# DES MOINES RIVER
# MONITORING AND ADAPTIVE MANAGEMENT PLAN
# SUSTAINABLE RIVERS PROJECT

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IOWA DNR Natural Resources

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STATE

Central College 1853

**November 2020**

**DES MOINES RIVER**
**MONITORING AND ADAPTIVE MANAGEMENT PLAN**
**SUSTAINABLE RIVERS PROJECT**



## TABLES

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## APPENDICES

## 1.0. INTRODUCTION

This Monitoring and Adaptive Management Plan (MAMP) was prepared as part of the implementation of environmental flows and environmental pool management associated with the operations of Saylorville and Red Rock Dams on the Des Moines River as part of the Sustainable Rivers Program (SRP). This MAMP presents an objective-based multi-agency approach for implementing an effective monitoring program to assess the status and trends of ecological resources along the Des Moines River. The MAMP Team is comprised of the U.S. Army Corps of Engineers (Corps), Rock Island District (District), The Nature Conservancy (TNC), the Iowa Department of Natural Resources (IADNR), the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service (USFWS) and various partners at academic institutions.

While the MAMP requirements found in Section 2039 of the Water Resources Development Act (WRDA) of 2007 (as amended by Section 1161 of WRDA 1161) apply to ecosystem restoration feasibility studies and is not directly applicable to this project, this MAMP generally follows the process outlined in WRDA for establishing a monitoring plan, developing success criteria, and defining adaptive measures. In addition, this MAMP also utilizes concepts described in the Corps' technical guide for adaptive management (Fischenich et. al., 2019).

In addition to the guidance mentioned above, the development of this MAMP, as well as the broader implementation of SRP objectives for the Des Moines River, follows the process outlined in the SRP's framework for monitoring and managing environmental flows (Higgins et. al., 2011). The SRP framework consists of a four-step process for developing and implementing environmental flows:

1. Defining an environmental flow prescription
2. Assessing the degree to which the prescription is implemented
3. Short-term monitoring of ecosystem response to environmental flows
4. Long-term monitoring of ecosystem status and trends that relate to flow

Specifically, this MAMP is focused on developing and implementing a monitoring and adaptive management framework to accomplish Step 3, as well as beginning the initial development of a long-term strategy to accomplish Step 4. As discussed in Section 2.1 of this document, environmental flow prescriptions for the Des Moines River were previously developed and incorporated into the water control plans for Red Rock and Saylorville Dams (Step 1).

The adaptive management process consists of an iterative approach to problem solving focused on objectives-based monitoring and refinement of the action to address uncertainties and assumptions associated with a given action. For the purposes of this MAMP, a general adaptive management framework (Fischenich et al., 2019) was

utilized to organize completed and ongoing tasks into a logical process as outlined in Table 1.

**Table 1.** Summary of the Adaptive Management Process

| Adaptive Management Step | Des Moines River Task |
|---|---|
| Assess and Define the Problem | Identify primary ecological concerns on the Des Moines River that can be addressed through flow and pool management. |
| Formulate Alternatives | Formulate environmental flows and environmental pool management alternatives. |
| | Develop an adaptive management strategy, including expected outcomes, objectives, and adaptive management triggers. |
| Implementation | Incorporate flows and pool management into operating plan. |
| | Obtain baseline monitoring. |
| Monitor | Implement monitoring. |
| Evaluate Results | Compare monitoring results to expectations and baseline condition, as well as management triggers. |
| | Evaluate assumptions and uncertainties. |
| Continue/Adjust/Success | If triggers met, refine pool and flow management based on defined contingency plans. |
| | Document decisions. |

This MAMP is intended to be a living document. As the Corps, resource agencies, and interested stakeholders continue to collaborate to improve our understanding of the interactions between dam operations and ecological resources in the watershed, operational objectives, monitoring metrics, and success criteria will continue to be developed and refined. This document is intended to provide the framework for operating Red Rock and Saylorville Dams from an ecological context while providing the flexibility to continue to improve operations into the future.

## 2.0. ENVIRONMENTAL FLOW AND POOL MANAGEMENT OBJECTIVES

### 2.1. Defining Environmental Flows

The objectives for environmental flows and environmental pool management on the Des Moines River were initially identified in the time leading up to and during the Environmental Flows Workshop held in Pella, Iowa, on October 25-26, 2016. The workshop was co-organized and co-sponsored by the Corps and TNC. More than 50 scientists and fisheries, water, and natural resource managers from Federal and state government agencies, universities, and non-governmental organizations attended the workshop. Prior to the workshop, interested stakeholders provided feedback regarding

primary ecological concerns on the Des Moines River. Based on the preliminary stakeholder feedback regarding ecological concerns, workshop attendees identified eight primary recommendations for developing environmental flows on the Des Moines River:

1. Reduce nitrate levels
2. Reduce mussel mortality
3. Reduce sturgeon mortality
4. Reduce gas bubble trauma in fish
5. Improve conditions for migrating water birds
6. Improve conditions for reptiles and amphibians
7. Reduce streambank erosion
8. Improve conditions for river recreation

With consideration to these areas of concern, three focus groups—a fish and mussel group, a water quality and other considerations group, and a floodplain habitat, riverine waterfowl, and wildlife group—were established to evaluate potential flow improvements. Focus groups consisted of a fish and mussel group, a water quality and other considerations group, and a floodplain habitat, riverine waterfowl, and wildlife group. Each group developed recommendations for environmental flows and environmental pool management, and these recommendations were subsequently aligned, resulting in the unified set of flow requirements for the Des Moines River (Figure 1), as well as the integrated environmental flow recommendations (Figure 2). The environmental flow recommendations summarized in Figures 1 and 2 served as a starting point for developing the recommended operations framework identified in Section 2.3.

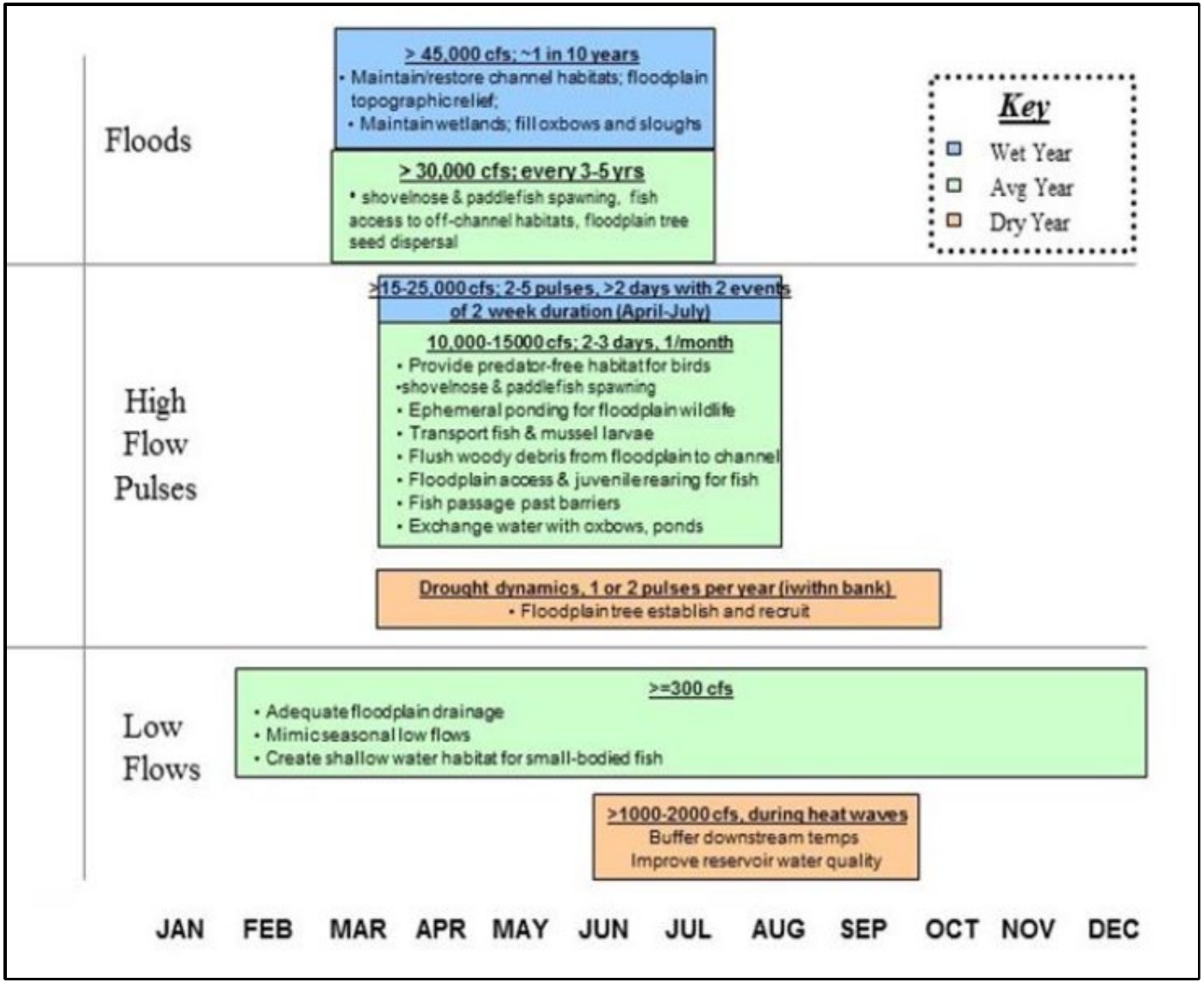


**Figure 1.** Unified Set of Flow Requirements for the Des Moines River Below Red Rock Dam

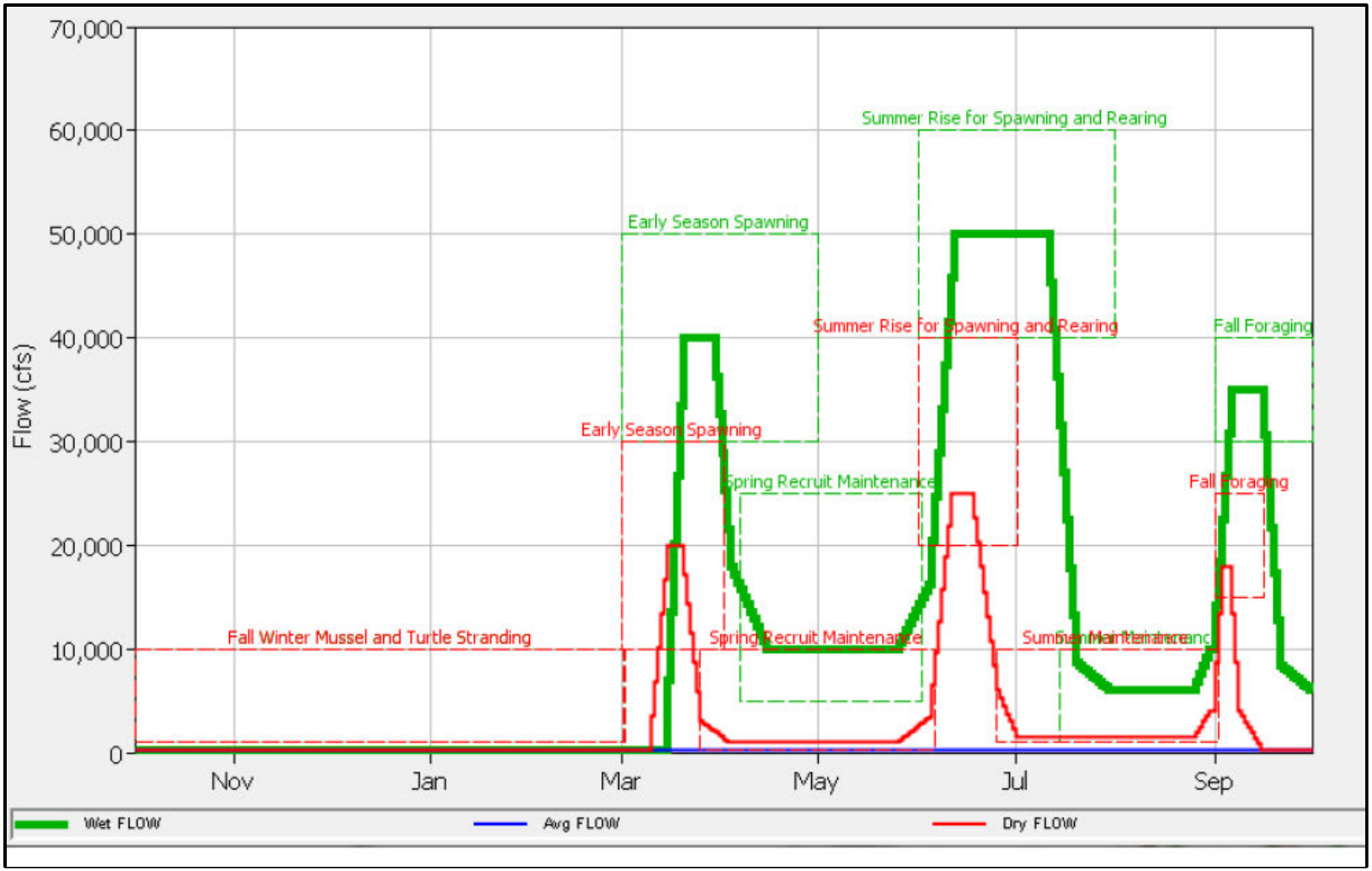


**Figure 2.** Integrated Environmental Flow Recommendations for the Reach of the Des Moines River Below Red Rock Dam

## 2.2. Incorporating Environmental Flows into Dam Operations

Subsequent to the identification of the broad ecological recommendations summarized in Figures 1 and 2, the Red Rock and Saylorville Dams' water control plans were revised to incorporate flexibility for the implementation of environmental flows and environmental pool management, as described in the Des Moines River Basin Master Reservoir Regulation Manual (USACE, 2019). Conservation pool bands introduced flexibility to accommodate maintenance activities and achieve environmental objectives when the projects are not in flood operations. Given operational constraints associated with Red Rock and Saylorville Dams, the actual operations implementable under the Des Moines River Basin Master Reservoir Water Control Manual are more limited than the ideal ecological flows outlined in the unified flow requirements.

Within conservation bands, the District can manage for aquatic, wetland, and migrating species. This benefits important mussel, fish, reptile, amphibian, and bird species during important life stages and seasons. The District used the Des Moines River Sustainable Rivers Study (SRS), conducted by the District and TNC, to develop possible lake levels and outflow management scenarios to benefit these animals and the ecosystem.

Although current reservoir operating rules restrict outflow reductions at Saylorville to a maximum of 3,000 cfs per day, there are no such restrictions at Red Rock. The Des Moines River SRS suggests placing a restriction on the maximum rate of change, both increasing (rise rate) and decreasing (fall rate). Several values were proposed as potential options, ranging from 3,000 to 5,000 cfs maximum change in outflow per day. The Des Moines River SRS also discussed whether restrictions on the rate of change should be flow dependent, i.e., smaller maximum rate of change allowed at low flow than during average or high flow conditions. The Des Moines River SRS report concluded research is needed to determine the appropriate rate of acclimation needed for fish to prevent gas bubble trauma and highlighted the need to better understand how the future operation of hydropower turbines may affect gas bubble trauma.

A comparison between the previous operating rules and the updated operating rules resulting from the SRS report are shown in Figures 3, 4, 5, and 6.

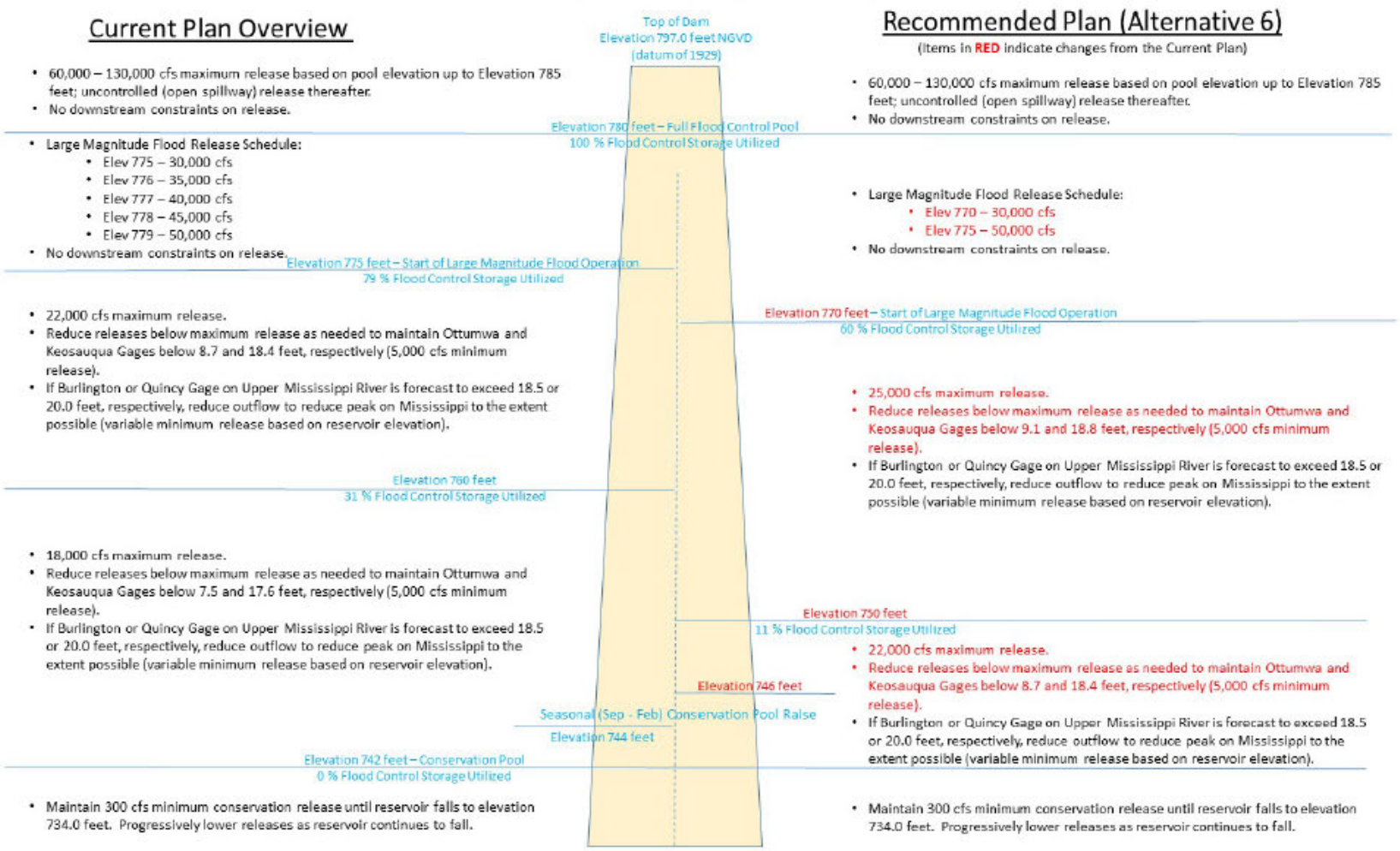


**Figure 3.** Comparison of Lake Red Rock Growing Season (May 1 to Dec 15) Water Control Plans Before (Current Plan Overview) and After (Recommended Plan) the Updates to the Water Control Plan

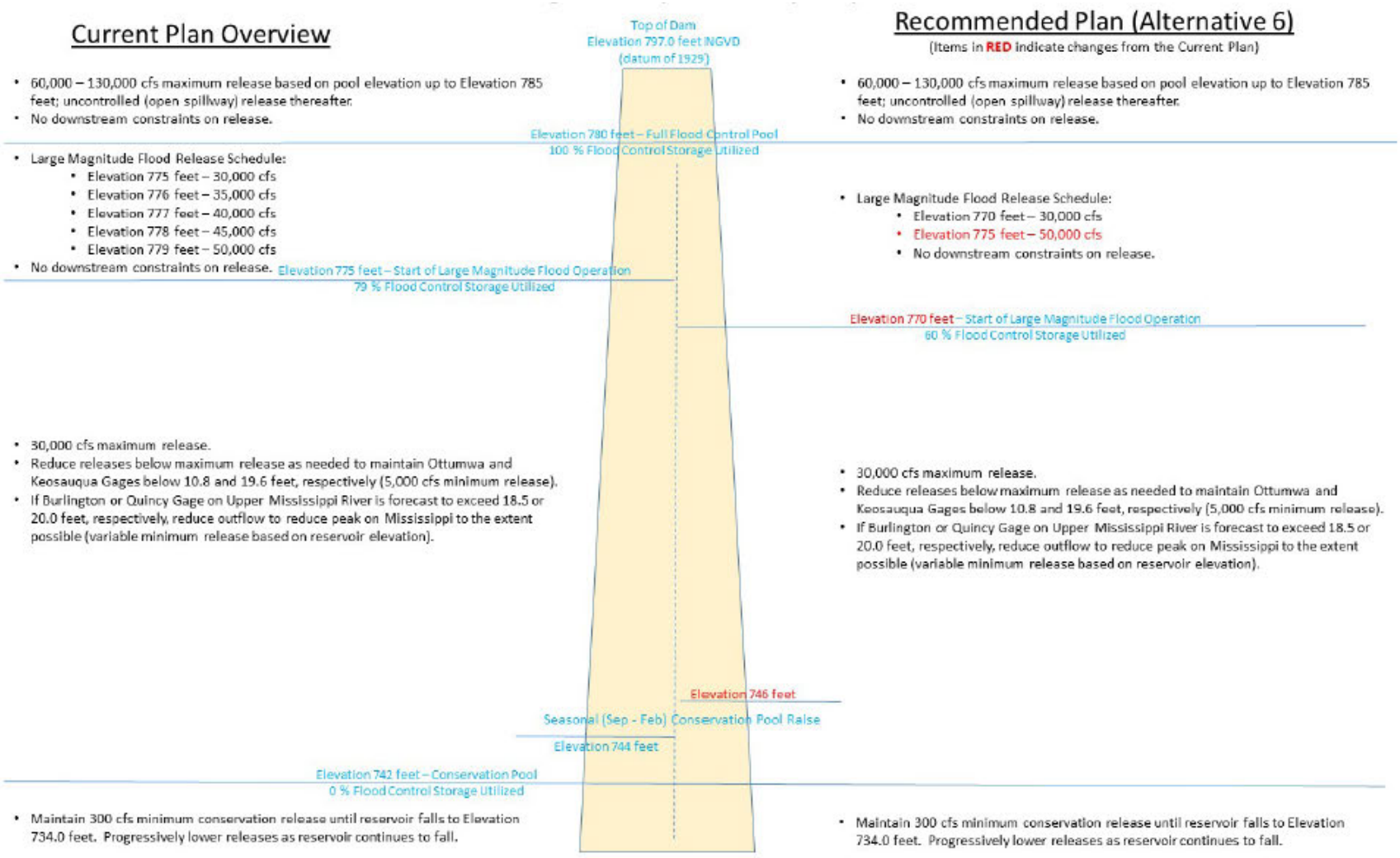


**Figure 4.** Comparison of Lake Red Rock Non-Growing Season (Dec 16 to Apr 30) Water Control Plans Before (Current Plan Overview) and After (Recommended Plan) the Updates to the Water Control Plan

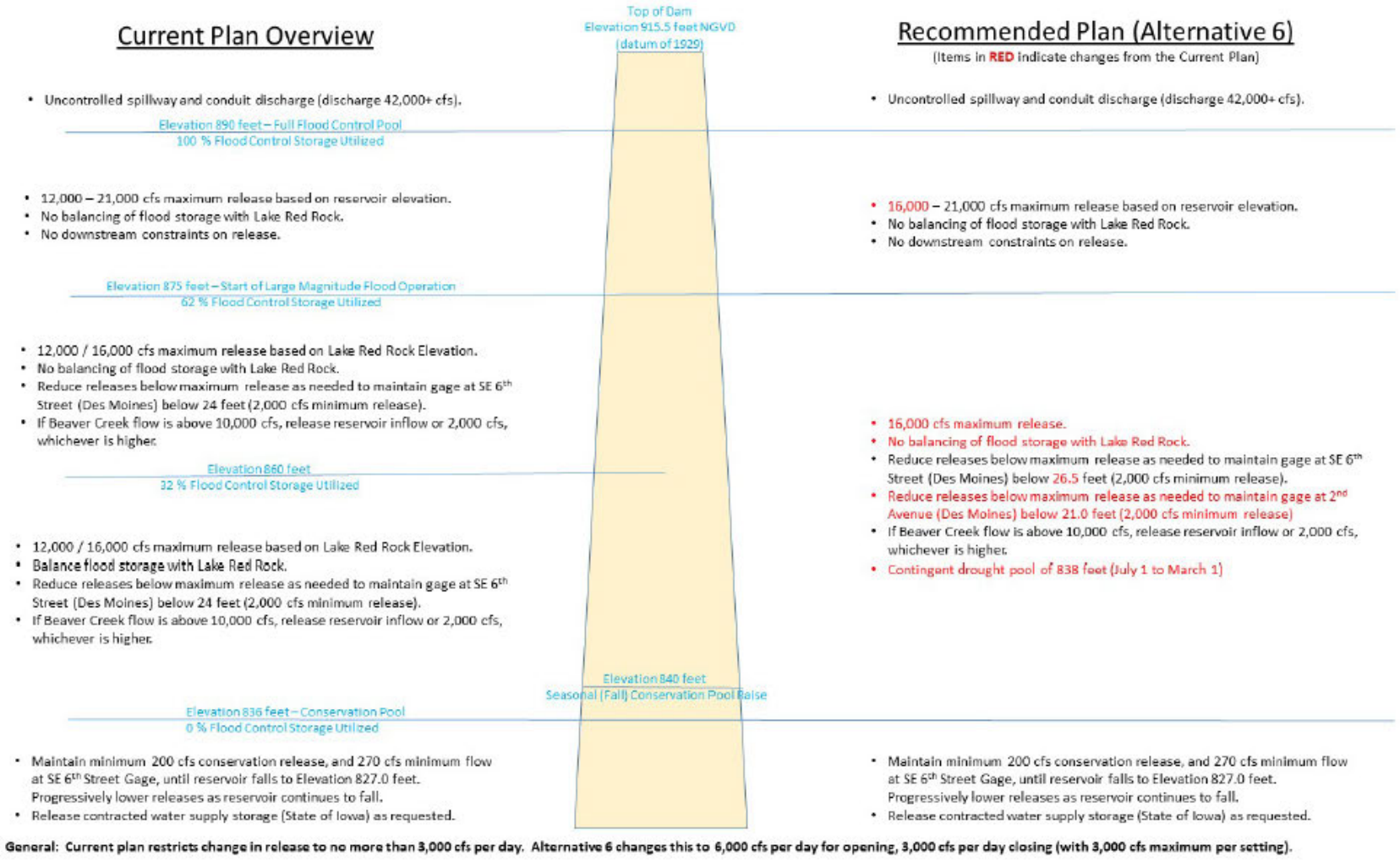


**Figure 5.** Comparison of Saylorville Lake Growing Season (Apr 21 to Dec 15) Water Control Plans Before (Current Plan Overview) and After (Recommended Plan) the Updates to the Water Control Plan

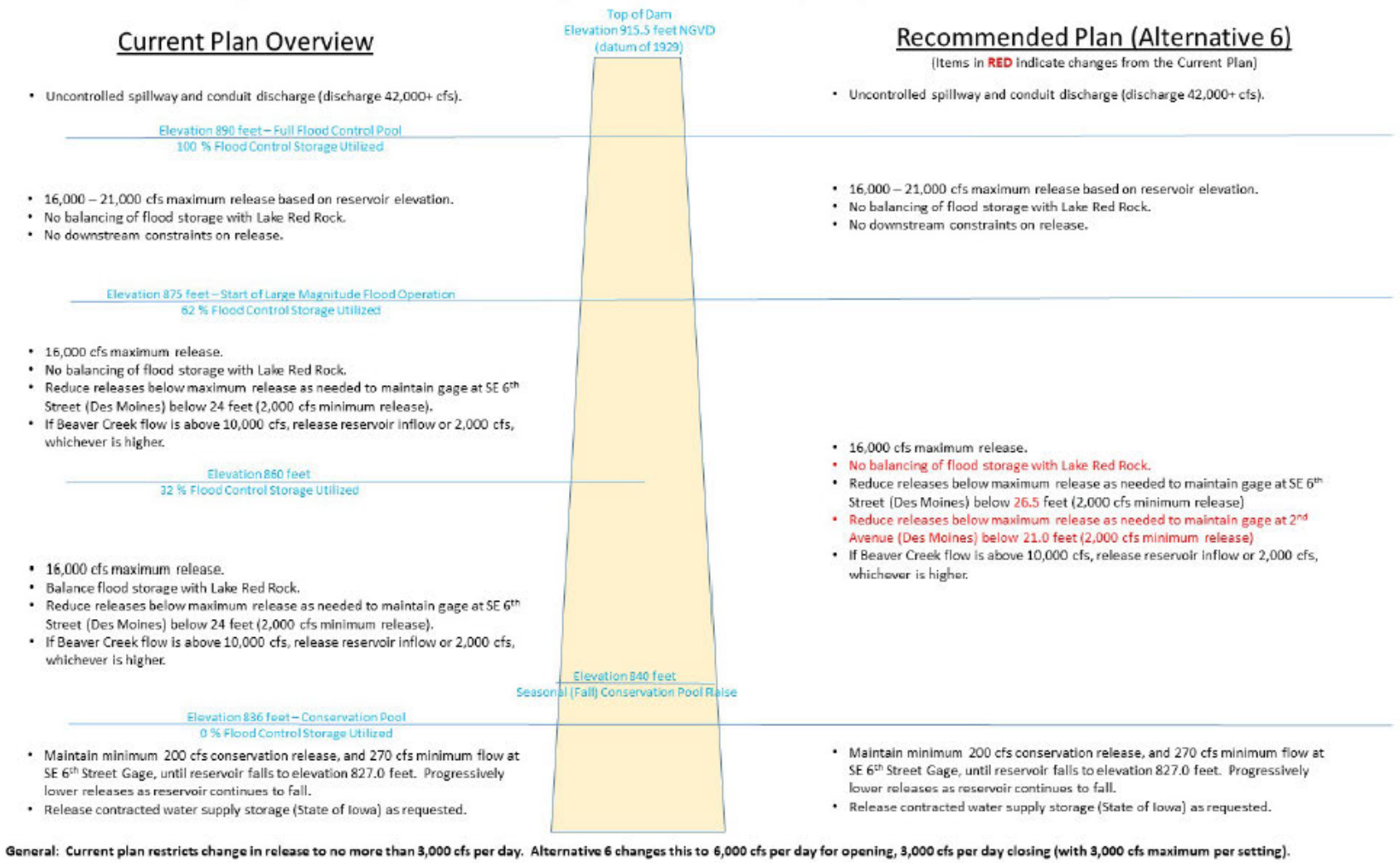


**Figure 6.** Comparison of Saylorville Lake Non-Growing Season (Dec 16 to Apr 20) Water Control Plans Before (Current Plan Overview) and After (Recommended Plan) the Updates to the Water Control Plan

## 2.3. Linking Environmental Flows and Pool Management to Objectives

For the purposes of developing an adaptive management framework (Figure 7), the actual range of implementable flows served as the starting point for the preliminary linking of flows to the ecological objectives (Figure 3). These objectives were identified at the environmental flows workshop described in Section 2.1.

Following the preliminary linking of implementable flows to objectives, flow prescriptions were more clearly defined with consideration of the recommendations provided by the environmental flows workshop. In addition, environmental pool management opportunities at both Red Rock and Saylorville Dams were evaluated, with consideration for previous and ongoing pool management efforts as well as the interaction between environmental pool management and environmental flow releases.

In support of these efforts, a collaborative workshop facilitated via webinar occurred on May 14, 2020. The workshop included representatives from the Corps, TNC, USGS, IADNR, and local universities, including many of the same participants as the environmental flows workshop. As a result, a refined list of targeted environmental flows and environmental pool management options and associated objectives was developed. The refined list was shared with workshop participants for review and additional refinement, resulting in management recommendations. (Tables 2 and 3).

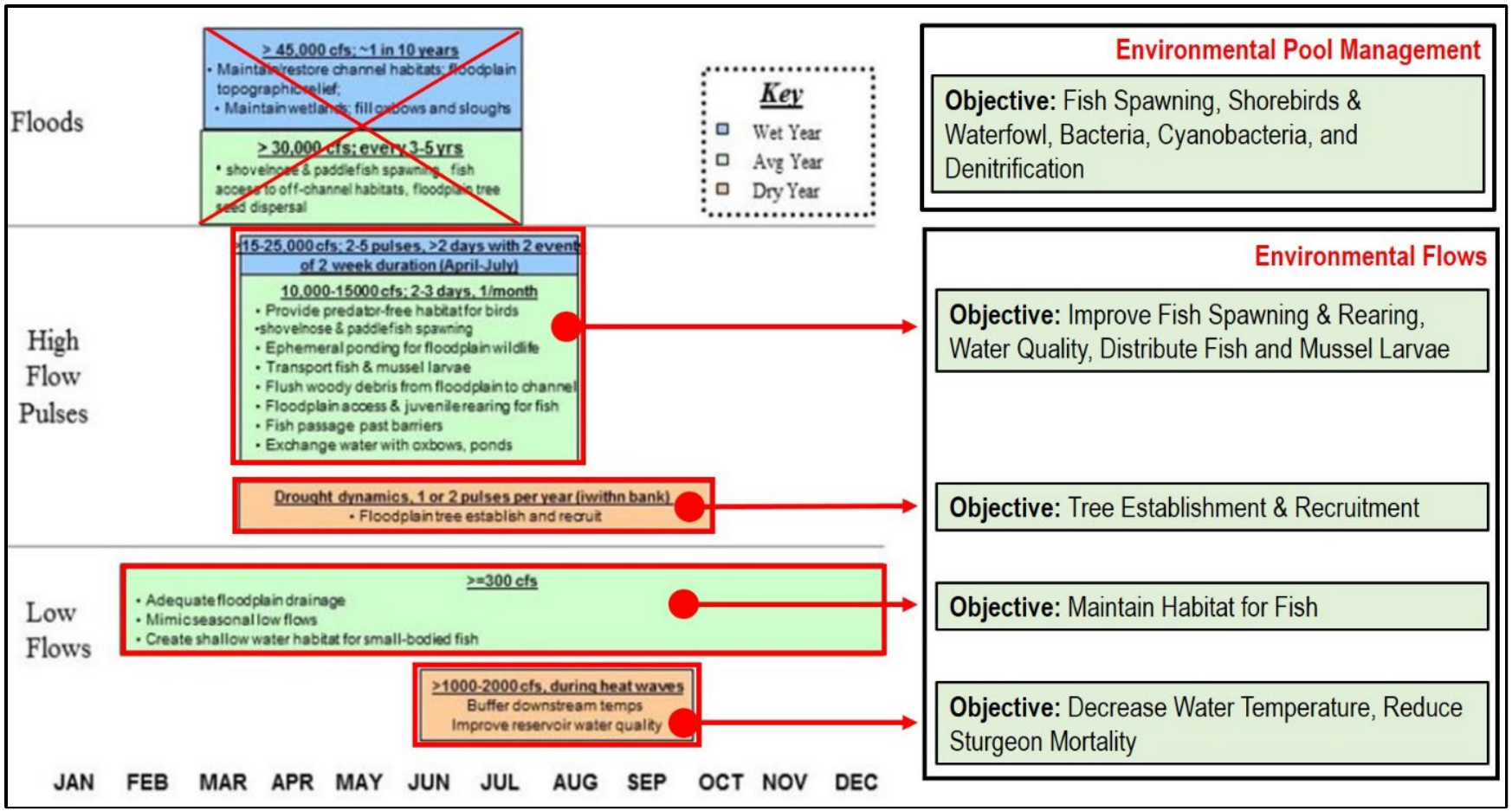


**Figure 7.** Implementable Environmental Flows (Red Boxes) Linked to Preliminary Objectives, Including Environmental Pool Management, for Lake Red Rock and the Des Moines River Below

**Table 2.** Summary of Recommended Environmental Flows for the Des Moines River

| Flow | Objectives | Red Rock Details |
|---|---|---|
| Early Season Spawning Pulse | **Primary:** Improve spawning conditions for native fish<br><br>Secondary: Avoid triggering walleye emigration from reservoir | • Magnitude of up to 30,000 cfs<br>• Duration: 7 days ascending, a several day peak, 7 days descending; volume dependent<br>• Timing from Mar 1 to Apr 30, targeting water temperatures between 16-20°C<br>• Frequency: 1:5 years |
| Summer High Flow Pulse | **Primary:** Improve spawning conditions for native fish | • Magnitude of 10,000-22,000 (conservation band) or up to 25,000 cfs in conjunction with FRM releases if pool is over 750 WSE.<br>• Duration: 7 days ascending, a several day peak, 7 days descending; volume dependent<br>• Timing from Apr 1 to Jul 30 (flows beyond June 15 may benefit invasive carp)<br>• Frequency: 1:5 years |
| Opportunistic Heatwave Pulse | **Primary:** Improve water temperatures for fish benefits | • Magnitude of 1,000 to 2,000 cfs<br>• Duration: volume dependent<br>• Timing: June 1 or later<br>• Frequency: opportunistic |
| Base Flow | **Primary:** Protection of mussel and sturgeon populations | • Maintain a baseflow at or greater than 300 cfs to the extent possible.<br>• If outflows must be entirely turned off, limit duration to 12 hours during daylight.<br>• If outflows must be shut off or reduced for a prolonged period, utilize a 3 to 4-week incremental reduction to encourage mussel migration. |

**Table 3.** Summary of Environmental Pool Management at Red Rock Reservoir and Saylorville Reservoir

| Pool Management | Objectives | Red Rock Details | Saylorville Details |
|---|---|---|---|
| Fall Pool Raise and Hold | **Primary:** Provide stop-over and foraging habitat for migrating waterfowl and shorebirds (spring)<br><br>**Secondary:** Hold winter pool levels steady to ensure aestivating reptiles and amphibians are not detrimentally impacted | • Raise the pool 2-5 feet from Sep to Nov gradually<br>• Hold high point through Mar 1<br>• Gradually lower WSE starting March 1 to 743 (3"/week)<br>• Gradually lower WSE from 743 to 741.5 from Apr 15 to May 30<br>• Frequency: 2 out of 3 years | • Raise the pool 2-4 feet from Sep to Nov gradually<br>• Hold high point through Mar 1<br>• Gradually lower WSE starting Mar 1 to 837 (3"/week)<br>• Gradually lower WSE from 837 to 836 from Apr 15 to May 30<br>• Frequency: 2 out of 3 years |
| Fall and Winter Pool Low Water Maintenance | **Primary:** Provide conditions within the reservoir beneficial for fish spawning<br><br>**Secondary:** Hold winter pool levels steady to ensure aestivating reptiles and amphibians are not detrimentally impacted | • Hold pool at 741.5 through winter<br>• Raise reservoir 6 inches per day starting Apr 25<br>• Hold pool at 743 through Aug 1<br>• Incrementally decrease pool to 741.5 by Sep 1<br>• Frequency: 1 every 3 years | • Hold pool at 836 through winter<br>• Raise reservoir 6 inches per day starting Apr 25<br>• Hold pool at 837 through Aug 1<br>• Incrementally decrease pool to 836 by Sep 1<br>• Frequency: 1 every 3 years |
| Summer Shorebird Management [1] | **Primary:** Provide stop-over and foraging habitat for migrating shorebirds (summer) | • Gradually lower the WSE from 743 to 741.5 starting on or around Jul 15 in 6-inch increments | • Gradually lower the WSE from 837 to 836 starting on or around Jul 15 in 6-inch increments |
| Opportunistic Post-flood Pool Management | **Primary:** Provide conditions within the reservoir beneficial for fish spawning | • Following a high flow FRM release in spring, hold the pool steady at some elevation above 743 from May to Aug (i.e. crappie spawn) | • Following a high flow FRM release in spring, hold the pool steady at some elevation above 837 from May to Aug (i.e. crappie spawn) |

[1] This management action can occur as modification to either the fall pool raise or fall and winter lower water maintenance.

## 2.4. Updated Flow and Pool Management Recommendations

The environmental flows (Table 2) and environmental pool management (Table 3) include several refinements from the initially recommended environmental flows (i.e. Figure 1). In addition, the environmental flows summary reiterates and refines recommendations for low-flow management. Primary changes from previous recommendations are as follows:

**2.4.1. Environmental Pool Management Refinements.** Under previous environmental pool management practices, the reservoir level would be raised in the fall, as proposed in Table 3. However, the pool would be drawn back down following the window of use by migratory waterfowl sometime during winter. This timeframe for pool drawdown has the potential to have significant detrimental effects to aestivating reptiles and amphibians. Based on water temperature, many reptiles and amphibians may begin aestivating in early fall (e.g., October). Organisms that rely on shallow water or mud-bottom habitat for aestivating (e.g., softshell and snapping turtles) could be detrimentally impacted if their aestivation site is exposed after they have become dormant for the season. As a result of this concern, the Red Rock Fall Pool Raise and Hold operation was modified to extend the recommended inundation period into the following spring, rather than dropping the water level in winter.

**2.4.2. Environmental Flow Refinements.** The preliminary environmental flow prescription recommended a fall spike release (Figure 2). Based on the Corps' and participating stakeholders' professional judgment, this release was expected to have minimal potential benefits. In addition, a fall spike release could have undesirable impacts, such as helping to distribute spawning Asian Carp, which have a more protracted spawning period than most native fish species. As a result of these concerns, the fall high flow pulse was removed from the list of environmental flows.

# 3.0. OBJECTIVES-BASED MONITORING

Since no continuous funding stream for implementing adaptive management on the Des Moines River is currently available, the Team initially looked for opportunities to leverage any existing monitoring programs. Prior to developing potential success metrics for monitoring and adaptive management, ongoing and anticipated future monitoring efforts were reviewed, as summarized below.

## 3.1. Ongoing Monitoring Efforts

Since 1967, the Saylorville and Red Rock projects have contracted with Iowa State University to conduct year-round water quality monitoring on the Des Moines and Raccoon Rivers. The purpose of these water quality monitoring efforts is to ascertain the effects of Saylorville and Red Rock Dams on downstream river quality and to

characterize upstream water quality. Over 40 parameters at 7 different sites are monitored throughout the year. For public health purposes, seasonal monitoring is conducted to analyze levels of bacteria and microcystin at beaches and the main body of the lake during peak recreational periods. The effort also includes annual fish tissue sampling to evaluate the health and safety of fish consumption.

To supplement water quality monitoring, the District's Water Quality Section deployed four continuous monitoring sondes at Lake Red Rock in 2020. The sondes are located at Whitebreast Beach, Red Rock headwaters, directly upstream of Red Rock Dam and directly downstream of the dam. The sondes are limited in the number of parameters collected but provide a more complete picture of water quality throughout the year.

The IADNR has a number of monitoring efforts that could be leveraged for the Corps' adaptive management work on the Des Moines River. The IADNR administers its Multiple Species Inventory and Monitoring (MSIM) Program, a long-term monitoring program. The monitoring protocols and permanent sampling areas serve as a baseline for long-term monitoring for Iowa's wildlife populations. MSIM activity has been limited in the Des Moines River corridor.

The IADNR Large Impoundment Fisheries Research Program currently has two ongoing studies with focus at Lake Red Rock. Rebecca Krogman leads an association of fish health with discharge downstream of large reservoirs study. The purpose of the study is to identify and monitor the environmental conditions leading to large-scale sportfish mortality in tailwaters of large reservoirs. The objective is to conduct an annual assessment of fish kills that occur below large reservoirs and measure related environmental conditions.

Krogman also leads the *Fish Movement and Mortality Associated with Dam Passage Study*. The purpose of this study is to evaluate the potential impact of dams and associated hydropower facilities on sport fish movement and movement-related mortality. The objective of this study is to conduct one multi-year evaluation of the extent of fish movement through several large dams and hydropower facilities and assess the risk of mortality related to turbine passage. This work is being accomplished using acoustic telemetry technology, and the program expanded the Mississippi River basin's acoustic reader array into the upper Des Moines River for the first time in 2020. Acoustic reader installations are ongoing, and acoustically tagged fish will be released above Saylorville Reservoir for the first time in fall 2020. Initial focal species include walleye and native carpsuckers. The study may also be expanded, as resources allow, to include hybrid striped bass, catfish, sturgeon, and other native sportfish species of interest which may be highly susceptible to downstream passage and emigration from the reservoirs. Fish detections at readers outside the reach where the fish was tagged and stocked may indicate long-distance movements and survival passing through Saylorville and Red Rock Dams.

### 3.2. Anticipated Future Monitoring Efforts

The Corps and USGS are collaborating to gather baseline information and evaluate monitoring opportunities and metrics from 2020 to 2022. The SRP is funding this effort. The USGS will review historic monitoring data, develop a suite of potential monitoring metrics, and gather preliminary baseline data associated with these metrics. Appendix B contains the USGS's performance work statement. In addition, if conditions allow, the metrics will be measured following a dam-related ecological flow and/or pool management actions (Table 2). Metrics will then be evaluated for response and sensitivity to dam operations, which will inform the choice of final metrics to serve as adaptive management triggers.

Based on the evaluation of historic conditions performed as part of the environmental flows workshop, the Team determined that flows between Saylorville and Red Rock dams do not differ significantly from historic hydrographs. As a result, the potential benefits that could result from environmental flows between these dams are not expected to be as significant as the potential benefits below Red Rock Dam. As a result, the focus of developing preliminary monitoring metrics will focus on Lake Red Rock or the river below Red Rock. Knowledge gained from this effort is also expected to inform the adaptive management of Saylorville Dam.

In addition to the collaborative efforts with USGS, several other potential monitoring programs may be implemented in upcoming years. The District submitted several research proposals for monitoring efforts associated with Red Rock Dam to both the SRP and the Ecosystem Management and Restoration Research Program (EMRRP). Proposals cover monitoring of migratory bird use, herpetological resources and habitat use, and denitrification. If any of these efforts is approved and funded, results may provide additional insight into the development of monitoring metrics and success criteria.

The MAMP Team expects the IADNR will contribute its Des Moines River fish and wildlife monitoring results to this effort. This may include, but not be limited to, water quality sampling, fish surveys, and migratory bird observations. The IADNR's historical and ongoing surveys will play an important part in the adaptive management decisions at Red Rock and Saylorville.

### 3.3. Linking Monitoring Metrics to Objectives

When the Team selects metrics to use as indicators or criteria for adaptive management, the initial focus will be on selecting metrics that are clearly linked to operational objectives consistent with the following criteria:

- Respond quickly and significantly to the operation being evaluated, at a spatial and temporal scale useful for guiding operational change.

- Be clearly linked to the desired or expected ecological outcome (i.e. the objective).
- Be strongly affected primarily by the operation being evaluated, rather than likely to be more strongly influenced by other external factors.
- Be easily measured and interpreted in the context of the operation being evaluated.

Existing monitoring efforts (Section 3.1) will be evaluated for potential metrics to inform adaptive management. Additional monitoring metrics will also be evaluated for potential inclusion (Section 3.2).

## 4.0. IMPLEMENTATION CONSIDERATIONS

Species, guilds, and habitats often have different and potentially conflicting resource needs, which creates unique challenges when attempting to implement operations for ecological benefit. In the context of this MAMP, several specific conflicting resource needs have been identified:

- The Red Rock and Saylorville Fall Pool Raise and Hold Operation benefits waterfowl but degrades inundated vegetation and may degrade crappie and other sportfish habitat the following season.
- During low water or hot years, water releases intended to reduce downstream water temperatures may reduce the likelihood of being able to implement a fall pool raise.
- Early season flow pulses benefit downstream habitat, but may impact fishery habitat in reservoir, depending on timing and water availability.
- Evacuating reservoirs before winter may benefit existing vegetation and associated fishery habitat, but negatively impacts aestivating reptiles & amphibians
- Evacuating reservoirs in late winter or early spring (i.e., before April) may provide benefit to some aquatic and fisheries resources but may trigger walleye emigration.

When implementing operations at Red Rock and Saylorville Dams, the Corps and other stakeholders in the Des Moines River watershed will address potential trade-offs through annual coordination, as discussed in Section 5.0. Several approaches can be utilized when making decisions regarding resource trade-offs.

Using available resource information (i.e., survey and monitoring data) and best-professional judgment, multi-disciplinary teams can incorporate resource needs and status into annual decision making. If survey data shows declining trends in a specific

ecological or biological resource, these can be weighed when making decisions regarding operational trade-offs. Conversely, if monitoring data shows a given biological or ecological resource is performing particularly well (e.g., increasing abundance or diversity), this information can also be considered.

In addition to considering the status of each resource when making operational decisions, recently implemented operations should also be considered when making decisions regarding upcoming operations. For example, in the context of the Des Moines River, if a fall pool raise has been implemented for several consecutive years in order to benefit waterfowl, strong consideration should be given to implementing an operation intended to benefit a different resource. In this case, the fall pool could be held steady (i.e. no raise) in order to benefit fisheries resources. Similar resource balancing was considered when developing the recommendations in Tables 2 and 3 and should continue to be considered during annual coordination efforts. The IADNR's recommendations are in Appendix A.

Given that two dams operate in relative proximity along the Des Moines River, resource trade-offs can also potentially be balanced across reservoirs and river reaches. For example, if an operational decision is made resulting in a resource trade-off at Red Rock, a different operation could potentially be implemented at Saylorville Dam with the intent of benefiting the resource on the detrimental end of the Red Rock operation. For example, if a fall pool raise is avoided at Red Rock one year in order to benefit fisheries resources, a fall pool raise could be implemented at Saylorville, balancing resource needs on a broader scale.

## 5.0. COORDINATION AND COMMUNICATION

The Corps and stakeholders share a proud partnership on the Des Moines River, developed over years of collaboration at Saylorville Lake and Lake Red Rock. The key to this partnership is communication. For many years, the District, IADNR, and USFWS have collaborated to implement operations for ecological benefit on the Des Moines River, in coordination with other partners including TNC, USGS, and the Natural Resource Conservation Service. Implementing this MAMP requires the agencies to work on behalf of the public and our natural resources.

In order to continue collaborating while implementing adaptive management on the Des Moines River, each February the District and interested agencies and stakeholders will meet to discuss the previous year's monitoring and management efforts. The annual meeting will provide a forum to review recent operations and available monitoring data on the Des Moines River and determine if operations are having the anticipated beneficial effects.

The District will detail the hydrologic events and flood-risk management (FRM) activities that took place over the previous year. This information can be used to consider if FRM operations are having an impact on natural resource management. In addition, the District will review the recent history of any environmental pool management or environmental releases that occurred on the Des Moines River. Agencies and stakeholders can provide data and information from recent monitoring efforts and outline their ongoing or anticipated monitoring efforts and resource management goals for the upcoming year.

The previously-established fall pool raise meeting will continue to occur annually in August. In this meeting, the District will outline the major hydraulic events at Coralville, Red Rock and Saylorville Reservoirs from the previous year. The IADNR will outline the water level management strategies it has developed to meet their fall pool management goals.

Meeting annually to review previous operations and monitoring data and collaborating on the implementation of adaptive management actions will allow the District to leverage available data and knowledge shared across agencies in order to improve the management of shared ecological resources within the watershed. Figure 8 outlines a timeline of upcoming MAMP efforts. The annual stakeholder meetings will be a good time to discuss these efforts.

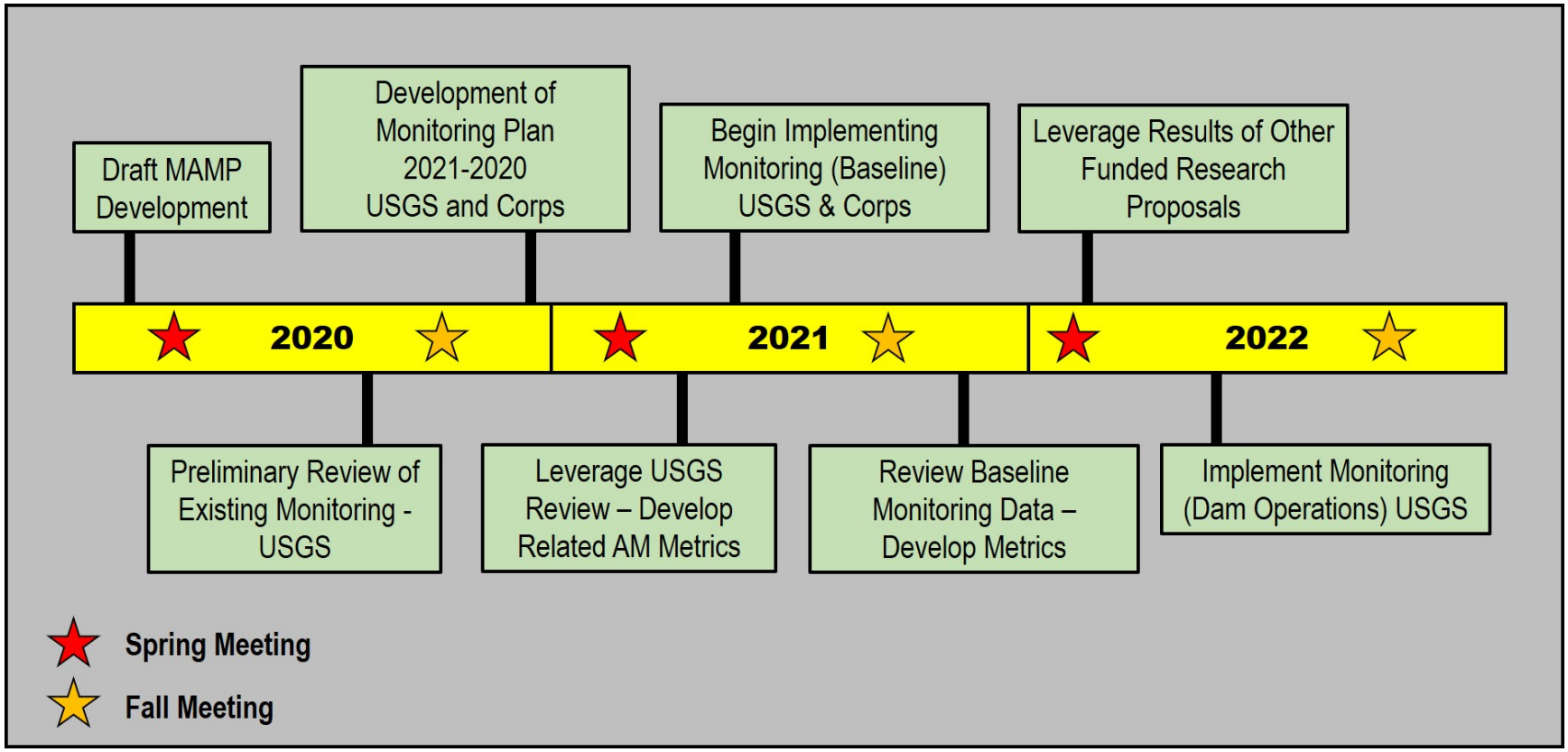


**Figure 8.** Anticipated Timeline of Upcoming Efforts Associated With Continued Development of the DSMR MAMP

## 6.0. ADAPTIVE MANAGEMENT CRITERIA

The Team has not yet developed the specific metrics and associated triggers. As discussed in Section 3, existing monitoring programs are being evaluated (Section 3.1) and additional metrics are being developed for potential implementation (Section 3.2). These efforts are expected to continue through FY 2021 and 2022. In particular, ongoing efforts in collaboration with USGS are expected to contribute significantly to the initial development of monitoring and adaptive management metrics.

### 6.1. Record Keeping and Reporting

Appendix C contains blank monitoring and reporting sample sheets used to document annual monitoring. The District will provide the annual documentation to the MAMP Team prior to the spring Team meeting. The MAMP Team should use the completed forms to provide information when submitting a request for funding.

The District will document MAMP decisions resulting from the spring and fall meetings and disseminate the minutes to stakeholders.

## 7.0. FUTURE FUNDING CONSIDERATIONS

There is currently no dedicated funding stream for the continuous implementation of monitoring and adaptive management. As a result, the Team will continue to pursue various funding mechanisms and opportunities for the development, refinement, and implementation of monitoring and adaptive management actions. Given the challenges associated with ensuring long-term funding, monitoring efforts have focused on first identifying existing monitoring programs that can be leveraged to inform adaptive management without the need for additional costs or monitoring efforts.

Collaboration with regional stakeholders is also critical to ensuring the long-term success of adaptive management on the Des Moines River. Through close coordination and collaboration with the IADNR, USFWS, USGS, TNC, various partners at academic institutions and other agencies, the District hopes to leverage each organization’s ongoing efforts and expertise to contribute to the adaptive management of resources within the Des Moines River corridor.

## 8. CITATIONS

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# DES MOINES RIVER
# MONITORING AND ADAPTIVE MANAGEMENT PLAN
# SUSTAINABLE RIVERS PROJECT

## APPENDIX A

## IOWA DEPARTMENT OF NATURAL RESOURCES RECOMMENDATIONS

# IOWA DEPARTMENT OF NATURAL RESOURCES

LEADING IOWANS IN CARING FOR OUR NATURAL RESOURCES

Iowa Department of Natural Resources
Fisheries Bureau
502 E. 9th Street
Des Moines, IA 50319

29 June 2020

To Mr. Hugh Howe and U.S. Army Corps of Engineers partners:

The Iowa Department of Natural Resources Fisheries Bureau recommends the following pool and river management guidelines to achieve specific objectives as part of the U.S. Army Corps of Engineers' adaptive management strategy on the Des Moines River, Iowa.

**Objective: Enhancement and Protection of Crappie Spawning and Nesting Habitat in Reservoir**

- During fall, lower the pool to the minimum (836 NGVD at Saylorville Reservoir, 741.5 NGVD at Red Rock Reservoir) as soon as possible to minimize degradation of existing vegetation and allow new growth to occur.
- During winter, hold the pool at the minimum (836 NGVD at Saylorville Reservoir, 741.5 NGVD at Red Rock Reservoir) until March 31, preserving structure created by terrestrial vegetation from the previous year and flushing turbid inflows through the reservoir.
- On April 25, begin raising the pool to the maximum (837 NGVD at Saylorville Reservoir, 743 NGVD at Red Rock Reservoir) at a rate of 6" per day, initiating Crappie spawning and making potentially better spawning and nesting habitats available. Peak water levels above the conservation band provide additional benefits to fish spawning and nesting, and reductions in pool level should be completed as slowly as possible.
- During summer, maintain at least the maximum pool until August 1, allowing spawning and subsequent nesting, egg incubation, hatching, and swim-up of Crappie fry.

This objective should be achieved 1 out of every 3 years to maintain adequate Crappie populations.

**Objective: Minimization of Walleye Emigration Downstream from Reservoir**

- During fall, do not retain water for a fall-timed pool raise, to mimic natural flow regimes and avoid mistimed excess discharges during late fall and winter. Maintain the pool at the minimum (836 NGVD at Saylorville Reservoir, 741.5 NGVD at Red Rock Reservoir).

- If a fall-timed pool raise occurred, reduce the pool to the minimum (836 NGVD at Saylorville Reservoir, 741.5 NGVD at Red Rock Reservoir) by December 15, beginning releases sooner and in smaller increments, to minimize winter emigration of Walleye which is known to occur between November and April.
- During April, release excess water as slowly as possible, avoiding drastic changes in outflow, to retain spawning Walleye in the reservoir.

This objective should be achieved every year to reduce emigration of not only Walleye, but also Hybrid Striped Bass, White Bass, and other native fish species. In addition, excessive discharges affect tailrace water quality, especially gas saturation, and can lead to lethal and sublethal fish impacts as a result of gas bubble trauma.

**Objective: Protection of Mussel Populations in River**

- Avoid dewatering the river as a result of shutting off dam outflows as much as possible. Collaboration with partners including the City of Des Moines and Missouri River Energy Services is recommended to coordinate maintenance work, thereby minimizing the number of dewatering events each year.
- If dam outflows must be turned off for short-term maintenance, do so for no more than 12 hours during daytime and no more than five days in a row, allowing exposed mussels to be covered by water during nighttime when they are most vulnerable to predation and allowing typical water levels to be recovered further downstream.
- If dam outflows must be turned off or greatly reduced for long-term projects, reduce outflows incrementally over the course of 3-4 weeks, encouraging migration of mussels to deeper water. Water levels in the river should drop no more than 2" per day to allow adequate time for mussel movement.

This objective should be targeted any time a dewatering event occurs below either Saylorville or Red Rock Dams.

**Objective: Protection of Sturgeon Populations in River**

- Similar to mussel recommendations, avoid dewatering the river as much as possible. Impacts downstream may include loss of coolwater refuges that are necessary for Shovelnose Sturgeon survival.
- During summer, supplement low flows in the Des Moines River between Red Rock Reservoir and Keokuk during periods of high temperature with 1,000-2,000 cfs pulses (in addition to existing outflow) from Red Rock Dam, to defray the effects of excessively warm water and loss of coolwater refuge on Shovelnose Sturgeon.

- Identify locations between Red Rock Reservoir and Keokuk which may serve as coolwater refuges if deepened or altered, and collaborate with Iowa Department of Natural Resources and other partners to improve such areas as essential sturgeon habitat. Given the amount of substrate as bedrock in this portion of the Des Moines River, alternatives besides deepening could include creation or protection of islands and establishment of flow-diverting structures (e.g., wing dams) to create areas with flow and depth diversity.

This objective should be targeted any time low flows below Red Rock Dam occur, but especially during summer and early fall.

**Objective: Enhancement of Native Large River Fish Spawning Success**

- During spring when water temperatures range between 16-20°C, allow an initial pulse in discharge to initiate Shovelnose Sturgeon migration and spawning. The pulse should have a duration of 2-3 weeks including the ascending, peak, and descending periods.
- Approximately 1 week after the initial peak, allow a secondary pulse in discharge to encourage larval drifting. The pulse should have a duration of 1.5 weeks including the ascending, peak, and descending periods.
- Complete flow pulses before June 15 to discourage Asian Carp spawning during summer. If water needs to be evacuated from the reservoir after June 15 and before August 1, begin releases sooner and in smaller increments to avoid a summer pulse conducive to Asian Carp spawning.

This objective should be targeted every year below both reservoirs to enhance native fish spawning.

We thank the U.S. Army Corps of Engineers for their consideration and potential implementation of these adaptive management strategies. Please contact us for any clarifications or supporting documentation.

Sincerely,

Ben Dodd, Boone District Fisheries Management
Mark Flammang, Rathbun District Fisheries Management
Ryan Hupfeld, Large Rivers Fisheries Research
Rebecca Krogman, Large Reservoirs Fisheries Research
Iowa Department of Natural Resources, Fisheries Bureau

# DES MOINES RIVER
# MONITORING AND ADAPTIVE MANAGEMENT PLAN
# SUSTAINABLE RIVERS PROJECT

# APPENDIX B

# U.S. GEOLOGICAL SURVEY
# PERFORMANCE WORK STATEMENT

**Performance Work Statement**
Sustainable Rivers Program – Science – Des Moines River

**MIPR Agreement Number**
XXXX
**Agency Name**
U.S. Army Corps of Engineers
**Legal Authority**
XXXXXXX (ex. Economy Act)
**DUNS Number**
XXXX
**IPAC billings Business Event Type Code (BETC)**
XXXX

**Your Project Point of Contact**
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**USGS Point of Contact**
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Iowa Cooperative Fish and Wildlife Research Unit Leader
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**Period of Performance**
09/01/2020 to 12/31/2023

**Description of Services/Responsibilities/Project Work**

This performance work statement details U.S. Geological Survey (USGS) support for a U.S. Army Corps of Engineers (USACE) effort known as the Sustainable Rivers Program (SRP) with a focus on performing the field science and monitoring needed to quantify ecosystem responses to effects of USACE reservoir operations.

The USGS is a world leader in the natural sciences. The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth, manage water and biological resources, and enhance and protect humanity's quality of life. "Water Resources" and "Ecosystems" are two of seven USGS mission areas. In support of these missions, USGS collects, monitors, analyzes, and provides science about natural resource conditions. The expertise of USGS enables scientific investigations that provide impartial information to resource managers and planners.

By many measures (e.g., number of reservoirs, total storage, geographic distribution), USACE is the largest water management organization in the nation. The USACE manages and operates approximately 50 dry dams, 310 multipurpose storage reservoirs, and 180 navigation-oriented lock and dams. The USACE is also steward to 12 million acres of land and water area and second only to the National Park Service in recreation days provided to visitors. Americans visit USACE lakes 360 million times each year and their recreation activities are enjoyed most in a healthy environment.

Sustainable Rivers Program. The SRP's mission is to improve the health and life of rivers by modifying existing USACE dam operations to restore and protect ecosystem benefits, while maintaining or enhancing authorized project benefits. The goal of SRP is to advance, implement, and incorporate environmental strategies at reservoirs.

Implementation of environmental flows is a key objective of SRP. Environmental flows are defined as the quantity, timing, and quality of water flows required to sustain ecosystems. For reservoir operators, environmental flows manifest as management decisions that manipulate water and land-water interactions to achieve ecological or environmental goals. The SRP process for environmental flows has three phases: "advance, implement, and incorporate". Advancing environmental flows involves engaging stakeholders in a science-based process to define the flow needs of riverine ecosystems. Implementation involves testing the effectiveness and feasibility of the defined flows. Incorporation involves including environmental flow strategies in reservoir operations policy such as water control manuals. Through this process, reservoir operations are altered such that the timing, duration and quantity of outflows support improved ecosystem condition.

As of 2019, SRP involved work on 66 USACE reservoirs in 16 river systems and 5,083 river miles. It is the largest scale and most comprehensive project for implementing environmental flows at USACE reservoirs.

SRP-Science. The SRP efforts have affected reservoir operations. The SRP has been less successful in supporting the monitoring needed to quantify ecosystem responses to reoperations, which limits communication of the SRP benefits. Through this work statement and other activities, SRP seeks to cultivate scientific understanding of 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

environmental 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.

Tracking implementation and ecological responses to environmental flows. Developing and implementing environmental flows and evaluating the resulting ecosystem changes involves: 1) defining an environmental flow prescription; 2) assessing the degree to which the prescription is implemented; 3) short-term monitoring of ecosystem responses to environmental flows; and 4) long-term monitoring of ecosystem status and trends that relate to environmental flows. At each stage of assessing and implementing an SRP project, monitoring and adaptive management can occur to improve results. To maximize the opportunity for adaptive management, monitoring plans are specific in terms of the connections between dam operations and the data being collected. Monitoring plans explicitly addresses spatial and temporal sampling configurations, statistical analytical approaches, reporting measures, and time frames for reporting.

Short-term experimentation and monitoring are designed to assess whether or not the implemented components of the flow prescription are resulting in the expected immediate and short-term geomorphic and biotic responses to specific components of flow. If expected environmental responses are not observed, or negative impacts to dam operations are occurring, revisions to environmental flow prescriptions and dam operations would be informed by those observations.

Long-term monitoring programs should be designed to track the status and trends (direction of change) in ecosystem condition in response to flow management. Like short-term monitoring, selection of specific indicators should be hypothesis-driven and flow-related. The strength of cause and effect links between river flows and ecosystem trends will depend on the selection of appropriate indicators that account for ecosystem responses to environmental flow implementation in the context of natural variation and regional trends. Long-term monitoring and reporting programs must integrate regular collaboration between scientists and dam operators to ensure the success of SRP projects. Environmental flows may need to evolve over time as reservoir operations adjust to anthropogenic or environmental factors.

Research needs and USGS role – Des Moines River

Goal and Objectives

The overarching objective of this research effort is to evaluate the operation of Red Rock Dam (RRD) within the context of environmental water management, which have been designed, in part, to provide benefits to fish communities. The activities discussed below will provide information regarding the response of fish habitat and communities to the operational

activities identified in the Des Moines River Monitoring and Adaptive Management Plan (DSMR MAMP), with the goal of evaluating whether or not the implemented operations are achieving the desired ecological goals for the DSMR system within the context of the SRP.

To this end, USGS will develop and implement a 2-year research program associated with the fisheries and fisheries habitat in the Des Moines River, with the goal of evaluating how fisheries resources respond to the operations of RRD. This data will be directly utilized in the adaptive management of dam operations and will be utilized in the continued development and refinement of the DSMR MAMP, facilitating achievement of the SRP goals for the Des Moines River. To achieve this goal, USGS will complete the following tasks:

Task 1: Compile and evaluate existing fisheries data on the Des Moines River to establish a baseline condition and as context for sampling efforts.

Task 2: Develop a draft Plan of Action to evaluate how dam operations influence fish communities. The draft Plan of Action will be provided to the USACE for review and comment. The draft Plan of Action will include:

a. Sampling locations to be utilized
b. Sampling methodology and metrics
c. Timing of sample collection (to encompass two field seasons in 2021 and 2022).
d. Proposed analytical approach
e. A summary providing relationship of data to dam operations

In order to develop the Plan of Action described in Task 2, USGS will review the environmental flows documentation for the DSMR and the conceptual draft of the DSMR MAMP. The Plan of Action should also:

a. Focus on metrics expected to respond quickly and significantly to the operations of RRD
b. Focus on metrics strongly affected primarily from environmental water management at RRD, rather than metrics likely to be more strongly influenced by other external factors.
c. Focus on metrics easily measured and interpreted in the context of environmental water management at RRD.

Task 3. Refine the draft Plan of Action, based on input from, and in collaboration with, the USACE. Prepare a final version of the Plan of Action.

Task 4. Implement the Plan of Action. Collaborate with the USACE during implementation to share preliminary data and refine the Plan of Action, as necessary, if issues or unforeseen challenges arise.

Task 5: Following completion of the sampling period described in the Plan of Action, provide the USACE a draft report summarizing the methods, analytical approaches, and results, with an analysis and narrative regarding how the data collected can help to inform dam operations in an ecological context. The draft report will be provided to the Corps for review.

Task 6: Refine the draft report, based input from, and in collaboration with, the USACE. Prepare a final version of the report.

USGS Cooperative Research Units - Educational Component

This work will be accomplished through a USGS Cooperative Fish and Wildlife Research Unit. Established in 1935, Cooperative Research Units provide graduate education opportunities and facilitate fisheries and wildlife research between natural resource agencies on topics of mutual concern. Staffed by USGS Federal personnel, Cooperative Research Units conduct research on renewable natural resource questions, participate in the education of graduate students, provide technical assistance and consultation on natural resource issues, and provide continuing education for natural resource professionals.

# DES MOINES RIVER
# MONITORING AND ADAPTIVE MANAGEMENT PLAN
# SUSTAINABLE RIVERS PROJECT

## APPENDIX C

## TEMPLATES AND EXAMPLES
## FOR MONITORING AND REPORTING
## LONG-TERM ECOSYSTEM TRENDS

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**INDICATOR X:**

**CONCEPTUAL LINK TO FLOW MANAGEMENT (REFER TO CONCEPTUAL MODEL):**

**MAJOR FACTORS INFLUENCING INDICATOR:**

**RESPONSE TIME AND OTHER FACTORS INFLUENCING INDICATOR:**

**METRIC TO BE USED TO EVALUATE RESPONSE INCLUDING SPATIAL EXTENT:**

**SAMPLING FREQUENCY:**

**EXAMPLE 1**

**INDICATOR 1:** % Change in area of native floodplain forest vegetation

**CONCEPTUAL LINK TO FLOW MANAGEMENT:** High flow pulses will allow germination of floodplain trees while low summer base flows will allow seedlings to become established (see ecological model in flow prescription report).

**MAJOR FACTORS INFLUENCING INDICATOR:** Structural constraints (Levees) to floodplain connectivity with river, implementation of flow prescription, deer browsing.

**RESPONSE TIME AND OTHER FACTORS INFLUENCING INDICATOR:** 5 years to achieve sufficient vegetation density for accurate satellite imagery assessment.

**METRIC TO BE USED TO EVALUATE RESPONSE INCLUDING SPATIAL EXTENT:** Change in area of dominant native vegetation in floodplains located laterally from 5 miles below dam to 38 miles below dam.

**SAMPLING FREQUENCY:** Every 5 years for on-the ground sampling (ground-truth imagery and evaluate species composition) and satellite imagery processing.

**EXAMPLE 2**

**INDICATOR 2:** % Change in density of riffle-spawning river main stem fish species

**CONCEPTUAL LINK TO FLOW MANAGEMENT:** Clean riffles provide necessary breeding habitats for riffle breeding fishes resulting in increased fish species densities (bottleneck has existed because of high embeddedness of riffle habitats due to lack of high flow pulses). (See ecological model in flow prescription report).

**MAJOR FACTORS INFLUENCING INDICATOR:** Sufficient force and duration of high flow pulses, sources of sediment.

**RESPONSE TIME AND OTHER FACTORS INFLUENCING INDICATOR:** 1 year for recruitment, 3 years to use standard adult fish sampling techniques.

**METRIC TO BE USED TO EVALUATE RESPONSE INCLUDING SPATIAL EXTENT:** Change in densities of adult age classes of 2 riffle-breeding fish species over time.

**SAMPLING FREQUENCY:** Every 3 years

**EXAMPLE 3**

**INDICATOR 3:** % Change in Osprey reproduction

**CONCEPTUAL LINK TO FLOW MANAGEMENT:** More successful breeding because of increase in prey (fish) populations as a result of repeated high flow pulses that provide access to floodplain habitat and improvements of riffle habitat for fish reproduction/rearing. (See ecological model in flow prescription report).

**MAJOR FACTORS INFLUENCING INDICATOR:** fish productivity, changes in nesting habitat

**EXPECTED RESPONSE AND RESPONSE TIME:** Increased osprey reproduction within 3 years

**METRIC TO BE USED TO EVALUATE RESPONSE INCLUDING SPATIAL EXTENT:** Change in number/density of breeding pairs over time from river mile 5 to 38.

**SAMPLING FREQUENCY:** Every 3 years

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**REPORTING SITE-LEVEL RESULTS FOR PROGRAMMATIC ROLL-UP**

**Reporting year:**

**Site name:**

**Number of dams engaged in SRP:**

**Stage of environmental flow development or implementation:**

**Projected/actual scope of benefit:**

**ESA Listed species benefiting from flow management:**

**Scope of critical habitat benefiting from flow management:**

**Environmental flow prescription component implemented:**

**Degree to which environmental flow prescription was implemented:**

**Types and degrees of ecosystem responses documented:**

**EXAMPLE**

**REPORTING SITE-LEVEL RESULTS FOR PROGRAMMATIC ROLL-UP**

**Reporting Year:** 2011

**Site name:** Orange River

**Number of dams engaged in SRP:** 1

**Stage of environmental flow development or implementation:** Validating/Adapting Environmental Flows

**Projected/actual scope of benefit:** 60 miles of river habitat, 15,250 acres of floodplain habitat

**ESA Listed species benefiting from flow management:** None

**Scope of critical habitat benefiting from flow management:** None

**Environmental flow prescription component implemented:** Floods, High flows, Low flows

**Degree to which environmental flow prescription was implemented:** Floods (100%), High flows (25%), Low flows (50%).

**Types and degrees of ecosystem responses documented:** Spawning habitat for salmon was improved through removing silt from gravel habitat from flood and high flow events, dewatering of active redds was avoided through maintaining minimum flows during low flow periods. Adult Chinook salmon densities have increased 15% in 5 years as a result of implementing comprehensive flow prescription. Native floodplain vegetation is establishing in larger areas due to comprehensive flow prescription. Exotic riparian vegetation species are decreasing in density and distribution due to floods (physical removal).