek has two impoundments within the Rock Island District (MVR); Fondulac Reservoir completed in 1949 and Farmdale Reservoir completed in 1951. Farmdale Reservoir is a dry reservoir where normally the land behind the impoundment is empty of standing water. When the flow in the creek exceeds the capacity of the culvert, water is retained in the reservoir area owned by the Corps. The stored water naturally releases at a rate dependent on the size of the culvert without the use of gates. The Corps owns a total of 973 acres of land in the Farm Creek Projects, most of which is available for low-impact recreation use by the public.

In 2020, Farmdale Reservoir became the first dry dam in the SRP. Since the land is owned by the Corps, resource managers determined that improvements may be possible including constructing intermittent wetlands, conducting invasive species management, restructuring Farm Creek to the original channel, and encouraging more ephemeral ponds across the landscape. MVR proposed to collaborate with state and federal partners and stakeholders including technical experts from Illinois DNR, USFWS, and TNC to develop specific guidance for implementing physical habitat improvements for a range of hydrologic conditions. The team had access to data sources and tools that to support this initiative including LiDAR imagery and HEC-RAS 2D modeling.

#### Status of 2021 work

In FY 2020, the Farmdale team implemented several habitat improvements that included wetland creation, saddle dam installation, creek reroute, and vernal pool creation within the flood control reservoir. These projects focused on a goal of attracting reptiles and amphibians. Additional similar small-scale habitat improvements were planned for the project area using FY 2021 funding. However, those actions were paused pending update of the project Operational Management Plan, including completion of environmental clearances needed for further implementation.

Some site monitoring was conducted on restoration sites and activities implemented in FY 2020. The ramped wetlands are showing some plant diversity, especially the circular one in Muddy Meadow. Multiple flowering plants in addition to the reed canary grass. Ramp wetlands in the sunny area near the creek are almost impossible to find. They have been mostly filled in with sediment from flooding and are overgrown with reed canary grass. Ramp wetland in shaded area shows some plant diversity. Neither shows much evidence of holding water, probably due to the soil type. Gravel dam has been mostly washed out by high water flows while the small rip rap dam is still in place and ponding.

#### Anticipated Work in 2022

In FY 2022, the Farmdale team would continue restoration activities originally planned for FY 2021 using carryover funds from that year. The team submitted a proposal for a small amount of additional FY 2022 SRP funding. They would focus on monitoring the new restoration projects (including involvement of local schools in environmental education programs) and incorporating lessons learned. In addition, the team would continue to evaluate whether other habitat enhancement projects are feasible within the reservoir.

### Future Vision

As the first dry dam project to implement restoration actions under SRP, efforts at Farmdale have proven helpful in generating interest for environmental enhancements at other Corps dry dams. The Farmdale team would like to maximize the use of seasonal water to support ecological resources and continue to study the effectiveness of projects within the limitations of the land owned in fee title by the Corps of Engineers within the dry reservoir. Potential future actions within the project area include restoring upland oak savannah habitat in a former organized camp, and also restoring an historic cutoff oxbow of Farm Creek.

### Fourche LaFave River (Nimrod Lake), AR – SWL (Gen)

The Fourche LaFave River forms in Western Arkansas, flows north eastwardly through the Ouachita Mountains and is impounded as Nimrod Lake. After leaving Nimrod, the river flows 62.6 miles through the Arkansas River Valley until it meets its confluence with the Arkansas River. The Fourche LaFave River has one major tributary that enters from the south, the South Fourche LaFave River. The Environmental Protection Agency (EPA) has listed the stream as impaired for fisheries and there are three endangered mussels and one endangered plant species within the river system; therefore, enough water needs to be maintained in the stream for species survival.

The Natural Resources Commission of the Arkansas Department of Agriculture (ANRD) is responsible for the management and protection of water and land resources for the health, safety, and economic benefit of the State of Arkansas. Part of this responsibility lies in the development and implementation of the Arkansas Water Plan (AWP). Title 24 Section 2405.2 of the AWP suggests specific recommendations for ANRD to follow when allocating surface water withdrawals for non-riparian use. These withdrawal recommendations depend upon a minimum amount of water flowing in the Fourche LaFave River to support fish and wildlife species that depend upon the water in the stream for their survival (minimum e-flow).

Nimrod Lake is a multi-purpose reservoir in the Little Rock District (SWL) operating under a 2002 Water Control Manual (WCM) that does not define minimum flow releases apart from specifying that 5 cfs shall be released during drought, emergencies, or maintenance. If the Corps operates within these boundaries, e-flows can be determined for Fourche LaFave River to support the fish and wildlife benefits. FY 2021 is the first year the Fourche LaFave River is supported by SRP and is expected to continue through FY 2023.

### Status of 2021 work

The Corps and ANRD did not have scientifically derived methodologies for minimum e-flow determinations in the Fourche LaFave River to support fish and wildlife. Therefore, the SWL team coordinated with ANRD and stakeholders to develop minimum flow values that could be used to simulate and analyze various operational recommendations. The team identified state partners and held a kick-off meeting with stakeholders in August 2021 requesting recommendations for species of concern. To date, they have received one species of concern, the alligator gar, from local biologists as well as trees at the connected Green Tree Reservoir that may be affected by operations.

In addition, streamflow statistics were calculated and will be refined after deliverables from state partners regarding additional species of concern are received. Future expectation e-flows workshop in 2022 and ultimately is reoperation and AMMP.

### Anticipated 2022 work

The team will continue FY 2021 work, including identifying partners, stakeholders, and an issues report in early FY 2022. The State of the Science report is in process and planned for completion by June 2022. An e-flows workshop and report detailing recommendations are planned for September 2022 and the update to the water control manual by the end of FY 2023, if needed. If fully realized, implementation of changes identified via the SRP process can have positive and lasting impacts on environmental factors that can be used by the ANRD for their water withdrawal permitting process for non-riparian use.

### Future Vision

Update water control manual to maximize environmental benefits in the system through re-operation, if needed. Continue monitoring and adaptive management.

## French Creek West Branch (Union City Reservoir), PA – LRP (DD)

Union City Dam is one of 16 flood risk management reservoirs in LRP. Of those, Union City project is the only dry-bed reservoir and provides flood protection for the French Creek Valley and to a lesser degree the Allegheny River below Franklin, Pa.

The dam functions as an uncontrolled structure that passively stores and releases water during period of peak flow. A 520-foot-long concrete conduit, 4.5 feet wide by 8 feet high, runs through the base of the dam to allow for uncontrolled discharge of waters. The conduit permits normal flows of French Creek to pass unimpeded. However, when inflows exceed the conduit's outflow capacity a temporary lake is formed. As inflow decreases, stored waters drain until the reservoir is emptied.

Union City Dam was added as an SRP project site 2021. LRP Project staff proposed a series of tasks designed to restore wetlands and create vernal pools in an approximately 20-acre site above the right abutment of the dam. The site was historically the location of a recreation site and project viewpoint that has subsequently been closed. Construction of the recreation site and the adjacent project overflow spillway impacted wetlands and rerouted surface runoff flow which has in turn caused erosion in the overflow area. In addition to wetland restoration and vernal pool creation, the project will attempt to establish plots of native pollinator species in a previously manicured environment to help control/limit invasive species and manage for development of the geographically rare white oak (*Quercus alba*).

### Status of 2021 work

The initial project proposal anticipated that a team of regional experts would be convened to assist in developing a design for the wetland restoration / vernal pool construction site. From the site design the team would obtain any necessary environmental clearances or other permits and compile a construction contract package. The contract would be bid and awarded before the end of calendar year 2021 with construction occurring in 2022.

Due to impacts of COVID-19 along with project staffing issues, initiation of the project was delayed. However, the team identified very similar wetland restoration / vernal pool construction project recently completed elsewhere in French Creek basin by the Natural Resources Conservation Service (NRCS). The services of the NRCS were obtained to assist in the site planning and design. An onsite visit with NRCS and other natural resource agency staff was conducted in November 2021 to initiate the site planning and design process.

### Anticipated 2022 work

The Union City Dam team did not submit a proposal for FY 22 funding; they anticipate completing the project using carryover FY 21 funds. NRCS staff will complete the site planning and design work in early 2022. Project staff will complete necessary permits and submit the project for construction contract bidding and approval. It is anticipated that construction of the wetland restoration / vernal pool complex will be initiated and completed by fall 2022. Construction of the surface water impoundments will be followed by efforts to establish plots of native pollinator species and to manage invasive species.

### Future Vision

This is a small-scale project, but it serves as an anchor project to attract local agencies for future participation. Project staff believe that there is significant potential for additional environmental improvement actions on French Creek. The Corps has historically had limited involvement in restoration activities in the region and limited engagement with key natural resource agencies and stakeholders. This project provides opportunity to reach out and engage those agencies and stakeholders and build relationships leading to future additional projects.

## Galisteo Creek (Galisteo Dam), NM – SPA (DD)

Galisteo Dam is located approximately 20 miles southwest of Santa Fe in the high desert of New Mexico on Galisteo Creek, 11.8 miles upstream from the creek's confluence with the Rio Grande and approximately 45 miles north of Albuquerque, New Mexico. The Galisteo Dam drainage area is 596 square miles. The Project is authorized for 89,468 acre-feet of flood control storage space and 9,320 acre-feet sediment storage space. Recreation facilities currently include a day-use facility with picnic shelters and an overlook.

The project scope of work is a continuation of an ongoing multi-year effort to restore native species habitat within the watershed upstream of Galisteo Dam funded through the project Environmental Stewardship Program. The additional activities funded through SRP will extend and complement ongoing native species restoration by planning and implementing ecologically beneficial measures such as physical modifications to the streambed and surrounding riparian habitat in the reservoir pool area.

The restoration project was identified as a priority at the 2020 SPD Dry Dams Regional Meeting. Planned tasks seek to improve the success of native riparian vegetation through reestablishment efforts and removal of non-native species as well as enhance wetlands by contouring land to better support inundation needed by native emergent wetland species. There are several issues which have negatively impacted the ecology of the watershed upstream of Galisteo Dam and which have been the focus of previous efforts. Historically the Galisteo Project issued grazing permits to local ranchers who ran cattle on Project land until the early 2000s. Today, while permits are no longer issued, cattle are present on Project lands and efforts are underway to have them removed. Additionally, dense monotypic stands of salt cedar exist along the streambed which effectively outcompete native vegetation and greatly reduce the likelihood of successfully restoring native habitat. In FY 2020, Project staff began efforts to restart an invasive species removal at Galisteo Project using project environmental stewardship funding. The work conducted under the SRP project is intended to complement the ongoing invasive species removal efforts to restore functioning native habitat. A primary objective for creating ephemeral pools upstream of Galisteo Dam is to provide breeding habitat for endemic amphibian populations, which are on the decline locally, regionally, and globally.

### Status of 2021 work

Proposed tasks for FY 2021 included establishing a Project Development Team (PDT), identifying regional partners, studying restoration opportunities, and developing a streambed modification and restoration plan. The PDT intends to use existing knowledge and expertise to develop a plan that focuses on creation of ephemeral pools and seasonal wetlands and planting and seeding native plants at Galisteo Dam. Work in 2021 would have included preparation of construction contract documents and award of the contract. Implementation of the project would have been initiated in early 2022.

The PDT did conduct onsite field surveys that resulted in identification of around 8 acres of existing quality wetland habitat in the reservoir area. However, hydrologic and hydraulic modeling and environmental assessment needed to plan and design streambed modifications was delayed by other higher priority work in Albuquerque District.

### Anticipated 2022 work

The revised schedule has completion of site planning and design actions, including the hydrologic and hydraulic modeling and environmental assessment by early summer 2022 and construction contract award by late 2022. The district will use carryover FY 2021 funding to complete the project; they have also submitted a proposal for a small amount of additional FY 2022 funding to conduct photo-monitoring of existing wetland areas in the project. The photo-monitoring will assist the project team in identifying areas of the project suitable for hydraulic modification to support expansion of wetlands/vernal pools and the response of native vegetation to periodic inundation.

### Future Vision

Galisteo Dam is the first Corps dry dam in an arid region to be included in SRP. In addition to having high potential for restoration of riparian habitat through creation of ephemeral pools and seasonal wetlands, it presents an outstanding opportunity for sharing knowledge with other Corps of Engineers projects about restoration in arid regions, particularly in conjunction with management of Salt Cedar and other critical invasive species.

## Iowa River (Coralville Lake), IA – MVR (Gen)

The Iowa River originates in north-central Iowa and flows 323 river miles until joining the Cedar River and ultimately the Mississippi River. Coralville Lake is a multi-purpose project providing primary benefits in flood control and low flow augmentation, and secondary benefits in recreation, fish and wildlife management, and forest management.

The Iowa River and management of Coralville Dam was a new project to SRP in 2020. Patterned after the work on the Des Moines River, the Corps and River stakeholders are considered e-flows and reservoir management during the update of the Water Control Plan to incorporate flexibilities that accommodate future adaptive management strategies.

### Status of 2021 work

During FY21, the Iowa River Team planned to hold an Environmental Flows Workshop in April. The workshop was rescheduled to August 2021. As the date approached, participant hesitancy, cancellations, along with agency restrictions, caused it to be postponed. It was suggested that the E-Flows Workshop may not be entirely necessary; comments from the Iowa River stakeholder meetings



were very similar to the comments received at the Des Moines River E-Flows Workshop in 2016. While the Iowa River is hydrologically similar, albeit smaller, than the Des Moines, the prescriptions developed for the Des Moines could be implemented on the Iowa River. The Nature Conservancy members of the team agreed and suggested that this approach could serve to regionalize and streamline the SRP process. Key Iowa River stakeholders agreed that this would be an efficient approach. The MVR team and ERDC will complete the flow prescription summary report in CY21. Funding for FY22 is being sought to begin drafting an Adaptive Management and Monitoring Plan (AMMP).

#### Anticipated 2022 work

The 2022 plan for the Iowa River and Coralville Reservoir is to complete the e-flows summary report and complete an Adaptive Management and Monitoring Plan (AMMP). The Iowa River team will identify the partners and conduct meetings/workshops to include the TNC, IDNR Fisheries/Mussels, academic, regional and district experts. The product will define the pre and post release metrics related to the timing and quantities of e-flows. The AMMP will aid partners and water managers to understand flow/level targets and coordination when river conditions become feasible.

#### Future Vision

As stated, the Iowa River SRP project is modeled after the extensive work completed and on-going on the Des Moines River. If as successful, this project will expand to include flow prescriptions, implementation and monitoring, and adaptive management.

### **Kanawha River (London Lock and Dam), OH – LRH (LD)**

London Locks and Dam is located on the Kanawha River, 82.8 miles above the confluence with the Ohio River and about 2 miles downstream from Montgomery, West Virginia. London Lock and Dam has authorized purposes of navigation, recreation, and fish and wildlife conservation.

London Lock and Dam was identified for study as the pool has limited amounts of navigation traffic and a larger amount of approved pool fluctuation compared to other pools within LRH. This pool is the uppermost navigation structure in the Kanawha River and is characterized by good water quality, connection to miles of riffle/run habitat, a large diversity of fish, and the presence of multiple endangered mussel species. These conditions may allow a prompt response from the aquatic habitat to alteration of operations. cursory evaluation has already revealed areas that could provide potential ecological uplift. The District has assembled an inter-disciplinary team including members from Corps Planning, Operations, and Water Quality/Management. FY 2021 is the first year that London Lock and Dam has been supported by SRP.

#### Status of 2021 work

The LRH team determined that seasonal drops in pool could expose gravel and sand habitat capable of sustaining ecologically significant beds of emergent, aquatic vegetation. These seasonal drops would be dependent on the authorized pool elevations and operations at the project. Therefore, the team proposed an initial assessment of environmental opportunities, agency coordination to form a PDT, and formulation of an array of alternatives to test operational changes of the structure.

In FY 2021, the team completed initial scoping of the project, research of the authorized operational authorities and current flexibilities and, identified potential sites within the pool that would allow for habitat development. Bathymetry data was collected and determined that a smaller boat and survey equipment was needed in the identified areas due to the shallowness and steepness of the areas. The

data collection with the smaller boat is pending as the boat is being repaired from incident on another project.

#### Anticipated 2022 work

The LRH team will complete the FY 2021 work with carry-over funds and anticipates being completed with work in April 2022, including data analysis, agency coordination, and formulation of alternatives.

#### Future Vision

The vision of the LRH team is to identify alternatives that can be implemented in the London Pool on the Kanawha River that would cause an ecological uplift in the pool and basin. As the alternatives are developed a clearer vision of future efforts will come into view.

### Kansas River, KS – NWK (Gen)

The Kansas River begins at the confluence of the Republican and Smoky Hill Rivers near Junction City, Kansas, and flows 173 miles where it joins the Missouri River at Kansas City, Kansas. The Kansas River drains 53,000 square miles, almost the entire northern half of Kansas and parts of Nebraska and Colorado. Stakeholders include irrigators, municipalities, industry, navigators and recreators. Eighteen federal reservoir projects affect 85 percent of the Kansas River drainage area.

In 2017, the Kansas District (NWK) and TNC established a steering committee made up of experts from state and federal agencies, academia, and stakeholders. USGS gage data was compiled to define post-dam conditions and prepared a literature review on historic flow conditions. This SRP effort was expanded between 2018 to 2020 to include an IPA with Kansas State to synthesize ecological data on native fish guilds, freshwater mussels, sandbar-nesting birds and other fauna and riparian habitat of the lower portion of the river. Since the SRP involvement with river management began, the ecological and hydrologic sciences of the system have been documented in a state of the science report, a draft literature review on sediment trapping has been prepared, a virtual turbidity needs workshop was conducted in August 2020, and an e-flows workshop was held in September 2020. These workshops were successful and included River stakeholders from state and federal agencies responsible for permitting and natural resources conservation.

There have been initial discussions regarding potential e-flow evaluations for Kanopolis, Wilson, and Harlan County Reservoirs and outreach to Section 7 dam owners within the basin.

#### Status of 2021 work

NWK completed the Final Kansas River SRP E-Flows Recommendations Workshop Summary in November 2021. This report was peer reviewed by scientists with USACE, KDWP, and Kansas State University. Further, NWK sent a coordination letter to the Bureau of Reclamation and provided an overview of the program during a coordination meeting. NWK will schedule a webinar to further introduce them to SRP and the efforts they are undertaking in the upper basins.

#### Anticipated 2022 work

NWK will capitalize on the first e-flows workshop and the proposals to begin discussion with the appropriate water managers and stakeholders to develop an implementation plan and explore monitoring opportunities. This task will kick-off the design of the implementation and monitoring phase of the Kansas River provisional e-flow recommendations from 2020 by conducting coordination meetings with Corps operations and water management staff and performing outreach with interested

stakeholders. It's anticipated that these efforts will culminate in the preparation of an Implementation Plan with recommendations from both e-flow workshops and advance implementation and monitoring. A 2<sup>nd</sup> E-flows workshop is planned for FY 2022 to discuss the reaches included in the geographic extension and modify proposals if needed.

#### Future Vision

NWK would like to expand the reach of SRP efforts to include the Section 7 reservoirs in the upper tributary basins operated by the Bureau to maximize environmental benefits related to e-flows within the river basin.

### **Kaskaskia River (Carlyle, Shelbyville, and Kaskaskia Lock & Dam), IL – MVS (Gen and LD)**

The Kaskaskia River Basin covers 10% of the State of Illinois, encompassing parts or all of 22 counties, with 30 main tributaries and 5,840 square miles of drainage. It is a tributary of the Mississippi River, with headwaters just west of Champaign, and flows southwesterly across the state for approximately 325 miles to its confluence with the Mississippi River, about eight miles north of Chester at river mile 117.

Carlyle Lake Dam was completed 1967 and Lake Shelbyville Dam was completed in 1970; both were built primarily for flood risk management. Kaskaskia Lock and Dam (RM 28) was completed in 1974 to provide a nine-foot navigation channel for a narrower tow/barge configuration than those that transit the Mississippi River locks and dams. Flexibility of dam operations offers potential to manage water levels lower during summer growing season to enhance aquatic plant growth.

The Kaskaskia River was identified as a high priority work area for SRP action at the 2019 Midwest Operations and Water Management Meeting. All three dams on the Kaskaskia River were proposed for SRP by the St. Louis District (MVS) in 2020. In FY 2020, the team analyzed daily flows for the previous 10 years at Kaskaskia River Lock and Dam and upstream releases at Carlyle Lake to determine feasibility of implementing water level management to expose shoreline substrate upstream of Kaskaskia Lock and Dam. Water control managers and other stakeholders held meetings with a small group of stakeholders to propose a 0.5' water level reduction at the dams to expose river edge for at least 30 days during the summer. The exposed substrate has viable native seeds that will regenerate and provide fish and wildlife habitat, capture suspended sediment and stabilize the riverbanks.

#### Status of 2021 work

FY 2021 work included public outreach to inform and educate the public on plans for water level management implementation at the two reservoirs and one lock and dam, vegetation monitoring during implementation to showcase successes, and satellite imagery to evaluate implementation and delineate acres exposed. A successful public outreach meeting occurred for the lower Kaskaskia on 27 May. The public outreach meeting at Carlyle was delayed due to a late drawdown and Covid 19 restrictions when suitable conditions were approaching. The Carlyle meeting occurred on 9 November 2021 and shared information about e-flows this summer and the positive vegetation response observed during a brief, late-season drawdown. Shelbyville was above normal pool during the growing season, so a drawdown was not possible at this location.

The satellite imagery taken during drawdown was acquired for Carlyle, Shelbyville, and Kaskaskia using non-SRP funding. Evaluation of the imagery for Carlyle and Shelbyville are near complete and is in progress for Kaskaskia. Delays acquiring suitable imagery and the complex water/land boundary delayed completion of border delineation. Carlyle Lake imagery at normal elevation was recently acquired and

Kaskaskia is in the queue at Digital Globe. Shelbyville Lake will be submitted when normal pool is achieved. Integrated Waterbird Management and Monitoring style vegetation surveys were conducted at Kaskaskia River and Carlyle Lake at 6 and 8 sites to provide percent cover and frequency information at sites. Summary reports for both the public meetings and vegetation surveys are anticipated in January 2022.

#### Anticipated 2022 work

The team proposes to build on the FY 2021 work that included successfully completing water level management efforts at both Carlyle Lake and Kaskaskia locks and dams, and attempted water level management at Shelbyville Lake. The team proposes additional public outreach and meetings to inform and educate the public on the 2021 successes and 2022 plans for water level management implementation at the two reservoirs and one lock and dam. Also proposed is a continuation of quantitative vegetation monitoring efforts during implementation to document plant response and biological impact, showcase success and use for future public outreach, and evaluation of satellite imagery at all three sites while water levels are at specific water level management elevations/zones of influence. The focus in FY 2022 is to gather images and spatially delineating normal pool levels for all three sites. The effort will allow MVS to quantifiably determine acres exposed during implementation. Paired with the vegetation monitoring data, the information will be a powerful indicator of the impact of the SRP actions in the basin.

#### Future Vision

During the summer of 2022 MVS expects to manage the Kaskaskia River similarly to the Environmental Pool Management (EPM) practice on the Mississippi River. Dam flexibility will provide for half foot reduction at each of the three dams. They expect exposed river sediment will stimulate aquatic plant growth along the shoreline and areas of extensive mudflats. If implementation is successful, the practice of EPM will likely become routine operations at these dams as basin hydrology allows. Continued monitoring and evaluation of conditions as well as discussions with stakeholders would be used to inform management and adjust as necessary. These management practices could eventually become a part of a Water Control Plan update.

### **Kiamichi River (Sardis Lake), OK – SWT (Gen)**

The Kiamichi River starts in LeFlore County and flows 177 miles southwest to its confluence with the Red River. Its headwaters are in the Ouachita Mountains near the Arkansas border. The Kiamichi drainage area is 1,830 square miles and flows through six Oklahoma counties. This is an arid river system that has been the subject of many water rights battles between the US, American Indian Tribes, and for ecological services.

The Kiamichi River was new to SRP in 2020. The primary goal of the effort is to further collaboration between the Corps and other stakeholders in identifying and evaluating alternatives based on future projected water demands and changes to the water control plan for Sardis Reservoir. Alternatives must allow for all authorized project purposes, ensure water supply contract requirements are met, and meet downstream needs of aquatic resources within the Kiamichi River from the headwaters to the upper flood pool reaches of Hugo Reservoir.

Tulsa District kicked off the Kiamichi SRP project late in FY 2020 due to funding and the COVID-19 pandemic. Nonetheless, the team was able to collaborate with TNC and stakeholders across the Kiamichi River including key local, state, federal and tribal and NGOs. Biological data for the Kiamichi River basin

was compiled in Feb 2020 and compilation of government reports, data, and peer reviewed literature is on-going. Preparation of an IPA with the University Oklahoma was also initiated for work to complete the State of the Science report. The team also conducted 5 small-group virtual stakeholder meetings from July to November, including with Choctaw and Chickasaw Tribes in July 2020.

#### Status of 2021 work

Due to staffing limitations, the project was delayed in FY 2021. However, the IPA for the State of the Science Report was fully executed in October 2020 with Dr. Caryn Vaughn, University of Oklahoma. The literature search was initiated. The hydrology and hydraulics team members are working with the Oklahoma Water Resources Board to obtain water rights and diversion point data to include in the SWT RiverWare model. One of the coordination meetings was a climate adaptation workshop targeting the Kiamichi Basin and was instrumental in identifying additional data needs and potential data gaps related to Phase III modeling efforts. The model will initially be used for developing a water budget for the basin, necessary to test e-flow prescriptions.

The State is working with Tribes to foster participation in the e-flow workshop planned for June 2022. The Water Unity Agreement needs to be signed, but congress provided an extension.

#### Anticipated 2022 work

Due to staffing limitations, the project was delayed again in FY 2021. Tulsa District intends to continue the effort initiated in FY 2020 and begin advancing FY 2021 work using carry-in funds. This work includes planning and implementation of an e-flow workshop. FY 2022 activities would now include: 1) basin stakeholder meeting to present critical components of the State of the Science Report; 2) a workshop with subject matter experts to refine life history components for critical fauna, including hydrologic needs within the constraints of the Tribal/State water sharing agreement; 3) hosting an e-flow workshop to identify achievable prescriptions; 4) continue to refine the Corps RiverWare model for the Kiamichi River Basin to simulate e-flow and climate resiliency alternatives; 5) share e-flow workshop basin stakeholder meeting results with the public.

#### Future Vision

Environmental flow considerations and implementation have the potential of adding to the benefits these dams can provide for fish, wildlife and plants of the Kiamichi River for citizens of Oklahoma and the Chickasaw Nation. These discussions must be interwoven into other agreements already underway for the basin.

### Lake Washington Ship Canal (Ballard Locks), WA – NWS (LD)

The Hiram Chittenden Project, commonly referred to as the Ballard Locks, is a lock and dam structure built in 1917 and operated by Seattle District. Located in the heart of a heavily urbanized environment, the Ballard Locks and Lake Washington Ship Canal (LWSC) connect the saltwater Puget Sound to the inland freshwater systems of Lake Union and Lake Washington. The Ballard Locks are operated to allow commercial and recreational boat traffic to move between Puget Sound and Lake Washington, maintain Lake Washington elevations, provide fish passage, and to control salinity intrusion. The LWSC begins at the Ballard Locks and ends 8.6 river miles upstream where it connects with Lake Washington. High water temperatures throughout LWSC, together with corresponding low dissolved oxygen concentrations, have been identified as an impediment to Endangered Species Act (ESA) listed adult salmonid species migrating upstream.

FY 2021 was the first year the Ballard Locks and Lake Washington Ship Canal were supported by the SRP to help identify environmental benefits from modifying operations of the locks (such as lockages, spillway flows and fish ladder flows).

#### Status of 2021 work

In FY 2021, NWS sought SRP funding to conduct modeling investigations of the LWSC via an existing CE-QUAL-W2 water quality and hydrodynamic model. The proposal was to contract a consultant to update and re-calibrate the model with recent data to possibly improve analysis of operations on water quality. The model would also be used to test alternative operational scenarios investigating whether water temperature can be controlled in concert with salinity intrusion to benefit salmon.

The contracting effort delayed start of project until October 2021, but the contractor has been provided the data to update the CE-QUAL-W2 model and will collaborate with NWS to calibrate, verify, and execute model runs. Modeling efforts and final report will help inform future NWS actions and meet the project authorization of environmental stewardship. The effort is estimated to be completed in June 2022.

#### Anticipated 2022 work

The NWS team and their contractor plans to execute the FY 2021 authorized work in FY 2022. Following the modeling effort, additional work may be proposed in FY 2023.

#### Future Vision

NWS intends to update, recalibrate and reverify an existing two-dimensional CE-QUAL-W2 model of the LWSC to better evaluate the impact of LWSC operations on water quality targets, and to understand whether operations of the Ballard Locks could be adjusted for those water quality targets within the model domain.

### Mill Creek (Mill Creek Dam and Flood Control Project), WA – NWW (Gen)

The Mill Creek Flood Control Project (Project) is operated by Walla Walla District with authorized missions of flood risk management and recreation. The Project consists of an off-stream storage reservoir and two diversion structures on Mill Creek in Walla Walla, Washington.

The Project has an environmental stewardship program and involves two species that are federally listed as threatened pursuant to the Endangered Species Act (ESA), Mid-Columbia River steelhead (*Oncorhynchus mykiss*) and bull trout (*Salvelinus confluentus*). Both species migrate through the project footprint to spawn in the headwaters of Mill Creek. Project operations and maintenance (O&M) affects physicochemical habitat for these species. The Project's O&M program recently underwent ESA consultation with Biological Opinions (BiOps) from NMFS and USFWS. Providing effective fish passage at the Project's main flood management diversion dam is a critical part of the Project's operations and the O&M ESA consultation. As a result, designs for a new and more effective fishway are underway.

Downstream of the project is the Mill Creek Flood Control District, consisting of leveed channel upstream and downstream of the City of Walla Walla, and a concrete channel through the City. These features were originally constructed by the Corps and are managed by Walla Walla County. The Corps is conducting a flood risk General Investigation (GI) with Walla Walla County which may result in recommending changes to the Mill Creek Project Water Control Manual.

The Mill Creek watershed has a substantial number of supporting stakeholders to include local and state governments, local Tribes, and concerned citizens. Collectively, these entities form the Mill Creek Work Group interested in making environmental improvements within the Mill Creek flood management system. FY 2021 was the first year of support by SRP for Mill Creek.

#### Status of 2021 work

The NWW team proposed to host a workshop to include the Mill Creek Working Group, scientific experts, and environmental practitioners. The goal of the workshop was to consolidate data from stakeholders to determine what environmental benefits could be derived from a habitat enhancement project. Facilitators will guide discussion to brainstorm ideas to increase environmental benefits through modified operations or other work in the 40-acre forebay above the Mill Creek Diversion Dam.

The team was able to consolidate data from existing studies and hosted planning meetings in the field with stakeholders. Research and develop criteria for pool manipulations and habitat improvement for flood plain connectivity, water temperature, fish passage, dam safety, and debris management were completed. Catalysts for future work include the ongoing design for a new fish ladder which could allow for some flexibility in forebay pool elevation, BiOps requiring an update to the water control manuals, a GI study requiring an update to the water control manual, and channel movement toward the toe of a levee that may require channel realignment for dam safety.

The draft summary report has been prepared and is being reviewed by the PDT. The report includes some planning alternatives. The working group meeting occurred on 12 October 2021 and the final summary report will be provided to SRP by 6 December 2021.

#### Anticipated 2022 work

Finalize the workshop summary report in December 2021 using FY 2021 carry-in funds. No other SRP work has been proposed for FY 2022 at this time but work on Mill Creek will continue at the NWW District. Updated hydrology studies, a restoration project upstream, and a new fish ladder are being completed that would need to be coordinated with the alternatives identified in the Report. An SRP proposal may be submitted in FY 2023.

#### Future Vision

If fully realized, implementation of changes identified via the SRP process could have positive and lasting environmental effects including changes in operations that benefits ESA-listed fishes.

### Mississippi River (Upper River Basin), IL and MO – MVP, MVR & MVS (LD)

The Upper Mississippi River has been modified for navigation and other purposes for over 100 years through a series of locks and dams constructed in the 1930s and 1940s. The primary purpose of these projects was to construct the Nine-Foot Channel Navigation Project. Each lock and dam create a navigation pool to provide relatively stable water levels during non-flood periods.

The high and relatively stable water levels created by the locks and dams subjected islands in the lower portion of the pools to wave erosion. Many islands disappeared along with the aquatic plant beds adapted to the shallow water. A river restoration program was secured through Congressional action and although critical river restoration has occurred, seasonal variability in flow and water levels has not.

The 3 Districts of the Upper Mississippi River have experimented with modifying operations of the locks and dams to restore some seasonal variability. The districts have reduced water levels during the

growing season in some pools to expose mudflats and prompt native seed germination. The St. Louis District (MVS) has been successful in using operational flexibility to keep water levels slightly lower in the summer while maintaining the navigation channel. Between 2015 and 2018, SRP supported MVS in monitoring adaptive management activities to demonstrate responses to these lower water levels at specific locations. Today, SRP is supporting improving the management of the entire system, including more than 30 locks and dams on the Upper Mississippi and Illinois Rivers.

The Upper Mississippi River team continued developing an implementation strategy for operationalizing water level management within the system. They acquired hourly flow and gage data from locks and dams for years 2016-2018 during the growing season and performed analysis of data to determine operational capability for small-scale water level management. The focus was to identify specific operating bands for each lock and dam on the Upper Mississippi River totaling over 500 river miles. The team quantified acres exposed through implementing pool by pool operations in 14 pools in Rock Island District (MVR) and 9 pools in St. Paul District (MVP) with additional success rate calculations for water level management. The objective of the PAS is to implement systemic water level management on the Upper Mississippi River

#### Status of 2021 work

In FY 2021, the Upper Mississippi River SRP team proposed to investigate, compile, and document Upper Mississippi River goals and objectives. In FY 2021 the team completed a report of FY 2020 accomplishments and expanded work by holding remote regional operational workshops for a small group of Water Control Managers. The workshops consisted of six meetings totaling 21 working hours between March and July 2021. The members considered programmatic implementation of water level management in the Upper Mississippi River. Participants represented the following agencies: USACE, USFWS, USGS, UMRBA, TNC, ILDNR, IADNR, MNDNR, WIDNR, and USEPA. The facilitator used SDM processes and an adaptive management framework to guide the discussions. Input was organized into a detailed report capturing the steps and decisions made during the workshops, and recommendations for characterizing the ecological conditions of pools to aid selecting and prioritizing pools for water level management.

#### Anticipated 2022 work

It's anticipated that this work will be continued to identify specific opportunities within the Upper Mississippi River for water level management and other focused efforts such as the vegetation study described below.

#### Future Vision

The Upper Mississippi River SRP team includes three Corps Districts, over 30 locks and dams and 500 river miles. The teams overriding goal is to maintain collaboration across the districts to manage operations that maximize ecosystems benefits while maintaining navigational requirements. This effort will surely act as a case study for other SRP projects, demonstrating collaboration in synchronizing operations of locks and dams across multiple facilities on a single system to meet common ecological and anthropogenic needs.

### Mississippi River (Vegetation Study), MO - MVS (LD)

The 3 Districts of the Upper Mississippi River have experimented with modifying operations of the locks and dams to restore some seasonal variability. The districts have reduced water levels during the



growing season in some pools to expose mudflats and prompt native seed germination. The St. Louis District (MVS) has been successful in using operational flexibility to keep water levels slightly lower in the summer while maintaining the navigation channel. To expand on this work and study vegetation resilience, the team acquired and installed remote cameras to evaluate vegetation response to water level management in Pools 26, 25, and 24 in 2020. There were 8 photo stations deployed successfully; however, two had substantial tree growth that rendered the photos unusable. The remaining six photo stations worked successfully, collecting two photos per day through late August of 2020. Videos of the photography data were created for these six stations and are available on the district website.

#### Status of 2021 work

The SRP team sought to build on the FY 2020 work on vegetation resilience as it relates to implementation of water level management. Phase 1 surveyed known locations of arrowhead and developed a survey protocol for assessing tuber bioenergetics and abundances with assistance from ERDC. Phase 2 completed field surveys and collaboration with HEC to develop ecological parameters for arrowhead, nodding smartweed, millet to refine the vegetation input criteria based on 2021 implementation of management strategies. Also considered were waterfowl species (mallard, Canada goose, and trumpeter swan). The hydrology and hydraulics were developed for species without EPM scenario to be used in ground truthing the CWMS vegetation model and waterfowl response with and without drawdown. Real-time observations will allow for refining model input criteria to achieve more accurate predictions of hydrology and vegetative dynamics by the Corps Water Management System.

Arrowhead samples were gathered in May, August, September, and October 2021 to evaluate tuber growth and density. The milestone for arrowhead was delayed due to late and slow development of tubers. Final tuber samples were dried and processed in November 2021. Additionally, arrowhead densities were gathered along 10 random transects at the Mile 210 area along with patch dimensions at multiple locations to allow tracking of aboveground cover and spread. Report and model verification is in progress.

Vegetation surveys were performed for arrowhead (*Sagittaria latifolia*) in Pool 26 at all previously documented locations. Unfortunately, arrowhead was not observed in the previous locations and tubers were not collected and the proposed evaluation of species resilience by relating tuber sizes to growth rates was not accomplished. This effort is proposed to be revisited in FY 2022 as understanding energetics for long-term viability is important information that could help direct water level operations.

#### Anticipated 2022 work

The team seeks to continue the Phase 2 FY 2021 work completed on the Upper Mississippi River for vegetation resilience as it relates to implementation of water level management and prepare a report of findings. The team would also continue to ground truth for the predictive CWMS vegetation model developed by HEC and compare 2022 tuber and patch growth success to FY 2022 EPM outcomes and the 2021 phase 2 field results.

### **Mississippi River (Melvin Price L&D, Lake Sturgeon Spawning), MO - MVS (LD)**

Melvin Price Lock and Dam (Mel Price) is a dam and two locks at river mile 200.78 on the Upper Mississippi River, about 17 miles north of St. Louis, Missouri. Mel Price is operated by the U.S. Army Corps of Engineers St. Louis District (MVS) and is authorized to provide a nine-foot navigation channel.

The lake sturgeon (LKSN) is a charismatic fish species that is unique due to its longevity and sheer size. Lake sturgeon, also known as “rubbernose” sturgeon can reach 8 feet long, weigh over 200 pounds and live over 100 years. LKSN are designated as state endangered species in Illinois and Missouri. In 2015, lake sturgeon was observed spawning in the Mel Price tailwater along the right descending bank. This site became the first confirmed sturgeon spawning location in Missouri, however some of the specifics around this event aren’t fully understood. It is known that water temperature, time of year, flow velocity, and substrate are critical to spawning. This project seeks to operationalize e-flows for lake sturgeon benefits by investigating flows for targeted operations, collaboratively monitoring lake sturgeon activity/response in the area, and conduct agency coordination and public outreach.

#### Status of 2021 work

Year one focused on establishing a baseline of flow conditions of prior use years in HEC-RAS 2D modeling, sturgeon sampling, tracking and spawn monitoring, as well as development and implementation of an SRP lake sturgeon conservation outreach plan.

#### Modeling

The Hydrologic Engineering Center River Analysis System (HEC-RAS) was used to simulate existing channel conditions. This analysis studied velocities affected by gate bay gate settings on the spawning zone of April 2015 as well as two similar events from 2016 and 2018 when LKSN were observed in the area, yet no spawning was confirmed. The tailwater averages for the 2018 and 2016 events were 405.3 and 405.1. The approximate tailwater elevation relationships between events simulated seem to indicate that tailwater might be the most functional parameter in establishing a relationship between the hydraulics and Lake Sturgeon spawn. These functional relationships can be used as a determining factor for decisions on ideal gate 9 and/or gate 8 settings. For a tailwater ranging from 403.0 feet to 406.5 ft, the current recommended settings for gate 8 is 4 to 5 feet, and gate 9 of 2 to 4 feet. A gate 8 and gate 9 opening of 5 feet and 4 feet would coincide with the lowest total gate openings within this tailwater range.

#### Monitoring

Lake sturgeon monitoring around Mel Price began in March of 2021 and continued into May. Monitoring consisted of two efforts: direct sampling for lake sturgeon and passive shoreline monitoring of the spawning location.

Direct sampling occurred during March and early April 2021 and involved setting trot lines in the Mel Price Tailwater. Lines were set between zero and three miles downstream from Mel Price. No lake sturgeon was captured during the 2021 season. It was noted that river flows remained elevated during the sampling period causing Mel Price to operate at Open River stage. All dam gates are completely out of the water during this stage and presumably fish can pass through the dam without any difficulty. While checking trot lines, we searched for tagged fish using radio telemetry. No tagged LKSN were detected during spring 2021.

Passive sampling efforts began in early April as water temperatures warmed and possible conditions for spawning occurred. During these daily visits, the team watched for congregating LKSN near the spawning area and interviewed anglers about potential sightings. No spawning behavior was detected. Since Mel Price was at Open River status until mid-April it is possible the site may not have been suitable in 2021.

### Outreach

FY 2021 Outreach initiatives for the Sustainable Rivers Program - Lake Sturgeon Project included: 1) the creation of museum exhibit materials currently on display at the National Great Rivers Museum, 2) incorporation of conservation efforts into educational and public programming, 3) media distribution, 4) and a call-to-action campaign. The new exhibit at the National Great Rivers Museum brings awareness to Lake Sturgeon conservation as well as the current research project taking place at Melvin Price Locks and Dam. The exhibit occupies a 28' x 7' section of wall within the museum and focuses on over river health and the diversity of LKSN within the Mississippi River, the Sustainable Rivers Program, LKSN life history, and a life-sized LKSN "pledge wall", where visitors can write and then hang their commitments to make choices that can make a positive impact on LKSN conservation. The exhibit was debuted on August 14<sup>th</sup>, 2021 during an event called *Mississippi Monsters: Fishy Festivities at the National Great Rivers Museum*. This event was held in partnership with the Illinois Natural History Survey and the Missouri Department of Conservation and featured the Lake Sturgeon Coordinator from the Missouri Department of Conservation. Since the exhibit's debut, over 6,500 visitors to the museum have seen the new exhibit wall.

Media distribution has included press releases, articles in the U.S. Army Corps of Engineers' Mississippi River Valley Division's quarterly publication "Our Mississippi" of which 50,000 copies were printed and distributed, event flyers, and approximately 250 identification cards obtained from MDC that are meant to help anglers identify lake sturgeon to ensure release as well as educate on proper procedures to follow if a tagged lake sturgeon is found. These cards will be handed out to local organizations as well as visiting public by USACE Rangers.

A call-to-action campaign consisted of new interpretive signs that have been hung at the LKSN spawning location, which are geared towards the area's heavy angler presence. The Riverlands Migratory Bird Sanctuary sees over 200,000 visitors a year, and the Maple Island Access Recreational Area is a favorite destination for both fishing and birding enthusiasts alike. These new signs, like the identification cards, will help local fishermen to know proper identification techniques, as well as who to call if a tagged LKSN is encountered.

### Anticipated Work in 2022

The LKSN SRP team will complete a FY 2022 accomplishments summary. Efforts will be focused on operationalizing gate settings at Mel Price to achieve desirable tail water velocities. Installation of velocity and water quality sensors will allow our team to monitor and adjust conditions in real-time. These data will also be utilized for further examination of gate setting alternatives and model calibration. The establishment of a relationship between tailwater elevation, head differential and total gate settings will be a priority. The team will continue partnering with the Missouri Department of Conservation to capture, tag, and track lake sturgeon in the Mel Price tailwater. The project will also seek to confirm spawning utilizing routine shoreline monitoring in April – May.

### Future Vision

LKSN range over the entire Upper Mississippi River, over which there are 27 locks and dams spanning several hundred river miles. If findings from Mel Price Locks and Dam prove to create beneficial spawning habitat for the species, it is possible flows could be operationalized at many of these structures throughout the Upper Mississippi River as well its tributaries.

## Neches River, TX – SWF (Gen)

The Neches River is in east Texas with the headwaters located near Colfax, Texas in the Fort Worth District (SWF). The Neches River flows approximately 416 miles into a coastal estuary, Sabine Lake, and ultimately into the Gulf of Mexico. The watershed of the Neches River and its tributaries encompass approximately 10,300 square miles. Town Bluff Reservoir is located on the mainstem of the Neches River while the Sam Rayburn Reservoir is located on the Angelina River just above Town Bluff and the confluence with the Neches River. Reservoir purposes include flood control, water supply, hydropower, and recreation.

The Lower Neches River supports some of the highest diversity of aquatic life in Texas, including the most diverse mussel community in the state. The rich fish and wildlife communities are evidenced by the Big Thicket National Preserve, the Sabine National Wildlife Refuge (NWR), The McFaddin NWR, the Texas Point NWR, the Lower Neches Wildlife Management Area (WMA), the Big Hill WMA, and the J.D. Murphree WMA all located downstream of Sam Rayburn and B. A. Steinhagen reservoirs.

SRP work on the Neches began in FY 2021 and seeks to optimize reservoir releases and river flows to benefit river ecology while continuing to operate for project purposes. Maintaining e-flows that benefit native species and ecological systems would provide year-round river water levels suitable for the behavioral, reproductive, and habitat needs of river and floodplain flora and fauna.

### Status of 2021 work

The SWF and TNC coordinated a workshop with the Lower Neches Valley Authority (LNVA), natural resource agencies, academia, and other scientific experts and environmental practitioners. The goal of the workshop was to bring stakeholders together to identify ecosystem problems and opportunities, including those that could be addressed by SRP. The workshop was held on 1 September 2021 and identified existing data and data gaps for the identified problems and/or opportunities. A summary report of the workshop is in development and will include a prioritized list of potential ecosystem projects, research, and studies to inform and guide the submission of future SRP proposals. The report is expected to be finalized by the end of 2021 calendar year.

### Anticipated 2022 work

The SWF team plans to complete the report in early FY 2022 and has submitted two proposals for SRP consideration in FY 2022: a proposal to investigate potential environmental strategies for operational changes at Sam Rayburn and Town Bluff Reservoirs in the Neches River basin for data compilation and literature review and for assessing opportunities to benefit freshwater mussels.

### Future Vision

The benefits of this workshop reached beyond its original intent and the Neches SRP team plans to continue to meet on SRP and other related issues into the future.

## Ohio River, IA, KY, OH, PA, WV – LRP, LRH, and LRL (LD)

The Ohio River is of national ecological and socioeconomic significance, containing a diverse aquatic community (approximately 160 fish and 120 mussel species) and providing vital services (e.g., navigation, recreation, drinking water) to over five million people. Altered hydrology has been identified as an urgent threat to the ecological sustainability of the Ohio River by altering water quality, sediment transport and distribution, floodplain connectivity, and availability of/access to critical (e.g., spawning and rearing) habitats. The *overall goal* of the three participating USACE districts is to develop the science

and tools needed to maximize ecological sustainability of the Ohio River mainstem through strategic operations of its 19 navigation dams and 68 contributing reservoirs while maintaining current mission goals (navigation, hydropower, flood risk management, etc.).

### Status of 2021 work

In 2021, the multi-district team set out to accomplish a series of efforts that will inform future changes with the goal of improving ecological conditions and sustainability within the Ohio River: 1) inventory and baseline conditions within the Ohio River; 2) characterize critical aspects of basin-level hydrology and identify additional hydrologic modeling and tools that may be needed to inform a systems approach to sustainable water management; 3) identify potential opportunities to maximize ecological sustainability through reservoir and navigation system operations; and 4) engage regional stakeholders to develop a coordinated approach to implementing the tools developed under the current study.

Inventory of existing conditions is complete. The initial inventory focused on the mainstem of the Ohio River, with some consideration to high value tributaries or reservoirs. Using publicly available data, the PDT has documented water quality trends, invasive species distributions, high quality habitats (i.e., islands, wildlife refuges, etc.), fish and mussel community characteristics, presence of threatened and endangered species, substrate types, ORSANCO ORFIN and macroinvertebrate assessment scores, and known water quality issues to the extent feasible. H&H Engineers, in coordination with Operations, have also documented physical characteristics and constraints of the navigation system, including presence and characteristics of hydropower; number and characteristics of gates, locks, and weirs; ordinary high-water marks; upper pool elevation; length of pool; drainage area; and travel times, among others. H&H Engineers have also evaluated the potential to use the Ohio River Community Model to assess future conditions of selected pools should e-flows be implemented. These accomplishments satisfy Tasks 1 and 2.

At the time of this writing, the PDT is working on Task 3, anticipated to be completed by February 2022. The PDT has identified 10 environmental opportunities for the Ohio River, including: 1) temporarily raise pool elevation; 2) temporarily lower pool elevation; 3) flow manipulation for habitat improvement; 4) selective withdrawal retrofits for flood risk management structures; 5) structural changes; 6) island restoration; 7) invasive species control; 8) modification of hydropower operating agreements; 9) rapid watershed assessment for tributaries; and 10) conservation lockages on tributaries. Environmental professionals from each District are researching potential benefits, drawbacks, and considerations of these opportunities to develop broad recommendations for implementation. H&H Engineers are modeling potential impacts of temporarily lowering pool elevation (opportunity 2) on navigability in three selected pools, one in each district. Geospatial sections have been engaged to summarize land use in the riparian corridors and assess the acreage of habitat that could be generated through temporarily raising (opportunity 1) and lowering (opportunity 2) the pool elevation. Information compiled from each discipline will be used to generate recommendations for further study, and these recommendations will be coordinated with Operations and stakeholders.

The PDT is currently targeting March 2022 for report completion, stakeholder engagement, and project closeout.

### Anticipated work in 2022

Environmental opportunities identified by the Districts include implementation of e-flows, conservation locking in ecologically significant tributaries, restoration of key habitats within the Ohio River system, structural changes and retrofits to navigation and flood risk management structures, and others. Implementation of these opportunities will require extensive stakeholder engagement beyond that

proposed in the FY 2021 study as well as procurement of additional resources, potentially through leveraged funding. The overall goal of the FY 2022 effort is to prepare and advance a stakeholder engagement campaign to present and refine the environmental opportunities identified by the Districts in FY 2021. Implementation of the proposed stakeholder engagement campaign will develop the partnerships required to advance future work and implement environmental opportunities across the Ohio River Basin.

#### Future Vision

Outcomes of the FY 2021 effort coupled with anticipated FY2022 work will culminate in a thorough assessment of opportunities within the Ohio River Basin. The process is focused on extensive outreach efforts to help carry momentum where the greatest opportunities exist. It is expected that the effort will move to identification of select sites for implementation of environmental actions.

### Osage River, KS and MO – NWK (Gen)

The Osage River was identified as a potential SRP project at the 2019 Upper Midwest Regional Meeting as a logical expansion of efforts on the Kansas River. The 2020 proposal included evaluation of three geographic areas: 1) headwaters of the Osage River, extending from Kansas to Truman Reservoir in Missouri, 2) the Sac River from Stockton Reservoir to the Osage River, and 3) the Pomme De Terre River from Pomme De Terre Reservoir to the Osage River. Initial work was slated to explore current and historic operating conditions and identification of both regulated and unregulated flow to the Osage. In 2020, the team executed an IPA with Oklahoma State and held a project kick-off meeting.

#### Status of 2021 work

The work on Osage River was delayed due to staffing limitations and Covid 19 restrictions. Funds were carried over to FY 2022.

#### Anticipated 2022 work

The NWK SRP team kicked off monthly science team meetings in December 2021 to prepare the ecological report prior to the planned e-flows workshop in June 2022. As part of this team, Oklahoma State will evaluate the species groups/ecological components in the basin. NWK Water Control staff will compile hydrological data for the three river reaches included in the Osage River SRP. This research is expected to identify ecological resources and provide background to define e-flows requirements to serve as catalysts for future outreach, science, and implementation and workshop. KS TNC staff will coordinate with MO TNC and begin planning coordination/outreach meetings. The team will prepare a summary report of findings by September 2022.

#### Future Vision

The current vision of the project is to implement meaningful long-term e-flow prescriptions within the 3 river reaches included in the Osage River SRP.

### Pecos River (Santa Rosa, Sumner and Brantley), NM – SPA (Gen)

The Pecos River runs through New Mexico and Texas to the Rio Grande near Del Rio, Texas. The basin is approximately 38,300 square miles and flows 926 miles from the headwaters. A total of 20.5 miles is designated a Wild and Scenic River. At origin the elevation is over 12,000 feet and it drops through canyons, plateaus, and broad valleys.

The Pecos River was a new SRP project in 2020 to initiate evaluation of e-flows and prepare a literature review and state of the science report. Albuquerque District investigations began with Santa Rosa, Sumner, and Brantley dams to explore options for e-flows, host stakeholder meetings, and complete a literature review. The Pecos SRP Team hosted meetings with key stakeholders beginning in April 2020 and continuing to date with several meetings a month. The team developed objectives, goals, and a table of contents for the literature search and state-of-the-science report. Finalizing the state-of-science e-flows work was delayed due to COVID-19 and staffing and is proposed to occur in 2021.

#### Status of 2021 work

The Pecos River effort was impacted by COVID-19 and federal partner staffing availability. In August 2020, team members were assigned responsibilities for topics to complete the report and the draft report and is mostly complete except for fish analysis. The anticipated draft report will be distributed to the PDT for initial review and comment and then to the broader stakeholder group in February and March 2022.

#### Anticipated 2022 work

The final state-of-the-science report and e-flow workshop and report will be completed in FY 2022. The team will continue regular meetings to execute planning for the e-flows and execution of the workshop.

#### Future Vision

Although the Pecos River is an arid western river, the vision for this river is to return some of the natural seasonal variability to the river. Sensitivities around water rights and allocations will supersede e-flows but with science-supported considerations based on SRP recommendations, there is greater likelihood of finding options to improve the hydrology through improved dam operations.

### Potomac River North Branch (Jennings Randolph Lake), MD and WV - NAB (Gen)

Jennings Randolph Lake (JRL) is located on the North Branch Potomac River and spans across Garrett County, Maryland, and Mineral County, West Virginia. The dam is located 58 miles upstream of the confluence of the North Branch and South Branch Potomac Rivers. Jennings Randolph Lake is operated by the U.S. Army Corps of Engineers, Baltimore District (NAB) and is often operated in conjunction with Savage River Dam, a State-owned project on the Savage River. Jennings Randolph Lake was originally authorized for the purposes of flood control (now flood risk management), domestic and industrial water supply, water quality control, and recreation. Whitewater recreation was added as a project purpose in 1988.

Storage within Jennings Randolph Lake at its summer pool is specifically allocated for both water quality and water supply. Originally, regulating Jennings Randolph Lake for water quality concerns centered around acid mine drainage and industrial pollutants in the watershed. The 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 regulation strategies included utilizing the selective withdraw capability of the outlet works to regulate the quality of the releases for pH, conductance, and dissolved oxygen. In addition, the release plan included maximizing the use of the water quality storage within the reservoir to help dilute downstream pollution. During the late summer and Fall, when there were extended periods of low 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 during extended low flow periods, Artificially Varied Flow (AVF) releases were initiated - AVF releases are pulse flows for removing accumulated organic sediments, thus improving the downstream aquatic environment.

As various remediation efforts were implemented such as treatment of acid mine drainage and stricter limits on industrial effluents, the overall condition of the North Branch Potomac River watershed improved. Fisheries both in-lake and downstream began to thrive. A thriving cold-water fishery developed downstream of Jennings Randolph which led to a significant increase in fishing interests and growing recreation businesses. Over the years, the main water quality concern began to shift to the downstream fishery and the ability of Jennings Randolph to maintain cold water releases for that cold water fishery. Release strategies shifted away from releasing as much as possible to utilizing the water quality storage more conservatively to conserve cold water storage to maintain downstream temperatures and desired flows for the downstream fishery.

#### Status of 2021 work

The North Branch Potomac River was in its first year of the Sustainable Rivers Program in FY 2021. FY 2021 efforts were primarily focused on internal coordination with Operations, Engineering (Water Management) and Planning regarding the evolution of the regulation of Jennings Randolph Lake to date, gaining a better understanding of e-flows, and assessing the potential for considering e-flows for Jennings Randolph and the North Potomac. Several internal meetings were held in FY 2021 in the July through September timeframe. Additional efforts included collecting and providing literature/documents to the team regarding Jennings Randolph Lake and e-flows. The ultimate goal of the literature review and meetings was to identify the viability of e-flows for Jennings Randolph and the North Branch Potomac River, especially in light of the various authorized purposes and public interests/needs. The FY 2021 SRP efforts were not complete as of 30 Sep and continued into FY 2022. In early October 2021, NAB participated in an NAD Regional Sustainable Rivers Program meeting which was extremely valuable, educational, and pivotal to the team and provided a lot of the information that was needed for an internal determination of the steps forward in this effort. It also brought awareness of other environmental actions to consider in addition to e-flows. One of the conclusions from this meeting was to continue further discussions of the potential for e-flows, and possibly other environmental opportunities for Jennings Randolph.

#### Anticipated 2022 work

Efforts carrying over from the FY2021 SRP proposal will include an internal working meeting to further discuss environmental opportunities with an expanded group of knowledgeable NAB staff. The working meeting would be scheduled for two dates (one in November and one in December) to do a more thorough look at various environmental opportunities for Jennings Randolph as a District with the goal of identifying which opportunities have the greatest and hopefully likely potential.

If funded, a proposed follow on SRP effort would then follow to hold a broader workshop to gather various resource agencies, partners, and stakeholders to discuss and evaluate environmental opportunities for Jennings Randolph Lake and the North Branch Potomac River.

#### Future Vision

It is envisioned that the results and recommendations that are identified through the SRP process will be used to inform decisions on an updated reservoir regulation plan for Jennings Randolph Lake, particularly for water quality while also incorporating considerations for the other authorized project purposes. Opportunities would provide a revised optimal use plan for the water quality storage given



current watershed conditions, provide improved streambed health and include considerations such as water temperature management interests for temperature sensitive fish species downstream. All of this would then be implemented in an updated Water Control Plan for Jennings Randolph Lake.

### Roanoke River (John H. Kerr Dam), VA and NC – SAW (Gen)

The Roanoke River flows over 400 miles from the Blue Ridge Mountains to the Albemarle Sound, encompassing a drainage area of about 9,600 square miles. The Upper and Middle Roanoke Basins are highly regulated, with multiple private and Corps-owned reservoirs. The Corps owns and manages two reservoirs in the Roanoke Basin: Philpott Reservoir on the Smith River and John H. Kerr Reservoir on the Roanoke River. Both are multi-purpose reservoirs, with flood risk management and hydropower as primary operational purposes.

The lower Roanoke River flows through a floodplain of national significance, containing “the largest intact and least disturbed bottomland hardwood cypress / tupelo ecosystems on the Atlantic Coast of America”. USFWS and TNC own over 95,000 acres in the lower 134 miles of the Roanoke River. This critical floodplain forest habitat was the impetus to identify a management alternative to restore flows that more closely resemble natural river flows. The alternative chosen is called Quasi-Run-of-River (QRR) that shifts the flood control operations defined in the Water Control Plan to release outflows that more closely mimic inflows. This change provides the flow that benefits the habitat while still supporting flood control and hydropower missions. QRR was officially implemented in June 2016. SRP supports the monitoring of the revised releases to assess if ecological outcomes meet intended results or require adaptive management changes.

#### Status of 2021 work

The Roanoke River is considered one of the most important riverine systems for diadromous fish reproduction on the Atlantic seaboard. Beginning in 2016, the Corps implemented a more naturally variable flow regime (QRR). Intensive monitoring of diadromous fish recruitment has occurred on the Roanoke both pre and post QRR, yet limited work had been completed for juvenile alosines (blueback herring, alewife, hickory shad) with river flow events.

In FY 2021, an extensive eDNA monitoring effort was initiated in the Roanoke Basin. Three mainstem and two tributaries were identified as high priority sampling locations. From February to November, weekly eDNA samples were collected. This period spanned the adult spawn and juvenile movement. Blueback herring DNA was found in all five locations sampled. Researchers are making their way through the extensive lab analysis of samples. In the meantime, the team has been securing permits to conduct electrofishing and netting starting in spawn of 2022.

SAW was also funded to evaluate hydrology effects on vegetation. It took several months execute a contract with CESU, delaying the work. By September 2022 the team had Duke University under contract to collect tree rings and create an ecosystem function of vegetation relationships on the Roanoke. TNC also secured a summer intern to evaluate remote sensing data with flooding and deforestation along the Roanoke. The work with Duke University is anticipated to go through Sept 2022.

#### Anticipated 2022 work

The team would like to continue the eDNA work through 2022 and expand to include traditional sampling. This data would help refine population estimates with the quantity of eDNA detected. Results

will be shared with a broad Corps audience to investigate how eDNA can be used as a tool by water managers.

As mentioned, the ecosystem function model and vegetation studies are just getting started. In the summer of 2022, a large vegetation monitoring effort is planned. This will be the first vegetation sampling after QRR was implemented in 2016 and will give insight into longer-term flow-ecology relationships.

#### Future Vision

With the additional information from monitoring, scientists will be able to evaluate the Quasi-Run-of-the-River (QRR) impact more fully to the river's geomorphology, floodplain forests and diadromous fish movement. Assessments will allow informed decisions about maintaining current operational changes or adapting these changes to better support the ecological outcomes that were defined for ecological health of the Roanoke River. It is anticipated that this information can be regionalized and used by neighboring river basins and beyond.

### Rogue River, OR – NWP (Gen)

The Rogue River Basin, located in southwestern Oregon, has a 5,156 square miles of drainage basin area and flows 215 miles in a generally westward direction from the Cascade Range to the Pacific Ocean. It is one of the original eight rivers named in the Wild and Scenic Rivers Act of 1968.

The USACE NWP operates two projects in the Rogue River Basin, Lost Creek and Applegate dams. Lost Creek Dam is authorized for flood risk management, fish and wildlife, hydropower, irrigation, water quality, water supply, and recreation purposes. Applegate Dam is authorized for flood risk management, fish and wildlife, irrigation, water quality, and recreation purposes. The current work is to conduct a literature review and hold meetings with technical experts to identify flow studies, operations, potential issues, and opportunities applicable to Rogue River Basin, Oregon.

#### Status of 2021 work

As of November 2021, the literature review work is on-going and source material has been collected and is being documented. Completion of the literature review is expected to be 30-March 2022.

#### Anticipated 2022 work

It is anticipated that the literature review will be completed in the first quarter of calendar year 2022. Once the deliverable is finalized, the SRP cadre will discuss next steps with stakeholders for possible follow-on work. Based on understandings gleaned from the literature review, an evaluation will be made for the need for a possible future SRP e-flow workshops, like the Willamette River basin SRP effort.

#### Future Vision

The future vision for the Rogue River SRP, is to assess how the program may benefit ecological conditions in the basin and whether conducting e-flow workshops would help better stakeholder better manage operations at the USACE Rogue River basin projects.

### Sugar Creek (Beach City Reservoir), OH – LRH (DD)

Beach City Dam is located on Sugar Creek, a tributary of the Tuscarawas River, about nine miles above New Philadelphia, Ohio. The dam was completed in 1936 for flood control and water conservation in the Muskingum Watershed. A weir just above the intake structure maintains the reservoir level. The weir structure has stoplogs that may be currently inoperable. Outlet gates are in the intake structure.

Sugar Creek was added as an SRP project site 2021. This SRP project is managed within SRP's dry dams initiative. While not technically a dry dam, Beach City Dam shares some similarities with dry dams; it has a small recreation/conservation storage pool that has significantly sedimented in. It was identified for study as the pool that has existing ecological habitat that may be enhanced by alteration of the dam operation as compared to other dry dams within LRH. A small recreation pool exists above Beach City Dam, but it has been greatly impacted by sedimentation. This shallow pool is surrounded by existing, high quality wetlands that developed within the flowage easement of the reservoir. cursory evaluation has shown that additional, high quality wetlands could be created within the shallow reservoir area. These conditions may allow a prompt ecological response to any pool alterations or changes to our operations. The District has assembled an inter-disciplinary team that is ready to carry out the study promptly, which include members from Planning, Operations, and Water Quality/Management.

#### Status of 2021 work

Proposed tasks for FY 21 included:

- a) Gather baseline information to identify existing ecological conditions and any adverse effects altered operations may have on the pool such as recreation, existing wetlands, and infrastructure.
- b) Using the current Operations Plan for Beach City Dam, determine the operational flexibility that may allow for seasonal pool drawdowns. Develop a strategy to modify the Operations Plan, if viable.
- c) Coordination with Federal, state, and local agencies on potential pool operation changes/alternatives.
- d) If deemed viable, develop test strategies to provide potential impacts/benefits from permanent operational changes.

Initiation of work on the project in FY 2021 was delayed. Initial site visit and survey data collection was conducted in November 2021. Initial site inspection confirmed that there is extensive high quality, forested wetlands above the dam and some located below the dam.

#### Anticipated 2022 work

The survey data collected in 2021 will be used to model the water in the basin and help shape how water release from Beach City Dam might be altered. Further stakeholder outreach is planned for late 2021 to through March 2022 identify and evaluate alternatives at the dam as most of the land upstream is owned by the Muskingum Watershed Conservancy District (MWCD) and natural areas managed by the Ohio Department of Natural Resources. The revised schedule includes completion of an implementation plan by end of April 2022. At the present time, due to uncertainty regarding the outcome of the implementation planning process, the District is not planning to submit a proposal for FY 2022 funding. Their plan is to wait until FY 2023 to provide time to adequately scope the implementation phase.

#### Future Vision

Beach City Dam is a small project that is characterized by extensive existing high-quality wetlands above and below the dam. The vision of the project team is to extend the area of wetland habitat complex in

the reservoir area by operational alternatives that may include drawing down the reservoir pool. Measures under consideration include modifying the weir structure to enable maintaining a lower pool. There is good potential that lessons learned at this project site can be shared at other similar projects around the country.

### Willamette River, OR – NWP (Gen)

The mainstem Willamette flows 187 miles north from the confluence of the Middle and Coast Fork Willamette Rivers, to its confluence with the Columbia River. Between the Cascade Mountain and Coast Ranges, the Willamette Basin is the largest watershed entirely contained within the state, draining about 12% of Oregon or 11,487 square miles. This river is easily accessible to 70% of Oregon's population.

The Corps Portland District (NWP) operates 13 dams in the Willamette Basin that provide a range of human benefits, including flood risk management, hydropower, irrigation, and recreation. However, operation of these dams has changed the volume and timing of water flow in the river, resulting in reduced peak flows, lower spring flows, increased summer low flows, and infrequent bankfull events. Through SRP, the Corps and TNC have worked together to determine e-flow requirements downstream of the dams and identified opportunities to restore key aspects of the flow regime. The work began in 2006 and reached a pivotal milestone in 2015 when a Memorandum for the Record was signed and recognized the implementation of e-flows in the Willamette Valley. Willamette continues to be an SRP location-based river as well as an SRP-Science river as described in the previous section. This section is focused on solely the location-based work.

#### Status of 2021 work

In general, the FY 2021 was continuation of post-implementation work for the Willamette River. This constitutes staff support for SRP-Science through implementation of monitoring and adaptive management plan. FY 2021 milestones include 1) support and providing technical input for tracking of e-flow implementation and 2) completing brief report summarizing contributions to that effort, with report anticipated in winter or spring FY 2022.

#### Anticipated 2022 work

The SRP team plans to build-upon and expand on-going work and may utilize location-based funding as funding allows.

#### Future Vision

It's likely that adapting flow prescriptions based on monitoring data or changing environmental needs will continue beyond FY 2022 to ensure project success over the long-term. The location-based efforts may include continued staff support of the science project, support for a stakeholder workshop to review and adapt flow prescriptions and report preparation through this adaptive management phase.

### Yakima River Delta (McNary Dam & Lake Wallula), WA – NWW (LD)

The Yakima River delta is located at the confluence of the Yakima and Columbia Rivers near the town of Richland, Washington, and in Lake Wallula, the reservoir pool created by McNary Dam (MCN). Completed in 1953, MCN is a Corps run-of-river project where total inflows and outflows are approximately equal within a daily interval. Hydrology in the Yakima delta is influenced by a combination of upstream flows from the Columbia and Yakima Rivers, lateral flows from the Snake

River, and the Lake Wallula stage controlled by MCN downstream. The Lake Wallula backwater can extend as much as ~2 miles up the Yakima River channel which influences the energy regime, fine sediment deposition, and flow mixing with the Columbia River. MCN pool operations are relatively dynamic with a normal operating range of 5 feet, and as a run-of-river project must account for large volume inflows, hydropower load following, and seasonal BiOp constraints at the daily to sub-daily scale.

The Yakima River and delta has historically been plagued by high temperatures and degraded water quality. The Columbia River and the backwater on the western side of Bateman Island are listed by the Washington State Department of Ecology as “impaired” on the State’s 303(d) list for temperature, dissolved gas, and pH and categorized as polluted. Summer in-stream temperatures make the lower Yakima River inhospitable to salmonid species and low dissolved oxygen levels threaten all aquatic life in the river. Aquatic invasive vegetation (AIV) found within the delta includes flowering rush (*Butomus umbellatus*), European milfoil (*Miriophyllum spicatum*) and water stargrass (*Heterantera dubia*) which dramatically impact dissolved oxygen and pH. The warmest waters in the lower Yakima River are found within the delta, specifically within the stagnant pools located west of Bateman Island. Limited sampling in the summer of 2008 identified Yakima flows entering the delta area at average temperatures of 80°F, rapidly warming to as much as 90°F in the delta area. Flow from the Columbia river is somewhat cooler with average summer temperatures of 67°F but can exceed 70°F at times. These extreme temperatures are a migration barrier to late-migrating salmon, including sockeye, summer Chinook, and fall Chinook. Temperature and water quality data for the Yakima delta is limited spatially and temporally and is a significant data gap in characterization of baseline conditions and simulation of mitigation alternatives.

FY 2021 is the first year SRP is supporting work in the Yakima River delta.

#### Status of 2021 work

NWW collected and analyzed baseline temperature data over the range of tributary inflows and MCN pool operations to evaluate the potential for beneficial departure in temperature and water quality characteristics. The team monitoring temperatures in the Yakima delta area using fixed location sensors and conducting eight synoptic surveys of temperature and water quality over a six-month period between May and September 2021. Some redeployment of sensors was necessary due to theft and vandalism. Additionally, a remote sensing reconnaissance survey was completed using instrumented UAV equipment to map the spatial distribution of water surface temperature in the study area. Data collected from the effort will be summarized in a data documentation memo and used to evaluate potential ecosystem benefits relative to MCN pool operations as well as establish baseline conditions and support future studies. Data analysis and reporting is in-progress and planned for completion prior to the end of the calendar year.

#### Anticipated 2022 work

The NWW team will be completing the data analysis and reporting in early FY 2022. No proposals were made for SRP support in FY 2022.

#### Future Vision

Anticipated future work includes hydrodynamic assessment of flow mixing, thermal stratification, and water quality of the delta to develop viable alternatives of operational and structural measures for improving ecosystem quality in the Yakima delta.

### TNTCX – Rivercane Range, multiple states – SWD, MVD, LRD, SAD (Gen)

Rivercane (*Arundinaria gigantea*) is a cultural keystone species critical to all aspects of life for many Native American communities whose ancestral homelands occurred within the rivercane range (Florida to eastern Texas in the south, parts of the Midwest, and north to New York). Dense stands of cane, known as canebrakes, were once abundant in the southeastern United States. Now canebrakes are a critically endangered ecosystem due to agriculture, grazing, fire suppression, and urbanization throughout their range. This effort investigates cultural and ecological opportunities related to rivercane restoration.

#### Status of 2021 work

In 2021, the TNTCX formed Rivercane Restoration Alliance to facilitate collaboration between the SRP team, interagency partners, and Tribal partners to integrate Traditional Ecological Knowledge (TEK) and scientific ecological knowledge to recommend approaches to rivercane recovery. The Indigenous Approaches to Rivercane Restoration Workshop executed in October 2021 had 187 participants over the course of the 3 days. Federal agency representatives (n=80) and Tribal Nation representatives (n=50) made up many of the participants. The remaining participants included a mix of State agency, private sector, non-profit, and academia (students and professors). Federal agencies participating in the workshop included USACE, USFWS, USFS, NRCS, Army, USGS, NPS, and BLM. Tribal Nations participating in the workshop included Bayou Lacombe Band of Choctaw Indians, Catawba Indian Nation, Cherokee Nation, Chickahominy Indian Tribe- Eastern Division, Chickasaw Nation, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Eastern Band of Cherokee Indians, Jena Band of Choctaw Indians, Kiowa Tribe, Miami Tribe of Oklahoma, Mississippi Band of Choctaw Indians, MOWA Band of Choctaw Indians, Poarch Band of Creek Indians, Tunica-Biloxi Tribe of Louisiana, United Keetoowah Band, and the United South and Eastern Tribes / Oneida Nation.

Through the TNTCX social media platforms, webpage, and partner network the Rivercane Restoration Alliance (RRA) was formed and now includes nearly 200 members. As a first step of engagement, a three-day virtual workshop was planned in close collaboration with interagency and Tribal partners. The purpose of the workshop was to provide a forum for the RRA partners to share stories, build relationships, develop conceptual ecological models (CEM), identify existing data and knowledge gaps, and inform recommendations for (Corps) rivercane restoration studies and projects. The virtual workshop was a huge success and identified three primary areas for continued engagement and development: 1) education about rivercane as a cultural keystone species, the ecological benefits it provides, and management approaches; 2) field studies of rivercane restoration at multiple locations across the range; and 3) access to rivercane stands for Tribal communities. Initial efforts to address these with remaining FY21 SRP funds include designing an online repository for the RRA to promote rivercane science and TEK and completing the rivercane restoration research report outlined in the FY21 Rivercane Restoration Project Scope Statement. The rivercane restoration research report will serve as a catalyst for future SRP outreach, science, and implementation projects focused on model development/refinement, monitoring plan development, and rivercane recovery. Other beneficial outcomes include utilizing this approach to further develop sustainable Federal/Tribal partnerships which promote innovative approaches to watershed management and environmental stewardship on USACE projects.

Anticipated 2022 work

The TNTCX team submitted a FY 2022 rivercane restoration SRP proposal that continues the RRA and the collaboration with our interagency and Tribal partners to complete/maintain the website, develop education materials for USACE and other land managers, design and implement rivercane restoration projects at USACE project(s), and continue education/outreach by participating in other rivercane or ecosystem restoration events.

Future Vision

The TNTCX SRP team would like to continue strategically building a coalition of scientists, Tribal communities, artists, Federal and State agencies, museums, and rivercane enthusiasts in the RRA and use that forum to support rivercane restoration activities throughout its range.

## APPENDIX A: Deliverables and Milestones - Status and Schedule - 2021

**Project: Sustainable Rivers Program (2021)**

**Baselining Date:** 04/01/2021

*Note\* Numbering below refers to SRP tasks and 1-6 are program- level tasks including preparation of RFPs, website development, assistance to location-based efforts, leading SRP meetings, etc. and are not included in this table. Location-based efforts begin at task no. 7 with SWL - Cossatot River and continue through no. 39. SWF - Big Cypress Bayou (Caddo Lake) and are provided here along with initial work of adding new infrastructure types - dry dams and locks and dams, training support, and executing regional meetings. "Team" dates reflect schedule at time of the FY 2021 IPR.*

**Effort Started:** 10/01/2020 (actual)  
**Effort Finished:** 07/31/2025 (planned)

### 7. SWL - Cossatot River

1.5 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	12/3/2020	3/4/2021	PWS advanced for review 12/3. Funds provided 3/4 (91 days).
<b>Milestone 2:</b>	Research report with water temp	1/15/2021		Completed except for water temp.
<b>Milestone 3:</b>	Environmental flows workshop	7/31/2021	4/1/2022	Been waiting on report review to hand to stakeholders and COVID.
<b>Milestone 4:</b>	Workshop summary report	9/30/2021	6/1/2022	Workshop delayed because of COVID and report not being reviewed.
<b>Milestone 5:</b>	Effort Finished	9/30/2021	9/30/2022	Workshop delayed because of COVID and report not being reviewed.

### 8. MVR - Des Moines River

4.1 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	12/8/2020	3/4/2021	PWS advanced for review 12/8. Funds provided 3/4 (86 days).
<b>Milestone 2:</b>	Coordinate science activities with USGS and CESU	3/31/2021	3/31/2021	
<b>Milestone 3:</b>	Nutrient workshop - Identify attendees	4/30/2021	4/30/2021	Delayed due to COVID
<b>Milestone 4:</b>	Nutrient workshop - Outreach meeting	6/30/2021	12/31/2021	Coordinate ahead of new workshop date
<b>Milestone 5:</b>	Nutrient workshop - Workshop prep	8/31/2021	2/28/2022	Coordinate ahead of new workshop date
<b>Milestone 6:</b>	Coordinate e-flows and EWLM and review deliverables	9/30/2021	9/30/2021	
<b>Milestone 7:</b>	Nutrient workshop - Host event	10/31/2021	3/31/2022	Due to agency COVID restrictions, workshop tentatively postponed until March.



<b>Milestone 8:</b>	Videography and summary doc	12/31/2021	12/31/2021	
<b>Milestone 9:</b>	Science activities report	12/31/2021	12/31/2021	
<b>Milestone 10:</b>	Nutrient workshop - Complete summary report	12/31/2021	5/31/2022	Pushed date to accommodate new workshop date
<b>Milestone 11:</b>	CESU - Waterbirds phases 2 and 3, 2021-2023	4/30/2023	4/30/2023	
<b>Milestone 12:</b>	Effort Finished	4/30/2023	4/30/2023	

**9. MVR - Iowa River**

1.4 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	12/8/2020	3/4/2021	PWS advanced for review 12/8. Funds provided 3/4 (86 days).
<b>Milestone 2:</b>	E-flows workshop	7/31/2021	7/31/2021	Due to agency COVID restrictions, workshop is cancelled. Utilizing information gathered from stakeholders and De Moines River to Implement and Incorporate with updated Regulation Manual.
<b>Milestone 3:</b>	E-flows workshop report	9/30/2021	12/15/2021	draft report - will use carry-in funding to complete this task
<b>Milestone 4:</b>	Effort Finished	9/30/2021	12/31/2021	

**10. MVR - Farm Creek/Farmdale**

0.8 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	1/11/2021	3/24/2021	PWS advanced for review 1/11. Funds provided 3/24 (72 days).
<b>Milestone 2:</b>	Implement restoration actions	5/31/2021	7/1/2022	Ability to implement affected by high water and need for environmental compliance review. On hold, waiting for environmental review by District Office.
<b>Milestone 3:</b>	Monitor completed projects	9/30/2021	7/1/2022	Traction with Citizen groups for science support didn't materialize as expected/ Will circle back with schools to explore opportunities for future support.
<b>Milestone 4:</b>	Report activities and results	12/31/2021	9/30/2022	
<b>Milestone 5:</b>	Effort Finished	12/31/2021	9/30/2022	

**11. TNTCXP - Rivercane Restoration**

1.5 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
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<b>Milestone 1:</b>	Effort Started	2/12/2021	3/24/2021	PWS advanced for review 2/12. Funds provided 3/24 (40 days).
<b>Milestone 2:</b>	Identify partners and literature review	6/15/2021	6/15/2021	Updated dates to reflect actuals and new projections
<b>Milestone 3:</b>	Hold workshop(s)	8/15/2021	10/15/2021	
<b>Milestone 4:</b>	Prepare workshop reports	10/15/2021	12/31/2021	
<b>Milestone 5:</b>	Prepare research report	2/15/2022	3/15/2022	
<b>Milestone 6:</b>	Submit final deliverables	3/31/2022	4/31/2022	
<b>Milestone 7:</b>	Effort Finished	3/31/2022	4/31/2022	

**12. SPA - Pecos River**

3.2 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	2/17/2021	4/1/2021	PWS advanced for review 2/17. Funds provided 4/1 (43 days).
<b>Milestone 2:</b>	PDT review of science report	5/31/2021	3/31/2022	Getting IPA in place to do initial refinement of document before PDT review. Send draft in Jan/Feb for internal review/comments and editing.
<b>Milestone 3:</b>	E-flows workshop coordination	6/30/2021	4/30/2022	Delayed accommodating completion of draft literature review/state-of-the-science report. Send draft final report for PDT and stakeholder review prior to workshop in June.
<b>Milestone 4:</b>	E-flows workshop and summary report	10/31/2021	6/30/2022	Delayed accommodating completion of the draft literature review/state-of-the-science report. Workshop in early June, summary report and final state of the science by end of June.
<b>Milestone 5:</b>	Effort Finished	10/31/2021	9/30/2022	Delayed accommodating completion of the draft literature review/state-of-the-science report.

**13. NWP - Rogue River**

0.8 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	2/17/2021	4/1/2021	PWS advanced for review 2/17. Funds provided 4/1 (43 days).
<b>Milestone 2:</b>	Identify partners / kickoff meeting	6/4/2021	8/1/2021	Kickoff delayed due to schedules and funding setup - Aug kickoff

<b>Milestone 3:</b>	Lit review and expert meetings	9/30/2021	12/15/2021	Proceeding currently. Received available lit docs 8-17-21. Pushed schedule a couple of months.
<b>Milestone 4:</b>	Draft technical memorandum	11/30/2021	1/31/2022	May be delayed a couple of months.
<b>Milestone 5:</b>	Final technical memorandum	1/15/2022	3/15/2022	May be delayed a couple of months.
<b>Milestone 6:</b>	Effort Finished	1/15/2022	3/15/2022	May be delayed a couple of months.

**14. MVS - Kaskaskia River**

0.8 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	2/17/2021	4/6/2021	PWS advanced for review 2/17. Funds provided 4/6 (48 days).
<b>Milestone 2:</b>	Public outreach meetings	8/30/2021	11/9/2021	5/27 Kaskaskia River meeting; 11/9 for Carlyle meeting
<b>Milestone 3:</b>	Public meetings summary report	9/15/2021	12/15/2021	
<b>Milestone 4:</b>	Veg survey and summary report	9/15/2021	12/15/2021	
<b>Milestone 5:</b>	Veg acres exposed and briefing materials	9/15/2021	9/30/2021	Data collected for the drawdown condition. Also need aerial and data for normal pool. Delineation to obtained vegetation acres deferred to 2022.
<b>Milestone 6:</b>	Effort Finished	9/15/2021	12/15/2021	

**15. NWW - Mill Creek**

1.5 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	2/22/2021	4/6/2021	PWS advanced for review 2/22. Funds provided 4/6 (43 days).
<b>Milestone 2:</b>	Stakeholder's workshop	4/30/2021	4/1/2021	
<b>Milestone 3:</b>	Gather data and develop alternatives	8/31/2021	8/31/2021	
<b>Milestone 4:</b>	Summary report and share with working group	9/30/2021	10/12/2021	Updated from 9/30/2021 due to working group not meeting in 2021. The new date is the actual date the status was briefed to the working group.
<b>Milestone 5:</b>	Effort Finished	9/30/2021	12/6/2021	As of 10/29/2021, the draft final summary report is out for PDT review. The final report will be delivered to SRP no later than 12/06/21.

**16. NWK - Kansas River**

1.7 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
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<b>Milestone 1:</b>	Effort Started	3/1/2021	4/23/2021	PWS advanced for review 3/1. Funds provided 4/23 (53 days).
<b>Milestone 2:</b>	E-flows workshop	8/31/2021	11/19/2021	Draft workshop summary report is out for PDT review. The final report will be delivered to SRP no later than 12/30/21
<b>Milestone 3:</b>	Implementation planning and coordination	9/30/2021	6/30/2022	Starting November 2021 and will complete coordination following 2nd e-flows workshop and prepare draft implementation and monitoring plan then.
<b>Milestone 4:</b>	2nd E-flows workshop and report	9/30/2021	2/27/2022	2nd e-flows workshop postponed until early 2022 to allow completion of 1st e-flows workshop summary report and revised ecological report to add geographic extension information.
<b>Milestone 5:</b>	Effort Finished	9/30/2021	6/30/2022	2nd e-flows workshop summary report

**17. NWK - Osage River**

0.9 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/1/2021	4/8/2021	PWS advanced for review 3/1. Funds provided 4/8 (38 days).
<b>Milestone 2:</b>	E-flows workshop and report	9/30/2021	8/30/2022	State of science report and e-flow workshop - mid to late June 2022 (science meetings starting Dec 2021 monthly)
<b>Milestone 3:</b>	fourth milestone for EMT	9/30/2021	9/30/2022	Need additional time for science team meeting and preparation of ecological report prior to workshop.
<b>Milestone 4:</b>	Effort Finished	9/30/2021	9/30/2022	

**18. MVS - Mississippi River - Mel Price L&D**

1.5 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/3/2021	4/12/2021	PWS advanced for review 3/3. Funds provided 4/12 (40 days).
<b>Milestone 2:</b>	Complete sturgeon tagging efforts	4/23/2021	4/1/2022	Tags acquired, sampling completed, no lake sturgeon captured
<b>Milestone 3:</b>	Complete sturgeon tracking and spawn monitoring	5/28/2021	5/28/2021	Tracking completed on existing tagged fish; shoreline monitoring completed in May 2021

<b>Milestone 4:</b>	Complete model development and alternatives analysis	8/31/2021	8/31/2021	Model development and alternatives analysis completed 9/2021
<b>Milestone 5:</b>	Complete season findings and outreach report	11/30/2021	11/30/2021	Season ending summary nearly complete, anticipate meeting 11/30 deadline
<b>Milestone 6:</b>	Effort Finished	11/30/2021	11/30/2021	Team procured tag hardware but didn't receive in time to deploy. Will deploy in FY22 if able.

**19. SAW - Cape Fear River**

2.8 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/9/2021	4/23/2021	PWS advanced for review 3/9. Funds provided 4/23 (45 days).
<b>Milestone 2:</b>	WQ contracts and fisheries partners in place	3/31/2021	3/1/2021	Fisheries people began monitoring in good faith before funds were in hand. Same with water quality researchers.
<b>Milestone 3:</b>	Fisheries groups refine sampling plan	3/31/2021	3/1/2021	Organized researchers and created a monitoring plan that included eDNA sampling, electrofishing, and telemetry tagging and sampling.
<b>Milestone 4:</b>	Monitoring diadromous fish over locks and dams	5/31/2021	6/1/2021	We sampled for fish from March until June. We accomplished one pulse in the basin before it went dry. All equipment was in place during the pulse.
<b>Milestone 5:</b>	WQ team refines second location for monitoring	5/31/2021	6/1/2021	Contracts were not in place to water quality researchers until Sept 2021. Because of this, researchers were willing to study lock and dam 1 ahead of receiving funds but did not want to do a second location without assurances they would receive the funds. Instead, efforts re-organized to be higher up in the basin.
<b>Milestone 6:</b>	Monitoring of e-flow pulse effects on WQ	10/31/2021	10/31/2021	Water quality researchers had equipment and sampling from June to early November, despite funding delays.
<b>Milestone 7:</b>	Fisheries team refines sturgeon marker with Fall spawn	10/31/2021	12/31/2021	eDNA researchers took samples and froze them. Contracts were delayed. Researchers plan to analyze the lab samples in December,

at which time we will get more information about the sturgeon marker and its accuracy.

<b>Milestone 8:</b>	Effort Finished	12/31/2021	8/15/2022	Researchers' contracts set for a year. Since contracts went into place in August and Sept 2021, end dates are Aug and Sept 2022.
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#### 20. SAW - Roanoke River

4.5 % of budget		Planned	Team	Comments
<b>Milestone 1:</b>	Effort Started	3/9/2021	4/23/2021	PWS advanced for review 3/9. Funds provided 4/23 (45 days).
<b>Milestone 2:</b>	Veg - Establish contracts and data share	5/31/2021	9/20/2021	We had to go through a new CESU. Duke University was contracted. Contracts went into place in September, and we started planning for the effort.
<b>Milestone 3:</b>	eDNA - Run blanks for sampling - 2021	5/31/2021	Feb-21	We ran several blanks in Feb 2021
<b>Milestone 4:</b>	eDNA - Sampling of adult diadromous fish	5/31/2021	1-Mar	We started weekly sampling of eDNA for adults
<b>Milestone 5:</b>	Veg - Radar maps and tree corings	8/31/2021	1/1/2022	Radar analysis is under way as of oct 2021. We are waiting for the dormant season to grab tree cores, so likely Jan or Feb 2022.
<b>Milestone 6:</b>	eDNA - Sampling of juvenile alosines	8/31/2021	1-May	We did weekly sampling throughout the entire growing season from March through November.
<b>Milestone 7:</b>	Veg - EFM base modeling	8/31/2021	1/1/2022	This has moved to be part of early 2022. Duke University contracts are now in place in researchers are learning the EFM model.
<b>Milestone 8:</b>	Veg - Radar maps, vegetation relationships updated, veg modeling	10/30/2021	4/1/2022	This step occurs after EFM modeling, thus is put in spring 2022.
<b>Milestone 9:</b>	eDNA - Researchers convene to review 2021 sampling year	12/31/2021	12/31/2021	This is likely to occur in Dec 2021 or Jan 2022. SRP connects with researchers regularly.
<b>Milestone 10:</b>	Veg - EFM modeling and write-up complete	12/31/2021	9/1/2022	This step occurs after the other and is delayed accordingly because of initial contract delays.

<b>Milestone 11:</b>	e-DNA - Run blanks for sampling - 2022	1/31/2022	1/31/2022
<b>Milestone 12:</b>	eDNA - Traditional and eDNA sampling of adult diadromous fish	5/31/2022	5/31/2022
<b>Milestone 13:</b>	eDNA - Traditional and eDNA sampling of adult juvenile alosines	8/31/2022	8/31/2022
<b>Milestone 14:</b>	eDNA - Analysis and summary of work	9/30/2022	9/30/2022
<b>Milestone 15:</b>	Effort Finished	9/30/2022	9/30/2022

**21. MVP - Bois de Sioux River (Mud Lake)**

1.8 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/15/2021	4/23/2021	PWS advanced for review 3/15. Funds provided 4/23 (39 days).
<b>Milestone 2:</b>	Prepare for public meetings	4/30/2021	7/14/2021	Funding delays.
<b>Milestone 3:</b>	Virtual outreach meetings conducted	6/30/2021	7/15/2021	Funding delays.
<b>Milestone 4:</b>	Final drawdown scoping document completed	9/30/2021	9/30/2021	
<b>Milestone 5:</b>	Effort Finished	9/30/2021	10/1/2021	

**22. SWF - Brazos and Neches Rivers**

2.0 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/17/2021	4/23/2021	PWS advanced for review 3/17. Funds provided 4/23 (37 days).
<b>Milestone 2:</b>	Complete Brazos workshop	8/15/2021	9/8/2021	
<b>Milestone 3:</b>	Complete Neches workshop	9/15/2021	9/1/2021	
<b>Milestone 4:</b>	Complete workshop summary report	10/31/2021	12/31/2021	Brazos report complete, Lower Neches in draft
<b>Milestone 5:</b>	Effort Finished	10/31/2021		

**23. NWW - Yakima River Delta (Lake Wallula) - LD**

1.6 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/25/2021	5/3/2021	PWS advanced for review 3/25. Funds provided 5/3 (39 days).
<b>Milestone 2:</b>	Deploy temperature sensors	4/30/2021	5/10/2021	Sensors Deployed Week of 5/10 with intermittent redeployment throughout the project due to theft & vandalism
<b>Milestone 3:</b>	Coordinate with WMO and RCC for pool changes	5/31/2021	6/30/2021	WMO & RCC preliminary coordination in May & June

<b>Milestone 4:</b>	Implement pool changes, if possible	7/31/2021	8/31/2021	Pool changes >24hrs not possible due to regional constraints & Mid C load following. July/Aug field schedule adapted to coincide with highs/lows of existing ops.
<b>Milestone 5:</b>	Thermal mapping events	8/31/2021	8/10/2021	UAV Thermal mapping completed 8/10/21
<b>Milestone 6:</b>	Retrieve sensors, process data, report	9/30/2021	9/30/2021	Sensors retrieved & data downloaded 9/23 to 9/30.
<b>Milestone 7:</b>	Effort Finished	9/30/2021	11/30/2021	Data analysis & reporting still in-progress & wrapping up mid-November

**24. SWT - Kiamichi River**

2.4 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	3/29/2021	4/28/2021	PWS advanced for review 3/29. Funds provided 4/28 (30 days).
<b>Milestone 2:</b>	Execute IPA	4/30/2021	11/9/2021	IPA executed in October 2020 for with Dr. Caryn Vaughn, University of Oklahoma to support H&H. IPA expires in June 2022.
<b>Milestone 3:</b>	Preliminary subject matter expert meeting	5/31/2021	3/28/2022	Delayed due to staffing changes
<b>Milestone 4:</b>	E-flows workshop dry-run	7/31/2021	5/25/2022	Delayed due to staffing changes
<b>Milestone 5:</b>	E-flows workshop and report	8/31/2021	6/30/2022	Planned schedule for the week of June 20th.
<b>Milestone 6:</b>	Finalize RiverWare parameterization	9/30/2021	9/30/2022	Delayed by one FY, but the H&H team members have been working with the Oklahoma Water Resources Board to obtain water rights and diversion point data to include in the SWT RiverWare model.
<b>Milestone 7:</b>	Effort Finished	9/30/2021	9/30/2022	Delayed by one FY due to staffing changes

**25. LRH - Kanawha River - LD**

1.2 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	4/5/2021	4/26/2021	PWS advanced for review 4/5. Funds provided 4/26 (21 days).
<b>Milestone 2:</b>	Initiate assessment of environmental opportunities	5/1/2021	7/13/2021	Slip due to competing projects and priorities.



<b>Milestone 3:</b>	Complete data compilation and initial agency coordination	10/1/2021	1/21/2022	Data collection still in progress as a smaller boat and survey method were deemed to be needed due to terrain.
<b>Milestone 4:</b>	Formulate final alternatives and continue coordination	11/1/2021	3/1/2022	
<b>Milestone 5:</b>	Complete implementation proposal	12/31/2021	4/29/2022	
<b>Milestone 6:</b>	Effort Finished	12/31/2021	4/29/2022	Requesting extended finished date due to competing priorities within the District for the study start.

**26. LRH - Sugar Creek (Beach City Dam) - DD**

1.2 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	4/19/2021	4/26/2021	PWS advanced for review 4/19. Funds provided 4/26 (7 days).
<b>Milestone 2:</b>	Complete baseline data collection, compilation, and initial resource agency coordination	10/1/2021	1/31/2022	Slip due to competing projects and priorities.
<b>Milestone 3:</b>	Formulate alternatives	11/1/2021	3/18/2022	Continued coordination with stakeholders (MWCD)
<b>Milestone 4:</b>	Complete implementation plan	12/31/2021	4/29/2022	
<b>Milestone 5:</b>	Effort Finished	12/31/2021	4/29/2022	Requesting extended finished date due to competing priorities within the district for the study start.

**27. LRL/LRP/LRH - Ohio River - LD**

4.0 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	4/20/2021	4/26/2021	PWS advanced for review 4/20. Funds provided 4/26 (6 days).
<b>Milestone 2:</b>	Inventory and baseline current conditions	8/1/2021	9/30/2021	Study process refined to allow for comprehensive documentation of environmental opportunities in Ohio River
<b>Milestone 3:</b>	Characterize hydrology and identify modeling needs	10/1/2021	9/30/2021	Modeling underway for 3 pools, 1 per district
<b>Milestone 4:</b>	Identify potential opportunities to maximize ecological sustainability	12/1/2021	2/1/2022	Ongoing - initial list of opportunities developed, technical analyses underway
<b>Milestone 5:</b>	Engage regional stakeholders	3/1/2022	3/31/2022	

<b>Milestone 6:</b>	Completion of final report and transfer of deliverables	3/31/2022	3/31/2022
<b>Milestone 7:</b>	Effort Finished	3/31/2022	3/31/2022

**28. LRP - French Creek (Union City Dam) - DD**

1.4 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	4/23/2021	4/28/2021	PWS advanced for review 4/23. Funds provided 4/28 (5 days).
<b>Milestone 2:</b>	Completion of site design	5/31/2021	1/15/2022	Field meeting to discuss preliminary site design (with NRCS) on 11/17/2021.
<b>Milestone 3:</b>	Delineation of work sites. Execution of appropriate permitting process.	8/15/2021	4/1/2022	
<b>Milestone 4:</b>	Compilation of excavation contracting package built and submitted to District contracting branch.	8/31/2021	4/15/2022	Contracting package submitted for review.
<b>Milestone 5:</b>	Request for bids and award of construction contract	9/30/2021	5/30/2022	
<b>Milestone 6:</b>	Creation of surface water retention structures	2/28/2022	10/1/2022	Best guess on when construction can occur based on contracting constraints.
<b>Milestone 7:</b>	Evaluation/maintenance of established impoundments	4/30/2022	1/15/2023	
<b>Milestone 8:</b>	Effort Finished	4/30/2022	1/15/2023	

**29. MVP - Mississippi River**

1.0 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	4/29/2021	5/4/2021	PWS advanced for review 4/29. Funds provided 5/4 (5 days).
<b>Milestone 2:</b>	Initiate SDM workshop coordination	4/30/2021	4/29/2021	
<b>Milestone 3:</b>	Hold SDM workshops	6/30/2021	7/13/2021	Six workshops held 5/11, 5/13, 5/18, 6/29, 7/12, and 7/13.
<b>Milestone 4:</b>	Complete workshop summary	8/31/2021	11/30/2021	Complete draft report and share with participants.
<b>Milestone 5:</b>	Effort Finished	8/31/2021	12/31/2021	Complete final review by outside agencies - USGS and facilitator (under contract to UMRBA) and deliver report.

**30. NAB - Potomac River/Jennings Randolph Lake**

0.8 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
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<b>Milestone 1:</b>	Effort Started	4/30/2021	5/5/2021	PWS advanced for review 4/30. Funds provided 5/5 (5 days).
<b>Milestone 2:</b>	Internal meetings to identify interests/needs/opportunities/stakeholders	5/15/2021	7/7/2021	Coordination meetings began in June; first official team meeting held July 7th and then again in August and October
<b>Milestone 3:</b>	Stakeholders and technical expert outreach	8/1/2021	10/19/2021	re-worked to be internal education and coordination however external stakeholders were identified for future efforts; SRP effort was discussed with ICPRB; ICPRB and MD DNR were contacted for FY22 proposal. External stakeholder meetings will occur in FY22 if SRP proposal is approved.
<b>Milestone 4:</b>	FY22 scope for full AVF study and RRM update	8/30/2021	10/12/2021	Re-worked to E-flow evaluation, identify environmental opportunities, with AVF considerations and RRM update.
<b>Milestone 5:</b>	FY21 summary report	9/30/2021	1/31/2022	Delayed - anticipate mid-January 2022
<b>Milestone 6:</b>	Effort Finished	9/30/2021	1/30/2022	

**31. SWT - Great Salt Fork of the Arkansas River**

1.1 % of budget				
<b>Milestone 1:</b>	Effort Started	<b>Planned</b> 5/7/2021	<b>Team</b> 6/3/2021	<b>Comments</b> PWS advanced for review 5/27. Funds provided 6/3 (7 days).
<b>Milestone 2:</b>	Initiate outreach, coordination, and literature review	5/31/2021	11/30/2021	Limited start due to staffing limitations, soon to be resolved.
<b>Milestone 3:</b>	Complete literature review	8/31/2021	1/31/2022	
<b>Milestone 4:</b>	White paper detailing opportunities	9/30/2021	4/15/2022	
<b>Milestone 5:</b>	Develop year 2 proposal and scope	11/30/2021	5/15/2022	
<b>Milestone 6:</b>	Effort Finished	11/30/2021	5/31/2022	Ready to submit for consideration for FY23 SRP funding if there's stakeholder interest and Dist. and resource agency support.

**32. NWS - Lake Washington Ship Canal**

1.2 % of budget				
<b>Milestone 1:</b>	Effort Started	<b>Planned</b> 5/12/2021	<b>Team</b> 5/20/2021	<b>Comments</b> PWS advanced for review 5/11. Funds provided 5/20 (9 days).

<b>Milestone 2:</b>	Meet with contractor and NWS team	7/1/2021	10/7/2021	Kick-off meeting was held on 7 Oct
<b>Milestone 3:</b>	Input data files delivered to contractor	7/15/2021	11/5/2021	
<b>Milestone 4:</b>	Updated, calibrated, and verified model is delivered to NWS team	10/15/2021	1/25/2022	
<b>Milestone 5:</b>	Model runs completed by NWS	12/1/2021	3/6/2022	
<b>Milestone 6:</b>	Complete report detailing water quality impacts of operational changes	2/15/2022	4/25/2022	
<b>Milestone 7:</b>	Effort Finished	2/15/2022	6/14/2022	Pushed out to accommodate contracting delays and scheduling conflicts.

**33. SWL - Fourche LaFave River**

1.3 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	5/12/2021	5/20/2021	PWS advanced for review 5/11. Funds provided 5/20 (9 days).
<b>Milestone 2:</b>	Complete state of science report	9/30/2021	6/1/2022	Late funding pushed this effort back.
<b>Milestone 3:</b>	Finish identification of partners, stakeholders, and issues report	11/30/2021	12/31/2021	Same as above, late funding pushed this effort back.
<b>Milestone 4:</b>	Environmental flows workshop	5/31/2022	5/31/2022	
<b>Milestone 5:</b>	Final report detailing e-flow recommendations	9/30/2022	9/30/2022	
<b>Milestone 6:</b>	Potential update to water control manual	9/30/2023	9/30/2023	
<b>Milestone 7:</b>	Effort Finished	9/30/2023	9/30/2023	

**34. MVS - Water Level Management - LD**

1.5 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	5/13/2021	5/20/2021	PWS advanced for review 5/13. Funds provided 5/20 (7 days).
<b>Milestone 2:</b>	Initiate L&D workshop coordination and prep	6/1/2021	6/1/2021	
<b>Milestone 3:</b>	Hold L&D workshop	8/26/2021	2/8/2022	COVID delay.
<b>Milestone 4:</b>	Complete workshop summary	9/15/2021	3/15/2022	COVID delay.
<b>Milestone 5:</b>	Effort Finished	9/15/2021	3/15/2022	COVID delay.

**35. NWP - Willamette River**

0.6 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
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<b>Milestone 1:</b>	Effort Started	5/26/2021	6/3/2021	PWS advanced for review 5/26. Funds provided 6/3 (8 days).
<b>Milestone 2:</b>	Initiate support and provide technical input for stream flow metric development	5/31/2021	5/31/2021	
<b>Milestone 3:</b>	Complete brief report and contributions to USGS work	12/31/2021	12/31/2021	
<b>Milestone 4:</b>	Effort Finished	12/31/2021	12/31/2021	

**36. MVS - Mississippi River**

0.5 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	6/3/2021	6/8/2021	PWS advanced for review 6/3. Funds provided 6/8 (5 days).
<b>Milestone 2:</b>	Complete preparation of ecological information for modeling	7/15/2021	7/28/2021	
<b>Milestone 3:</b>	Complete H&H for without EPM scenario	8/15/2021	10/21/2021	
<b>Milestone 4:</b>	Complete vegetation resilience survey	9/1/2021	11/7/2021	
<b>Milestone 5:</b>	Complete modeling	10/15/2021	10/15/2021	
<b>Milestone 6:</b>	Complete model verification	11/15/2021	11/15/2021	
<b>Milestone 7:</b>	Complete associated report and briefing materials delivered to HEC	12/31/2021	12/31/2021	
<b>Milestone 8:</b>	Effort Finished	12/31/2021	12/31/2021	

**37. SPA - Galisteo Creek - DD**

6.7 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	6/4/2021	7/7/2021	PWS advanced for review 6/3. Funds provided 7/7 (33 days). Accomplished May 20, 2021
<b>Milestone 2:</b>	Identification of stakeholders, formation of PDT	5/15/2021	5/20/2021	
<b>Milestone 3:</b>	Complete habitat plan and initiate implementation	11/30/2021	5/30/2022	In progress, new options being considered
<b>Milestone 4:</b>	Initiate contract award	1/1/2022	7/1/2022	
<b>Milestone 5:</b>	Complete initial phases of habitat plan	3/31/2022	9/31/2022	
<b>Milestone 6:</b>	Effort Finished	3/31/2022	9/31/2022	

**38. SAM – Alabama River**

2.4 % of budget		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
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<b>Milestone 1:</b>	Effort Started	6/15/2021	7/13/2021	PWS advanced for review 6/15. Funds provided 7/13 (23 days)
<b>Milestone 2:</b>	Initiate planning and methodology meetings with USACE and external agencies	1/15/2022	To be determined (TBD)	Funding delays.
<b>Milestone 3:</b>	Initiate historic fisheries assemblage data consolidation with external agencies	2/1/2022	TBD	Funding delays.
<b>Milestone 4:</b>	Initiate fisheries data collection above and below Claiborne and Millers Ferry	3/1/2022	TBD	Funding delays.
<b>Milestone 5:</b>	Complete baseline fisheries assemblage data collection under current conservation locking operations	4/30/2022	TBD	Funding delays.
<b>Milestone 6:</b>	Compile all data and complete implementation proposal for the upcoming year as determined by the PDT through agency coordination	5/31/2022	TBD	Funding delays.
<b>Milestone 7:</b>	Identification of preferred test alternative, if any	1/31/2023	TBD	Funding delays.
<b>Milestone 8:</b>	Complete fisheries assemblage data collection under preferred test alternative conservation locking operations	4/30/2023	TBD	Funding delays.
<b>Milestone 9:</b>	Complete monitoring report	9/30/2023	TBD	Funding delays.
<b>Milestone 10:</b>	Effort Finished	9/30/2023	TBD	Funding delays.

### 39. SWF - Big Cypress Bayou (Caddo Lake)

1.4 % of budget

		<b>Planned</b>	<b>Team</b>	<b>Comments</b>
<b>Milestone 1:</b>	Effort Started	7/1/2021	7/13/2021	PWS advanced for review 7/1. Funds provided 7/13 (12 days).
<b>Milestone 2:</b>	Alternatives - Complete yield analysis	8/31/2021	10/14/2021	RiverWare was completed on 2/14/21
<b>Milestone 3:</b>	Alternatives - Complete alternative strategies	10/31/2021	12/15/2021	Organizing meeting with technical team to occur by

				mid dec. to finalize alternative strategies.
<b>Milestone 4:</b>	Modeling - Complete EFM/RAS simulations	10/31/2021	2/1/2022	HEC-RAS inputs for EFM were completed 10/5/21 and EFM criteria were validated 10/24/21. Ready to assess alternatives.
<b>Milestone 5:</b>	Alternatives - Complete report	11/30/2021	3/1/2022	
<b>Milestone 6:</b>	Modeling - Complete report	11/30/2021	3/1/2022	
<b>Milestone 7:</b>	Effort Finished	11/30/2021	3/1/2022	

## APPENDIX B: Funding and Execution - Fiscal Year 2021 (as of 10/1/21)

In FY 2021, SRP was in the President's Budget \$500k and received \$5M through appropriations. Funds in excess of the President's Budget became available to SRP on 29 Mar 2021, which means the Program received 90% of the budget with 50% of the fiscal year remaining. Dates of location-based teams first receiving FY 2021 funds to support their efforts are listed as the "Estimated" dates in Appendix A. Some location-based carryover was planned as execution schedules for that work had tails in FY 2022.

Table B1. Allocations and carryover per major program components, FY 2021 (\$, millions).

Component	FY 2021:	Budgeted	Carryover to FY 22
Programmatic		1.9	0.3
- Program support		0.8	0.3
- Technologies		0.6	0.0
- Validation		0.5	0.0
Location-based		3.1	1.8
- Labor (generated by HEC)		1.9	1.1
- Repositions, MIPRs, etc.		1.1	0.8
Total		5.0	2.1

Table B2. Allocations and carryover per major program components, FY 2020 (\$, millions).

Component	FY 2020:	Budgeted	Carryover to FY 21	Carryover to FY 22
Programmatic		2.9	0.6	0.0
- Program support		0.8	0.1	0.0
- Technologies		1.3	0.5	0.0
- Validation		0.7	0.0	0.0
Location-based		2.1	0.5	0.2
- General		1.9	0.5	0.2
- Locks and dams		0.16	0.0	0.0
- Dry dams		0.04	0.0	0.0
Total		5.0	1.1	0.2



Table B3. Allocations and carryover per detailed program components, FY 2021 (\$, thousands).

	Budgeted	Obligated	Carryover (labor)	Carryover (reposition)
Programmatic	1,889	1,626	281	1
- Program support	772	491	281	1
- HEC	155	155	0	0
- IWR/NWD	191	74	117	0
- IPA (1)	88	88	0	0
- IPA (2)	101	101	0	0
- Detail and Extension	112	48	64	0
- GIS Support (Locks and Dams)	35	17	18	0
- GIS Support (Dry Dams)	37	9	28	1
- Regional meetings	53	0	53	0
- Tech	585	585	0	0
- Time series analysis	140	140	0	0
- Alternatives formulation and GIS	445	445	0	0
- Validation (SRP-Science)	550	550	0	0
- Des Moines River	150	150	0	0
- North Carolina Rivers	150	150	0	0
- Upper Ohio River	125	125	0	0
- Willamette River	125	125	0	0
- Program Overcommit	-19	---	---	---
Location-based	3,061	1,217	1,072	773
- LRD - Ohio River	200	83	117	0
- LRH - Sugar Creek	60	1	54	5
- LRH - Kanawha River	60	1	52	7
- LRP - French Creek	70	0	12	58
- MVP - Bois de Sioux River	87	59	26	1
- MVP - Mississippi River (SDM)	50	50	0.2	0
- MVR - Des Moines River	212	202	3	7
- MVR - Farm Creek	40	5	35	0
- MVR - Iowa River	70	61	9	0
- MVS - Cross MSC workshop	74	7	14	53
- MVS - Kaskaskia River	39	36	3	0
- MVS - Mississippi River (sturgeon)	74	74	0.0	0
- MVS - Mississippi River (veg)	25	17	7	0
- NAB - Potomac River	40	16	24	0
- NWK - Kansas River	85	0	85	0
- NWK - Osage River	45	0	45	0
- NWP - Rogue River	40	4	36	0
- NWP - Willamette River	30	11	19	0
- NWS - Ballard Locks	64	63	1	0
- NWW - Mill Creek	75	44	31	0
- NWW - Yakima River Delta	80	80	0.2	0
- SAM - Alabama River	120	0	10	110
- SAW - Cape Fear River	152	119	0.2	33
- SAW - Roanoke River (fish)	100	67	0.0	33
- SAW - Roanoke River (veg)	123	29	0.0	94
- SPA - Galisteo Creek	330	8	111	212
- SPA - Pecos River	160	47	65	49
- SWF - Big Cypress Creek	70	17	53	0
- SWF - Brazos and Neches Rivers	100	68	22	10
- SWL - Cossatot River	75	12	63	0
- SWL - Fourche LaFave River	65	16	49	0
- SWT - Kiamichi River	120	0	76	44
- SWT - Salt Fork of Arkansas River	52	0	50	2
- TNTCX - Rivercane	75	21	0	54
Total	4,950	2,843	1,353	774

Table B4. Program administrative costs, FY 2021 (\$, thousands). All SRP components with administrative costs are included in this table. Associated budgeted totals are from Table B3.

	Budgeted	Administrative	Notes (assumptions)
Program support			
- HEC	155	77	50% of budgeted
- IWR/NWD	191	96	50% of budgeted
- IPA (1)	88	22	25% of budgeted
- Detail and Extension	112	27	50% of extension
Location-based			
- MVR - Des Moines River	212	7	CESU fees
- NWS - Ballard Locks	64	9	Contracting fees
- SAW - Cape Fear River	152	10	CESU fees
- SAW - Roanoke River (fish)	100	10	CESU fees
- SAW - Roanoke River (veg)	123	10	CESU fees
Program totals (budget, admin, % admin)	4,950	268	5.4%