CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

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US Army Corps of Engineers®
Rock Island District

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IOWA RIVER, CORALVILLE LAKE

Executive Summary

The Coralville dam was constructed by the U.S. Army Corps of Engineers (Corps), Rock Island District (District), on the Iowa River upstream of Iowa City in 1958. Since construction, the Coralville Reservoir has prevented flood damages along the Iowa and Mississippi Rivers and continues to provide a reliable source of water to maintain minimum conservation releases on the Iowa River during periods of drought. The completion of the dam has also provided fish and wildlife benefits and continues to offer valuable recreation opportunities in and around the lake.

Although the construction of the Coralville dam created the reservoir, it is important to note that the reservoir is commonly referred to as Coralville Lake by the public. For the purpose of this Study, language throughout may utilize "reservoir" or "lake" in its context, but either is in reference to Coralville Lake. Furthermore, the dam itself was the original Corps Project and shall be referred to throughout this Study as Coralville Dam rather than Project.

Coralville Dam was a congressionally-authorized Civil Works project in 1938 (Figure ES-1). The dam is located in the Iowa-Cedar Rivers Basin, a tributary to the Mississippi River. The dam is on the Iowa River, 83.3 miles above its mouth and 5 miles upstream of Iowa City (City). The dam and lake are primarily in Johnson County with portions extending upstream into Linn and Iowa Counties. The Cedar River is the largest tributary within the basin and joins the Iowa River downstream of the dam. The Coralville Dam's authorized purposes are to provide primary benefits in flood risk management (FRM) and low flow augmentation along the Iowa and Mississippi Rivers and secondary benefits for fish and wildlife management and recreation.

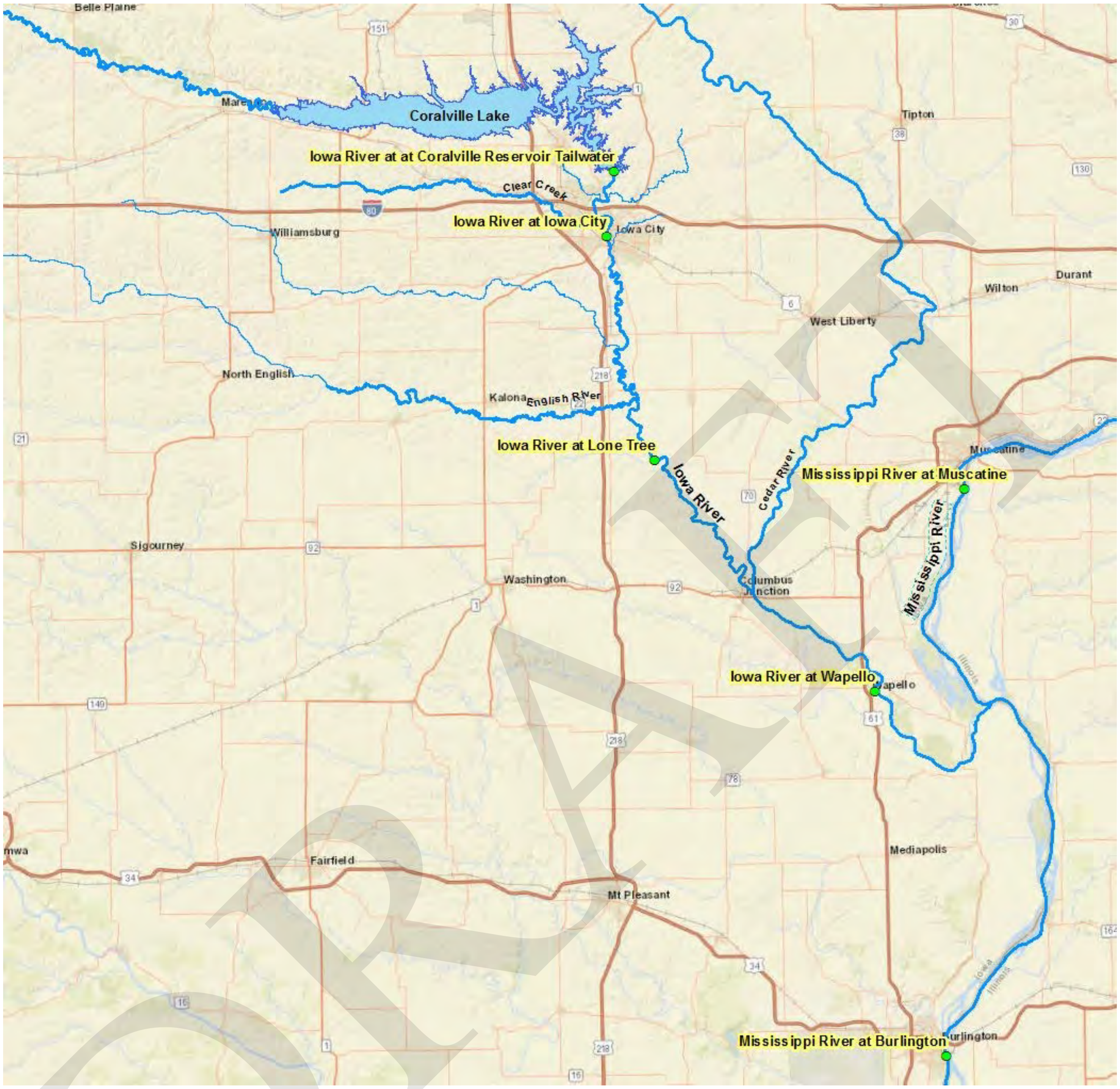

Figure ES-1. Iowa River Location Map, Extending Upstream of Coralville Lake to Burlington, IA on the Mississippi River

The current Coralville Lake Water Control Plan (WCP) and Manual was last revised in January 2001. Reservoir water control plans document operational parameters defining how and when water is stored and released. These parameters include a schedule of releases, conservation pool levels to be maintained during non-flood or drought conditions, and downstream water level constraints. Anytime WCPs are updated, the water control manual which includes historical and other pertinent information including the WCP is also updated as required by Engineering Regulation 1110-2-240, *Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors.*

The following issues were considered while formulating alternatives for the study. The primary purpose and need for the WCP update and are individually discussed in subsequent paragraphs:

1. The Iowa River has experienced a significant increase in the magnitude and frequency of flooding.

2. Sedimentation within the reservoir has negatively impacted available conservation storage capacity reducing the reliability to meet minimum conservation releases during periods of drought.

3. Changes in land use and FRM infrastructure that affect the nature and start of impacts (e.g., levees within the City of Coralville, changes to Dubuque Street, etc.) have occurred downstream of Coralville Lake.

The purpose of the Study is to update the Coralville Lake WCP to better meet mission objectives based on changes in flood frequencies, land use, and reservoir sedimentation. The District completed this feasibility report with an integrated environmental assessment to present a detailed account of the planning, regulatory and environmental considerations resulting in a Tentatively Selected Plan (TSP). When approved, the TSP will be incorporated and subsequently lead to a revised Coralville Lake Water Control Manual for FRM from Coralville Lake throughout the Iowa-Cedar Rivers Basin. The Iowa-Cedar Rivers Basin has experienced significant land use changes. These changes influence runoff rates into the main stem Iowa River and its tributaries, resulting in increased flood risk within the Iowa-Cedar Rivers Basin. Following the 2008 Iowa River flood, the District re-evaluated regulated flow frequencies on the Iowa River.

During the planning process, alternatives were developed by the planning team with input from stakeholders and the public to address increased flood risk. Alternatives were evaluated on whether they enhanced, maintained and/or reduced the ability to meet goals and objectives of the Coralville Feasibility Study (Study). Screening criteria included FRM (primary study authorization), fish and wildlife, recreation, and other stakeholder interests such as water releases from Coralville Lake.

There were eight major alternatives considered during this study along with five variations of some of the alternatives including the No Action Alternative (current WCP). The planning team did not specifically name each alternative; they are simply referred to as Alternatives 1-8. Each Alternative is outlined below:

- **Alternative 1. No Action**, a continuation of the current regulation procedures.

- **Alternative 2.** This alternative incorporates elements of recent deviations (2018, 2019, and 2020) that includes a 10,000 cfs year-round maximum release during normal flood operations, tiered and elevated downstream constraints with variable minimum releases, altered dates for seasonal downstream constraints and a modified major flood operation schedule eliminating induced surcharge operation.

- **Alternative 2A:** Alternative 2A includes all the modifications in Alternative 2 and elimination of the current spring drawdown.

- **Alternative 2B.** Alternative 2B includes all the modifications of Alternative 2 are followed except that tiered growing season constraints are held through the entire year.

- **Alternative 2C:** Alternative 2C includes all the modifications of Alternative 2 except that non-growing season constraints are held through the entire year.

- **Alternative 3.** This alternative is a Maximum Release plan that provides for increasing outflows in relation to all alternatives considered only constrained by outlet capacity.

- **Alternative 3A.** This alternative incorporates the same changes as Alternative 3 except that this is a dry reservoir scenario with no conservation pool with the exception of holding back flood water when inflow exceeds outlet capacity.

- **Alternative 4:** This is another variation of Alternative 2 but includes elevation based growing season releases to reduce downstream impacts when reservoir water levels are in the lower portion of the Flood Control Pool.

- **Alternative 4A:** Alternative 4A is the same as Alternative 4 but with a provision to maintain the maximum non-growing season release if the reservoir pool is above elevation 700 on May 1.

- **Alternative 5.** This alternative is similar to Alternative 2 except that the maximum-growing release is less aggressive and limited to 8,000 cfs along with altered dates for growing vs. non-growing season downstream constraints and releases.

- **Alternative 6:** This alternative is a stakeholder alternative provided by the Johnson County Homeland Security and Emergency Management Agency. Changes from the current WCP include a slightly reduced summer conservation pool level, an increase in the maximum growing season release, elimination of constraints at Lone Tree and Burlington, altered start date for growing season, and an altered Large Magnitude Flood Schedule beginning earlier.

- **Alternative 7:** Alternative 7 is a stakeholder alternative provided by the Two Rivers Levee and Drainage District. Changes from the current WCP include a slightly reduced summer conservation pool level, the reservoir release is only constrained by the capacity of the outlet up to 16,500 cfs, elimination of the constraint at Lone Tree, and increases in the constraints at Wapello and Burlington.

- **Alternative 8:** Alternative 8 is similar to Alternative 4 with the maximum growing season release based on whether the flood pool is above or below elevation 700 feet (85,000 cfs. vs. 10,000 cfs), a modified Large Magnitude Flood Schedule, and the same downstream constraints throughout the entire year (18.5 feet at Lone Tree and 25 feet at Wapello).

Each alternative is presented and discussed in more detail in Chapters III and IV.

Final criteria used to select the TSP were based on which alternative reduced economic flood damages the most and was compatible with meeting other Study objectives. Initial screening of the alternatives was accomplished using performance metrics representing reservoir and river conditions related to thresholds of significant operational change (e.g., activation of the emergency spillway) or significant changes in the nature and consequences of flooding. In addition, the alternatives were screened giving consideration to the acceptability, effectiveness, efficiency, and completeness of each alternative. After initial screening of the alternatives, four alternatives were chosen for detailed hydrologic and economic analysis: Alternative 1, *No Action*, Alternative 2C, Alternative 5, and Alternative 8.

Tables ES-1 and ES-2 show the results of the economic analysis for the total period of record 1919–2019 and an abbreviated wetter period from 1959–2019 which is considered to be more representative of recent hydrologic conditions. Under both the full period of record analysis and the abbreviated wetter period, Alternative 2C provided greater flood damage reduction benefits than either Alternative

1, Alternative 5, or Alternative 8. Additionally, of the screened plans, the greater maximum allowable release provided for in Alternative 2C offers the greatest flexibility to meet potential upward trends in future precipitation and streamflow.

Based on the economic analysis and resulting damage summary, Alternative 2C is the TSP for updating the current Coralville Lake WCP. Figure ES-2 provides a summary of the TSP.

Throughout the planning process, the District engaged stakeholders across the study area and incorporated concerns and feedback provided. Although certain communities and stakeholders had initial concerns, the District addressed these through a series of public meetings and presentations. The District does not anticipate that the TSP will be controversial in nature as local emergency managers, the Iowa Department of Natural Resources, city and county governments, and Non-governmental Organizations have been active Study partners through the National Environmental Policy Act process. The TSP requires no construction, operational, or implementation costs.

Table ES-1. Flood Damages Comparison Full Period of Record for No-Action (Alternative 1) vs Alternatives 2C, 5, and Alternative 8, (1919-2019)

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
AVERAGE ANNUAL DAMAGES						
Alternative 1	$270,000	$103,000	$976,000	$434,000	$999,000	$2,782,000
Alternative 2C	$160,000	$65,000	$857,000	$498,000	$998,000	$2,578,000
Alternative 5	$185,000	$77,000	$874,000	$495,000	$1,016,000	$2,647,000
Alternative 8	$180,000	$67,000	$870,000	$495,000	$999,000	$2,611,000
AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	$99,000	$38,000	$119,000	($64,000)	$1,000	$193,000
Alternative 5	$76,000	$26,000	$102,000	($61,000)	($17,000)	$126,000
Alternative 8	$80,000	$36,000	$106,000	($61,000)	-	$161,000
PERCENTAGE AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	69%	58%	14%	-13%	0%	7.91%
Alternative 5	46%	34%	12%	-12%	-2%	5.10%
Alternative 8	50%	54%	12%	-12%	0%	6.55%

Table ES-2. Flood Damages Comparison Partial Period of Record for No-Action (Alternative 1) vs Alternatives 2C, 5, and Alternative 8, (1959-2019)

Period 1959-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
AVERAGE ANNUAL DAMAGES						
Alternative 1	$282,000	$148,000	$1,840,000	$587,000	$1,389,000	$4,246,000
Alternative 2C	$205,000	$110,000	$1,560,000	$659,000	$1,413,000	$3,947,000
Alternative 5	$255,000	$122,000	$1,589,000	$610,000	$1,434,000	$4,010,000
Alternative 8	$209,000	$120,000	$1,570,000	$643,000	$1,419,000	$3,961,000
AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	$77,000	$38,000	$280,000	($72,000)	($24,000)	$299,000
Alternative 5	$27,000	$26,000	$251,000	($23,000)	($45,000)	$236,000
Alternative 8	$73,000	$28,000	$270,000	($56,000)	($30,000)	$285,000
PERCENTAGE AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	38%	35%	18%	-11%	-2%	7.58%
Alternative 5	11%	21%	16%	-4%	-3%	5.89%
Alternative 8	35%	23%	17%	-9%	-2%	7.20%

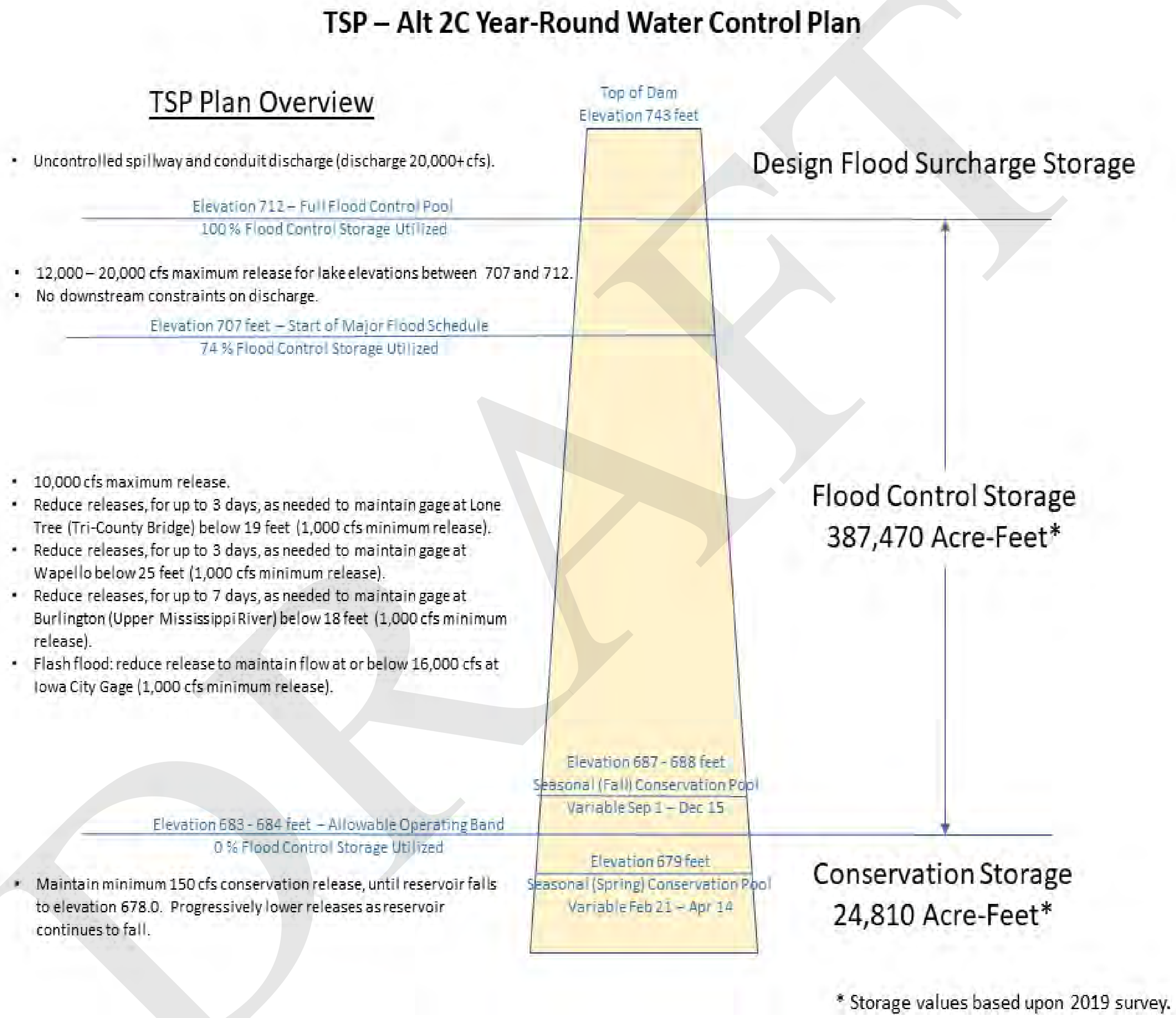

Figure ES-2. Coralville Lake Water Control Plan – TSP (Alternative 2C)

CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

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FINDING OF NO SIGNIFICANT IMPACT

APPENDICES

ACRONYMS

Acronym	Definition
AAD	Average Annual Damages
ACE	Annual Chance Exceedance
ACS	American Community Survey
APE	Area of Potential Effect
BCSD	Bias Corrected Spatial Downscaling
CCB	County Conservation Board
CEQ	Council of Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO_2	Carbon Dioxide
CWA	Clean Water Act
CWMS	Corps Water Management System
DO	Dissolved Oxygen
EA	Environmental Assessment
ECB	Engineering and Construction Bulletin
EO	Executive Order
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Environmentally Sensitive Area
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFS	Flood Frequency Study
FIRM	Flood Insurance Rate Map
FRM	Flood Risk Management
FSST	Flandreau Santee Sioux Tribe
FWCA	Fish and Wildlife Coordination Act
FWS	Fish and Wildlife Services
FY	Fiscal Year
GCM	Global Climate Model
GHG	Greenhouse Gas
HA	Hydrologic Alteration
HAZUS	Hazards United States
HEC	Hydrologic Engineering Center
HEC-FIA	Flood Impact Analysis Software
HEC-RAS	River Analysis System Software
HEC-ResSim	Reservoir Simulator Software
HEC-SSP	Statistical Software Package Software
HPMP	Historic Property Management Plan
HTRW	Hazardous Toxic and Radioactive Waste
HUC	Hydrologic Unit Code
IBA	Important Bird and Biodiversity Area
IDALS	Iowa Department of Agriculture and Land Stewardship
Iowa DNR	Iowa Department of Natural Resources
IIHR	Iowa Institute of Hydraulic Research

Acronym	**Definition**
IPaC	Information, Planning, and Conservation
ISU	Iowa State University
IWR	Institute for Water Resources
LiDAR	Light Detection and Ranging
LMF	Large Magnitude Flood
MBTA	Migratory Bird Treaty Act
MMC	Mapping, Modeling, and Consequences
MOA	Memorandum of Agreement
MRES	Missouri River Energy Services
MSA	Metropolitan Statistical Area
MSIM	Multiple Species Inventory Monitoring
MVD	Mississippi Valley Division
MVR	Mississippi Valley, Rock Island District
NASS	National Agricultural Statistics Service
NATA	National-Scale Air Toxics Assessment
NEPA	National Environmental Policy Act
NFHL	National Flood Hazard Layer
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NRHP	National Register of Historic Places
NRI	National Rivers Inventory
NSI	National Structure Inventory
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
OMP	Operational Management Plan
PCB	Polychlorinated biohenyl
RCRA	Resource Conservation and Recovery Act
RMC	Risk Management Center
ROI	Region of Influence
SHPO	State Historic Preservation Office
SRP	Sustainable Rivers Project
THPO	Tribal Historic Preservation Officer
TNC	The Nature Conservancy
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCP	Water Control Plan
WMA	Wildlife Management Area

CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER & CORALVILLE LAKE

CHAPTER I: PURPOSE AND NEED FOR FEDERAL ACTION

A. INTRODUCTION

The *Coralville Lake Water Control Plan Feasibility Study* (Study) is a re-evaluation and update to the Water Control Plan (WCP) for Coralville Lake located within the Iowa-Cedar Rivers Basin. Although the construction of the Coralville Dam created the reservoir, it is important to note that the reservoir is commonly referred to as Coralville Lake by the public. For the purpose of this Study, language throughout may utilize “reservoir” or “lake” in its context, but either is in reference to Coralville Lake. Furthermore, the dam itself was the original Corps Project and shall be referred to throughout this Study as Coralville Dam rather than Project.

This Study is important, especially since the water control plan and manual were last updated in January 2001. The WCP presents operational parameters defining how and when water is stored and released. These include a schedule of releases, conservation pool levels to be maintained during non-flood or drought conditions, and downstream water level constraints. The Coralville Reservoir is authorized for FRM, low flow augmentation, fish, and wildlife management as well as recreation, although the lake is not regulated specifically for these latter purposes. This Study does not involve any modifications to the dam structures themselves, but rather is evaluating how to best manage water using the existing Coralville Dam. As such, the Study also does not propose any new construction or modification of the dam and levee structures (including the remedial works) previously constructed. Additionally, there is no anticipated cost for the Study outcome or TSP implementation.

The Study area encompasses the Iowa-Cedar Rivers Basin (Figure 1), a tributary to the Mississippi River. The Iowa-Cedar Rivers Basin is 12,640 square miles and begins in north central Iowa and southeastern Minnesota and extends south/southeast across central and southeastern Iowa. The Iowa River is approximately 323 miles long and joins the Mississippi River across from New Boston, Illinois. The U.S. Army Corps of Engineers (Corps), Rock Island District (District) impounded the Iowa River by a congressionally authorized Civil Works project, Coralville Dam (authorized in 1938). The authorized purposes included flood control and water conservation for the Iowa and Mississippi Rivers by Public Law 75-761 and recreation and fish and wildlife enhancement by Public Law 78-534 and by Public Law 94-587. The feasibility study scope will maintain the existing authorized purposes and priorities. Downstream of the dam are thousands of acres of agricultural land, wildlife habitat, and a number of cities and small towns.

This feasibility report with an integrated environmental assessment documents the Study process and results including an account of the planning, regulatory, and environmental considerations that could result in would changes to the current WCP/manual. The Commander of the Mississippi Valley Division, U.S. Army Corps of Engineers, has the authority to approve proposed changes.

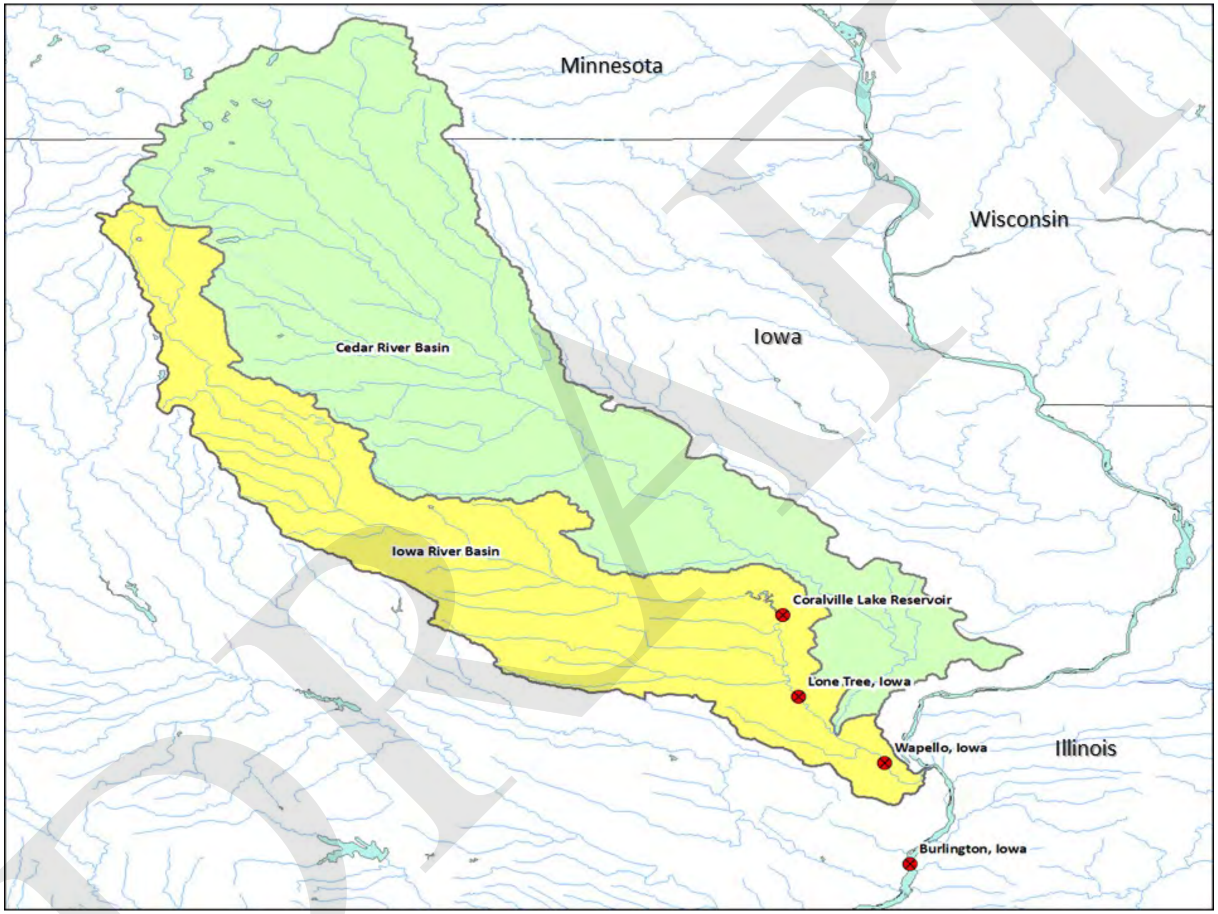

Figure 1. Overview Map of the Iowa-Cedar Rivers Basin

B. PURPOSE AND NEED

The overall plan for FRM for the Coralville Lake is to implement a regulation plan with due regard to various constraints to provide a part of the comprehensive scheme for conservation and FRM in the Iowa River and the Upper Mississippi River Basins. Other components of the overall plan for water control in the Iowa-Cedar Rivers Basin are the Lake Macbride Remedial Works and the Amana, Iowa, Remedial Works. For conservation storage, the plan of regulation is to provide a minimum low-flow in the Iowa River (150 cfs) downstream of Coralville Lake during periods of low flow and droughts.

The FRM objective of the current WCP for Coralville Lake is to manage water levels at the downstream control points at Lone Tree and Wapello, Iowa, on the Iowa River and Burlington, Iowa, on the Mississippi River in order to minimize the frequency and duration of damaging flows, as described in the following paragraphs of this section of the report.

The Iowa-Cedar Rivers Basin has experienced significant land use changes in the last century, from a prairie and forested landscape. Although there have been pockets of urbanization in Iowa City and the Coralville area, in general the basin remains largely agricultural. These changes influence runoff rates of the main stem Iowa River and its tributaries, resulting in increased flood risk within the Iowa-Cedar Rivers Basin.

Changing weather patterns have also increased the susceptibility of the environment and flood risk along the Iowa River. These factors resulted in a changed environment from which the District must try to manage water levels along the Iowa River for the stated purposes of FRM, low flow augmentation, fish and wildlife management, and recreation.

As mentioned above, the Water Control Manual was last updated in January 2001. Guidance contained in Engineering Regulation (ER) 1110-2-240, *Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors,* recommends WCPs and manuals be reviewed every 8 years for potential updates. The need for the Study arises from changes over time to hydrologic loading, land use, and reservoir sedimentation.

Alterations to the existing WCP will be considered in the context of their effect on human life and the environment within the constraints of the authorized missions of the reservoir. Any scenarios that cause additional overall system risk will not be further considered.

Following the 2008 Iowa River flood, the District received funding to re-evaluate regulated flow frequencies on the Iowa River to improve the characterization of flood risk, update the reservoir pool-frequency relationships and update the flow frequency values downstream of the District reservoirs, henceforth referred to as the Regulated Flow Frequency Study (FFS).

The Iowa River FFS, completed in October 2009, concluded the frequency of flooding on the Iowa River increased and indicated flood events like 1993 and 2008 are more likely to occur in the future than previously estimated. While there may be many underlying reasons why river flows and flooding have increased (e.g., changes in land use, increased precipitation), the Study was not designed or conducted to define the cause(s). The scope of the Study was to examine river and reservoir data and project future flood probabilities. The Study findings clearly indicate flooding is more frequent than previously estimated. Thus, floodplains adjacent to the Iowa River and some areas once thought to be outside of the floodplain or protected by flood-risk-management projects have a greater risk of flooding than was previously estimated.

Considering the results of the FFS, a study to update the WCP for Coralville Lake was proposed. The District recognized the need to comprehensively study and evaluate alternatives related to management of the reservoir.

Some of the alternatives that were considered included modifying downstream constraints, modifying the normal seasonal release schedules, and modifying the Large Magnitude Flood (LMF)schedule. It is the District's priority to develop feasible alternatives to reduce the risk of flooding along the Iowa and Mississippi Rivers.

C. DECISION

The District update has studied the WCP for Coralville Lake. The District identified alternative water control strategies that improve the Coralville Dam's ability to meet the congressionally authorized purposes, including reducing future flood risk and maintaining public safety. While it is impossible to eliminate all flood risk, the goal of this Study is to modify the WCP to better manage the reservoir to meet the Coralville Dam's authorized purposes based on current hydrologic conditions. As discussed above, the Study proposes no new construction.

The TSP developed in this Study will serve as the basis for updating the WCP for Coralville Dam. The WCP is a separate document that will be written after the recommendations of this report are approved.

D. AUTHORITY

Coralville Lake was authorized for flood control and conservation by Congress in the Flood Control Act of 28 June 1938. Recreation facility authorization started with Section 4 of the Flood Control Act of 22 December 1944 and continued under Section 111 of the Water Resources Development Act of 1976. Management for fish and wildlife was authorized as part of the 1958 Fish and Wildlife Coordination Act (Public Law No. 624, 85th Congress). The Iowa and Mississippi Rivers primary authorized purpose was originally flood control, but was semantically changed to FRM. Other purposes included low flow augmentation for water quality, fish and wildlife management, and recreation. It should be noted that while access and facilities are provided for recreation, water is not managed for these latter purposes.

ER 1110-2-240 and ER 1110-2-8156, *Preparation of Water Control Manuals,* apply to Corps actions in developing WCPs or in operating non-Corps reservoirs, locks, dams, and other water control projects in which storage is operated and managed for flood control and navigation and subject to Corps direction pursuant to Section 7 of the Flood Control Act of 1944 or other laws. These policies may also provide guidance in other cases where water resources infrastructure is similarly operated for flood control or navigation and subject to Corps direction through the establishment of water control or operational plans.

ER 1110-2-240 requires reservoirs and inter-related water resources systems to have an up-to-date Water Control Manual. The WCPs contained in the manuals must be prepared to consider all applicable Congressional Acts relating to operation of Federal facilities, i.e., Fish and Wildlife Coordination Act (FWCA), National Environmental Policy Act (NEPA), the Clean Water Act (CWA).

Policy Guidance Letter dated 2 July 2013 states updates to Water Control Manuals would generally be categorized as "other work products" and requires compliance with Engineering Circular 1165-2-217 *Civil Works Review Policy*.

ER 1110-2-8156 provides guidance on the content and format of Water Control Manuals with additional guidance in Engineering Manual 1110-2-3600, *Management of Water Control Systems*. Additional guidance on WCP development can be found in ER 1105-2-100, *Planning Guidance Notebook* and
ER 1165-2-119, *Modifications to Completed Projects*.

E. SCOPING AND SIGNIFICANT ISSUES

The scope of this Study was carefully considered by the planning team and developed within the Principles & Guidelines and NEPA requirements. The scoping process consisted of facilitating all of the necessary steps to re-evaluate and update the WCP for Coralville Lake on the Iowa River, including all regulated waters within and below Coralville Lake. Early in the planning process, the following scoping items were identified and were evaluated during the planning study:

- Maximizing flood risk management (FRM) benefits of the reservoir
- Evaluating downstream control points to identify when significant flood damages begin.
- Assessing frequency of flooding impacts to flowage easement lands at Coralville Lake
- Minimizing flood damage to marinas and Corps facilities
- Providing adequate releases for water quality
- Evaluating impacts to industry & municipality vs. agricultural
- Evaluating cost/benefit of alternatives (i.e. review/update Damages Prevented analytic model)
- Seeking opportunities to improve ecological/environmental benefits within the watershed related to Iowa River water management.
- Minimizing negative ecological impacts of flow regulation.
- Maximizing positive impacts on reservoir and downstream water quality
- Maximizing all additional authorized Coralville Dam purposes within FRM constraints to include safe public recreation opportunities and environmental stewardship
- Evaluating benefit of reservoir operations for fish and wildlife benefit
- Assessing impacts of historic and future reservoir sedimentation.
- Reducing impacts to riverbank and lake shoreline erosion/sloughing
- Minimizing impacts of Large Magnitude Flood events
- Identifying potential partnering/coordination opportunities to support sound land/water management and watershed budgeting initiatives

- Identifying cost/benefit of additional water level monitoring equipment/process

- Evaluating the need for additional gauge locations for evaluating inflow and outflow stages

To ensure coordination with potential modifications to the Coralville Lake WCP, the District solicited input from the public, local emergency management, state, county and Federal agencies, and tribal nations. Public meetings and multiple agency meetings were held to gather valuable input for the scope of the Study. In preparation for the public scoping meetings, the planning team developed the following potential topics of discussion for participants; however, participants were not limited to the examples provided:

- How, and under what conditions, participants are impacted by water levels (either flood or drought) along the Iowa River.

- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River.

- Environmental concerns, comments or observations related to reservoir operations or Iowa River flows.

- Regarding the way water is managed at Coralville Lake, recommendations on problems and/or opportunities that should be evaluated as part of the Study.

- Alternatives or actions you believe should be evaluated as part of the Study.

The District held four separate public meetings that had significant turnout for public participation. The first public meeting was held in Wapello on February 26, 2019 and the second public meeting was held the next day in Iowa City on February 27, 2019. The third public meeting was held in Marengo on April 2, 2019 and the fourth public meeting was held in Amana on April 15, 2019. The public meetings were an important element to the scoping process and the District was able to gain valuable input and feedback from the public participation.

In addition to public meetings, there were also separate stakeholder engagement meetings to guide the planning team in the scoping process.

In addition to scoping, significant physical and regulatory issues that have priority over recreation with regard to regulation of the Coralville Dam exist for the Study. These include FRM, low-flow augmentation, and fish and wildlife management in Coralville Lake and Dam. While recreation is an authorized purpose and provides important benefits and opportunities, water is not regulated for the purpose of recreation.

The current approved plan of regulation considers several constraints regarding downstream channel capacity including flooding in Iowa City and Coralville vicinity, looking upstream of Coralville Dam and Reservoir, and minimum low-flow requirements.

F. PROBLEMS AND OPPORTUNITIES

Land-use changes have altered the landscape within the Iowa-Cedar Rivers Basin over the past few centuries, and climate variations and land management have resulted in changes to the hydrologic regime (hydrology) of the basin. As the basin environment responded to and changed over time through both natural and man-made forces, floods increased in frequency and magnitude. Consequently, water level management has become increasingly challenging. Increased flood risk, significant changes in land use, sedimentation, and ecosystem degradation are all factors that impact the hydrology within the Iowa-Cedar Rivers Basin.

Problem 1. Flood Risk Management. Over time, changes in precipitation and runoff in the Iowa-Cedar Rivers Basin led to changes in the magnitude and frequency of flooding. Historic flooding in 1993, 2008, 2013 resulted in widespread flood damages along the Iowa and Upper Mississippi Rivers.

Opportunity 1.1. *Seek opportunities to improve recreational activities consistent with reservoir operating objectives of FRM, low-flow augmentation and fish and wildlife management.* The reservoir's primary operational authorities are FRM, low flow augmentation, and fish and wildlife management which also provide recreational opportunities even though the lake is not specifically regulated for this purpose. However, flood events sometimes result in inundation of recreational areas. By more effectively managing flows and storage at the reservoir, the District could potentially reduce flooding impacts to recreational facilities.

Problem 2. Increased Runoff due to Land Use. Changes in land use have increased runoff rates into the Iowa River. Land use changes include loss of native ground cover (prairies and woodland habitat), increased urbanization, and changes in agricultural practices and tiling.

Problem 3. Sedimentation. Sedimentation was anticipated and included in the development of the WCP for the reservoir study. Landscape and hydrologic changes within the watershed have increased the delivery rate of sediment to the reservoir. In addition, sedimentation affects recreational activities including hunting access and operation of motorized watercraft in the upper reaches of Coralville Lake.

G. GOALS AND OBJECTIVES

The District, with input from the public, emergency management agencies, state, county and Federal agencies, and tribal nations, developed the following Study goals and objectives during the scoping process.

Goal 1. *Reduce Future Flood Risk along the Iowa and Upper Mississippi Rivers*

Objective 1a. Modifications to the WCP to better manage the observed, higher inflow volumes due to increased run off.

Objective 1b. Reduce risks to life, health, and safety of residents due to flooding events along the Iowa and Upper Mississippi Rivers.

Objective 1c. Reduce future flood risk to critical infrastructure, commercial, residential, and agricultural areas along the Iowa and Upper Mississippi Rivers.

Objective 1d. Maintain communication mechanisms to ensure populations at risk have access to timely and relevant information on impending water levels.

Objective 1e. Coordinate with local urban entities to ensure maximum flood risk mitigation and minimal contribution to degraded hydrological conditions.

Goal 2: *Improve low flow augmentation reliability*

Objective 2a. Maintain conservation flows to meet ecological, habitat, and municipal water supply needs downstream.

Goal 3: ***Promote Fish and Wildlife Sustainability***

Objective 3a. Implement practices that may reduce nitrate levels and /or improve water quality.

Objective 3b. Implement practices that may reduce mussel mortality.

Objective 3c. Implement practices that may reduce sturgeon mortality.

Objective 3d. Implement practices that may improve conditions for migrating waterfowl and shorebirds.

Objective 3e. Implement practices that may improve conditions for reptiles and amphibians.

Objective 3f. Preserve aquatic and terrestrial habitats and connectivity for flora and fauna during migration periods.

Goal 4: ***Promote Enhancement of Recreational Features***

Objective 4a. Sustain the availability of water-based recreational features at Coralville Lake within the parameters of other missions.

Objective 4b. When possible, reduce the potential of financial impacts to recreational interests as a result of water level fluctuations.

Goal 5: ***Accommodate Other Stakeholder Interests***

Objective 5a. When possible, reduce rate of release changes to reduce potential river and lake shore erosion.

H. PLANNING CONSTRAINTS

Sections F & G above outlined several Problems and Objectives in addition to Flood Risk Management for Coralville Lake. Like all planning efforts, there are both planning and resource constraints that create obstacles to successfully achieve every planning goal. The objective of this study is to find the best alternative that can be recommended as a Tentatively Selected Plan for updating the Coralville Lake Water Control Plan to better meet mission objectives. However, at the same time, USACE is constrained by the project authorizations for the Coralville dam and reservoir. IN other words, there can be no elimination of existing project purposes or new purposes that would require congressional authorization. Any goals or objectives identified that would require congressional authorization would be considered for future study under non-O&M funds. Currently, this study is funded provision to maintain the maximum non-growing season release if the reservoir pool is above elevation 700 on May 1 by Operation & Maintenance funding and therefore is limited by this resource constraint.

I. RELATED NEPA DOCUMENTATION AND OTHER STUDIES

Many reports and studies have been published about Coralville and the Iowa River, with the most relevant listed below

Coralville Lake

1. Pool Raise and Release Rate Studies

Regulation Plan Study - Plan 7 of Coralville Reservoir Operation, approved August 2, 1954. This was the first operating plan for the Study. Under this plan, maximum outflow was 10,000 cubic feet per second (cfs) during the non-growing season and 8,500 cfs during the growing season.

Regulation Plan Study - Plan 8 of Coralville Reservoir Operation. This plan was approved April 10, 1963 and included changes to Plan 7 to provide for non-growing season of 10,000 cfs; a transition period between April 21 and May 1, with releases between 6,000 and 10,000 cfs dependent on the reservoir elevation on April 21; and a growing season release rate of between 4,000 and 6,000 cfs dependent on the reservoir elevation on May 1.

Water Levels of the Coralville Reservoir, Iowa; Report to the Committee on Appropriation, House of Representatives. Prepared by the Corps of Engineers in Response to House of Representatives Report No. 1459, dated June 14, 1968, 90th Congress, 2nd Session, submitted April 8, 1969.

Flood Damages on the Iowa River, 1976, Thomas E. Crowley, III, Faze Krim and Rosa Chen, Iowa Institute of Hydraulic Research, Iowa City, located in the University of Iowa Library.

Stochastic Trade-Offs for Reservoir Operation, 1977, Thomas E. Crowley, III and Rosa Chen, Iowa Institute of Hydraulic Research, Iowa, located in the University of Iowa Library.

Iowa-Cedar River Basin, Coralville Lake Effects in the Lower Iowa River Valley, October 1978. Special Information Report, U.S. Army Corps of Engineers, Rock Island District.

2. Regulated Flow Frequency Study

Iowa River Regulated Flow Frequency Study, U.S. Army Corps of Engineers, Rock Island District, October 2009.

3. Original Design Documentation

Revised Definite Project Report, Appendix I Hydrology, Coralville Reservoir, Rock Island District Army Corps of Engineers, April 1, 1948

Revised Definite Project Report, Appendix XIII Plates, Coralville Reservoir, Rock Island District Army Corps of Engineers, April 1, 1948.

4. Historical Regulation and Operation & Maintenance Manuals

Coralville Reservoir, Iowa River, Iowa, Regulation Manual, dated April 30, 1951, Rock Island District, U.S. Army Corps of Engineers, and supplement thereto dated February 1, 1961.

Upper Mississippi River Basin, Iowa River, Iowa, Master Reservoir Regulation Manual, Coralville Lake 1959, revised January 31, 1991, U.S. Army Corps of Engineers, Rock Island District.

Water Control Plan with Final Supplemental Environmental Impact Statement, Coralville Reservoir, Iowa, November 1991, U.S. Army Corps of Engineers, Rock Island District.

Appendix A Master Reservoir Regulation Manual Drought Contingency Plan, October 1996, U.S. Army Corps of Engineers, Rock Island District. This document provides a base reference for water management decisions and responds to a water shortage in the Iowa River Basin due to climatological droughts.

Water Control Manual, Coralville Lake, Iowa River Basin, Coralville, Iowa, 1959, revised January 2001, U.S. Army Corps of Engineers, Rock Island District.

5. Sedimentation Surveys

Coralville Lake Report of Sedimentation, 2008. U.S. Army Corps of Engineers, Rock Island District.

Coralville Lake, Iowa River, Iowa, Report of Sedimentation, 1983 Resurvey, February 1987, U.S. Army Corps of Engineers, Rock Island District.

Sedimentation in the Coralville Reservoir, 1976, T. E. Crowley, Limited Distribution Report No. 63, Located in the University of Iowa, Hydraulic Library.

6. Flood and Flood Damage Reduction Studies

1993 Post Flood Report, Upper Mississippi River Basin, September 1994, U.S. Army Corps of Engineers, Rock Island District. This report includes the description and causes of the flood, resources utilized, data collected, recommended efficiencies, and findings and conclusions about the event.

Floods in the Iowa River Basin Upstream from Coralville Lake, Iowa, 1973, A. J. Heinitz, Iowa Institute of Hydraulic Research series: (100-S-1 l) and available from the University of Iowa Library.

Flood of June 17, 1990, in the Clear Creek Basin, East Central Iowa, Open File Report 94-78, U.S. Geological Survey (USGS).

Implementation of HMR52 Procedures for Probable Maximum Precipitation and Flood (PMP/PMF) Estimates, Memorandum for the Commander, U.S. Army Corps of Engineers, June 1990.

The Human Ecological Impact of Structural Flood Control on the Iowa River, Iowa, 1973, James S. Garner and Nancy Hyltquist, Iowa Institute of Hydraulic Research, Iowa City, Iowa. Located in the University of Iowa Library.
Flood Insurance Studies for Coralville, Iowa; Iowa City, Iowa; and for Johnson County, Iowa, in February 2007. Study performed by the Federal Emergency Management Agency.

Iowa Reservoirs Dam Safety Floodplain Management Study, Hydraulic Modeling and Mapping, Coralville Dam downstream to the Mississippi River, Iowa River, U.S. Army Corps of Engineers, Rock Island District, January 2013.

Hydraulic Model Report, Flood Inundation Modeling & Consequence Assessment Study, Coralville Dam, Iowa River Basin, Johnson County, Iowa, U.S. Army Corps of Engineers, Rock Island District, March 2014.

7. Other Studies and Reports

Coralville Lake, Iowa River, Iowa, Resource Master Plan, Design Memorandum No. l 5C, Revision No. 2, April 1976, Prepared by Midwest Research Institute in Kansas City, Missouri, and Hansen Lind Meyer in Iowa City, Iowa, for the U.S. Army Corps of Engineers, Rock Island District.

Coralville Lake Resource Master Plan, April 1977, U.S. Army Corps of Engineers, Rock Island District.
Final Environmental Impact Statement for Coralville Lake and the Downstream Area of Influence to Columbus Junction, Iowa, U.S. Army Corps of Engineers, Rock Island District April 1977.

Evaluating Two of Iowa's Reservoirs for Economic Hydroelectric Power Development Using Computer Simulation Techniques, 1989. Engineering Thesis of Justin Rundle, available at the University of Iowa Library.

Section 216 Initial Appraisal, Coralville Lake, Johnson County, Iowa, March 1995, U.S. Army Corps of Engineers, Rock Island District. This appraisal concludes a significantly changed economic and physical condition exists upstream and downstream of the reservoir.

Section 216, Review of Completed Works, Reconnaissance Report, Coralville Lake, Johnson County, Iowa, U.S. Army Corps of Engineers, Rock Island District, May 1997.

Emergency Action Plan, Coralville Dam and Amana Remedial Works, Iowa River, Iowa, 2012. U.S. Army Corps of Engineers, Rock Island District. This plan is a guide for identifying types of dam emergencies which could occur and actions to be taken.

DRAFT Coralville Dam Flood Control Pool & Amana Remedial Works, Iowa River and Price Creek, Iowa, Periodic Assessment No. 1, U.S. Army Corps of Engineers, Rock Island District, July 2014.

CHAPTER II: INVENTORY AND FORECASTED CONDITIONS

A. INTRODUCTION

The District inventoried the applicable social, economic, and environmental factors for the Study area within the Iowa River floodplain corridor. The floodplain corridor includes federally-managed lands upstream of Coralville Dam near Amana, Iowa, to the confluence with the Mississippi River (River Mile 434.1). The District used applicable social, economic, and environmental factors as the foundation of the analysis, to evaluate and compare alternatives and select the District's TSP. These factors establish a baseline to measure the Coralville Dam impacts. The floodplain corridor includes the following parameters:

- the river and adjacent lands (agriculture, urban, and wildlife habitat);
- constructed facilities adjacent to the river;
- areas subject to flood inundation as a result of Coralville Lake water releases and unregulated tributary inflows; as well as lake levels upstream of the Coralville Dam; and
- area of influence varies based on the resource and was tailored to capture the measurable impacts

The District focused on information gathered from this Study area, or area of influence. If the District used data from outside this area in their analysis, rationale is provided in the resource sections below.

Resources Not Evaluated in Detail. The District considered all possible environmental factors potentially influenced by the Study alternatives and eliminated resources from further evaluation not in the area of potential affect, or that would not be impacted by any of the alternatives. These resources include:

- Wild and Scenic Rivers
- Mineral and Energy Resources
- Noise
- Air quality (The planning area is completely not in a non-attainment zone.)

Relevant Resources Found in the Planning Area. The District focused their evaluation on those resources potentially affected by any of the alternatives. These resources are described within this chapter and include:

- Floodplain Resources
- Land Use
- Aquatic & Wildlife Resources (Fish and Mussels, Mammals, Migratory Birds)
- Threatened and Endangered Species
- Invasive Species
- Vegetation
- Water Quality, Wetlands, Rivers, and Streams
- Hydrology and Hydraulics
- State Parks, Conservation Areas, and Other Areas of Recreational, Ecological, Scenic, or Aesthetic Importance
- Historical and Cultural Resources
- Socioeconomics Resources
- Minority and Low-Income Populations
- Human Health and Safety
- Sustainability, Greening and Climate Change
- Constructed Resources (Utilities, Infrastructure, Transportation, Among Others)
- Recreation
- Sedimentation/Soils/Prime and Unique Farmland
- Hazardous Substances/Petroleum Products

Each resource section described in this chapter also includes a description of the future without project conditions, or the No Action Alternative. The No Action Alternative is the base condition to which the effects of the action alternatives are compared, as required by the NEPA. Under the No Action Alternative, environmental consequences will still occur because the existing environment is not static. Chapter I, Section H, *Planning Constraints*, lists several earlier studies proposing additional FRM actions. The District does not anticipate implementing any additional FRM measures. No other FRM actions are currently being planned or need to be implemented from the previous reports.

B. GENERAL SETTING

The Iowa-Cedar Rivers Basin (Figure 2) begins in North Central Iowa and extends southerly across central Iowa to Southeastern Iowa. The Iowa River joins the Mississippi River 20 miles South of Muscatine, Iowa, across from New Boston, Illinois.

The Iowa-Cedar Rivers Basin drains a 12,640 square mile area. Cedar Falls/Waterloo, Cedar Rapids, and Iowa City/Coralville are the largest population centers within the basin. The total Iowa-Cedar Rivers Basin population is 1,007,575 (2009). Land use and land cover in the Iowa-Cedar Basin is primarily agricultural with about 93% of the total area used for cropland or pasture. Land is largely privately owned. The remaining land area consists of about 4% forests, about 2% urban and about 1% water and wetlands.

Coralville Lake is located in Johnson County on the Iowa River in eastern Iowa, approximately 83.3 miles upstream from the confluence with the Mississippi River. The conservation pool impounded by the dam is within Johnson County. The flood pool extends into Iowa County. The City of Iowa City is 5 miles to the south of Coralville Lake. The lake is surrounded by the growing communities of Solon, North Liberty, and Coralville.

Figure 2. Iowa-Cedar Rivers Basin

C. FLOODPLAIN RESOURCES

1. Natural Floodplain. By their very nature, floodplains are the low, flat, periodically flooded lands adjacent to rivers and are subject to the land-shaping and water flow processes. As distinguished from the floodplain, a river floodway is the dry zone typically between levees, which is designed to convey flood waters. It is only during and after major flood events the connections between a river, its floodway and its floodplain become more apparent. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater.

2. Regulatory Floodplain. The regulatory floodplain is defined by areas inundated by the 1% annual exceedance probability discharge. A 100-year flood is defined as a flood event having a 1% chance of occurring in any given year. For land use planning purposes, the regulatory floodplain is usually viewed as all lands within reach of a 100-year flood. The Federal Emergency Management Agency (FEMA) produces floodplain maps, defining what's in and out of the 100-year (or "regulatory") floodplain in order to implement the National Flood Insurance Program. Flood Insurance Rate Map Zones (FIRM) are depicted in the floodplain terminology Table 1.

Table 1. Floodplain Terminology

Terms	Measured Flood Event	Common Name	FIRM Zones
Base Flood	1% chance flood	100-year flood	Zone AE, A
	0.2% chance flood	500-year flood	Zone X
	0.1% chance flood	1000-year flood	Zone X
Floodway			Zone AEF

A common misconception about the 100-year flood is that it represents the peak flow from historical records, or it will occur once every 100 years. In fact, a 100-year flood has a 26% chance of occurring during a 30-year period, the length of many home mortgages. The 100-year flood is a statistically derived regulatory standard used by Federal agencies, and most states, to administer floodplain management programs. A more technically accurate term for the 100-year flood is the 1% chance exceedance flood, or a flood level which has a 1% chance of happening in any given year.

For this Study, the District assumed the area of influence would be approximate to the 500-year floodplain, i.e. area inundated by the 0.2% exceedence probability annual discharge. Changes between the current (baseline) WCP and the possible revised plan alternatives do not measurably impact flood events exceeding the 500-yr event as they all result in similar, unregulated discharges from Coralville Lake.

Future Condition. The FEMA may change the regulatory floodplains based on future precipitation trends and changes in flood frequency. If a change occurs, the District would consider whether any additional changes to the Water Control Plan WCP are warranted.

D. LAND USE

The 2016 National Land Cover Database (NLCD) Data includes the most up-to-date data concerning the Study area. Table 2 and Figure 3 depict the Study area's various land uses.

Table 2. Land Cover Type

Land Cover Type	Area (ha)
Open Water	6,600
Developed, Open Space	823
Developed, Low Intensity	615
Developed, Medium Intensity	256
Developed, High Intensity	157
Barren Land	46
Deciduous Forest	1,410
Evergreen Forest	4
Mixed Forest	372
Shrub/Scrub	5
Grassland/Herbaceous	4,009
Pasture/Hay	1,001
Cultivated Crops	14,819
Woody Wetlands	8,587
Emergent Herbaceous Wetlands	7,369

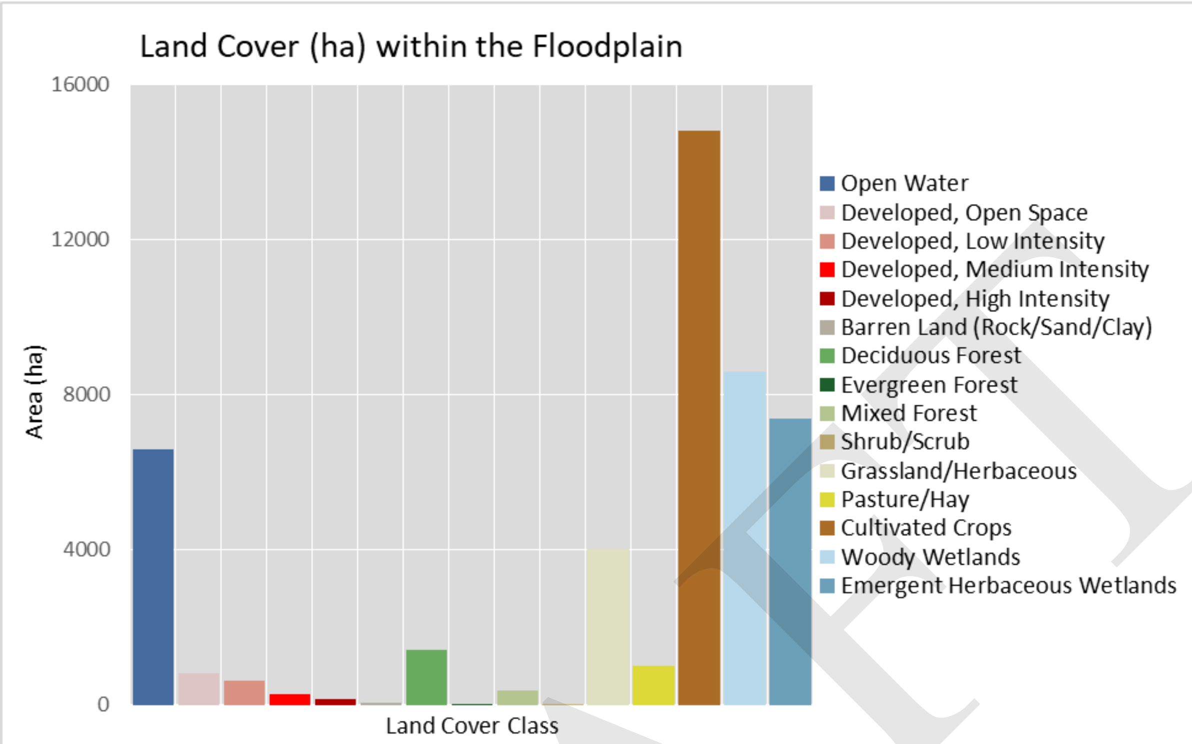

Figure 3. Land Use Land Cover Class *(Source: National Land Cover Dataset, 2016)*

According to the NLCD database, the largest land cover type within the floodplain of the Study area is Cultivated Crops, followed by wetlands and open water. Land use and land cover in the Iowa-Cedar Rivers Basin is primarily agricultural with about 93% of the total area used for cropland or pasture. Land is largely privately owned. The principal crops are corn, soybeans, hay, and oats. The remaining land area consists of about 4% forests, about 2% urban, and about 1% water and wetlands. Industrial outputs are food processing, machinery, electric equipment, chemical products, publishing, and primary metals. Iowa produces the nation's largest amount of ethanol and many farms in the Cedar-Iowa basin grow corn for the growing biofuel industry.

Following the Floods of 1993 and 2008, communities and landowners downstream of Coralville Lake have taken measures to reduce their exposure to future flooding. In the City of Coralville, a levee and floodwall system has been constructed along the Iowa River to provide flood protection against flooding 2 feet higher than the 2008 record flood event. In Iowa City, a combination of buyouts, relocations, structural flood proofing, and temporary flood fighting measures have been implemented to reduce future risk to the City as well as the University of Iowa. In downstream historically agricultural areas, extensive lands (particularly in the Wapello Reach) have been enrolled in permanent NRCS conservation easements, reducing future agricultural flooding impacts in these areas.

Land Use Plans. Corps reservoir master plans are management plans for environmental stewardship of the land and recreational opportunities. Master plans do not address the specifics of regional water quality or water level management for FRM.

Master plans present an inventory of land resources; land classifications; and three main focus areas—Sustainable Environment, A Natural Place to Play, and Connections. The focus areas provide management concepts for environmental stewardship of environmentally sensitive areas and other lands; existing and expanded recreational facilities; and connections between people and nature. All actions by the District, partnering agencies, and individual granted leases use District-managed lands (out-grantees) must be consistent with the master plans.

Master Plans are based on responses to regional and local needs, resource capabilities and suitability and expressed public interests consistent with authorized Coralville Dam purposes and pertinent legislation and regulations. They provide a District-level policy consistent with national objectives and other State and regional goals and programs. The plans are distinct from the Project-level implementation emphasis of the Operational Management Plan (OMP). Policies in the master plan are guidelines implemented through provisions of the OMP, specific design memorandums, and the annual management plans. Coralville Lake staff are in the process of updating and approving their master plan. The current master plan was approved in 1977.

While the Iowa DNR manages a large share of federally-managed lands at Coralville Lake for wildlife management purposes, it does not have an established planning document, other than the original lease agreements. The District reviews and approves the Iowa DNR's annual work plan at each site.

Additionally, much of the agricultural land in the Wapello reach has been converted from production to conservation land through the Federal Conservation Reserve Program (CRP). The U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) administers the CRP through exchange or yearly rental payments for removal of environmentally sensitive landform agricultural production. The enrollment of lands in the CRP successfully increases available wildlife habitat, improves water quality, and reduced soil erosion. Landowners in the project area continue to apply for enrollment of their land along the Iowa River in the CRP, which may result in increased lands within the project area under conservation management.

Future Condition: The Iowa-Cedar Rivers Basin should continue to be predominately agricultural land use; however, urbanization and non-permeable surfaces should continue to expand at their current rate. This may increase flash flooding and increased run-off. Local FRM measures may result from the urban growth near the river. Land under current county, state, and Federal management should continue as public lands. These lands' missions should remain as FRM, water supply, fish and wildlife management, and recreation.

The enrollment of low lying, flood-prone, agricultural areas into permanent NRCS conservation easements is expected to continue as funding for the NRCS programs allow. In 2019, the NRCS received funding for the program and requested applications for easements on historically flooded areas from farmers. The response in Iowa, which included lands along the Iowa River below Coralville, far exceeded the current funding capabilities of the program. Due to the uncertain nature of funding for such programs, the current land use condition was assumed in assessing potential flood damages in this Study.

E. WILDLIFE RESOURCES

Fisheries, Mussels, and Their Habitats. Fisheries and other aquatic resources in Coralville Lake and the Iowa River are managed by the Iowa DNR Fisheries Bureau. Work is aimed at monitoring fish, mussels, and aquatic life, as well as maintaining a sport fishery for anglers. Primary management species in the Iowa River include Walleye, hybrid Striped Bass (Striped Bass x White Bass), and Northern Pike, which require stocking due to limited or no reproduction. Largemouth Bass, Channel and Flathead Catfish, White Bass, crappie, and other pan fishes reproduce naturally and only require supplemental stocking when necessary. A contract commercial fish harvester is allowed to remove rough fish species from September 15th to May 15th. Each year they remove approximately 250,000 pounds of rough fish from Coralville Lake. Riverine fishes below the dams include species such as catfish, suckers, minnows, Walleye, and gar. Rarer species like American Eel and Shovelnose Sturgeon also inhabit the Iowa River at certain times of the year.

Shoreline development, bridges, and dams limit the river's natural setting in many places. Still, the Study area supports a good fishery near dams, snags, and other places where flow and structure are diverse. The Coralville dam limits upstream movement of fish in the lake, while also losing many due to flushing through the outlet, such as striped bass, muskellunge, and other game fish.

The Iowa River was historically inhabited by at least 36 species of mussels. Unfortunately, a loss in species diversity has occurred below Coralville Lake. However, this is not surprising, as a loss in species diversity and range size has been a statewide trend in Iowa (Poole and Downing, 2004). Recent mussel surveys in the Iowa River found 22 species, including the federally-endangered Higgins-eye pearlymussel. The stretch of the Iowa River from below Coralville Lake to Hills, Iowa is anecdotally known as one of the best mussel beds in the State of Iowa in terms of species richness and diversity.

Wildlife and Its Habitat. The Study area is a mosaic of habitat types closely associated with the riverine environment. Agriculture, urbanization, recreation, dams, and other infrastructure such as utility and transportation corridors contribute to habitat fragmentation and other stressors to wildlife.

Iowa ranks among the lowest in public land ownership and is considered to have one of the most altered landscapes nationally (National Wilderness Institute, 1995). Large, intact tracts of wildlife habitat are uncommon in most of the state and as a result, the full value of the resources found at Coralville Lake and Iowa River, and their impact on wildlife and vegetation native to eastern Iowa are difficult to measure, but are assuredly high. Identified as a "Large Habitat Complex in the Southern Iowa Drift Plain" by the Iowa Wildlife Action Plan (2006, update 2015), it is the largest contiguous area of undeveloped land between the Mississippi and Des Moines Rivers. This is critical for species whose populations are negatively impacted by habitat fragmentation.

The 24,689 acres of Coralville Lake include (at conservation pool level): 5,430 acres of water, 9,897 acres of deciduous and coniferous forest, 3,506 acres of wetland, and 1,318 acres of prairie and savannah. There are 4,066 acres of land are in agricultural production, which provide funding for outgrantees, act as food plots in designated areas, and allows former landowners to continue farming the land until funding is available to convert the land to forest or prairie. Since the completion of Coralville Dam, 309 acres of deciduous forest and 67 acres of coniferous forest, along with 338 acres of prairie have been planted.

Pressures on the resource are significant and multifaceted. Invasive species, climate change, and urbanization pose the greatest threats to maintaining sustainable ecosystems. Annual visitation of over one million people also has an impact on Coralville Lake's natural resources. Recreational activities from boating, hiking, snowmobiling, ATV use, horseback riding and hunting all pose some degree of disturbance to wildlife and natural resources. Human disturbance can be a limiting factor and dense visitation impacts may be difficult to quantify.

Neighboring urban development will have a significant impact on local wildlife populations. A majority of the lands being converted to residential and commercial purposes were once either primarily forested, row crop agriculture, or pasture. Forested and agricultural lands provide a higher wildlife habitat value than do urban landscapes. This reduction in habitat will place more demand on remaining ecosystems found on Corps lands. An increase in the urban/parkland interface will also

create more opportunities for human conflict with wildlife that inhabits parklands adjacent to housing developments (i.e. raccoons, White-tailed deer, and opossums).
There are several large tracts of timber, however the majority of adjacent property is residential or industrial areas. Despite the human disturbances such as traffic, recreation, noise, and lights, the river corridor has suitable habitat for those species accustomed to an urban setting. Common residents are white-tailed deer, bats, squirrels, cottontail rabbits, raccoons, and year-round resident birds such as owls, and songbirds. Mammals such as muskrat, mink, raccoons, and beaver may use the river side habitat.

Existing rip rap mainly near the dam, outlet, and along urban levees, may make traversing these areas more difficult for wildlife species, however species such as mink will regularly hunt these areas for small mammals and fish.

Migratory Birds. All of Coralville Lake fee title lands, as well as several tributaries, have been recognized as an Important Bird Area (IBA) for the State of Iowa by the Audubon Society in 2004. An IBA is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. An IBA supports:

- Species of conservation concern (e.g. threatened and endangered species);
- Range-restricted species (species vulnerable because they are not widely distributed);
- Species that are vulnerable because their populations are concentrated in one general habitat type or biome; and,
- Species, or groups of similar species (such as waterfowl or shorebirds), that are vulnerable because they occur at high densities due to their congregatory behavior (National Audubon Society, 2016).

Migrating birds such as warblers, waterfowl, and songbirds migrate and nest through the river corridors in the planning area. Bird nesting occurs along the mud flats in the upper reaches of each lake as well as the woodlands and prairies near the lake and the downstream Study areas. Coralville Lake is also considered an important part of the Mississippi Flyway, a migratory bird corridor.

The US Fish and Wildlife Service's (USFWS) website, *Information for Planning and Consultation* (IPAC), (USFWS, 2020, Appendix D) listed 23 migratory bird species of conservation concern and has the highest priority for conservation that may use the Study area sometime during their nesting or migration seasons (Table 3).

Table 3. Migratory Birds of Conservation Concern

Species	Scientific Name	Season	Habitat[1]
American Bittern	*Botaurus lentiginosus*	Breeding	EW
American Golden-plover	*Pluvialis dominica*	Migration	EW
Bald Eagle	*Haliaeetus leucocephalus*	Year-round	BLH/OW
Black Rail	*Laterallus jamaicensis*	Breeding	EW
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Breeding	UH
Bobolink	*Dolichonyx oryzivorus*	Breeding	P
Buff-breasted Sandpiper	*Calidris subruficollis*	Migration	EW/OW
Cerulean Warbler	*Dendroica cerulea*	Breeding	UH
Dunlin	*Calidris alpina arcticola*	Migration	EW/MF
Eastern Whip-poor-will	*Antrostomus vociferus*	Breeding	UH
Golden Eagle	*Aquila chrysaetos*	Wintering	OW/BLH
Henslow's Sparrow	*Ammodramus henslowii*	Breeding	P
Hudsonian Godwit	*Limosa haemastica*	Migration	MF
Kentucky Warbler	*Oporornis formosus*	Breeding	BLH/UH
Least Bittern	*Ixobrychus exilis*	Breeding	EW
Lesser Yellowlegs	*Tringa flavipes*	Migration	EW/MF
Prothonotary Warbler	*Protonotaria citrea*	Breeding	BLH
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Year-round	UH
Ruddy Turnstone	*Arenaria interpres morinella*	Migration	MF
Rusty Blackbird	*Euphagus carolinus*	Wintering	EW
Semipalmated Sandpiper	*Calidris pusilla*	Migration	MF/OW
Short-billed Dowitcher	*Limnodromus griseus*	Migration	MF
Wood Thrush	*Hylocichla mustelina*	Breeding	UH

[1]BLH=bottomland hardwoods, UH=upland hardwoods, SS=shrub/scrub, P=prairie, EW=emergent wetlands, UE-upland edge, OW=open water, MF=mudflats (USFWS, 2020)

Fish and Wildlife Management. Wildlife and fisheries management are important components of the resource management program. Coralville Lake lands outgranted to the Iowa DNR for wildlife management total 13,427 acres. Close coordination and partnering occurs between District staff and the Iowa DNR to reach management objectives. Hunting, fishing, and wildlife viewing are popular at Coralville Lake and efforts will continue to preserve and promote these activities. Additional land along the Iowa River Corridor is collectively managed by the Iowa DNR and multiple county conservation boards (CCB).

Wildlife management activities are targeted primarily at white-tailed deer, eastern wild turkey, waterfowl, and mourning doves. Additionally, small game hunting and upland birds are managed species, but are limited by lack of suitable habitat. Non-game wildlife species benefit from habitat provided project wide. Through cooperative efforts each project's natural resource team and their partners have restored and maintained this public land for multiple user groups to enjoy now and in the future (Figure 4).

Figure 4. Habitat Management at Coralville Lake

F. ENDANGERED, THREATENED, AND CANDIDATE SPECIES

The District conducted a preliminary review of federally-listed threatened and endangered species in the Study area using the IPAC website (USFWS, 2020a) (Appendix D, *Correspondence and Coordination*). The website lists nine species that may occur in the Study area due to suitable habitat (Table 4). Two other species not listed in the IPaC but are species of concern are the Monarch butterfly and the Black rail.

Table 4. Threatened and Endangered Species for the Study Area

Common Name	Classification	Habitat
Indiana bat *Myotis sodalis*	Endangered	Caves, mines (hibernacula); small stream corridors with well-developed riparian woods; upland forests (foraging)
Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during late spring and summer.
Eastern Prairie Fringed Orchid *Platanthera leucophaea*	Threatened	Mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches. The eastern prairie fringed orchid also occurs in bogs, fens, and sedge
Prairie Bush-clover *Lespedeza leptostachya*	Threatened	Tallgrass prairies
Western Prairie Fringed Orchid *Platanthera praeclara*	Threatened	Mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.
Rusty patch Bumblebee *Bombus affinis*	Endangered	Grasslands and tallgrass prairies of the Upper Midwest and Northeast
Higgins Eye (pearlymussel) *Lampsilis higginsii*	Endangered	Larger rivers where it is usually found in deep water with moderate currents. Sand and gravel substrate.
Sheepnose Mussel *Plethobasus cyphyus*	Endangered	Larger rivers where it is usually found in deep water with moderate currents. Sand and gravel substrate.
Spectaclecase (mussel) *Cumberlandia monodonta*	Endangered	Larger rivers where it is usually found in deep water with moderate currents. Rocky substrate.
Monarch (butterfly) *Danaus plexippus*	Candidate species	Milkweed host plant (primarily Asclepias spp.)
Eastern black rail *Laterallus jamaicensis jamaicensis*	Threatened	Wet sedge meadows with dense cover

Ref: US Fish and Wildlife Service webpages:

http://www.fws.gov/midwest/Endangered/lists/iowa_cty.html

http://www.fws.gov/midwest/Endangered/lists/iowa_cty.htmlhttp://www.fws.gov/midwest/Endangered/lists/iowa_cty.html

http://www.fws.gov/midwest/Endangered/lists/iowa_cty.html
(updated February 13, 2020)

The Indiana bat and Northern long-eared bat may inhabit the wooded areas within the Study area. Both bat species utilize mature or dead trees with flaky bark as their summer maternity sites and may forage in areas near the river.

Prairie bush clover is a federally-threatened prairie plant found only in the tallgrass prairie region of four Midwestern states. Prairie bush clover's rarity is probably best explained by the loss of its tallgrass prairie habitat. At the beginning of the 19^{th} century, native prairie covered almost all of Illinois and Iowa, a third of Minnesota and 6% of Wisconsin. Prairie with moderately damp-to-dry soils favored by prairie bush clover was also prime cropland; today only scattered remnants of prairie can be found in the four states. Many of today's prairie bush clover populations occur in sites that were too steep or rocky for the plow.

The western prairie fringed orchid is restricted to west of the Mississippi River and currently occurs in Iowa, Kansas, Minnesota, Nebraska, North Dakota, and in Manitoba, Canada. This orchid occurs most often in mesic-to-wet unplowed tallgrass prairies and meadows but has been found in old fields and roadside ditches.

The Higgins eye pearlymussel relies on deep, free-flowing rivers with clean water. Much of their historic habitat has been changed from free-flowing river systems to impounded river systems. Impoundments changed water flow patterns, substrate characteristics, and host fish habitat which, in turn, affect how Higgins eye feed, live, and reproduce. Municipal, industrial, and farm run-off degrade water quality. As filter-feeders, mussels concentrate chemicals and toxic metals in body tissues and can be poisoned by chemicals in their water. Dredging and waterway traffic produce siltation which can cover river substrate and mussel beds. Higgins eye pearlymussel have been documented immediately downstream of the Coralville Dam as recently as August 2019.

The Sheepnose is a freshwater mussel found across the Midwest and Southeast. However, it has been eliminated from two-thirds of the total number of streams from which it was historically known. The Sheepnose is a medium-sized mussel that grows to about 5 inches in length. It lives in larger rivers and streams where it is usually found in shallow areas with moderate to swift currents flowing over coarse sand and gravel. Most populations of Sheepnose are small and geographically isolated. These small populations, which live in short sections of rivers, are susceptible to extirpation from single catastrophic events, such as toxic spills. In addition, isolation makes natural repopulation impossible without human assistance. The Sheepnose mussel is considered extirpated from the Iowa River.

Historically, the Spectaclecase mussel was found in at least 44 streams of the Mississippi, Ohio, and Missouri River basins in 14 states. It has been extirpated from 3 states and today is found in only 20 streams. The Spectaclecase's current range includes Alabama, Arkansas, Illinois, Iowa, Kentucky, Minnesota, Missouri, Tennessee, Virginia, West Virginia, and Wisconsin. With few exceptions, Spectaclecase populations are fragmented and restricted to short stream reaches. No recent surveys have found Spectaclecase in the Iowa River.

The Rusty Patched Bumble Bee was listed as federally-endangered in March 2017. The population has declined by 87% in the last 20 years. The species is likely to be present in only 0.1% of its historical range (USFWS, 2019). There are many potential reasons for the rusty patched bumble bee decline including habitat loss, intensive farming, disease, pesticide use and climate change. Currently, three rusty patched bumble bee "High Potential Zones" overlap parts of the Study area and nearly all of the Study area is within the "Low Potential Zones." It is likely more rusty patched bumblebees will be identified at Coralville Lake, since it is a large contiguous area with relatively undisturbed habitat.

During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily Asclepias spp.). Sufficient quality and quantity of nectar from flowers are needed for adult feeding throughout the breeding and migration seasons. Individual monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, where the migratory generation of adults is in reproductive diapause and lives for an extended period of time.

In the interior United States, eastern black rails use wet sedge meadows with dense cover. Black rail also use shallow wetlands often dominated by cattails. Many black rails nest in marshes along the Atlantic seaboard and in the Midwest., but in winter, they concentrate in the coastal marshes of East Texas, Louisiana, and Florida, areas that face many threats. The black rail is exceedingly rare in Iowa, showing up only accidentally.

Although the bald eagle is no longer listed as threatened or endangered under the Endangered Species Act, they are protected by the Bald and Golden Eagle Protection Act to prohibit killing, selling, or otherwise harming eagles, their nests, or eggs. Despite the Coralville Lake's urban setting and presence of human activity, many eagles forage, roost, and nest in the Iowa River corridor. Large numbers of bald eagles use the lake for feeding and roosting during the winter, which attracts many visitors to Coralville Lake. Several nests have also been observed around Coralville Lake and the Iowa River.

The Iowa River Valley is home to 150+ state listed species. These include mussels, amphibians, reptiles, birds, mammals, and plants. For county specific information, see, the Iowa DNR's Natural Areas Inventory webpage for up to date information on state listed species (https://programs.iowadnr.gov/naturalareasinventory/pages/Query.aspxhttps://programs.iowadnr.gov/naturalareasinventory/pages/Query.aspx.

Future Condition: Fish and wildlife species (common to rare), will continue to inhabit the riverine and urban areas along the river and lakes. As urbanization increases, introduction of invasive species, or other habitat threats, animal species may shift from specific niche species to generalists who can adapt to future habitat changes or declines.

G. INVASIVE SPECIES

The potential for exotic and invasive plants in urban settings is prevalent. Invasive species continue to pose significant threats to resources along the Iowa River. Sixty-four terrestrial invasive plant species and 11 terrestrial animal species have been identified on Coralville Lake lands alone. Many species pose relatively minor risk to altering native systems, while others have the potential to greatly impact them. "Escaped" plants and seeds from home gardens are a constant threat to native vegetation. More persistent species such as Tree-of-Heaven prefer wet fields, roadsides, fencerows, woodland edges, and forest openings. Several plants like exotic bush honeysuckle, oriental bittersweet, and garlic mustard prefers shaded or semi-shaded areas (upland and floodplain forests, shrublands, and shaded yards). Phragmites is a very persistent wetland invasive plant found in the Study area. A few species including *Serecea Lespedeza*, Autumn olive, and Crown vetch cause serious threats and expensive control measures on an annual basis. All of these species have the ability to significantly alter native ecosystems.

Aquatic invasive species include zebra mussels, quagga mussels, rusty crayfish, big head carp, grass carp, and silver carp in the river. Barriers such as the Coralville Dam have helped to curb these species' upstream migration.

Aquatic plants have difficulty establishing in the reservoir and pose a smaller threat; however, if zebra mussels, Big Head Carp, Silver Carp, or Black Carp were introduced, they would negatively affect the overall fishery of Coralville Lake.

Invasive species pose a significant threat to the Coralville Lake landscape. The vegetative management program spends over $60,000 annually on invasive species management. Now and in the future, the Emerald ash borer will have tremendous consequences, both in actual costs to manage and the overall dynamic change that will occur within forests. Trees are also very susceptible to invasive species, as evidenced by the Emerald ash borer, Gypsy moth (oak) and Thousand cankers disease (walnut and chestnuts).

Future Condition: The success of an invasive species is in large part due to favorable conditions resulting from the complex interactions among natural and anthropogenic factors such as native and nonnative pests, fires, droughts, hurricanes, wind storms, ice storms, climate warming, management practices, human travel, and trade (Dix, et al., 2009). Globalization involves the movement of people and products around the globe. The transport and introduction of invasive species and non-native wildlife are one consequence of globalization. These trends will likely continue in the future. However, many strategies are in development to stop the damage caused by invasive species and to prevent future releases and invasions. Educating the public about the dangers and adverse effects of transporting and introducing non-native species to new areas is an important component of invasive species management. Many laws and regulations have also been passed to combat the future spread of invasive species.

H. VEGETATION

The existing upland and wetland forests located on and adjacent to the river are structurally diverse and include elements such as dead snags, an overstory and understory, and downed logs. These are all indicative of habitat for a variety of species.

Surveys conducted by the Government Land Office prior to European settlement (circa mid-1800s) documented the majority of the land along the Iowa River corridor extending to Corps-managed boundaries was predominantly "Scattered Oaks" (oak savanna as it is identified now), and to a lesser extent "tall grass prairie" and "timber." Oak savanna is the transition zone between timber and tall grass prairie ecosystems and is comprised of large open-grown oak trees with a diverse ground cover of shade tolerant grasses and forbs. What remnant oak savanna remained after European settlers converted the land to agricultural production was most often found in steep valleys that were inaccessible or impractical for farming. Lack of landscape scale fire has allowed natural succession to occur in these remnants, and the majority of oak savanna originally found on Corps-managed lands have succeeded to timber (called Deciduous Forest in other sections of this plan). Through combinations of prescribed fire and mechanical thinning (removal of shade tolerant trees and invasive species), oak savanna is being restored on Corps-managed lands where practical, or timber stands are enhanced to encourage mast production for wildlife enhancement. Timber stands which were planted on agricultural lands during the 1980s and 1990s are actively managed by mechanical thinning (removal of shade tolerant trees and invasive species) and the introduction of prescribed fire.

Prairie habitat comprises about 1,300 acres or 18% of total acreage of Coralville Lake. The majority of prairie stands have resulted from re-establishment of warm season grasses on previous agricultural land or upon conversion of brome sod fields. A few small patches of native prairie are known to occur in the Study area and may be true remnants of the original tall grass prairie. These areas have been found in railroad rights-of-way and on slopes considered inaccessible for farming. Prairies located on government lands are actively managed through prescribed fires, mechanical removal of brush, and over-seeding with hand collected seed or local ecotype purchased seed.

Future Condition: The current vegetation types and quantity may experience slight declines based on urbanization and the spread of invasive plant species, despite efforts to restore native habitat and manage invasive species.

I. RIVERS AND STREAMS, WATER QUALITY, WETLANDS

Rivers and Streams. Within the Study area, the Iowa River has several tributaries, the Cedar River being the largest. The District monitors 23 streams within the Iowa-Cedar Rivers Basin. These rivers and streams are like other Iowa streams as far as their benefits to drinking water, fish, wildlife, and humans. There are other small intermittent streams and drainages throughout the planning area. Levees and small head dams have heavily constrained some of the streams in certain segments through the planning area.
Table 5 and Figure 5 identify the major rivers and streams in the Iowa River Watershed.

Table 5. Major Rivers and Gaged Streams in the Iowa River Watershed

ID	Name	Length (km)	Length (miles)
1	Iowa River	520	323
2	South Fork Iowa River	103.85	64.53
3	Timber Creek	38.64	24.01
4	Deer Creek	NA	NA
5	Richland Creek	NA	NA
6	Walnut Creek	107.23	66.63

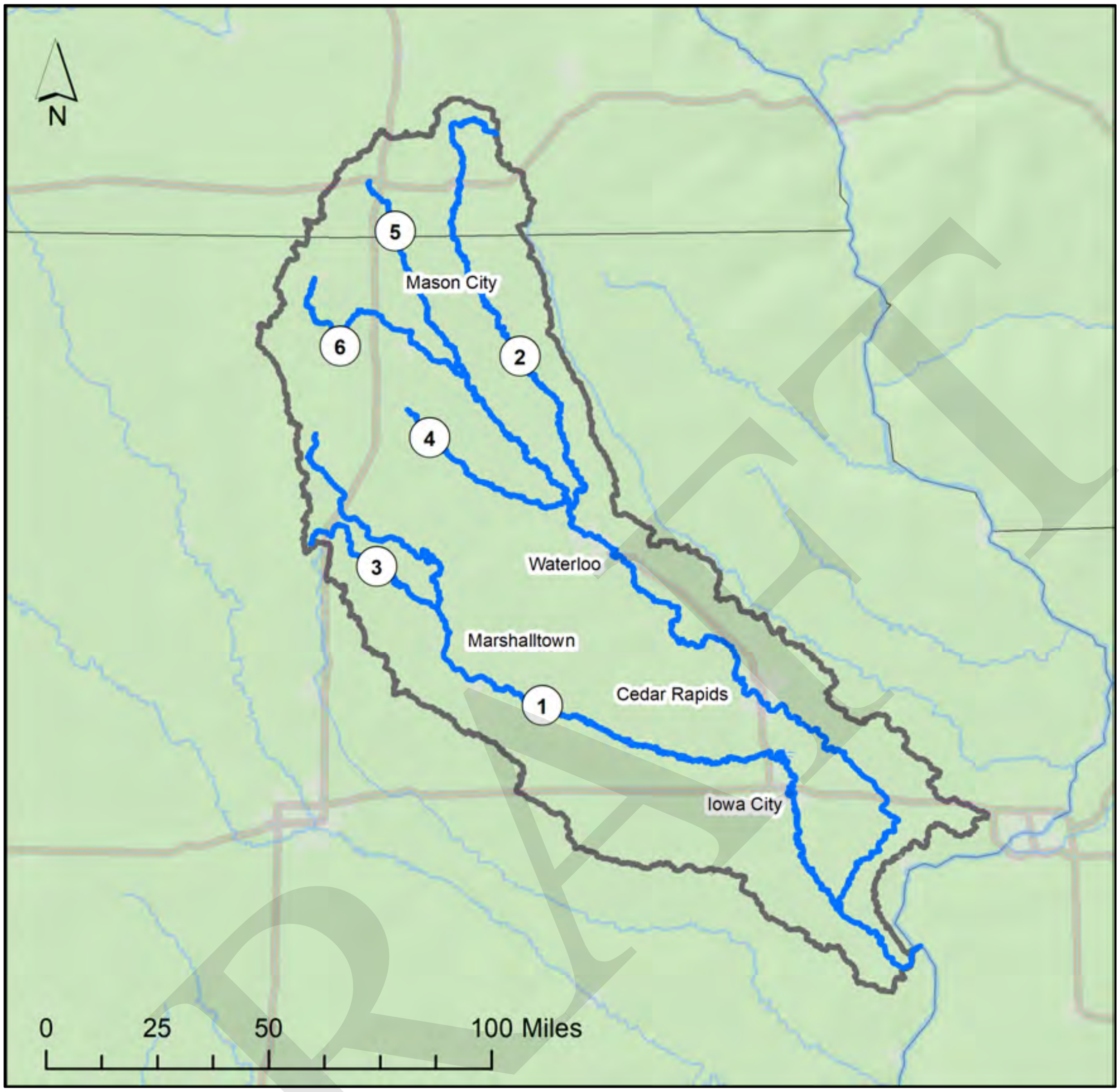

Figure 5. Major Rivers and Streams in the Iowa River Watershed

Water Quality. The Iowa DNR manages water quality through the implementation of the state's Water Quality Standards. Lakes and stretches of streams and rivers in Iowa each have specific designations, based on what they are used for—recreation such as swimming or fishing; drinking water; or maintaining a healthy population of fish and other aquatic life.

There are five categories or designations for Iowa's water quality:

Category 1: All designated uses (e.g., for water contact recreation, aquatic life, and/or drinking water) are met.

Category 2: Some of the designated uses are met but insufficient information exists to determine whether the remaining uses are met.

Category 3: Insufficient information exists to determine whether any uses are met.

Category 4: The waterbody is impaired but a total maximum daily load (TMDL) is not required.

Category 5: The waterbody is impaired and a TMDL is required, designated as a CWA, Section 303(d) Impaired Water Body.

If the water quality in the stream or lake does not meet its designated use, it does not meet Iowa's water quality standards and is considered "impaired" .http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Quality-Standards .http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Quality-Standards . Water quality improvement plans investigate streams and lakes on Iowa's impaired waters list. The ultimate goal is to improve water quality and remove streams and lakes from the impaired list. The plans, developed by the Iowa Department of Natural Resources (Iowa DNR), use research results and the public's input to help reduce the amount of pollutants reaching our water.

In Iowa, there were 831 impairments of 622 stream/river segments and 285 impairments of 146 lakes, reservoirs, and wetlands (Iowa DNR, 2018). There are several rivers and streams in the planning area with water quality concerns including a designation 303(d) status (Figure 6).

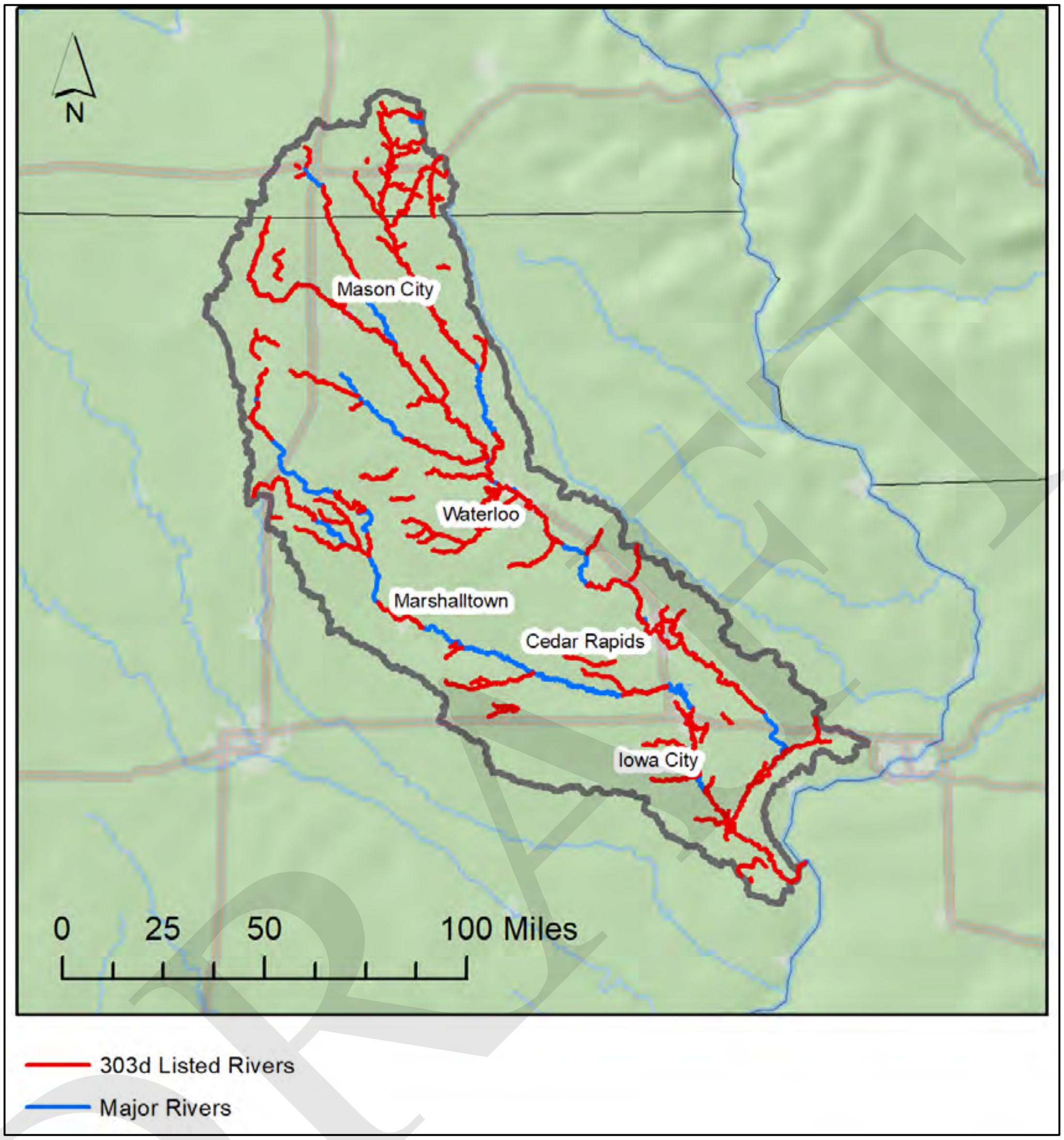

Figure 6. Iowa-Cedar Rivers Basin Impaired Water Bodies

Coralville Lake and the Iowa River within the Study area are on 2018 Iowa Impaired Waters List. The majority of the Study area falls under Category 5A, except for the 9-mile reach immediately downstream of the Coralville Dam, categorized as 4A. Coralville Lake's primary impairment is turbidity. The Iowa River suffers varying impairments throughout its course within the Study area, including turbidity, bacteria (*E. coli*), low fish and invertebrate biotic index, loss of native mussels, and pesticide pollution.

Wetlands. The District reviewed the USFWS National Wetlands Inventory (NWI) data to identify areas of potential wetland within the Study area. Table 6 and Figure 7 provides a summary of NWI-indicated wetland currently mapped within the floodplain of the Study area.

Table 6. Summary of NWI-Indicated Wetlands (ha) within the 500-year Floodplain

Wetland Type	Area (ha)
Freshwater Emergent Wetland	4,126.5
Freshwater Forested/Shrub Wetland	8,352.03
Freshwater Pond	585.47
Lake	3,523.37
Riverine	2,690.38

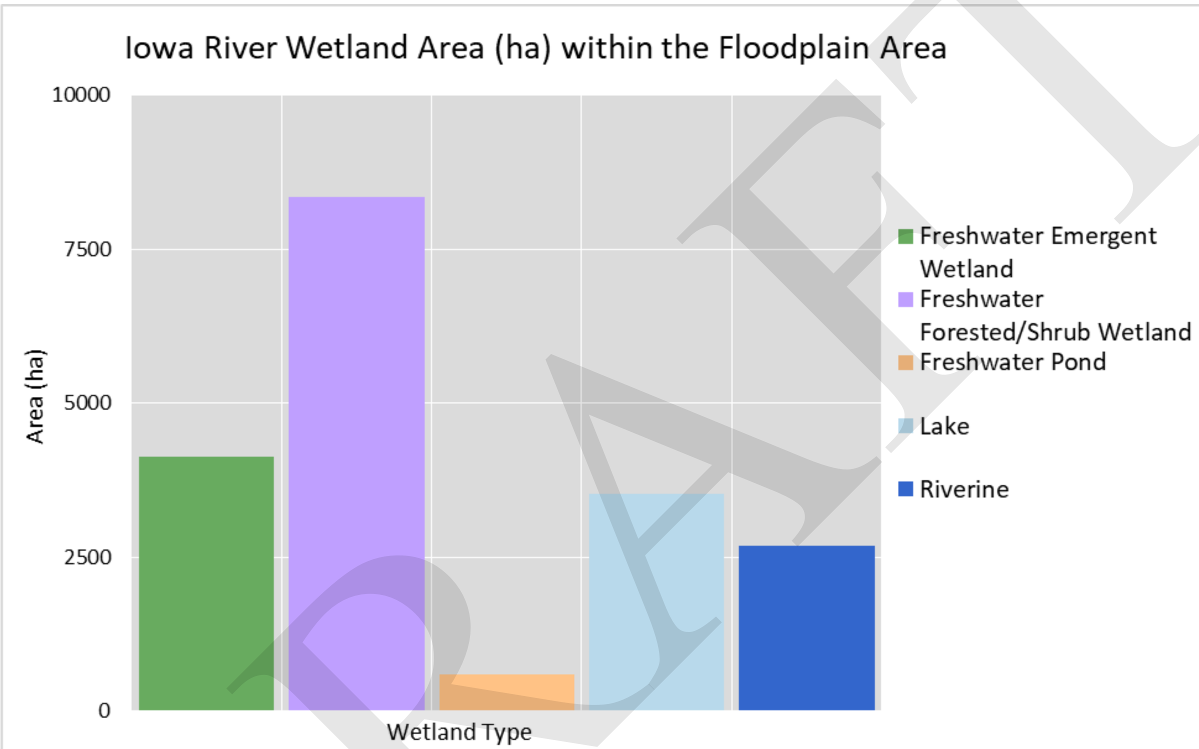

Figure 7. Iowa River Wetland Area (ha)

Future Conditions. The Study area's rivers and streams should not change in the near future. Climate change (increased precipitation) and urbanization (increased impermeable surfaces) may promote flash flooding more often.

Urbanization increases flood volume, frequency, and peak flood value because it brings with it more impervious surfaces, such as roads and large paved areas. This causes increased runoff that would occur more rapidly and with greater peak flows than under rural conditions. Urbanization would tend to increase flash flooding, turbidity, pollutant loads, and bank erosion. Increases in dissolved solutes (conductivity), suspended solids (turbidity), fecal bacteria, nitrogen and phosphates, dissolved oxygen, and/or toxics (e.g. metals, pesticides, pharmaceuticals, other organic pollutants) would tend to increase. Additionally, chloride, sulfates, ammonia, and bacteria by infiltration from surface water polluted by municipal and industrial wastes and/or from leaking sewer lines could contaminate the groundwater.

To address the potential for an increase in contaminants entering water sources, the Iowa DNR, and the Iowa Environmental Protection Agency (IA EPA) would continue to update and enforce regulations addressing and minimizing the pollutant effects on water quality.

Wetland conditions should remain at risk of invasive plants and development.

J. HYDROLOGY AND HYDRAULICS

The Iowa-Cedar Rivers Basin is generally long, narrow, and sinuous with variable topography. The average slope of the river is 1.9 feet per mile. The watershed is also long and narrow. Its length is approximately 180 miles and its greatest width is about 38 miles with an average width of 18.5 miles. The maximum difference in elevation between uplands and streams is approximately 150 feet. The Cedar River, having a watershed area of about 7,870 square miles, but considered a tributary of the Iowa River, joins the latter 29.6 miles above its mouth. The total drainage area for the Iowa River and its tributaries is approximately 12,640 square miles.

The current WCP for Coralville Lake was developed based on the hydrologic record available at the time (1904 to 1996) the current plan was developed. Since the Coralville Dam was constructed, significant changes in rainfall and resulting inflow to the reservoir have been observed. Annual precipitation records show significant upward trends in precipitation over the 20th and early 21st centuries (Figure 8). This observed trend of increased annual precipitation has resulted in an increased inflow volume into Coralville Lake.

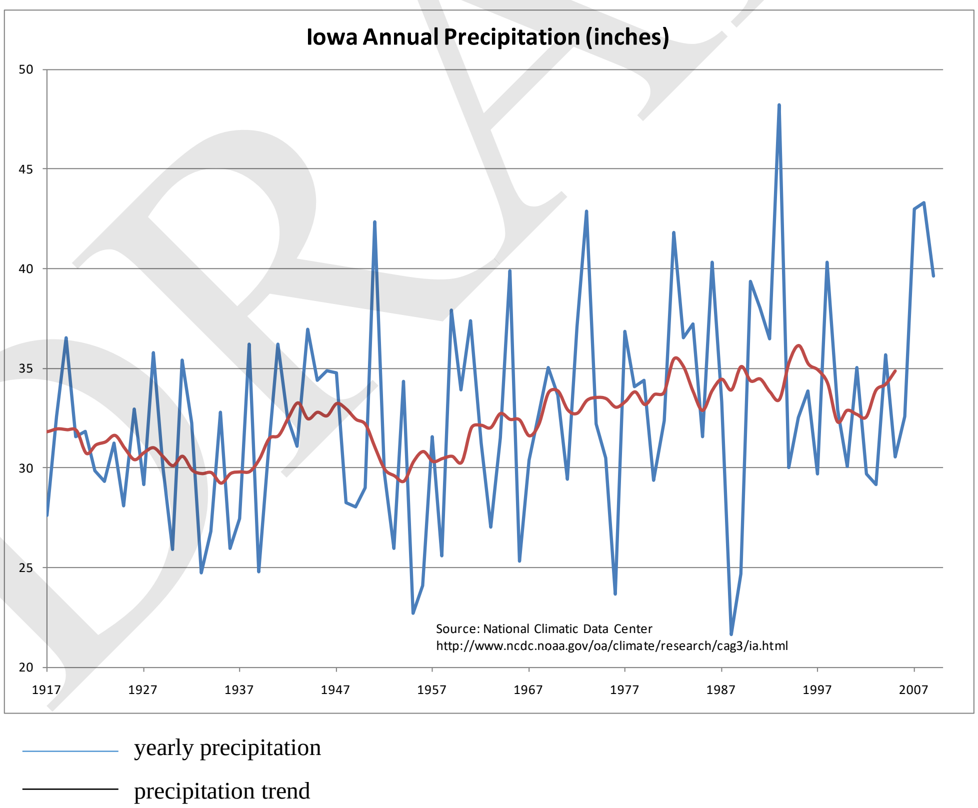

Figure 8. Iowa Annual Precipitation

Due to the use of reservoir storage to manage flood flows, peak annual reservoir elevations and downstream flood flows are driven by overall flood volumes rather than peak daily inflows.

Coralville Lake. The Coralville Lake is located in the south-central part of the Iowa-Cedar Rivers Basin in east-central Iowa. The Iowa River drainage area is approximately 12,640 square miles, of which 3,115 square miles is upstream of Coralville Lake. The Coralville dam is situated on the Iowa River, approximately 83.3 miles above its mouth and 6 miles upstream of Iowa City, Iowa. The Coralville Lake and Dam Study area is located primarily in Johnson and Louisa Counties, Iowa, with portions extending upstream into Iowa and Linn Counties and downstream into Washington County.

The Coralville Lake was originally authorized for the primary purpose of flood control, with recreation and fish and wildlife facilities subsequently authorized. Operation of the dam provides FRM benefits for communities downstream of the lake, as well as along the Mississippi River below the confluence with the Iowa River. Low-flow release agreements have been reached between the Iowa City Water Works and the State of Iowa to provide a minimum flow of 150 cfs at Iowa City, Iowa. Also, a drought contingency plan constructively rations water during extreme drought periods.

The current WCP for Coralville Lake considers several constraints in determining outflow. Among these are the downstream channel capacity, flood stages at Lone Tree and Wapello on the Iowa River and at Burlington, Iowa, on the Mississippi River. Consideration is also given to the pool level, the maximum rate that the reservoir outflow may be changed, and minimum low-flow requirements. Flood risk management and low-flow augmentation have priority over recreation needs. While recreation is an authorized purpose providing many recreational opportunities including boating, swimming and camping, the lake is not regulated to support these activities.

The District developed the current WCP with the objective of reducing the discharge at the downstream control points during runoff events when there is less utilization of flood control storage. As more storage capacity is utilized, the degree of downstream protection is reduced. For reduction of flooding at the downstream control points, about 70% of the reservoir flood storage capacity is utilized prior to the reservoir reaching the major flood level of 707 feet NGVD.

The overall plan for FRM for the Coralville Lake is to implement a regulation plan with due regard to various constraints to provide a part of the comprehensive scheme for conservation and FRM in the Iowa River and the Upper Mississippi River Basins. Other components of the overall plan for water control in the Iowa-Cedar Rivers Basin are the Lake Macbride Remedial Works and the Amana, Iowa, Remedial Works. For conservation storage, the plan of regulation is to provide a minimum low-flow in the Iowa River (150 cfs) downstream of Coralville Lake during periods of low flow and droughts.

Integrated Project Components. Integrated components of the Coralville Lake are as follows:

- Coralville Lake for flood control
- Amana, Iowa, Remedial Works for flood control
- Lake Macbride Remedial Works for flood control and recreation
- Coralville conservation pool for low-flow augmentation

The FRM objective of the current WCP for Coralville Lake is to manage water levels at the downstream control points at Lone Tree and Wapello, Iowa, on the Iowa River and Burlington, Iowa, on the Mississippi River in order to minimize the frequency and duration of damaging flows, as described in the following paragraphs of this section of the report.

At Lone Tree, the control stage is 14.0 feet for the growing season and 16.0 feet for the non-growing season which corresponds to discharges of 12,000 cfs and 18,000 cfs respectively. At Wapello the control stage is 21.0 feet for the growing season and 22.0 feet for the non-growing season, which corresponds to discharges of 40,000 cfs and 48,000 cfs respectively. The control stage on the Mississippi is 18.0 feet at Burlington, Iowa. If the lake level is between the conservation pool level (683.0 feet, NGVD) and 707.0 feet, NGVD, and a downstream constraint is exceeded, a reduction of the release rate to as low as 1000 cfs is made. This reduction is made for the peak three days of the expected crest at Lone Tree and Wapello and the peak 7 days at Burlington. The reduction is made to keep the control point below or as close to its constraint as possible, while not letting the release drop below 1,000 cfs.

In the reach of the Iowa River from Coralville Lake to the mouth, the channel capacity increases from 12,000 cfs to 40,000 cfs as registered at the Lone Tree and Wapello gages, respectively. During the non-growing season (December 15 through May 1) larger discharges can be tolerated through the two reaches without causing significant damage. If the lake level is between the conservation pool (683 feet, NGVD) and 707 feet, NGVD, inflows will be released up to a maximum outflow of 6,000 cfs in the growing season (May 1 through December 15), and a maximum of 10,000 cfs in the non-growing season (December 16 through April 30).

When reservoir levels are at or forecasted to exceed the major flood pool level of 707.0 feet, NGVD, the Major Flood Schedule prescribing releases is followed, and all other constraints are disregarded. On this schedule, during the growing season releases are incrementally increased based on lake level from 7,000 cfs at elevation 707 feet NGVD to a fully open conduit with a release of 20,000 cfs at 712 feet NGVD. Similarly, during the non-growing season, releases are incrementally increased from 10,000 cfs at elevation 707 feet to 20,000 cfs at elevation 712 feet. If the lake level continues to rise exceeding elevation 712, water flows over the spillway and the total combined release (spillway plus conduit discharge) increases in excess of 20,000 cfs. Once the inflow to the reservoir has peaked, the release is based on either the minimum outflow required to utilize the remaining storage below elevation 712 feet, or the present outflow, whichever is higher. As the reservoir pool recedes and reaches elevation 707 feet, the release is gradually reduced, following the normal flood control schedule.

During drought when inflow is not sufficient to maintain conservation pool, 150 cfs is released until the pool falls below 678 feet at which time releases are further reduced to conserve remaining reservoir storage.

Details of the current WCP for Coralville Lake are shown in Figures 9 and 10 and Table 7.

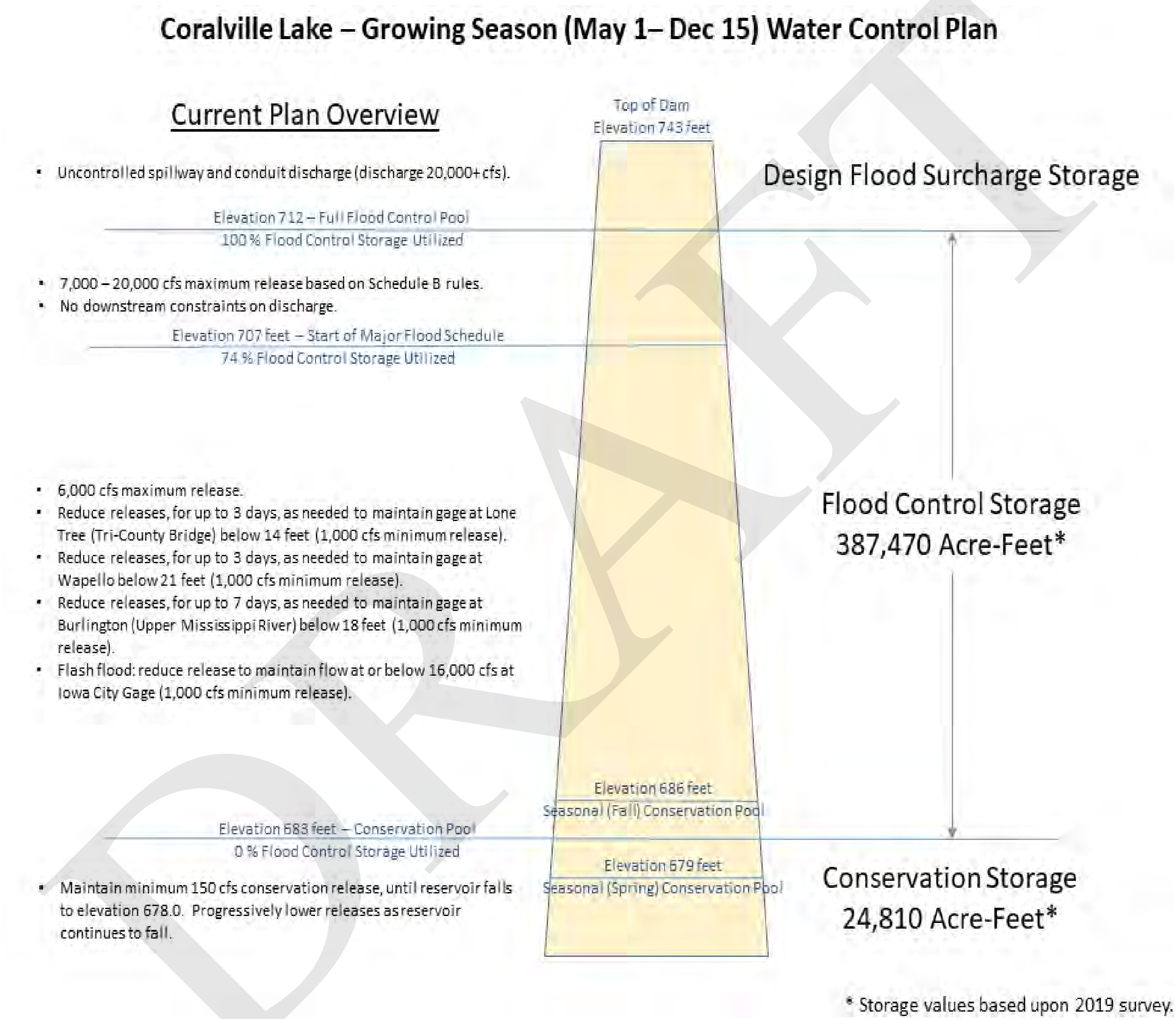

Figure 9. Coralville Lake Growing Season Water Control Plan

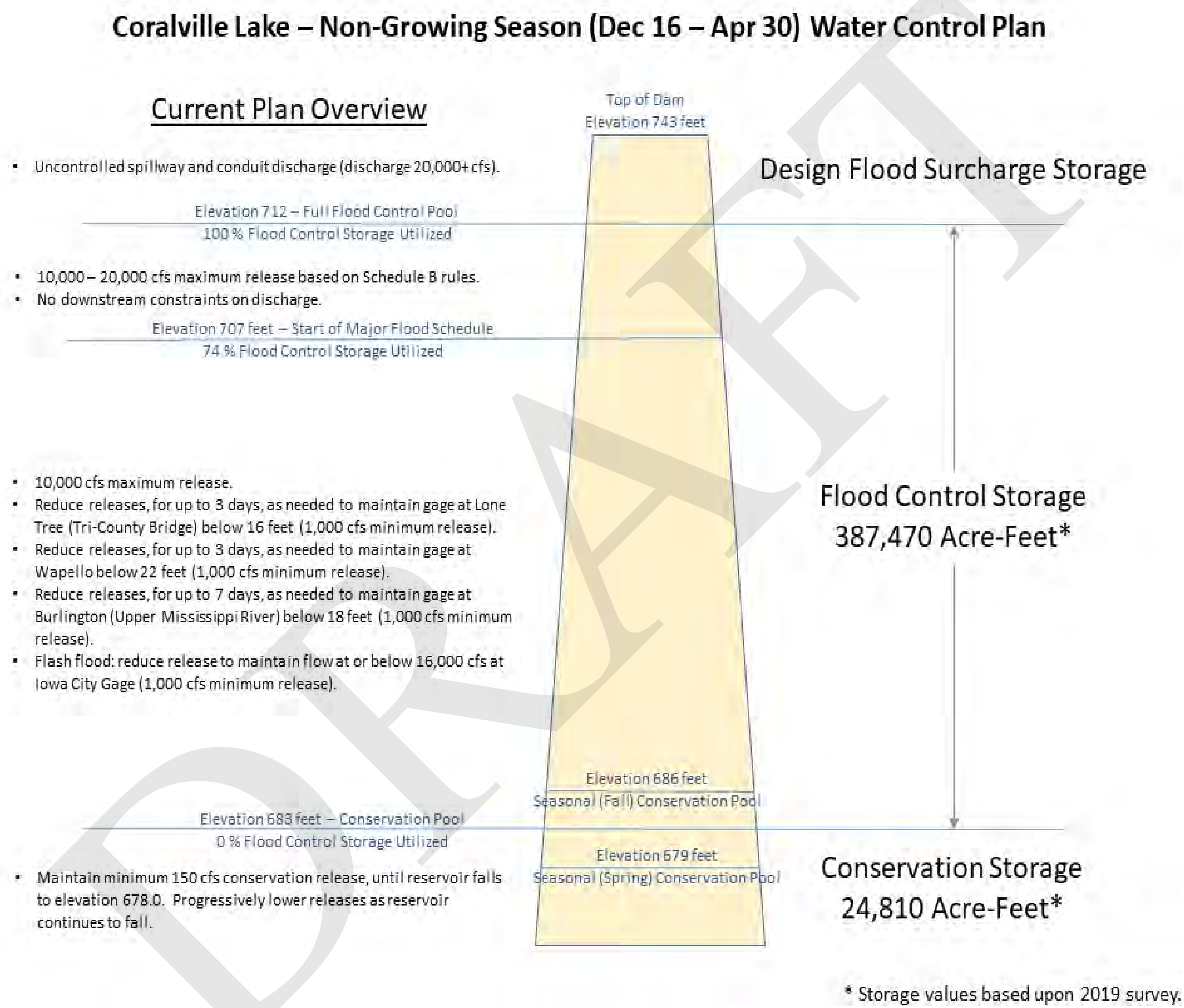

Figure 10. Coralville Lake Non-Growing Season Water Control Plan

Table 7. Pertinent Elevation-Area-Discharge Data

Description	Elev NGVD Ft	Surface Area Acres (Ac)[1]	Incremental Storage Ac-Ft [1]	Storage (Ac-Ft)	Maximum Outlet Capacity (cfs)	Discharge Capacity Spillway (cfs)
Surcharge Pool	737.9	43,500	930,300	1,342,600	22,100	244,000
Top of Flood Control Pool	712	24,960	387,470	412,280	21,000	0
Top of Fall Conservation Pool	686	6,070	15,100	39,910	13,000	0
Top of Conservation Pool	683	4,090	12,070	24,810	11,800	0
Top of Spring Conservation Pool	679	2,130	12,740	12,740	10,500	0

[1] Based on 2019 area and volume computations. At request of Iowa DNR, the conservation pool may vary between elevations 679 to 683 feet from 15 Feb to 20 May and from 683 to 686 from 01 Oct to 15 Dec

The following provides information pertinent to the Coralville Dam and Reservoir:

CORALVILLE LAKE

PERTINENT DATA

Location	Iowa River, River Mile 83.3, Johnson County, Iowa
Drainage Area	3,115 square miles
Volume of 1-inch of runoff	166,000 acre-feet
Uncontrolled Drainage Area	
Above Iowa City	156 square miles
Above Lone Tree	1,178 square miles
Above Wapello	9,384 square miles

DAM EMBANKMENT

Type	Rolled Earth-fill with Riprap Slope Protection
Height	743 feet NGVD (100 feet above streambed)
Length	1,400 feet
Top Width	22 feet

OUTLET FACILITIES

Type of outlet	One Circular Concrete Conduit with one Intake Tower
Conduit Diameter	23 feet
Type of Service Gates	3 electrically operated gates, each 8 feet wide by 20 feet high, 4-inches thick

SPILLWAY

Type	Chute Spillway with uncontrolled concrete weir
Crest elevation	712 NGVD
Real Estate Guide Taking Lines (fee title)	702 feet NGVD
Flowage Easement	702 -717 feet NGVD

K. STATE PARKS, CONSERVATION AREAS, AND OTHER AREAS OF RECREATIONAL, ECOLOGICAL, SCENIC, OR AESTHETIC IMPORTANCE

Parks, conservation areas, and wildlife management areas (WMA) in or near the planning area are listed in Table 8. In addition to the lands and waters managed by the District's Coralville Lake Project, the Project area contains approximately 18,040 hectares of public lands for recreation and conservation use. An example of a popular recreational area is the bridge with the bike trail pictured in Figure 11. These areas are free of housing developments or other buildings and provide simple pleasures such as relaxing, exercising, hunting, fishing, and nature watching. Some of these areas provide protection to sensitive plants and wildlife.

During high water events on the river or in the reservoir, many recreation facilities go out of service. The District designed many of the recreation facilities along the reservoir's shorelines to accommodate low water and high-water conditions. Their design maximizes recreation opportunities as well as keep maintenance costs low.

Future Conditions: Public lands should not change in the future. They will continue to play an important role for people's enjoyment and education, as well as important wildlife areas. Because these areas are in public ownership, their popularity should increase as other non-public lands become more urbanized. Conservation easements should continue but may depend on state and Federal funding. These areas are generally low in agriculture value, so there should be incentive to the landowners to continue setting aside flood prone lands for wildlife if there is a financial incentive.

Table 8. Parks, Conservation Area, and Wildlife Management Areas in the Study Area

Park Name	Owner	Manager	Type
Auburn Hills Park	City of Coralville	City of Coralville	City Park
Big Grove Preserve	Johnson County Heritage Trust	Johnson County Heritage Trust	Non-governmental Organizations Preserve
Brown Deer Golf Course	City of Coralville	City of Coralville	Public Golf Course
Cappy Russell Access	Louisa CCB	Louisa CCB	County Park
Central Park	City of Coralville	City of Coralville	City Park
Chauncey Swan Park	City of Iowa City	City of Iowa City	City Park
Chinkapin Bluffs Recreation Area	Louisa CCB	Louisa CCB	County Park
City Park	City of Iowa City	City of Iowa City	City Park
Clear Creek Greenbelt	City of Coralville	City of Coralville	City Park
Cone Marsh WMA	Iowa DNR	Iowa DNR - Wildlife	State WMA
Coralville Bike Trail	City of Coralville	City of Coralville	Recreation Area
Coralville Lake	Corps of Engineers	Corps of Engineers	Federal Lands and Waters
Coralville Lake - Scales Point Leased Area	Corps of Engineers	Private	Federal Recreation Area
Court Hill Park	City of Iowa City	City of Iowa City	City Park
Crandic Park	City of Iowa City	City of Iowa City	City Park
Creekside Commons Park	City of North Liberty	City of North Liberty	City Park
Creekside Park	City of Iowa City	City of Iowa City	City Park
Dovetail Recreation Area	City of Coralville	City of Coralville	City Park
Edgewater Park	City of Coralville	City of Coralville	City Park
Edgewater park Addition	City of Coralville	City of Coralville	City Park
English River Access	Iowa DNR	Iowa DNR - Wildlife	Access
Ferry Landing	Corps of Engineers	Corps of Engineers	Recreation Area
Finkbine Golf Course	University of Iowa	University of Iowa	Public Golf Course
Finkbine Prairie (East)	University of Iowa	University of Iowa	Research Area
Finkbine Prairie (West)	University of Iowa	University of Iowa	Research Area
Glendale Park	City of Iowa City	City of Iowa City	City Park
Hawkeye WMA	Corps of Engineers	Iowa DNR - Wildlife	State of Iowa WMA

Park Name	Owner	Manager	Type
Hanging Rock Ridge WMA	Iowa DNR	Iowa DNR - Wildlife	State of Iowa WMA
Hawkeye Softball Complex/Cretzmeyer Track	University of Iowa	University of Iowa	Recreation Area
Hawkeye WMA	Corps of Engineers	Iowa DNR - Wildlife	State WMA
Heritage Museum	City of Coralville	City of Coralville	Historical Site
Hickory Hill Park	City of Iowa City	City of Iowa City	City Park
Hills Access	Johnson CCB	Johnson CCB	County Park
Hoover Nature Trail	Linn County Trails Association	Linn County Trails Association	Recreation Area
Hubbard Park	University of Iowa	University of Iowa	Green space
Hunter's Run Park	City of Iowa City	City of Iowa City	City Park
Hwy 61 Access	Louisa CCB	Louisa CCB	County Park
Indian Fish Trap State Preserve	Amana Society	Amana Society	State Preserve
Indian Slough Wildlife Area	Louisa CCB	Louisa CCB	WMA
Iowa City Greenspace	City of Iowa City	City of Iowa City	Green space
Iowa River	State of Iowa	Iowa DNR	Sovereign Waters
Iowa River Bottoms	Johnson County	Johnson County	County Park
Jerry Quinlan WMA	Iowa DNR	Iowa DNR - Wildlife	State WMA
Kiwanis Park	City of Iowa City	City of Iowa City	City Park
Lake MacBride State Park	Iowa DNR, ACE	Iowa DNR - Parks	State Park
Lake Odessa WMA	Corps of Engineers	Iowa DNR - Wildlife	State WMA
Lake View OHV Park	Corps of Engineers	Iowa DNR - Law	State Off Highway Vehicles Area
Larry Quinlan WMA	Iowa DNR	Iowa DNR - Wildlife	State WMA
Longfellow Nature Trail	City of Iowa City	City of Iowa City	City Park
MacBride Recreation Area	Corps of Engineers	University of Iowa	Recreation Area
Mesquakie Park	City of Iowa City	City of Iowa City	City Park
Millrace Flats WMA	Iowa DNR	Iowa DNR - Wildlife	State WMA
Mississippi River	Multiple	Iowa DNR	Sovereign Waters
Mississippi River Islands WMA	Corps of Engineers	Iowa DNR - Wildlife	State WMA
Mormon Handcart Park	University of Iowa	University of Iowa	Historical Site
Napoleon Park	City of Iowa City	City of Iowa City	City Park
North Ridge Park	City of Coralville	City of Coralville	City Park
Oakdale Open Space	University of Iowa	University of Iowa	Green space
Old State Quarry State Preserve	Corps of Engineers	University of Iowa	State Preserve

Park Name	Owner	Manager	Type
O'mara - Newport Woods	Johnson County Heritage Trust	Johnson County Heritage Trust	Non-governmental Organizations Preserve
Outdoor Research Area	University of Iowa	University of Iowa	Research Area
Parkview Court (Recreation Trail)	City of North Liberty	City of North Liberty	City Park
Parkview Court Entry (Recreation Trail)	City of North Liberty	City of North Liberty	City Park
Peninsula Park	City of Iowa City	City of Iowa City	City Park
Port Louisa National Wildlife Refuge	Iowa FWS	Iowa FWS	National Wildlife Refuge
Ralston Creek	City of Iowa City	City of Iowa City	Green space
Recreation Trail	City of North Liberty	City of North Liberty	City Park
River Forks Access	Louisa CCB	Louisa CCB	County Park
River Junction Access	Johnson CCB	Johnson CCB	Access
Rogers Green -	City of Iowa City	City of Iowa City	City Park
Rotary Camp Cardinal Park	City of Coralville	City of Coralville	City Park
S.T. Morrison Park	City of Coralville	City of Coralville	City Park
Sand Lake City Park	City of Iowa City	City of Iowa City	City Park
Soccer Park/Water Treatment Plant	City of Iowa City	City of Iowa City	City Park
Stainbrook State Preserve	Corps of Engineers	University of Iowa	State Preserve
Swan Lake (Johnson) WMA	Iowa DNR	Iowa DNR - Wildlife	Sovereign Waters
Sycamore Wetlands	City of Iowa City	City of Iowa City	City Park
Terrel Mill Park	City of Iowa City	City of Iowa City	City Park
Turkey Creek Preserve	Johnson County Heritage Trust	Johnson County Heritage Trust	Non-governmental Organizations Preserve
University of Iowa Arboretum	University of Iowa	University of Iowa	Green space
Wapello Bottoms WMA	Iowa DNR	Iowa DNR - Wildlife	State WMA
Wastewater Treatment Plant	City of Iowa City	City of Iowa City	City Park
Water Plant Park	City of Iowa City	City of Iowa City	City Park
West River Bluffs	University of Iowa	University of Iowa	Green space
Wetlands Reserve Program	Iowa FWS	Iowa FWS	WMA
Williams Prairie State Preserve	TNC	TNC	State Preserve
Willow Creek Park	City of Iowa City	City of Iowa City	City Park

Figure 11. Woodpecker Trail Bridge Coralville Lake in Johnson County

L. HISTORICAL AND CULTURAL RESOURCES

The following information was largely taken from the cultural resources existing condition description in the Draft Coralville Master Plan as prepared by the assigned District Archeologist and was current as of 2018. Long before construction of Coralville Dam, Coralville Lake formed due to the Iowa River's natural impoundment approximately two miles upriver of Iowa City. Located almost entirely within the Southern Iowa Drift Plain landform, human habitation around the lake has occurred for the past 13,000 years, from the Paleoindian period through the Archaic and Woodland periods into the Meskwaki occupation of the area and subsequent Euro-American settlement.

Archaeological survey and data recovery excavations have been conducted at Coralville Lake for several decades. Notable surveys and excavations include the Smithsonian's work in advance of and concurrent with reservoir construction (Caldwell 1961; Wheeler 1949), large-scale surveys in the 1980s (Anderson and Overstreet 1986; Emerson et al. 1984; Overstreet and Stark 1985; Overstreet et al. 1985, 1987; Richardson et al. 1989; Schermer 1983), and a survey in anticipation of Lake Macbride restoration (Sellars and Ambrosino 2000). Work completed in the 1980s formed the basis for most conclusions and recommendations within the most recent Historic Properties Management Plan (HPMP; Overstreet 1986).

Many small-scale investigations have also been conducted, mainly related to construction projects (e.g., Doershuk and Peterson 2005; Fishel 1993; Kendall 2016; Peterson 1999; Rogers 2015). Examples include those at the Late Woodland Walter's Site (13JH42; Anderson 1971), multicomponent Woodpecker Cave (Enloe 2014, 2016), indeterminate-aged prehistoric sites (Titus 1996), and historic farmstead remnants (Gade 1998; Peterson and Jones 1996; Snow and Link 1997). Approximately 9,230 acres of the Project's total 24,591 acres (roughly 38%) of land and water have been explored through formal archaeological investigation, although some surveys pre-date the utilization of modern archaeological field methods. In addition, avocational archeologists have recorded many sites in the Iowa Site File.

The 411 archaeological sites identified on U.S. Government fee-titled lands at Coralville Lake are located in impounded areas, along the lake's periphery, or on adjacent uplands. One midden has only been documented to contain shell, and therefore may be non-cultural (13JH207), however the remaining 410 properties represent a wide variety of site types. These include historic farmstead remnants, an 1838–1839 Meskwaki village, a Euro-American cemetery, pre-contact era mounds, lithic scatters, habitations, and rock shelters. A total of 226 sites located around Coralville Lake lack diagnostic materials, resulting in general temporal association with Native American habitation prior to European colonization.

Thirteen sites around the lake have been found to contain or are likely to contain human remains. These include 10 mounds or mound groups (13JH1, 13JH3, 13JH6, 13JH331, 13JH343, 13JH519, 13JH1303-1304, 13JH1443-1444), a corner of one historic cemetery (the Alt/Wein Cemetery; 13JH1365), isolated human remains from the Sandy Beach site (13JH43; habitation/scatter; Middle Archaic and Woodland era site components), and Woodpecker Cave (13JH202; Middle and Late Archaic, Early to Late Woodland eras and Great Oasis site components). There are no identified Traditional Cultural Properties (TCPs) at Coralville Lake.

Only one site is known to meet the requirements for listing on the National Register of Historic Places (NRHP), a Woodland Era habitation site called Sugar Bottom NW (13JH272). Thirty-eight sites have been recommended for testing to assess NRHP eligibility, 300 have been recommended or determined ineligible, and the remaining 72 archaeological sites have no associated NRHP eligibility recommendation. Sites lacking eligibility recommendations are primarily avocational archeologist-recorded finds or historic sites recorded on the basis of archival information alone.

Three Paleoindian Period (11,500-8,500 Before Common Era or B.C.E.) sites have been identified around the reservoir (13JH53, 13JH126, 13JH161). Early Paleoindian populations in Iowa are associated with Clovis and Folsom cultural complexes, and are generally described as highly mobile hunter-gatherers who lived in small groups and maintained large territories. Their subsistence economy emphasized large game, but evidence exists that they also utilized deer, fish, berries, and small mammals as they seasonally followed big game herds. In Iowa, Late Paleoindian and Early Archaic cultures existed contemporarily, with Early Archaic sites more prevalent in the eastern portion of the state in proximity to the Eastern Woodlands.

The area's Archaic Period (8,500-800 B.C.E.) utilization is represented by at least 34 sites. During this time the average number of persons living in settlements increased, and some groups grew large enough to form small villages. Artifact assemblages dating to this period demonstrate greater diversity of lithic and biological resources, and the presence of specialized equipment suggests increased exploitation of aquatic resources and nuts. Archaic sites here include scatters, habitations, and a rock shelter. The nearby Late Archaic Edgewater Park site (13JH1132) was identified as a small encampment and resource processing site in the City of Coralville along the Iowa River. Soil samples collected from the site contained seeds that suggest occupants were practicing the earliest stages of domestication.

Although some crop domestication occurred during the Late Archaic, not until the Woodland Period (800 B.C.E – Common Era or C.E. 1250) did farming intensify. This increasing reliance on crops meant that people could live in one location for longer durations, because there was a more dependable food supply. Village size increased, food storage pits became common, and ceramics were developed to aid in food processing. A greater variety of exotic raw materials and finished goods can be found at sites dating to this period, suggesting that trading networks became increasingly complex. The Coralville Lake area includes 93 identified Woodland sites, including mounds, two possible villages, other habitations, scatters, and rock shelters. Two sherds resembling Great Oasis (C.E. 900-1100) ceramics have been identified from assemblages at Woodpecker Cave (13JH202), and represent that culture's easternmost manifestation. Additionally, two sherds similar to Central Plains tradition ceramics have been identified from the site.

Five Late Prehistoric sites are recorded around the lake. An association with the Oneota tradition (C.E. 1000-1650) has been suggested for some components of these sites, mostly on the basis of avocational reports of isolated shell-tempered sherds at multicomponent sites 13JH2, 13JH26, and 13JH205. A number of modern tribes descend from Oneota peoples, including the Baxoje (Ioway), Ho-Chunk/Winnebago, Otoe-Missouria, Omaha, and Ponca. Sites 13JH1379 and 13JH1380 each resulted in the recovery of a small projectile point, very tentatively associated with the Late Woodland or Late Prehistoric periods.

The arrival of Marquette and Joliet to the Upper Mississippi River in 1673 represents the beginning of the historic period in Iowa, with the first documented contact between European and Native peoples in the region. Historic-era Native American sites identified around Coralville Lake include Poweshiek's 1838-1839 Meskwaki village (associated with two site numbers: 13JH1177, 13JH1337), its associated trading post (13JH1251), and a nearby artifact scatter (13JHJ1252). In addition, the location of the "paper" town (platted but probably never occupied) of Monroe (13JH1338) likely was chosen due to its proximity to the trading post, river, and Meskwaki farm fields. Other Meskwaki-related sites such as winter camps may be present but remain unidentified.

After the Black Hawk War in 1832, the United States officially combined the Meskwaki, or "Fox," and Sauk tribes into a single federally-recognized group known as the Sac & Fox Confederacy. The Meskwaki were removed from their ancestral homelands along with the Sauk people to a reservation in eastern Kansas in 1839. After all Meskwaki lands had been conceded through treaty in 1845, Euro-American settlers arrived, quickly purchasing all available lands and converting much of the prairie and timber into farmland. There are 95 known historic era archeological sites in and around the reservoir. In addition to the Meskwaki-related sites, historic era archeological sites include a sawmill, flour mill, school, church/school, farmsteads, rural residences, road/trail remnants, and artifact scatters.

Reservoir erosion has destroyed many recorded archaeological sites surrounding the lake. However, sedimentation has buried some sites with historic alluvium, effectively sealing those deposits. Some archeological sites remain in relatively undisturbed contexts, such as those found on ridgetops and high terrace landforms. Well-preserved examples include the Woodland era habitation Sugar Bottom NW (13JH272; on an upland noseslope) and McAlister Creek VI (13JH151; Archaic habitation on a high terrace).

In addition to archeological resources, inventoried architectural buildings and structures at Coralville Lake include NRHP-listed resources at Lake Macbride State Park, contributing to the Multiple Property listing "Civilian Conservation Corps (CCC) Properties in Iowa State Parks: 1933-1942" (McKay 1989). These CCC-constructed resources include the superintendent's stone residence, a frame maintenance building, a set of portals, a culvert, and a limestone footbridge. Non-contributing resources include a refectory, a pit vault latrine, a shelter, the bathhouse, and archeological remnants of limestone stairs (13JH1083).

The Old State Quarry (Iowa Architectural Site 52-00166) is NRHP-listed due to its association with the construction of important buildings, including the Iowa Territorial Capitol at Iowa City and the present Iowa State Capitol. Several other inventoried architectural resources are NRHP-ineligible (Hoosier Creek bridges 52-00250 and 52-00170; Krieger Farmhouse 52-05039).

The Coralville Dam complex construction began in 1949 and the dam became operational in 1958. Original (1948) plans group the proposed dam-related structures or objects into the categories of earth embankment (dam), outlet works (gates, approach channel, outlet control house, service bridge to control house, conduit, stilling basin, and outlet channel), spillway, and hydraulic gages. The Coralville Lake dam complex minimally includes those structures and objects, and may additionally include other associated resources, such as roads, recreational facilities, and administrative buildings. The District plans to conduct an NRHP eligibility assessment of the complex in the coming years.

M. SOCIOECONOMIC RESOURCES

The Region of Influence (ROI) for the socioeconomic resources includes four counties in Iowa: Johnson, Linn, Louisa, and Washington. Socioeconomic data is presented for the four-county ROI.

Population. Population of the ROI in 2020 was estimated to be 407,857, an increase of 13% from year 2010. A majority of the Study area's population resides in Linn and Johnson Counties (92%), encompassing the Cities of Cedar Rapids, Coralville, and Iowa City. A substantial amount of the population growth within the ROI took place in Johnson County. Table 9 and Figure 12 reflect population growth for Johnson, Linn, Louisa and Washington Counties as well as the overall ROI and the State of Iowa. Johnson County population increased 105% or an additional 76,064 people over 50 years between 1970 and 2020.

Table 9. Region of Influence Population Growth 1970 - 2040

	Dec 1970	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020	Dec 2030	Dec 2040
Johnson County	72,207	82,203	96,595	111,455	131,293	148,271	155,914	162,628
Linn County	163,394	169,764	169,295	192,365	211,679	227,186	241,359	253,999
Louisa County	10,694	12,084	11,620	12,174	11,364	10,902	10,766	10,748
Washington County	18,988	20,169	19,617	20,718	21,697	21,499	20,423	19,553
ROI	265,283	284,220	297,127	336,712	376,033	407,857	428,463	446,928
State of Iowa	2,828,500	2,916,000	2,781,018	2,929,067	3,050,738	3,169,479	3,260,354	3,344,330

Source: U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

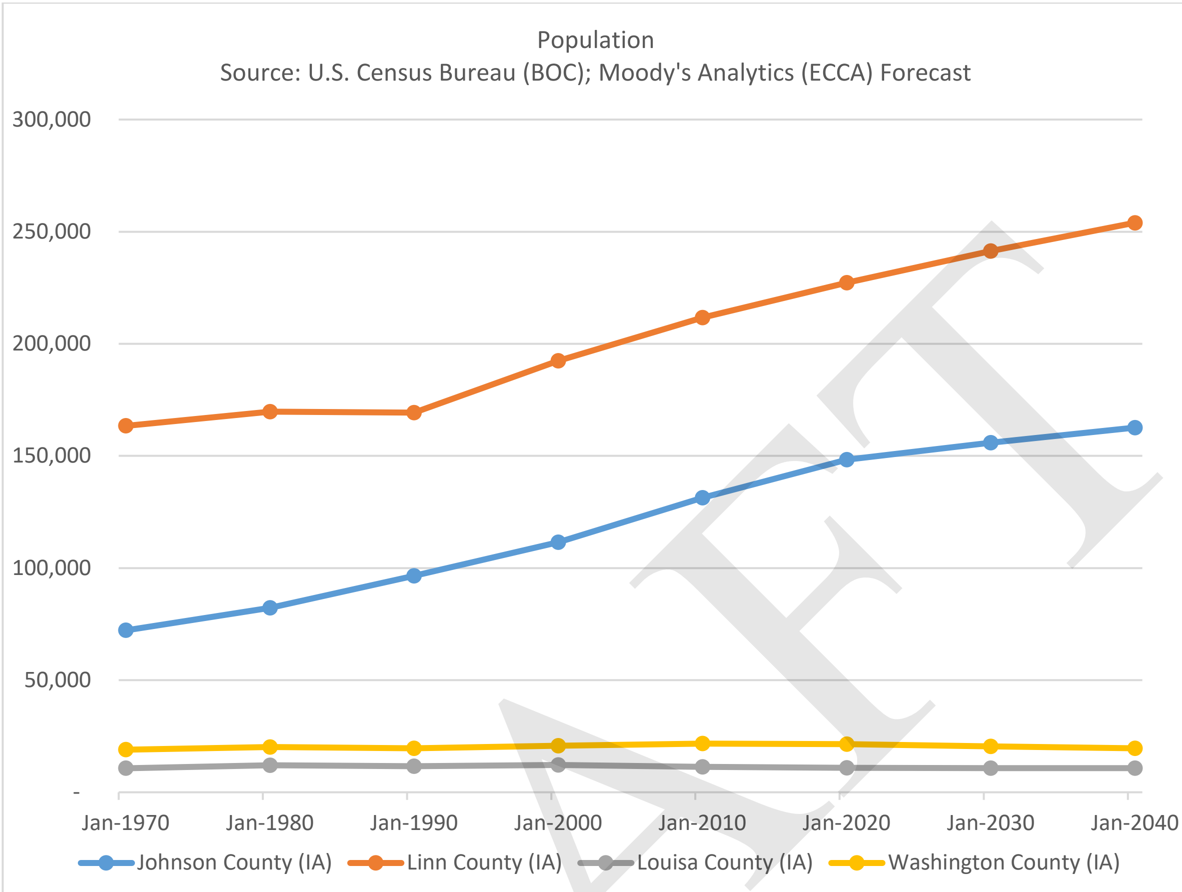

Figure 12. Region of Influence Population, 1970-2040

Households. In 2020, 169,474 households were present in the ROI. The increase in households tracks with the increase in population within the area, as shown in Table 10 and Figure 13.

Table 10. Region of Influence Increase in Population to Households

	Dec 1970	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020	Dec 2030	Dec 2040
Johnson County	22,500	30,400	36,246	44,352	52,936	60,885	67,010	72,309
Linn County	50,876	61,766	65,706	77,182	86,409	95,456	106,004	115,297
Louisa County	3,457	4,228	4,306	4,525	4,342	4,305	4,457	4,609
Washington County	6,138	7,223	7,456	8,092	8,747	8,828	8,777	8,693
ROI	82,972	103,618	113,714	134,151	152,434	169,474	186,248	200,908
Iowa	896,993	1,053,825	1,065,959	1,152,776	1,224,584	1,309,677	1,408,382	1,493,360

Source: U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

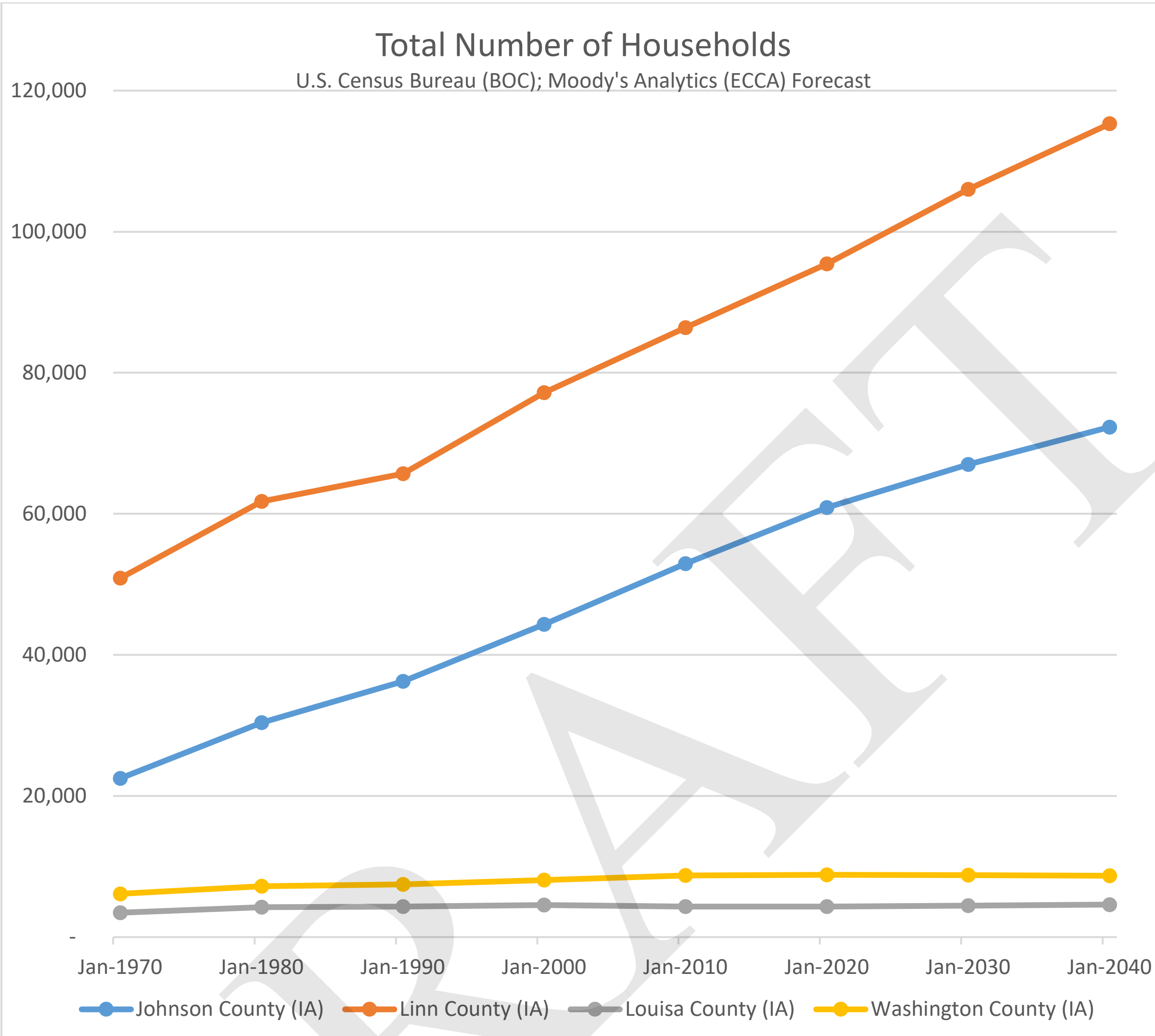

Figure 13. Region of Influence Households, 1970-2040

Race/Ethnic Diversity. Ethnic diversity in the Study area is lower than state and national levels. The largest three races represented by proportion are White (86.6%), Black or African American (5.5%), and Asian, (3.7%). All counties in the Study area have a majority white population (Tables 11 and 12).

Table 11. Racial Composition in Study Area, Estimated 2018 (Total Population)

	Total Population	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander	Some Other Race Alone	Two or More Races
Johnson County	147,001	120,694	9,945	290	9,240	98	3,277	3,457
Linn County	222,121	196,391	11,858	370	5,205	288	1,896	6,113
Louisa County	11,223	10,234	125	57	422	-	286	99
Washington County	22,143	21,307	201	60	104	-	183	288
ROI	402,488	348,626	22,129	777	14,971	386	5,642	9,957

Table 12. Racial Composition in Study Area, Estimated 2018

	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races
Johnson County	82.1%	6.8%	0.2%	6.3%	0.1%	2.2%	2.4%
Linn County	88.4%	5.3%	0.2%	2.3%	0.1%	0.9%	2.8%
Louisa County	91.2%	1.1%	0.5%	3.8%	0.0%	2.5%	0.9%
Washington County	96.2%	0.9%	0.3%	0.5%	0.0%	0.8%	1.3%
ROI	86.6%	5.5%	0.2%	3.7%	0.1%	1.4%	2.5%

Income. Per Capita income within the ROI is presented in Table 13 ranges from $44,521 in Louisa County to $65,619 in Washington County (estimated 2020).

Table 13. Income: Per Capita ($)

	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020	Dec 2030	Dec 2040
Johnson County	9,955	18,494	30,342	39,569	57,312	82,991	121,267
Linn County	10,829	20,040	31,932	41,374	56,941	78,768	111,915
Louisa County	9,051	16,046	24,194	31,365	44,521	60,545	83,428
Washington County	9,609	17,255	28,475	38,920	65,619	113,433	196,098
Iowa	8,869	16,480	25,572	36,607	56,862	86,353	132,922

Source: U.S. Bureau of Economic Analysis (BEA); U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

Employment. Table 14 and Figure 14 present Employment: Total Nonfarm Payroll for the ROI. Total nonfarm payroll employment is the number of paid US workers in all businesses, excluding those who work for farms, serve in the military, volunteer for nonprofit organizations, and perform unpaid work in their own household. Self-employed, unincorporated individuals are excluded as well. Government; Trade, Transportation, and Utilities; and Education & Health Services are the leading employment categories within the ROI (estimated 2020).

Table 14. Employment: Total Nonfarm Payroll

Description:	Dec 1970	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020
Natural Resources and Mining	216	250	188	144	158	160
Construction	3,551	6,210	6,401	9,638	9,363	12,258
Manufacturing	26,796	31,759	27,381	28,161	26,508	25,557
Trade; Transportation; and Utilities	18,813	22,462	29,701	39,965	43,275	48,298
Information	2,917	3,769	5,252	9,559	7,392	6,298
Financial Activities	4,229	6,039	6,972	10,789	13,002	14,650
Professional and Business Services	5,102	7,773	10,538	19,474	18,787	22,502
Education & Health Services	6,520	10,281	15,062	20,410	27,516	31,422
Leisure and Hospitality	5,816	10,468	13,201	16,544	19,222	22,599
Other Services (except Public Administration)	3,375	4,191	6,062	6,603	6,634	7,558
Government	25,710	33,518	38,898	42,615	47,618	52,181
Total Nonfarm Payroll	103,045	136,718	159,657	203,901	219,477	243,483

Source: U.S. Bureau of Labor Statistics: Census of Employment & Wages (QCEW - ES202);
Moody's Analytics (ECCA) Forecast

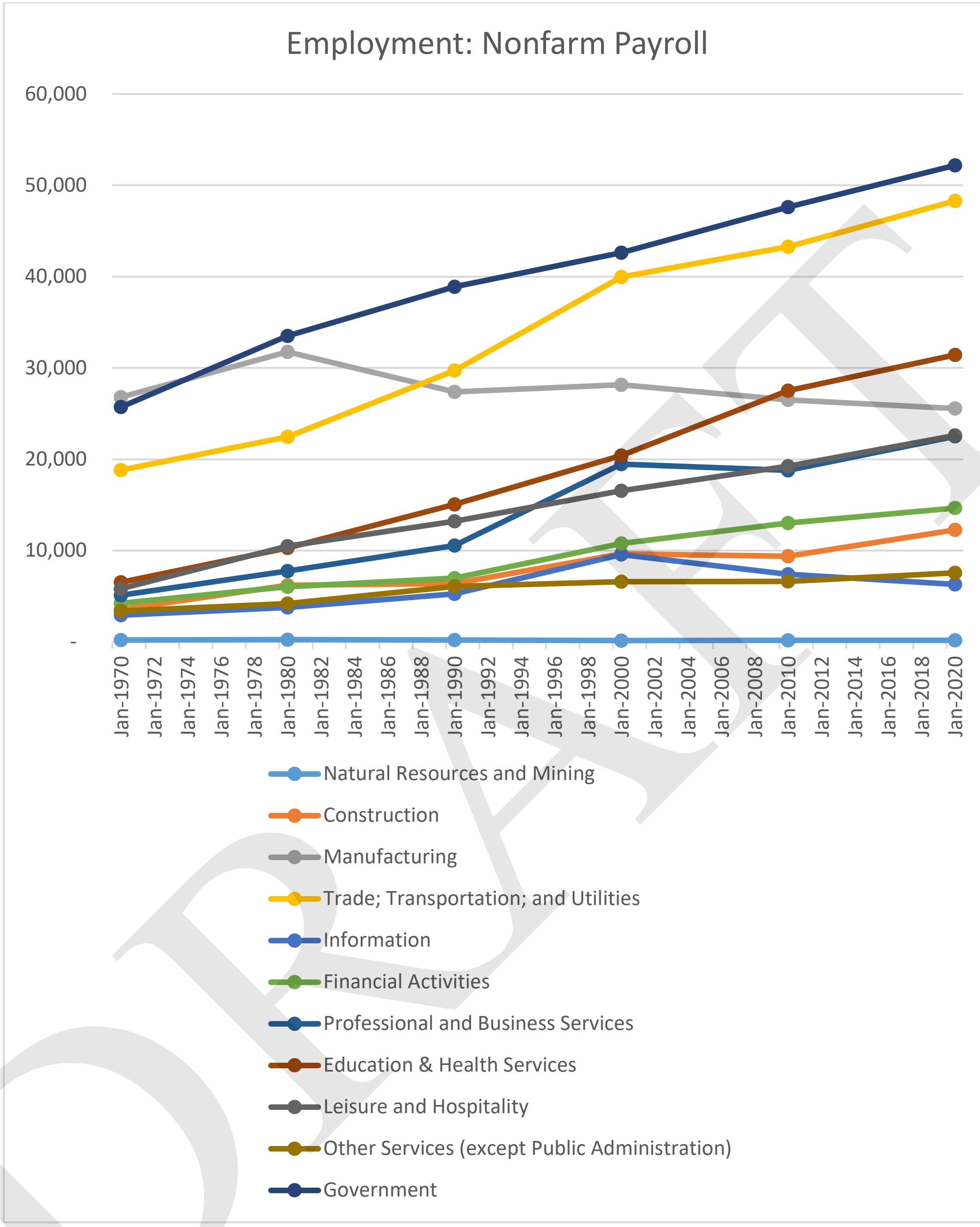

Figure 14. Employment: Total Nonfarm Payroll

Education Level. The ROI has a high percentage of persons age 25 and older with a High School Degree or greater. The ROI average education level tracks higher than the United States average (Table 15).

Table 15. Education Level in Region of Influence

	Johnson County	Linn County	Louisa County	Washington County	United States
High School Graduate or Higher, % of Persons Age 25+, 2014-2019	95.3%	94.7%	81.9%	91.1%	87.7%
Bachelor's Degree or Higher, % of Persons Age 25+, 2014-2019	53.0%	33.0%	14.2%	21.5%	1.5%

Source: U.S. Census and ACS 2014-2019.

Future Conditions: The future conditions, or No Action Alternative, includes the current operating scenarios and therefore, conditions occurring today are likely to exist in the future.

Minority and Low-income Populations (Environmental Justice). Environmental justice is defined as the fair treatment and meaningful involvement of all people, the final decision should be whether the Study area is likely to, or is already, impacted by greater adverse effects than a demographically similar reference community.

The five-year average (2014-2018) American Community Survey (ACS) data was queried to obtain relevant information associated with environmental justice. This ACS data is tabulated by the U.S. Census Bureau and was procured from the national, state, and county perspective in order to provide a multi-level geographical analysis.

In order to identify whether the potential alternatives may disproportionately affect minorities or impoverished citizens, an analysis was conducted utilizing county obtained from ACS. The following information was collected from specific census block groups in the Study area.

- **Racial and Ethnic Characteristics.** Race and ethnic populations in each census block of the Project area were characterized using the following racial categories: Hispanic, White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Persons of Hispanic Origin, and Other. These categories are consistent with the affected populations requiring study under Executive Order (EO) 12898. Table 11 lists race and ethnic characteristics per County in the ROI.

- **Percentage of Minority Population.** As defined by the U.S. Census Bureau, the minority population includes all non-Whites and White-Hispanic persons. According to Council of Environmental Quality (CEQ) guidelines, "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50% or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." The map following this section displays the block group locations in relation to the ROI.

- **Low-Income Population.** The percentage of persons living below the poverty level, as defined in the 2014-2018 ACS, was one of the indicators used to determine the low-income population in a given census block or tract. Low-income population is defined as a group with 20% or more of its residents below the poverty threshold.

Minority and population below poverty level percentages are shown in Table 16 and Table 17. Percent minority as a fraction of population, where minority is defined as all but Non-Hispanic White Alone. Calculated from the Census Bureau's American Community Survey 5-year summary estimates.

Percent of individuals whose ratio of household income to poverty level in the past 12 months was less than 2 (as a fraction of individuals for whom ratio was determined). Calculated from the Census Bureau's American Community Survey 5-year summary estimates.

Table 16. Percentage of Minority Population in Study Area

	Johnson County	Linn County	Louisa County	Washington County	ROI
White Alone	82.1%	88.4%	91.2%	96.2%	86.6%
Black or African American Alone	6.8%	5.3%	1.1%	0.9%	5.5%
American Indian and Alaska Native Alone	0.2%	0.2%	0.5%	0.3%	0.2%
Asian Alone	6.3%	2.3%	3.8%	0.5%	3.7%
Native Hawaiian and Other Pacific Islander Alone	0.1%	0.1%	0.0%	0.0%	0.1%
Some Other Race Alone	2.2%	0.9%	2.5%	0.8%	1.4%
Two or More Races	2.4%	2.8%	0.9%	1.3%	2.5%

Source: 2018 American Community Survey (ACS) 5 Year Estimate

Table 17. Low Income Population in Study Area

	Population for Whom Poverty Status Is Determined	
Johnson County	**Total**	138,866
	Below Poverty Level	24,728
	Percent Below Poverty Level	17.8
Linn County	**Total**	216,510
	Below Poverty Level	20,566
	Percent Below Poverty Level	9.5
Louisa County	**Total**	11,074
	Below Poverty Level	1,231
	Percent Below Poverty Level	11.1
Washington County	**Total**	21,749
	Below Poverty Level	2,021
	Percent Below Poverty Level	9.3

Source: 2018 American Community Survey (ACS) 5 Year Estimate

Future Conditions: The future conditions include the current operating scenarios and conditions occurring today are likely to exist in the future. Therefore, impacts to Environmental Justice resources, including minority and low-income population, taking place today are expected to occur in the future.

N. HUMAN HEALTH & SAFETY

The Coralville Lake Project offer FRM for people living downstream. The purpose of the District's FRM mission is to reduce the threat to life and reduce property damages from riverine flooding. The District's FRM projects include structural and non-structural measures. The District is an integral part of the nation's efforts to manage floodplains and maintain and operate aging water resources infrastructure. Execution of the FRM program serves to integrate and synchronize programs and activities within the Corps and with counterpart activities of the Department of Homeland Security, FEMA, other Federal agencies, state organizations, and regional and local agencies.

Coralville Lake's FRM structures include the Coralville Dam (embankment, outlet works, overflow spillway), Lake MacBride Remedial Works and Amana Iowa Remedial Works.

In addition to the FRM health and human safety component, low flow augmentation for water quality, fish and wildlife enhancement and recreational safety is a high priority at the reservoir. Reservoir staff fosters public and employee safety through education, research, and proactive visitor assistance activities, such as personal visitor contact, water safety patrols, and timely maintenance of signs and public use facilities.

Future Conditions. The area populations would continue to increase and, concurrently, development would also continue to increase. Water use and current water borne issues should continue into the future.

O. SUSTAINABILITY, GREENING AND CLIMATE CHANGE

Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (January 24, 2007), directs Federal agencies to conduct their environmental, transportation and energy-related activities in an environmentally, economically, and fiscally sound and sustainable manner. The District strives to protect, sustain, and improve the natural and man-made environment of the Nation, and is committed to compliance with applicable environmental and energy statutes, regulations, and EOs. Sustainability is an overarching concept encompassing energy, climate change, and the environment to ensure Federal activities do not negatively impact resources for future generations. Proposed alternative plans must provide for sustainable solutions addressing both short- and long-term environmental as well as social and economic considerations.

Many scientists believe greenhouse gases (GHGs) are components of the atmosphere trapping heat relatively near the surface of the earth and contribute to the greenhouse effect (or heat-trapping) and climate change. Most GHGs occur naturally in the atmosphere from natural processes and events, but increases in their concentration result from human activities such as burning fossil fuels. Several studies conclude global temperatures are expected to continue to rise as human activities continue to add carbon dioxide (CO_2), methane, nitrous oxides, and other GHGs to the atmosphere.

In 2010, the CEQ released draft guidance on when and how Federal agencies should consider GHG emissions and climate change in NEPA analyses. This draft guidance includes a presumptive effects threshold of 27,563 tons of CO_2 equivalent emissions from a Federal action annually (CEQ, 2010). In 2017, CEQ withdrew Final Guidance for Federal Departments & Agencies on GHG Emissions and Effects of Climate Change in NEPA Reviews.

Climate change impacts within the Study area would likely involve increased temperatures (Figure 15) and increased precipitation leading to further altered (flashier) hydrologic conditions (Figure 16). Any changes in hydrologic conditions occurring within the basin would likely result from less frequent but more intense warm-weather precipitation events, moderately to severely reduced summer flow conditions and degraded water quality, less winter ice cover and more cold-weather erosion events. The character of riparian habitats may also change, and invasive species may move into the area with changing climate (Pryor et al., 2014). Extreme rainfall events and flooding have increased during the last century and these trends are expected to continue, causing erosion, declining water quality, and negative impacts on transportation, agriculture, human health, and infrastructure. The range and distribution of fish and other aquatic species will likely change, and an increase in invasive species would also likely occur (Pryor et al., 2014).

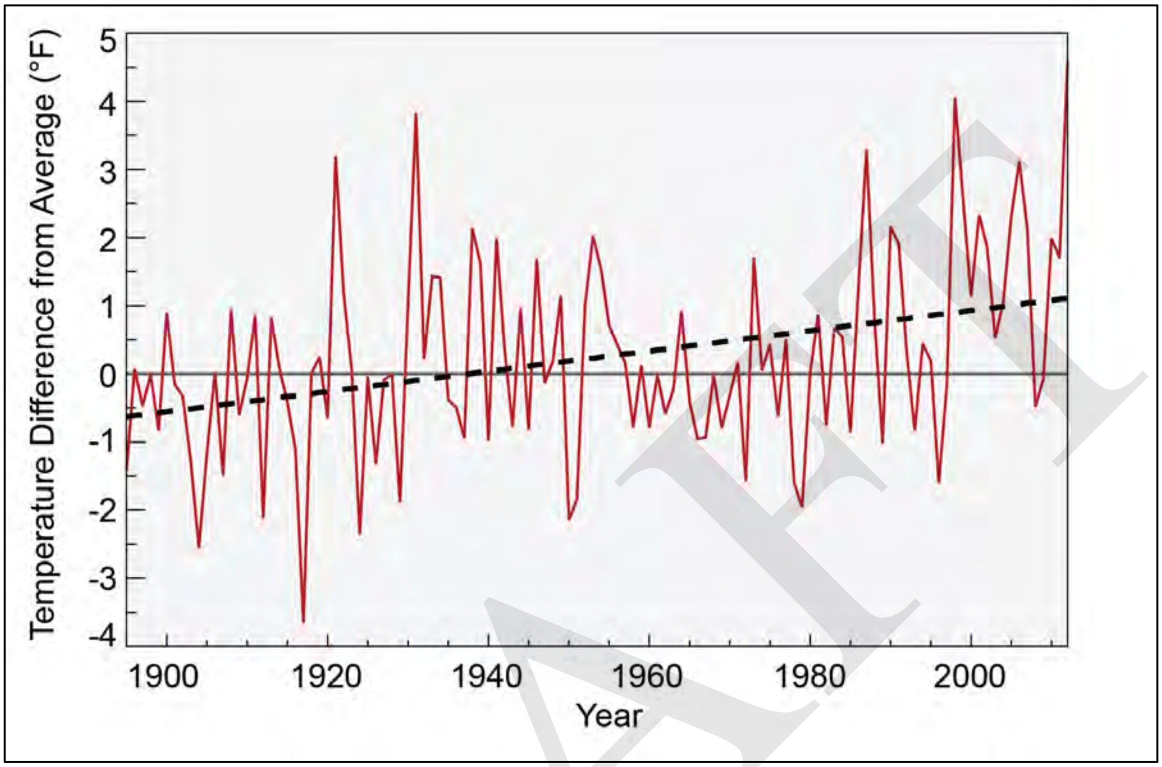

Figure 15. Temperatures Rising in the Midwest
Annual average temperatures (red line) across the Midwest show a trend towards increasing temperature. The trend (heavy black line) calculated over the period 1895-2012 is equal to an increase of 1.5°F. (Source: updated from Kunkel et al. 2013).

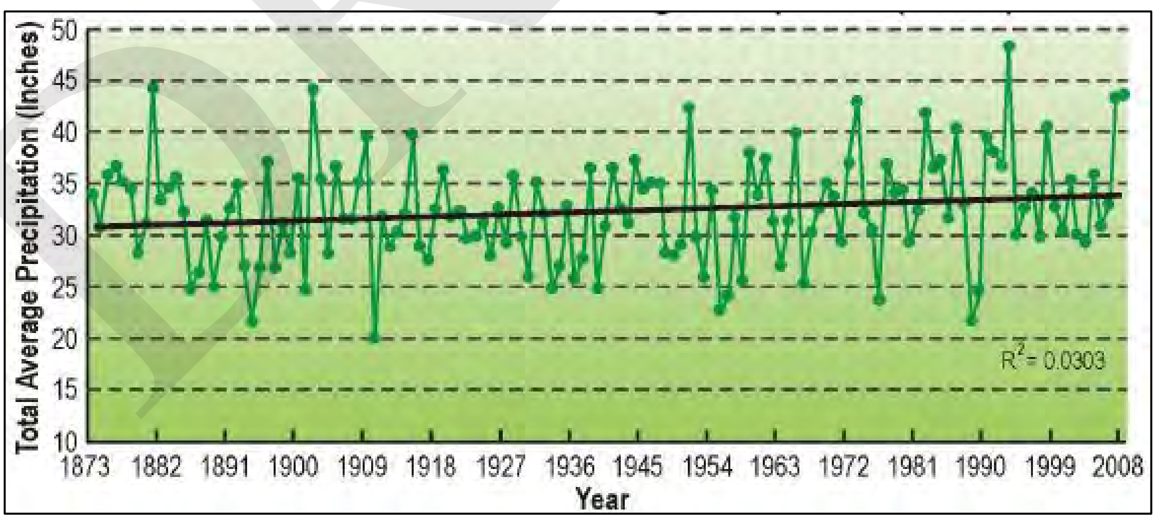

Figure 16. Iowa Annual State-wide Precipitation in Inches from 1873-2008
Note the State has had an 8% increase in annual precipitation over this 136-year period (Iowa Climatology Bureau, 2010. (http://www.iowadnr.gov/Conservation/Climate-Change)

In the next few decades, it is expected longer growing seasons and rising CO_2 levels would increase yields of some crops, though such benefits will be progressively offset by extreme weather events. Though adaptation options can reduce some of the detrimental effects, in the long-term, the combined stresses associated with climate change are expected to decrease agricultural productivity (Pryor et al., 2014).

The climate change assessment tools, utilized in the Study are consistent with USACE Engineering and Construction Bulletin (ECB) 2016-25, *Guidance for Incorporating Climate Chance Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects* to provide an indication of the potential for non-stationarity and impact to flood risk. Additional discussion on this topic is found in Appendix C, *Climate Change Impact Assessment*.

Future Conditions: District projects, programs, missions, and operations have generally proven to be robust enough to accommodate the range of natural climate variability over their operating life spans. However, recent scientific evidence shows in some places and for some impacts relevant to District operations, climate change is shifting the climatological baseline about which natural climate variability occurs, and may be changing the range of variability as well. This is relevant to the District because the assumptions of stationary climatic baselines and fixed range of natural variability, as captured in the historic hydrologic record may no longer be appropriate for long-term projections of flood risk.

The District considered climate change impacts on the hydrology of the Iowa-Cedar Rivers Basin in accordance with ECB 2016-25, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects*, as well as USACE Engineering Technical Letter 1100-2-3, *Guidance for Detection of Nonstationarities in Annual Maximum Discharges*.

Overall, there is no consensus among the gages in the Iowa-Cedar Rivers Basin to suggest that trends in observed data or detected nonstationarity change points should be applied to the entire watershed such that only the more recent portion of the observed record should be used to estimate flow statistics for alternative evaluation. 1-day, 7-day, and 15-day annual max unregulated inflows to Coralville Reservoir (computed from HEC Res-Sim) were evaluated for changepoints. Robustness was identified in a changepoint (~1957) found in each of the volume duration time series, however the (~1957) changepoint did not show consensus (multiple tests identifying a changepoint in the same statistical property), therefore there was not enough evidence to identify a strong changepoint nor to support two distinct periods that should be analyzed separately. Each of the volume duration time series (1-, 7-, and 15-day) showed an upward trend in annual maximums. However, the prevalence of an upward trend in streamflow and precipitation records, points to the hydrologic uncertainty of simply utilizing the full period of record and assuming stationarity. Relaxing sensitivity parameters in order to try to pick up detections from additional tests did not change the results.

Available literature and Corps Climate Assessment tools do not reach a consensus on observed and projected streamflow throughout the Iowa-Cedar Rivers Basin due to long-term persistent climate trends or anthropogenic climate change. However, there is some agreement that streamflow variability will increase, and extreme events will likely occur more frequently.

P. CONSTRUCTED RESOURCES - PUBLIC STRUCTURES, UTILITIES, TRANSPORTATION, OTHER

There are many critical structures such as hospitals, schools, fire stations, police stations, pump stations, electrical sub stations, wastewater treatment and drinking water facilities in the Study area.

Within the Study area there is an FRM dam (Coralville Lake Dam), once recreation dam associated with the Coralville Project (Lake MacBride), and two low head dams (Coralville Mill Dam and Burlington Street Dam).
There are over 30 river crossings of the Iowa River and Coralville Lake in the Project area, including interstate, state, county, and local highways as well as railroad and bicycle trails. There are also utility crossings such as overhead transmission lines or underground pipes.

Future Conditions: Infrastructure in and near the river will remain an integral part of the Iowa River. These structures will require maintenance, upgrades, and replacement. Additional constructed structures would reduce the river's meander into a stable channel.

Q. RECREATION

Recreation at Coralville falls within two categories and can be identified as either land or water-based recreation. Management objectives for each type vary depending on the location, safety hazards, and the intensity of use. At Coralville Lake, the operations project managers use their Master Plan to guide their work necessary to meet the public's needs for land and/or water-based recreation, while maintaining stewardship to the resource. Land-based recreation activities include camping, picnicking, biking, hiking, disc golf, shore fishing, hunting, bird, and wildlife watching, cross country skiing, sledding, snowmobiling, horseback riding, geo-caching, sightseeing, etc. on or adjacent to Corps-managed land.

Facility types typically found within recreation areas within the Iowa River Valley include campsites, picnic shelters, picnic sites, playgrounds, disc golf courses, equestrian trails, sand volleyball courts, horseshoe pits, ball fields, hunting areas, and hard and soft trails. These recreation areas are managed by several entities, which include the District, the Iowa DNR, CCBs, and city governments. Land-based recreation includes modernizing and rehabilitating existing recreation areas and providing a justified level of service.

Water-based recreation activities occurring within the planning area's water managed areas include pleasure boating, fishing, waterfowl hunting, sailing, swimming, paddle boarding, kayaking, water skiing and tubing, wind surfing, parasailing, and canoeing (Figure 17). The District manages the majority of water-based recreation with assistance from the Iowa DNR and Coast Guard Auxiliary. The management objective is to ensure public safety, while providing recreation opportunities on the water. This involves promoting water safety, studying recreation carrying capacity vs. current use patterns, zoning requirements for no-wake or restricted areas, and areas to remain open for public recreation.

Future Conditions: The parks, wildlife, historical, and recreation areas would remain an important part of the community. As development and human population increase around Coralville Lake and the Project Area, the need for sufficient recreations areas and the value provided to the community will continue to increase.

Figure 17. Marina at Coralville Lake

R. SEDIMENTATION/GEOLOGY/SOILS/PRIME AND UNIQUE FARMLAND

Reservoir Sedimentation: Reservoir sedimentation is an important issue with regard to meeting authorized purposes and reservoir life. The rate of sedimentation varies based on watershed characteristics. As sediment deposition occurs, reservoir storage capacity for both water conservation and FRM is reduced.

Results of the latest sedimentation survey shows about 61% filling below the conservation pool elevation 683.0 ft of Coralville Reservoir in the 60.6-year period between the dates of initial operation in September 1958 and the most recent survey of the lake in the spring of 2019. Based on this resurvey, the amount of deposition below elevation 712 ft (flood control pool elevation) amounted to 79,700 ac-ft since operation of the reservoir began in September 1958 equating to about 1,320-acre feet of storage loss per year. The current rate of sedimentation is approximately four times greater than the original 1948 predicted rate of 400 acre-ft /year, but is consistent with the overall rates calculated previously in 1999 and 2008 that utilized GIS and modern elevation survey methods. For the 2019 resurvey, the amount of sediment deposition below elevation 683 NGVD29 (conservation pool) amounted to 49% of the total deposition in the reservoir since September 1958.

Approximately 40,600 acre-feet of sediment deposition occurred between elevations 683 feet and 712 feet (current flood control pool) from 1958 to 2019 which equates to a loss of 9.5% of the original volume available between those elevations. The future long-term rate of sediment entrapment within the reservoir (712 ft and below) is expected to be similar to the previous surveys, at approximately 1,300 ac-ft per year.

Geology, Soils, & Prime and Unique Farmland. The Iowa-Cedar Rivers Basin lies in the Dissected Till Plains of the Central Lowland Province of the United States. Characteristic of this province is that the surface bedrock is almost entirely sedimentary and of Paleozoic age. The general regional structure is that of broad basins separated by intervening low domes. The bedrock is made up of limestone, shale, and sandstone. Limestone greatly predominates. The strata have a slight dip to the southwest. This dip approximates 10 feet per mile. The strike is northwest southeast; this gives the shape of a band to the areas outcrop of each formation.

Soil mapping is available showing the various soil types, parent material, slope, drainage, and fertility characteristics. This information is used to determine resource protection needs, historic biotic occurrence, stability, fertility, and drainage characteristics for various uses. The Gridded Soil Survey Geographic Database was developed by the National Cooperative Soil Survey, Natural Resources Conservation Service, U.S. Department of Agriculture (Soil Science Division Staff, 2017). Table 18 and Figure 18 summarize the planning area's soil information.

Table 18. Soil Farm Class Within the Study Area Floodplain Area

Soil Farm Class	Area (ha)
Farmland of Statewide Importance	4,905.61
All Areas Are Prime Farmland	8,706.57
Prime Farmland if Drained	9,984.73
Prime farmland if Irrigated	609.50
Prime Farmland if Protected from Flooding or Not Frequently Flooded During the Growing Season	800.86
Prime Farmland if Drained and Either Protected from Flooding or Not Frequently Flooded During the Growing	3,197.32
Not Prime Farmland	17,867.37

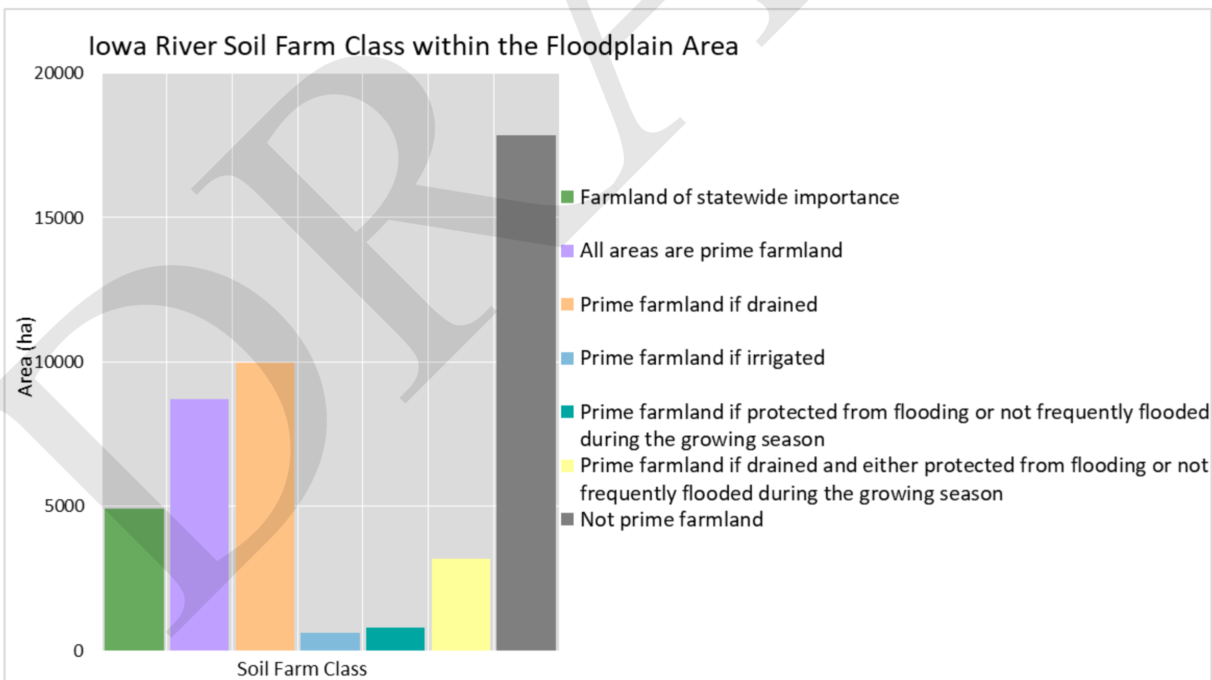

Figure 18. Soil Farm Class within Study Area Floodplain Area

Future Conditions: The geologic character of the Study area should remain relatively unchanged. However, soils should continue moving throughout the system and silting-in the reservoir. The topography of the Study area would change with accretion and erosion activities throughout the riverine system in the Study area.

S. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

Per ER 1165-2-132, *Hazardous Toxic and Radioactive Waste HTRW Guidance for Civil Works Projects*, HTRW includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq (CERCLA). [See 42 U.S.C. 9601(14].) Hazardous substances regulated under CERCLA include "hazardous wastes" under Sec. 3001 of the Resource Conservation and Recovery Act, 42 U.S.C. 6921 et seq; "hazardous substances" identified under Section 311 of the Clean Air Act, 33 U.S.C. 1321; "toxic pollutants" designated under Section 307 of the CWA, 33 U.S.C. 1317; "hazardous air pollutants" designated under Section 112 of the Clean Air Act, 42 U.S.C. 7412; and "imminently hazardous chemical substances or mixtures" on which EPA has taken action under Section 7 of the Toxic Substance Control Act, 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories.

The USEPA's EnviroMapper Database and the Iowa DNR's Facility Explorer Database list 23 regulated facilities or incidents within close proximity to the planning area. Given the level of ongoing development in the region surrounding the Coralville Reservoir, it is difficult to accurately identify all of the potential hazardous materials that may exist within or adjacent to the Project boundary. Federal law requires site-specific due diligence on a case-by-case basis before development can take place.

Previous studies with integrated environmental assessments have been conducted for the Coralville Reservoir. Since this Study will not involve the acquisition of real estate outside of that already under the control of USACE nor the construction of new engineering measures, it is deemed unnecessary to conduct an HTRW assessment at this time. Should conditions change, the District would conduct a HTRW assessment, as needed.

Future Conditions: There is no anticipated change to HTRW risks.

T. SUMMARY OF FUTURE CONDITIONS

The Iowa-Cedar River Basin should continue to be predominately agricultural land use; however, urbanization and non-permeable surfaces should continue to expand at their current rate. This may increase flash flooding and increased run-off. As urbanization increases, introduction of invasive species, or other habitat threats, animal species may shift from specific niche species to generalists who can adapt to future habitat changes or declines. Climate change (increased precipitation) may also promote flash flooding more often.

The District anticipates the population with the Study area will continue to grow from 407,857 to 446,928 by 2040, an increase of approximately 10%. While this growth and development pattern is not as drastic as those found in other parts of Iowa, it may contribute to continued resource decline in the river's vicinity.

Available literature and Corps Climate Assessment tools do not reach a consensus on observed and projected streamflow throughout the Iowa-Cedar Rivers Basin due to long-term persistent climate trends or anthropogenic climate change. However, there is some agreement that streamflow variability will increase, and extreme events will occur more frequently.

CHAPTER III: FORMULATION OF ALTERNATIVES

A. ALTERNATIVE FORMULATION STRATEGIES FINAL ARRAY OF ALTERNATIVES

Based on the Study goals, objectives and planning constraints, an initial array of alternatives was developed. The existing water control plan, Alternative 1, *No Action*, plus seven major alternatives were formulated for consideration with an additional five alternatives that are minor variations of Alternatives 2, 3 and 4. This initial set of alternatives focused on FRM and to a lesser degree low flow augmentation as these are the primary authorizations for the Coralville Dam. Details of each alternative are presented in Section B, *Alternatives Considered but Not Carried Forward for Detailed Analysis*.

There are a few regulation rules for the reservoir that are common to all of the alternatives, including the No Action Alternative, but which are omitted or ambiguous in the current WCP.

These include:

- Once the reservoir has peaked and storage is being evacuated, the maximum daily reduction in outflow should be maintained so as not to exceed a recession rate in the pool in excess of more than 1.3 feet per day in order to limit erosion around the rim of the reservoir.

- As the reservoir recedes following a Large Magnitude Flood (LMF), the maximum release rate is to be maintained until either elevation 705 (LMF- Alternative 6, explained below) or 707 is reached and then gradually reduced to follow the normal flood control operation schedule.

- All alternatives that include a conservation pool with the exception of the No Action Alternative will allow the pool to be maintained within a 1-foot operating band between elevations 683.0 and 684.0 with an allowable fall pool level up to elevation 688.0 and a spring drawdown to elevation 679.0.

B. ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD FOR DETAILED ANALYSIS

The alternatives that were considered but not carried forward were eliminated from further consideration as they either did not improve or worsened the frequency of occurrence and or duration of flooding during the initial hydraulic evaluation as compared to the alternatives carried forward. Details related to the hydraulic evaluation and elimination of alternatives from further consideration are presented in Chapter IV.

Alternative 2. This alternative incorporates elements of recent approved deviations from the current WCP that includes a 10,000 cfs year-round release during normal flood operations, tiered downstream constraints with variable minimum releases, altered dates for seasonal downstream constraints and a modified major flood operation schedule eliminating induced surcharge operation. Additional details of this alternative include the following:

- Elimination of growing season release reduction, holding a maximum of 10,000 cfs all year.

- Tiered, seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases. When forecast indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.
  - Growing Season:
    - Release not less than 6,000 cfs when the stages at Lone Tree and Wapello reach 16 feet and 22 feet, respectively
    - Release not less than 1,000 cfs when the stages at Lone Tree and Wapello reach 19 feet and 25 feet, respectively
  - Non-Growing Season: Release not less than 1,000 cfs when the stages at Lone Tree and Wapello reach 19 feet and 25 feet, respectively

- No changes to the Iowa City (16,000 cfs) and Burlington (18 feet) downstream constraints

- Altered dates for seasonal downstream constraint changes (Apr 15 – Dec 15)

- Modified LMF Operations release schedule and elimination of "Induced Surcharge Operation" (Table 19).

Table 19. Alternative 2 Large Magnitude Flood Schedule

Forecasted Peak Pool Elevation (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

Alternative 2A: This alternative is a variation of Alternative 2. All of the modifications in Alternative 2 are followed along with elimination of the spring drawdown to elevation 679 feet.

Alternative 2B: This is another variation of Alternative 2, which includes all of the changes made in Alternative 2, except that the tiered growing season downstream constraints are held all year.

Alternative 3: "Maximum Release Plan" plan provides envelope for increasing outflows and constraints in relation to all alternatives considered. This alternative consists of the following measures:

- No change to conservation levels including spring drawdown
- Release constrained by outlet capacity only
- No downstream constraints

Alternative 3A: This alternative incorporates the same changes as Alternative 3. However, this is the "Dry Reservoir Scenario". No conservation pool is held at any time, with the exception of holding back floodwaters when inflow exceeds outlet capacity.

Alternative 4: This alternative is another variation of Alternative 2. However, Alternative 4 includes elevation-based growing season releases to reduce downstream impact for water levels in the lower portion of the Flood Control Pool:

- Maximum growing season release determined by reservoir pool elevation:
  - Below Elevation 700 feet – 8,500 cfs
  - Above Elevation 700 feet – 10,000 cfs
- Non-Growing Season Release – 10,000 cfs

Alternative 4A: Alternative 4 with provision to maintain non-growing season maximum discharge (10,000 cfs) if above elevation 700 on May 1.

- Maximum discharge is maintained until pool is lowered to conservation levels.

Alternative 6: Alternative 6 is a stakeholder alternative provided by the Johnson County Homeland Security (HS) & Emergency Management Agency (EMA). The changes from the existing Coralville Dam regulation plan are as follows:

- Decrease the summer Conservation Pool elevation from 683 feet to 682 feet
- Maximum growing season release changed to 9,000 cfs. No change to maximum non-growing season release.
- Growing season to start on May 20 and end on Dec 01 (changed from May 01 and Dec 15, respectively)
- Raise the Iowa City flow constraint from 16,000 cfs to 16,500 cfs
- Change the Wapello constraint
  - Increase the growing season maximum stage from 21 feet to 23 feet
  - Increase the non-growing season maximum stage from 22 feet to 25 feet
  - Increase the minimum releases from Coralville Dam from 1,000 cfs to 3,000 cfs
- Eliminate the downstream stage constraints at Lone Tree and Burlington
- Altered LMF Release Schedule, starting at Elevation 705 feet and increasing flows more rapidly (Table 20).

Table 20. Alternative 6 Large Magnitude Flood Schedule

Forecasted Peak Pool Elevation (feet)	Release (cfs)
705	11,000
706	12,000
707	13,000
708	15,000
709	16,000
710	18,000
711	20,000
712	Fully Open

Alternative 7. Alternative 7 is a stakeholder alternative provided by the Two Rivers Levee & Drainage District, which is located in Louisa and Des Moines Counties, Iowa, downstream of Wapello, Iowa. The changes from the existing Coralville Dam regulation plan are as follows:

- Decrease the summer Conservation Pool elevation from 683 feet to 682 feet
- Reservoir releases only constrained by the capacity of the outlet, up to a maximum release of 16,500 cfs. Above that flow, follow the existing LMF Release Schedule from Alternative 1
- Change the Wapello constraint
  - Increase the growing season maximum stage from 21 feet to 23 feet
  - Increase the non-growing season maximum stage from 22 feet to 25 feet
- Increase the stage constraint at Burlington on the Mississippi River from 18 feet to 20 feet
- Eliminate the stage constraint at Lone Tree
- No change to the flow constraint and Iowa City

C. ALTERNATIVES CARRIED FORWARD FOR DETAILED ANALYSIS

Alternative 1- No Action- Maintains the current WCP and facilitates no changes to the current Iowa-Cedar Rivers Basin Master Reservoir Regulation Manual for Coralville Lake. Under this baseline alternative the reservoir would continue to be operated under the current WCP. This would mean:

- Maintain the normal Conservation Pool level of 683 feet.
- Reservoir releases during normal flood control operations (reservoir elevations between 683 and 707 feet):
  - Growing season maximum release: 6,000 cfs
  - Non-growing season maximum release: 10,000 cfs
- Downstream constraint at Iowa City (flash flood operations): Any date that the flow at the Iowa City gage is at, above, or forecast to exceed 16,000 cfs, reduce the release to not less than 1,000 cfs to maintain the flow at or below 16,000 cfs.
- Seasonal downstream constraints at Lone Tree and Wapello. When forecasts indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.
  - Growing Season: Release not less than 1,000 cfs when stages at Lone Tree and/or Wapello are forecast to exceed 14 and 21 feet, respectively
  - Non-growing Season: Release not less than 1,000 cfs when stages at Lone Tree and/or Wapello are forecast to exceed 16 and 22 feet, respectively
- Downstream constraint at Burlington: Any date the Mississippi River is forecast to exceed a stage of 18 feet at Burlington, Iowa, reduce the release to not less than 1,000 cfs during the peak 7-days of the Mississippi River crest with due allowance for travel time.

- LMF operations begin at elevation 707 feet with 71.5% of flood storage capacity being utilized. Prescribed releases are followed between elevations 707 and 712 feet and all constraints are relaxed (Table 21).

Table 21. Alternative 1 Large Magnitude Flood Schedule

Forecasted Peak Pool Elevation (ft)	Growing Season Release (cfs)	Non-growing Season Release (cfs)
707	7,000	10,000
708	8,000	10,000
709	9,000	10,000
710	10,000	
711	11,000	
711.1	12,000	
711.2	13,000	
711.3	14,000	
711.4	15,000	
711.5	16,000	
711.6	17,000	
711.7	18,000	
711.8	19,000	
711.9	20,000	
712	Gates Fully Open	

Alternative 2C: Maintain the measures implemented in Alternative 2 (alternative considered but not carried forward), with the only difference being that the higher non-growing constraints are maintained throughout the entire year.

This would mean:

- Elimination of growing season release reduction, holding a maximum of 10,000 cfs all year during normal flood operation.
- When forecasts indicate constraint stages will exceed 19 feet at Lone Tree and/or 25 feet at Wapello, reduce the release to not less than 1,000 cfs during the peak 3-days of the crest with due allowance for travel time.
- No changes to the Iowa City (16,000 cfs) and Burlington (18 feet) downstream constraints
- Modified Large Magnitude Flood Operations (LMF) release schedule, as shown in Table 22, which eliminates "induced surcharge operation".

Table 22. Alternative 2 Large Magnitude Flood Schedule

Forecasted Peak Pool Elev (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

Alternative 5: Alternative 5 is almost the same as Alternative 2 (alternative considered but not carried forward) with the only difference being that the growing season maximum release is 8,000 cfs. Downstream stage constraints are April 15 – Dec 15 (growing season) and Dec 16 –April 14 (non – growing season). Details of this alternative include:

- Growing season maximum release is 8,000 cfs (May 1 - Dec 15).
- Non-growing season maximum release is 10,000 cfs (Dec 16 - Apr 30)
- Tiered, seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases. When forecast indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.
  - Growing Season:
    - Release not less than 6,000 cfs when the stages at Lone Tree and/or Wapello are forecast to exceed 16 feet and 22 feet, respectively
    - Release not less than 1,000 cfs when the stages at Lone Tree and/or Wapello are forecast to exceed 19 feet and 25 feet, respectively
  - Non-Growing Season: Release not less than 1,000 cfs when the stages at Lone Tree and/or Wapello are forecast to exceed 19 feet and 25 feet, respectively
- No changes to the Iowa City (16,000 cfs) and Burlington (18 feet) downstream constraints
- Altered dates for seasonal downstream constraint changes (Apr 15 – Dec 15)
- Modified Large Magnitude Flood Operations (LMF) release schedule, and elimination of “Induced Surcharge Operation” (Table 23).

Table 23. Alternative 2 LMF Schedule

Forecasted Peak Pool Elev (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

Alternative 8: Alternative 8 is similar to Alternative 4 (alternative considered but not carried forward) but with the same downstream constraints throughout the entire year and a modified LMF schedule. Details of this alternative include:

- Maximum growing season release determined by reservoir pool elevation:
  - Below Elevation 700 – 8,500 cfs
  - Above Elevation 700 – 10,000 cfs
- Maximum non-growing season release is 10,000 cfs
- Release not less than 1,000 cfs when forecasts indicate the stage at Lone Tree constraint is 18.5 feet and Wapello constraint is 25 feet.

- The LMF schedule is shown in Table 24.

Table 24. Alternative 8 LMF Schedule

Forecasted Peak Pool Elev (feet NGVD)	Release (cfs)
707	12,000
710	16,000
711	18,000
711.5	20,000
712	Fully Open

CHAPTER IV: EVALUATION OF ALTERNATIVE PLANS

A. INTRODUCTION

Potential alternatives were initially evaluated on the basis of whether the alternatives enhanced, maintained or reduced the ability to meet Study goals and objectives. Screening criteria included FRM (primary Coralville Lake authorization), low flow augmentation, fish and wildlife, recreation, and other stakeholder interests such as inundation of flowage easement lands within Coralville Lake. Following the completion of the qualitative screening process, the alternatives were analyzed quantitatively using the reservoir simulation model HEC-ResSim to further evaluate each alternatives effectiveness, primarily focusing on FRM and to a lesser extent water conservation.

The initial quantitative screening process was conducted by modifying an existing HEC-ResSim model of the Iowa River/Iowa-Cedar Rivers Basin using study and tributary flow data spanning the years from 1917 through 2019 as primary inputs to the model. Model results were provided as daily flows and reservoir elevations throughout the system. Each alternative plan was modeled, and results were evaluated and compared based on estimating frequency and duration of a series of metrics related to key flows and reservoir levels related to changes in Dam operations or the nature/severity of flood impacts.

B. STEP 1. HYDRAULIC EVALUATION

Results from the HEC-ResSim model are presented in Table 25, which provide a comparison of reservoir simulation results for each alternative plan, organized by river reach and associated concerns and metrics. Results related to each metric are presented in terms of exceedance probability, duration or other pertinent measures as shown in the tables. The highlighted results shown in green in the table under each alternative indicate that the frequency, duration, or other pertinent measure improved for that alternative when compared to Alternative 1, *No Action Alternative*. Similarly, highlighted results shown in red in the table under each alternative indicate that the frequency, duration, or other pertinent measure were worse for that alternative when compared to Alternative 1, *No Action Alternative*. Non-highlighted results in the tables indicated that in implementing that alternative, conditions remained the same as in the No Action Alternative.

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Table 25. Summary of Reservoir Simulation Results for Alternative Plans

Summary of Reservoir Simulation Results for Alternative Plans

Based Upon Period of Record Simulations (1917-2019)

Flood Risk Management

River Reach	Concern	Metric	Unregulated	Alternative 1	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3	Alternative 3A	Alternative 4	Alternative 4A	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Above Coralville Lake	Frequency of Flooding of Land Within Flowage Easements	Number of Years Reservoir Exceeded Elevation 702 feet NGVD	NA	29	23	23	24	22	4	**3**	23	23	23	18	17	22
	Duration of Flooding of Land Within Flowage Easements	Percent of Time Reservoir Exceeds Elevation 702 feet NGVD	NA	2.4%	1.6%	1.6%	1.6%	1.5%	**0.2%**	**0.2%**	1.6%	1.6%	1.7%	1.1%	0.8%	1.6%
	Overtopping of Spillway, Potential Erosion of Spillway Channel	Number of Years Reservoir Exceeded Elevation 712 feet NGVD	NA	3	2	2	2	2	**1**	**1**	2	2	2	2	2	2
	Overtopping of Spillway, Potential Erosion of Spillway Channel	Total Duration of Spillway Events (Number of Days Above Elevation 712 feet NGVD)	NA	29	26	25	25	21	**7**	**7**	26	26	25	24	24	23
	Flooding in Upstream Communities in the Amana Area and Loading of Remedial Works (Top of original Remedial Levee 717.0 ft NGVD)	Number of Years Reservoir Exceeded Elevation 715 feet NGVD	NA	1	1	1	1	1	**0**	**0**	1	1	1	1	1	1
Coralville Tailwater	Flooding of Access to River Front Estate NE	Number of Years of 13,000 cfs, or greater, Release From Coralville Dam	50	7	5	5	5	**4**	30	24	5	5	5	9	37	**4**
	Installation of Removable Flood Wall on 1st Avenue in Coralville, Closing Road to Traffic.	Number of Years of 17,000 cfs, or greater, Release From Coralville Dam	32	5	3	3	3	**2**	5	5	3	3	3	**2**	3	3
Iowa City Reach (Between Clear Creek and English River Confluences)	Flash Flooding in Iowa City	Number of Years Exceeding 16,500 cfs at Iowa City Gage	37	6	6	6	6	**4**	14	12	6	6	6	6	20	**4**
	Significant Increase in Floodwaters Impacting Access to, and Use of, University of Iowa Buildings	Number of Years Exceeding 20,000 cfs at Iowa City Gage	24	4	**2**	**2**	**2**	**2**	5	5	**2**	**2**	**2**	**2**	**2**	**2**
Lone Tree Reach (Between English and Cedar River Confluences)	Significant Increase in Flooding of Agricultural Areas and Secondary Roads	Number of Years Exceeding 16 ft (17,000 cfs) at Lone Tree Gage	50	**24**	35	35	26	42	47	44	34	34	34	44	47	40
	Start of Flooding for a few Residences and Significant Increase in Agricultural Damage	Number of Years Exceeding 19 ft (27,750 cfs) at Lone Tree Gage	22	**8**	**8**	**8**	**8**	**8**	18	16	**8**	**8**	**8**	11	**8**	**8**
Wapello Reach (Between Cedar and Mississippi River Confluences)	Flooding of Agricultural Areas and Secondary Roads	Number of Years Exceeding 22 ft (44,300 cfs) at Wapello Gage	45	**38**	39	39	39	39	41	41	**38**	**38**	39	40	40	39
	Widespread Flooding of Agricultural Lands and Roads, Increasing Non-Crop Damage	Number of Years Exceeding 25 ft (63,150 cfs) at Wapello Gage	28	**20**	**20**	**20**	**20**	**20**	24	24	**20**	**20**	**20**	21	21	**20**
Burlington Reach (Mississippi River)	Mississippi River Flooding	Average Reduction in Peak Mississippi River Flow for Events Exceeding Burlington Gage Constraint	0	10,546	10,873	10,983	11,069	10,907	3,803	4,241	10,918	10,918	11,105	7,798	**12,158**	11,023

Notes:
Metrics that improve over the baseline (Alternative 1) are shown in Green, those that worsen are shown in Red.
The best performing Alternative for each metric is shown in **Bold**.

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In order to eliminate alternatives less effective at meeting Study objectives, metrics were categorized based on the importance of the metric with regard to reducing flood risk concerns and operational feasibility and effectiveness. Downstream of the reservoir, when releases exceed 13,000 cfs evacuation of residents in Riverview Estates a few miles downstream of the reservoir is initiated due to loss of access by residents and emergency responders. When reservoir releases approach 17,000 cfs, 1st Avenue, a major artery in the City of Coralville is closed to allow installation of a removable flood wall in order to protect businesses along that thoroughfare. In addition, anytime discharges exceed 16,500 cfs at the Iowa City gage, there is a potential for flash flooding along Clear Creek, a tributary to the Iowa River. Further downstream flows commensurate with stages of 19 feet (27,750 cfs) at Lone Tree or 25 feet at Wapello (63,150 cfs) cause widespread flooding of agricultural land as well as closure of roads and non-crop damage. Of utmost importance is the frequency and duration of spillway overtopping. Overtopping of the spillway creates significant impacts downstream as flows exceed or equal 20,000 cfs when reservoir water levels approach elevation 712 feet. Flows exceeding 20,000 cfs at the Iowa City gage, cause significant impacts with regard to access to and use of buildings on the University of Iowa campus and in Iowa City. In addition, there is increased potential for erosion in the downstream spillway channel.

While Alternatives 2, 2A and 2B reduced the frequency or duration of impacts related to the concerns discussed above as compared to Alternative 1, *No Action Alternative* – current regulation plan), results between these alternatives for the most part were equal. Flows for Alternative 2 and its variants, are higher than those seen for Alternative 1 at Lone Tree, Iowa, and Wapello, Iowa, for frequencies below the 10% to 4% Annual Chance Exceedance (ACE) (10 to 25-year) events due to the higher allowable maximum flood control releases from Coralville Lake. However, with the exception of the higher flow frequencies at Lone Tree and Wapello for low impact events, Alternative 2C performed somewhat better for all of the other metrics and will be carried forward for detailed analysis. Alternative 2C reduced the frequency and duration of spillway overtopping, reduced flooding of Riverview Estates, reduced the frequency of flash flooding in Iowa City, and reduced the frequency of closing 1st Avenue in Coralville.

While maximum release alternatives 3 and 3A reduced the frequency and duration of adverse impacts upstream of Coralville Reservoir and resulted in reducing spillway overtopping events from 2 to 1, these alternatives were eliminated from further consideration due to the significant increase in the frequency and duration of adverse impacts for the entire reach of the Iowa River downstream of the reservoir as well as the Mississippi River.

Alternatives 4 and 4A are variations of Alternative 2 but include elevation-based growing season releases to reduce downstream impact when lake levels are relatively low, and storage is available. Alternative 4A is a variation of Alternative 4 but considers the lake elevation on May 1 as a decision point with the maximum discharge being maintained until the pool falls to the conservation level. However, the results of the HEC-ResSim for both of these alternatives were relatively the same as Alternative 2 but increased the magnitude of flows at Iowa City, Iowa, and Lone Tree, Iowa, below the 5% ACE (20-year) event, Wapello, Iowa, below the 20% ACE (5-year) event (see Appendix B, *Hydrology and Hydraulics*). These two alternatives were also eliminated from further consideration.

Alternative 5 is also a variation of Alternative 2. However, this alternative limits the maximum growing season release to 8,000 cfs when the lake is below elevation 707. Since this alternative is somewhat less aggressive than Alternative 2, adverse impacts to downstream agricultural land are reduced as compared with Alternative 2. Alternative 5 also reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. Alternative 5 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet, but less so than other alternatives due to its lower maximum growing season release. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, Iowa (see Appendix D*, Hydrology and Hydraulics,* for details). Based on these results, Alternative 5 was selected to be carried forward for further detailed analysis.

Alternative 6, a stakeholder alternative provided by Johnson County HS and EMA is an aggressive alternative which was conceived to limit impacts in the damage centers of Iowa City, Coralville, and surrounding Johnson County by increasing the maximum growing season release, raising downstream, constraints, increasing the minimum allowable release and transitioning to the large magnitude flood earlier when the reservoir is at elevation 705 feet instead of 707 feet. Due to the aggressive nature of this alternative, impacts downstream at Lone Tree as well as in Riverview Estates occur with greater frequency than all of the alternatives analyzed with the exception of Alternatives 3 and 3A which were only limited by the conduit capacity. Therefore, the impacts of this alternative were considered unacceptable and it was eliminated from further consideration.

Alternative 7 is another stakeholder alternative formulated by the Two Rivers Levee and Drainage District. Similar to Alternative 6, this alternative increases the growing season constraint for Wapello, but in addition increases the Mississippi River constraint. The maximum allowable release is only constrained by the capacity of the outlet and the Iowa City flow constraint. This alternative increases the frequency of flooding impacting access to Riverview Estates but reduces the frequency of flooding along 1st Avenue in Coralville and flooding in Iowa City. However, the frequency of flooding downstream of Iowa City (Lone Tree/Wapello reaches) was increased although there was a slightly greater reduction in Mississippi River flows at Burlington than the other alternatives. Nonetheless, Alternative 6 was eliminated from further consideration as a viable alternative due to the predominance of negative impacts for most of the metrics.

Finally, Alternative 8 is very similar to Alternative 4 but with the same downstream constraints throughout the entire year and a modified, more aggressive LMF schedule. Analysis of this alternative revealed that the frequency of occurrence of reaching water level or flow triggers related to impacts both upstream and downstream of the reservoir were improved for almost all of the metrics considered as compared to Alternative 1. Therefore, this alternative is also carried forward for detailed flow frequency and economic analysis.

The screening of alternatives compared performance across metrics based on acceptability, efficiency, effectiveness, and completeness. Completeness is the extent to which a given alternative provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. Effectiveness is the extent to which an alternative alleviates the problems and achieves the opportunities. Efficiency is the extent to which an alternative is the most cost-effective means of alleviating the problems and realizing opportunities, consistent with protecting the Nation's environment. Acceptability is the workability and viability of the alternative with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies. Table 26 provides a summary of alternative performance in acceptability, efficiency, effectiveness, and completeness criteria.

Table 26. Summary of Alternative Performance in Acceptability, Efficiency, Effectiveness and Completeness Criteria

	Acceptability	Efficiency	Effectiveness	Completeness
Alternative 1 (No Action)	Alternative is considered to be acceptable to public, state, and local entities as it is the currently approved operations plan.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	While Alternative is acceptable at meeting FRM criteria and addressing some of the identified problems and opportunities, it is not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2A	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2B	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2C	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. This alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk.* This alternative was somewhat more aggressive and reduced impacts over alternatives 2, 2A and 2B and will be further analyzed considering economic benefits.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 3	Alternative is not acceptable to public, state, and local entities as it does not meet FRM criteria and is not meeting the primary authorized purpose of FRM.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities. Alternative did not meet all FRM criteria and therefore did not meet Goal 1: *Reduce Future Flood Risk*, the primary authorization for the Coralville Dam. Alternative is not considered effective.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 3A	Alternative is not acceptable to public, state, and local entities as it does not meet FRM criteria and is not meeting the primary authorized purpose of FRM.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities Alternative did not meet all FRM criteria and therefore did not meet Goal 1: *Reduce Future Flood Risk*, the	Alternative is complete, no other plans or investments are needed for implementation.

			primary authorization for the Coralville Dam. Alternative is not considered effective.	
Alternative 4	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation
Alternative 4A	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 5	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. This alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*. This alternative was somewhat less aggressive than Alternative 2C and had slightly reduced agricultural impacts during non-flood years. It will be further analyzed considering economic benefits.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 6	Alternative is a stakeholder alternative that is not acceptable to all public, state, and local entities and does not meet FRM criteria and other authorized purposes.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk* for certain metrics while negatively impacting others.	Alternative is complete in that no other plans or investments are needed for implementation.
Alternative 7	Alternative is a stakeholder alternative that is not acceptable to all public, state, and local entities does not meet FRM criteria and other authorized purposes.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk* for certain metrics while negatively impacting others.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 8	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. This alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*. This alternative is less complex to interpret and execute than many of the other alternatives. It will be further analyzed considering economic benefits.	Alternative is complete, no other plans or investments are needed for implementation

With the intent of selecting a TSP, Alternative 2C (similar to Alternative 2 but with tiered non-growing season constraints maintained throughout the year), Alternative 5 (similar to Alternative 2 but with maximum growing season release of 8,000 cfs) and Alternative 8 (similar to Alternative 4 but with the same downstream constraints throughout the entire year and a modified LMF schedule) were selected for detailed hydrologic and economic analyses as all three plans provide enhanced flood risk reduction when compared to the other alternatives. Additionally, detailed economic analysis of Alternative 1, *No Action Alternative*, is required for comparison purposes in all Corps studies as the baseline alternative.

C. STEP 2: ECONOMIC EVALUATION

Economic assessments were completed on alternatives carried forward for detailed analysis, Alternative 1, *No Action Alternative*, Alternative 2C, Alternative 5, and Alternative 8, using HEC-FIA. The HEC-FIA used a structure inventory from the nationwide National Structure Inventory (NSI). To estimate agriculture damages, the HEC-FIA model used corn and soybean acreages from a 2019 land cover grid from National Agricultural Statistics Service (NASS), and prices and yield from the 2019 Purdue Crop Cost & Return Guide, which is published annually by the University of Purdue Agriculture Extension Service. The crop budget uses variable & fixed costs, crop yields, replanting rates, and duration damage curves by month that allow the model to determine damages by frequency. Hydraulic stage data were used to determine the flood depths at each location or structure, and structure depth-damage curves were used to estimate structural damages.

The economic model was split into the following six reaches:

1. Above Coralville Lake (Pool)
2. Coralville Tailwater (to Confluence with Clear Creek)
3. Iowa City Reach (between Clear Creek and English River Confluences)
4. Lone Tree Reach (between English River and Cedar River Confluences)
5. Wapello Reach (between Cedar River and Mississippi River Confluences)
6. Burlington Reach (Mississippi River)

Each reach was analyzed using depth, duration, and arrival grids. The change in benefits, or damages avoided, for each alternative was determined through the hydraulic frequency of each of the flows or stages occurring. Results of this analysis are summarized in Chapter VI, Section B, *Process for Selection of a TSP*, and the detailed assessment is provided in Appendix E.

The final array of Alternatives, 2C, 5 and 8, met all Study goals and objectives. Final economic criteria used to select the TSP was based on which alternative reduced flood damages the most while maintaining compatibility with other Study objectives and goals. Tables 22 and 23 in Chapter VI-B present the final comparison of Alternatives 2C, 5 and 8.

CHAPTER V: THE ACTION ALTERNATIVES' ENVIRONMENTAL CONSEQUENCES

A. INTRODUCTION

With-Project Conditions Environment Summary. Along with FRM improvements, the District considered environmental impacts and environmental compliance to verify the preferred alternative. An environmental impact, or effect, may be described in terms of significance, duration, frequency, location, magnitude, or other characteristics, such as reversibility, the ability to retrieve, and the relationships to long-term productivity.

B. COMPARING FINAL ARRAY

Chapter 2 describes Alternative 1, *No Action,* in detail. Table 27 summarizes environmental impacts in a qualitative assessment if the District were to select Alternative 2C, 5 or 8. Impacts to environmental resources were considered to be similar in nature across the range of with-study alternatives. However, the magnitude of adverse and beneficial impacts to resources for the with-study alternatives were considered to be proportional to the impact of each action alternative.

Table 27. Summary of Environmental Impacts

Public Interest Category/Measure	Alternatives			
	No Action	2C	5	8
Floodplain Resources	-	+	+	+
Land Use	o	o	o	o
Aquatic & Wildlife Resources	o	+	+	+
Threatened & Endangered Species	o	+	+	+
Invasive Species	o	o	o	o
Vegetation	o	+	+	+
Water Quality,	o	+	+	+
Wetlands	o	+	+	+
Rivers	o	+	+	+
Streams	o	+	+	+
Hydrology and Hydraulics	-	+	+	+
State Parks, and Other Aesthetic Resources	o	o	o	o
Cultural and Historic Resources	o	o	o	o
Socioeconomics	o	+	+	+
Minority and Low-Income Populations	o	o	o	o
Human Health & Safety	o	+	+	+
Sustainability, Greening & Climate Change	o	o	o	o
Constructed Resources	o	+	+	+
Recreation	o	o	o	o
Sedimentation/Soils/Prime and Unique Farmland	o	o	o	o
Hazardous Substances, Toxic, Radioactive Waste (HTRW)	o	o	o	o

++ Expected major long-term environmental or social benefit as a result of alternative implementation.
\+ Expected moderate long-term environmental or social benefit as a result of alternative implementation.
o No or minor expected long-term environmental or social benefit or impact as a result of alternative implementation.
\- Expected moderate long-term environmental or social impact as a result of alternative
-- Expected major long-term environmental or social impact as a result of alternative implementation.

Significance. Resource significance is determined by the importance and non-monetary value of the resource based on institutional, public, and technical recognition in the Study area. The potential significant impacts of the Study were considered in compliance with the Council of Environmental Quality (CEQ) NEPA regulations (40 Code of Federal Regulations (CFR) 1500.1(b), 1501.7(a)(2) and (3), and 1502.2(b)). "Significant" is defined as, "likely to have a material bearing on the decision-making process" (Apogee Research, Inc., 1995).

Engineering Regulation 1105-2-100, Corps' Planning Guidance Notebook, defines these significance criteria as:

- **Institutional Recognition:** Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. Sources of institutional recognition include public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal Government; plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; and charters, bylaws, and other policy statements of private groups.

- **Public Recognition.** Public recognition means that some segment of the general public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, and providing volunteer labor and correspondence regarding the importance of a resource.

- **Technical Recognition:** Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgment of critical resource characteristics. Whether a resource is determined to be significant may of course vary based on differences across geographical areas and spatial scale. While technical significance of a resource may depend on whether a local, regional, or national perspective is undertaken, typically a watershed or larger (e.g. ecosystem, landscape, or ecoregion) context should be considered. Corps planners should describe technical significance in terms of one or more of the following criteria or concepts: scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity.

This section outlines the possible environmental impacts associated with the alternatives carried forward for detailed analysis (Alternatives 2C, 5, and 8). The District compared the Alternative 1, *No Action*, to these alternatives for operational differences in Chapter III, *Formulation of Alternatives*. The following section compares the action alternatives' environmental consequences with the No Action alternative (profiled in Chapter II, Affected Environment).

The District determined the environmental consequences would be very similar among the action alternatives. Therefore, in the sections below, consequences are described individually where the consequences differ between Alternatives 2C, 5, and 8 or described as the "action alternatives" in sections where consequences are expected to be similar across Alternatives 2C, 5, and 8.

C. FLOODPLAIN RESOURCES

Since Alternatives 2C, 5, and 8 operate similarly to the No Action Alternative during low flow and high flows no additional impacts to floodplain natural and constructed resources are expected. The alternatives would not result in a decrease in floodplain capacity or an increase in flood risk. The proposed action would be in compliance with Executive Order 11988, *Floodplain Management*. Based on the District's hydraulic modelling, the action alternatives should reduce overall flood risk in the floodplains below each reservoir.

D. LAND USE

The action alternatives are consistent with current land uses and would enhance the existing public use areas and general quality of life for local residents. The alternatives would not alter existing land uses or transportation facilities within the Study area. None of the action alternatives would negatively impact the community state parks, conservation areas, and other areas of recreational, ecological, scenic, or aesthetic importance (per 40 CFR 1508.27(b)(3)).

Operating the dam during non-flood periods for natural resource management would contribute to the Master Plan goals.

E. AQUATIC WILDLIFE RESOURCES

Under the action alternatives and under normal operating conditions (outside flood conditions), the District could manage water levels and outflows for aquatic, wetland, and migrating species within the operating conservation band. This would benefit important mussel, fish, herptiles, and birds during important life stages and seasons.

For any of the three alternatives selected, the District would coordinate with the resource agencies as time allows for operation or maintenance induced low flow periods during year-round conditions, especially during cold temperatures (40 degrees F or below for water and or air temperature). If the District or other entity requests the flows out of the dam be reduced for dam inspections, maintenance, or any other activity, the District would minimize reductions in outflow in coordination with the resource agencies to minimize impacts to aquatic wildlife resources downstream of the dam.

F. ENDANGERED, THREATENED, & CANDIDATE SPECIES

The District determined the action alternatives would have **No Effect** to any listed species or species being considered by the FWS for listing. The District concludes the action alternatives would not change hydraulic scenarios to cause negative impacts to listed species. Updates to the Coralville Reservoir WCP, and guidelines mentioned in the previous section would ensure protection of listed mussel species occupying the areas near the dam outlets under Alternative 2C, 5, or 8. Updates would not include a change to the minimum low-flow requirements, which are critical to the protection of the Iowa River's diverse mussel population.

G. INVASIVE SPECIES

Implementation of the No Action or the action alternatives would not have an effect on invasive species introduction, spread, or management. The District would continue to implement best management practices with regards to invasive species management at Coralville Lake. Following District policy and using adaptive and best management practices in prevention, education, early detection, rapid response, and containment in trying to control invasive species will aid in cost effective and environmentally sound invasive species management regardless of the selected plan.

H. VEGETATION

Alternatives 2C, 5, or 8 could operate lake and river levels during normal operations for more flexible natural resources management than the No Action Alternative. This may result in improved vegetation communities. The District would be able to focus on habitat management problems and opportunities to promote aquatic and wetland plant growth.

For instance, maintaining the lakes a foot or two higher than normal and then dropping them to flat pool during the growing season would promote plant growth on the exposed mudflats in the upper reaches of each lake.

Under Alternative 1, *No Action*, the District is required to operate the lake at flat pool with no ability to fluctuate the levels for habitat management except in the fall for migrating bird benefits. A fall pool raise would still be a wildlife management option under Alternative 2C, 5 or 8.

I. RIVERS AND STREAMS, WATER QUALITY, WETLANDS

Alternatives 2C, 5, or 8 would not impact Iowa River or Coralville water quality. The District would continue low flow augmentation practices to ensure adequate water volume at downstream water intakes and outfalls.

Water residence time in Coralville Lake was compared for Alternatives 1, 2C, 5, and 8 for the growing season (1 May-15 Dec) when the pool is at conservation elevation. For the period of record analysis (1959-2019), when the pool is at conservation elevation, the change in residence time during the growing season was -4.24 days (15.33 to 11.09 days, 27.7%). Therefore, the proposed action alternatives would not significantly change the water retention time at the reservoir to substantially alter water quality positively or negatively. Since the District proposes no construction or would have no discharge into the Waters of the United States, a CWA, Section 401 Water Quality Certification is not required.

During the update to the Des Moines River Basin Master Reservoir Regulation Manual, Iowa DNR sent an email stating that it is well documented that water residence time is an extremely important factor when it comes to managing and maintaining reservoir fisheries (USACE, 2019). The Iowa DNR has observed that flow rates and Walleye loss are positively correlated at Rathbun Lake. This same relationship has been shown to be true for crappie species. In addition, turbidity will likely increase in the reservoir as increased velocities carry sediment further into the basin. A reduction in water residence time is not beneficial for reservoir fisheries management or angling. In response to this concern, the District and partner agencies would adaptively manage spring reservoir levels within the conservation band to promote fish spawning and rearing conditions. There may not be optimal fish spawning and rearing conditions every year, but if conditions would allow it, the District would hold spring water levels to promote the fisheries. The District's efforts to promote the reservoir's spring fisheries is in place now and would continue with any of the Study alternatives.

Without watershed improvements, under the No Action alternative or the action alternatives, the threat of water quality impairment would continue its current trend.

Annual wetland management may or may not be an achievable goal due to other habitat management objectives in the Master Plan for any given year. Flood risk management takes priority over wetland management. Still, wetlands at the reservoir would improve under the action alternatives given the added flexibility of water level management during normal (non-flood) years.

The action alternatives would not have additional (positive or negative) impact to the rivers and streams in the Study area. The proposed action alternatives would not impact any water bodies designated as a wild or scenic waterway, in accordance with the Wild and Scenic Rivers Act.

The District would continue their robust water quality monitoring program under any of the alternatives. Based on the results of water quality monitoring, the Iowa DNR or the District may impose beach closures, or other precautionary steps. If possible, the District would attempt to offset water quality problems while operating the reservoir within in its conservation band.

J. HYDROLOGY AND HYDRAULICS

The action alternatives carried forward have positive impacts on the system's hydrology/hydraulics by conserving reservoir storage through earlier releases of water during small scale flood events, thereby reducing flood risk during long duration, large magnitude flood events resulting from multiple storms.

While higher non-damaging flood events within bank flows would be observed more frequently. It should be noted that in order to conserve flood storage, the frequency and duration of flows exceeding the channel capacity downstream of the reservoir will be reduced in most cases.

Opportunities for increased flexibility in reservoir operations would be built into the regulation schedules. This would allow water managers to easily adapt project regulation for each event based on information available at the time of the event. Overall, this flexibility would help to account for the uncertainty in projected climate change impacts in the Iowa River watershed and would help to reduce future flood risk. Figures 19, 20, 21, 22, 23 and 24 illustrate the proposed operational rule changes between current operations and Alternatives 2C, 5 and 8. Operational rules in red on the right of the illustration are proposed rule changes.

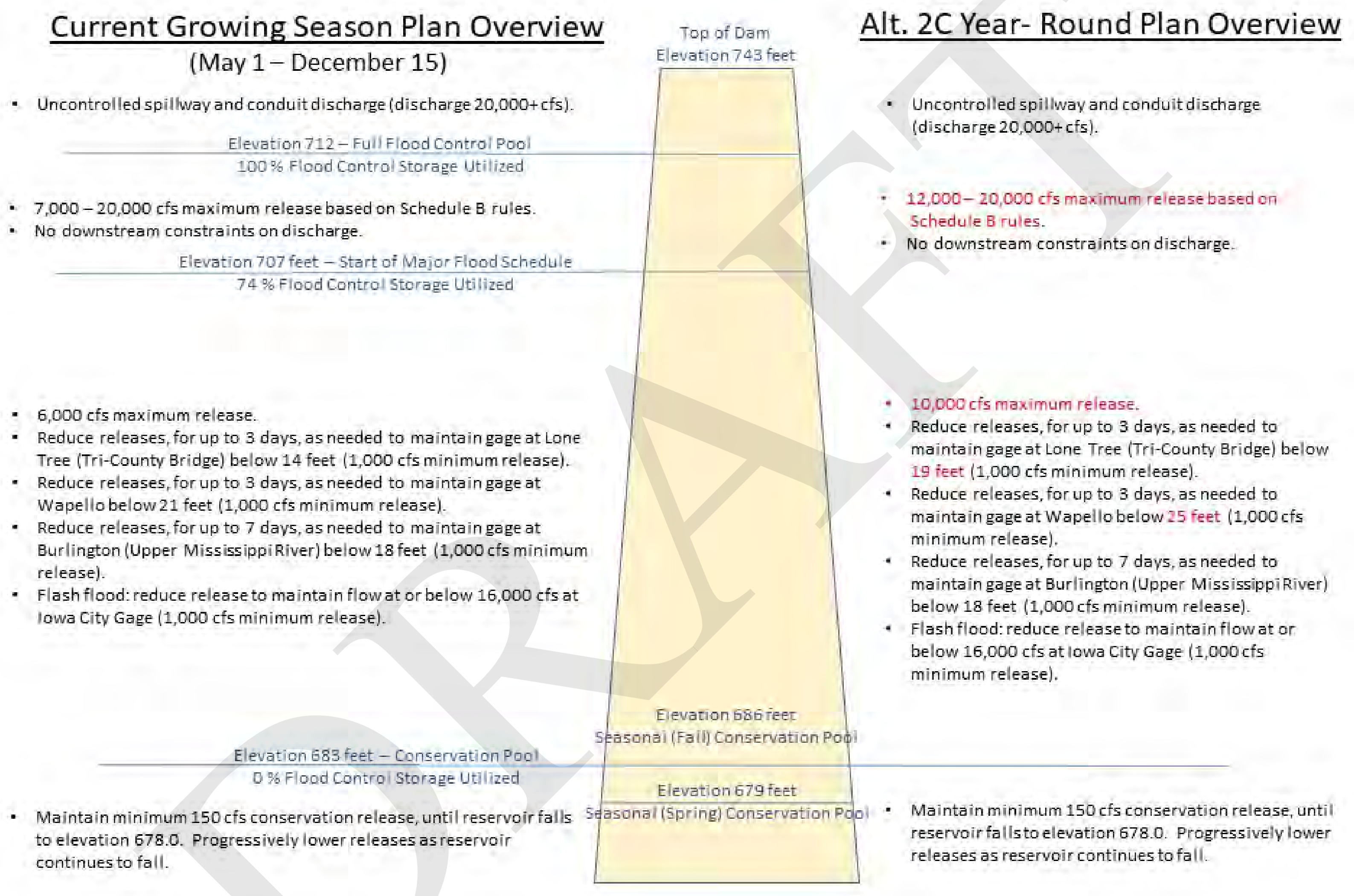

Figure 19. Coralville Lake Water Control Plan – Current Growing Season Plan (May 1 – December 15) vs Alternative 2C Year-Round Plan

Figure 20. Coralville Lake Water Control Plan – Current Non-Growing Season Plan (December 16 – April 30) vs Alternative 2C Year-Round Plan

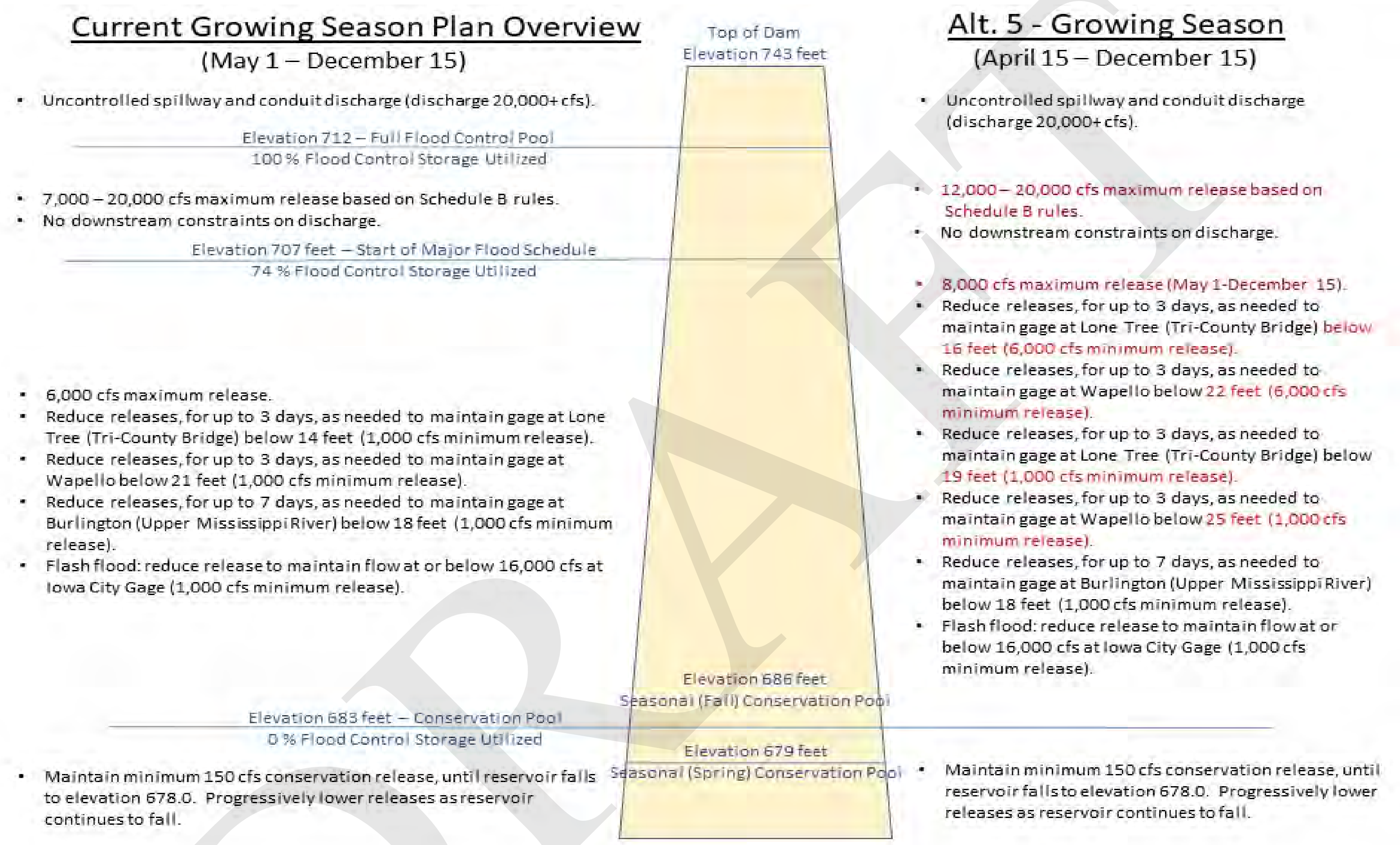

Figure 21. Coralville Lake Water Control Plan – Current Growing Season Plan (May 1 – December 15) vs Alternative 5 – Growing Season (April 15 – December 15)

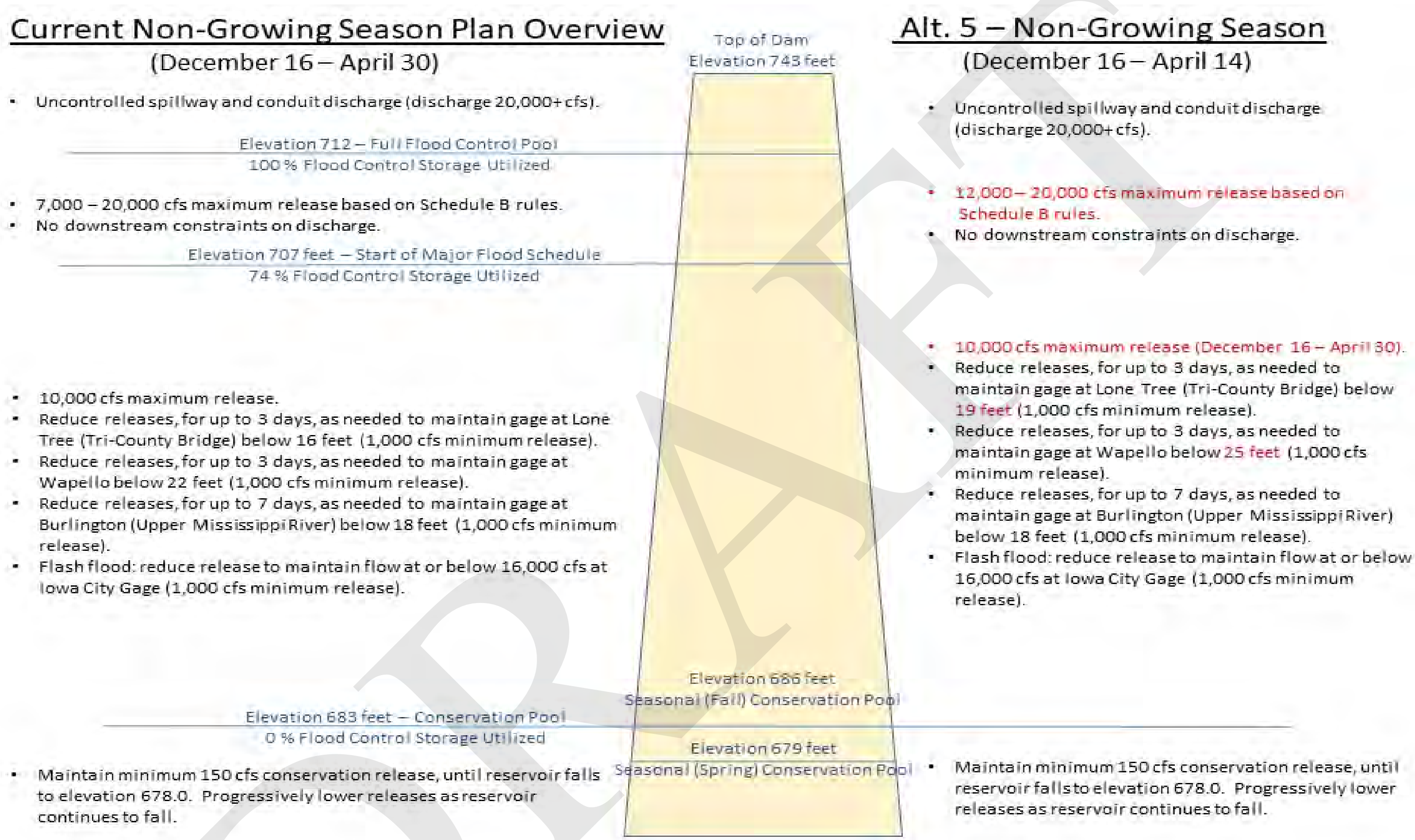

Figure 22. Coralville Lake Water Control Plan – Current Non-Growing Season Plan (December 16 – April 30) vs Alternative 5 – Non-Growing (December 16 – April 14) Season

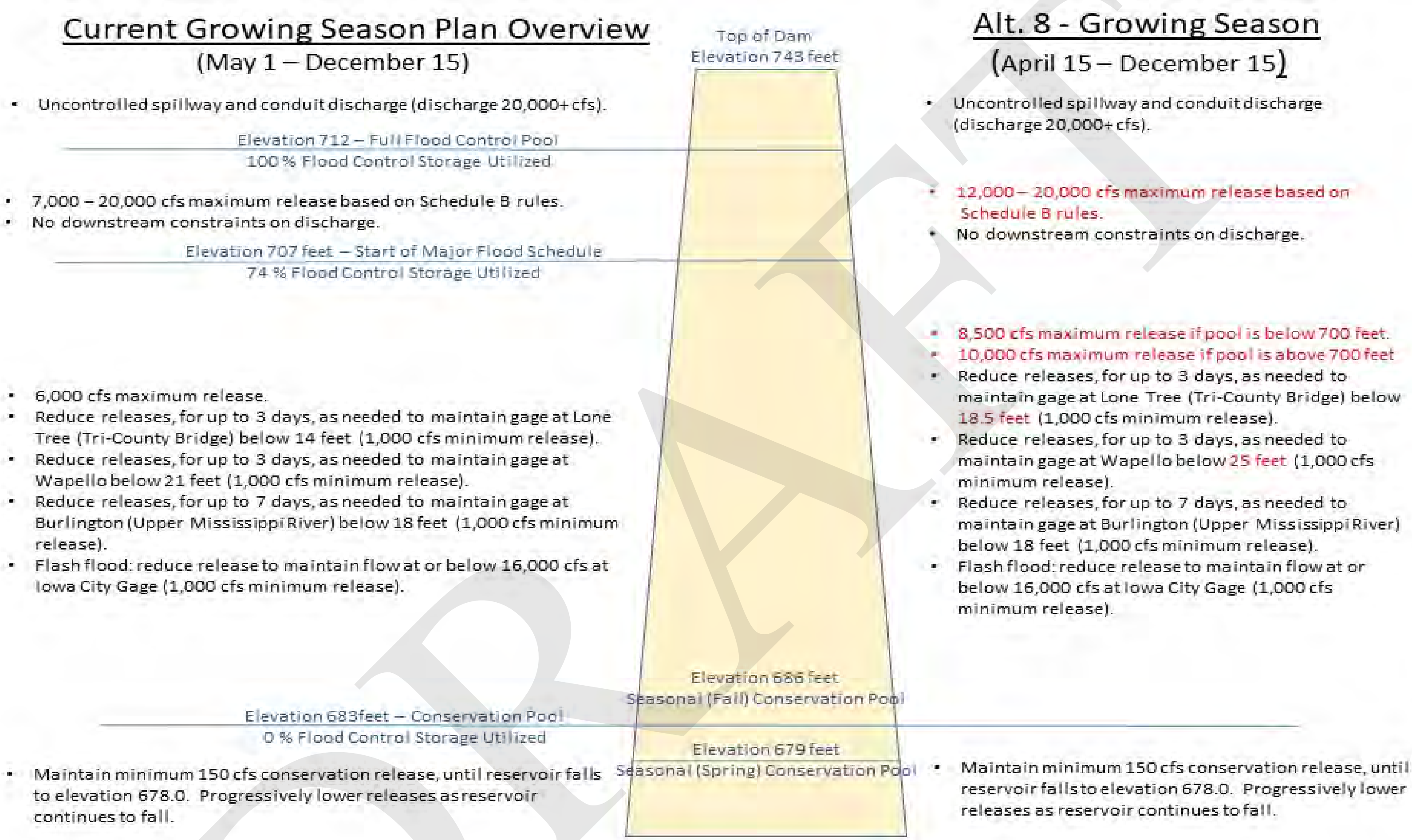

Figure 23. Coralville Lake Water Control Plan – Current Growing Season Plan (May 1 – December 15) vs Alternative 8 - Growing Season (April 15 – December 15)

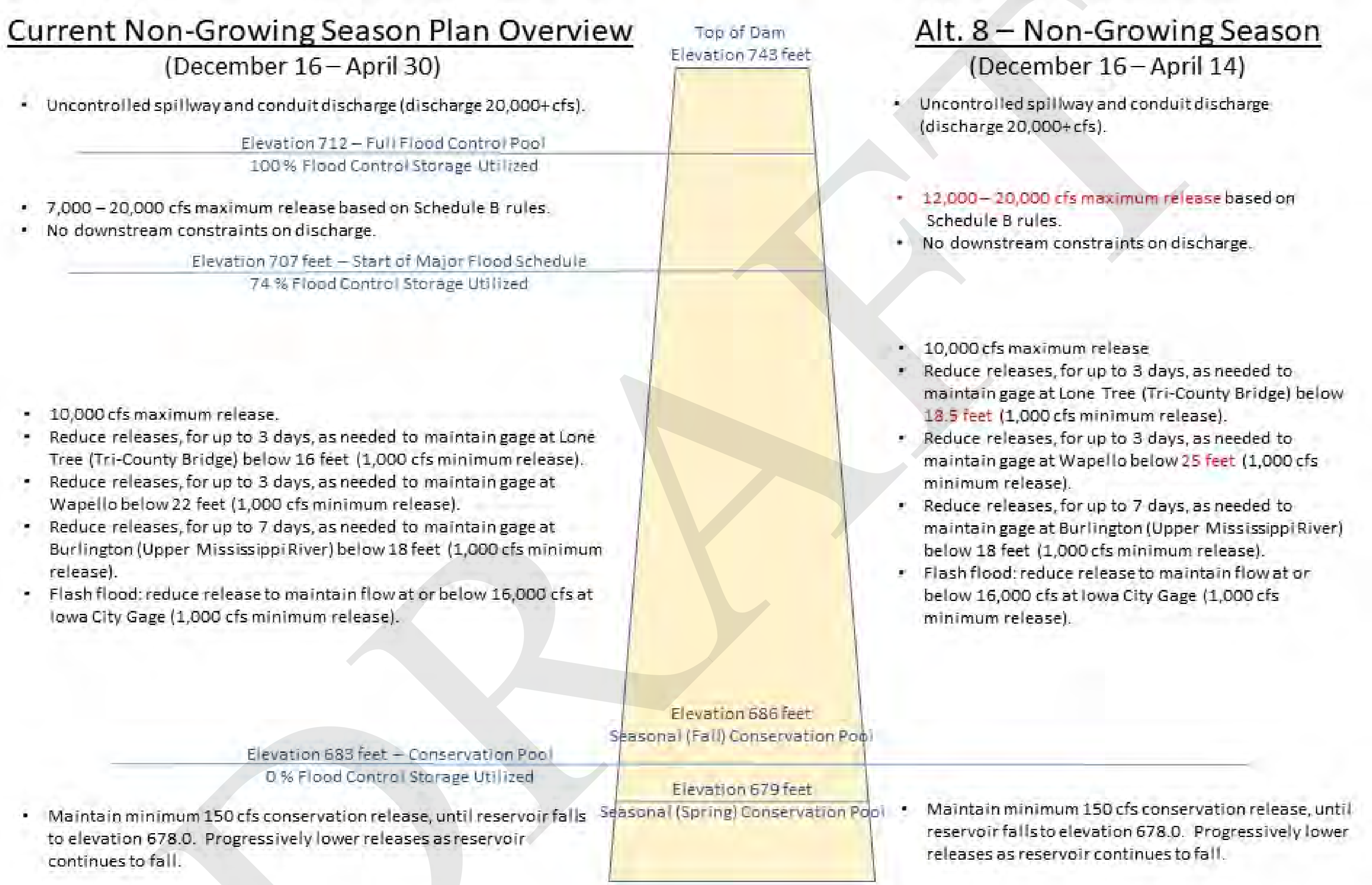

Figure 24. Coralville Lake Water Control Plan – Current Non-Growing Season Plan (December 16 – April 30) vs Alternative 8 – Non-Growing (December 16 – April 14)

K. STATE PARKS, CONSERVATION AREAS, AND OTHER AREAS OF RECREATIONAL, ECOLOGICAL, SCENIC, OR AESTHETIC IMPORTANCE

The action alternatives do not require construction so there would be no impacts from construction lighting, noise, dust, or other disturbances to the planning area. Long-term beneficial impacts would include natural resource restoration opportunities.

The activities within the action alternatives are consistent with current land uses and potentially would improve habitat and wildlife viewing, thereby enhancing the general quality of life for local residents.

Several public areas are adjacent to or in the planning area ranging from city parks to preserves. Alternative 2C may increase the frequency of nuisance flooding in Iowa City parks, but will help avoid negative impacts due to high magnitude flood events. Any impacts to the community, state parks, conservation areas, and other areas of recreational, ecological, scenic, or aesthetic importance would be minimal in nature for any of the action alternatives [per 40 CFR 1508.27(b)(3)].

L. HISTORICAL AND CULTURAL RESOURCES

Confirmed National Register of Historic Places (NRHP)-listed or eligible archeological sites are limited to the Woodland Era habitation site called Sugar Bottom NW (13JH272). Thirty-eight sites are recommended for testing to assess NRHP eligibility, 300 are recommended or determined ineligible, and the remaining 72 archaeological sites have no associated NRHP eligibility recommendation. Sites in the latter category primarily relate to avocational-archeologist recorded finds or historic sites recorded on the basis of archival information alone. Because maximum water outflow rates and pool elevations associated with the preferred plan are the same as those presently utilized—with only timing and release triggers being modified—preferred plan is anticipated to cause no adverse effects to historic properties.

The action alternatives maintain the same flood pool elevations as were coordinated in the past, and all proposed maximum flow rates are within rates already utilized. Implementation of the preferred alternative is expected to have no measurable impacts on historic properties as compared to the existing WCP. Implementation of the preferred alternative is not expected to affect sites 13PK404 or 13PK415, which have not been assessed for their NRHP eligibility.

The District initiated consultation with the SHPO, Tribes, and interested parties and proposed a finding of No Adverse Effects in a letter dated July 9, 2020. SHPO concurred with this determination by stamped approval dated August 5, 2020 (R&C# 200700037). The Crow Creek Sioux THPO concurred with the determination by e-mail dated July 14, 2020. The Ho-Chunk Nation THPO concurred with the determination by e-mail dated July 29, 2020. They further requested to remain as a consulting party for the undertaking and in the event of unanticipated discovery. The District received no other NHPA-related responses.

M. SOCIOECONOMIC RESOURCES

Alternatives 2C, 5, and 8 are expected to reduce the number of extreme floods. With improved flexibility under the normal non-flood operations that manipulate lake and river levels, socioeconomic resources are expected to be improved. Socioeconomic resources would be positively impacted as flooding frequency could be reduced in developed areas.

Three economic reaches, including Coralville Lake, Coralville Tailwater, and Iowa City are expected to see a reduction in damages from flood events. The Wapello reach would see little reduction with Alternative 2C, an increase with Alternative 5 and no reduction with Alternative 8. The Lone Tee Reach would see an increase with any of the alternatives. Population, housing, businesses, and agriculture would realize positive benefits from both Alternatives 2C, 5 and 8 in terms of FRM. Alternative 2C provides a higher level of risk reduction than Alternatives 5 and 8, compared to Alternative 1, *No Action*. Alternative 2C, would provide the largest percent reduction in Average Annual Damages (AAD) in the Coralville Pool reach Area closely followed by Coralville Tailwater reach Area. The Alternative 2C annual damage reductions would have a positive impact on all socioeconomic resources in the Study area. A vast majority of the FRM benefits are from reduced flooding of structures. See the Appendix E, *Economics*.

Environmental Justice. Impacts associated with the action alternatives are expected to have positive benefits for people in the Study area, including minority and low-income residents throughout the WCP Study area. Environmental Justice Communities are spread throughout the WCP Study area, with most of the Environmental Justice communities (as identified using block group data) located in Johnson County. There would be no direct or indirect high adverse impacts on minority and/or low-income communities within the Study area as per 2016 U.S. Census information and requirements of EO 12898.

N. HUMAN HEALTH & SAFETY

The proposed action would not impact human health and safety.

O. SUSTAINABILITY, GREENING & CLIMATE CHANGE

Corps of Engineers projects, programs, missions, and operations have generally proven to be robust enough to accommodate the range of natural climate variability over their operating life spans. However, recent scientific evidence shows in some places and for some impacts relevant to Corps operations, climate change is shifting the climatological baseline about which that natural climate variability occurs, and may be changing the range of that variability as well. This is relevant to the Corps because the assumptions of stationary climatic baselines and fixed range of natural variability, as captured in the historic hydrologic record may no longer be appropriate for long-term projections of flood risk.

The District considered climate change impacts on the hydrology of the Iowa-Cedar Rivers Basin in accordance with ECB 2016-25, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects* as well as Engineering Technical Letter 1100-2-3, *Guidance for Detection of Nonstationarities in Annual Maximum Discharges.*

The majority of stream flow gages evaluated in the Iowa River exhibit upward trends in annual peak flow. The exception being the Iowa City gage, located immediately below Coralville Lake, which exhibited a downward trend in peak annual stream flow due to the regulating effects of the reservoir. The statistical significance of the computed upward trends was mixed. Evaluation of historical precipitation trends identified a statistically significant upward trend, reinforcing the upward trend in annual peak stream flow.

For the Iowa-Cedar Rivers Basin, according to the Climate Hydrology Assessment Tool, there is projected to be an increase in variability and an upward trend of annual maximum monthly flow through the 21st century. According to the Vulnerability Assessment tool, the Iowa-Cedar Rivers

Basin is moderately vulnerable to climate change impacts on FRM. While the literature review indicated precipitation is projected to increase, there is less consensus on the projection of future stream flows. Multiple authors suggest there may be seasonal changes in stream flow with higher flows in the winter/spring and lower flows in the summer/fall. Although available literature and Corps Climate Assessment tools do not reach a consensus on observed and projected stream flow throughout the Iowa-Cedar Rivers Basin due to long-term persistent climate trends or anthropogenic climate change, there is some agreement that stream flow variability would increase, and extreme events will occur more frequently.

P. CONSTRUCTED RESOURCES - PUBLIC STRUCTURES, UTILITIES, TRANSPORTATION, OTHER

The action alternatives would not have negative impacts to constructed resources. The alternatives would not alter existing land uses or transportation facilities within the Study. Further, the action alternatives would not impact surrounding facilities such as police stations, fire stations, schools, hospitals, and post offices.

Q. RECREATION

The action alternatives would not have any impacts to lake or river recreation. With improved natural resource management, there may be additional eco-recreation opportunities. Based on the proposed higher, earlier releases to preserve flood storage, and thereby reduce the likelihood of higher reservoir releases during moderate to major flood years, Alternatives 2c, 5, or 8 would improve the availability of water based recreational features at Coralville Lake (Goal 4.a). This means boat ramps and entrance roads may stay open longer or remain open as a result of fewer high-water events.

R. SEDIMENTATION/SOILS/PRIME AND UNIQUE FARMLAND

The action alternatives would not have any additional impacts to prime or unique farmland.

S. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

None of the alternatives would be expected to affect HTRW sites within the planning area. The lands affected by any of the action alternatives would not be expanded beyond what already exists, so known HTRW sites would not change.

CHAPTER VI: SELECTED PLAN

A. CONSERVATION POOL MANAGEMENT

The current operating plan for Coralville Lake utilizes a single elevation to define the conservation pool level to be maintained during normal (non-flood or drought) operations. In reality the reservoir level fluctuates daily sometimes by as much as 1-foot above the authorized conservation pool elevation of 683 feet due to natural causes (rain, wind) and operational reasons (discrete gate settings based upon forecasted flow conditions).

In updating the WCP, it is desired to formally accommodate these fluctuations into an identified operating band (as opposed to continuing to identify a single elevation). Operating within a defined band, as opposed to a single target value, is currently incorporated into the WCPs at the other reservoir and lock and dam projects within the District. Use of an operating band accounts for operational uncertainties inherently related to forecasting reservoir inflows as well as providing operational flexibility to support:

- completion of routine, minor maintenance activities;
- accommodating minor (short-term) stakeholder requests;
- management for fish and wildlife resources during non-flood or drought periods; and
- flexibility in the operating band can potentially offset some of the negative aspects of sedimentation such as meeting conservation release targets during dry periods.

Examples of routine, minor maintenance activities include short term reductions in releases to accomplish inspection activities and facilitate removal of debris that can accumulate upstream of the outlet works of the dam. Minor stakeholder requests typically focus on temporarily reducing releases to assist search and rescue operations in the river downstream of the reservoir or water intake/outlet maintenance. These types of operations result in short term usage of a small amount of reservoir storage that can immediately be released following the event (often within the same day), while maintaining the reservoir elevation within a defined operating band.

With regard to management of fish and wildlife resources, operation of Coralville Lake for fish and wildlife resources was authorized as part of the 1958 Fish and Wildlife Coordination Act. Under the current WCP, the primary operational consideration included for fish and wildlife management is the allowance for up to a 3-foot fall pool raise to be conducted between September 15 and December 15. As part of this Study effort, the Study team met with the state and Federal resource agency partners to identify several potentials to increase the flexibility of reservoir operations to support fish and wildlife objectives which include:

- increasing the allowable fall pool raise to provide greater benefits to migratory waterfowl;
- allowing the fall pool raise to be held through the winter months (ending May 1) to reduce the impacts to herptiles associated with drawing the pool down in mid-December; and
- allowing for not drawing the conservation pool down to 679 in the spring to improve water quality and conditions for fish.

The identified measures are designed to provide operational flexibilities to support fish and wildlife resources during non-flood or drought periods. Historically, Coralville Lake has been in normal (non-flood or drought) operations in excess of 90% of the time. By identifying and incorporating operational flexibilities in the form of an operating band (rather than identifying highly specific seasonal operations), the Study is better able to support a range of potential management actions and allows for adaptive management.

Based on the proposed measures, the District considered the following operating bands:

- December 16 – February 20 (“winter” season - variable) Elevations 683 - 688
- February 21 – April 14 (“spring’ season - variable) Elevations 683 – 679
- April 15 – August 30 (“summer” season) Elevation 683 – 684
- September 1 – December 15 (‘fall” season - variable) Elevations 687 – 688

To test the impacts of the proposed operating flexibilities on the Study’s FRM mission against the alternatives considered, sensitivity analyses were run in HEC-ResSim by conducting period of record analyses (1917-2019) using 3 different conservation pool levels:

- Existing conservation pool schedule
- Top of the proposed operating band
- Bottom of the proposed operating band

The results of the analysis indicated that maintaining the pool at the bottom of the proposed operating band showed no change in flood releases compared to the current pool management schedule. However, maintaining the pool at the top of the proposed operating band when holding the fall pool level of 688 throughout the winter, showed an increase in maximum flood releases for several flood events. In practice, it would be difficult to be proactive in bringing the pool back down early (prior to March 1) if significant snowpack or forecasted precipitation were to occur due to the presence of ice cover.

Therefore, based on the results of the analysis and practical considerations, it is recommended that the operating band for much of the year be between elevation 683 and 684 feet; reflecting the range over which reservoir levels have historically been managed. During the late winter and spring (February 15 – May 20), the operating limits would expand to incorporate, but not require, the current spring drawdown to elevation 679 feet. The flexibility in later winter and spring operations would allow for situational management of water levels based upon observed conditions. During wet conditions, characterized by heavier than normal snowpack or significant forecasted rainfall events, the reservoir could be lowered within the band in advance of the runoff to increase available storage. During dry to normal conditions, the normal conservation level (elevation 683 feet) can be maintained to preserve full conservation storage, benefit fish and wildlife, and to improve public safety. In the fall (15 September through 15 December) the current allowable fall pool raise would be increased by two feet (from elevation 686 feet to elevation 688 feet). A more detailed discussion of the analysis and these results is available in Appendix D, *Hydrology and Hydraulics.*

B. ENVIRONMENTAL OPERATING PRINCIPLES AND CAMPAIGN PLAN GOALS

The significance of the Iowa River's contribution to the health of aquatic, terrestrial, and migrating birds' ecosystems are of national importance. Preserving the opportunity to restore additional habitat in the future is supported by the Corps Environmental Operating Principles and Campaign Plan goals. These principles and goals were considered in the development of the TSP in order to provide additional flexibility to the TSP. While these provide additional flexibility within the TSP, integrating these principles and goals would not result in allocating storage at Coralville Reservoir for environmental and ecological purposes. The principles are:

1. Foster sustainability as a way of life throughout the organization.

2. Proactively consider environmental consequences of all Corps activities and act accordingly.

3. Create mutually supporting economic and environmentally sustainable solutions.

4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.

5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.

6. Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.

7. Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

These principles were considered in developing the TSP, which would address these principles in the following ways:

1. The TSP would incorporate environmental sustainability by operating the Coralville Lake outflows in a conservation band when flooding or drought is not a concern. This would create a more naturally functioning wetland, lake, and river ecosystem.

2. Coordination with resource agencies and stakeholders through development of the Study identified and resolved or reduced the risk of environmental consequences of implementation of the TSP.

3. The TSP would create aquatic and riparian habitat conditions required by numerous fish and wildlife species living in or migrating through the system. The economic benefits were not quantified but would tend to invigorate the existing ecotourism economy associated with the resource. Implementation would not impact flood risk or floodplain development and would not cause negative environmental impacts.

4. The TSP has been reviewed and found to be consistent with all applicable laws and policies, including those related to potential impacts to human and natural environments. The District would meet their corporate responsibility and accountability for the TSP in accordance with those laws and policies.

5. The TSP would balance providing ecosystem and habitat benefits without increasing the existing flood risk. Cost and schedule risk assessment was considered for study implementation to assure costs and construction schedules were achievable. Risk management was also applied in the development of the adaptive management and monitoring plan to assure restoration plans realized forecast environmental outputs.

6. The District has operated the Coralville Lake since 1958. The knowledge of resource agency subject matter experts and long-standing partnership with the resource agencies was leveraged in the collection of field data and to develop the possible conservation band management for environmental management.

7. The Study process involved coordination with and the participation of numerous agencies and interested resource partners. Both the local sponsor and the District met with the public to seek input at the beginning and during the Study.

Appropriate ways and means were used to assess impacts to the environment through the NEPA and use of engineering models, environmental surveys, and coordination with natural resource agencies.

The Corps' Campaign Plan is a strategic change decision document. It drives and aligns strategic change; anticipates and shapes future operating and fiscal environments; unites all of the Corps with a common vision, purpose, and direction; and responsively adapts to mission and "battle space" changes. The plan is composed of four goals: Support National Security, Deliver Integrated Water Resource Solutions, Reduce Disaster Risk, and Prepare for Tomorrow. The TSP relates to the second goal. The second goal reflects an effort to operationalize the civil works strategic plan by focusing on holistic integrated water resource management. The goal has four objectives: deliver quality water resources solutions and services, deliver the civil works program using innovative solutions, develop the civil works program to meet the future water resources needs of the Nation, and manage the life-cycle of water resources infrastructure systems to consistently deliver reliable and sustainable performance. Each objective has three action items. Of the twelve items, those to which the TSP relates are listed below: The applicable Campaign Plan goal is Goal 2 – Deliver Integrated Water Resource Solutions. The goal has four objectives:

1. Deliver Quality Water Resource Solutions and Services
2. Deliver the Civil Works Program and innovative solutions
3. Develop the Civil Works Program to meet the future needs of the Nation
4. Manage the life cycle of water resources infrastructure systems to consistently deliver reliable and sustainable performance.

The preserved study opportunity would apply to Objectives 1 and 3 by maintaining the ability to initiate an FRM in the timeliest manner in the future. The significance of the FRM and natural resources value to the surrounding ecosystem are of national importance.

Appropriate ways and means were used to assess impacts to the environment through the NEPA and use of engineering models, and coordination with natural resource agencies.

C. PROCESS FOR SELECTION OF A TENTATIVELY SELECTED PLAN

Selection of a TSP was accomplished by developing analytic frequency curves for each of the four alternatives carried forward by following the procedures used in developing the regulated flow frequency relationships used in the 2009 Iowa River Regulated FFS. The procedures generally consisted of:

- developing an unregulated period of flow record based upon the HEC-ResSim simulation using historical inflows;
- developing volume-duration-frequency curves for reservoir inflow volumes using the simulated unregulated flow record;
- estimating the critical duration for flood inflows;
- developing a relationship between the regulated peak reservoir outflow and the unregulated inflow volume for the identified critical duration; and
- combining the volume-duration-frequency curve for the critical duration with the regulated versus unregulated relationship to obtain the regulated frequency curve.

Results of the Hydrologic Engineering Center's model, HEC-RAS, for computing water surface elevations and developing inundation mapping were provided as input to the flood impact analysis package, HEC-FIA, to develop stage/flow versus damage relationships for each reach. Results from the HEC-ResSim simulations were then used to develop regulated flow (or stage in the reservoir) frequency estimates for each alternative considered. The two results (HEC-FIA and regulated flow frequencies) are numerically integrated to develop average annual damage (AAD) estimates for each alternative which can be compared to identify the relative FRM benefits. Tables 28 and 29 provide a summary of computed average annual damages, and associated reductions in damage, for each alternative (2C, 5, and 8) compared to Alternative 1. Results are presented in terms of dollars and percent reduction in damages. This analysis was conducted for the entire period of record between 1917 and 2019, and a shorter, wetter period extending from 1959 to 2019 which was evaluated to test the robustness of the Study conclusion (i.e., do the two time periods identify the same best performing plan).

Table 28. Average Annual Damages Full Period of Record

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages ($)					
Alternative 1	270,000	103,000	976,000	434,000	999,000	2,782,000
Alternative 2C	160,000	65,000	857,000	498,000	998,000	2,578,000
Alternative 5	185,000	77,000	874,000	495,000	1,016,000	2,647,000
Alternative 8	180,000	67,000	870,000	495,000	999,000	2,611,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	99,000	38,000	119,000	(64,000)	1,000	193,000
Alternative 5	76,000	26,000	102,000	(61,000)	(17,000)	126,000
Alternative 8	80,000	36,000	106,000	(61,000)	-	161,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Percentage Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	69%	58%	14%	-13%	0%	7.91%
Alternative 5	46%	34%	12%	-12%	-2%	5.10%
Alternative 8	50%	54%	12%	-12%	0%	6.55%

Table 29. Average Annual Damages Partial Period of Record

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages ($)					
Alternative 1	282,000	148,000	1,840,000	587,000	1,389,000	4,246,000
Alternative 2C	205,000	110,000	1,560,000	659,000	1,413,000	3,947,000
Alternative 5	255,000	122,000	1,589,000	610,000	1,434,000	4,010,000
Alternative 8	209,000	120,000	1,570,000	643,000	1,419,000	3,961,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	77,000	38,000	280,000	(72,000)	(24,000)	299,000
Alternative 5	27,000	26,000	251,000	(23,000)	(45,000)	236,000
Alternative 8	73,000	28,000	270,000	(56,000)	(30,000)	285,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Percentage Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	38%	35%	18%	-11%	-2%	7.58%
Alternative 5	11%	21%	16%	-4%	-3%	5.89%
Alternative 8	35%	23%	17%	-9%	-2%	7.20%

D. DISCUSSION OF TENTATIVELY SELECTED PLAN

Based on the hydrologic and economic analysis of the screened alternatives, Alternative 2C was identified as the preferred alternative (TSP) for replacing the current Coralville Lake WCP. Details of the TSP are shown in Figure 25 and addresses normal flood management operations, large magnitude flood operations, drought, and conservation pool management.

The criteria used to select the TSP was which alternative resulted in the lowest, system-wide, average annual flood damages and was compatible with meeting the other Study goals and objectives. Alternative 2C results in the lowest, system-wide, average annual damages (AAD) for both the full period of record (1919-2019) and the abbreviated wetter period (1959-2019) analyzed. Within individual study reaches, Alternative 2C provides the greatest reduction in flood damages in three of the five damage reaches studied (including the areas upstream of the reservoir and in downstream reaches extending from Coralville Dam through Iowa City). Within two reaches, Lone Tree and Wapello, the average annual damages were greater under Alternative 2C than under the current water control plan (Alternative 1).

Upstream of Coralville Dam, the frequency and duration of flooding of lands is reduced. This includes agricultural areas for which the Federal government acquired (as part of the Coralville Lake Project) easements for occasional overflow as well as flooding along the remedial works near the historical Amana Colonies.

Downstream of Coralville Dam, including the heavily populated City of Coralville and Iowa City areas, Alternative 2C reduces the likelihood of large magnitude and spillway releases that cause significant impacts and damages in those communities.

While average AAD were 12 percent higher in the Lone Tree reach under Alternative 2C as compared to Alternative 1, the increase in AAD in the Lone Tree reach is primarily to low-lying agricultural land that is impacted by flash flooding from English Creek. Under Alternative 2C, releases from Coralville Lake would not be as aggressively reduced during such downstream flash-flood events in favor of preserving storage within the reservoir to reduce the risk of large magnitude flooding or spillway releases which result in more wide-spread damage to urban and agricultural areas. The tradeoff between overall damage reduction during major flood events and localized impacts during short-duration flash flooding appeared to be acceptable to landowners in the Lone Tree Reach as was indicated during earlier scoping meetings. This approach to managing reservoir releases was also preferred by Johnson County.

In the Wapello reach, while AAD for Alternative 2C were slightly higher than Alternative 1, they were lower than with Alternatives 5 and 8. However, similar to the Lone Tree Reach, flood damages in the Wapello reach are influenced to a much greater degree by the Cedar River which is unregulated, than by the operation of Coralville Reservoir. Additionally, much of the low-lying agricultural land in the Wapello reach has been taken out of production and permanently enrolled in conservation easement programs offered through the Natural Resources Conservation Service (NRCS).

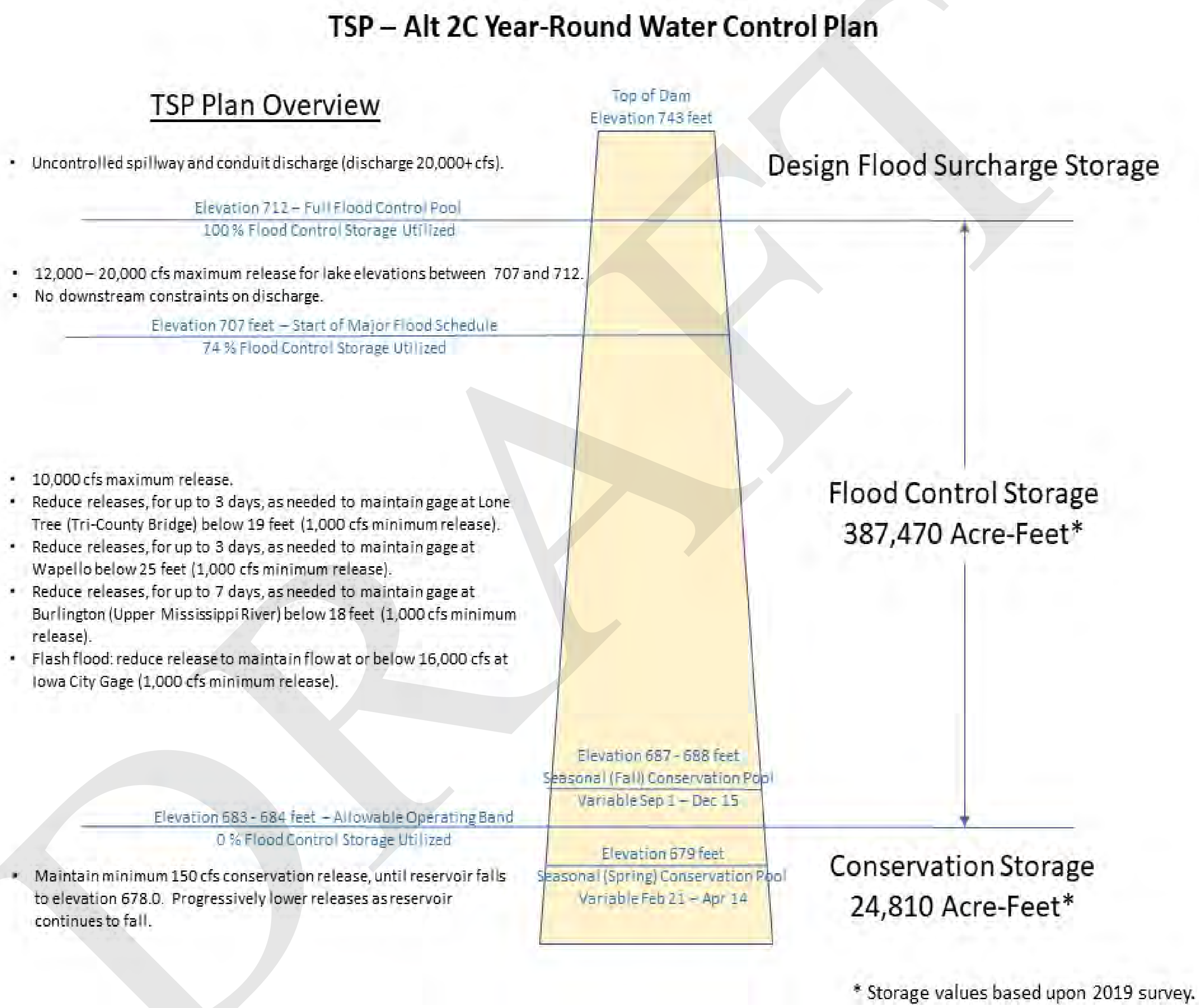

Figure 25. Tentatively Selected Plan – Alternative 2C

E. PARTNER COORDINATION

Public Involvement. The District held 4 open house-style public meetings between February and April 2019 (Table 30). The District conducted the meetings to obtain public input for scoping at the beginning phase of the feasibility study to ensure agency perspectives aligned to the extent allowable under law and policy with public needs. District representatives including reservoir staff, were available to answer questions from the public or other agency representatives. The meetings consisted of an approximately 30-minute meeting followed by an open question and answer session.

Table 30. Public Meeting Locations

Date	Location	Time
February 27, 2019	Iowa City	6:00 pm –8:00 pm
February 26, 2019	Wapello, Iowa	6:00 pm –8:00 pm
April 2, 2019	Marengo, Iowa	6:00 pm –8:00 pm
April 15, 2019	Amana, Iowa	6:00 pm –8:00 pm

The following is a brief synopsis of the public's input.

Public Meetings

Participants at each public meeting were given the same questionnaire to complete. The questionnaire was developed by the planning team and proved to be helpful in the planning process. The planning team received several questionnaire responses from participants which were then sorted by the following goals:

- Goal 1 - Comments to reduce future flood risk
- Goal 2 - Comments to improve low flow augmentation reliability
- Goal 3 - Comments to improve fish and wildlife sustainability
- Goal 4 - Comments to promote enhancement of recreational features
- Goal 5 – Comments to accommodate other interests

The majority of comments were from individuals providing input to the flood stages where they experienced significant flooding and the impacts it had to their property. Many participants also provided their recommendation on reservoir pool levels and releases.

Further information and details of the public meetings in Wapello, Marengo, Iowa City and Amana can be found in Appendix D.

Agency Coordination. The USFWS, the Iowa DNR, The Nature Conservancy (TNC), and other natural resources managers were invited to participate and were involved throughout the Study's duration. The plan fulfills a number of missions and objectives common to these organizations. The organizations provided input throughout the Study and were involved in plan formulation, and data collection (Appendix D). The District integrated their comments into this planning document. The Iowa SHPO, federally-recognized tribes, and other interested parties have been invited to comment on the District's No Adverse Effects finding for this Study.

Additionally, a project under the Sustainable Rivers Program has been approved for the Iowa-Cedar Rivers Basin. The District anticipates the relationships built and feedback given by the natural resources management partners during the course of this Study will assist to guide the goals and implementation of the Iowa River SRP. The District tried to anticipate many of the environmental benefits and worked to incorporate the SRP goals into the modeling and plan formulation of this Water Control Feasibility Report with Integrated Environmental Assessment. However, the partners involved with the SRP could identify other environmental features that were not considered or may need to be revisited during the process of developing the SRP.

Stakeholder Input. The District engaged with public agency partners and stakeholders from county and local emergency management, public works, and engineering offices throughout the Iowa River watershed. Input received from these stakeholders helped in identification of critical thresholds and impacts. Several meetings were held, and communication continued throughout the Study period, including during the three temporary deviation periods within 2017-2019. The stakeholders provided feedback regarding impacts of potential changes to the WCPs for Coralville Lake. Below is a summary of the stakeholder input that was received.

Input for Coralville Lake Reservoir Operations:

1. Increase the downstream constraints at Lone Tree and Wapello to conserve reservoir storage and lessen the risk of substantially higher releases.

2. Increase the growing season maximum release from 6,000 cfs to as much as 10,000 cfs to conserve reservoir storage and lessen the risk of substantially higher releases and spillway flows.

3. Investigate beginning LMF operations at a lower lake elevation with more aggressive increases in releases to lessen the risk of substantially higher releases and spillway flows.

Public Review. The District will circulate this feasibility report to a wide distribution list (Appendix E) to solicit public input as part of the decision-making process. The District will also post the report on the District's website's Public Notice link (http://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Civil-Works-Public-Notices/). During the public review, the District will hold virtual public meetings to solicit input on this report and the TSP. The District will integrate all comments received into its decision-making process. Appendix D contains all comments received and the District's responses.

F. ENVIRONMENTAL COMPLIANCE

The District prepared this integrated report to satisfy the requirements of all applicable environmental laws and regulations. The District's efforts comply with the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Part 1500–1508) and the District's implementing NEPA regulation ER 200-2-2, *Environmental Quality: Policy and Procedures for Implementing NEPA*, 33 CFR 230. In implementing the TSP, the District would follow provisions of all applicable laws, regulations, and policies related to the proposed actions. The following sections present brief summaries of Federal environmental laws, regulations, and coordination requirements applicable to this Study.

Clean Water Act. The CWA was enacted to restore and maintain the integrity of the nation's waters. There are two fundamental goals: to eliminate the discharge of pollutants into the nation's waters, and to achieve water quality levels that are fishable and swimmable. Two sections of the Act are discussed below.

Section 404(b)1. The Corps, under the direction of Congress, regulates the discharge of dredged and fill materials into all waters of the United States, including wetlands. Although the Corps does not issue itself permits for construction activities affecting waters of the U.S., it must meet the legal requirement of the Act. Since the action alternatives do not require any fill activities, the District did not complete a CWA, Section a 404(b)(1) analysis.

Section 402. Since there are no construction activities associated with the TSP, a National Pollutant Discharge Elimination System requirement of the CWA Section 402(p) is not required.

Clean Air Act of 1970. Federal agencies are required by this Act to review all air emissions resulting from federally-funded projects or permits to ensure conformity with the State Implemented Plans in non-attainment areas. The project's affected area (the lake and Iowa River to the confluence with the Mississippi River) is not in air nonattainment zone meaning there are no air restrictions for the operation of the Coralville Dam. The TSP would be in accordance with the Clean Air Act.

Endangered Species Act (ESA). The TSP would have "no effect" on any federally-listed endangered or threatened species. "No effect" means the proposed project would not affect, directly or indirectly any ESA-listed species or critical habitat. Generally, this means no ESA-listed species or critical habitat would be exposed to any potentially harmful/beneficial elements of the action. Additional documentation is not required under this Act for consultation with the USFWS. The "no effect" determination fulfilled the District's ESA, Section 7(a)2 consultation requirements.

Executive Order 13112, Invasive Species. The EO 13112 recognizes the significant contribution native species make to the well-being of the nation's natural environment and directs Federal agencies to take preventative and responsive action to the threat of the invasion of non-native plants and wildlife species in the United States. This EO establishes processes to deal with invasive species and, among other items, establishes that Federal agencies "will not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The TSP would be in compliance with EO 13112 since the action alternatives are within the existing Coralville Lake operation.

Executive Order 11988, Floodplain Management. EO 11988 was enacted May 24, 1977, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star.975). The purpose of the EO was to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

The order states each agency shall provide and shall take action to reduce the risk of the flood loss to minimize the impacts of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing federally-undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

The FEMA digital flood insurance rate maps of the Study area were analyzed to establish the locations of the 100-year and 500-year flood zones. All alternatives were designed to ensure that the proposed alternatives would not result in a decrease in the floodplain capacity and an increase in flood risk to the Study area.

The TSP would be implemented within the 500-year floodplain, but there would be no direct or indirect impact to the floodplain or related to floodplain development. It was not necessary to apply the eight-step process required by the Water Resources Council, Floodplain Management Guidelines for Implementing EO 11988, and February 10, 1978.

Migratory Bird Treaty Act, Migratory Bird Conservation Act, and Executive Order 13186, Migratory Birds. The importance of migratory non-game birds to the nation is embodied in numerous laws, executive orders, and partnerships. The Fish and Wildlife Conservation Act of the Army for Civil Works demonstrates the Federal commitment to conservation of non-game species. Amendments to the Act adopted in 1988 and 1989 direct the Secretary to undertake activities to research and conserve migratory non-game birds. EO 13186 directs Federal agencies to promote the conservation of migratory bird populations, including restoring and enhancing habitat. Migratory Non-Game Birds of Management Concern is a list maintained by the USFWS. The list helps fulfill the primary goal of the USFWS to conserve avian diversity in North America. The USFWS Migratory Bird Plan is a draft strategic plan to strengthen and guide the agency's Migratory Bird Program. The proposed natural resource management capabilities within the TSP would contribute directly to the USFWS Migratory Bird Program goals to protect, conserve, and restore migratory bird habitats to ensure long-term sustainability of all migratory bird populations. The TSP's increased natural resource management capabilities would promote bird nesting and migratory habitat.

Bald and Golden Eagle Protection Act. The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. If the District implements the TSP, there would be no negative impacts to eagles. There is no construction required and the TSP would not promote additional development that might impact eagles. In fact, the TSP increased natural resource management capabilities would maintain eagle nesting and feeding opportunities at Coralville.

Executive Order 12898, Environmental Justice. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, dated February 11, 1994, requires all Federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations. Data was compiled to assess the potential impacts to minority and low-income populations within the Study area.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Even though minority communities exist in portions of the project area, implementation of any of the action alternatives would not have a disproportionately high or adverse effect on these populations. The TSP would be consistent with EO 12898.

Executive Order 13045, Protection of Children. EO 13045 *Protection of Children from Environmental Health Risk*s, dated April 21, 1997, requires Federal agencies to identify and address the potential to generate disproportionately high environmental health and safety risks to children. This EO was prompted by the recognition that children, still undergoing physiological growth and development, are more sensitive to adverse environmental health and safety risks than adults.

The Project, or in this case the TSP would cause no short-term impacts on the protection of children. Since no construction or project altering activities would take place, there is no risk to children or their neighborhoods. Further, green space and public parks where children thrive, would not be diminished or lost if the proposed project is implemented.

Farmland Protection Policy Act of 1981. The TSP would not affect downstream farmland since the action alternatives do not significantly alter downstream flows.

Rivers and Harbors Act

Section 10 (30 Stat. 1151; 33 U.S.C 403, 1899). The TSP would not place any permanent obstruction across navigable water nor would it place obstructions to navigation outside established Federal lines.

Section 122 (PL 91-6110, 1970) 17 Points. This Act assures the District will consider all possible adverse economic, social and environmental effects relating to any proposed project have been fully considered in developing such project. The final decisions on the Project are made in the best overall public interest taking into consideration the need for FRM, navigation, and associated purposes, and the cost of eliminating or minimizing such adverse effects. The Act referred to the specific resources all projects need to consider during the planning process. Table 31 outlines each of these resources and the Project's possible impacts. These resources are commonly called the 17 Points.

Table 31. Rivers and Harbors Act – 17 Points[1]

Resource	Possible Project or TSP Effects[1]
Air	No Impacts
Noise	No Impacts
Water Pollution	No Impacts
Man-made Resources	No Impacts
Natural Resources	Positive Impacts
Aesthetic Values	No Impacts
Community Cohesion	No Impacts
Availability of Public Facilities and Services	No Impacts
Availability of Public Services	No Impacts
Employment	No Impacts
Tax Income Value Losses	No Impacts
Property Value Losses	No Impacts
Displacement of People	No Impacts
Business and Industrial Growth	No Impacts
Farms	No Impacts
Community Growth	No Impacts
Regional Growth	No Impacts

[1] All 17 points – Reason for Possible Project Effects: No construction activity or change in long-term O&M.

Engineer Regulation 1105-2-100. In addition to the resources listed in Table 32, ER 1105-2-100, *Planning Guidance Notebook* 1983, identifies other resources to consider for the project planning in Table 25.

Table 32. Engineering Regulation 1105-2-100 Resources

Resource	Possible Project or TSP Effects	Reasons
Life	Positive Effect	Added FRM
Health	Positive Effect	Added FRM
Safety	Positive Effect	Added FRM
Long Term Productivity	Positive Effect	Added Natural Resource Benefit
Energy Requirements	No Effect	
Energy Conservation	No Effect	

Executive Order 11990 Protection of Wetlands. This EO states each Federal agency shall avoid undertaking new construction located in wetlands unless there is no practicable alternative to such construction, and the proposed action includes all practicable measures to minimize harm to wetlands. This WCP update would not initiate or alter water management to change any existing wetland impacts. The TSP is in full compliance with the EO.

Wild and Scenic Rivers Act of 1968, as amended. The Iowa River is not listed in the National Rivers Inventory (NRI). The Cedar River, a tributary of the Iowa River, from Highway 6 to the confluence with the Iowa River is listed in the NRI as outstandingly remarkable for its cultural, fish, and wildlife resources. The NRI is used to identify rivers that may be designated by Congress to be Component Rivers in the National Wild and Scenic Rivers System. However, neither the Iowa River, nor its tributaries, are designated as Wild and Scenic Rivers.

Federal Water Project Recreational Act of 1966. The Act states, "it is the policy of Congress and the intent of this Act that in investigating and planning any Federal navigation, flood control, reclamation, hydroelectric, or multipurpose water resource project that consideration shall be given to the opportunities, if any, which the Project affords for outdoor and for fish and wildlife enhancement ..."

The District considered recreation impacts in project planning but concluded the TSP would not significantly alter recreation opportunities.

National Historic Preservation Act of 1966. Federal agencies are required under Section 106 of the NHPA of 1966, as amended, to *"take into account the effects of their undertakings on historic properties"* and consider alternatives *"to avoid, minimize or mitigate the undertaking's adverse effects on historic properties" [*(36 CFR 800.1(a-c)] in consultation with the SHPO officer and appropriate federally-recognized Indian Tribes (Tribal Historic Preservation Officers - THPO) [(36 CFR 800.2(c)].

Other applicable cultural resources laws, rules, and regulations will inform how investigations and evaluations will proceed throughout the Study and implementation phases (e.g., Archeological and Historic Preservation Act of 1974, National Environmental Policy Act of 1969, Native American Graves Protection and Repatriation Act, Engineer Regulation 1105-2-100).

The District initiated consultation with the SHPO, Tribes, and interested parties and proposed a finding of *No Adverse Effects* in a letter dated July 9, 2020. SHPO concurred with this determination by stamped approval dated August 5, 2020 (R&C# 200700037). The Crow Creek Sioux THPO concurred with the determination by e-mail dated July 14, 2020. The Ho-Chunk Nation THPO concurred with the determination by e-mail dated July 29, 2020. They further requested to remain as a consulting party for the undertaking and in the event of unanticipated discovery. The District received no other NHPA-related responses.

Archaeological and Historic Preservation Act. The Archaeological and Historic Preservation Act of 1974 amends the 1960 Reservoir Salvage Act by providing for the preservation of significant scientific, prehistoric, historic and archaeological materials and data that might be lost or destroyed as a result of flooding, the construction of access roads, relocation of railroads and highways, or any other federally-funded activity associated with the construction of a dam or reservoir. The TSP would not create any new dams, raise water levels beyond the existing conditions, or increase flooding. No impact to any project significant scientific, prehistoric, historic, and archaeological materials and data is anticipated.

Fish and Wildlife Coordination Act. The FWCA requires Federal agencies that are impounding, diverting, channelizing, controlling, or modifying the waters of any stream or other water body to consult with the USFWS and appropriate state fish and game agency to ensure wildlife conservation receives equal consideration in the development of such projects. The USFWS and the Iowa DNR have been involved in the planning process of this Study since the initial stages participating in the planning process, data collection efforts, providing input and comment throughout the process. For past water regulation manual updates, the District and USFWS agreed a FWCA Coordination Act Report is not required for this type of project. Therefore, the TSP is in full compliance with the FWCA.

Advisory Circular 150/5200-33B – Hazardous Wildlife Attractants on Near Airports. The advisory circular provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. The circular provides guidance on wetlands in and around airports and establishes notification procedures if reasonably foreseeable projects either attract or may attract wildlife.

In response to the advisory circular, the U.S. Army as well as other Federal agencies, signed a Memorandum of Agreement (MOA) with the Federal Aviation Administration (FAA) to address aircraft-wildlife strikes. The MOA establishes procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the U.S.

Because the TSP would not be actively managing wetland habitat in the airports' runway zones, the District determined there would be no adverse impacts or increased likelihood of bird/airplane accidents.

G. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

There would be no short-term use issues with the TSP. The District anticipates long-term FRM benefits as well as long-term productivity for natural resource management. Long-term productivity would be enhanced through improved natural resource inspired lake and river levels during non-flood periods.

H. RELATIONSHIP TO LAND USE PLANS

The current land use plans at each reservoir would not change because the Coralville Lake is compatible with all existing land use plans within the Study area. The land use remains the same because the TSP would not add or remove any mission elements.

The Coralville Lake Master Plan is currently under revision. This Study is compatible with the existing Coralville Lake Master Plan (1977), as well as the proposed revision.

A Real Estate review of easements and other lands within the Study area determined that existing easements are sufficient to meet the needs of the TSP and that no additional real estate interests are needed.

I. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The TSP would not entail significant irretrievable or irreversible commitments of resources. Long-term sustainability actions were included for the benefit of environmental resources.

J. INDIRECT EFFECTS

Indirect effects, as defined by the CEQ regulations, are "caused by the proposed action and occur later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystem" (40 CFR 1508.8). Indirect effects differ from direct impacts associated with the construction and operation of the proposed project and are caused by an action or actions having an established relationship or connection to the proposed project. Indirect effects can be linked to direct effects in a causal chain, which can be extended as indirect effects producing further consequences.

As previously discussed, implementation of the proposed action would directly result in a net beneficial impact to FRM and natural resources along the Iowa River. In addition, the TSP's ecosystem measures may result in benefits extending farther outside the Study area for several notable environmental resources such as migrating birds.

K. REASONABLY FORESEEABLE EFFECTS

The July 16, 2020, revised CEQ regulations define a reasonably foreseeable effect as environmental trends and planned actions in the affected area. To the extent environmental trends or planned actions in the area(s) are reasonably foreseeable, they should be included in the discussion of the affected environment. Reasonably foreseeable effects should have a reasonably close causal relationship to the proposed action.

Reasonably foreseeable effects associated with this Project may include the operation of project facilities, upgrades, and maintenance of recreation sites, as well as residential, commercial, and industrial development throughout the region. Continued project operations would result in the sustained maintenance and development of recreational facilities. These facilities would enhance the recreational offerings made by the District and other management partners. Such improvements would result in varying levels of impacts to the surrounding resources. Similarly, surrounding residential, commercial, and industrial development could result in varying levels of adverse impacts to many resources. Within the Project boundary, adverse impacts would be offset through resource stewardship efforts.

The Preferred Alternative would provide updated FRM and improved natural resource management capabilities to the region. An SRP has been approved for the Iowa River and would be undertaken in the coming years. This SRP will build upon this project and further assist in implementing natural resources management goals for the future. Other actions in the region would be climate change, improved infrastructure, regional growth, and urbanization; these actions are speculative. The District's FRM mission will be challenging, but flexible to accommodate system wide changes in the future.

The programmatic approach to project management, would allow for future development plans and mitigation responses to be adapted to address any adverse actions. This would allow the District and other management partners at Coralville Lake to continue to reduce the contribution of its activities to regional cumulative impacts through proactive actions and adaptive resource management strategies.

L. ADAPTIVE MANAGEMENT AND MONITORING PLAN

A fully vetted monitoring and adaptive management is not required for this WCP update. If the FRM efforts need modification, there is a formalized procedure to request a deviation from the Corps' Mississippi Valley Division for the approved plan.

For the natural resource management aspect of operating within the conservation band, the District would continue its existing practice of meeting with its resource partners on an annual basis. During this meeting the District and agencies discuss the current year's desired outcomes based on the ability to manage with a drier or wetter than normal conditions. They also discuss the next year's management goals. If conditions are right, the District would operate the dams to the best of their ability to meet these goals. This report offers management scenarios fitting with the proposed conservation operating band. The District would also implement other operating scenarios within the conservation band not in the plan if there were a potential for natural resource benefit.

M. RISK AND UNCERTAINTY

Uncertainty gives rise to risk. Risk is a measure of the probability and consequence of uncertain future events. It is the chance of an undesirable outcome. Uncertainty often results from a lack of knowledge about critical elements or processes contributing to risk or natural variability in the same elements or processes. Planning, risk and uncertainty were identified throughout the Study. Risk informed decisions were made regarding the reliability of estimated benefits and the costs of alternative plans.

Measures were developed to manage risk, expanding on and referencing successful similar work completed by previous water regulation manual updates nationwide. Experience from previous projects helped in the identification of possible risks and decrease uncertainty in plan formulation. No measure or alternative in the TSP is burdened by significant risk or uncertainty regarding its eventual success. Significant risks were avoided by using proper design, appropriate selection, and correct seasonal timing of applications. Risks were also managed through extensive coordination with other agencies and District experts.

During 2018, 2019, and 2020 deviations from the existing Coralville Reservoir WCP created an opportunity to test the acceptability and effectiveness of various aspects of some of the alternative plans considered in this Study. These deviations helped the District formulate alternatives as well as strengthen the hydraulic modelling in the evaluation of alternatives. Future climate and precipitation amounts are the principal sources of uncertainty.

N. DAM SAFETY CONSIDERATIONS

The Rock Island District reviewed the Potential Failure Modes Analyses (PFMA) Coralville Lake to determine any potential change, associated with Alternative 2C, to conditions impacting the significant failure modes and risk drivers identified in the 2014 Risk Assessment Report.

For Coralville Dam, there was one risk driver identified: a spillway event leading to loss of spillway slabs and training wall causing erosion of the embankment. For the Amana Remedial Works, there were three risk drivers identified: overtopping erosion, backward erosion piping (BEP) into the CMP at the pump station, and BEP under the flood wall. The TSP would result in lower reservoir levels than would otherwise occur under the existing plan and would therefore reduce the risk of reaching loading conditions that correspond to the identified potential failure modes.

O. CONCLUSIONS

The TSP selected for the Coralville Lake Water Control Plan Feasibility Study is Alternative 2C. Alternative 2C provides the greatest maximum allowable release offering the greatest flexibility to meet potential upward trends in future precipitation and streamflow. Alternative 2 C is also the TSP based on the economic analysis and resulting damage summary highlighted in Tables 28 & 29 above.

Throughout the planning process, the District engaged stakeholders across the study area and incorporated concerns and feedback provided. Although certain communities and stakeholders had initial concerns, the District addressed these through a series of public meetings and presentations. The District does not anticipate that the TSP will be controversial in nature as local emergency managers, the Iowa Department of Natural Resources, city and county governments, and Non-governmental Organizations have been active Study partners through the National Environmental Policy Act process. The TSP also requires no construction, operational, or implementation costs.

Finally, the selected TSP, Alternative 2 C is designed to meet the goals to strengthen the FRM measures on Coralville Lake by reducing risks to life, health, and safety of residents due to flood events along the Iowa River. Additionally, a reduction in future flood risk to critical infrastructure, commercial, residential, and agricultural areas along the Iowa River is anticipated.

The TSP has positive impacts on the hydrology/hydraulics of the system by conserving reservoir storage through earlier releases of water during small-scale flood events, thereby reducing flood risk during long duration, large magnitude flood events resulting from multiple storms.

The TSP would incorporate environmental sustainability by regulating the Coralville Reservoir pool in conservation bands when flooding is not a concern, creating a more naturally functioning wetland, lake, and river ecosystem. Furthermore, the TSP would create aquatic and riparian habitat conditions required by numerous fish and wildlife species living in or migrating through the system. Implementation would not impact flood risk or floodplain development and would not cause negative environmental impacts.

The TSP has positive impacts on recreational areas as they are projected to be inundated less frequently, potentially reducing operational costs. Further, the TSP is consistent with and fully supports the authorized purposes of Coralville Lake and will be used to update the Coralville Lake Water Control Plan

CHAPTER VII. LITERATURE CITED

Apogee Research, Inc & U.S. Army Engineer Institute for Water Resources. 1995. Resource significance in environmental project planning. U.S. Army Corps of Engineers, Water Resources Support Center, Institute for Water Resources; Springfield, VA. National Technical Information Service, distributor, Alexandria, VA. 58pp.

Braatz, D. T., Halquist, J. B., Warvin, R. J., Ingram, J., Feldt, J. J., & Longnecker, M. S. (1997). Moving from the Traditional to the Technically Advanced. In *NWS Hydrologic Products & Services*. N.p.: NOAA. Retrieved from http://www.nws.noaa.gov/oh/hrl/papers/ams/amspaper.htmhttp://www.nws.noaa.gov/oh/hrl/papers/ams/amspaper.htmhttp://www.nws.noaa.gov/oh/hrl/papers/ams/amspaper.htmhttp://www.nws.noaa.gov/oh/hrl/papers/ams/amspaper.htm

Dix, Mary Ellen, Marilyn Buford, Jim Slavicek, Allen M. Solomon, and Susan G. Conard. 2009. Invasive Species and Disturbances: Current and Future Roles of Forest Service Research and Development. A Dynamic Invasive Species Research Vision: Opportunities and Priorities 2009–29. pp 91-102.

Iowa Climatology Bureau. 2010. (http://www.iowaagriculture.gov/climatology.asp) in the Iowa Climate Change Impacts Committee. 2010. Climate change impacts on Iowa. January 1, 2011 Report to the Governor and the Iowa General Assembly. http://www.iowadnr.gov/Conservation/Climate-Change.

Iowa Department of Natural Resources. 2016. Iowa's Section 303(d) Impaired Waters Listings. http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Impaired-Watershttp://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Impaired-Waters.http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Impaired-Waters.http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Impaired-Waters. 2016 305(b) Assessment Summary. 2016 Impaired Waters List: Approved by U.S. EPA January 16, 2018

2015. Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program. Updated October 2015

Iowa State University, Department of Natural Resource Ecology and Management and Iowa Department of Natural Resources. 2013. Multiple Species Inventory and Monitoring Final Report (MSIM) – Evaluate Indicators of Environmental Sensitivity with Respect to Native Flora and Fauna – Saylorville Project, Iowa.

Kallemeyn, Larry. 1983. Status of the Pallid Sturgeon: *Scaphirhynchus albus*. Fisheries, Vol 8, Issue 1. 9pp.

Kunkel, K. E. Stevens, L. E. Stevens, S. E. Sun, L. Janssen, E. Wuebbles, D. Hilberg, S.D. Timlin, M.S. Stoecker, L. Westcott, N.E. Dobson, J.G. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 3. Climate of the Midwest U.S. NOAA Technical Report NESDIS 142-3. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 3. Climate of the Midwest U.S. NOAA Technical Report NESDIS 142-3. 103pp.

National Audubon Society. 2016. Important Bird Areas Program A Global Currency for Bird Conservation. https://www.audubon.org/https://www.audubon.org/https://www.audubon.org/https://www.audubon.org/

Pryor, S. C., D. Scavia, C. Downer, M. Gaden, L. Iverson, R. Nordstrom, J. Patz, and G. P. Robertson. 2014. Chapter 18: Midwest. Pages 418-440 in J. M. Melillo, T. C. Richmond, and G. W. Yohe, eds. Climate change impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, doi:10.7930/J0J1012N.

Poole, K. Elizabeth, and John A. Downing. 2004. Relationship of declining mussel biodiversity to stream-reach and watershed characteristics in an agricultural landscape. J.N. Am. Benthol. Soc. 23(1):114-125. 12pp.

Rosburg, Thomas. 2013. Natural Resources Inventory of the City of Des Moines Parks and Conservation Land Report to: City of Des Moines Parks and Recreation Department 3226 University Avenue, Des Moines, Iowa 50311. https://www.dmgov.org/Departments/Parks/Pages/NaturalResourcesandWildlife.aspx

Soil Science Division Staff. 2017. Soil survey manual. C. Ditzler, K. Scheffe, and H.C. Monger (eds.). USDA Handbook 18. Government Printing Office, Washington, D.C.

U.S. Environmental Protection Agency. 2018. US Environmental Protection Agency's Envirofacts website. http://www.epa.gov/enviro/http://www.epa.gov/enviro/http://www.epa.gov/enviro/http://www.epa.gov/enviro/

2017. EJSCREEN EPA's Environmental Justice Screening and Mapping Tool (Version 2017). https://ejscreen.epa.gov/mapper/https://ejscreen.epa.gov/mapper/https://ejscreen.epa.gov/mapper/https://ejscreen.epa.gov/mapper/

U.S. Fish and Wildlife Service. 2020. Information for planning and consultation webpage. https://ecos.fws.gov/ipac/https://ecos.fws.gov/ipac/https://ecos.fws.gov/ipac/https://ecos.fws.gov/ipac/

U.S. Geological Survey. 2016. National Land Cover Database Land Cover Collection. https://catalog.data.gov/dataset/national-land-cover-database-nlcd-land-cover-collectionhttps://catalog.data.gov/dataset/national-land-cover-database-nlcd-land-cover-collectionhttps://catalog.data.gov/dataset/national-land-cover-database-nlcd-land-cover-collectionhttps://catalog.data.gov/dataset/national-land-cover-database-nlcd-land-cover-collection

United States Census Bureau. 2018. American FactFinder web application. Accessed online at http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh in May 2018.

FINDING OF NO SIGNIFICANT IMPACT

CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

The U.S. Army Corps of Engineers, Rock Island District (Corps) conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The final Integrated Feasibility Report and Environmental Assessment (IFR/EA) dated **DATE OF IFR/EA**, for the **Coralville Lake Water Control Feasibility Study** addresses **proposed modification to the Water Control Plan to better manage Coralville Lake, and maximize its authorized purposes, based on the current hydrologic conditions** in the **Iowa-Cedar Rivers Basin, Johnson, Washington, Louisa, and Des Moines Counties, Iowa**.

The Final IFR/EA, incorporated herein by reference, evaluated various alternatives that would **reduce flood risk)** in the Study area. The TSP is the **National Economic Development (NED) Plan** and includes:

Alternative 1. No Action. Under this alternative, the District would continue to operate Coralville Lake under the current WCP. This alternative maintains the current WCP and facilitates no changes towards the current Iowa-Cedar Rivers Basin Master Reservoir Regulation Manual for Coralville Lake.

Alternative 2C. The District's Preferred Alternative: Under this alternative, this District would eliminate the growing season release reduction, holding a maximum of 10,000 cfs all year during Normal Flood Operations. This alternative eliminates seasonal downstream constraints in lieu of year-round constraints at Lone Tree and Wapello and uniform minimum releases. When forecasts indicate constraint stages will exceed 19 feet at Lone Tree and/or 25 feet at Wapello, releases would be reduced to not less than 1,000 cfs during the peak 3-days of the crest with due allowance for travel time. This alternative would also modify the Large Magnitude Flood Operations (LMF) release schedule compared to the existing plan and eliminate "Induced Surcharge Operation". However, this alternative would not change downstream constraints from the existing plan for Iowa City or Burlington. Figure 1 outlines the details of this alternative addressing normal flood management operations, large magnitude flood operations, drought, and conservation pool management.

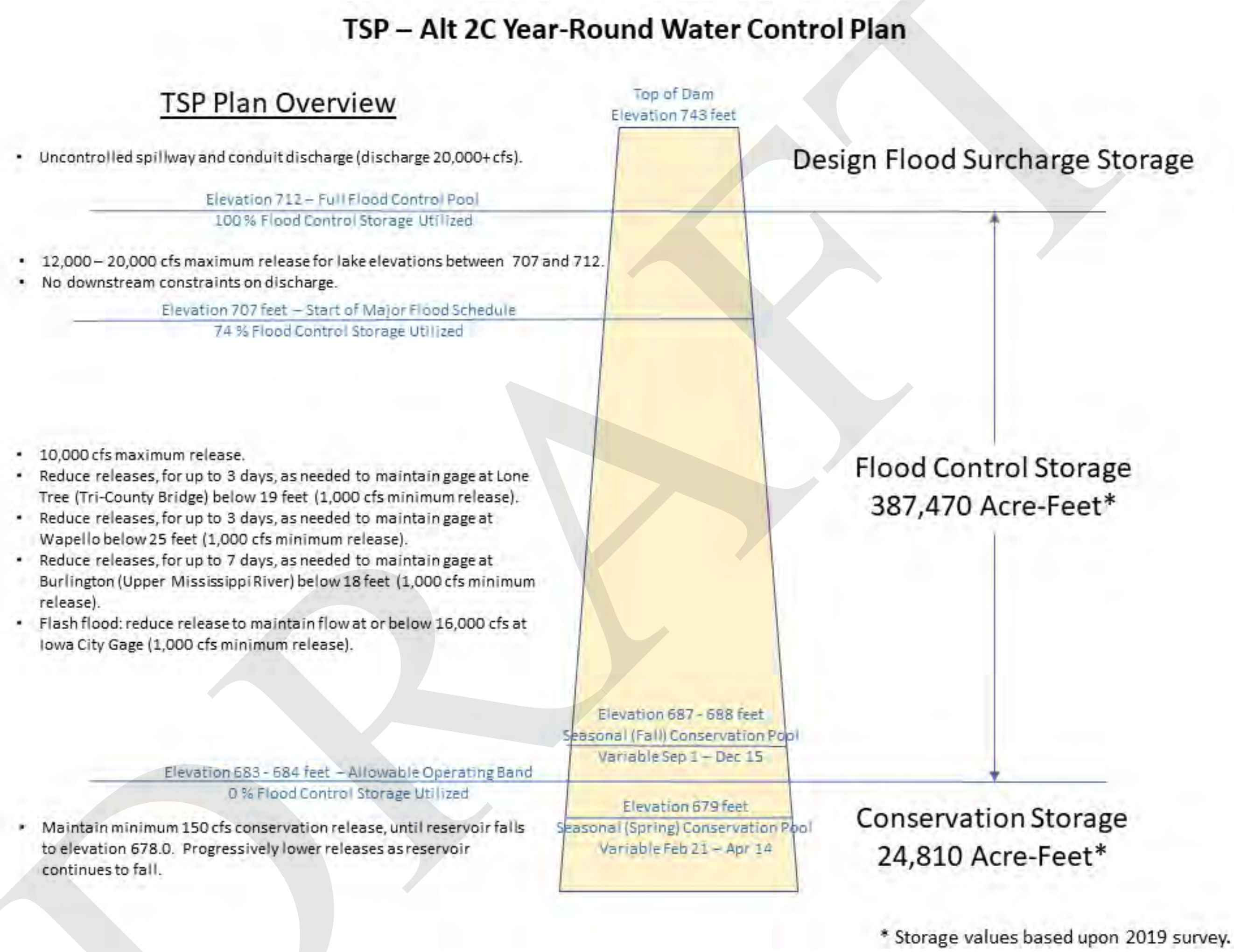

Figure 1. Tentatively Selected Plan – Preferred Alternative 2C

Alternative 5: Under this alternative, the District would tier seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases. When forecast indicate any of these constraints will be exceeded, releases would be reduced to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time. As such, during the growing season, a minimum allowable release of 6,000 cfs would occur when the stages at Lone Tree and/or Wapello are forecast to exceed 16 feet and 22 feet, respectively. Likewise, a minimum allowable release of 1,000 cfs would occur when forecasts indicate stages at Lone Tree and/or Wapello exceed 19 feet and 25 feet, respectively. During the non-growing season, a minimum allowable release of 1,000 cfs would occur when the stages at Lone Tree and Wapello are forecast to exceed 19 feet and 25 feet, respectively. Growing season maximum release would be 8,000 cfs (May 1 - Dec 15), while non-growing season maximum release would be 10,000 cfs (Dec 16 - Apr 30). This alternative would not change the current plan's downstream constraints at Iowa City or Burlington. This alternative would alter the dates for seasonal downstream constraint changes to April 15 – December 15. This alternative would also modify the Large Magnitude Flood Operations (LMF) release schedule compared to the existing plan and eliminate "Induced Surcharge Operation".

Alternative 8: Under Alternative 8, the District would determine maximum growing season releases by reservoir pool elevation. When Coralville Lake is below elevation 700, the maximum growing season release would be 8,500 cfs. When Coralville Lake is above elevation 700, the maximum growing season release would be 10,000 cfs. This alternative would include a maximum non-growing season release of 10,000 cfs. A minimum allowable release of 1,000 cfs would occur when the stages at Lone Tree and/or Wapello are forecast to exceed 18.5 feet or 25 feet respectively during the peak 3-days of the crest with due allowance for travel time.

SUMMARY OF POTENTIAL EFFECTS:

For all alternatives, the potential effects were evaluated, as appropriate. Table 1 summarizes the potential effects of the Preferred Alternative.

The Preferred Alternative does not require compensatory mitigation.

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the TSP.

Public review of the draft IFR/EA and FONSI will be completed on **DATE DRAFT EA AND FONSI REVIEW PERIOD ENDED**. All comments submitted during the public review period were responded to in the Final IFR/EA and FONSI

Table 1: Summary of Potential Effects of the Tentatively Selected Plan

	Insignificant Effects	Insignificant Effects as a Result of Mitigation*	Resource Unaffected by Action
Aesthetics	☐	☐	☒
Air quality	☐	☐	☒
Aquatic resources/wetlands	☒	☐	☐
Invasive species	☐	☐	☒
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species/critical habitat	☐	☐	☒
Historic properties	☐	☐	☒
Other cultural resources	☐	☐	☒
Floodplains	☐	☐	☒
Hazardous, toxic & radioactive waste	☐	☐	☒
Hydrology	☒	☐	☐
Land use	☒	☐	☐
Navigation	☐	☐	☒
Noise levels	☐	☐	☒
Public infrastructure	☒	☐	☐
Socio-economics	☒	☐	☐
Environmental justice	☒	☐	☐
Soils	☒	☐	☐
Tribal trust resources	☐	☐	☒
Water quality	☒	☐	☐
Climate change	☐	☐	☒

OTHER ENVIRONMENTAL AND CULTURAL COMPLIANCE REQUIREMENTS:

A. ENDANGERED SPECIES ACT. Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers determined the TSP would have no effect on federally-listed species or their designated critical habitat. The U.S. Army Corps of Engineers coordinated this determination with the U.S. Fish and Wildlife Service during the public and agency review.

B. NATIONAL HISTORIC PRESERVATION ACT.

HISTORIC PROPERTIES NOT ADVERSELY AFFECTED:

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that historic properties would not be adversely affected by the TSP. The District initiated consultation with the SHPO, Tribes, and interested parties and proposed a finding of *No Adverse Effects* in a letter dated July 9, 2020. SHPO concurred with this determination by stamped approval dated August 5, 2020 (R&C# 200700037). The Crow Creek Sioux THPO concurred with the determination by e-mail dated July 14, 2020. The Ho-Chunk Nation THPO concurred with the determination by e-mail dated July 29, 2020. They further requested to remain as a consulting party for the undertaking and in the event of unanticipated discovery. The District received no other NHPA-related responses.

C. CLEAN WATER ACT SECTION 404(B)(1) COMPLIANCE. Pursuant to the Clean Water Act of 1972, as amended, this project does not require section 404(b)(1) analysis.

D. CLEAN WATER ACT SECTION 401 COMPLIANCE. Since the District proposes no construction or discharge into the Waters of the United States, a Clean Water Act, Section 401 Water Quality Certification is not required.

OTHER SIGNIFICANT ENVIRONMENTAL COMPLIANCE

FINDING

Technical, environmental, and economic criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.* All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives.

The District determined the Preferred Alternative meets the objectives of providing sound flood risk management and natural resources management at Coralville Lake, Johnson County, Iowa. The other alternatives do not meet the District's objectives or do not reduce flood damages to extent of the Preferred Alternative.

I have reviewed the information provided in the accompanying IFR/EA, along with data obtained from cooperating Federal, state, and local agencies, and from the interested public. Based on this review, I find the proposed Project would not significantly affect the quality of the human environment. Therefore, it is my determination an Environmental Impact Statement is not required. The District would re-evaluate this determination if warranted by later developments.

____
Date

____
Steven M. Sattinger, P.E.
Colonel, **US Army**
Commander & District Engineer

CORALVILLE LAKE WATER CONTROL
FEASIBILITY STUDY
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX A

CLIMATE CHANGE IMPACT ASSESSMENT

CORALVILLE LAKE WATER CONTROL
FEASIBILITY STUDY
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX A

CLIMATE CHANGE IMPACT ASSESSMENT

I. BACKGROUND

Recent scientific evidence shows that in some places and for some impacts relevant to U.S. Army Corps of Engineers (Corps) operations, climate change is shifting the climatological baseline about which natural climate variability occurs, and may be changing the range of variability as well. This is relevant to the Corps because the assumptions of stationary climatic baselines and fixed range of natural variability, as captured in the historic hydrologic record may no longer be appropriate for long-term projections of flood risk, drought and environmental flows. An assessment of climate change impacts, described herein, is needed to support an update to the Coralville Lake Water Control Plan. Specifically this assessment is needed to verify the appropriate period of analysis for the updated Regulated Flow Frequency Study found in Appendix B, *Hydrology & Hydraulics*.

Climate Change impacts on the hydrology of the Iowa-Cedar River Basin were evaluated in accordance with the Corps' Engineering and Construction Bulletin 2018-14, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects* (Reference 7), and Engineering Technical Letter (ETL) 1100-2-3 *Guidance for Detection of Nonstationarities in Annual Maximum Discharges* (Reference 8).

The USACE's current policy is to interpret and use climate change information for hydrologic analysis through a qualitative assessment of potential climate change threats and impacts potentially relevant to the particular USACE project for which the hydrologic analysis is being performed. As indicated in Figure A-1, qualitative analysis required includes consideration of both past (observed) changes as well as potential future (projected) changes to relevant hydrologic inputs.

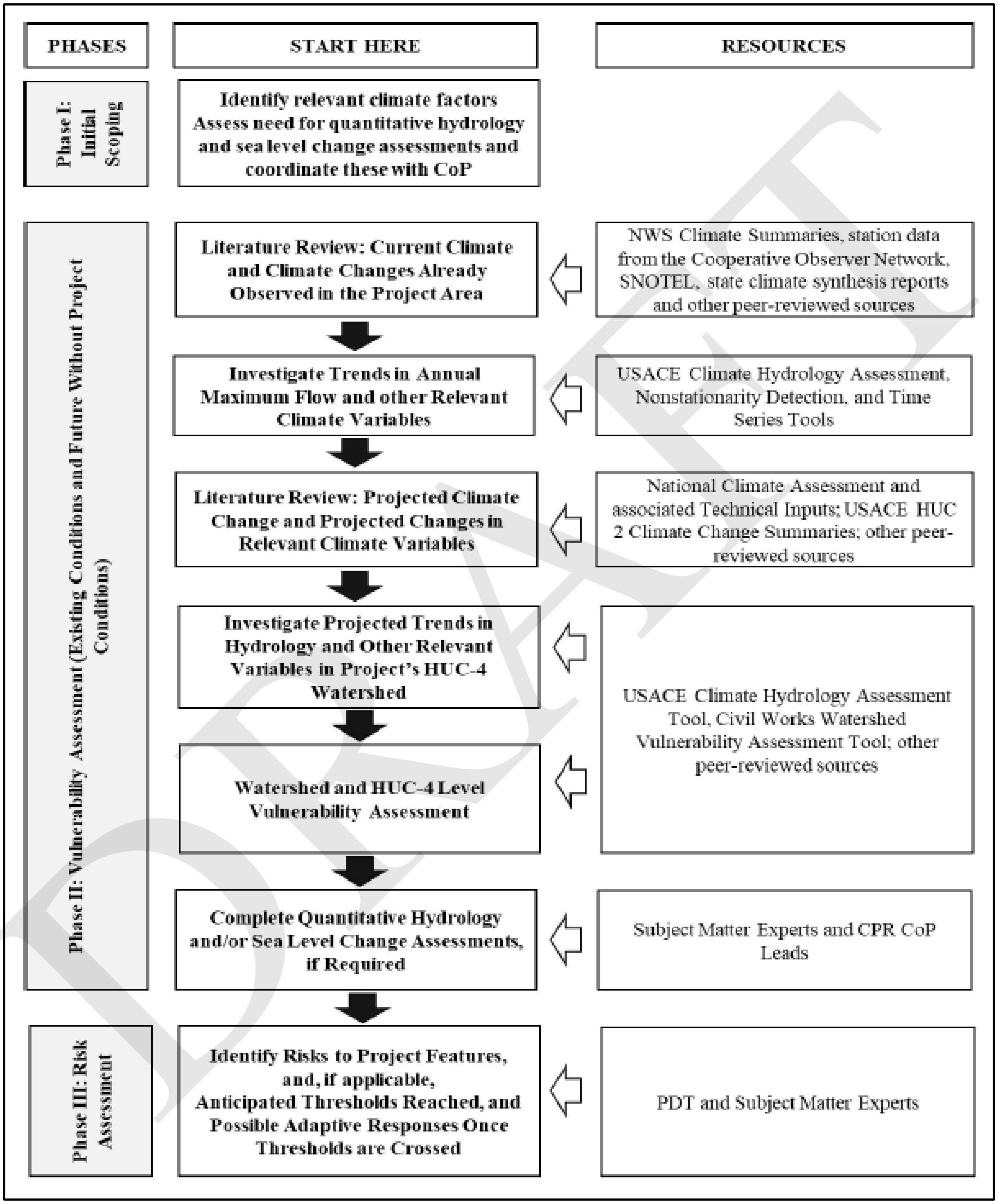

Figure A-1: Flowchart for Conducting a Qualitative Assessment of Climate Change Impacts in Inland Hydrologic Analyses (Reference 6)

II. PHASE I ASSESSMENT: RELEVANT CLIMATE VARIABLES

Reservoir regulation and release considers several constraints including downstream channel capacity, flood stage at downstream control points, pool level, maximum outflow change requirements and minimum low-flow requirements. Changes to the frequency and/or magnitude of incoming flows, due to both land use/land cover and climate change, have the potential to change the frequency of reservoir operations. Relevant climate variables for assessing changes in inflow to Coralville Reservoir include streamflow in addition to precipitation and temperature. Although streamflow is the primary climate variable driving reservoir release, precipitation and temperature influence the temporal distribution and abundance of streamflow. Temperature and precipitation are unique variables in that they reflect trends influenced purely by climate, whereas changes in land use/land cover as well as climate can influence trends in streamflow.

III. PHASE II ASSESSMENT: LITERATURE REVIEW

A literature synopsis was generated to summarize published conclusions regarding observed trends as well as projected trends in climate variables for the Iowa-Cedar River Basin.

A. USACE Climate Change and Hydrology Literature Applicable to USACE Mission – Upper Mississippi Region 07 (Reference 5)

The USACE Climate Change and Hydrology Literature Synthesis for Upper Mississippi Region 07 summarized the climate change literature for the region regarding observed temperature, precipitation, and hydrology and projected temperature, precipitation, and hydrology (Figure A-2).

- Summary of Observed Temperature: the majority of authors reported increasing trends in observed air temperature including increasing daily minimum and mean temperatures, and a decreasing trend in maximum temperatures.

- Summary of Observed Precipitation: strong consensus between authors of a large increasing trend in precipitation.

- Summary of Observed Hydrology: strong consensus between authors showing an increasing trend in observed low, mean, and peak streamflow.

- Summary of Projected Temperature: strong consensus between authors showing an increase in temperatures over the next century.

- Summary of Projected Precipitation: general consensus between authors showing an increase in projected annual and extreme precipitation.

- Summary of Projected Hydrology: no clear consensus between authors as some studies project an increase in streamflow as a result of higher precipitation while other studies project a decrease in streamflow as a result of increased evapotranspiration. Multiple authors suggest increases in streamflow in the winter and spring and decreases in summer streamflow.

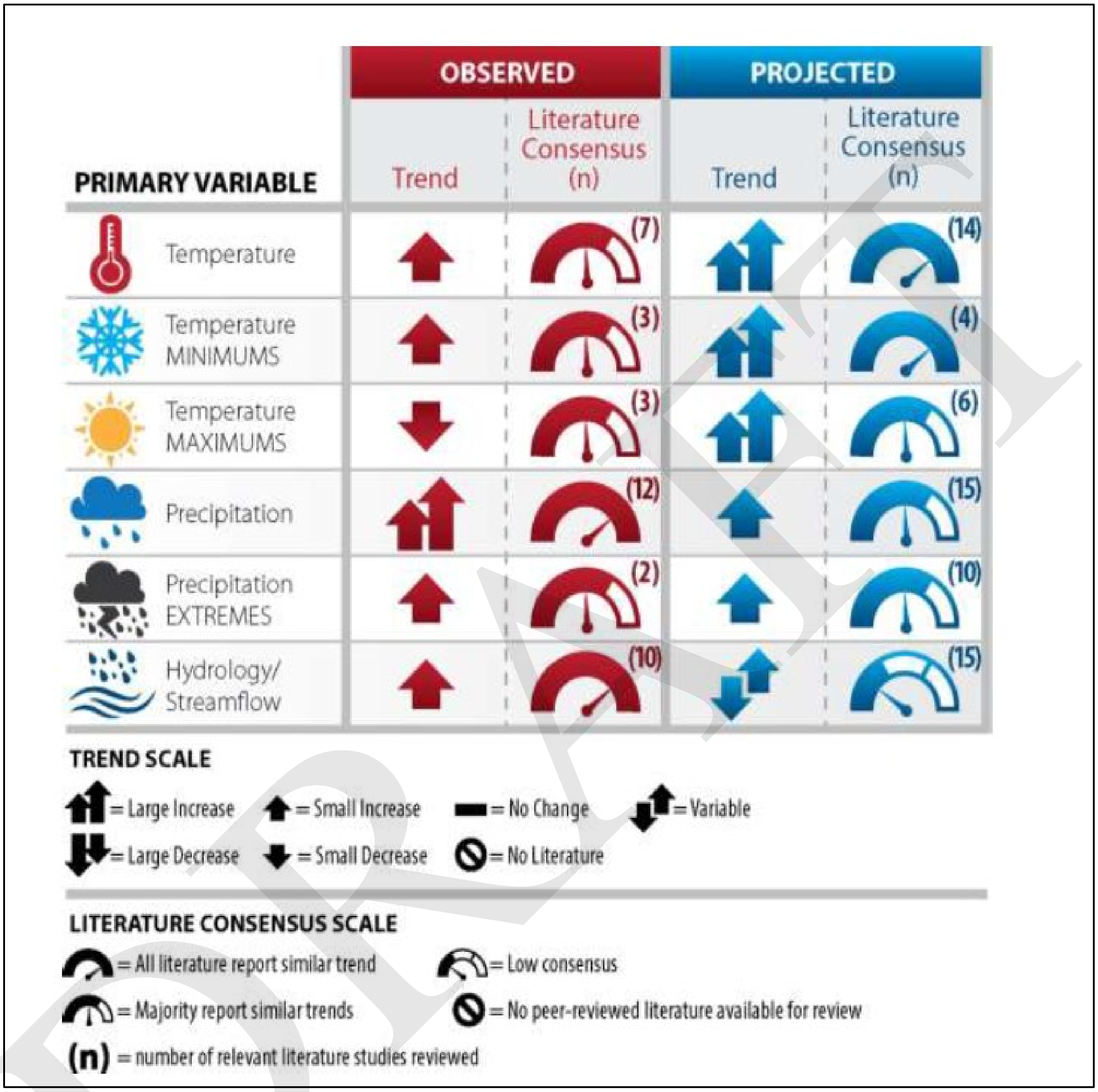

Figure A-2: Summary of Climate Literature Consensus for the Upper Mississippi Region 07 (Reference 6, page 41)

B. USGS Flood Trends Report: Fragmented Patterns of Flood Change Across the United States (Reference 1)

The USGS conducted an assessment to determine if changes in flood magnitudes were consistent across certain geographic regions of the United States. The study concluded that there were changes in trends at specific locations for peak magnitude, frequency, duration and volume of frequent floods. However, the study indicated no evidence that these sites were related geographically.

The study analyzed regions of the United States based on grid cells and the stream gages located within each cell (Figure A-3). The Iowa-Cedar River Basin is spread over three cells in this analysis; there is no consensus among the cells showing there is or is not statistically significant trends in flood frequency, peak magnitude, duration, or volume. The grid cell that covers the southeast portion of the Iowa-Cedar River Basin shows a statistically significant trend (p<0.1) for flood frequency, peak magnitude, duration, and volume. However, the majority of this grid cell is located in western Illinois and northeastern Missouri and covers only the mouth of the Iowa-Cedar River Basin. Therefore, the gages in this grid cell may not be an accurate representation of the Iowa-Cedar River Basin. In addition, the detailed gage analysis conducted in the Phase II Assessment and outlined in Part IV of this appendix is more representative of the observed hydrology in the Iowa-Cedar River Basin than this generalized USGS streamflow study.

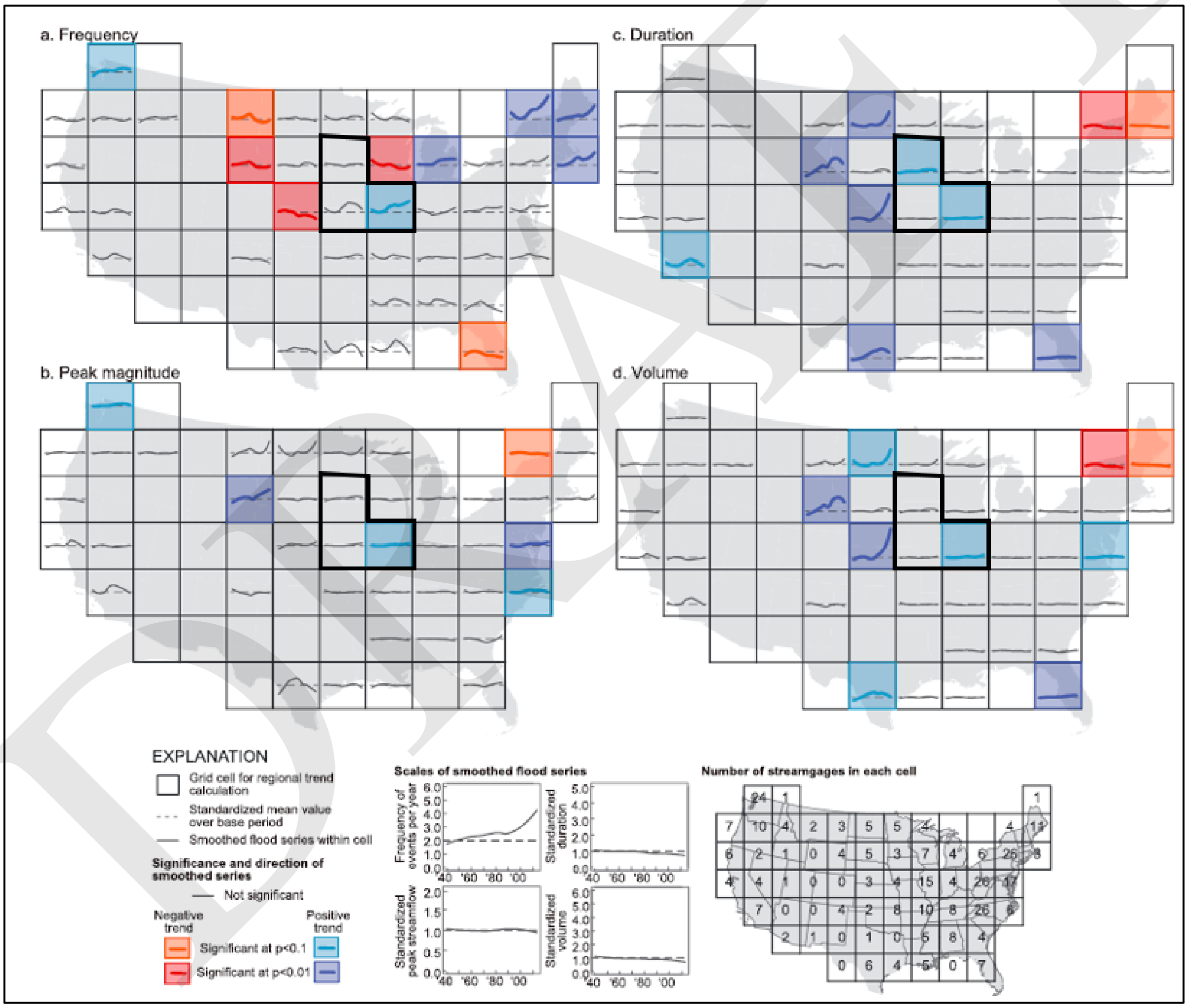

Figure A-3: Regional Changes in Floods Across the United States (1940-1969 vs 1970-2013) (Reference 1, page 10,234)

C. Climate Change Impacts in the United States: The Fourth National Climate Assessment – Chapter 21: Midwest (Reference 3)

The Fourth National Climate Assessment (NCA4), Volume II was released in 2018 and assessed climate impacts across the different regions of the United States. The Iowa River Basin is located entirely within the Midwest region for the National Climate Assessment.

The Fourth National Climate Assessment reports observed increasing humidity, with dew point temperatures increasing in all seasons throughout the Midwest. Throughout the United States, projected changes in annual average temperature, annual maximum temperature and 0.1 probability 5-day maximum temperature are highest in the Midwest. Annual precipitation across the Midwest region has observed increases of 5% to 15%, with similar increases projected by late century (2070-2089). Since 1901, both frequency and intensity of heavy precipitation events have increased and are projected to continue to increase. There is very high confidence that increases in warm-season absolute humidity and precipitation very likely have resulted in soil erosion. The NCA4 reports there is very high confidence that flood risk is increasing in the Midwest, however the relative contributions from climate change and land-use change remain uncertain. Projected increases in the frequency and magnitude of heavy precipitation are likely to further increase flood risk in the future.

D. 2010 Climate Change Impacts on Iowa 2010 (Reference 4)

The 2010 Climate Change Impacts on Iowa documents a long-term upward trend in temperature and further reports that long-term winter temperatures have increased six times more than summer temperatures (Figure A-4). Since 1970, nighttime temperatures have increased more than daytime temperatures, driving the upward trend in daily average temperatures. The 2010 Climate Change Impacts on Iowa report illustrates a long-term upward trend in precipitation for the state, with Eastern Iowa having an even higher upward trend than the statewide average. Over the last 40 years, an increase in summer heavy precipitation has been documented. Increased extreme precipitation events have the potential to cause increased erosion of agricultural fields and runoff of nutrients, pesticides and herbicides.

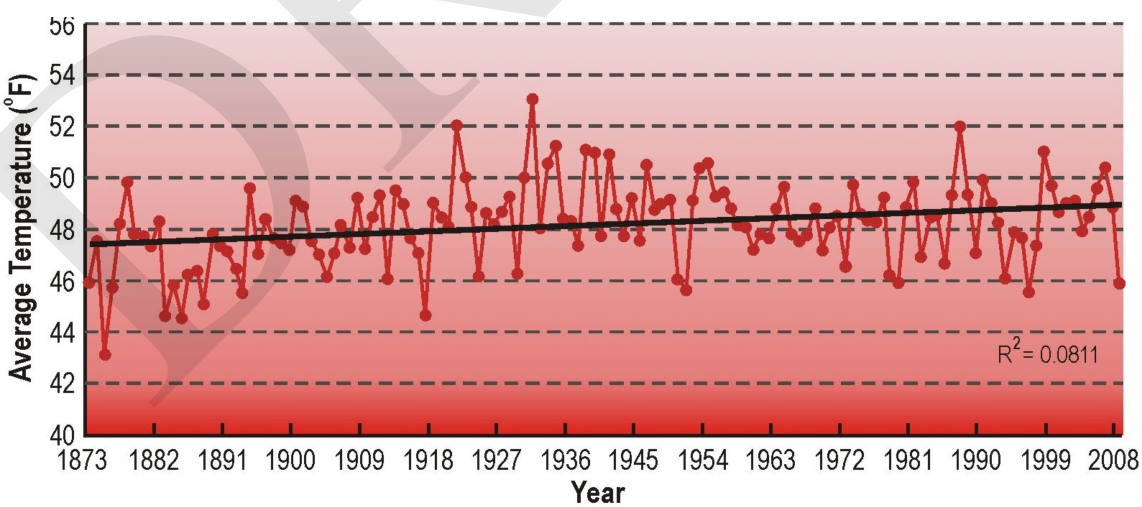

Figure A-4: Annual Average of Iowa's State-wide Daily Average Temperatures (°F) from 1873-2008 (Reference 4, page 10)

E. 2017: Iowa State Climate Summary (Reference 5)

National Oceanic and Atmospheric Association's (NOAA) 2017: Iowa State Climate Summary reported an increase in average annual temperatures of about 1°F over the last two decades (Figure F-5). Average annual temperatures are projected to increase, resulting in projections of increased intensity of future droughts. NOAA's 2017 State Climate Survey for Iowa reports an observed increase in the frequency of extreme precipitation events and projects increased precipitation, with the largest increases expected in spring and winter as well as an increase in the frequency of extreme precipitation in the future. The occurrence of more frequent extreme precipitation during spring could produce increased erosion in agricultural watersheds when delays in planting result in fallow fields.

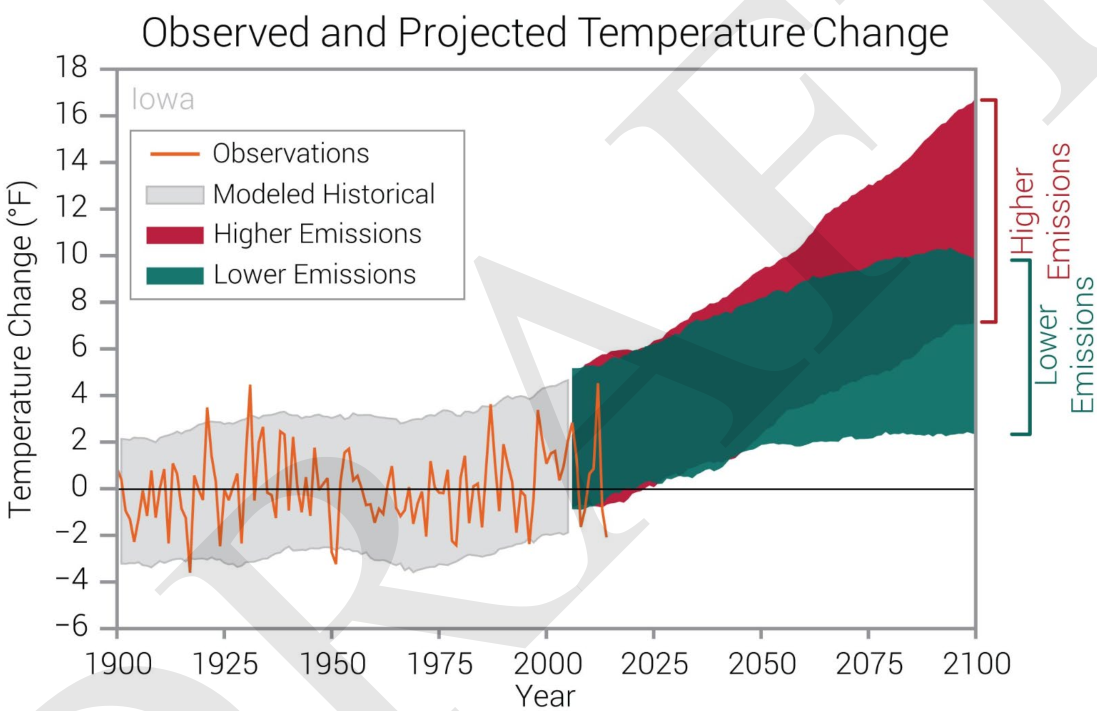

Figure F-5: Observed and Projected Average Annual Temperature in Iowa
(Reference 5, page 1)

IV. PHASE II ASSESSMENT: TRENDS IN OBSERVED CLIMATE VARIABLES

This portion of the climate change assessment focuses on carrying out first order statistical analyses using streamflow records observed at USGS gages within the Iowa-Cedar River Basin, daily inflows to the Coralville Reservoir computed by the Rock Island District's (District) HEC-ResSim model, and temperature and precipitation records observed at the Iowa City National Weather Service (NWS) Coop Gage (#134101).

A. Assessment of Trends and Detection of Nonstationarities in Observed Streamflow Records (References 2 and 9)

The USACE Time Series Toolbox (TST) statistical tests were applied to assess for monotonic trends in observed annual maximum discharge at each of the long-term gage sites (Reference 9). The regression tests used by the TST include the test for traditional simple linear regression used by the Climate Hydrology Assessment Tool (CHAT) and the Mann-Kendall and Spearman-Rank Order tests (Reference 10) for monotonic trend significance as used by the Nonstationarity Detection (NSD) Tool (Reference 2). In addition to performing the same trend analysis functions as the CHAT and NSD, the TST uses a Sen's slope regression to fit the data.

The TST was also used to apply tests for nonstationarity to determine whether observed flows in the Iowa-Cedar River Basin between water years (WY) 1905 and 2019 are representative of stationary hydroclimatic conditions. The statistical tests for nonstationarity applied by the TST are the same as those applied by the USACE NSD (Reference 2). However, the TST allows the user to extend the period of record (POR) beyond the current NSD analysis period (WY 2014/2015), and the option to analyze different annual time series datasets, such as volume-duration or meteorologic data. The TST applies these same statistical tests for nonstationarity to other annual time series of interest. Reservoir water control operations are generally driven by longer term flood volumes, therefore the TST was used to assess stationarity of the 7-day and 15-day volume-duration annual maximum flow records.

Stationarity of the flow records within the Iowa River Basin assessed using the TST apply a series of nonparametric statistical tests to the observed flow record at three, relatively "pristine", long-term gage sites upstream of Coralville Reservoir, as well as to daily inflows to the Coralville Reservoir computed by the District's HEC-ResSim model. Streamflow records are described as "pristine" when there are minimal man-made flood control structures impacting flows. The flow records at these "pristine" sites may be affected by other anthropogenic activities, such as land use changes and alterations in agricultural practices, and this is why they are referred to as "relatively pristine"; only known man-made flood control structures were considered in identifying relatively "pristine" gage sites. All three of these "pristine" sites are on the Iowa River. A forth gage also located on the Iowa River was excluded from the analyses due to an insufficient length of record (Iowa River at County Highway E49 near Tama, IA). Statistical tests were also applied to flow records from four gage sites on the Iowa River, downstream of Coralville Dam, in order to determine if the detection tool identifies the construction of the dam as a change point. Two "pristine" gage sites along the Cedar River, and one gage on the English River were also included in the nonstationarity assessment. For the assessment of the "pristine" gage sites and the HEC-ResSim-computed inflows, any detected nonstationarities should not be caused by the construction of a water resource project. A detected nonstationarity could be associated with a widely distributed land use/land cover change and/or climate change. Figures F-6 and Table F-1 describe the gages located within the basin, identify those that were included in the trend assessment and nonstationarity detection analyses, and describe why certain gages were excluded.

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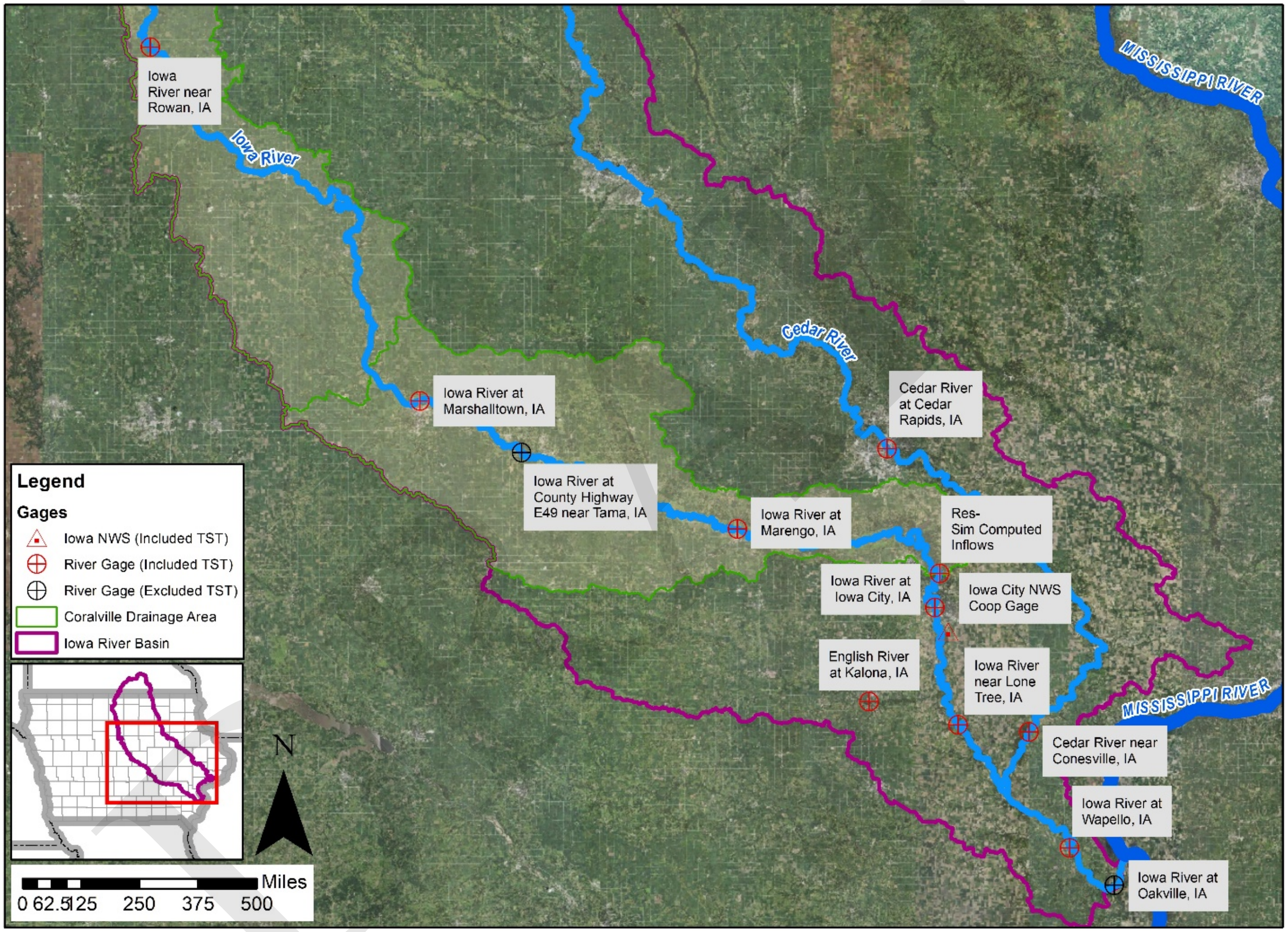


Figure A-6: Current USGS flow gages for the Iowa River Basin and Major Tributaries from Rowan, IA to Oakville, IA Gages included in the Nonstationarity Detection Analysis are highlighted in red.

Table A-1: USGS Stream Gages on Iowa River, Major Tributaries and Cedar River from Rowan, IA to Oakville, IA (upstream to downstream)

Current gages included only annual peak streamflows through 2019 at the time of the analysis.

USGS Gage Name	USGS Gage Number	Period of Record (WY)	Included in Nonstationarity Detection	Reason for Exclusion/*Notes
Upstream of Coralville				
Iowa River near Rowan, IA	05449500	1941-2019*	Yes	*1977 missing, analysis completed for 1941-2019
Iowa River at Marshalltown, IA	05451500	1915-2019*	Yes	*1928, 1931 & 1932 missing, analysis completed for 1915-2019
Iowa River at County Hwy E49 near Tama, IA	05451770	2012-2019	No	Short POR
Iowa River at Marengo, IA	05453100	1957-2019	Yes	
HEC-ResSim Computed Inflows	CRVI4	1905-2019	Yes	
Downstream of Coralville				
Iowa River at Iowa City, IA	05454500	1903-2019	Yes	
English River at Kalona, IA	05455500	1940-2019	Yes	
Iowa River near Lone Tree, IA	05455700	1957-2019	Yes	
Iowa River at Wapello, IA	05465500	1903-2019	Yes	
Iowa River at Oakville, IA	05465700	2008-2019	No	Short POR
Cedar River				
Cedar River at Cedar Rapids, IA	05464500	1903-2019	Yes	
Cedar River near Conesville, IA	05465000	1940-2019	Yes	

1. Gages Upstream of Coralville Reservoir. The gages upstream of Coralville Reservoir include the Iowa River near Rowan, IA; Iowa River at Marshalltown, IA; Iowa River at County Highway E49 near Tama, IA; and Iowa River at Marengo, IA. The most upstream gage site is USGS gage 05449500, located along the Iowa River near Rowan, IA. The peak annual discharge period of record for the gage near Rowan begins in WY 1941 and continues to WY 2019, and captures a drainage area of 429 square miles. Peak annual discharge during the 1977 WY for the Rowan gage was missing, however the monotonic trend and change point analyses using the TST utilized the full record (1941-2019), as only one year during this period was missing.

Figure A-7 shows the trend analysis results for the Rowan gage, including the linear regression equation, significance of the linear regression and the Sen's slope equation. The simple linear regression trend line is assessed using a hypothesis test (t-Test) (α=0.05 level of significance) for a slope equal to zero (i.e. linear regression p-value <0.05 is a rejection of the null hypothesis, with 95% confidence of a slope not equal to zero). A p-value <0.05 is a typical threshold for significance and with no compelling reason to depart from this standard, it was maintained for these analyses. Within the TST, further evaluation of the trend is carried out using the Mann-Kendall Test (α=0.05 level of significance) and the Spearman Rank Order Test (α=0.05 level of significance). Each of these three tests can be individually assessed for significance at the α=0.05 level. However, trend significance at an overall p-value of 0.05 based on all three tests requires a rejection of the null hypothesis by any one of the three tests at a p-value <0.0167 (0.05/3=0.0167), in accordance with the Bonferroni correction. Table A-2 summarizes significance tests for the TST trend analyses at each of the gages. Results for the Rowan gage suggest an upward trend in annual peak flow, however the linear regression t-Test, as well as the Mann-Kendall and Spearman Rank Order Tests indicate no significant evidence of an upward trend. Figure A-8 shows the nonstationarity detection results for the Rowan gage, with no change points identified.

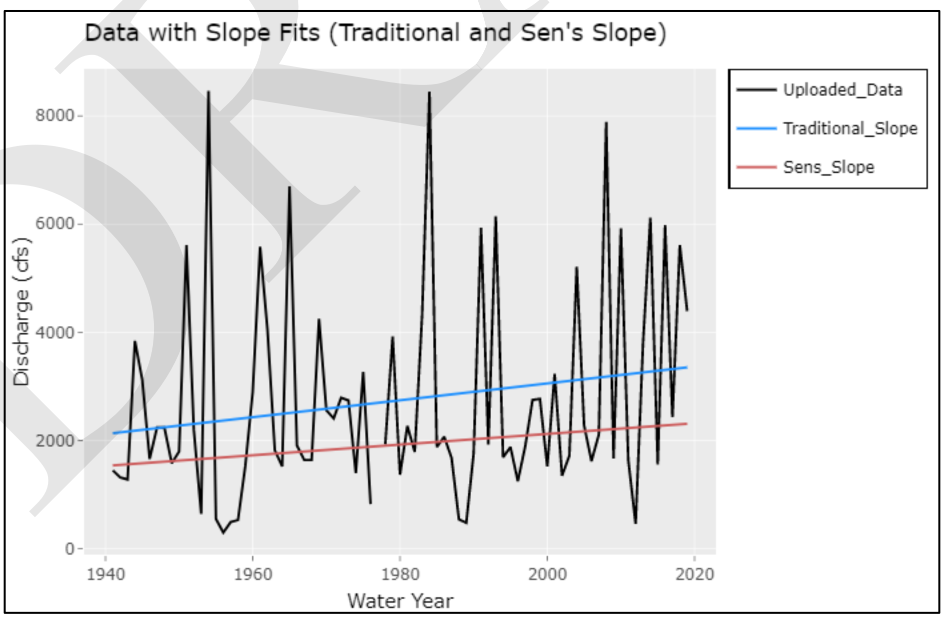
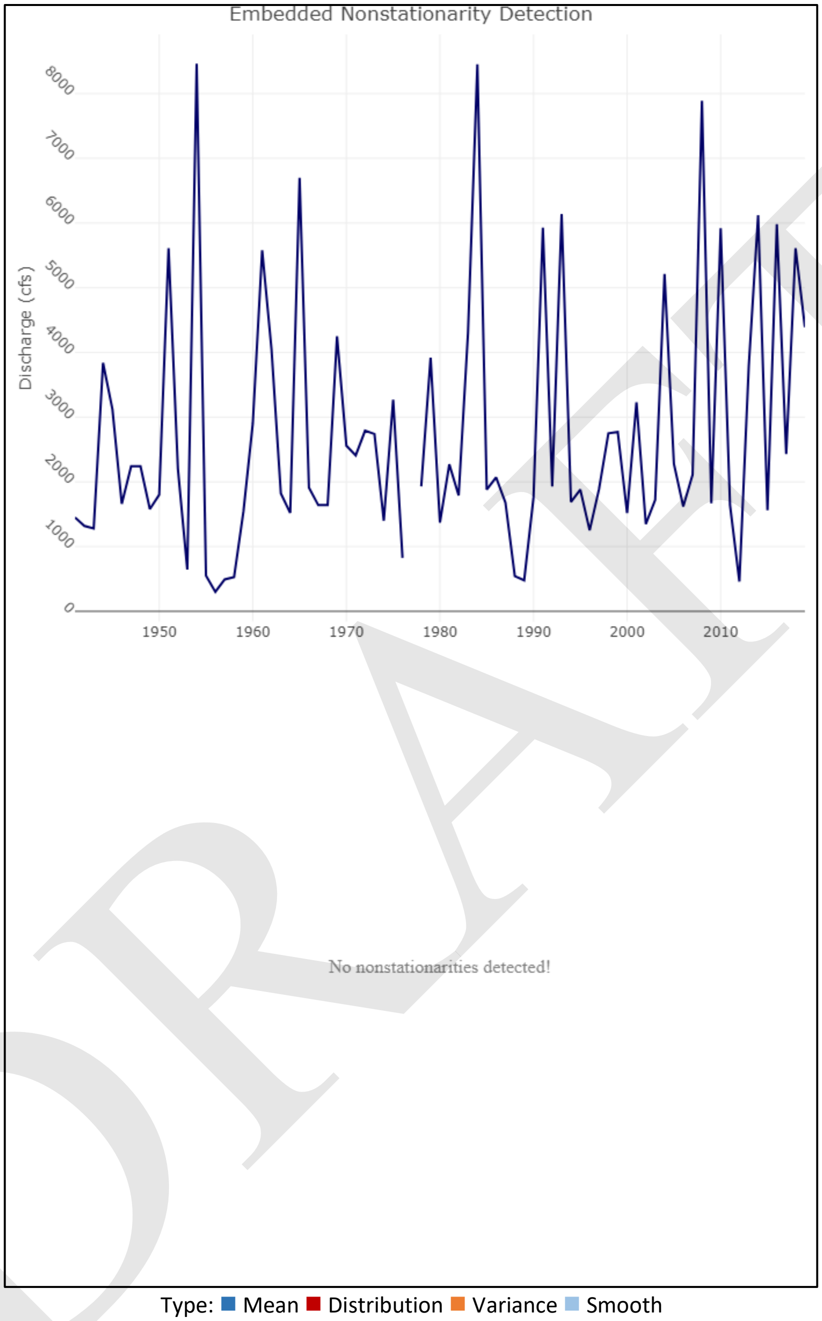


Figure A-7: Annual Peak Streamflow for Iowa River near Rowan, IA. (Linear Regression Equation: Q = 15.6*[Water Year] – 28145, p=0.10412. Sen's Slope Equation: Q = 9.8529*[Water Year] – 17584) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-8: Nonstationarity Analysis of Maximum Annual Flow, USGS gage 05449500 – Iowa River near Rowan, IA (Reference 9)

Table A-2: Significance of Linear Regression and Monotonic Trend

Gage Site	POR Assessed	Trend Direction	Linear Regression P-value (Significance)	Mann-Kendall P-value (Significance)	Spearman Rank-Order P-value (Significance)
USGS gage 05449500 Iowa River near Rowan, IA	1941-2019	Upward	0.10412 (No)	0.099297 (No)	0.079074 (No)
USGS gage 05451500 Iowa River at Marshalltown, IA	1915-2019	Upward	0.61652 (No)	0.43668 (No)	0.40368 (No)
USGS gage 05453100 Iowa River at Marengo, IA	1957-2019	Upward	0.37539 (No)	0.68234 (No)	0.61028 (No)
CRVI4 HEC-ResSim-Computed Inflow to Coralville Reservoir	1905-2019	Upward	0.01164 (Yes)	0.016603 (Yes)	0.013822 (Yes)
CRVI4 HEC-ResSim-Computed 7-Day Volume Inflow to Coralville Reservoir	1905-2019	Upward	0.0042055 (Yes)	0.014343 (Yes)	0.0094539 (Yes)
CRVI4 HEC-ResSim-Computed 15-Day Volume Inflow to Coralville Reservoir	1905-2019	Upward	0.0011967 (Yes)	0.0056466 (Yes)	0.0030618 (Yes)
USGS gage 05454500 Iowa River at Iowa City, IA	1903-2019	Downward	0.11141 (No)	0.046513 (Yes)	0.041987 (Yes)
USGS gage 05455500 English River at Kalona, IA	1940-2019	Upward	0.044411 (Yes)	0.072014 (No)	0.05895 (No)
USGS gage 05455700 Iowa River near Lone Tree, IA	1957-2019	Upward	0.093636 (No)	0.30762 (No)	0.26506 (No)
USGS gage 05465500 Iowa River at Wapello, IA	1903-2019	Upward	0.02177 (Yes)	0.15961 (No)	0.16592 (No)
USGS gage 05464500 Cedar River at Cedar Rapids, IA	1903-2019	Upward	0.0073125 (Yes)	0.020444 (Yes)	0.017167 (Yes)
USGS gage 05465000 Cedar River near Conesville, IA	1940-2019	Upward	0.007874 (Yes)	0.020883 (Yes)	0.019873 (Yes)

"No" indicates no significance at $p<0.05$ significance level
"Yes" indicates significance at $p<0.05$ significance level

The next downstream gage site is USGS gage 05451500, located along the Iowa River at Marshalltown, IA. The Marshalltown gage has a POR for peak annual flow from 1915 to 2019 (WY) and captures a drainage area of 1,532 square miles. Water years 1928, 1931 and 1932 are missing in the record, however the trend and nonstationarity analyses still utilized the lengthened 1915-2019 record, consideration of missing data was given when interpreting results. Figure A-9 and Table A-2 show trend analysis results for the Marshalltown gage. Results for the Marshalltown gage suggest a slight upward trend in annual peak flow, however the linear regression t-Test, as well as the Mann-Kendall and Spearman Rank Order Tests indicate no significant evidence of an upward trend. Figure A-10 shows the output of the TST nonstationarity detection analysis for the Marshalltown gage, with no change points detected.

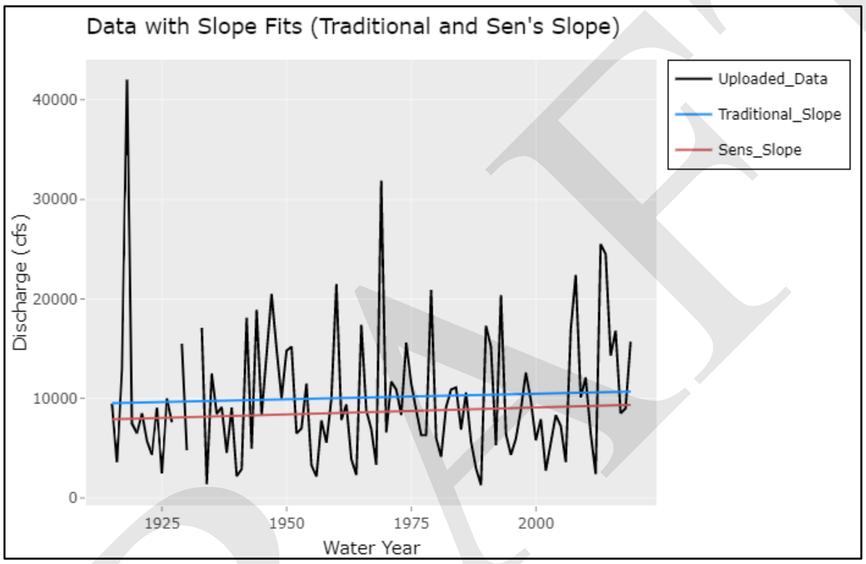
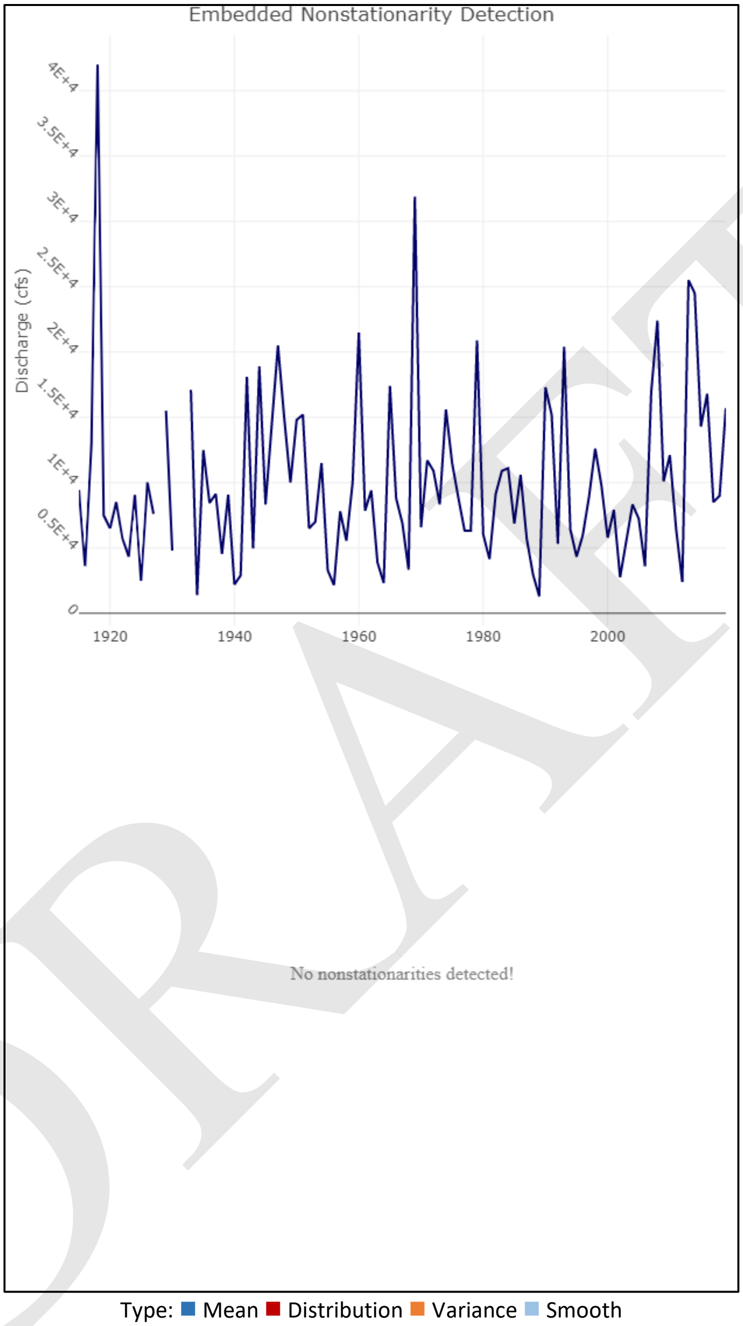


Figure A-9: Annual Peak Streamflow for Iowa River at Marshalltown, IA. (Linear Regression Equation: Q = 11.144*[Water Year] – 11812, p=0.61652. Sen's Slope Equation: Q = 13.962*[Water Year] – 18830) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
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LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-10: Nonstationarity Analysis of Maximum Annual Flow, USGS gage 05451500 – Iowa River at Marshalltown, IA (Reference 9)

USGS gage 05451770, located along the Iowa River at County Highway E49 near Tama, IA is the next downstream gage and has a POR of less than 30 years (2012-present). Due to the short POR, this gage was excluded from the trend analyses and statistical tests for non-stationarity.

The downstream-most gage site upstream of Coralville Reservoir is USGS gage 05453100, located along the Iowa River at Marengo, IA. The Marengo gage has a continuous POR from 1957 to 2019 (WY) and captures a drainage area of 2,794 square miles. Figure A-11 and Table A-2 show trend analysis results for the Marengo gage. Results for the Marengo gage suggest a slight upward trend in annual peak flow, however the linear regression t-Test, as well as the Mann-Kendall and Spearman Rank Order Tests indicate no significant evidence of an upward trend. Figure A-12 shows the output of the nonstationarity detection analysis for the Marengo gage, with no change points detected.

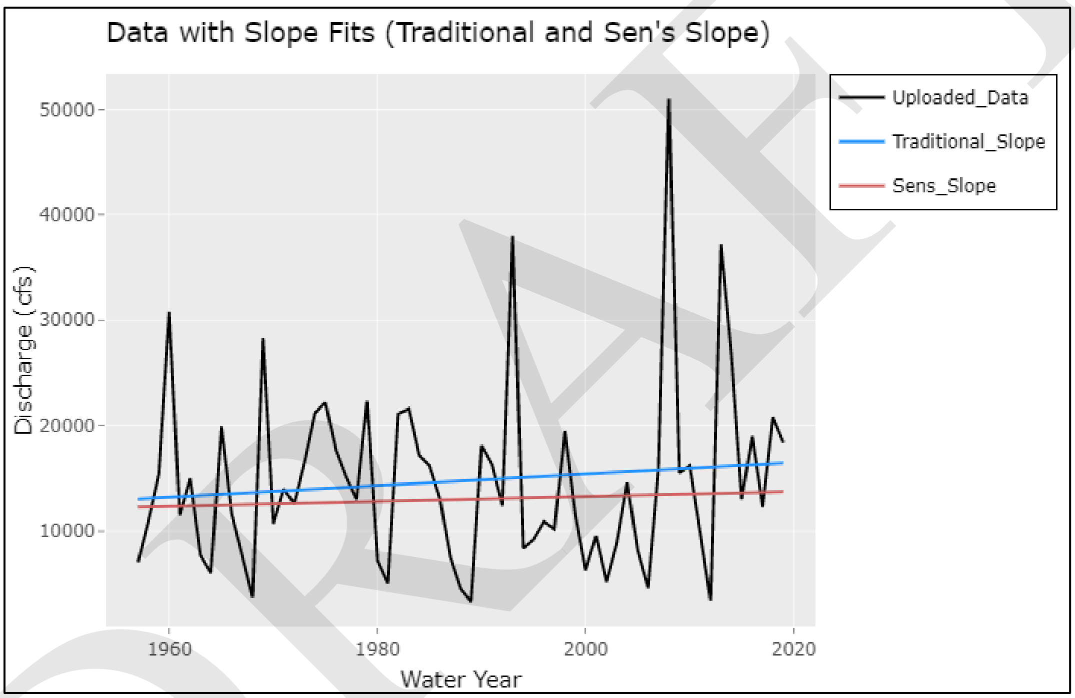
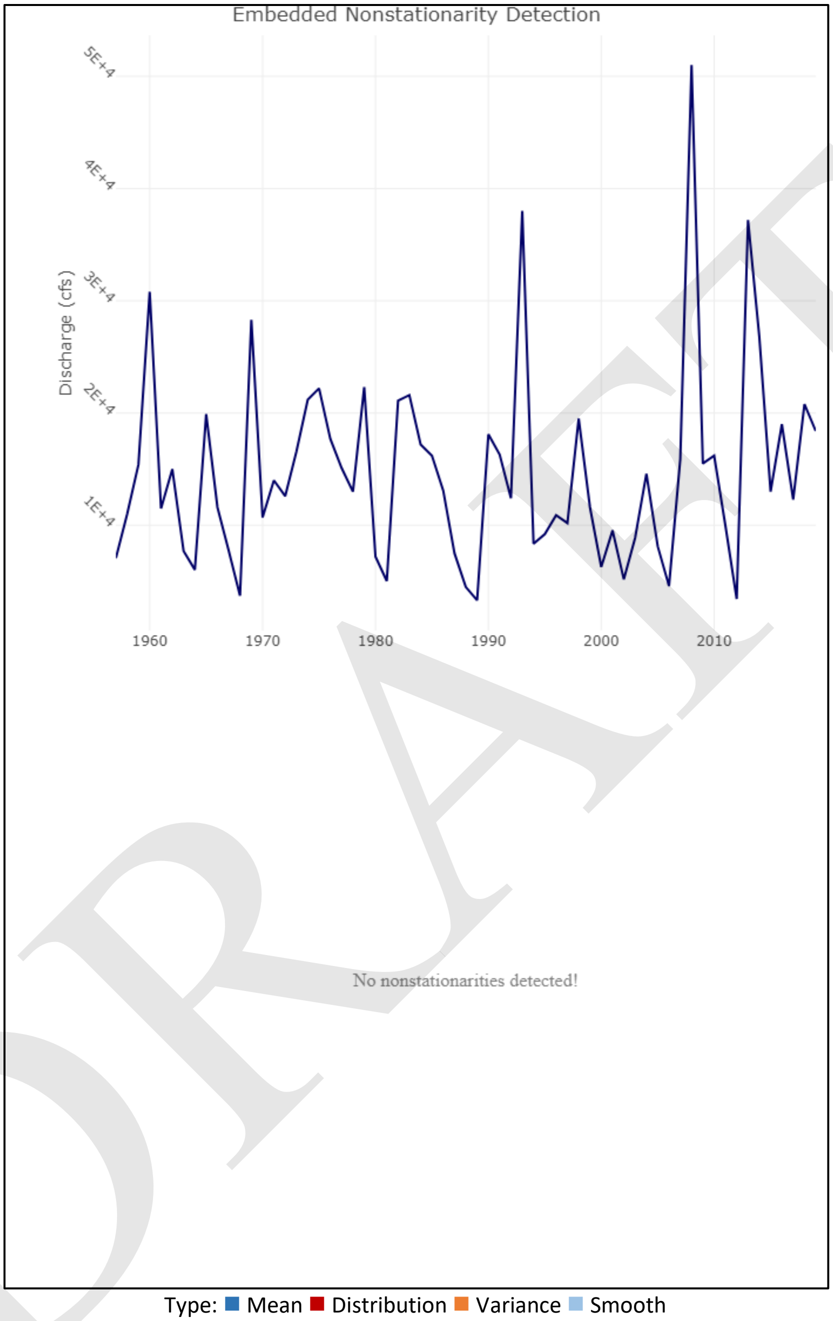


Figure A-11: Annual Peak Streamflow for Iowa River at Marengo, IA. (Linear Regression Equation: Q = 54.832*[Water Year] – 94259, p=0.37539. Sen's Slope Equation: Q = 23.333*[Water Year] – 33387) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-12: Nonstationarity Analysis of Maximum Annual Flow, USGS gage 05453100 – Iowa River at Marengo, IA (Reference 9)

Daily inflows to the Coralville Reservoir computed by the District's HEC-ResSim model at CRVI4 were evaluated for monotonic trends and nonstationarities in the flow record. The POR for computed inflows is 1905 through 2019 (WY). The drainage area contributing to CRVI4 is 3,115 square miles. As mentioned previously, peak outflows from Coralville Lake are more closely correlated to longer duration inflow volumes than to peak daily inflow, therefore the TST was used to assess nonstationarities in annual peak 7-day and 15-day volume-duration inflows in addition to annual maximum inflow.

Trend analysis results for annual maximum, annual peak 7-day volume-duration, and annual peak 15-day volume duration inflows are shown in Figures A-13, A-16 and A-18, respectively, and Table A-2. Results for each of these inflow records suggest a statistically significant upward trend. These trends are considered significant at an overall $p<0.05$ based on all three tests (linear regression, Mann-Kendall and Spearman Rank-Order), in accordance with the Bonferroni correction as previously described ($\alpha=0.0167$ level of significance). In addition to increasing annual maximum inflows over the historic period, Figure A-14 demonstrates an increasing trend in cumulative inflow volumes during the fall pool raise period (August 1-December 31) for 1917-2019 (note that success of the fall pool raise was assessed with the HEC-ResSim model, not based upon a threshold inflow volume).

Results from the nonstationarity detection analysis for the peak annual inflow record indicates distribution change points in 1958 & 1968, mean change points in 1957 & 1968 and a variance change point in 2010 (Figure A-15). Nonstationarity test results are further assessed to evaluate how "strong" a change point is, to help establish how meaningful the results are to the study. A "strong" change point requires: (1) consensus; (2) robustness; and (3) an operationally significant change in magnitude. Consensus indicates two or more tests of the same statistical property detect a change point. Robustness indicates that tests targeting two or more different statistical properties identify the same change point. Assessments of the magnitude of change in terms of operational significance were generally not made for this study. Due to the number of different constraints influencing reservoir release other than inflow, reservoir operational significance was not determined. Although change points were identified for a downstream control point used for reservoir operation, the results did not indicate consensus or robustness and therefore an assessment of magnitude was unnecessary. Concurrent change points in both distribution and mean in 1957/1958 and in 1968 demonstrate robust change points, however there is no consensus in either of these change points. Table A-3 summarizes the evaluation of nonstationarity detection results for all records.

Figure A-17 shows nonstationarity results for annual peak 7-day volume-duration inflow. A distribution change point in 1958, a mean change point in 1957 and a variance change point in 2010 were all identified, indicating a robust 1957/1958 change point, but no consensus (Table A-3).

Figure A-19 shows nonstationarity results for annual peak 15-day volume-duration inflow. Table A-3 shows mean change point in 1957 and a variance change point in 1958 suggest robustness, but no consensus.

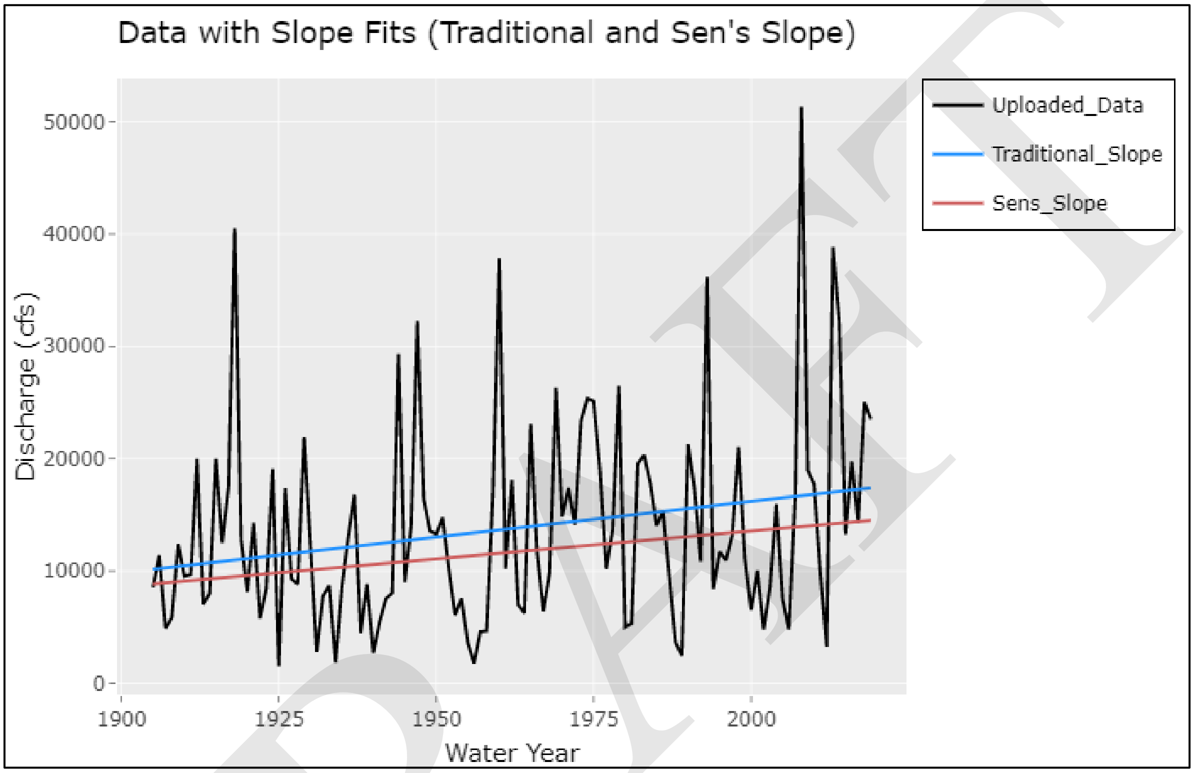


Figure A-13: Annual Peak Computed Inflow to Coralville Reservoir
(Linear Regression Equation: Q = 63.611*[Water Year] – 111020, p=0.01164
Sen's Slope Equation: Q = 49.597*[Water Year] – 85633) (Reference 9)

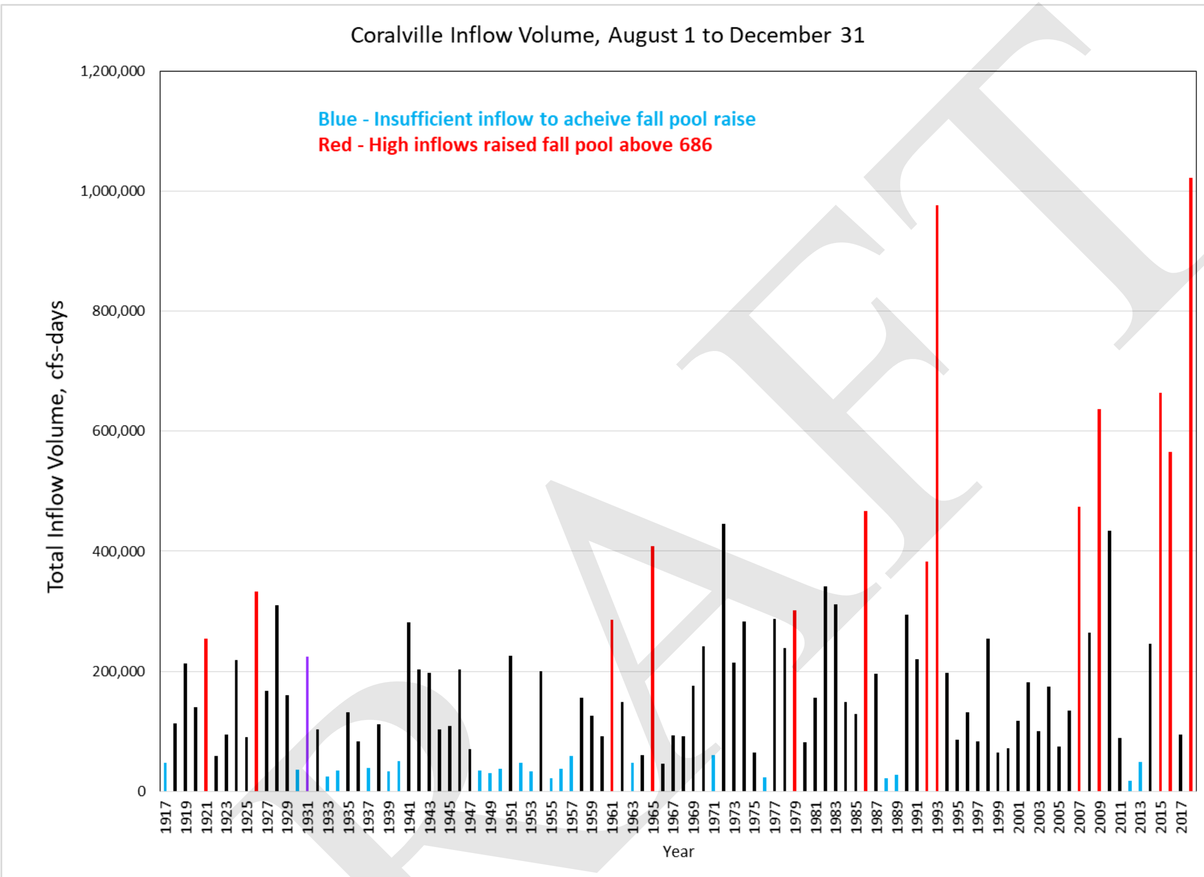
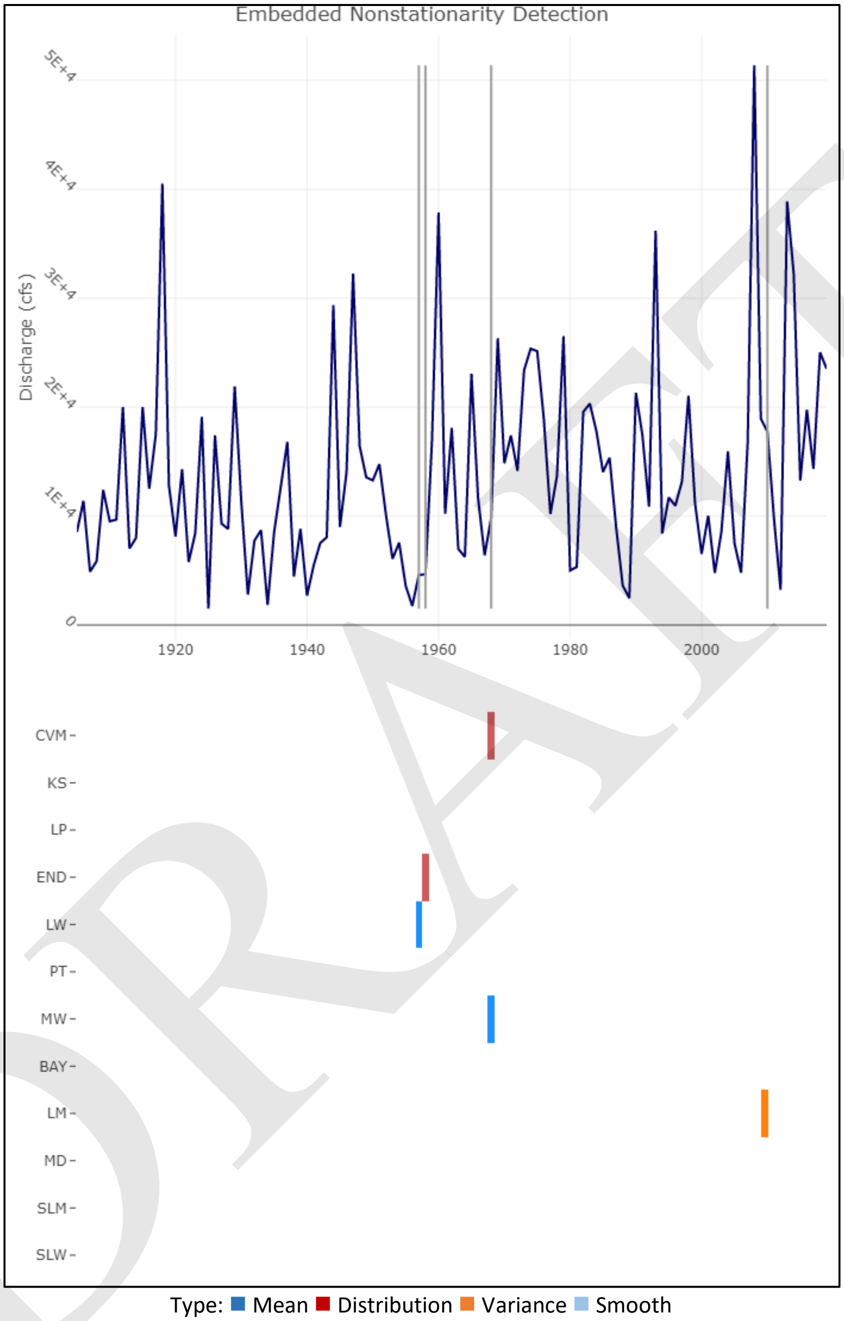


Figure A-14: Total Inflow Volume to Coralville Reservoir from August 1 to December 31



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-15: Nonstationarity Analysis of Maximum Annual Flow, CRVI4 – HEC-ResSim-Computed Inflows to Coralville Reservoir (Reference 9)

Table A-3: Nonstationarity Detection Results Evaluation

Gage Site	POR Assessed	Consensus (Year)	Robust (Year)
USGS gage 05449500 Iowa River near Rowan, IA	1941-2019	-	-
USGS gage 05451500 Iowa River at Marshalltown, IA	1915-2019	-	-
USGS gage 05453100 Iowa River at Marengo, IA	1957-2019	-	-
CRVI4 HEC-ResSim-Computed Inflow to Coralville Reservoir	1905-2019	-	1957/1958 1968
CRVI4 HEC-ResSim-Computed 7-Day Volume Inflow to Coralville Reservoir	1905-2019	-	1957/1958
CRVI4 HEC-ResSim-Computed 15-Day Volume Inflow to Coralville Reservoir	1905-2019	-	1957/1958
USGS gage 05454500 Iowa River at Iowa City, IA	1903-2019	1951/1953	1953
USGS gage 05455500 English River at Kalona, IA	1940-2019	-	-
USGS gage 05465500 Iowa River at Wapello, IA	1903-2019	-	-
USGS gage 05464500 Cedar River at Cedar Rapids, IA	1903-2019	2005-2007	1954
USGS gage 05465000 Cedar River near Conesville, IA	1940-2019	-	-

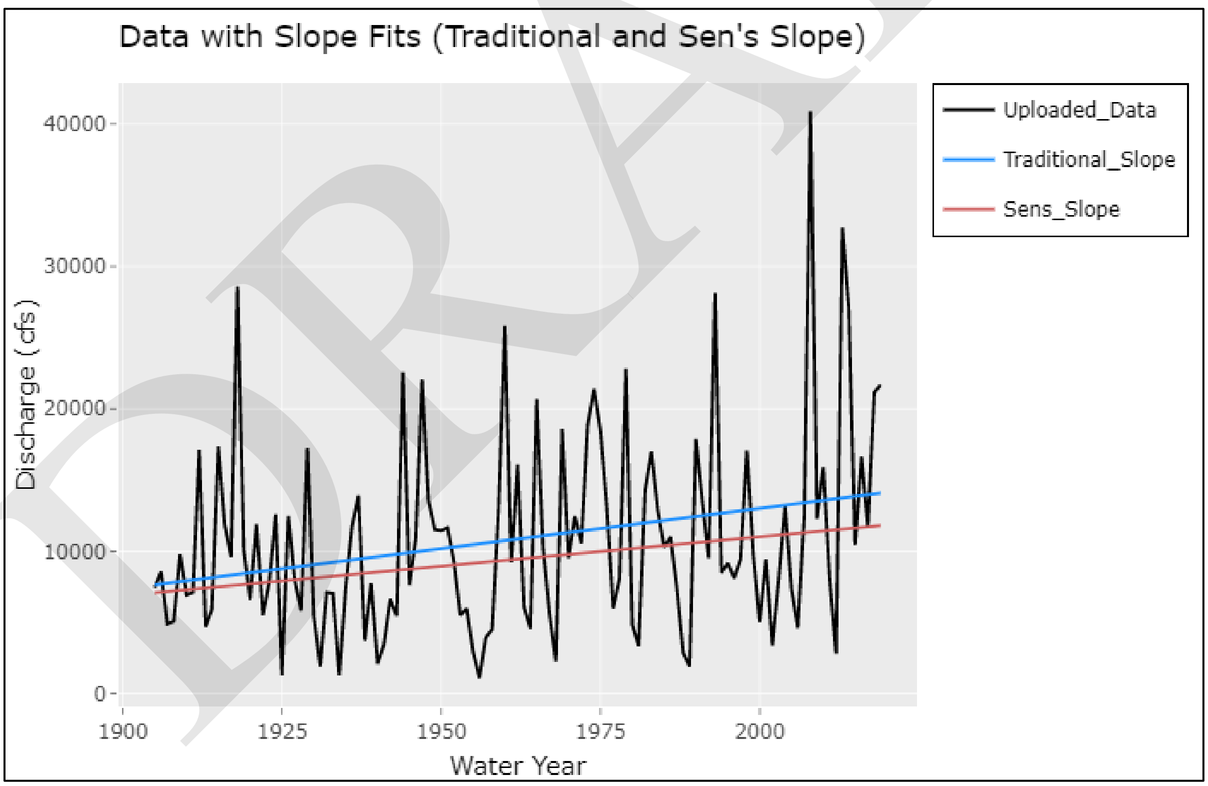
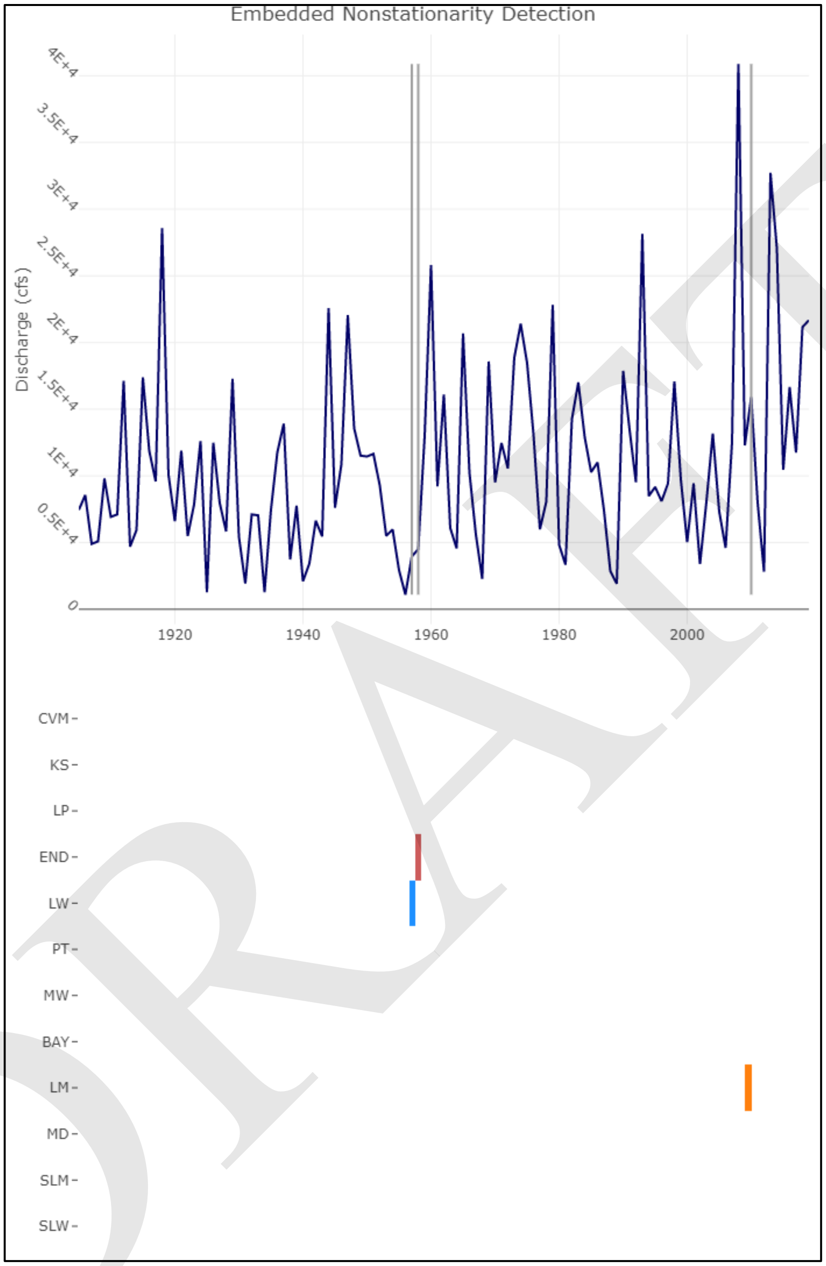


Figure A-16: Annual 7-day Volume-Duration Maximum Computed Inflow to Coralville Reservoir (Linear Regression Equation: Q = 56.464*[Water Year] – 99920, p=0.0042055 Sen's Slope Equation: Q = 41.309*[Water Year] – 71601) (Reference 9)



Type: Mean Distribution Variance Smooth

Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-17: Nonstationarity Analysis of Maximum Annual 7-day Volume-Duration Flow, CRVI4 – HEC-ResSim-Computed Inflows to Coralville Reservoir (Reference 9)

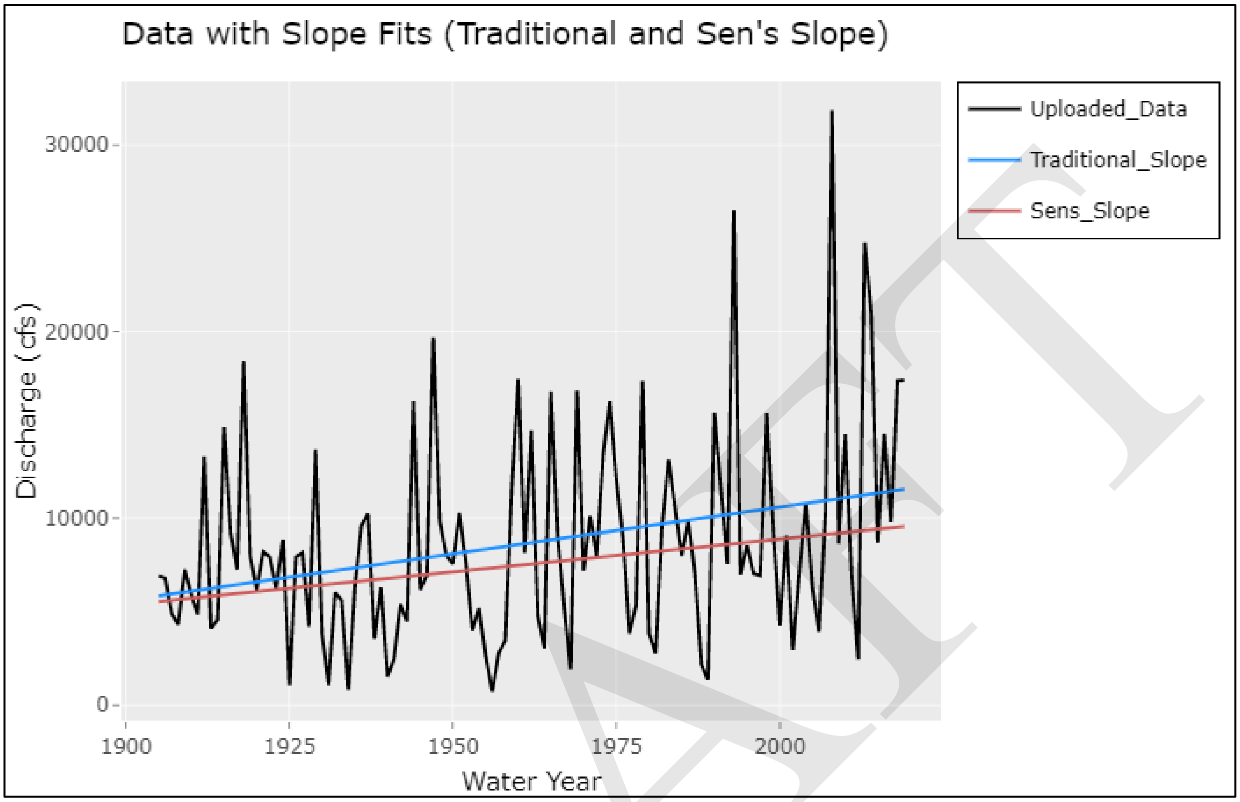
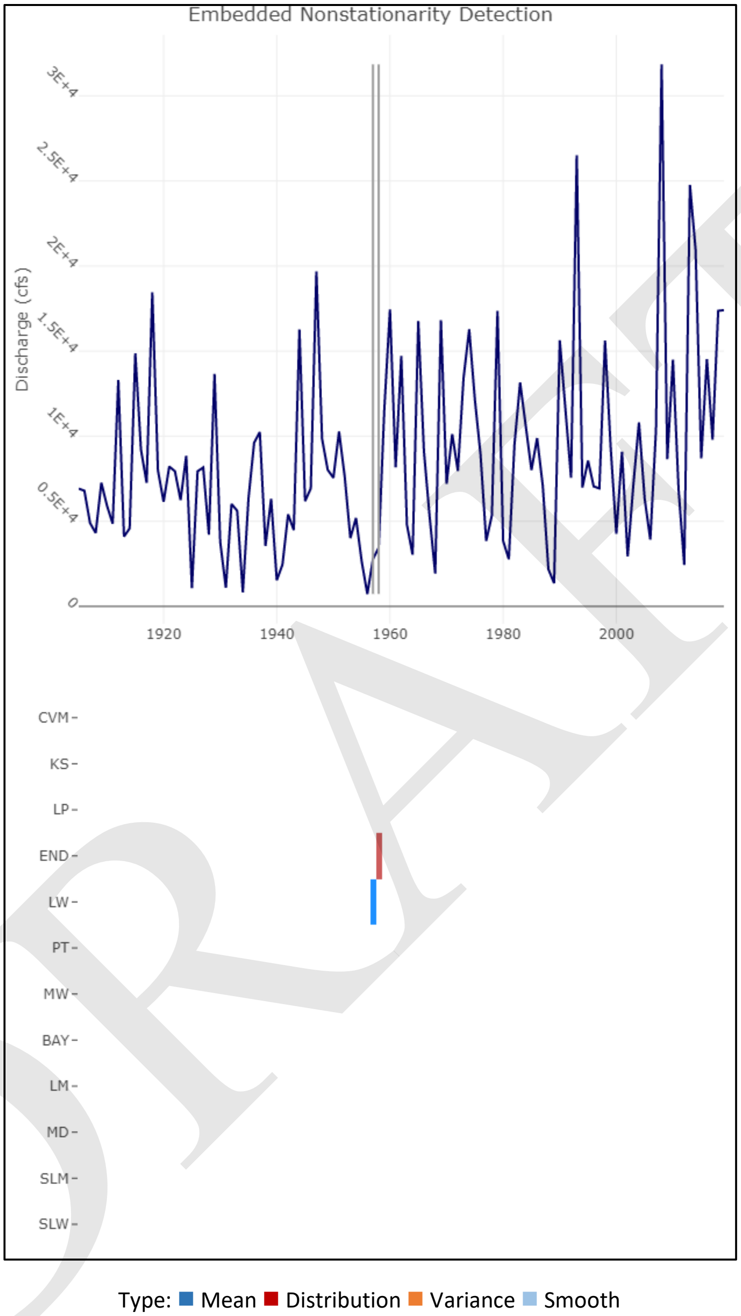


Figure A-18: Annual 15-day Volume-Duration Maximum Computed Inflow to Coralville Reservoir (Linear Regression Equation: Q = 50.066*[Water Year] – 89527, p=0.0011967 Sen's Slope Equation: Q = 35.204*[Water Year] – 61513) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-19: Nonstationarity Analysis of Maximum Annual 15-day Volume-Duration Flow, CRVI4 – HEC-ResSim-Computed Inflows to Coralville Reservoir (Reference 9)

2. Gages Downstream of Coralville Reservoir. Several gages located downstream of Coralville Reservoir provided long-term annual peak flow records for trend analysis and nonstationarity detection. Analysis of potential change points at gages on the Iowa River, downstream of the reservoir, would potentially identify when the dam went into operation in 1958 as one of the change points. Three gages along the Iowa River and one gage on the English River tributary were analyzed using the TST for monotonic trends and nonstationarities in peak annual flow.

The first gage downstream of Coralville Dam is USGS gage 05454500, located on the Iowa River at Iowa City, IA. The Iowa City gage has a POR from WY 1903 to WY 2019 and captures a drainage area of 3,271 square miles. Figure A-20 and Table A-3 show trend analysis results. The linear regression and Sen's Slope indicate a downward trend in annual peak streamflow, likely due to the influence of Coralville Lake for years after 1958. The Mann-Kendall and Spearman-Rank Order Tests for the Iowa River at Iowa City, IA each indicated a significant trend in the negative direction for peak annual flow for the POR, despite the linear regression test indicating no significant evidence of a downward trend. The Mann-Kendall and Spearman Rank Order Tests are considered more robust to outliers in the data.

Figure A-21 shows results from the TST nonstationarity detection analysis indicating a mean change point in 1929, a distribution change point in 1951 based on the Lombard Wilcoxon test, two distribution change points in 1953 based on the Cramer-von-Mises and Energy Divisive tests, a mean change point in 1953 and a variance change point in 1957. Consensus in the distribution tests and robustness in the mean and distribution tests support a "strong" 1951/1953 change point (Table A-3). The nonstationarity statistical test sensitivity parameters were relaxed to determine if additional change points closer to 1958, when the dam went into operation, could be identified if parameters other than the default were used. Even when using extreme sensitivity parameters, no other tests identified change points. The identified dates may be influenced by the drought conditions that existed during the mid- to late-1950s which the detection tests would not be able to differentiate from the peak reduction effects of the reservoir that began immediately thereafter.

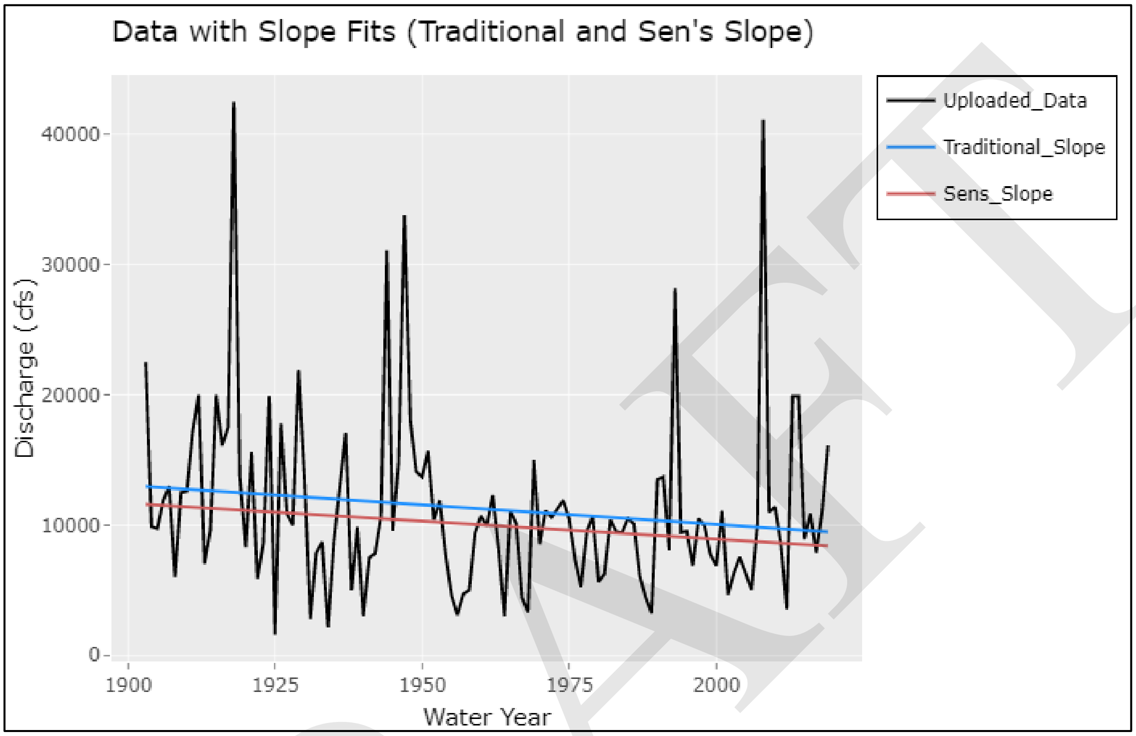
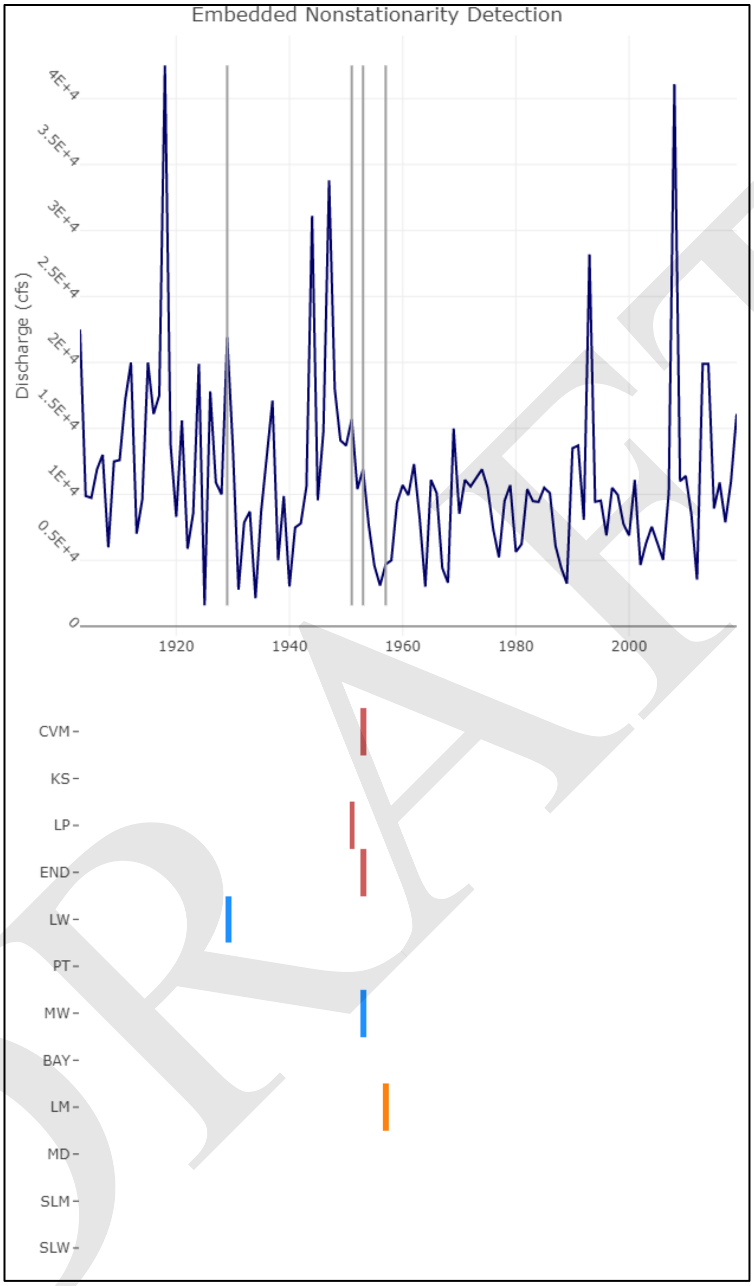


Figure A-20: Annual Peak Streamflow for Iowa River at Iowa City, IA
(Linear Regression Equation: Q = -30.051*[Water Year] + 70156, p=0.11141
Sen's Slope Equation: Q = -27.518*[Water Year] – 63963) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-21: Nonstationarity Analysis of Maximum Annual Flow, USGS Gage 05454500 – Iowa River at Iowa City, IA (Reference 9)

USGS Gage 05455500 is located on the English River at Kalona and flows into the Iowa River downstream of Iowa City. The English River gage has a POR beginning in WY1940-2019 and a drainage area of 574 square miles. Figure A-22 and Table A-2 show trend analysis results for the English River gage. Results for the English River gage indicate an upward trend in annual maximum flow. The linear regression t-Test indicates a significant trend in the positive direction, whereas both the Mann-Kendall and Spearman Rank Order Tests do not support a significant positive trend. Figure A-23 and Table A-3 show results from the TST nonstationarity detection, with a single change point in the mean in 2005.

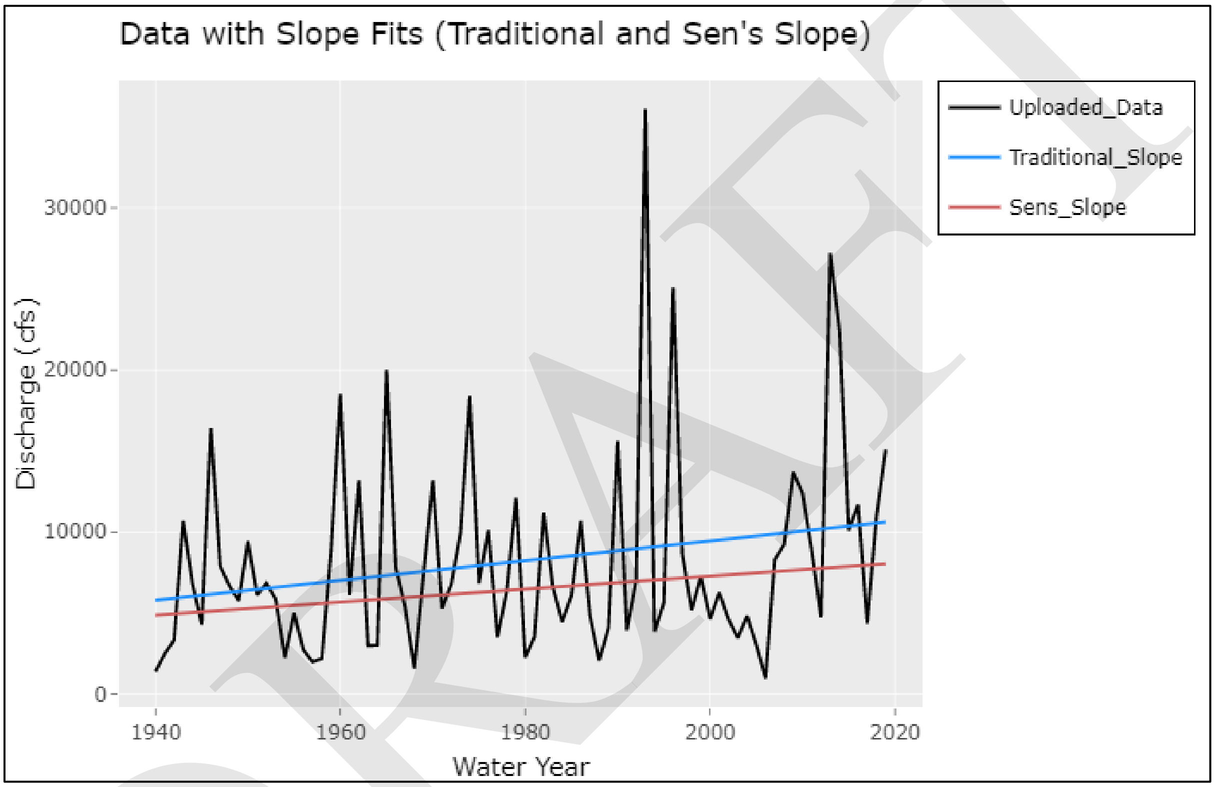
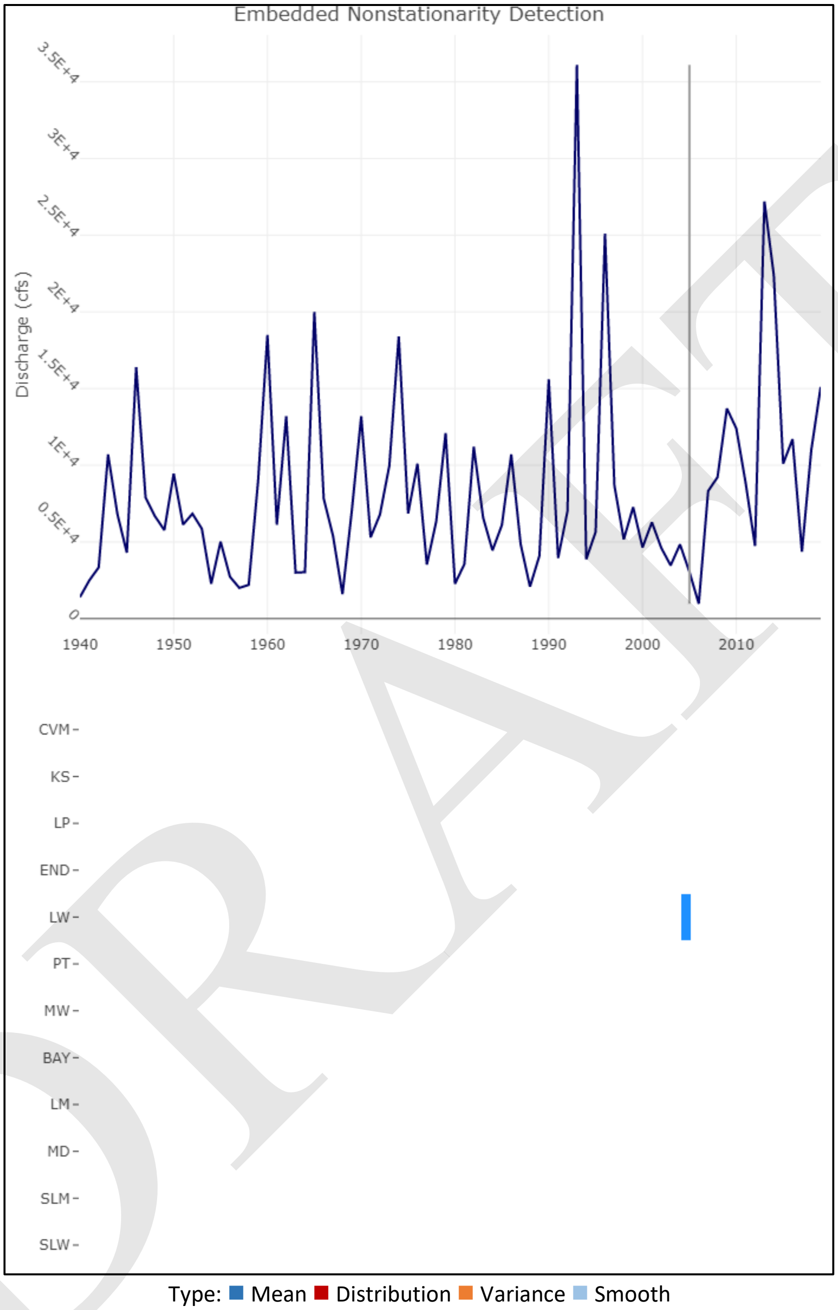


Figure A-22: Annual Peak Streamflow for English River at Kalona, IA
(Linear Regression Equation: Q = 60.945*[Water Year] – 112430, p=0.044411
Sen's Slope Equation: Q = 40*[Water Year] – 72715) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-23: Nonstationarity Analysis of Maximum Annual Flow, USGS Gage 05455500 – English River at Kalona, IA (Reference 9)

The downstream-most gage on the Iowa River before its confluence with the Cedar River is USGS gage 05455700 near Lone Tree, IA. The Lone Tree gage has a POR from WY1957 to 2019 and a drainage area of 4,293 square miles. Figure A-24 shows trend analysis results, illustrating an upward trend. However, the trend significance results summarized in Table A-2 indicate no significant upward trend based on each of the three tests. Figure A-25 illustrates the results of the nonstationarity detection analysis, showing no detected change points.

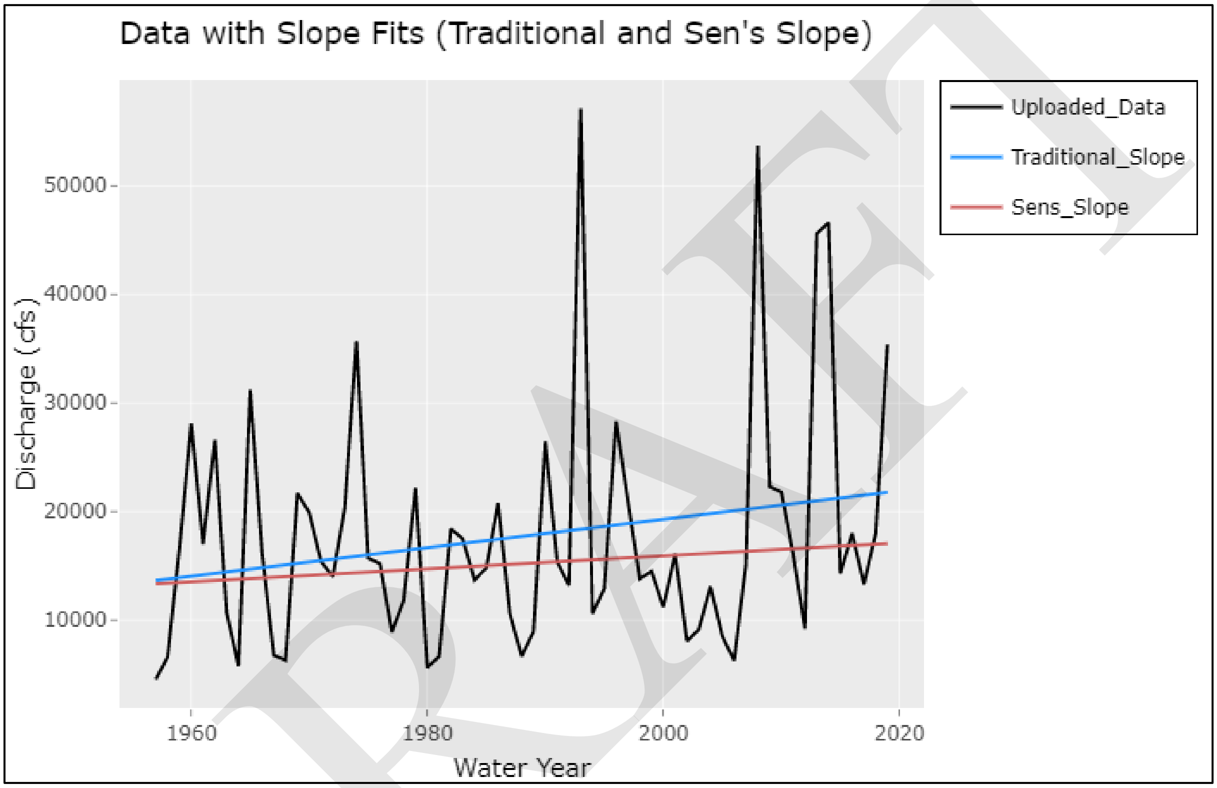
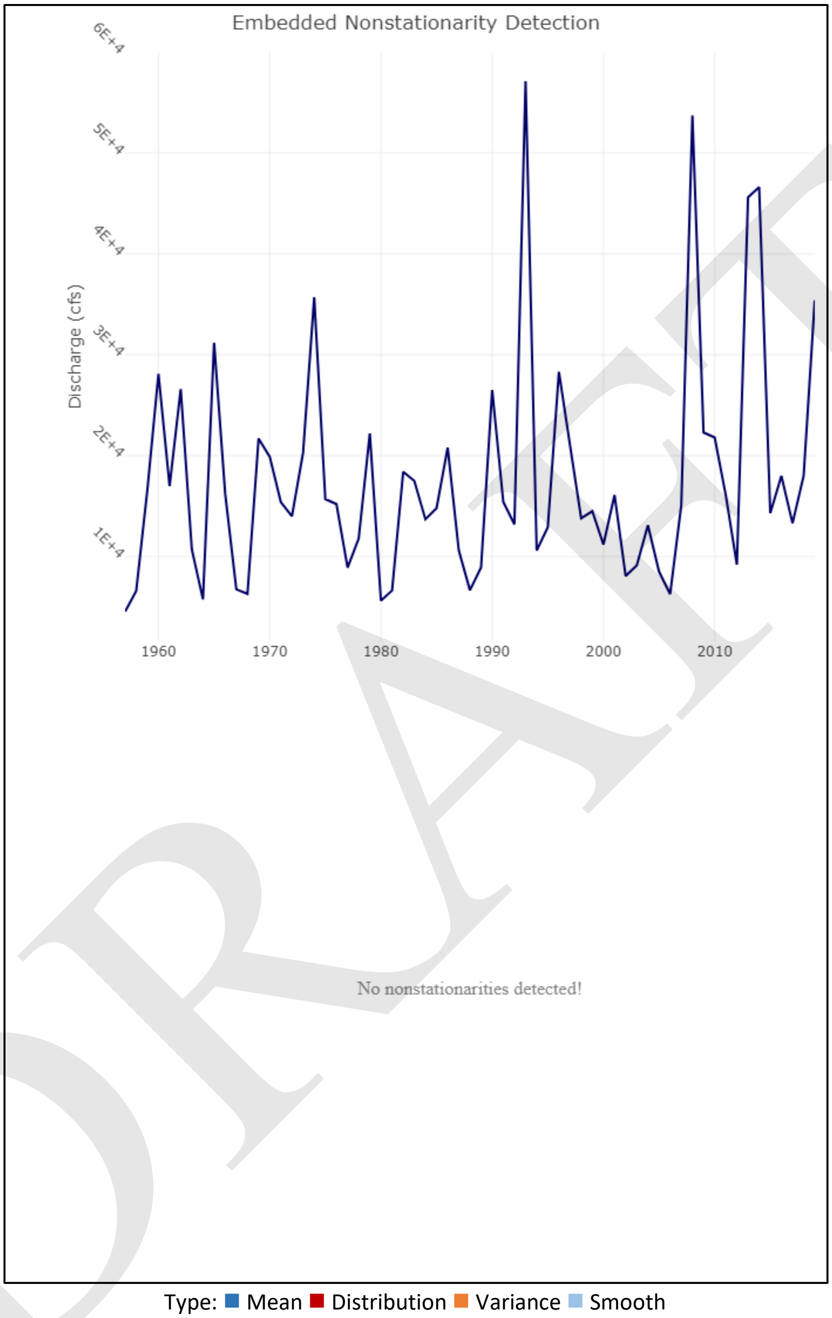


Figure A-24: Annual Peak Streamflow for Iowa River near Lone Tree, IA
(Linear Regression Equation: Q = 130.98*[Water Year] – 242680, p=0.093636
Sen's Slope Equation: Q = 59.73*[Water Year] – 103540) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-25: Nonstationarity Analysis of Maximum Annual Flow, USGS Gage 05455700 – Iowa River near Lone Tree, IA (Reference 9)

Downstream of the confluence with the Cedar River, the next downstream gage on the Iowa River is USGS gage 05465500 Iowa River at Wapello, IA. The Wapello gage has a POR from WY1903-2019 and a drainage area of 12,500 miles. Figure A-26 and Table A-2 show trend analysis results. Results for the Wapello gage indicate a statistically significant positive trend in annual maximum streamflow, based on the linear regression t-Test. The Mann-Kendall and Spearman-Rank Order tests did not show a statistically significant upward trend for the Wapello gage. The nonstationarity detection results for the Wapello gage indicate a variance change point in 1927 and a mean change point in 1988 (Figure A-27 and Table A-3). No change point associated with Coralville Lake beginning operation was identified in, or around, 1958. This is likely due to the significant unregulated tributary inflows (notably the Cedar River) between Coralville Lake and Wapello. At Wapello, only 25% of the contributing watershed is located above Coralville Dam.

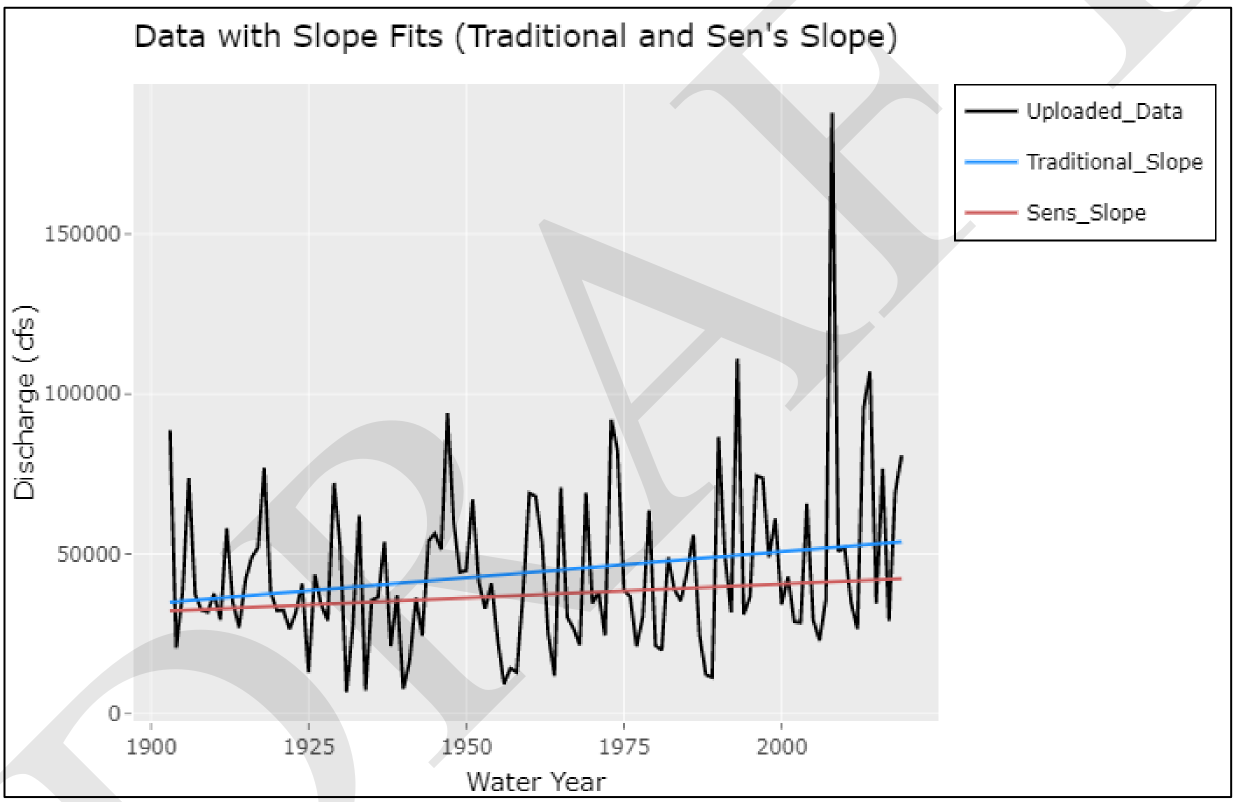
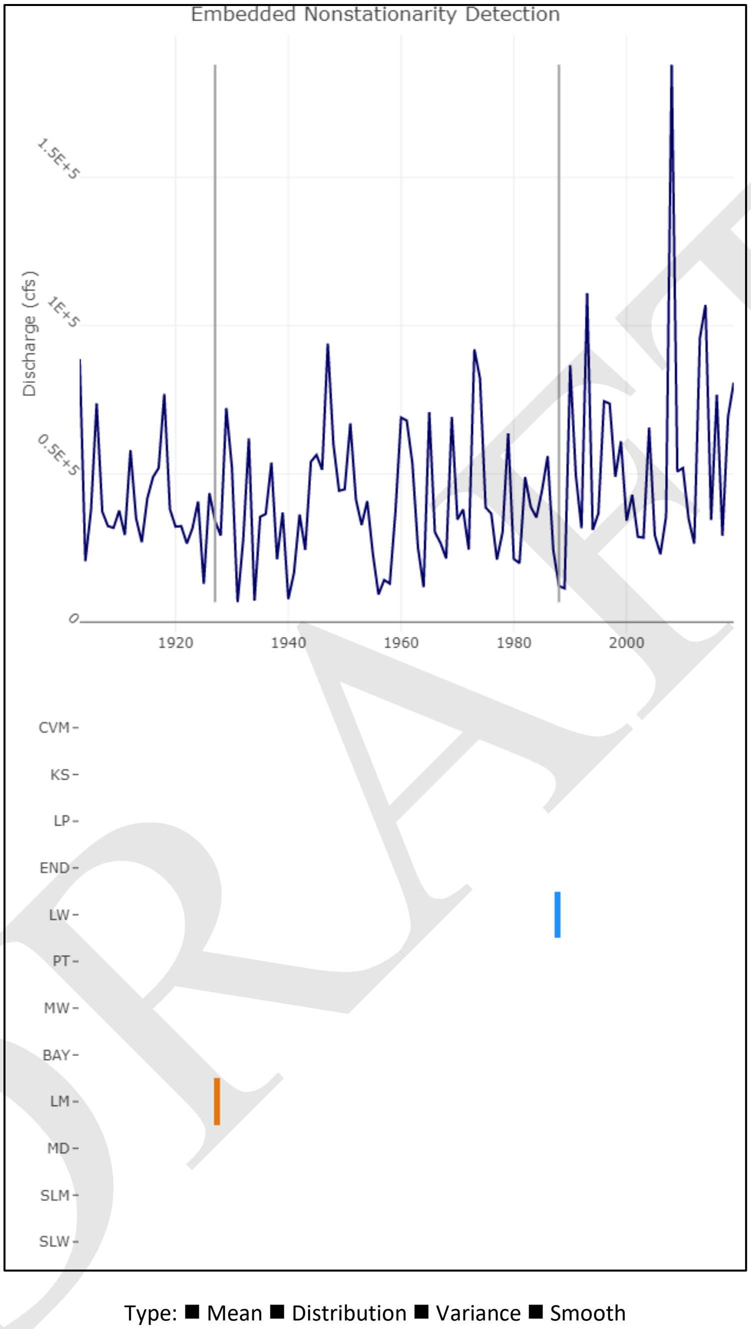


Figure A-26: Annual Peak Streamflow for Iowa River at Wapello, IA
(Linear Regression Equation: Q = 162.87*[Water Year] – 275030, p=0.02177
Sen's Slope Equation: Q = 86.826*[Water Year] – 133070) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-27: Nonstationarity Analysis of Maximum Annual Flow, USGS Gage 05465500 – Iowa River at Wapello, IA (Reference 9)

USGS gage 05465700, located on the Iowa River at Oakville, IA is the next downstream gage and has a POR of less than 30 years (2008-present). Due to the short POR, this gage was excluded from the trend analyses and statistical tests for non-stationarity.

3. Gages on the Cedar River. The most upstream gage analyzed on the Cedar River is USGS gage 05464500, located at Cedar Rapids, IA. The Cedar River joins the Iowa River downstream of Coralville Reservoir, near Columbus Junction, IA. The Cedar Rapids gage has a continuous POR from the 1903 WY to 2019 WY and captures a drainage area of 6,510 square miles. Figure A-28 and Table A-2 show the trend analysis results, indicating a statistically significant positive trend in annual maximum flow. This trend is considered significant at an overall $p<0.05$ based on all three tests (linear regression, Mann-Kendall and Spearman Rank-Order), in accordance with the Bonferroni correction as previously described ($\alpha=0.0167$ level of significance). Results of the nonstationarity detection analysis for the Cedar Rapids gage are shown in Figure A-29, with variance change points identified in 1923, 1954 and 1965; distribution change points identified in 1954 and 1958; a mean change point in 2006 and a smooth mean change point from 2005-2007. As summarized in Table A-3, these results indicate consensus in a 2005-2007 change point and robustness in a 1954 change point.

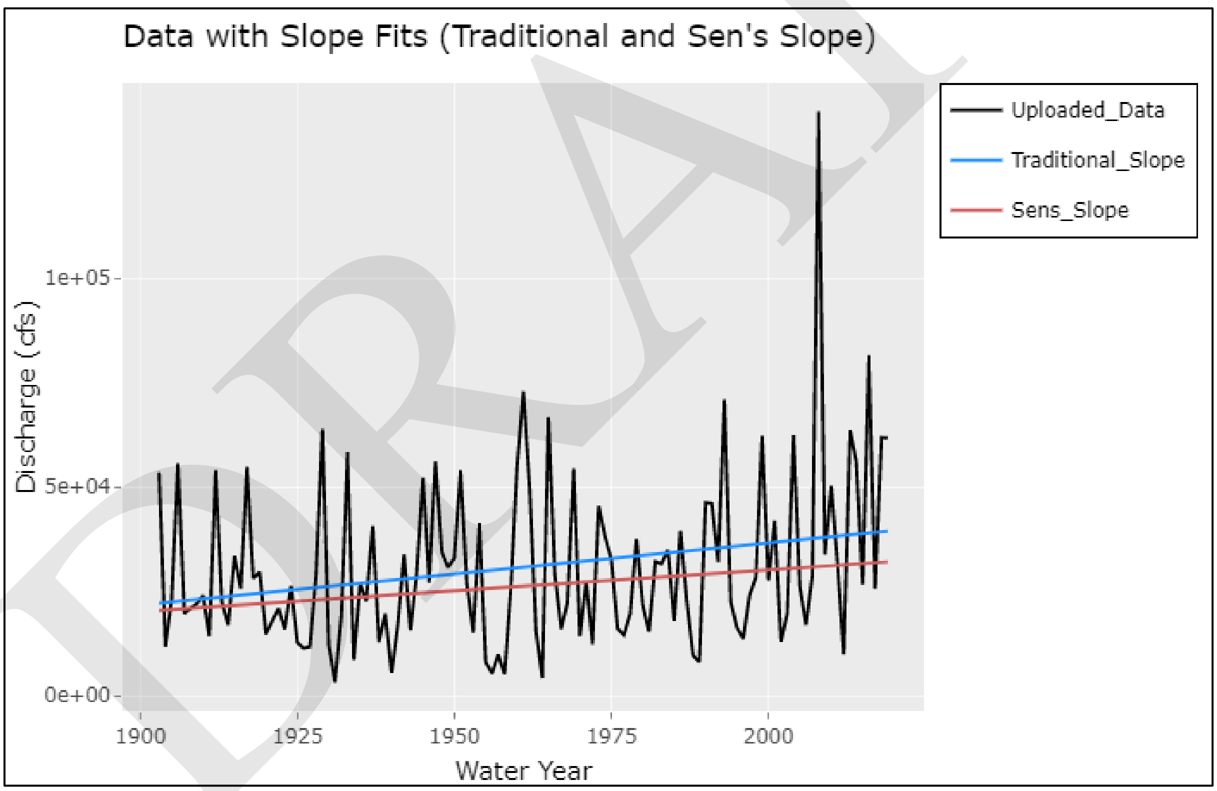
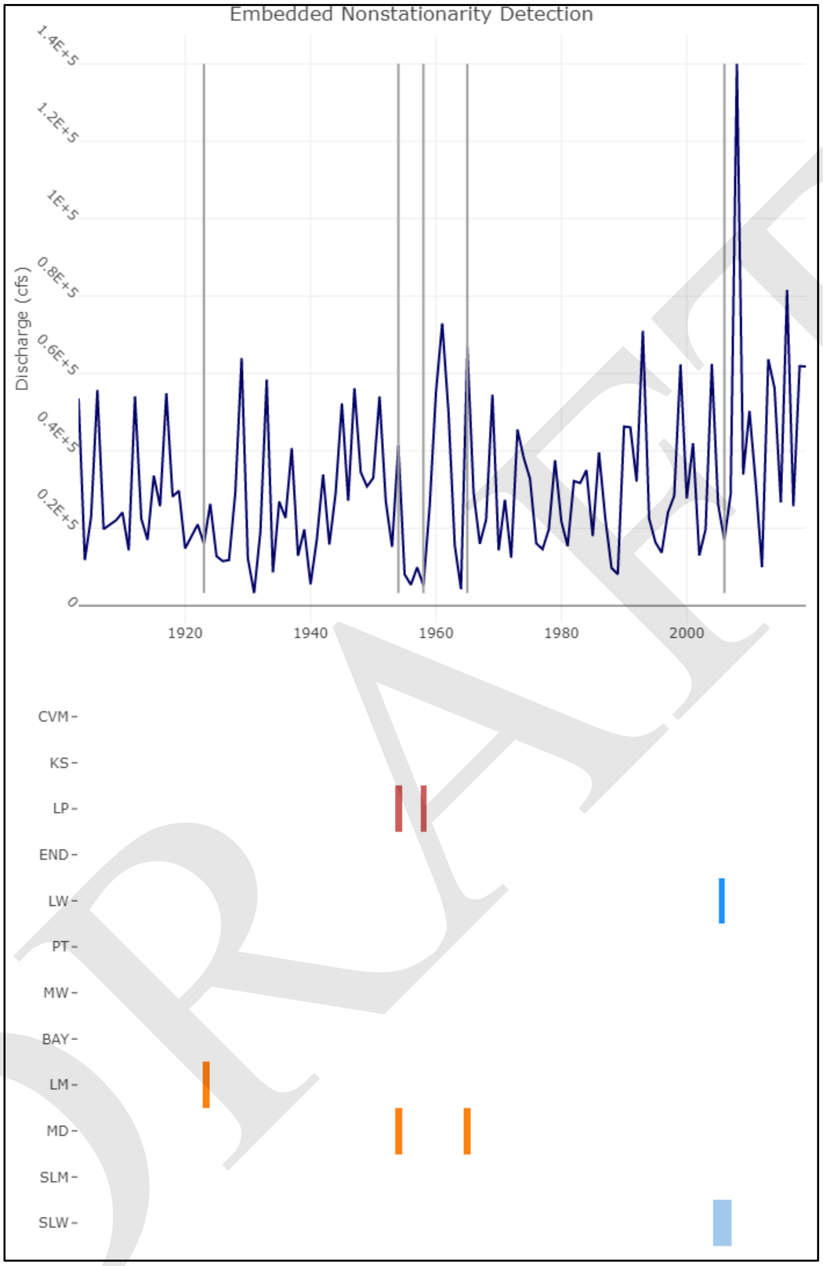


Figure A-28: Annual Peak Streamflow for Cedar River at Cedar Rapids, IA
(Linear Regression Equation: Q = 148.81*[Water Year] – 260950, p=0.0073125
Sen's Slope Equation: Q = 100*[Water Year] – 169800) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-29: Nonstationarity Analysis of Maximum Annual Flow, USGS gage 05464500 – Cedar River at Cedar Rapids, IA (Reference 9)

The most downstream gage site on the Cedar River is USGS gage 05465000, located near Conesville, Iowa. The Conesville gage has a continuous POR from WY 1940 to 2019 and captures a drainage area of 7,787 square miles. The results of the trend analysis, as shown in Figure A-30 and Table A-2 indicate a statistically significant positive trend in annual maximum flow. This trend is considered significant at an overall $p<0.05$ based on all three tests (linear regression, Mann-Kendall and Spearman Rank-Order), in accordance with the Bonferroni correction as previously described ($\alpha=0.0167$ level of significance). Results of the nonstationarity detection analysis, shown in Figure A-31 and Table A-3, illustrate a distribution change point in 1989 and a mean change point in 2011.

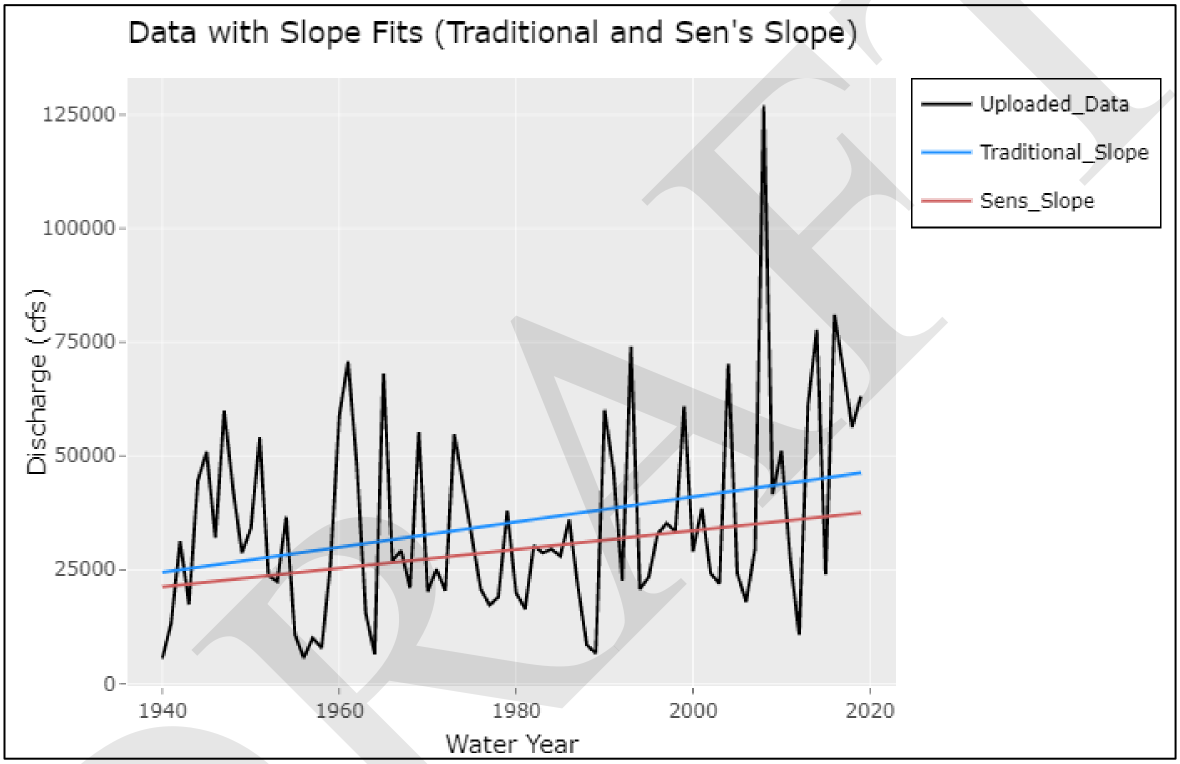
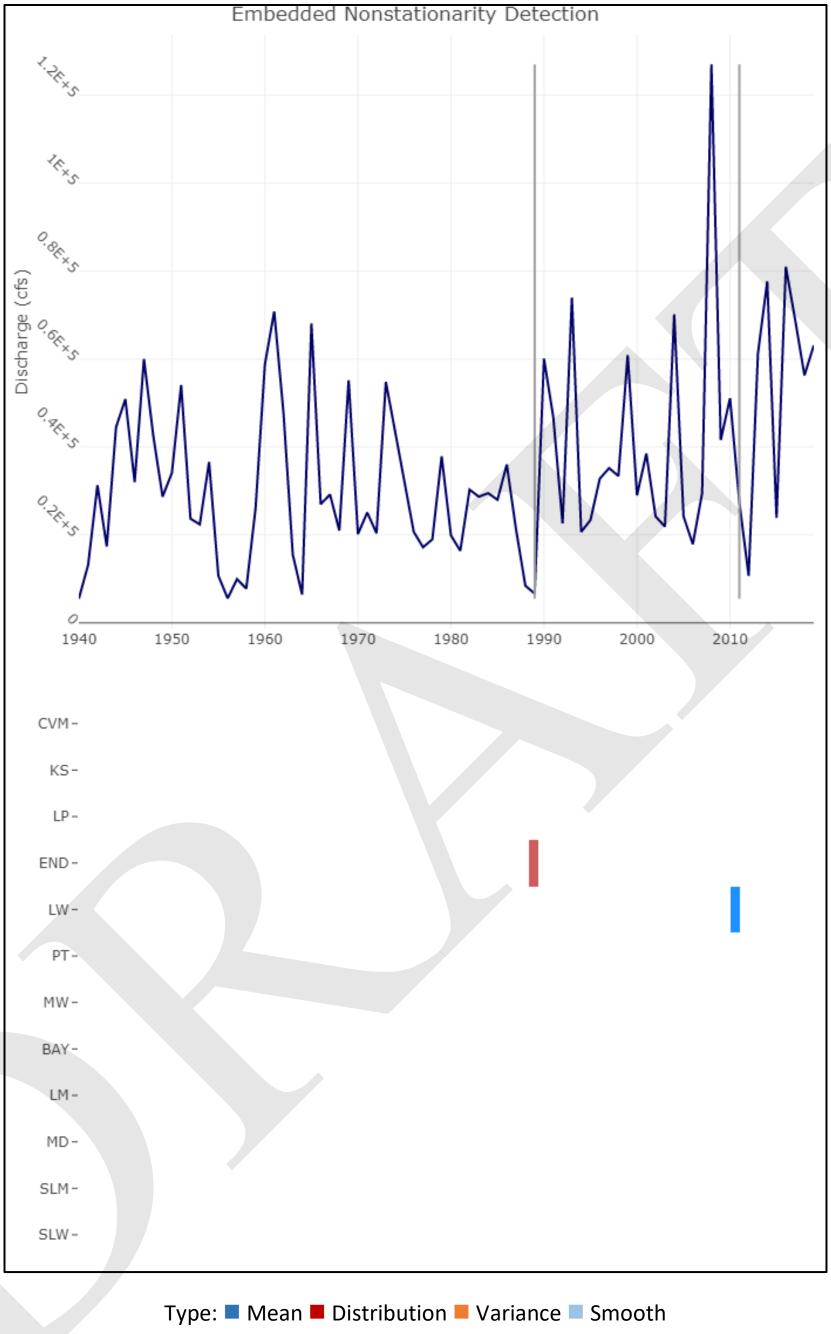


Figure A-30: Annual Peak Streamflow for Cedar River near Conesville, IA
(Linear Regression Equation: Q = 276.82*[Water Year] – 512620, p=0.007874
Sen's Slope Equation: Q = 206.07*[Water Year] – 378560) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-31: Nonstationarity Analysis of Maximum Annual Flow, USGS gage 05465000 - Cedar River near Conesville, IA (Reference 9)

B. Trends and Detection of Nonstationarities in Observed Precipitation Records (Reference 9)

The Iowa City NWS Coop Gage #134101, located just southeast of Iowa City, provided long-term total annual precipitation records from WY 1894-2019 for analysis of long-term trends and change points using the TST. The record showed missing data in 1896, and 1948-1951 and therefore the nonstationarity detection used a shortened POR, beginning in WY 1952. Results of the trend analysis indicate an upward trend in annual precipitation (Figure A-32). This trend is considered significant at an overall $p<0.05$ based on all three tests (linear regression [p=0.0084754], Mann-Kendall [p=0.030799] and Spearman Rank-Order [p=0.034443]), in accordance with the Bonferroni correction as previously described ($\alpha=0.0167$ level of significance). Figure A-33 shows results of the nonstationarity detection analysis. The Bayesian test for change in the mean, identified two change points in 1992 and 1993.

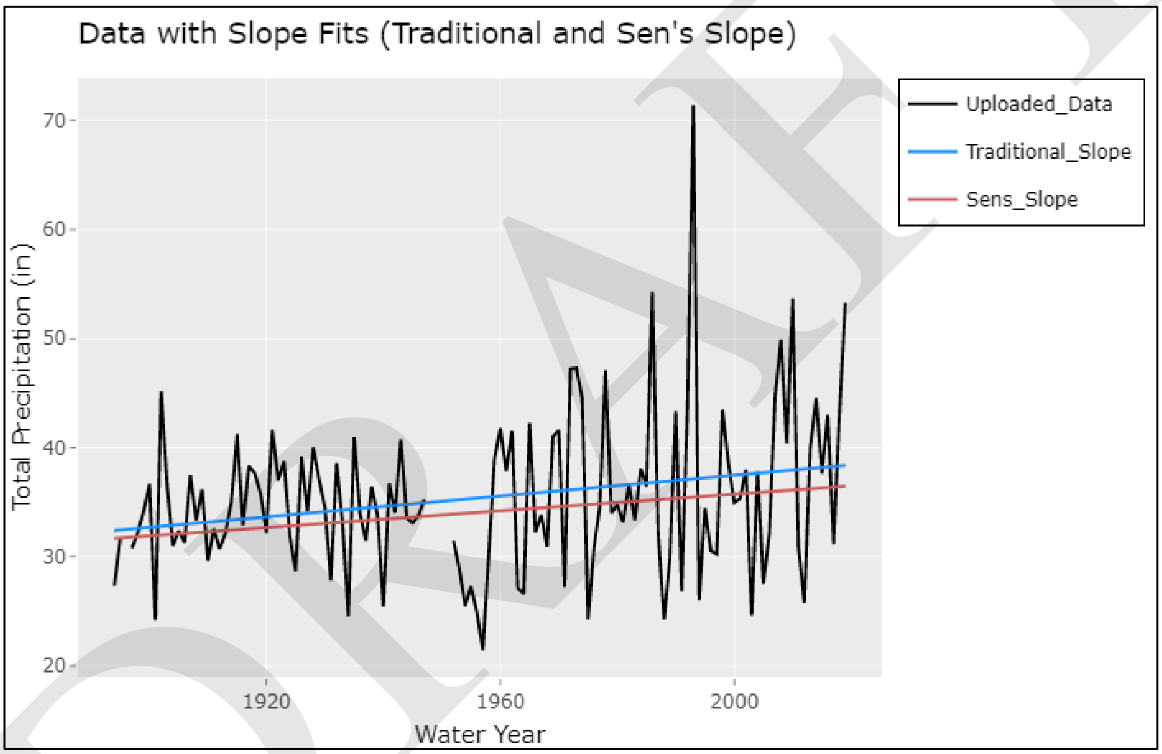
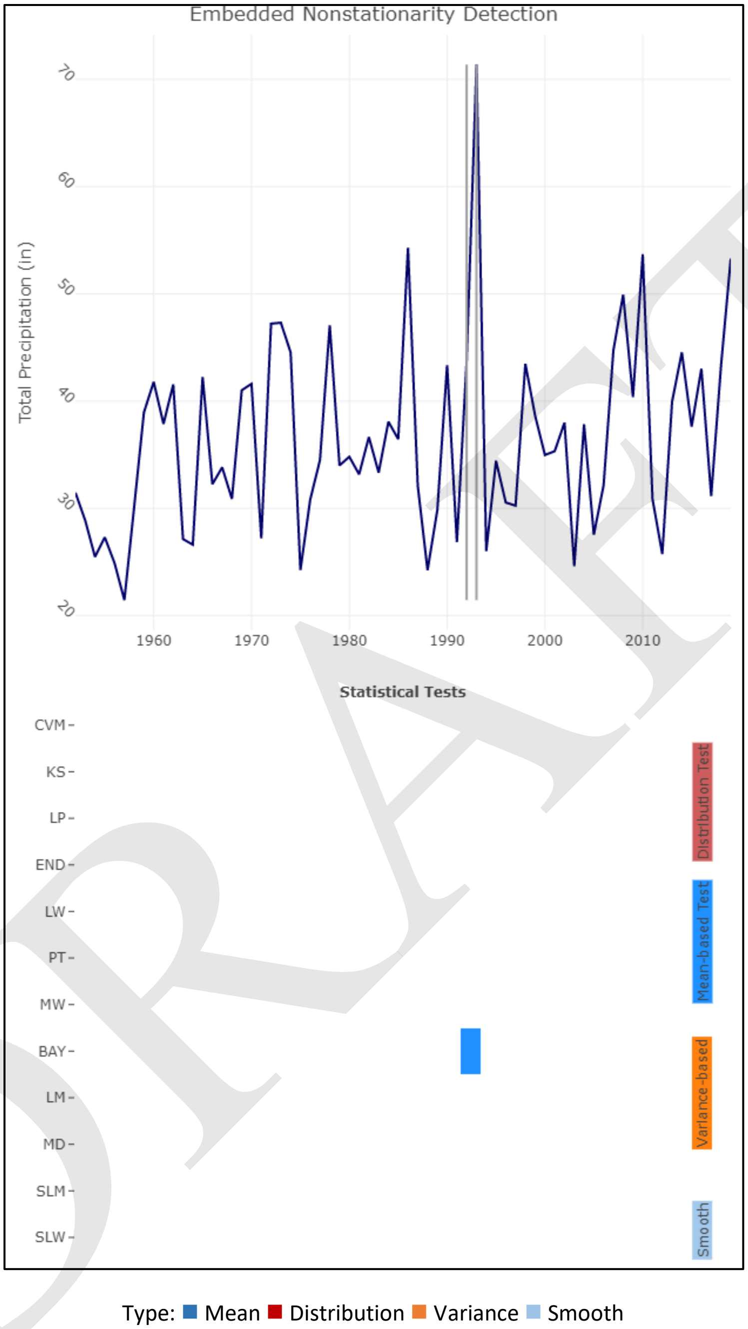


Figure A-32: Annual Total Precipitation for Iowa City NWS Coop gage #134101
(Linear Regression Equation: P = 0.047738*[Water Year] – 58, p=0.0084754
Sen's Slope Equation: P = 0.038207*[Water Year] – 40.677) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-33: Nonstationarity Analysis of Total Annual Precipitation, Iowa City NWS Coop Gage #134101 (Reference 9)

C. Trends and Detection of Nonstationarities in Observed Temperature Records (Reference 9)

Annual average maximum and annual average minimum temperature data from the Iowa City NWS Coop Gage #134101, provided long-term temperature records for analysis of trends and change points using the TST. The POR available for annual average maximum and minimum temperature included WY 1894-2019, with missing data from 1948-1951, therefore nonstationarity detection analyses of temperature records used a shortened POR beginning in WY 1952. Figure A-34 illustrates a positive linear trend in annual average maximum temperature. This trend is considered significant at an overall $p<0.05$ based on all three tests (linear regression [p=0.0013602], Mann-Kendall [p=0.0043542] and Spearman Rank-Order [p=0.0051407]), in accordance with the Bonferroni correction as previously described (α=0.0167 level of significance). Figure A-35 shows results of the nonstationarity detection analysis for the annual average maximum temperature record, indicating a variance change point in 1974, as well as 2011 and 2012 change points in the mean identified by the Bayesian test.

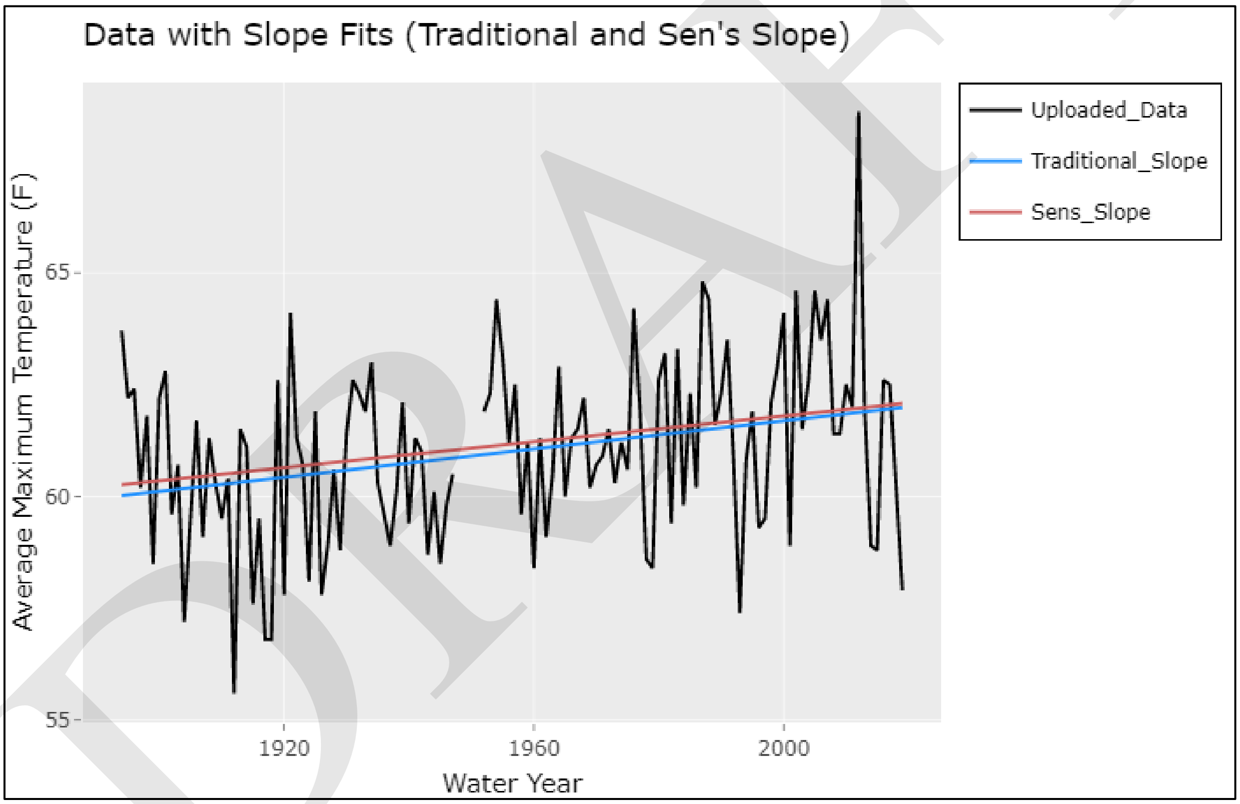
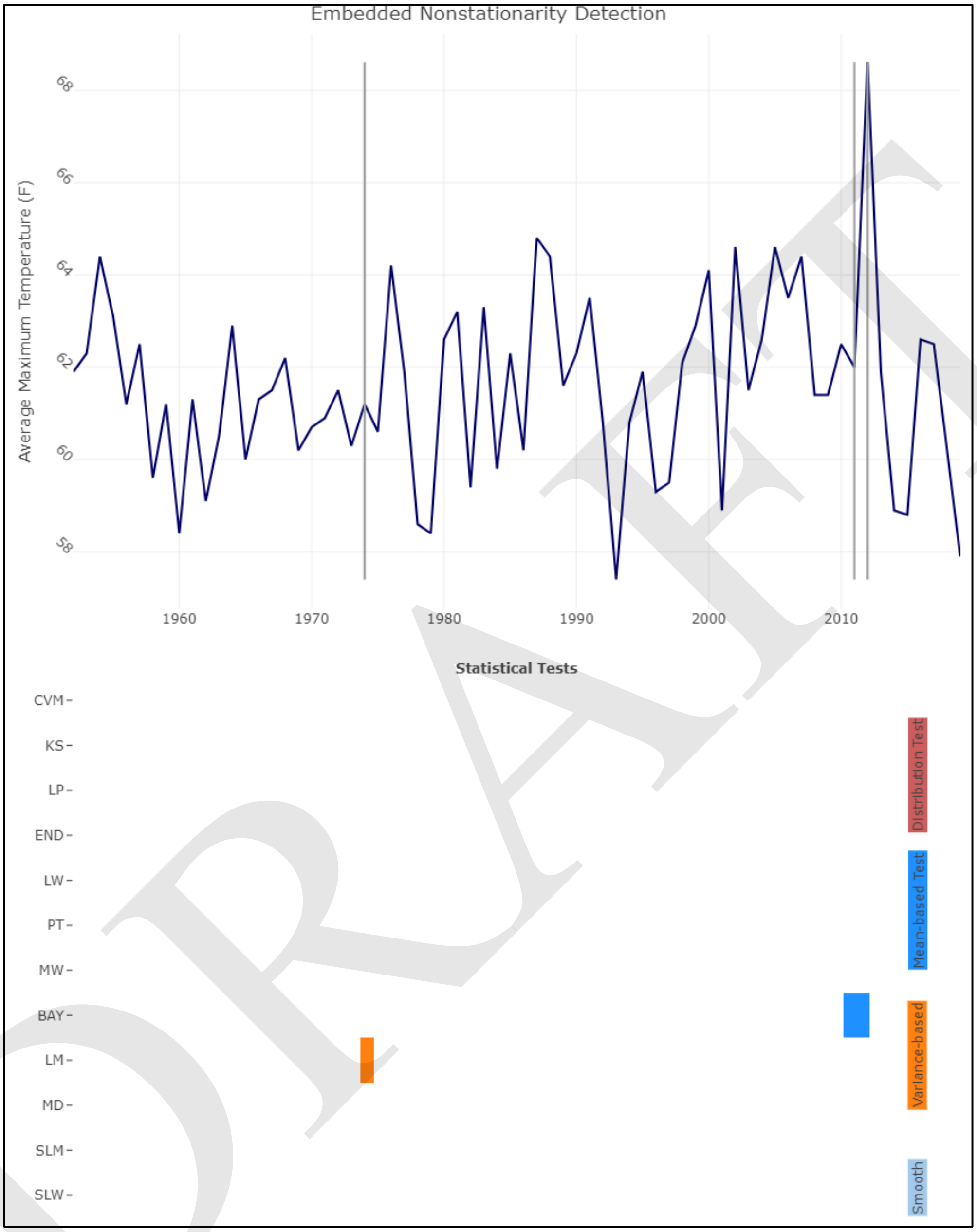


Figure A-34: Annual Average Maximum Temperature for Iowa City NWS Coop Gage #134101
(Linear Regression Equation: T = 0.015764*[Water Year] – 30.161, p=0.0013602
Sen's Slope Equation: T = 0.014493*[Water Year] – 32.816) (Reference 9)



Type: Mean Distribution Variance Smooth

Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-35: Nonstationarity Analysis of Annual Average Maximum Temperature, Iowa City NWS Coop Gage #134101 (Reference 9)

Figure A-36 illustrates a positive linear trend in annual average minimum temperature. This trend is considered significant at an overall $p<0.05$ based on all three tests (linear regression [p=1.123e^{-9}], Mann-Kendall [p<2.2e^{-16}] and Spearman Rank-Order [p=1.8059e^{-9}]), in accordance with the Bonferroni correction as previously described (α=0.0167 level of significance). Figure A-37 shows results of the nonstationarity detection analysis for the annual average minimum temperature record. Results indicate consensus in a 1965-1972 change point in the mean based on the Mann-Whitney (1967) and Smooth Lombard Wilcoxon, and consensus in a 1971 distribution change point based on the Cramer-von Mises, Lepage and Energy Divisive tests. A 1997 distribution change point and a 2012 mean change point were also identified.

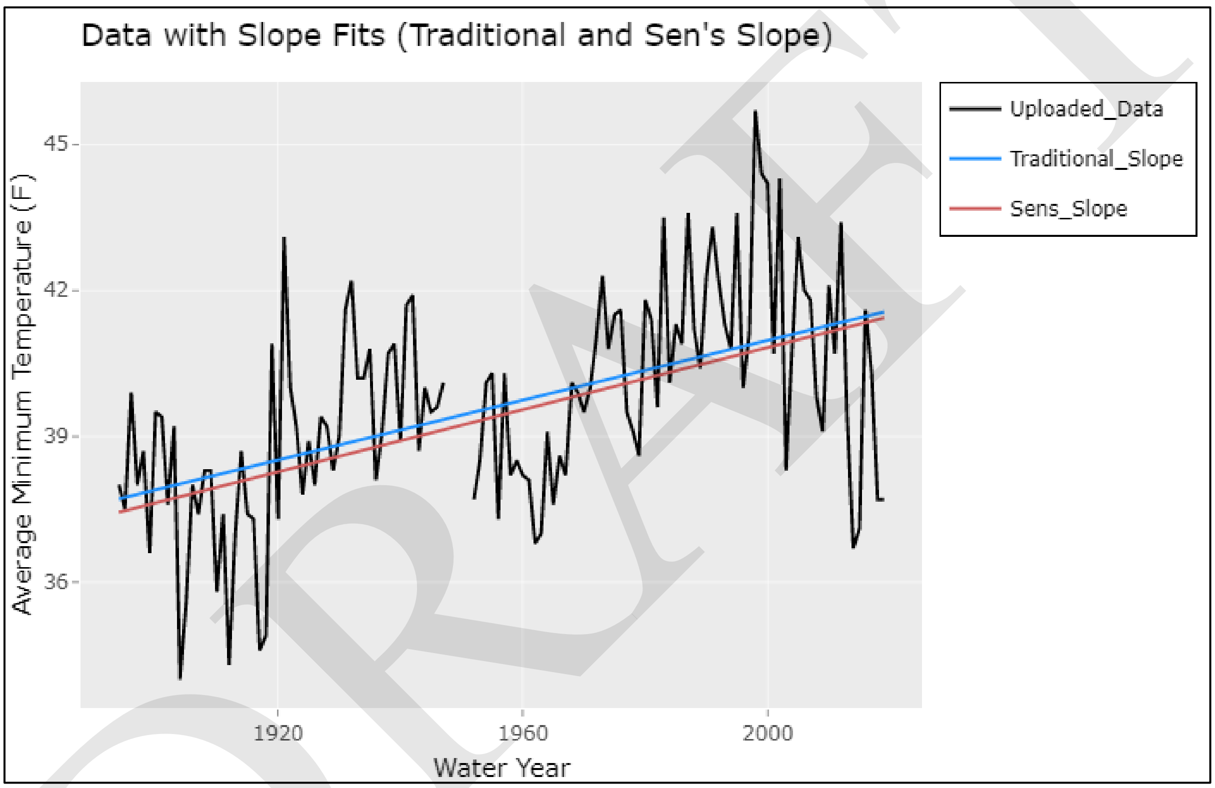
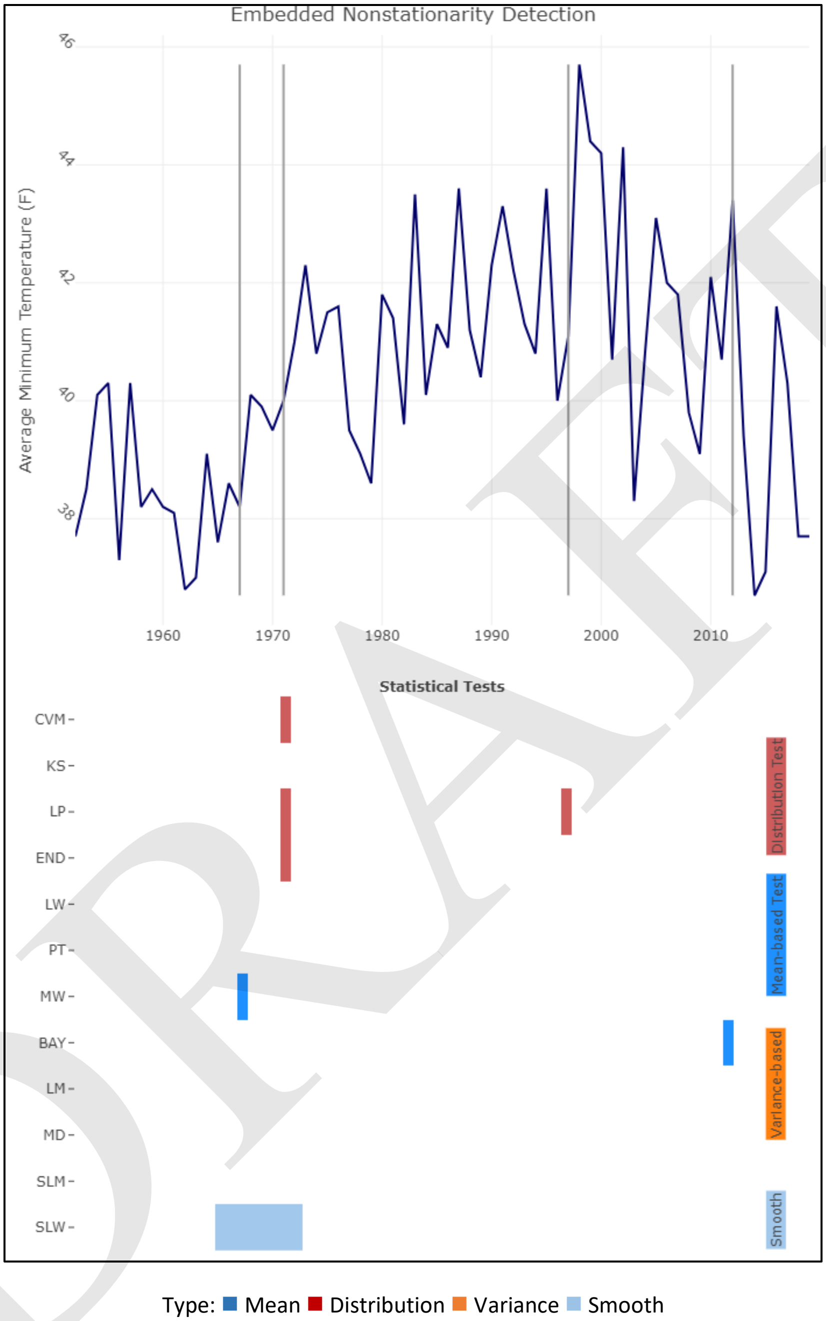


Figure A-36: Annual Average Minimum Temperature for Iowa City NWS Coop Gage #134101
(Linear Regression Equation: T = 0.030733*[Water Year] – 20.493, p=1.123e^{-9}
Sen's Slope Equation: T = 0.031944*[Water Year] – 23.063) (Reference 9)



Abbreviation	Statistical Method	Abbreviation	Statistical Method
CVM	Cramer-von-Mises	**BAY**	Bayesian
KS	Kolmogorov-Smirnov	**LM**	Lombard Mood
LP	Lepage	**MD**	Mood
END	Energy Divisive	**SLM**	Smooth Lombard Mood
LW	Lombard Wilcoxon	**SLW**	Smooth Lombard Wilcoxon
PT	Pettitt	**MW**	Mann-Whitney

Figure A-37: Nonstationarity Analysis of Annual Average Minimum Temperature, Iowa City NWS Coop Gage #134101 (Reference 9)

V. PHASE II: PROJECTED CHANGES TO WATERSHED HYDROLOGY AND ASSESSMENT OF VULNERABILITY TO CLIMATE CHANGE

This part of the climate change assessment focuses on carrying out an analysis of projected future streamflow datasets at the HUC-4 watershed scale.

A. USACE Climate Hydrology Assessment of Projected Data (Reference 10)

The USACE Climate Hydrology Assessment Tool was used to analyze potential future changes to flood flows in the Upper Mississippi-Iowa-Skunk-Wapsipinicon Basin (Reference 10). Figure A-38 shows the range of projected annual maximum monthly streamflows developed from 93 different hydrology climate model runs from 2000-2099. Hydrologic climate model output is generated using a variety of greenhouse gas emission scenarios (RCPs) and general circulation models or Global Climate Models (GCMs) to project precipitation and temperature in the future. These outputs are spatially downscaled using the BCSD statistical method and then used in the U.S. Bureau of Reclamation's Variable Infiltration Capacity precipitation-runoff model to generate a streamflow response. There is a considerable spread in the projected annual maximum monthly flows, and the variability is increasing towards the end of the 21st century (Figure A-38).

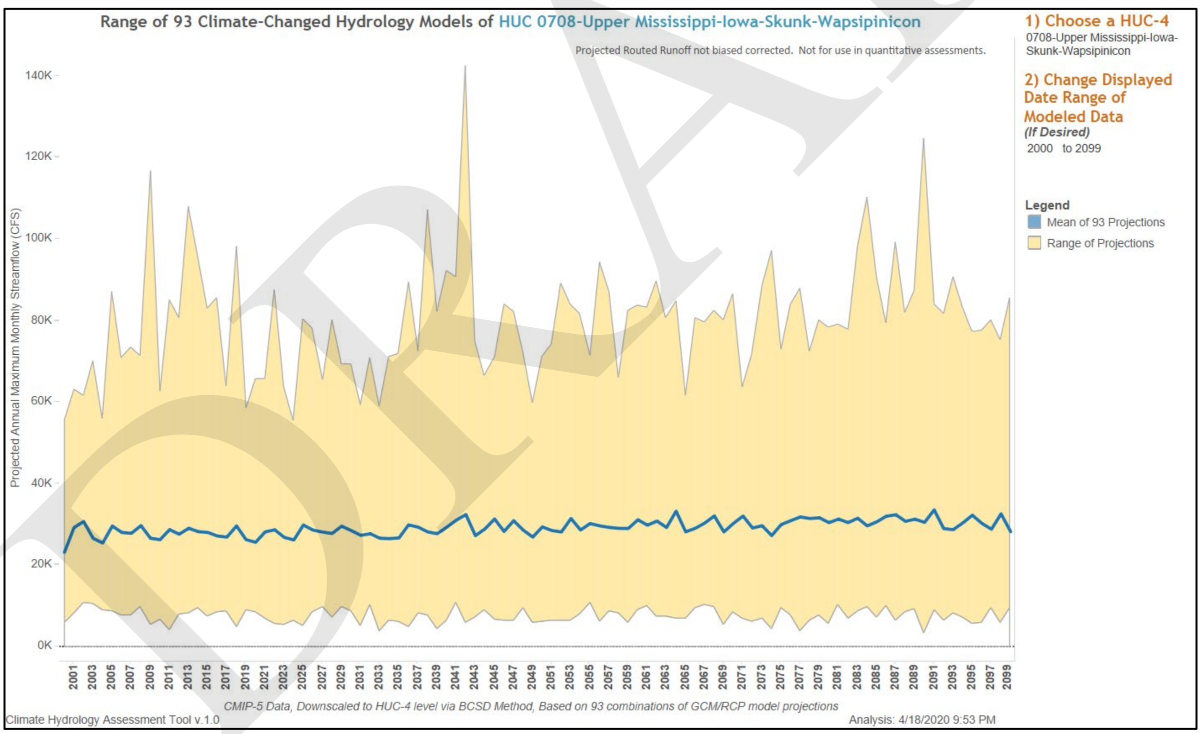


Figure A-38: Range of Projected Annual Maximum Monthly Streamflow among Ensemble of 93 Climate-Changed Hydrology Models, HUC 0708 Upper Mississippi-Iowa-Skunk-Wapsipinicon Basin (Reference 10)

The overall projected trend in the mean projected annual maximum monthly streamflow increases over time (Figure A-39). This increase is statistically significant as the p-value for the linear regression t-Test is considerably less than 0.05 ($p<0.0001$). This suggests that there will be an increased chance of flood risk in the future for the Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin compared to the current time. Although the p-value indicates that a positive trend is statistically significant, there is uncertainty in the magnitude of the trend. The most likely value of the trend in the data is the best fit line of the data, which indicates an increase of approximately 40 cfs/yr. This result is not relatively large in magnitude, but does indicate an increase over time. This result is qualitative only. This analysis was done at the HUC 04 level and therefore cannot be directly applied to the regulation of Coralville Dam. However, the projected increase in variability of annual maximum monthly flows through the 21st century should be considered when identifying the potential climate vulnerabilities of Coralville Lake.

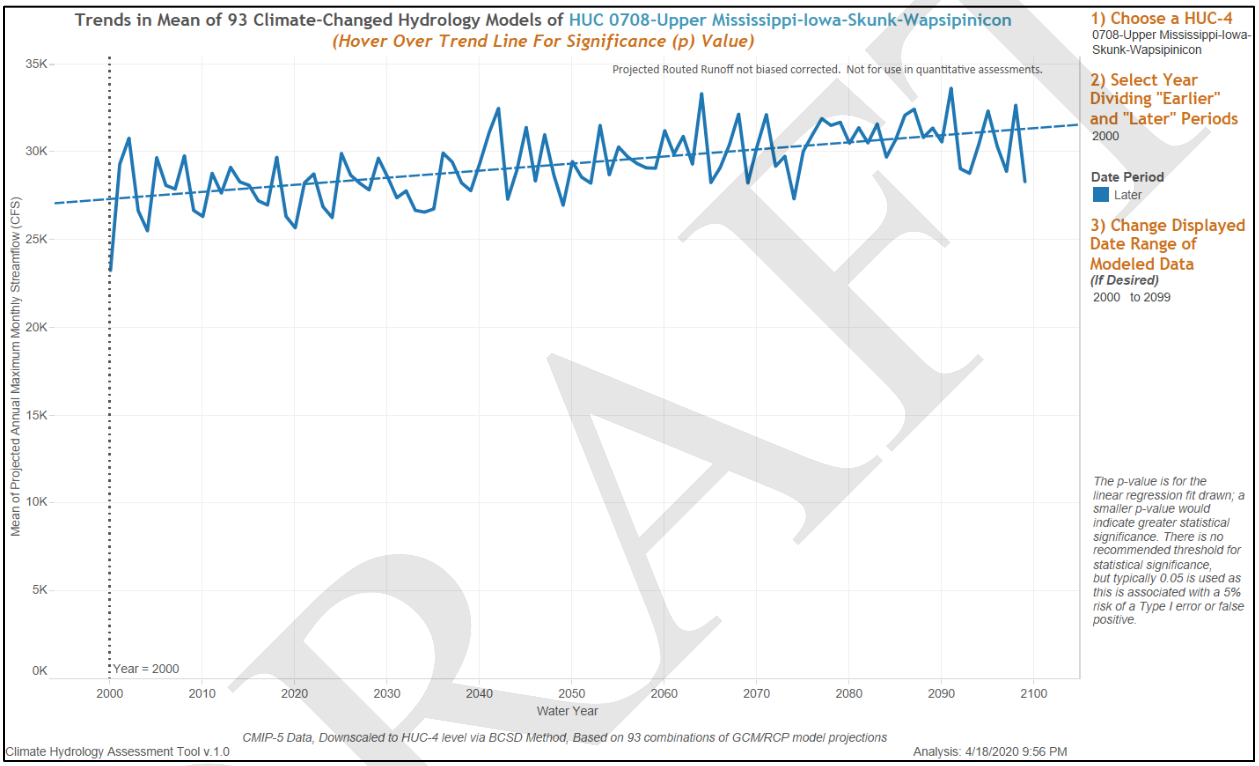


Figure A-39: Mean Projected Annual Maximum Monthly Streamflow, HUC 0708
Upper Mississippi-Iowa-Skunk-Wapsipinicon Basin
(Linear Regression Equation: Q = 40.3183*[Water Year] – 53326.3, R^2=0.376668, $p<0.0001$) (Reference 10)

B. USACE Watershed Climate Vulnerability Assessment Tool (Reference 11)

The USACE Watershed Climate Vulnerability Assessment Tool facilitates a screening level, comparative assessment of how vulnerable a given HUC-4 watershed is to the impacts of climate change relative to the other 202 HUC-4 watersheds within the continental United States (CONUS). The tool can be used to assess the vulnerability of a specific USACE business line such as "Flood Risk Management" to projected climate change impacts. Assessments using this tool help to identify and characterize specific climate threats and particular sensitivities or vulnerabilities, at least in a relative sense, across regions and business lines. The Watershed Vulnerability Tool uses the Weighted Order Weighted Average (WOWA) method to represent a composite index of how vulnerable a given HUC-4 watershed (Vulnerability Score) is to climate change specific to a given business line. The HUC-4 watershed with the top 20% of WOWA scores are flagged as being vulnerable. Indicators considered within the WOWA score for Flood Risk Management include the acres of urban area within the floodplain, the coefficient of variation in cumulative annual flow, runoff elasticity (ratio of streamflow runoff to precipitation), and two indicators of flood magnification (indicator of how much high flows are projected to change over time).

When assessing future risk projected by climate change, the USACE Climate Vulnerability Assessment Tool makes an assessment for two 30-year epochs of analysis centered at 2050 and 2085. These two periods were selected to be consistent with many of the other national and international analyses. The Vulnerability Tool assesses how vulnerable a given HUC-4 watershed is to the impacts of climate change for a given business line using climate hydrology based on a combination of projected climate outputs from GCMs and RCPs resulting in 100 traces per watershed per time period. The top 50% of the traces are referred to as the "wet" scenario and the bottom 50% of the traces are referred to as the "dry" scenario. Meteorological data projected by the GCMs is translated into runoff using the Variable Infiltration Capacity Macroscale hydrologic model. The default National Standard Settings were used to carry out this Vulnerability Assessment.

Results of the Climate Vulnerability Assessment Tool as summarized in Figure A-40 suggests that relative to other basins in the CONUS, within the Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin (HUC 0708) the flood risk management business line is moderately vulnerable to the impacts of climate change. As illustrated by the vulnerability index scores in Table A-4 Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin has moderate vulnerability scores for all scenarios/epochs relative to other watersheds in the District and in the Mississippi Valley Division (Division). The difference in the vulnerability score for the Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin compared to the rest of the District is likely due to the different indicators driving the vulnerability scores and differences in the future projected streamflow and precipitation used as inputs to the vulnerability tool. The Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin has relatively less variation in cumulative annual flow than the neighboring Des Moines River Basin (Figure F-40), and more urban area in 0.2% floodplain than both the Des Moines and Upper Mississippi–Maquoketa-Plum River Basins (Table A-5). These indicator results lend to the Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin having an overall moderate vulnerability to increased flood risk relative to neighboring HUC-4 watersheds within the District.

Table A-4: Projected Vulnerability for the Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin (HUC 0708) with Respect to Flood Risk Management Compared to the National, Division, and District Ranges (Reference 11)

Scenario - Epoch	Vulnerability Score (WOWA Score)	National Range	Division Range	District Range
Dry – 2050	52.41	35.15-70.08	42.18-54.37	46.72-53.80
Dry – 2085	49.56	35.66-69.10	42.13-55.98	47.38-55.65
Wet – 2050	55.00	39.80-92.85	47.13-59.88	52.99-59.88
Wet - 2085	55.69	40.86-86.71	48.07-60.93	54.70-58.88

Table A-5 Comparison of Different Indicators for the Upper Mississippi-Iowa-Skunk-Wapsipinicon, Des Moines and Upper Mississippi-Maquoketa-Plum River Basins (Reference 11)

2050 Epoch	Upper Mississippi-Iowa-Skunk–Wapsipinicon (0708)		Des Moines River (0710)		Upper Mississippi-Maquoketa-Plum (0706)	
Indicator	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
	Contribution to WOWA Flood Risk Vulnerability Score					
Variation in Cumulative Annual Flow	2.12	2.43	4.96	8.33	3.28	3.52
Runoff Elasticity (% Change in Runoff/% Change in Precipitation)	8.50	22.78	15.10	23.81	8.50	13.69
Flood Magnification-Cumulative	26.19	14.30	28.31	14.50	26.60	21.23
Flood Magnification-Local	13.41	4.89	9.29	4.76	13.18	6.99
Urban Area in 0.2% Floodplain	4.78	8.02	2.21	2.41	1.42	1.45
Total (WOWA Score)	55.00	52.41	59.88	53.80	52.99	46.88

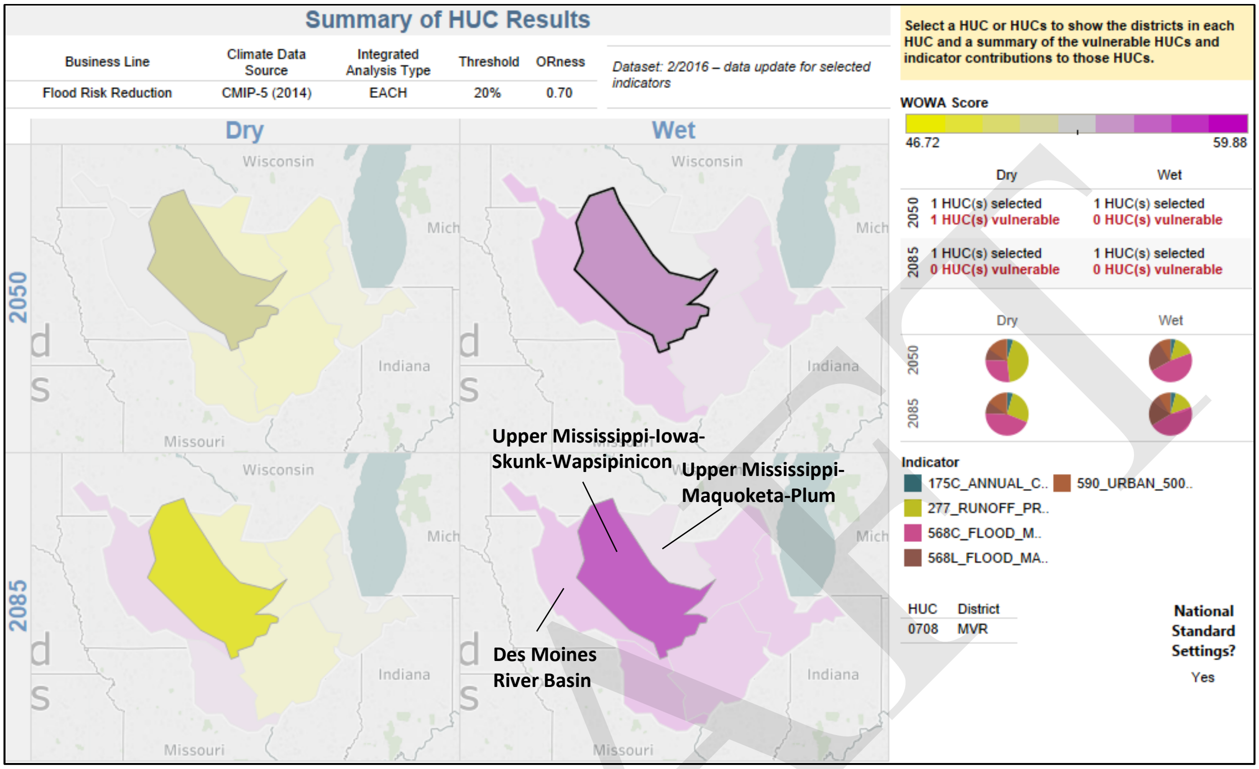


Figure A-40: Projected Vulnerability for the Upper Mississippi-Iowa-Skunk-Wapsipinicon River Basin (HUC 0708) with Respect to Flood Risk Management (Reference 11)

VI. CONCLUSIONS

A. Observed Changes

The literature review identified the following general trends in Iowa and the Upper Mississippi Region:

- Increasing trends in observed air temperature including increasing daily minimum and mean temperatures with faster rates of warming during winter and nighttime temperatures.

- A mild observed upward trend in precipitation with an observed increase in frequency of extreme precipitation events.

- An increasing trend in observed low, mean, and peak streamflow.

Analyses were performed for stream gages in the Iowa-Cedar River Basin to evaluate the streamflow records for long-term trends in peak annual flows and to detect potential nonstationarities in the data that may warrant consideration of utilizing only the more recent portion of the observed record to estimate flow statistics. These analyses involve detection of potential “change points” that represent the presence of statistically significant changes in the mean, variance, or distribution of the streamflow data. ETL 1100-2-3, *Guidance for Detection of Nonstationarities in Annual Maximum Discharges; Section B-5,* states that “a “strong” change point is one for which there is a consensus among multiple change point detection methods, robustness between changes in statistical properties, and for which an operationally significant change in magnitude is determined."

For the Iowa-Cedar River Basin, potential changepoints meeting one or more of the three necessary criteria to define a "strong" changepoint were identified (Table A-3) at three of the nine gage locations analyzed. Change points most likely to be attributable to climatic change effects are around 1957/1958 for the Coralville Lake inflow (CRVI4) records and in 1954 in the Cedar Rapids gage record. Neither of these change points meet the definition of a "strong" change point, per ETL 1100-2-3, due to a lack of consensus or robustness. The strong change point around 1951/1953 identified in the Iowa City gage record likely reflects the construction of Coralville Lake (located immediately upstream) and the significant drought that occurred immediately prior.

The majority of streamflow gages evaluated exhibit upward trends in annual peak flow (Table A-2). The exception being the Iowa City gage, located immediately below Coralville Lake, which exhibited a downward trend in peak annual streamflow due to the regulating effects of the reservoir. The statistical significance of the computed upward trends was mixed. Evaluation of historical precipitation trends identified a statistically significant upward trend, reinforcing the upward trend in annual peak streamflow.

B. Projected Changes

Projected climate changes are described through USACE tools and the literature at a regional level or HUC 04 watershed scale. According to the Climate Hydrology Assessment Tool, for the Iowa River watershed, there is projected to be an increase in variability and an upward trend of annual maximum monthly flow through the 21st century. According to the Vulnerability Assessment tool, the Iowa River watershed is moderately vulnerable to climate change impacts on flood risk management as compared to other HUC 04 watersheds.

The literature review indicated that precipitation is projected to increase, but there is less consensus on the projection of future streamflows. Multiple authors suggest that there may be seasonal changes in streamflow with higher flows in the winter/spring and lower flows in the summer/fall. The literature does suggest that there is more uncertainty in projected streamflow (compared to projected temperature or precipitation) and that there is a possibility of more extreme events.

VII. RECOMMENDATIONS

During the public scoping and stakeholder meetings conducted for this study, numerous questions and comments were received related to perceived increases in the frequency of flooding and how the study team would consider this in identifying recommended changes to the water control plan. Based on the qualitative assessment discussed above, there is no consensus among the gages in the Iowa River basin to suggest that trends in observed data or detected nonstationarity change points should be applied to the entire watershed such that only the more recent portion of the observed record should be used to estimate flow statistics for alternative evaluation. However, the prevalence of an upward trend in streamflow and precipitation records points to the hydrologic uncertainty of simply utilizing the full period of record and assuming stationarity, and does not fully address the comments related to perceived increases in flooding and the potential effects on selection of the preferred water control plan for Coralville Lake.

In order to better address the public and stakeholder comments, a hydrologic sensitivity analysis was conducted to determine the effect of the evaluated record length on the study conclusions (i.e., evaluation and selection of which alternative minimizes flood risk along the system). The sensitivity analysis consisted of fully analyzing the hydrologic and economic performance of the alternative plans utilizing two time periods. The first is the full period of record (1917-2019) for which systemic flow data is available. The second focusses on the latter part of the record which has been wetter with higher inflow volumes into Coralville Lake. The period selected for the more recent, wetter, period was 1959 to 2019. This is due to the occurrence of potential change points at various dates within the 1950s, identified at the various gages, as well as the timing of Coralville Lake going into operation (1959 was the first full year of operation). As a result of the lake going into operation, additional gages were established that provide for a higher resolution of flow data than existed prior to the lake's construction. Some of the inflow records prior to 1959 were, out of necessity, estimated from surrounding gages (see Section II.A.1.a, Appendix B). The results of the hydrologic analyses are presented in Appendix B. Evaluation of the two time periods allows the study team to evaluate the robustness of the study findings (i.e., do both time periods favor the same alternative or does consideration of the wetter period tend to favor a different alternative) as future projected climate changes indicate a long term upward trend in precipitation and the potential for more extreme flood events. As discussed in the main report, both time periods identified the same preferred alternative (Alternative 2C).

In addition to identifying a preferred alternative, the selected plan developed as part of the study includes modifications to add additional flexibility, where possible, to the water control plan through establishment of a conservation pool operating band, expanded fall pool raise limits at Coralville Lake, and higher maximum seasonal releases during normal flood operations. The collective changes allow Coralville Lake to reduce average annual flood damages and provide for opportunities to enhance fish and wildlife management during non-flood or drought periods in a more flexible framework that allows these operations to better respond to conditions experienced within a particular year.

In evaluating the hydrologic sensitivity of the project to potential effects of future climate change, it is important to recognize that the scope of the study is to evaluate how to best manage the existing Coralville Lake project to support the authorized operating purposes. Many of the operational parameters contained in the Coralville Lake Water Control Plan are not controlled by estimates of current or future hydrology but rather are related to physical constraints in the system. These include the physical capacity of the dam conduit and gates, the downstream carrying capacity of the Iowa River below Coralville Dam, and downstream stage constraints that represent thresholds above which there are significant changes in the consequences of flooding. The importance of the hydrologic estimates is in helping to characterize the likelihood of flow conditions, which, along with consequence information, facilitate understanding, and communication of flood risk.

In addition, per ER 1110-2-240, *Water Control Management*, water control manuals should be periodically reviewed and administrative updates performed not less than every 10 years. Historically, major revisions to the water control manual (i.e., revisions that resulted in changes to the water control plan) occurred in 1958 (original plan), 1963, 1982, and 1993. The frequency with which the water control plans are reviewed and updated helps to reduce the risks associated with long-term climate predictions due to the ability to continuously adapt the water control plans over the life of Coralville Lake to reflect not only hydrologic changes, but also changes in land use (and associated consequences).

VIII. REFERENCES

1. Archfield, S.A., R.M. Hirsch, A. Viglione, and G. Bloschl (2016). Fragmented patterns of flood change across the United States. Geophysical Research Letters 43, 10,232-10,239.

2. Friedman, D., J. Schechter, A.M. Sant-Miller, C. Mueller, G. Villarini, K.D. White and B. Baker (2018). US Army Corps of Engineers Nonstationarity Detection Tool User Guide. US Army Corps of Engineers, Washington, D.C.

3. Angel, J., C. Swanston, B.M. Boustead, K.C. Conlon, K.R. Hall, J.L. Jorns, K.E. Kunkel, M.C. Lemos, B. Lofgren, T.A. Ontl, J. Posey, K. Stone, G. Takle, and D. Todey, 2018: Midwest. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 872–940. doi: 10.7930/NCA4.2018.CH21Iowa Climate Change Impacts Committee (2011). 2010 Climate Change Impacts on Iowa.

4. Frankson, R., K. Kunkel, S. Champion, and J. Runkle (2017). 2017: Iowa State Climate Summary. NOAA Technical Report NESDIS 149-IA, 4pp.

5. USACE (2015). Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions – Water Resources Region 07, Upper Mississippi, Civil Works Technical Reports, CWTS-2015-13, USACE, Washington, DC

6. USACE (2018). Engineering and Construction Bulletin 2018-14: *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Project*s.

7. USACE (2017). Engineering Technical Letter 1100-2-3: *Guidance for Detection of Nonstationarities in Annual Maximum Discharges*.

8. USACE (2020). Time Series Toolbox. http://ec2-34-205-128-255.compute-1.amazonaws.com:8080/tst_app/

9. USACE (2020). Climate Hydrology Assessment Tool. http://corpsmapu.usace.army.mil/cm_apex/f?p=313:10:0::NO

10. USACE (2020). Vulnerability Assessment Tool. https://maps.crrel.usace.army.mil/apex/f?p=214:40:1857666071867::NO:::

CORALVILLE LAKE WATER CONTROL
FEASIBILITY STUDY
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX B

HYDROLOGY AND HYDRAULICS

CORALVILLE LAKE WATER CONTROL
FEASIBILITY STUDY
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX B

HYDROLOGY AND HYDRAULICS

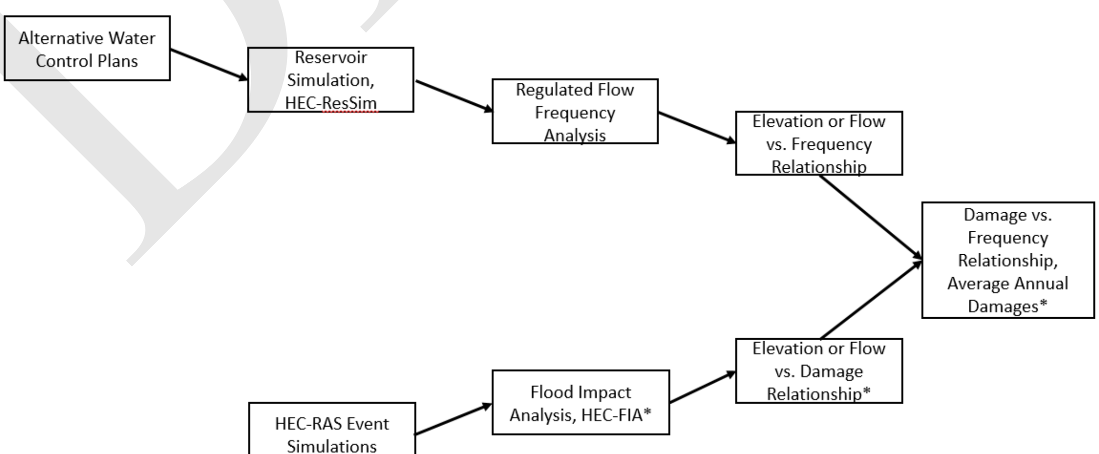
I. GENERAL

The hydrology and hydraulics of the Iowa River Watershed was analyzed to facilitate the evaluation of the identified regulation alternatives. A detailed Hydrologic Engineering Center (HEC) Reservoir Simulator (HEC-ResSim) model was developed and calibrated to the observed record at Coralville Lake. This model was then used to evaluate the 102-year period of record from 1917 to 2019 for all alternatives. The unregulated and regulated model results were used to develop regulated flow frequency estimates for the existing condition and screened alternatives.

The existing HEC River Analysis System (HEC-RAS) model from the 2015 Corps Water Management System (CWMS) effort was utilized to create inundation boundaries and depths downstream of both dams, and these results were integrated into the economic model (Appendix C).

The analyzed area on the Iowa River extends from Coralville Lake to the confluence of the Mississippi River, and on the Mississippi River from the tailwater of Lock and Dam 16 to Burlington, Iowa (Figure B-1). The pertinent river gages are shown in Figure B-2.

The flow chart below shows the relationship, and information flow, between hydrologic and hydraulic study products and the economic evaluation of alternatives. Appendix B details the model creation and calibration process, the processes used to develop the Regulated Flow Frequency relationships, and the alternatives analyzed in this study. All elevations are listed in National Geodetic Vertical Datum (NGVD) of 1929.



* See Appendix C, Economics

II. MODEL SELECTION AND DESCRIPTION

A. Reservoir Simulation Model

1. Legacy Models

a. "CORSIM" Model. The original Des Moines River computer model, "CORSIM", was written in September 1976 by William McDonald in Fortran IV following logic laid out by S.K. Nanda. The program read a binary flow file consisting of daily unregulated flows at the reservoir and downstream constraint locations. The physical reservoir data and regulation plans were "read in" from a text file. The program simulated the regulation of the reservoir by routing "hold outs" from the reservoir down to the control points to calculate a regulated flow. The program used Tatum routing, a coefficient-based routing method developed in the Rock Island District for the Des Moines River Basin.

The unregulated flow record was determined from the U.S. Geological Survey (USGS) daily flow record for the period of time from 1904 until the reservoir was placed in operation in 1959. For that period, the unregulated flow records at Coralville Reservoir, Iowa City, Lone Tree, and Wapello were determined by the USGS daily flow record. The Wapello record was estimated from 1904 until 1956 when the gage was established. For the period of record after Coralville Dam was placed in operation, the unregulated daily record was estimated by routing the 1-day, midnight-to-midnight change in storage (hold out in cfs-days) downstream and adding it to the USGS daily record. The resulting period of record unregulated flows for Coralville Reservoir (inflow), Iowa City, Lone Tree, and Wapello were the base input flow record for CORSIM.

The program then followed the regulation plan for Coralville Dam operation and determined what the regulated outflow would be, calculated the hold outs (inflow minus outflow), and routed the hold outs downstream, subtracting them from the unregulated flow to determine what the regulated flow would have been under the modeled regulation plan. The CORSIM model was in use by the District from its inception in 1976 until the implementation of the original HEC-ResSim model for the Iowa River Basin in 2005, and was the reservoir model used to generate the period of record results that formed the basis for the 2002 Regulated Flow Frequency Study and the "Iowa River Regulated Flow Frequency Study" completed in October 2009 (USACE 2009; hereafter referred to as the 2009 FFS).

b. "IowaPlanning" HEC-ResSim Model. The reservoir's forecasting model transitioned to the HEC-ResSim platform in 2005 and converted the CORSIM logic from the Fortran IV model to the HEC-ResSim software. This forecasting model was used as a baseline and updated for planning purposes following the 2009 FFS. The model, entitled "IowaPlanning" (i.e., the Planning Model), was more detailed than the HEC-ResSim model used for daily forecasting. The Planning Model used inflows to the upstream reservoir and tributary flows along with local flow records and routed flows through the system, instead of the unregulated flows and routed hold outs used by the CORSIM model.

The Planning Model has been in use by the District since implementation, updated as necessary to conform to the newest releases of the HEC-ResSim software. A version of this model is also used for daily reservoir forecasting on the Iowa River by CEMVR-EC-HW (Water Control Section).

2. New HEC-ResSim Model. The HEC-ResSim Planning Model was used as a baseline for creation of the new ResSim model. The new model makes extensive use of downstream controls, seasonal release changes, and Jython scripting to model the reservoir releases from Coralville Lake as accurately as possible. Existing rules were updated to reflect changes in the HEC-ResSim program and more robust downstream and reservoir minimum release rules were put into place. The overall schematic of the HEC-ResSim model is shown in Figure B-2.

Model inflows were added at:

- Coralville Lake (main model inflows)
- Iowa River at Iowa City, Iowa (between Clear and Ralston Creeks in Iowa City) – this is a downstream control point for flash flood operations within Iowa City
- Iowa River near Lone Tree, Iowa (Tri-County Bridge, downstream of the confluence of the Iowa and English Rivers) – this is a downstream control point for Coralville Dam releases
- Iowa River at Wapello, Iowa (downstream of the confluence of the Iowa and Cedar Rivers) – this is a downstream control point for Coralville Dam releases
- Burlington, Iowa (downstream of the confluence of the Mississippi and Iowa Rivers) – this is a downstream control point for Coralville Dam releases

Major changes between the Planning Model and the new HEC-ResSim Model created for this analysis include:

- Updated elevation-storage-area curve to reflect the new reservoir Light Detection and Ranging (LiDAR) and bathymetric surveys completed in 2019
- Updated maximum increasing and decreasing rates of change to reflect cubic feet per second (cfs)/hour instead of cfs/day
- Added the Large Magnitude Flood (LMF) Script to better model how reservoir operations are completed during large events
- Updated the maximum release rules in the "Normal Flood Control" and "Conservation zones to accurately model increased outflows when the Coralville pool is projected to exceed elevation 707 feet ("Projected Pool Releases")
- Reordered rules as necessary for HEC-ResSim priority requirements

3. LMF Script. Storm events which result in reservoir elevations exceeding 707 feet cause the LMF Release schedule to come into effect. Flows increase stepwise as the reservoir elevations rise in an effort to evacuate water from high elevations as quickly as possible. These high flows are held through the duration of the receding limb of the hydrograph and step down as necessary to maintain "maximum fall" requirements (less than 1-foot drop in reservoir elevation per day) or lack of head to maintain the release rates.

Creation of a Jython script was necessary to override releases as the model processed high inflow storm events. This script was developed in conjunction with the HEC for the 2018 Des Moines River Regulation Plan Update and was adapted to fit the requirements of Coralville Dam. The goal of this release script it to maintain the higher release rates achieved in the LMF Release Schedule through the duration of a large event, as it would be impractical to reduce to lower flows while inflows are still high (causing the reservoir elevations to rebound to higher levels).

The script achieves this by performing the following:

- When reservoir elevations have not exceeded 707 feet during an event, the script is inactive.
- Once elevation 707 has been passed, the script activates and performs the following:
  - If the reservoir elevation is above 707 feet and rising, Coralville Dam either releases the next higher step on the LMF Release Schedule or maintains the current release rate if that step has not been met.
  - If the reservoir elevation is above 707 feet and either steady or falling, the current release is maintained.
  - If the reservoir elevation decreases below 707 feet, current releases are maintained until 1) there is not sufficient head to maintain that release rate, 2) releases must be decreased to maintain no more than 1 foot of reservoir elevation loss per day, or 3) releases decrease below either 10,000 cfs in the non-growing season or 6,000 cfs in the growing season (this results in the script deactivating, and normal operations resume).
  - Once the reservoir elevation falls below a prescribed elevation (currently set at 687 feet) or release rates drop below 6,000/10,000 cfs release during the growing/non-growing season, the script deactivates, and normal operations resume.

When this script is active, it overrides all downstream control rules and normal operations releases to drain the pool as quickly as possible. These rules restart when the script is deactivated. The script also determines the day of the year and leap year status to determine reservoir releases (growing vs. non-growing season).

4. Calibration

a. Recent and Period of Record Runs. Once the rulesets were completed, the new HEC-ResSim model was run using observed inflows from 1993 through 2019. These inflows were chosen as they reflected the operation since the last Regulation Manual update. The observed flows during that timeframe would most resemble those followed by the model ruleset.

Observed reservoir elevations and releases were added to the model at Coralville Lake to compare to those generated by the HEC-ResSim model runs. Where discrepancies occurred between the observed values and the model results, rules were updated or changed in priority to better match the historic data. For some events, such as the 1993 storms and the 2015-2019 years, operational deviations explain the differences in the observed and model generated data.

The largest deviations between the observed data and simulated results are due to the utilization of downstream control rules. These rules are in effect at four locations downstream of Coralville Dam (Iowa City, Lone Tree, Wapello, and Burlington). When specified flow rates are exceeded at these points, releases from the reservoir are decreased to maintain those flows at the violated control point. While the HEC-ResSim model makes perfect decisions based on the data it is provided, the observed data is a result of decision making by the Water Control Team with the information available at the time of the event, such as forecasts and existing condition reports. There are timesteps in the simulations where the model decided either to reduce or maintain flow due to downstream control rules that were done differently in actual operations. The gage rating curves for the Coralville tailwater, Iowa City, Lone Tree, and Wapello gages are provided in Figure B-3 through Figure B-6.

The effects of these deviations are especially evident in the 2013 simulation, as illustrated in Figure B-7. The model reduced outflows from the reservoir twice preceding the peak inflows, as a downstream control point was violated. These decreased outflows resulted in peak reservoir elevations and release rates that are higher than those seen in the observed data, since the Water Control team did not reduce releases during the actual event.

Following the recent period of record calibration, the existing model was rerun using 103 years of calculated inflows for the Iowa River (1917 to 2019). The results were analyzed to ensure the model obeyed the rules properly and that expected reservoir elevations and releases were created across the period of record. Overall, the model matched elevations and releases as expected. As stated above, discrepancies between the model results and expected values and observed data were explained by either deviation operations at the reservoir, changes in the historic water regulation plan, or utilization of the downstream control rules.

B. Iowa River Hydraulic Model

This study made use of the existing HEC-RAS model created for the 2014 CWMS effort for the Iowa River Watershed. The model spans the Iowa River from immediately downstream of Coralville Dam to the confluence of the Mississippi and Iowa Rivers, and the Mississippi River from the tailwater at Lock and Dam 16 to Burlington, Iowa. Some small changes were made to that model (i.e., updated levee alignment and height information, additional cross sections in areas of particular concern, elevation changes for the tops of inline structures) due to changes since the completion of that modelling effort. An overview of the model geometry is shown in Figure B-8.

Several flow profiles were analyzed for releases from each dam, based on prescribed releases in the current Regulation Manual, the analysis completed in the 2009 FFS, and flows corresponding to recommended releases in analyzed alternatives. The model was run for each set of reservoir releases separately.

The HEC-RAS simulations were completed in unsteady flow with unchanging time series (the same flows for the duration of the simulation), as arrival time and duration of inundation were not of interest for this analysis. Each reservoir release was entered into the Unsteady Flow Data Editor with corresponding downstream flows as needed. Inflows from any watercourse other than Clear Creek, English River, and Cedar River were set as low as possible to maintain model stability while minimizing the effect to release amounts in the river and backwater effects. Mississippi River inflows were also set to low values to minimize backwater effects at the confluence of the Mississippi and Iowa Rivers.

1. Coralville Lake Releases. Releases from Coralville Lake were used to evaluate in-channel and flood inundation extents for the area between Coralville Lake and the confluence of the Mississippi and Iowa Rivers. Thirty release rates from Coralville Dam were simulated. The following list details the most pertinent of those considered:

- 1,000 cfs: This flow was used for an in-channel flow baseline.

- 6,000 cfs: the current maximum growing season release from Coralville Dam when elevations within Coralville Lake are below 707 feet.

- 8,000 cfs: The 50% Annual Chance Exceedance (ACE) (2-year) event from the 2009 FFS.

- 9,000 cfs: The 20% ACE (5-year) event from the 2009 FFS.

- 10,000 cfs: The current maximum non-growing season release from Coralville Dam when elevations within Coralville Lake are below 707 feet. This is also nearly the value of the 10% ACE (10-year) event from the 2009 FFS (10,880 cfs).

- 13,000 cfs: This is the observed damaging flow for areas immediately downstream of Coralville Dam (River Front Estates area).

- 15,000 cfs: This flow, combined with the inflows used for Clear Creek, produce the damaging flows triggering flash flood operations in Iowa City, requiring reductions in flows from Coralville Lake.

- 22,200 cfs: The 2% ACE (20-year) event from the 2009 FFS.

- 28,600 cfs: The 1% ACE (100-year) event from the 2009 FFS.

- 35,200 cfs: The 0.5% ACE (200-year) event from the 2009 FFS.

- 40,000 cfs: This flow, combined with the inflows used for Clear Creek, is the overtopping event for the levee system at Iowa River Landing, immediately downstream of Interstate 80 in Iowa City.

- 44,400 cfs: The 0.2% ACE (500-year) event from the 2009 FFS.

- 51,500 cfs: The 0.1% ACE (1000-year) event from the 2009 FFS.

2. Flood Inundation Mapping. Results from the HEC-RAS model runs were entered into ArcGIS. The inundation extents were checked with those seen in the 2009 FFS. Areas of the inundation which were determined to be disconnected from direct river flooding (i.e., existing ponds, quarry areas, etc.) were removed. Depth rasters were created using RAS Mapper and imported into ArcGIS.

The pool areas within Coralville Lake were determined by using the available 0.25-meter LiDAR surface completed in 2019. Contours were generated in ArcGIS for multiple water surface elevations within the lake and used to create depth rasters for pool inundation extents. The elevations used were:

- 683 feet
- 700 feet
- 702 feet
- 707 feet
- 710 feet
- 711 feet
- 712 feet
- 715 feet
- 717 feet
- 720 feet
- 725 feet

The inundation extents for the 0.1% ACE (1000-year) event were buffered 100-feet and used to create a general damage area. This area was split into four polygons based on geographic location, hydrologic boundaries, and drainage area information provided in the USGS gage information to facilitate association of damages to specific areas of study. These damage area polygons covered the following locations:

- Downstream of Coralville Dam (USGS Gage #05453520)
- Iowa River at Iowa City, Iowa (USGS Gage #05454500)
- Iowa River near Lone Tree, Iowa (Tri-County Bridge) (USGS Gage #05455700)
- Iowa River at Wapello, Iowa (USGS Gage #05465500)

The four damage are polygons and the modified depth rasters for the reaches between Coralville Dam and the confluence of the Mississippi and Iowa Rivers were provided to Economics for use within the HEC Flood Impact Analysis (HEC-FIA) tool to assist with analysis of damages. Plates 1 through 12 provide Inundation Maps for select reservoir elevations and downstream discharges.

C. Regulated Flow Frequency Analysis

Regulated flow frequency relationships were developed for Alternatives 1 (the "No Action" alternative, representing the existing water control plan) and Alternatives 2C, 5, and 8 (the screened plans carried through to economic analysis). Screening of other alternatives was accomplished through comparison of regulated flow frequency curves developed using plotting position only. The procedures used in developing the regulated flow frequency relationships follows the procedures used in the 2009 Regulated Flow Frequency Study for the Iowa River (USACE, 2009). The procedures generally consisted of:

- Developing an unregulated flow record based upon the HEC-ResSim simulation using historical reservoir and tributary inflows (1917 through 2019).

- Developing volume-duration-frequency (VDF) curves for flow volumes using the simulated unregulated flow record at each gage.

- Selecting the critical duration for flood inflows at each gaged location.

- Developing a relationship between the 1-day regulated peak reservoir outflow and the unregulated inflow volume for the identified critical duration at each gaged location.

- Combining the unregulated VDF curve for the critical duration with the regulated versus unregulated relationship to obtain the 1-day regulated flow frequency curve at each gaged location.

The VDF analyses were completed using HEC's Statistical Software Package (HEC-SSP) v2.2. The analyses were conducted using the Expected Moments Algorithm (EMA) – log-Pearson Type III Distribution with the Multiple Grubbs-Beck low outlier test. The regulated versus unregulated relationships were developed using regression tools within Microsoft Excel and final plotting of the regulated frequency curves was accomplished using the U.S. Army Corps of Engineers' (USACE) Risk Management Center's (RMC) Probability Scale Plotter Macro within Microsoft Excel.

The regulated flow frequency analyses in Sections III and V utilize the entire period of record (1917-2019). A sensitivity analysis, focusing on the wetter, later portion of the record (1959-2019) is contained in Section VI.

III. EVALUATION OF EXISTING WATER CONTROL PLANS

A. Period of Record Reservoir Simulation

As discussed in Section II.A.2, the HEC-ResSim model was created to simulate the existing conditions on the Iowa River. The results of this calibrated simulation were used as a baseline from which comparisons of all other alternatives were made. The existing water control plan is Alternative 1, the No Action Alternative.

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B. Regulated Flow Frequency Analysis

The HEC-ResSim model developed and calibrated in Section II.A.2 was used to simulate (1) the unregulated flows for the period of record and (2) the daily regulated flows and reservoir elevations for the existing water control plan. The HEC-ResSim model results were used to update the regulated flow frequency estimates for the existing water control plan. Due to the presence of high flows during the fall in some years, calendar year was used for the regulated flow frequency analyses instead of water year.

1. VDF Analysis. A VDF analysis was performed on the simulated, period of record, unregulated flows for each gage location using HEC-SSP. Analyses for the 1, 3, 5, 7, 10, 15, 30, and 60-day peak annual durations were conducted. For the Iowa City 3-day and Lone Tree 7-day curves, the Multiple Grubbs-Beck test identified 41 and 43 low outliers respectively. This resulted in computed standard deviation and skew values significantly different than those computed for other durations as well as at the surrounding gages. As a result, the low outlier test for these two location-duration combinations were overridden based upon a visual evaluation of the plotted data.

Table B-1 shows the computed VDF statistics for each gage and duration on the Iowa River. To obtain VDF curves that are consistent for a particular gage, the computed statistics were adjusted in the following manner:

- The sample means were left unadjusted as across all gages and durations the mean values uniformly decreased with increasing duration.

- The sample standard deviations were adjusted for each gage based upon a paired regression of the sample mean and standard deviation values for each duration.

- The sample skews were adjusted to represent regionalized estimates for each duration by first computing the arithmetic average skew for each duration (based upon the sample skews for the four Iowa River Gages) and then regressing a relationship between duration and the computed average skew.

These adjustment methods are consistent with those used in the 2009 FFS. The resulting adjusted skew values ranged from -0.23 to -0.37. The skew values utilized in the 2009 FFS ranged from -0.17 to -0.20, and an earlier 2002 update utilized skew values of -0.2 to -0.3. Figure B-9 shows the resulting VDF curves for Coralville Lake. While the adjustment methodology utilized is consistent with the 2009 and 2002 studies, the differences in skews relate to changes in the available record as well as changes in low outlier censoring methods. As shown in Table B-1, the Multiple Grubbs-Beck test identified up to 13 low outliers whereas in past analyses no more than 2 were identified. The higher 1-day adjusted skew value of -0.37, computed in this study, is more consistent with the published recommended peak skew value for the State of Iowa of -0.4 (Eash, 2013).

Table B-1. Iowa River VDF Statistics of Log10 Unregulated Annual Maximum Flows

Gage	Duration	Mean	StdDev	Skew	Outliers	$StdDev_{reg}$	Regional Skew
Coralville Release	1-Day	4.056	0.301	-0.401	0	0.306	-0.367
	3-Day	4.015	0.302	-0.374	0	0.302	-0.363
	5-Day	3.982	0.304	-0.433	0	0.299	-0.358
	7-Day	3.951	0.304	-0.509	0	0.297	-0.353
	10-Day	3.918	0.290	-0.351	12	0.294	-0.346
	15-Day	3.863	0.286	-0.297	13	0.289	-0.335
	30-Day	3.746	0.279	-0.365	10	0.279	-0.300
	60-Day	3.634	0.269	-0.301	6	0.269	-0.230
Iowa City	1-Day	4.077	0.299	-0.363	0	0.305	-0.367
	3-Day	4.031	0.299	-0.353	2	0.302	-0.363
	5-Day	3.996	0.302	-0.407	0	0.299	-0.358
	7-Day	3.965	0.303	-0.489	0	0.297	-0.353
	10-Day	3.928	0.296	-0.412	5	0.295	-0.346
	15-Day	3.873	0.294	-0.370	8	0.291	-0.335
	30-Day	3.760	0.283	-0.364	10	0.283	-0.300
	60-Day	3.650	0.271	-0.268	6	0.275	-0.230
Lone Tree	1-Day	4.200	0.295	-0.125	0	0.298	-0.367
	3-Day	4.154	0.298	-0.215	0	0.296	-0.363
	5-Day	4.108	0.296	-0.267	0	0.294	-0.358
	7-Day	4.077	0.291	-0.213	2	0.293	-0.353
	10-Day	4.034	0.292	-0.305	2	0.291	-0.346
	15-Day	3.978	0.288	-0.246	3	0.289	-0.335
	30-Day	3.866	0.288	-0.366	5	0.284	-0.300
	60-Day	3.757	0.277	-0.226	6	0.280	-0.230
Wapello	1-Day	4.602	0.281	-0.463	0	0.281	-0.367
	3-Day	4.567	0.280	-0.446	3	0.277	-0.363
	5-Day	4.535	0.267	-0.274	8	0.274	-0.358
	7-Day	4.502	0.272	-0.412	8	0.270	-0.353
	10-Day	4.465	0.267	-0.402	9	0.266	-0.346
	15-Day	4.411	0.268	-0.402	9	0.261	-0.335
	30-Day	4.323	0.242	-0.077	10	0.251	-0.300
	60-Day	4.218	0.244	-0.116	9	0.240	-0.230

Table B-2 shows the resulting unregulated volume-frequency values.

Table B-2. Iowa River Unregulated Annual Maximum Flow (cfs) versus Exceedance Probability

Gage	Duration	Exceedance Probability						
		0.5	0.1	0.02	0.01	0.005	0.002	0.001
Coralville	1-Day	11,890	27,200	41,980	48,400	54,850	63,450	69,990
	3-Day	10,800	24,480	37,620	43,310	49,030	56,640	62,430
	5-Day	10,000	22,500	34,470	39,660	44,870	51,810	57,080
	7-Day	9,300	20,830	31,880	36,670	41,480	47,880	52,760
	10-Day	8,600	19,130	29,210	33,580	37,970	43,820	48,280
	15-Day	7,570	16,640	25,310	29,060	32,840	37,870	41,720
	30-Day	5,750	12,400	18,760	21,530	24,330	28,080	30,960
	60-Day	4,410	9,370	14,220	16,370	18,580	21,570	23,890
Iowa City	1-Day	12,460	28,440	43,840	50,510	57,230	66,160	72,960
	3-Day	11,130	25,220	38,760	44,630	50,520	58,370	64,330
	5-Day	10,320	23,210	35,570	40,920	46,300	53,450	58,900
	7-Day	9,600	21,500	32,900	37,830	42,800	49,410	54,440
	10-Day	8,810	19,660	30,060	34,570	39,100	45,150	49,760
	15-Day	7,740	17,120	26,100	30,000	33,930	39,180	43,180
	30-Day	5,940	12,940	19,690	22,650	25,640	29,650	32,730
	60-Day	4,570	9,880	15,140	17,490	19,890	23,170	25,730
Lone Tree	1-Day	16,520	36,990	56,460	64,850	73,260	84,410	92,870
	3-Day	14,850	33,100	50,400	57,900	65,390	75,320	82,860
	5-Day	13,340	29,600	45,040	51,690	58,360	67,220	73,940
	7-Day	13,020	28,840	43,870	50,360	56,880	65,530	72,110
	10-Day	11,230	24,780	37,660	43,230	48,830	56,270	61,930
	15-Day	9,870	21,700	33,000	37,890	42,820	49,380	54,390
	30-Day	7,580	16,570	25,250	29,050	32,900	38,070	42,040
	60-Day	5,860	12,830	19,820	22,950	26,170	30,570	34,010
Wapello	1-Day	41,560	88,880	132,420	150,900	169,280	193,480	211,720
	3-Day	38,370	81,230	120,470	137,090	153,610	175,350	191,730
	5-Day	35,570	74,770	110,560	125,710	140,770	160,590	175,520
	7-Day	32,990	68,660	101,080	114,780	128,400	146,300	159,780
	10-Day	30,250	62,370	91,470	103,750	115,960	132,010	144,110
	15-Day	26,640	54,280	79,250	89,790	100,270	114,060	124,450
	30-Day	21,650	43,200	62,690	70,960	79,210	90,110	98,370
	60-Day	16,860	33,020	47,930	54,350	60,830	69,490	76,140

2. Duration Selection. Selection of the annual maximum unregulated volume-duration frequency curve to use in computing the regulated frequency curve depends on the relative effects of Coralville Lake reservoir storage on reducing flood flows at downstream locations. Selection of the appropriate duration focuses on large volume flood events (~greater than the 10% ACE (10-year) event) that result in releases that exceed the normal flood control release, which is typically around a bank full discharge. For lesser flood events, the inflow volumes are well controlled, and releases are successfully limited to seasonal maximums over a wide range of inflow volumes.

Selection of the duration was accomplished through plotting of the annual peak unregulated flow volumes (for each duration) versus the peak annual 1-day regulated flow based upon the existing condition HEC-ResSim simulation for the period of record flows. The selected duration was chosen as the duration that performed best with regards to:

- For areas immediately below Coralville Lake, producing a consistent break point at which higher volumes of unregulated inflow produced 1-day peak releases above the normal seasonal maximum.

- Producing consistent 1-day peak releases for similar volumes of unregulated inflow (i.e., minimized the degree of scatter in the 1-day regulated versus n-day unregulated relationship, with emphasis on the LMF events).

- Producing high consistency in the ranked order of events for the n-day unregulated volume versus the 1-day regulated flow.

Table B-3 shows the ranked 1-day reservoir releases for Coralville Lake and downstream gages versus the n-day inflow volumes. Figure B-10 through Figure B-14 show the plotted relationship between the 1-day regulated flow versus the unregulated flow volumes (for select durations) at each location. To assist in evaluation of the critical duration, additional scaled events were included to evaluate performance of the durations for rare flood events. Multipliers of 1.25, 1.5, and 1.75 were applied to the 1993, 2008, 2013, and 2014 (Wapello only) flood events using the “Inflow Multipliers” option within HEC-ResSim. The use of multiple major flood events provided for additional data points to capture the influence of varying hydrograph shapes on regulated peak flow releases.

For Coralville Lake release and the Iowa City gage, the 15-day inflow duration was selected. Of the various durations, the 15-day duration correctly orders the largest flood events and minimizes the amount of scatter in the 1-day regulated versus n-day unregulated flow volume. The 2009 study also utilized the 15-day duration for these two locations.

For the Lone Tree and Wapello gages, the 1-day inflow duration was selected due to the significant influence of unregulated tributary flow affecting these gages. As shown in Table B-3, the 1-day duration performs well in ordering the unregulated and regulated flow volumes for the Wapello gage. At Lone Tree, the 15-day unregulated duration comes closest to ordering the events; however it results in significantly greater scatter than the 1-day duration (Figure B-13) for the largest flood events, the area of greatest interest. For this reason, the 1-day duration was used. The 2009 study also utilized the 1-day duration for these two locations.

Table B-3. Unregulated Flow Duration Selection for Computation of Regulated Frequency Curves – Alternative 1
(Years ranked from largest to smallest annual maximum volume)

Coralville							
Unregulated							***Regulated***
1-Day	3-Day	**5-Day**	7-Day	10-Day	15-Day	30-Day	***1-Day***
2008	2008	2008	2008	2008	2008	1993	***2008***
1918	2013	2013	2013	2013	1993	2008	***1993***
2013	1918	1918	1918	1993	2013	1947	***2013***
1960	1993	1993	1993	2014	2014	2013	***2018***
1993	1960	1960	2014	1918	1947	2014	***2014***
2014	2014	2014	1960	1960	1918	2018	***1947***
1947	1947	1947	1979	1947	1960	1918	***1969***

Iowa City							
Unregulated							***Regulated***
1-Day	3-Day	5-Day	7-Day	10-Day	15-Day	30-Day	***1-Day***
2008	2008	2008	2008	2008	2008	1993	***2008***
1918	2013	2013	2013	2013	1993	2008	***1993***
2013	1918	1918	1993	1993	2013	1947	***2013***
1960	1960	1993	1918	2014	2014	2013	***2014***
1993	1993	1960	2014	1918	1947	2014	***2018***
2014	2014	2014	1960	1960	1918	2018	***1947***
1947	1947	1979	1979	1979	2018	1969	***1969***

Lone Tree							
Unregulated							***Regulated***
1-Day	3-Day	5-Day	7-Day	10-Day	15-Day	30-Day	***1-Day***
1993	2008	2008	2008	2008	2008	1993	***1993***
2008	1993	1993	1993	1993	1993	2008	***2008***
1974	1960	1960	2014	2014	2014	2014	***2013***
1960	2014	2014	1960	1960	2013	1947	***2014***
2013	1974	1974	1974	2013	2018	1974	***2018***
2014	2013	2013	2013	2018	1974	2018	***1974***
1990	1979	1990	2018	1974	1979	2013	***1965***

Wapello							
Unregulated							***Regulated***
1-Day	3-Day	5-Day	7-Day	10-Day	15-Day	30-Day	***1-Day***
2008	2008	2008	2008	2008	2008	1993	***2008***
2013	2014	2014	1993	1993	1993	2008	***2013***
2014	1993	1993	2014	2014	2014	2018	***1993***
1993	2013	2013	2013	2013	2013	1969	***2014***
1973	1960	1960	1960	2018	1969	2014	***1973***
1960	1973	1973	1965	1965	2018	2013	***1960***
1974	1974	1965	2018	1960	1965	1979	***1965***

3. Regulated versus Unregulated Relationship. The regulated versus unregulated relationship is used to compute the annual maximum 1-day regulated frequency curve from the critical duration annual maximum unregulated volume frequency curve. In order to estimate the regulated versus unregulated relationship for rarer events, the regression line was computed based upon the 1993, 2008, 2013 and 2014 (Wapello only) simulated events, including scaled versions of those events as discussed in Section III.B.2, *Duration Selection*.

a. Coralville Lake. The regulated versus unregulated relationship for Coralville Lake is characterized by zones where flows are less than or greater than the seasonal maximum release of 10,000 cfs. For events that exceed the 10,000 cfs release, releases are progressively increased during major flood operations to 21,000 cfs. Above elevation 712 feet, the uncontrolled spillway activates and releases from the spillway and conduit increase with increasing reservoir elevation. The Coralville Lake tailwater gage represents the reach of the Iowa River from Coralville Dam to its confluence with Clear Creek.

Figure B-15 shows the estimated regulated versus unregulated relationship for Coralville Lake. The regulated versus unregulated flow pairs shown are the annual maximum 15-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulation. For regulated releases in excess of 21,000 cfs, the regression line was computed based upon the 1993, 2008, and 2013 simulated events (including scaled versions of those events, discussed in Section III.B.2).

b. Iowa River at Iowa City, IA. The regulated versus unregulated relationship for the Iowa City gage reflects the Coralville Lake release and unregulated contributions from local tributaries in the Iowa City area including Rapid and Clear Creek. The Iowa River gage represents the reach of the Iowa River from its confluence with Clear Creek to its confluence with the English River. Figure B-16 shows the estimated regulated versus unregulated relationship for Iowa City. The regulated versus unregulated flow pairs shown are the annual maximum 15-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulation. The regression line was computed based upon the 1993, 2008, and 2013 simulated events (including scaled versions of those events, discussed in Section III.B.2).

c. Iowa River at Lone Tree, IA. The regulated versus unregulated relationship for the gage located near Lone Tree, IA, is influenced by the significant amount of unregulated flow that enters the river reach between Coralville Lake and the gage. Between Coralville Dam and Lone Tree, the drainage area increases by roughly a third (3,115 versus 4,293 square miles). Therefore, the regulated versus unregulated relationship reflects the combination of the regulated Coralville Lake releases and the unregulated flow from the English River and other local tributaries. The Lone Tree gage represents the reach of the Iowa River from its confluence with the English River to its confluence with the Cedar River. Figure B-17 shows the estimated regulated versus unregulated relationship for the Lone Tree gage. The regulated versus unregulated flow pairs shown are the annual maximum 1-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulation. The regression line was computed based upon the 1993, 2008, and 2013 simulated events (including scaled versions of those events, discussed in Section III.B.2).

d. Iowa River at Wapello, IA. The regulated versus unregulated relationship for the gage located at Wapello, IA, is heavily influenced by the Cedar River which joins the Iowa River upstream of Wapello at Columbus Junction, IA. At Wapello, only 25% of the contributing watershed area is upstream of Coralville Lake. The Wapello gage represents the reach of the Iowa River from its confluence with the Cedar River to its confluence with the Mississippi River. Figure B-18 shows the estimated regulated versus unregulated relationship for the Wapello gage. The regulated versus unregulated flow pairs shown are the annual maximum 1-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulation. The regression line was computed based upon the 1993, 2008, 2013, and 2014 simulated events (including scaled versions of those events, discussed in Section III.B.2).

4. Regulated Flow Frequency Curves. The regulated flow frequency curves were estimated by integrating the regulated versus unregulated relationship with the 1-day or 15-day unregulated VDF curve identified in Section III.B.2

a. Coralville Lake Regulated Flow Frequency Curve. The Coralville Lake regulated flow frequency curve was computed by integrating the 15-day VDF curve (Table B-1) and the regulated versus unregulated relationship (Figure B-15). For flood frequencies less than approximately the 10% ACE (10-year) event, the regulated versus unregulated flow pairs from the period of record HEC-ResSim simulation (plotted using Weibull plotting position) were used to inform the flow frequency estimates, and typically are associated with seasonal maximum release rates for normal flood operations at the reservoir. The resulting regulated flow frequency curve is shown in Figure B-19. Table B-4 provides the existing condition (current water control plans) flow frequency estimates for gage locations along the Iowa River.

Table B-4. Regulated 1-Day Flow and Elevation Frequencies - Alternative 1 Existing Conditions. Based on Period of Record Simulations (1917-2019)

		Gage Location				
Recurrence Interval	Exceedance Probability	Coralville Lake (Elevation, ft)	Coralville Release (Flow, cfs)	Iowa City (Flow, cfs)	Lone Tree (Flow, cfs)	Wapello (Flow, cfs)
1.1-yr	0.9	685.9	4,600	4,600	6,700	17,600
1.4	0.7	686.0	6,000	6,900	10,100	28,400
2-yr	0.5	691.7	10,000	10,000	13,300	36,600
5-yr	0.2	706.9	10,000	10,900	18,900	62,600
10-yr	0.1	709.5	10,000	11,900	26,200	74,500
20-yr	0.05	711.7	18,000	19,500	33,800	86,100
50-yr	0.02	713.7	24,000	25,700	48,100	123,600
100-yr	0.01	715.2	29,700	31,400	55,600	140,600
200-yr	0.005	716.3	35,400	37,100	63,000	157,400
500-yr	0.002	717.6	43,100	44,600	72,900	179,700
1000-yr	0.001	718.4	49,000	50,400	80,400	196,400

b. Iowa City, Lone Tree, and Wapello Regulated Flow Frequency Curves. The regulated flow frequency curves for the gages on the Iowa River below Coralville Lake were similarly computed by integrating the applicable 15-day (Iowa City) or 1-day (Lone Tree, Wapello) VDF curve and the regulated versus unregulated relationship. For flood frequencies less than approximately the 10% ACE (10-year) event, the regulated versus unregulated flow pairs from the period of record HEC-ResSim simulation (plotted using Weibull plotting position) were used to inform the flow frequency estimates. The resulting regulated flow frequency curves are shown in Figure B-20 through Figure B-22. Table B-4 provides the existing condition (current water control plan) flow frequency estimates for gage locations along the Iowa River.

5. Reservoir Elevation Frequency Analysis. The Coralville Lake reservoir elevation frequencies were computed by integrating the outlet works rating curve (USACE, 2001) and the regulated flow frequency curve for flow releases exceeding the maximum regulated condition (release of 21,000 cfs). Plotting position exceedance probability estimates were used for more frequent events when the reservoir utilizes storage to control flows per the release schedule. Figure B-23 shows the resulting reservoir elevation frequency curve. Table B-4 provides the existing condition (current water control plan) flow and elevation frequency estimates for gage locations along the Iowa River.

6. Comparison to Previous Estimates. This section provides a comparison of the regulated flow frequency estimates at Coralville Lake to those published in 2009 and 2002. The primary differences between the estimates relate to the available period of record upon which the flow frequency estimates were based as well as guidance changes in the low outlier censoring methodology utilized (Single versus Multiple Grubbs-Beck).

As shown in Table B-5 the estimated regulated flow frequency values at Coralville Lake increased over the 2009 estimates for the more frequent events due to the inclusion of several additional flood years within the available record, most notably the Floods of 2013, 2014, and 2018. For the rarer frequencies, the 2009 and current estimates converge around the 0.002 probability event due to the more negative skew values computed in this study (see Section III.B.1).

Table B-5. Comparison of Coralville Lake 1-Day Regulated Flow Frequency Estimates (Values in cfs)

Exceedance Probability	Current Study	2009 FFS	2002 Study
0.5	10,000	Not Estimated	8,600
0.1	10,000	10,000	10,000
0.02	24,000	21,300	18,400
0.01	29,700	27,700	21,100
0.005	35,400	34,300	23,900
0.002	43,100	43,300	Not Estimated
0.001	49,000	50,500	Not Estimated

IV. EVALUATION OF ALTERNATIVE WATER CONTROL PLANS

This section provides a description of the alternative plans and an evaluation of the hydraulic impacts associated with the changes to the water control plan for Coralville Lake. Evaluation of the hydraulic impacts is accomplished through plotting of the period of record HEC-ResSim results (peak annual flows and reservoir Elevations) and comparison to the existing conditions (Alternative 1) and unregulated condition, where appropriate. For the purposes of this initial evaluation, estimates of exceedance probability were based on Wiebull plotting position. In addition to evaluating the change in peak annual flow and reservoir elevations, the change in duration of flooding within Coralville Lake was evaluated to assess the change in duration of flooding on flowage easement lands within the reservoir. Regulated flow frequency analysis was performed on the screened final array of alternatives and is discussed in Section III.B (for the existing water control plan) and Section V (for the screened alternatives).

A. Alternative 1 – the "No Action" Alternative

This alternative maintains the current water control plan and facilitates no changes towards the current Iowa River Basin Master Reservoir Regulation Manual for Coralville Lake. Under this baseline alternative, the reservoir would continue to be operated under the current regulation plan.

Summary of the current regulation plan:

- Maintain the normal Conservation Pool level of 683 feet.

- Reservoir releases during normal flood control operations (reservoir elevations between 683 and 707 feet):
  - Growing season maximum release: 6,000 cfs
  - Non-growing season maximum release: 10,000 cfs

- Downstream constraint at Iowa City (flash flood operations): Any date that the flow at the Iowa City gage is at, above, or forecast to exceed 16,000 cfs, reduce the release to not less than 1,000 cfs to keep the flow at or below 16,000 cfs.

- Seasonal downstream constraints as Lone Tree and Wapello: When forecast indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.
  - Growing Season: Release no less than 1,000 cfs when stages at Lone Tree and Wapello exceed 14 and 21 feet, respectively
  - Non-growing Season: Release no less than 1,000 cfs when stages at Lone Tree and Wapello exceed 16 and 22 feet, respectively

- Downstream constraint at Burlington: Any date the Mississippi River is forecast to exceed a stage of 18 feet at Burlington, Iowa, reduce the release to not less than 1,000 cfs during the peak 7-days of the Mississippi River crest with due allowance for travel time.

- LMF begin at elevation 707 feet with 71.5 percent of flood storage capacity being utilized. Prescribed releases, as seen in Table B-6 are followed between elevations 707 and 712 feet and all constraints are relaxed.

Table B-6. Alternative 1 LMF Operations

<table>
<tr><th>Forecasted Peak Pool Elevation (ft)</th><th>Growing Season Release (cfs)</th><th>Non-growing Season Release (cfs)</th></tr>
<tr><td>707</td><td>7,000</td><td>10,000</td></tr>
<tr><td>708</td><td>8,000</td><td>10,000</td></tr>
<tr><td>709</td><td>9,000</td><td>10,000</td></tr>
<tr><td>710</td><td colspan="2">10,000</td></tr>
<tr><td>711</td><td colspan="2">11,000</td></tr>
<tr><td>711.1</td><td colspan="2">12,000</td></tr>
<tr><td>711.2</td><td colspan="2">13,000</td></tr>
<tr><td>711.3</td><td colspan="2">14,000</td></tr>
<tr><td>711.4</td><td colspan="2">15,000</td></tr>
<tr><td>711.5</td><td colspan="2">16,000</td></tr>
<tr><td>711.6</td><td colspan="2">17,000</td></tr>
<tr><td>711.7</td><td colspan="2">18,000</td></tr>
<tr><td>711.8</td><td colspan="2">19,000</td></tr>
<tr><td>711.9</td><td colspan="2">20,000</td></tr>
<tr><td>712</td><td colspan="2">Gates Fully Open</td></tr>
</table>

B. Alternative 2

This alternative incorporates elements of recent deviations that include a 10,000 cfs year-round release during normal flood operations, tiered downstream constraints with variable minimum releases, altered dates for seasonal downstream constraints and a modified major flood operation schedule eliminating induced surcharge operation. The normal conservation pool will be maintained within a 1-foot operating band between elevations 683 and 684 feet, with an allowable fall pool level up to 688 feet, and a spring drawdown to elevation 679 feet.

Summary of the modifications to the existing Coralville regulation plan:

- Elimination of growing season release reduction, holding a maximum of 10,000 cfs all year
- Tiered, seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases
  - Growing Season:
    - Release a maximum of 6,000 cfs when the stages at Lone Tree and Wapello reach 16 feet and 22 feet, respectively
    - Release a maximum of 1,000 cfs when the stages at Lone Tree and Wapello reach 19 feet and 25 feet, respectively
  - Non-Growing Season: Release a maximum of 1,000 cfs when the stages at Lone Tree and Wapello reach 19 feet and 25 feet, respectively
- No changes to the Iowa City and Burlington downstream constraints
- Altered dates for seasonal downstream constraint changes
- Modified LMF Operations release schedule, detailed in Table B-7, and elimination of "Induced Surcharge Operation"

Table B-7. Alternative 2 LMF Operations

Forecasted Peak Pool Elevation (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

The results of the HEC-ResSim simulations for Alternative 2 are shown in Figure B-24 through Figure B-27. As shown, Alternative 2 reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flows exceeding the 10% to 4% ACE (10- to 25-year) event. In addition, Alternative 2 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to two (1993 and 2008). Alternative 2 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet.

However, the flows for Alternative 2 are higher than those seen for Alternative 1 at Lone Tree, IA and Wapello, IA for frequencies below the 10% to 4% ACE (10- to 25-year) events due to the higher maximum flood control releases from Coralville Lake.

C. Alternative 2A.

This alternative is a variation of Alternative 2. All of the changes made in Alternative 2 are used with the exception of elimination of the spring drawdown to elevation 679 feet.

The results of the HEC-ResSim simulations for Alternative 2A are shown in Figure B-24 through Figure B-27. As shown, Alternative 2A performs similarly to Alternative 2. The frequency of reservoir elevations below elevation 700 feet is slightly higher than those seen in Alternative 2, as the elimination of the spring drawdown causes storage within the flood pool earlier. However, there are few if any differences between Alternative 2 and Alternative 2A above elevation 700 feet.

D. Alternative 2B

This is another variation of Alternative 2, Alternative 2B includes all of the changes made in Alternative 2, except that the tiered growing season downstream constraints are held all year.

The results of the HEC-ResSim simulations for Alternative 2B are shown in Figure B-24 through Figure B-27. As shown, there are few differences between Alternative 2 and Alternative 2B above elevation 707 feet. However, storage within the flood pool occurs more often below elevation 707 feet, as the more aggressive downstream constraints results in reductions in flows occurring more often. However, this alternative reduces the frequency of higher downstream flows at Lone Tree between 16- and 19-feet back to those seen in Alternative 1, as downstream controls are no longer accounting for stages in that range.

E. Alternative 2C

This is another variation of Alternative 2, Alternative 2C includes all of the changes made in Alternative 2 except that the non-growing season downstream constraints are now held all year.

The results of the HEC-ResSim simulations for Alternative 2C are shown in Figure B-24 through Figure B-27. As shown, Alternative 2C further reduces peak water surface elevations in Coralville Lake from those seen in Alternative 2, preserving flood storage over a wider range of exceedance probabilities. The result is a larger reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flood exceeding the 10% to 4% ACE (10- to 25-year) event. However, this alternative increases the frequency of higher downstream flows at Lone Tree between 16- and 19-feet more than Alternative 2, as downstream controls are no longer accounting for stages in that range.

F. Alternative 3

Alternative 3 is the "Maximum Release Plan". This plan provides an envelope for increasing outflows and constraints in relation to alternatives considered. This alternative consists of the following measures:

- No change to the current conservation pool levels, including the spring drawdown
- Reservoir releases are constrained only by the outlet capacity
- No downstream constraints.

The results of the HEC-ResSim simulations for Alternative 3 are shown in Figure B-28 through Figure B-31. As shown, Alternative 3 reduces peak reservoir elevations within Coralville Lake more than Alternatives 1, 2, 2A, and 2B, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flows exceeding the 5% ACE (20-year) event. In addition, Alternative 3 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to one (2008). Alternative 3 also reduces the duration of flood storage events within Coralville Lake for events below 712 feet.

This alternative does increase the magnitude of flows at Iowa City, IA below the 5% ACE (20-year) event, at Lone Tree, IA and Wapello, IA below the 2% ACE (50-year) event. This would result in a higher frequency of flooding for lands downstream of Coralville Lake that are currently protected by Alternative 1, with flows similar than those seen in the unregulated analysis.

G. Alternative 3A

This alternative incorporates the same changes as Alternative 3. However, this is the "Dry Reservoir Scenario". No conservation pool is held at any time, with the exception of holding back floodwaters when inflow exceeds outlet capacity.

The results of the HEC-ResSim simulations for Alternative 3A are shown in Figure B-28 through Figure B-31. As shown, Alternative 3A reduces the peak reservoir elevations within Coralville Lake slightly more than Alternative 3. Frequencies of storage in the flood pool are slightly lower than

Alternative 3, as lack of a flood control pool provides more storage space at lower elevations. As releases exceed 13,000 cfs from Coralville Lake, frequencies seen in Alternative 3A converge with those of Alternative 3.

H. Alternative 4

This alternative is another variation of Alternative 2. However, Alternative 4 includes elevation-based growing season releases to reduce downstream impact in the lower elevations of the Flood Control Pool:

- Maximum growing season release determined by reservoir pool elevation:
  - Below Elevation 700 feet – 8,500 cfs
  - Above Elevation 700 feet – 10,000 cfs
- Non-Growing Season Release – 10,000 cfs

The results of the HEC-ResSim simulations for Alternative 4 are shown in Figure B-32 through Figure B-35. As shown, Alternative 4 reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flows exceeding the 10% to 5% ACE (10- to 20-year) event. Similar to Alternative 2, Alternative 4 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to two (1993 and 2008). Alternative 4 also reduces the duration of flood storage events within Coralville Lake for events below 712 feet.

This alternative does increase the magnitude of flows at Iowa City, IA and Lone Tree, IA below the 5% ACE (20-year) event, Wapello, IA below the 20% ACE (5-year) event.

I. Alternative 4A

Alternative 4A modifies the Alternative 4 plan by allowing a delay of growing season releases if the reservoir water surface elevation is between elevation 700 and 707 feet on May 01. If this criterion is met, 10,000 cfs releases will continue until the water surface elevation returns to Conservation Pool elevation 683 feet, at which point the growing season maximum release schedule in Alternative 4 will begin.

The results of the HEC-ResSim simulations for Alternative 4A are shown in Figure B-32 through Figure B-35. As shown, Alternative 4A is nearly identical to Alternative 4, as there are only three years when the rules differ (1965, 1973, and 1983). The difference between the two alternatives for these three years are negligible and did not have a noticeable effect on the results.

J. Alternative 5

This alternative is another variation of Alternative 2. All of the same changes to the original regulation plan are part of this alternative, with the exception of the maximum growing season release. When the water elevation is below 707 feet, the maximum growing season release is 8,000 cfs.

The results of the HEC-ResSim simulations for Alternative 5 are shown in Figure B-36 through Figure B- 39. As shown, Alternative 5 reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flows exceeding the 10% to 5% ACE (10- to 20-year) event. In addition, Alternative 5 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to two (1993 and 2008). Alternative 5 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet, but less so than other alternatives due to its lower maximum growing season release.

This alternative does increase the magnitude of flows at Lone Tree, IA below the 4% ACE (25-year) event, and at Wapello, IA below the 20% ACE (5-year) event.

K. Alternative 6

Alternative 6 is a stakeholder alternative provided by the Johnson County Iowa Homeland Security (HS) and Emergency Management Agency (EMA). The changes from the existing Coralville Dam regulation plan are as follows:

- Decrease the summer Conservation Pool elevation from 683 feet to 682 feet
- Maximum growing season release changed to 9,000 cfs. No change to maximum non-growing season release.
- Growing season to start on May 20 and end on Dec 01 (changed from May 01 and Dec 15, respectively)
- Raise the Iowa City flow constraint from 16,000 cfs to 16,500 cfs
- Change the Wapello constraint
    - Increase the growing season maximum stage from 21 feet to 23 feet
    - Increase the non-growing season maximum stage from 22 feet to 25 feet
    - Increase the minimum releases from Coralville Dam from 1,000 cfs to 3,000 cfs
- Eliminate the downstream stage constraints at Lone Tree and Burlington
- Altered LMF Release Schedule, detailed in Table B-8, starting at Elevation 705 feet and increasing flows more rapidly

Table B-8. Alternative 6 LMF Operations

Forecasted Peak Pool Elevation (feet)	Release (cfs)
705	11,000
706	12,000
707	13,000
708	15,000
709	16,000
710	18,000
711	20,000
712	Fully Open

The results of the HEC-ResSim simulations for Alternative 6 are shown in Figure B-40 through Figure B-43. As shown, Alternative 6 reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities, more than all alternatives save Alternatives 3, 3A, and 7. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flows exceeding the 5% ACE (20-year) event. In addition, Alternative 6 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to two (1993 and 2008). Alternative 6 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet.

This alternative does increase the magnitude of flows at Lone Tree, IA and Wapello, IA below the 4% ACE (25-year) event.

L. Alternative 7

Alternative 7 is a stakeholder alternative provided by the Two Rivers Levee & Drainage District, which is located in Louisa and Des Moines Counties, downstream of Wapello, Iowa. The changes from the existing Coralville Dam regulation plan are as follows:

- Decrease the summer Conservation Pool elevation from 683 feet to 682 feet
- Reservoir releases only constrained by the capacity of the outlet, up to a maximum release of 16,500 cfs. Above that flow, follow the existing LMF Release Schedule from Alternative 1
- Change the Wapello constraint
    - Increase the growing season maximum stage from 21 feet to 23 feet
    - Increase the non-growing season maximum stage from 22 feet to 25 feet
- Increase the stage constraint at Burlington on the Mississippi River from 18 feet to 20 feet
- Eliminate the stage constraint at Lone Tree
- No change to the flow constraint and Iowa City

The results of the HEC-ResSim simulations for Alternative 7 are shown in Figure B-44 through Figure B-47. As shown, Alternative 7 reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities. Only Alternatives 3 and 3A preserve more storage than this alternative. The reduction in frequency of exceeding elevation 707 results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA for flows exceeding the 5% ACE (20-year) event. In addition, Alternative 7 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to two (1993 and 2008). Alternative 7 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet.

However, as this alternative does not regulate flows until they exceed 16,500 cfs, flows at the Coralville Dam tailwater downstream through Wapello, IA are higher in magnitude than Alternative 1 for frequencies greater than 10% to 5% ACE (10- to 20-year) events. This would result in a higher frequency of flooding for lands downstream of Coralville Lake that are currently protected by Alternative 1, with flows similar than those seen in the unregulated analysis.

M. Alternative 8

Alternative 8 is similar to Alternative 4 but with the same downstream constraints throughout the entire year and a modified LMF schedule. Details of this alternative include:

- Maximum growing season release determined by reservoir pool elevation:
  - Below Elevation 700 feet – 8,500 cfs
  - Above Elevation 700 feet -10,000 cfs
- Maximum non-growing season release is 10,000 cfs
- Move to a single year-round downstream constraint at Lone Tree and Wapello of 18.5 feet and 25 feet, respectively. These values correspond to the updated moderate flood stages at both gages.
- Altered LMF Release Schedule, detailed in Table B-9, starting at Elevation 707 feet and increase rapidly

Table B-9. Alternative 8 LMF Operations

Forecasted Peak Pool	Release
707	12,000
710	16,000
711	18,000
711.5	20,000
712	Fully Open

The results of the HEC-ResSim simulations for Alternative 8 are shown in Figure B-48 through Figure B-51. As shown, Alternative 8 reduces peak reservoir elevations within Coralville Lake similarly to Alternatives 2 and 4, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, IA, for flows exceeding the 10% to 5% ACE (10- to 20-year) events. In addition, Alternative 8 reduces the number of simulated events with uncontrolled spillway releases from three (1993, 2008, and 2013) to two (1993 and 2008). Alternative 8 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet.

However, the flows for Alternative 8 are higher than those seen for Alternative 1 at Lone Tree, IA and Wapello, IA for frequencies below the 10% (10- year) events due to the higher maximum flood control releases from Coralville Lake.

V. REGULATED FLOW FREQUENCY ANALYSIS OF FINAL ARRAY OF ALTERNATIVES

Regulated flow frequency estimates were developed for the final array of alternatives – Alternatives 1, 2C, 5, and 8. The regulated flow frequency values for Alternative 1 are contained in Section III.B. This section presents the results of the regulated flow frequency analysis for Alternatives 2C, 5 and 8. The methodology used to develop the regulated flow frequencies was the same as used for Alternative 1, therefore this section simply presents the results of the analyses, refer to Section III.B for a more detailed description of methodology.

A. VDF Analysis

The VDF analysis was performed on the simulated, period of record, unregulated flows for each gage location using HEC-SSP and is the same for all Alternatives. Table B-1 shows the computed VDF statistics for each gage and duration on the Iowa River.

B. Duration Selection

The peak unregulated flow volumes (for each duration) versus the peak annual 1-day regulated flow based upon the existing condition HEC-ResSim simulation for the period of record flows were plotted to determine if there was a justification for using a different critical duration for Alternative 2C, 5 or 8 then was selected for Alternative 1. Figure B-52 through Figure B-55 show, for each alternative, the plotted relationship between the 1-day regulated annual maximum flow versus the 15-day (Coralville Lake and Iowa City gages) or 1-day (Lone Tree and Wapello gages) unregulated annual maximum flow volumes. To assist in evaluation of the durations, additional scaled events were included to evaluate performance of the durations for rare flood events. Multipliers of 1.25, 1.5, and 1.75 were applied to the 1993, 2008, 2013, and 2014 (Wapello only) flood events using the “Inflow Multipliers” option within HEC-ResSim. The use of multiple major flood events provided for additional data points to capture the influence of varying hydrograph shapes on regulated peak flow releases.

Based upon review of the plotted results, the decision was made to proceed with use of the same critical durations as selected for Alternative 1.

C. Regulated versus Unregulated Relationship

The regulated versus unregulated relationship is used to compute the annual maximum 1-day regulated frequency curve from the critical duration annual maximum unregulated volume frequency curve. In order to estimate the regulated versus unregulated relationship for rarer events, the regression line was computed based upon the 1993, 2008, 2013 and 2014 (Wapello only) simulated events, including scaled versions of those events as discussed in Section III.B.2, *Duration Selection*.

1. Coralville Lake. Figure B-52 shows the estimated regulated versus unregulated relationships for Coralville Lake for each alternative. The regulated versus unregulated flow pairs shown are the annual maximum 15-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulations. For regulated releases in excess of 21,000 cfs, regression lines were computed based upon the 1993, 2008, and 2013 simulated events, including scaled versions of those events as discussed in Section III.B.2, *Duration Selection*.

2. Iowa River at Iowa City, IA. Figure B-53 shows the estimated regulated versus unregulated relationships for Iowa City for each alternative. The regulated versus unregulated flow pairs shown are the annual maximum 15-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulations.

3. Iowa River at Lone Tree, IA. Figure B-54 shows the estimated regulated versus unregulated relationships for Lone Tree for each alternative. The regulated versus unregulated flow pairs shown are the annual maximum 1-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulations.

4. Iowa River at Wapello, IA. Figure B-55 shows the estimated regulated versus unregulated relationships for Wapello for each alternative. The regulated versus unregulated flow pairs shown are the annual maximum 1-day inflow volume and peak 1-day release from the period of record HEC-ResSim simulations.

D. Regulated Flow Frequency Curves

The regulated flow frequency curves were estimated by integrating the regulated versus unregulated relationship with the 1-day or 15-day unregulated VDF curve identified in Section IV, C.

1. Coralville Lake Regulated Frequency Curve. The Coralville Lake regulated flow frequency curve was computed by integrating the 15-day VDF curves (Table B-1) and the regulated versus unregulated relationships (Figure B-52) for each alternative. For flood frequencies less than approximately the 10% ACE (10-year) event, the regulated versus unregulated flow pairs from the period of record HEC-ResSim simulation (plotted using Weibull plotting position) were used to inform the flow frequency estimates, and typically are associated with seasonal maximum release rates for normal flood operations at the reservoir. The resulting regulated flow frequency curves are shown in Figure B-56 through Figure B-58. Table B-10 through Table B-12 provide the flow frequency estimates for Alternatives 2C, 5, and 8 at gage locations along the Iowa River.

Table B-10. Regulated 1-Day Flow and Elevation Frequencies - Alternative 2C

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow, cfs)**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	685.7	4,600	4,600	6,700	17,600
1.4	0.7	686.0	8,400	8,500	10,100	28,900
2-yr	0.5	686.6	10,000	10,200	14,500	37,800
5-yr	0.2	705.5	10,000	12,500	22,100	63,400
10-yr	0.1	707.2	12,000	14,900	27,000	74,700
20-yr	0.05	709.5	12,000	16,200	36,100	84,500
50-yr	0.02	712.3	20,600	23,000	46,400	121,800
100-yr	0.01	714.5	26,900	29,100	53,900	138,900
200-yr	0.005	715.9	33,300	35,300	61,500	155,900
500-yr	0.002	717.4	41,800	43,500	71,500	178,300
1000-yr	0.001	718.3	48,300	49,800	79,100	195,200

Table B-11. Regulated 1-Day Flow and Elevation Frequencies – Alternative 5

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow,**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	685.7	4,600	4,600	6,700	17,600
1.4	0.7	686.0	8,000	8,000	10,100	28,600
2-yr	0.5	689.0	9,400	10,000	14,300	37,800
5-yr	0.2	705.6	10,000	12,200	22,200	62,900
10-yr	0.1	707.8	12,000	14,200	27,000	75,600
20-yr	0.05	709.4	14,000	17,200	35,100	87,800
50-yr	0.02	712.9	21,600	23,500	47,100	122,700
100-yr	0.01	714.7	27,700	29,500	54,600	139,600
200-yr	0.005	716.0	33,900	35,600	62,100	156,500
500-yr	0.002	717.4	42,100	43,700	72,000	178,800
1000-yr	0.001	718.4	48,400	49,900	79,600	195,500

Table B-12. Regulated 1-Day Flow and Elevation Frequencies – Alternative 8

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow,**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	685.7	4,600	4,600	6,700	17,600
1.4	0.7	686.0	8,400	8,500	10,100	28,900
2-yr	0.5	686.9	9,600	10,000	14,300	37,600
5-yr	0.2	705.6	10,000	12,000	22,100	63,400
10-yr	0.1	707.5	12,000	14,400	26,800	74,300
20-yr	0.05	709.8	12,000	16,400	36,100	84,500
50-yr	0.02	712.7	21,100	23,400	46,500	122,300
100-yr	0.01	714.6	27,300	29,400	54,100	139,300
200-yr	0.005	715.9	33,400	35,400	61,600	156,200
500-yr	0.002	717.3	41,600	43,400	71,700	178,500
1000-yr	0.001	718.3	47,900	49,500	79,300	195,200

2. Iowa City, Lone Tree, and Wapello Regulated Flow Frequency Curves. The regulated flow frequency curves for the gages on the Iowa River below Coralville Lake were similarly computed by integrating the applicable 15-day or 1-day VDF curve and the regulated versus unregulated relationship. For flood frequencies less than approximately the 10% ACE (10-year) event, the regulated versus unregulated flow pairs from the period of record HEC-ResSim simulation (plotted using Weibull plotting position) were used to inform the flow frequency estimates. The resulting regulated flow frequency curves are shown in Figure B-59 through Figure B-67. Table B-10 through Table B-12 provide the flow frequency estimates for Alternatives 2C, 5, and 8 at gage locations along the Iowa River.

E. Reservoir Elevation Frequency Analysis

The Coralville Dam reservoir elevation frequencies were computed by integrating the outlet works rating curve and the regulated flow frequency curve for flow releases exceeding the maximum regulated condition (release of 21,000 cfs). Plotting position exceedance probability estimates were used for more frequent events when the reservoir utilizes storage to control flows per the release schedule. Figure B-68 through Figure B-70 shows the resulting reservoir elevation frequency curves for Alternatives 2C, 5, and 8.

VI. HYDROLOGIC SENSITIVITY ANALYSIS

A. Period of Record Adjustment

As discussed in the recommendations of Appendix A, the latter, wetter, period of the record was evaluated to test the hydrologic sensitivity of the regulated flow frequency estimates and subsequent economic analysis. The general methodology used to develop the regulated flow frequencies for the 1959-2019 period was the same as used for the full period of record, therefore this section focusses on any differences and presents the results of the analyses; refer to Section III.B for a more detailed description of the methodology used in computation of the regulated flow frequencies.

B. Regulated Flow Frequency Analysis

The HEC-ResSim model results (unregulated flows as well as computed daily regulated flows and reservoir elevations) for the years 1959 to 2019 were used to compute the regulated flow frequency estimates for the existing and alternative water control plans. Due to the presence of high flows during the fall in some years, calendar year was used for the regulated flow frequency analyses instead of water year.

1. VDF Analysis. A VDF analysis was performed on the simulated, 1959 to 2019, unregulated flows for each gage location using HEC-SSP. Analyses for the 1, 3, 5, 7, 10, and 15-day peak annual durations were conducted. For most location and duration combinations, the Multiple Grubbs-Beck test identified no, or a single, low outliers. However, for some durations, particularly for the Lone Tree Gage, 10 or more low outliers were identified. This resulted in computed standard deviation and skew values significantly different than those computed for other durations as well as at the surrounding gages. As a result, the low outlier test for these location-duration combinations were overridden (resulting in fewer outliers) based upon a visual evaluation of the plotted data in order to produce regionally, and gage consistent, VDF curves.

Table B-13 shows the computed VDF statistics for each gage and duration on the Iowa River. To obtain VDF curves that are consistent for a particular gage, the computed statistics were adjusted in the same manner as described in Section III.B.1. The resulting adjusted skew values ranged from -0.31 to -0.47 (compared to the period of record range of -0.23 to -0.37). While the adjustment methodology utilized was the same as for the period of record analysis, the differences in skews relate to the shortened record utilized.

Table B-13. Iowa River VDF Statistics of log10 Unregulated Annual Maximum Flows

Gage	Duration	Mean	StdDev	Skew	Outliers	$StdDev_{reg}$	Regional Skew
Coralville Release	1-Day	4.124	0.281	-0.445	0	0.283	-0.306
	3-Day	4.078	0.286	-0.396	0	0.286	-0.329
	5-Day	4.046	0.291	-0.440	0	0.289	-0.352
	7-Day	4.016	0.291	-0.475	0	0.291	-0.375
	10-Day	3.977	0.295	-0.519	0	0.294	-0.410
	15-Day	3.925	0.296	-0.546	0	0.298	-0.467
Iowa City	1-Day	4.152	0.276	-0.403	0	0.278	-0.306
	3-Day	4.099	0.283	-0.391	0	0.283	-0.329
	5-Day	4.064	0.289	-0.461	0	0.287	-0.352
	7-Day	4.034	0.292	-0.522	0	0.290	-0.375
	10-Day	3.995	0.295	-0.546	0	0.294	-0.410
	15-Day	3.943	0.296	-0.573	1	0.299	-0.467
Lone Tree	1-Day	4.298	0.272	-0.115	0	0.275	-0.306
	3-Day	4.251	0.276	-0.230	0	0.275	-0.329
	5-Day	4.199	0.276	-0.257	0	0.275	-0.352
	7-Day	4.167	0.276	-0.287	0	0.275	-0.375
	10-Day	4.124	0.276	-0.330	0	0.275	-0.410
	15-Day	4.068	0.277	-0.377	0	0.276	-0.467
Wapello	1-Day	4.677	0.262	-0.186	0	0.267	-0.306
	3-Day	4.644	0.263	-0.21	0	0.265	-0.329
	5-Day	4.605	0.263	-0.231	0	0.262	-0.352
	7-Day	4.575	0.264	-0.308	0	0.261	-0.375
	10-Day	4.539	0.261	-0.36	0	0.258	-0.410
	15-Day	4.490	0.260	-0.413	0	0.255	-0.467

The resulting unregulated volume-frequency values for the 1-day and critical durations (if different) are shown in Table D-14.

Table B-14. Iowa River Unregulated Annual Maximum Flow (cfs) versus Exceedance Probability

		Exceedance Probability						
Gage	**Duration**	**0.5**	**0.1**	**0.02**	**0.01**	**0.005**	**0.002**	**0.001**
Coralville	1-Day	13,750	29,900	45,410	52,170	59,000	68,160	75,180
	15-Day	8,870	19,420	28,800	32,670	36,440	41,300	44,880
Iowa City	1-Day	14,680	31,520	47,550	54,500	61,520	70,900	78,080
	15-Day	9,250	20,330	30,200	34,260	38,230	43,350	47,130
Lone Tree	1-Day	20,510	43,650	65,520	74,980	84,510	97,230	106,950
Wapello	1-Day	49,040	102,190	151,670	172,930	194,270	222,660	244,270

2. Duration Selection. The duration of the annual maximum unregulated flow frequency curve to use in computing the regulated frequency curve depends on the relative effects of Coralville Lake reservoir storage on reducing flood flows at downstream locations. Reduction in the period of record utilized for the sensitivity analysis does not alter the critical duration determined based on the period of record analysis.

Per Section III.B.2, *Duration Selection,* for the Coralville Lake release and the Iowa City gage, the 15-day unregulated flow duration was selected. For the Lone Tree and Wapello gages, the 1-day unregulated flow duration was selected due to the significant influence of unregulated tributary flow affecting these gages.

3. Regulated versus Unregulated Relationship. The regulated versus unregulated relationships associated with each alternative does not change as a result of utilizing a shortened period of record in this analysis. Development of the regulated versus unregulated relationships for the base and alternative water control plans are described in Sections III.B.3 and V.C.

4. Regulated Flow Frequency Curves. The regulated flow frequency curves were estimated by integrating the regulated versus unregulated relationship with the 1-day or 15-day unregulated VDF curve.

a. Coralville Lake Regulated Flow Frequency Curve. The Coralville Lake regulated flow frequency curve was computed by integrating the (1959-2019) 15-day VDF curve (Table B-13) and the regulated versus unregulated relationship (Figure B-10 through Figure B-11). For flood frequencies less than approximately the 10% ACE (10-year) event, the regulated versus unregulated flow pairs from the period of record HEC-ResSim simulation (plotted using Weibull plotting position) were used to inform the flow frequency estimates, and typically are associated with seasonal maximum release rates for normal flood operations at the reservoir. The resulting regulated flow frequency curves for each alternative are shown in Figure B-71 to Figure B-74. Table B-15 through Table B-18 provide the existing condition (current water control plans) and alternative flow frequency estimates for gage locations along the Iowa River.

Table B-15. Regulated 1-Day Flow and Elevation Frequencies - Alternative 1 Existing Conditions. Based on 1959-2019 Simulations

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow,**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	686.0	5,100	5,300	7,700	21,100
1.4-yr	0.7	689.3	6,700	8,100	12,400	28,700
2-yr	0.5	697.6	10,000	10,300	15,700	40,600
5-yr	0.2	708.1	10,000	11,200	23,000	72,700
10-yr	0.1	711.1	12,000	14,500	31,600	80,200
20-yr	0.05	712.6	21,000	22,700	45,800	104,000
50-yr	0.02	715.2	29,300	31,700	56,200	141,000
100-yr	0.01	716.2	35,200	37,500	64,600	161,000
200-yr	0.005	717.2	40,900	43,300	73,000	180,000
500-yr	0.002	718.4	48,300	50,700	84,300	206,000
1000-yr	0.001	719.1	53,800	56,100	92,900	226,000

Table B-16. Regulated 1-Day Flow and Elevation Frequencies - Alternative 2C. Based on 1959-2019 Simulations.

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow,**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	686.0	5,200	5,300	7,800	21,100
1.4-yr	0.7	686.0	10,000	10,300	13,100	31,300
2-yr	0.5	694.2	10,000	10,900	17,800	42,600
5-yr	0.2	707.0	12,000	14,100	26,800	71,900
10-yr	0.1	708.0	12,000	16,000	34,200	81,200
20-yr	0.05	710.5	16,000	17,700	45,000	105,000
50-yr	0.02	714.4	26,500	29,400	54,500	140,000
100-yr	0.01	715.8	33,000	35,800	63,000	159,000
200-yr	0.005	717.0	39,400	42,100	71,600	179,000
500-yr	0.002	718.3	47,600	50,100	83,000	205,000
1000-yr	0.001	719.1	53,700	56,100	91,800	225,000

Table B-172. Regulated 1-Day Flow and Elevation Frequencies - Alternative 5. Based on 1959-2019 Simulations.

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow,**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	686.0	5,200	5,300	7,800	21,100
1.4-yr	0.7	686.4	8,000	9,100	13,100	30,100
2-yr	0.5	696.5	10,000	10,700	16,300	41,900
5-yr	0.2	707.2	12,000	13,400	26,700	71,800
10-yr	0.1	708.8	12,000	14,900	30,500	81,200
20-yr	0.05	711.5	18,000	19,600	41,000	109,000
50-yr	0.02	714.6	27,300	29,800	55,200	140,000
100-yr	0.01	715.9	33,600	36,100	63,600	160,000
200-yr	0.005	717.0	39,800	42,300	72,100	179,000
500-yr	0.002	718.3	47,700	50,200	83,500	206,000
1000-yr	0.001	719.1	53,500	56,100	92,100	225,000

Table B-18. Regulated 1-Day Flow and Elevation Frequencies - Alternative 8. Based on 1959-2019 Simulations.

		Gage Location				
Recurrence Interval	**Exceedance Probability**	**Coralville Lake (Elevation, ft)**	**Coralville Release (Flow,**	**Iowa City (Flow, cfs)**	**Lone Tree (Flow, cfs)**	**Wapello (Flow, cfs)**
1.1-yr	0.9	686.0	5,200	5,300	7,800	21,100
1.4-yr	0.7	686.2	8,500	9,900	13,100	30,500
2-yr	0.5	694.6	10,000	10,700	17,500	42,600
5-yr	0.2	707.0	12,000	13,600	25,300	71,800
10-yr	0.1	708.2	12,000	15,400	34,200	81,200
20-yr	0.05	710.3	18,000	19,500	45,500	106,000
50-yr	0.02	714.5	26,800	29,700	54,700	140,000
100-yr	0.01	715.9	33,100	35,900	63,200	160,000
200-yr	0.005	717.0	39,300	42,000	71,800	179,000
500-yr	0.002	718.2	47,200	49,800	83,200	205,000
1000-yr	0.001	719.0	53,100	55,500	91,900	225,000

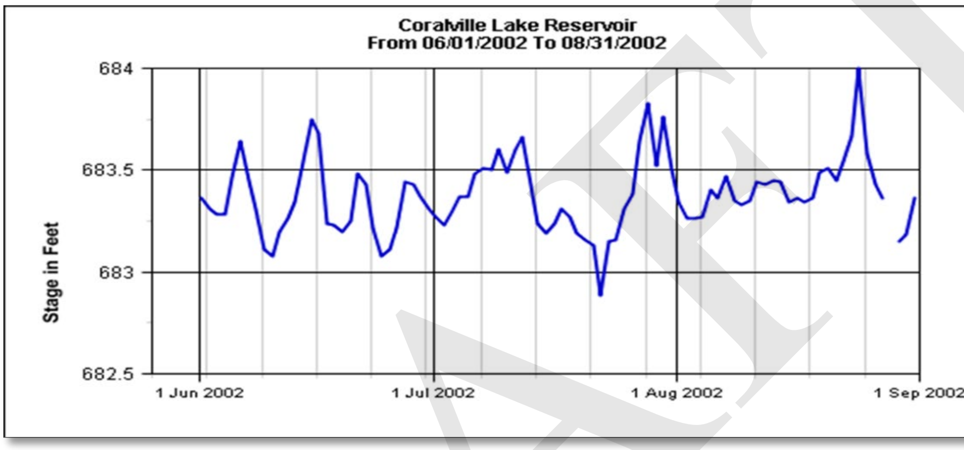
b. Iowa City, Lone Tree, and Wapello Regulated Flow Frequency Curves. The regulated flow frequency curves for the gages on the Iowa River below Coralville Lake were similarly computed by integrating the applicable (1959-2019) 15-day or 1-day VDF curve and the regulated versus unregulated relationship. For flood frequencies less than approximately the 10% ACE (10-year) event, the regulated versus unregulated flow pairs from the period of record HEC-ResSim simulation (plotted using Weibull plotting position) were used to inform the flow frequency estimates. The resulting regulated flow frequency curves for each alternative are shown in Figure B-75 through Figure B-86. Table B-15 through Table B-18 provide the existing condition (current water control plans) and alternative flow frequency estimates for gage locations along the Iowa River.

5. Reservoir Elevation Frequency Analysis. The Coralville Lake reservoir elevation frequencies were computed by integrating the outlet works rating curve and the regulated flow frequency curve for flow releases exceeding the maximum regulated condition (release of 21,000 cfs). Plotting position exceedance probability estimates were used for more frequent events when the reservoir utilizes storage to control flows per the release schedule. Figure B-87 through Figure B-90 show the resulting reservoir elevation frequency curves for each alternative. Table B-15 through Table B-18 provide the existing condition (current water control plans) and alternative flow frequency estimates for gage locations along the Iowa River.

6. Comparison to Period of Record Estimates. Figure B-87 through Figure B-90 show a graphic comparison of the regulated flow and elevation frequency curves along the Iowa River. As shown, the regulated and unregulated flow frequency estimates increase, at all locations, in the 1959 to 2019 record as compared to the full period of record (1917-2019). In general, for rarer events, the estimated frequency of a given peak flow is approximately twice as likely in the 1959 to 2019 record as compared to the full period of record.

VII. ESTABLISHMENT OF AN ALLOWABLE OPERATING BAND AND EVALUATION OF FISH AND WILDLIFE MEASURES

The current operating plan for Coralville Lake utilizes a single elevation to define the conservation pool level to be maintained during normal (non-flood or drought) operations. In reality, the reservoir level fluctuations daily due to natural (rain, wind) and operational (discrete gate settings based upon forecasted flow conditions) reasons. The following chart shows the type of normal fluctuations that occur within the reservoir during non-flooding periods.



As shown above, the reservoir elevation fluctuated within approximately a 1-foot band above the stated conservation pool level of 683 feet. In general, the reservoir is operated to avoid falling below this elevation due to access impacts at infrastructure around the lake and to not impact available conservation storage (used for low-flow augmentation during periods of drought) which has been reduced due to ongoing reservoir sedimentation. In updating the water control plan, it is desired to formally accommodate these fluctuations into an identified operating band (as opposed to continuing to identify a single elevation). Operating within a defined band, as opposed to a single target value, is currently incorporated into the water control plans at the other reservoir and lock and dam projects within the Rock Island District. Use of an operating band accounts for operational uncertainties inherently related to forecasting reservoir inflows as well as provides the operational flexibility to support:

- Completion of routine, minor maintenance activities
- Accommodating minor (short-term) stakeholder requests
- Management for fish and wildlife resources during non-flood or drought periods

Examples of routine, minor maintenance activities include short term reductions in dam releases to accomplish inspection activities (e.g., condition survey of the stilling basin) and similar reductions to facilitate removal of debris from the upstream trash racks. An example of a minor stakeholder request received in the past is to temporarily reduce dam releases to assist search and rescue operations in the river downstream of the reservoir. These types of operations result in short term usage of a small amount of reservoir storage that can immediately be released following the event (often within the same day), while maintaining the reservoir elevation within a defined operating band. Management for fish and wildlife resources during non-flood or drought periods is discussed in the section below.

A. Evaluation of Potential Fish and Wildlife Measures

Operation of Coralville Lake for fish and wildlife resources was authorized as part of the 1958 Fish and Wildlife Coordination Act (Public Law No. 624, 85th Congress). The Act authorizes such operations provided that they are "compatible with the purposes for which the project was authorized." Under the current water control plan, the primary operational consideration included for fish and wildlife management is the allowance for up to a 3-foot fall pool raise to be conducted between September 15 and December 15. As part of this study effort, the study team met with the state and federal resource agency partners to identify potential additional measures to include in the study. The natural resource partners identified the following potential measures:

- Increasing the allowable fall pool raise to provide greater benefits to migratory waterfowl.

- Allowing the fall pool raise to be held through the winter months (ending May 1) to reduce the impacts to herptiles associated with drawing the pool down in mid-December.

- Allowing for not drawing the conservation pool down to 679 in spring to improve conditions for fish in the reservoir.

The identified measures are designed to provide operational flexibilities to support fish and wildlife resources during non-flood or drought periods. Historically, Coralville Lake has been in normal (non-flood or drought) operations in excess of 90% of the time (Figure B-27). By identifying and incorporating operational flexibilities in the form of an operating band (rather than identifying highly specific seasonal operations), the project is better able to support a range of potential management actions and allows for adaptive management. This flexibility is critical due to:

- Fish and wildlife priorities and concerns can and will change over time;

- The same management actions may not be needed or desired every year;

- Opportunities are likely to be dictated by flow conditions within an individual year; and

- Ongoing reservoir sedimentation may change needs and/or opportunities over time

To test whether the potential fish and wildlife measures could be incorporated within a proposed operating band without negatively impacting flood risk management, sensitivity analyses were run in HEC-ResSim by conducting period of record analyses (1917-2019) with the preferred flood risk management plan, Alternative 2C, and using 2 different conservation pool levels: (1) the target reservoir elevation in the current water control plan; and (2) the upper limit of the potential operating band if all of the fish and wildlife measures were incorporated. The results of the analysis are summarized below for each potential measure:

- Increasing the allowable fall pool raise. Raising the allowable fall pool raise by 2 feet in the HEC-ResSim model produced no impact to downstream peak discharges. While fall flood events (or summer events that extend into the fall season) have occurred, the flooding overrides (rather than adds to) the fall pool raise operations. The one year that did show a minor impact was in 2015 where a unique December heavy rainfall event occurred. For this one event, the resulting reservoir elevation would have been increased due to the higher fall pool raise in place at the time of the rain event; however, the resulting peak reservoir elevation was still below that which would have resulted in any increase in reservoir release.

- Holding the fall pool raise through the winter months. Holding the fall pool raise through winter (until March 1) resulted in a few years where the reservoir could not be fully brought down to normal conservation levels before the start of spring flooding. This resulted in higher peak reservoir levels that in one year (2010) resulted in a higher peak reservoir release (in the other impacted years, it resulted in higher reservoir levels but did not change the peak release). Attempting to mitigate this risk (by monitoring snowpack and precipitation forecasts) through proactively drawing the reservoir back down earlier than March 1 would be difficult due to the presence of ice cover on the lake during the winter months. Attempting to draw down the lake with an intact ice cover would result in public safety concerns. For these reasons, this measure is not recommended for implementation.

- Allowing the option to not draw down the reservoir level to 679 feet (4 feet below normal conservation levels). While the value of the storage created by the spring drawdown has been diminished due to reservoir sedimentation, in the right year, it can make a difference. Completely eliminating the 4-foot spring drawdown of the reservoir resulted in one year (1973) where the higher starting conditions resulted in an increase in the peak release from the reservoir. Unlike the winter operations discussed above, the spring reservoir level could be managed in response to observed snow pack, streamflows, and forecasted precipitation to balance needs across the authorized operating purposes (flood risk management, low-flow augmentation, and fish and wildlife management).

B. Recommended Operating Band

Figure B-91 shows the recommended operating limits for Coralville Lake during normal (non-flood or drought) conditions. For much of the year, the allowable operating band would be between elevation 683 and 684 feet; reflecting the range over which reservoir levels have historically been managed. During the late winter and spring (February 15 – May 20), the operating limits would expand to incorporate, but not require, the current spring drawdown to elevation 679 feet. In the fall (15 September through 15 December) the current allowable fall pool raise would be increased by two feet (from elevation 686 feet to elevation 688 feet).

The flexibility in late winter and spring operations would allow for situational management of water levels based upon observed conditions. During wet conditions, characterized by heavier than normal snowpack or significant forecasted rainfall events, the reservoir could be lowered within the band in advance of the runoff to increase available storage. During dry to normal conditions, the normal conservation level (elevation 683 feet) can be maintained to preserve full conservation storage, benefit fish and wildlife, and to improve public safety (in recent years, reservoir sedimentation has result in boaters becoming stuck in the drawn down lake necessitating local rescue response). The flexibility to preserve the normal conservation level during periods of drought has become more critical due to ongoing reservoir sedimentation. Since being placed into operation in 1958, 62% of the available conservation storage below elevation 683 feet has been lost due to sedimentation. Automatically drawing down the lake to elevation 679 would eliminate an additional 54% of the remaining conservation storage available to meet the low-flow augmentation (drought management) mission, greatly reducing the reliability of the project to meet conservation releases during a drought.

VIII. REFERENCES

Eash, D.A., Barnes, K.K., and Veilleux, A.G., 2013, Methods for estimating annual exceedance-probability discharges for streams in Iowa, based on data through water year 2010: U.S. Geological Survey Scientific Investigations Report 2013–5086, 63 p. with appendix. U.S.

U.S. Army Corps of Engineers; 2001; Water Control Manual, Coralville Lake, Iowa River Basin, Coralville, Iowa; Rock Island District, Rock Island, IL.

U.S. Army Corps of Engineers; 2009; Iowa River Regulated Flow Frequency Study; Rock Island District, Rock Island, IL.

Figure B-1. Iowa River Location Map, extending from upstream of Coralville Lake to Burlington, Iowa on the Mississippi River.

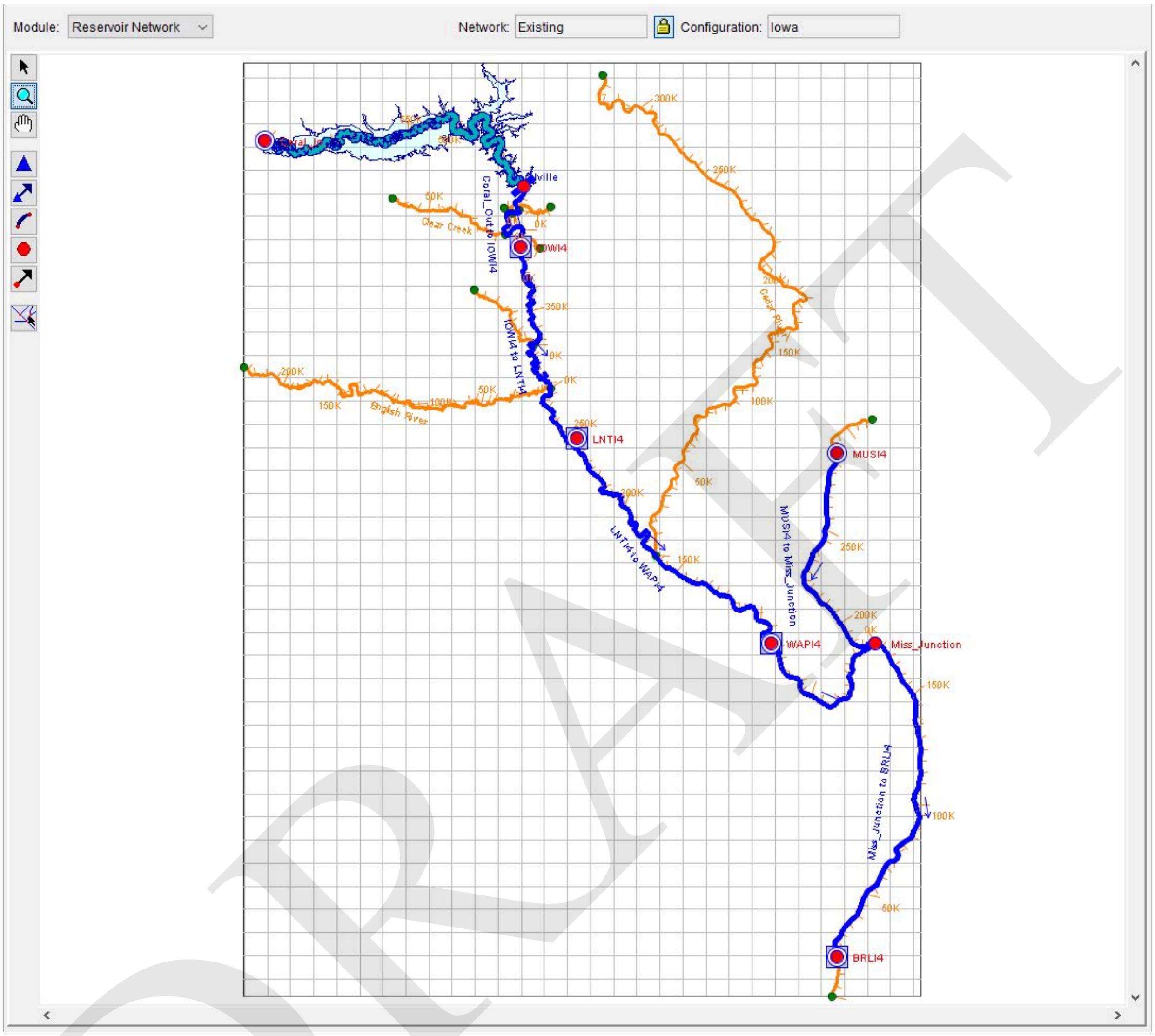


Figure B-2. The HEC-ResSim model schematic for the Existing Conditions between Coralville Lake on the Iowa River and Burlington, Iowa on the Mississippi River. The schematic shows the location of the Coralville Lake inflow and outflow points, as well as the common computation points (CCPs) on the Iowa River at Iowa City (IOWI4), Lone Tree (LNTI4), and Wapello (WAPI4), and on the Mississippi River at Muscatine (MUSI4) and Burlington (BRLI4).

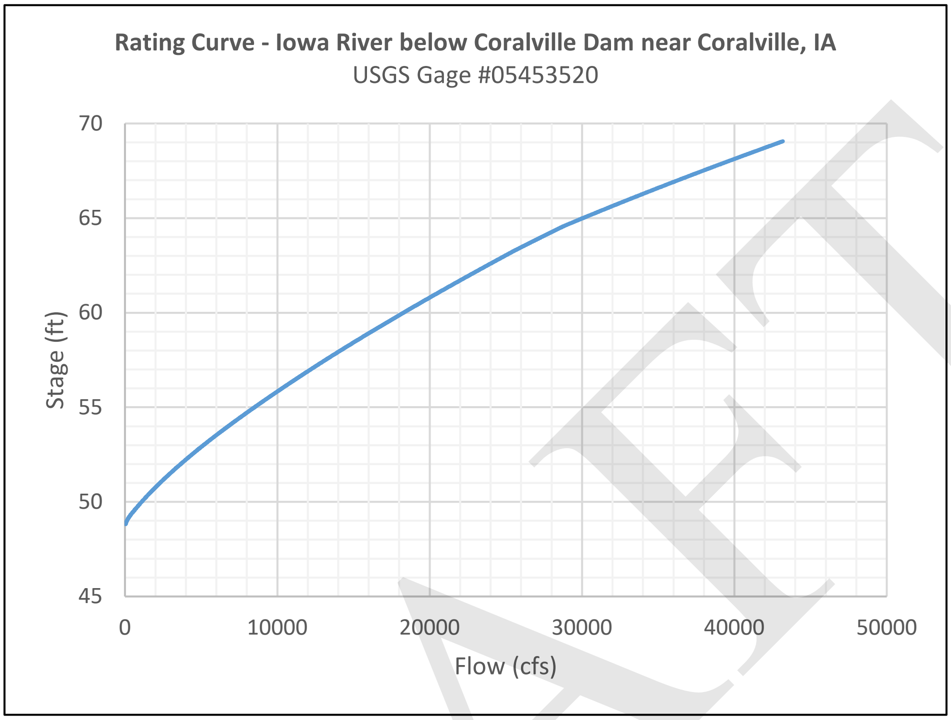


Figure B-3. Rating curve for the Iowa River below Coralville Dam near Coralville, IA, USGS Gage #05453520

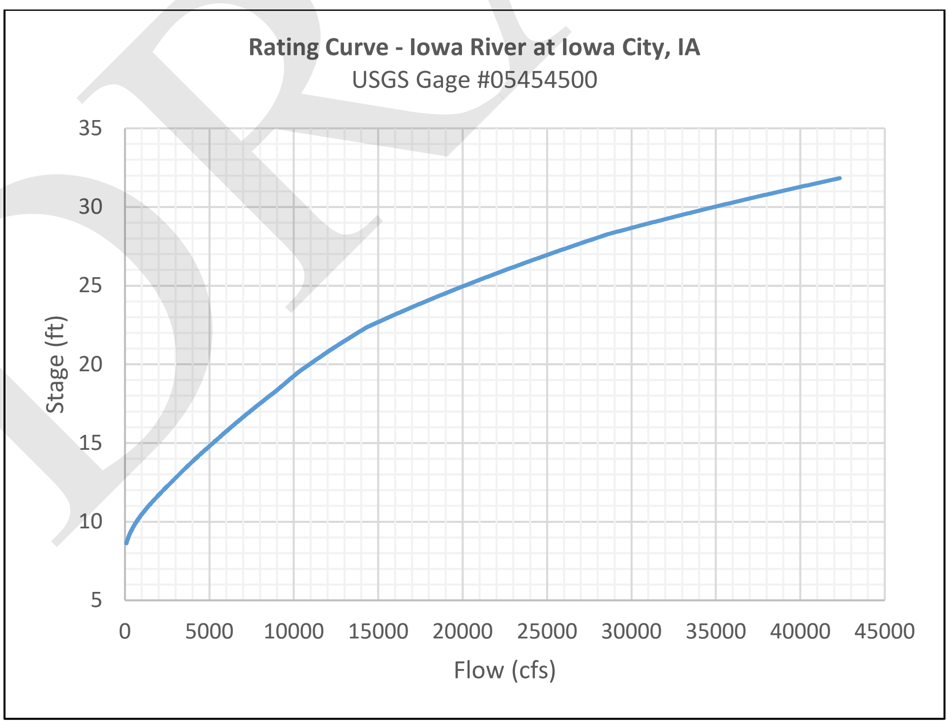


Figure B-4. Rating Curve for the Iowa River at Iowa City, Iowa Gage, USGS Gage #05454500

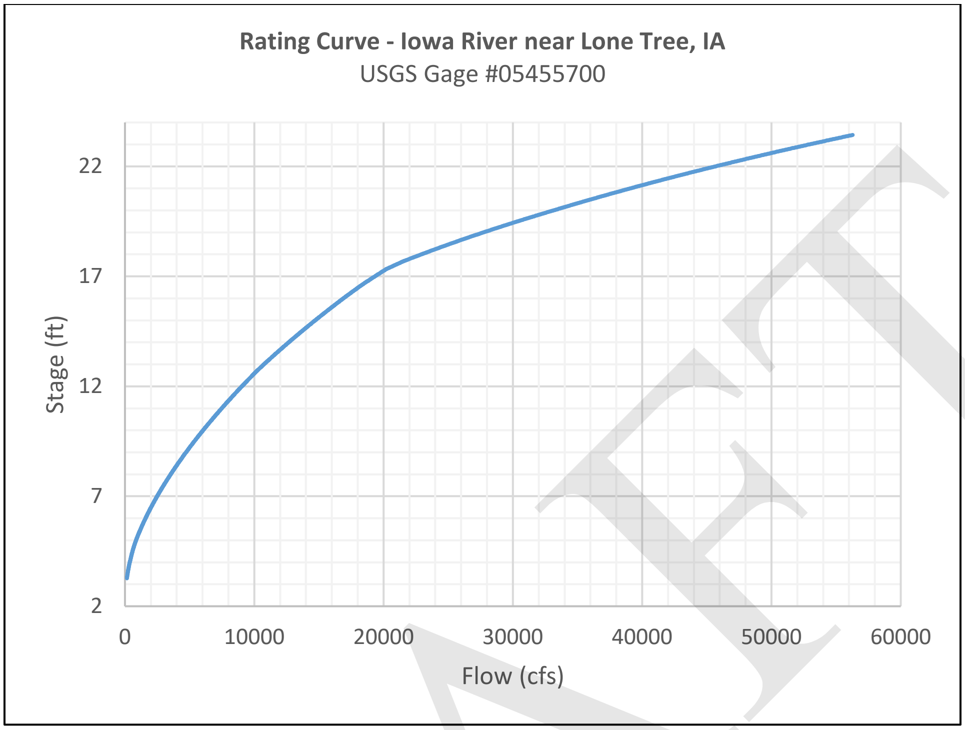


Figure B-5. Rating Curve for the Iowa River near Lone Tree, Iowa Gage, USGS Gage #05455700

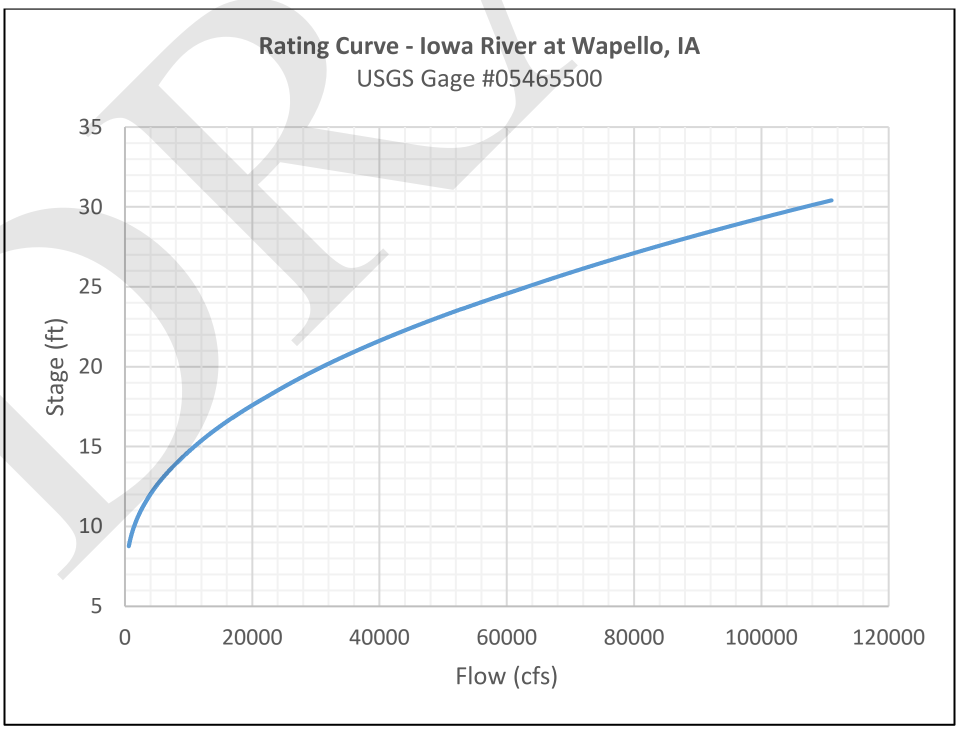


Figure B-6. Rating Curve for the Iowa River at Wapello, IA Gage, USGS Gage #05465500

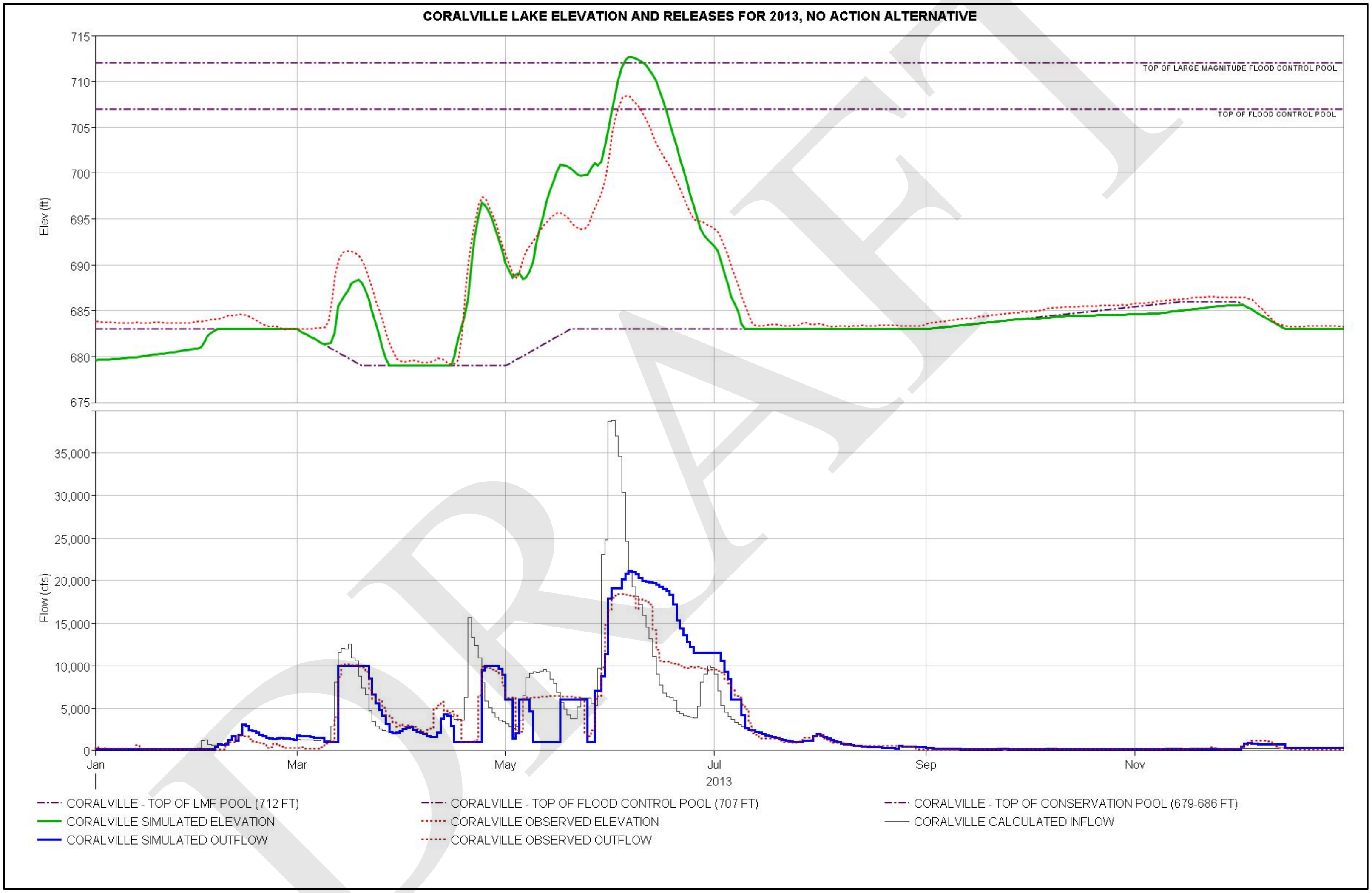


Figure B-7. Coralville Lake reservoir elevation and releases for 2013 calibration. Note the decrease in simulated releases prior to the event peak that was not replicated in the observed data.

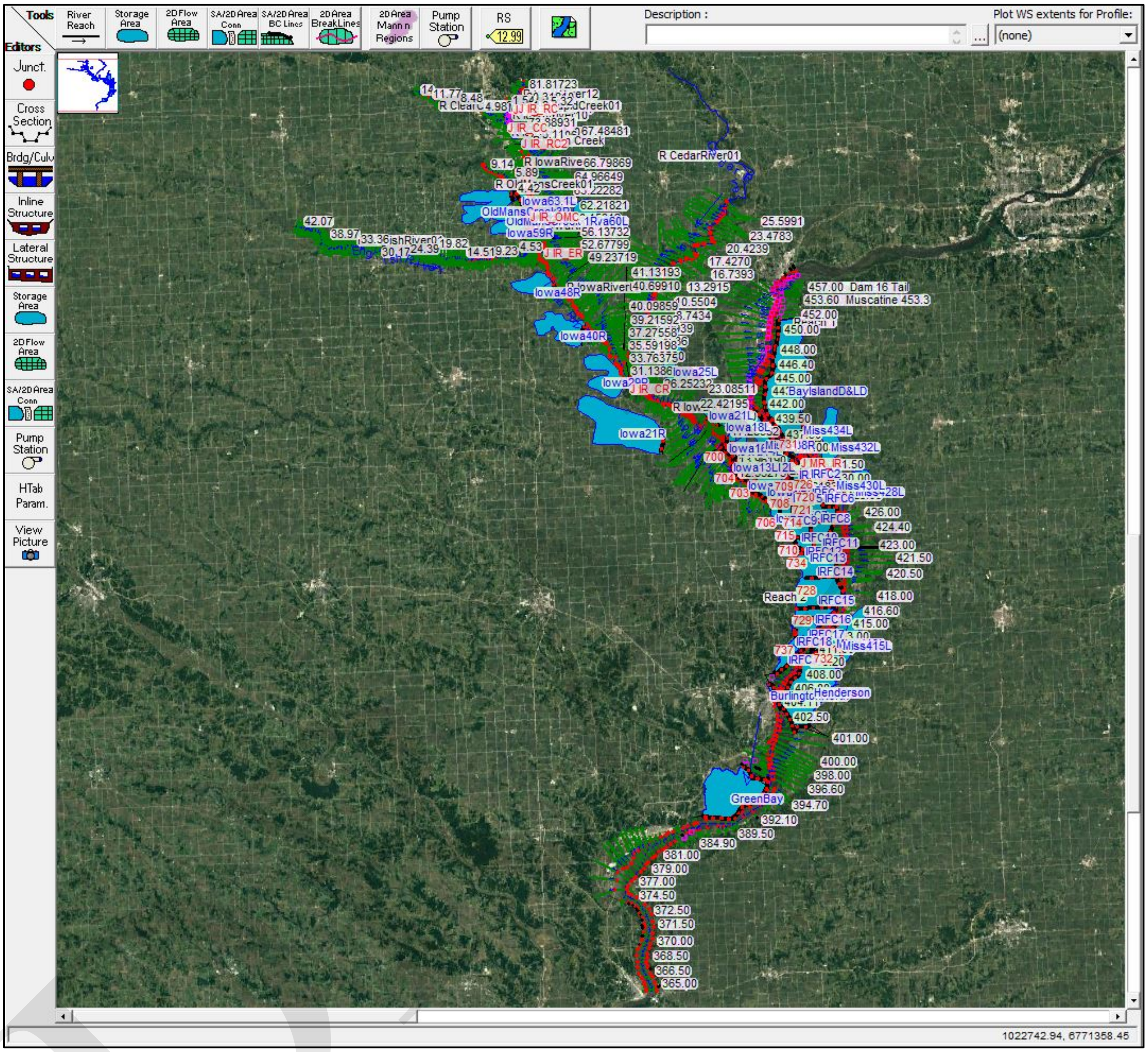


Figure B-8. Overview of the HEC-RAS model geometry. The model spans from immediately downstream of Coralville Dam to the confluence of the Mississippi and Iowa Rivers, and on the Mississippi River from the Dam 16 tailwater to Burlington, Iowa.

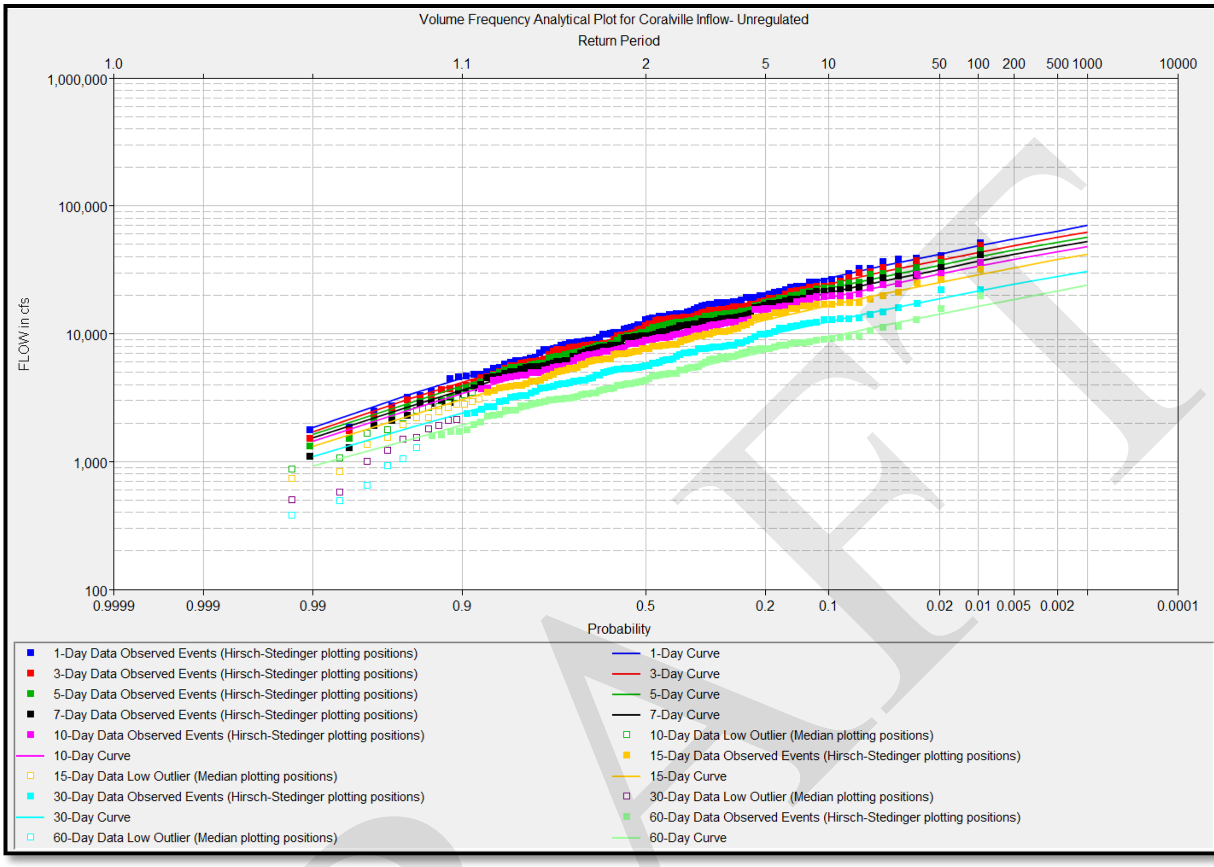
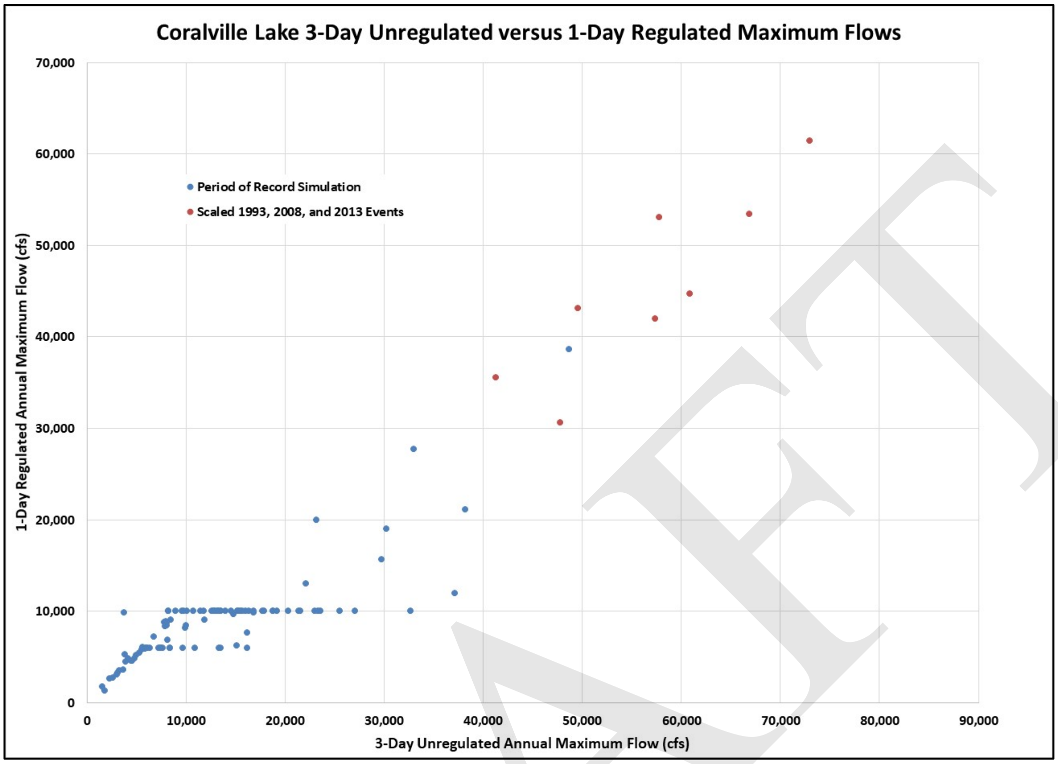


Figure B-9. Coralville Dam VDF Curves



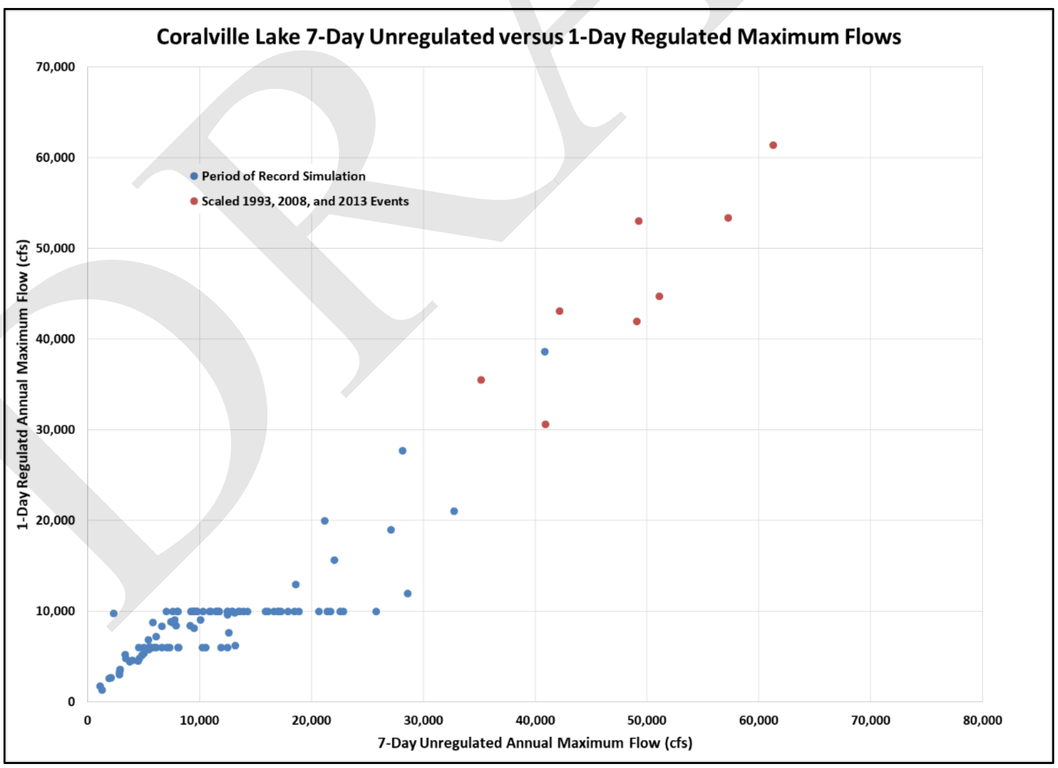
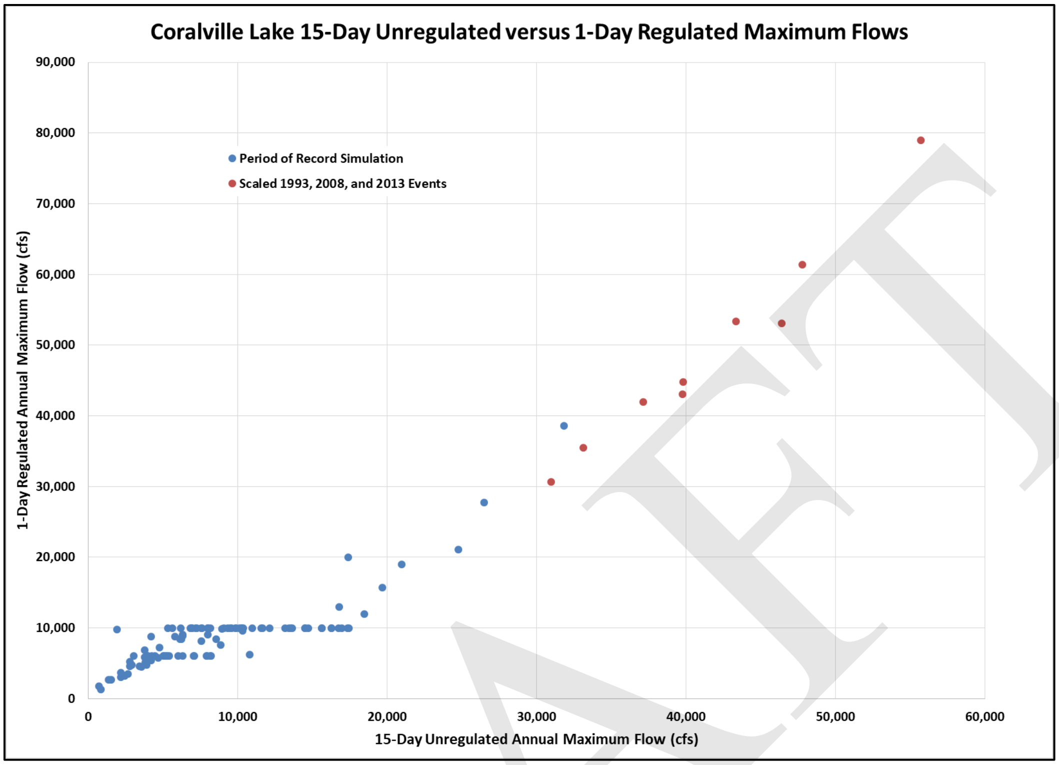


Figure B-10. Coralville Lake 3-Day and 7-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)



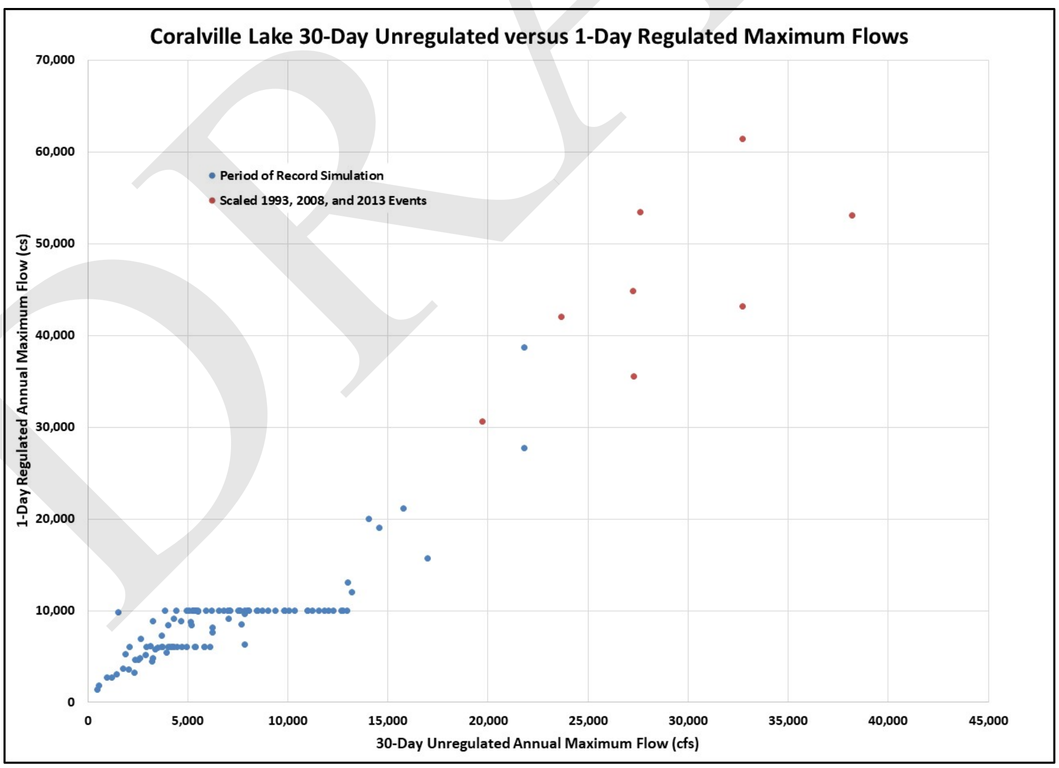
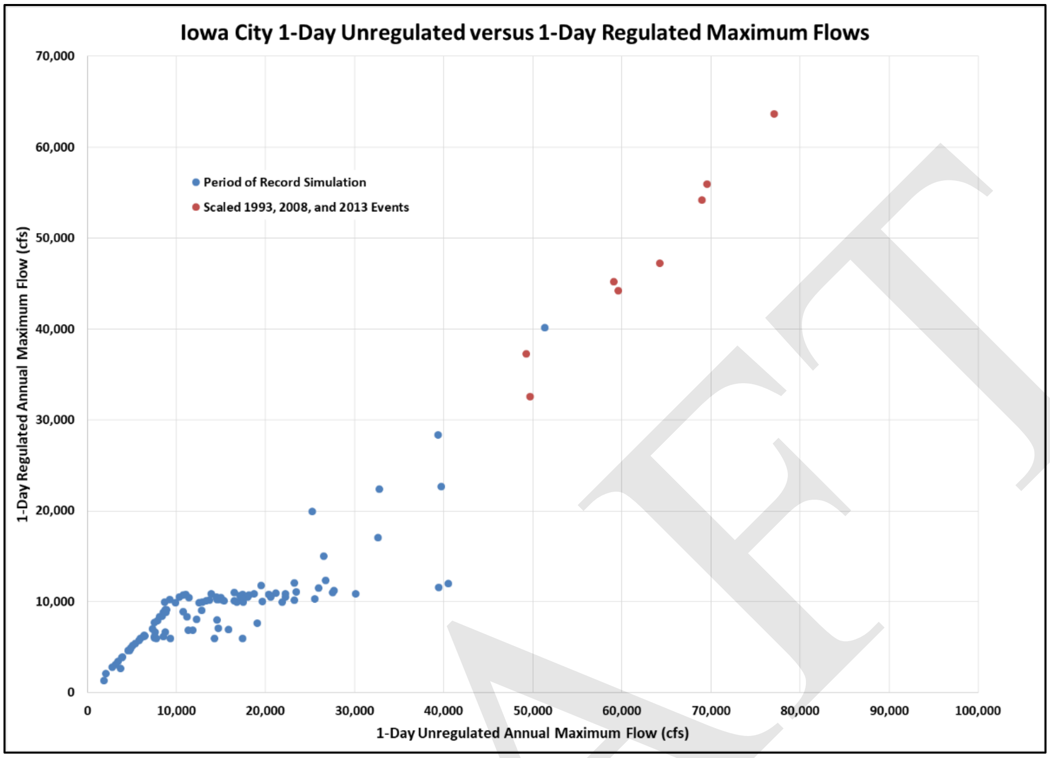


Figure B-11. Coralville Lake 15-Day and 30-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)



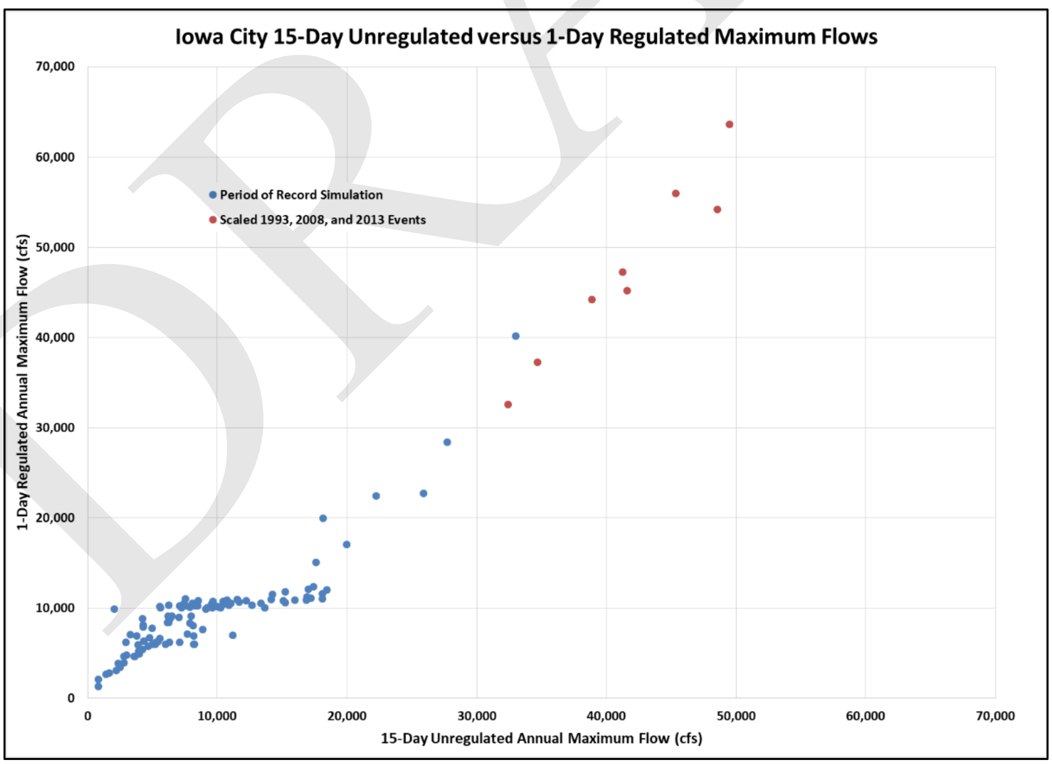
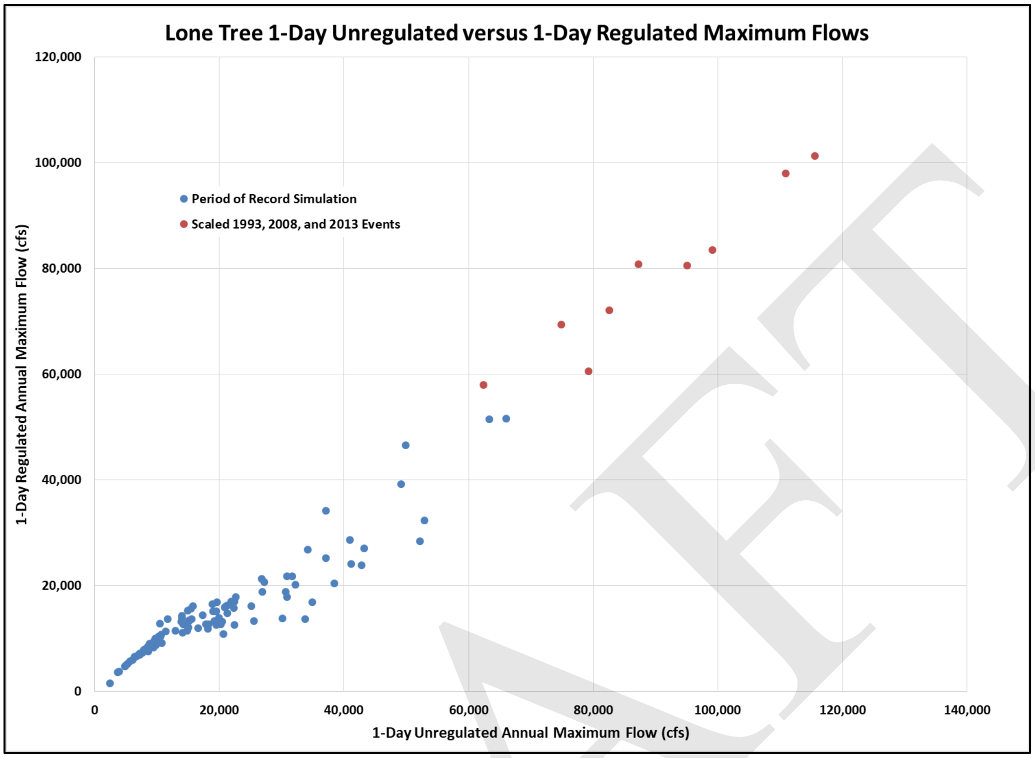


Figure B-12. Iowa River at Iowa City 1-Day and 15-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)



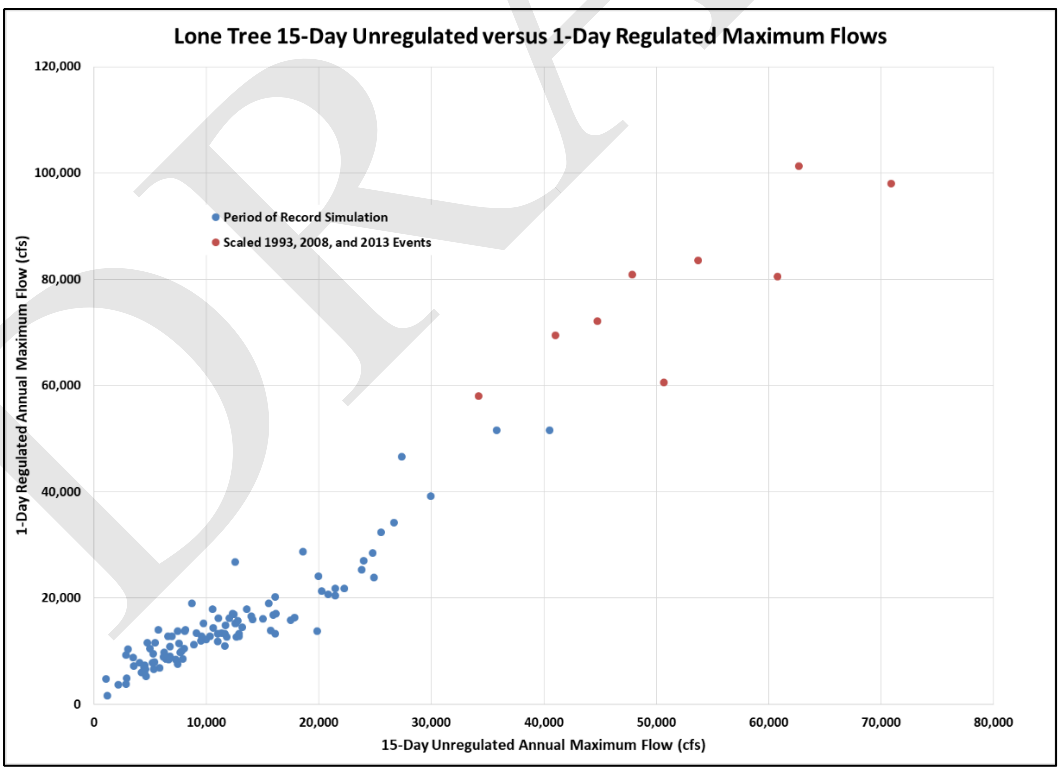


Figure B-13. Iowa River at Lone Tree 1-Day and 15-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)

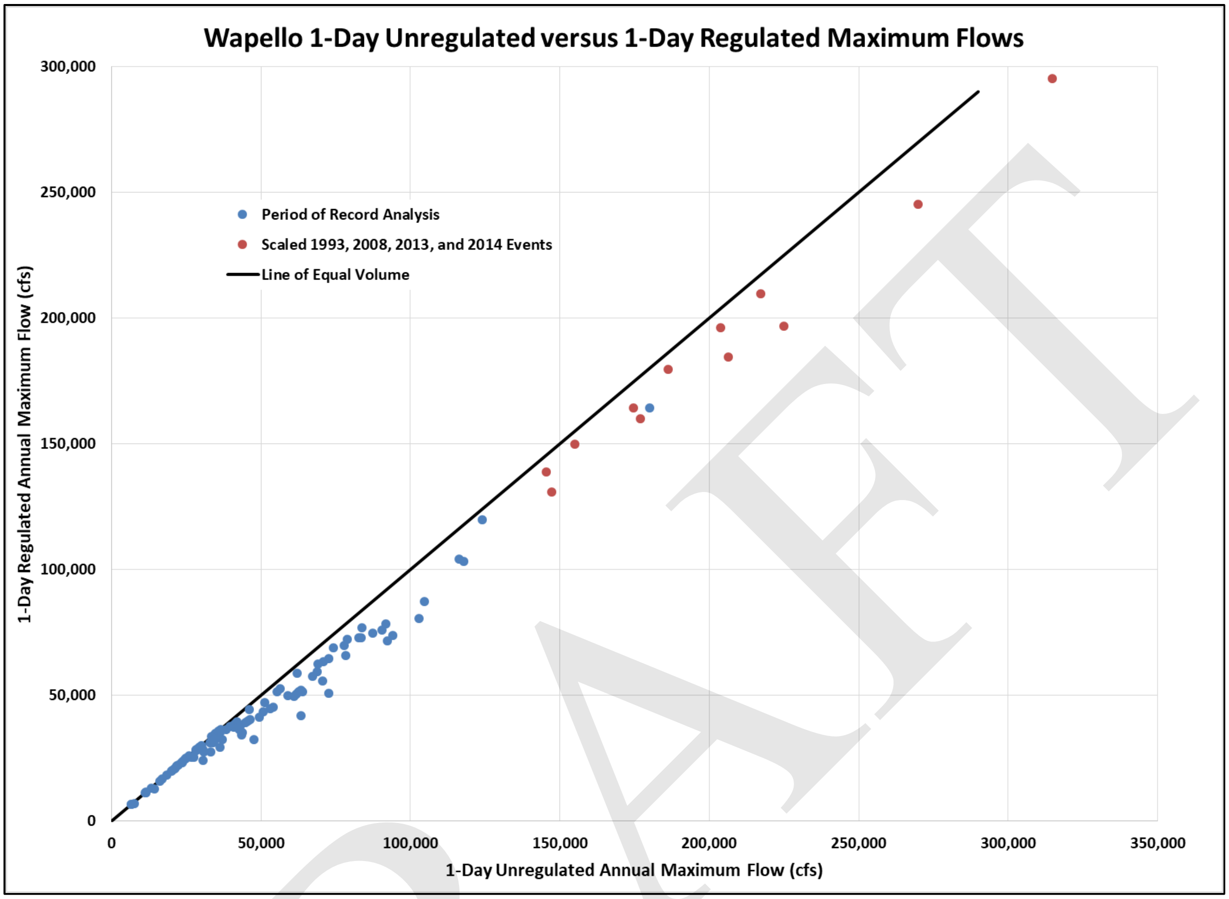


Figure B-14. Iowa River at Wapello 1-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)

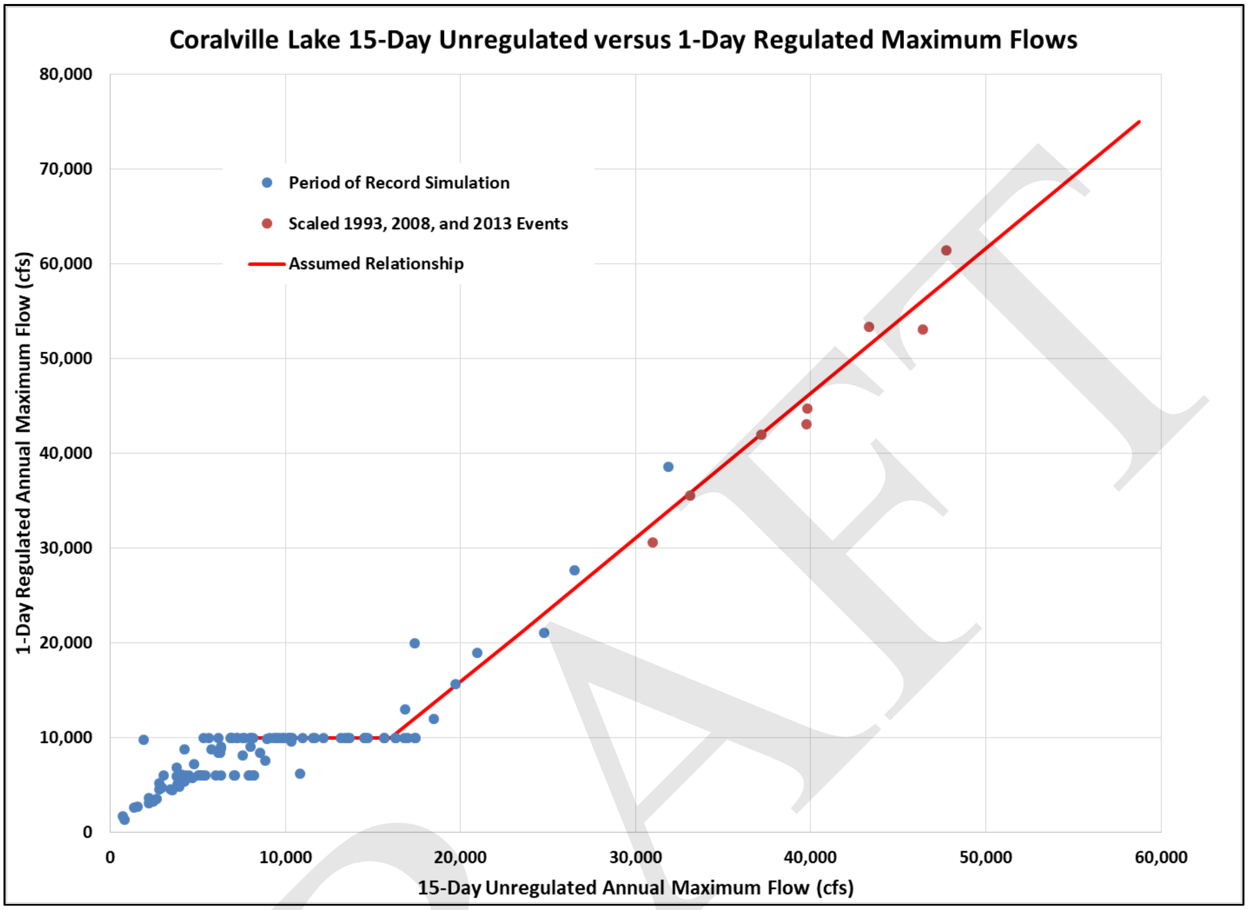


Figure B-15. Coralville Lake 15-Day Unregulated versus 1-Day Regulated Relationship – Existing Water Control Plan (Alternative 1)

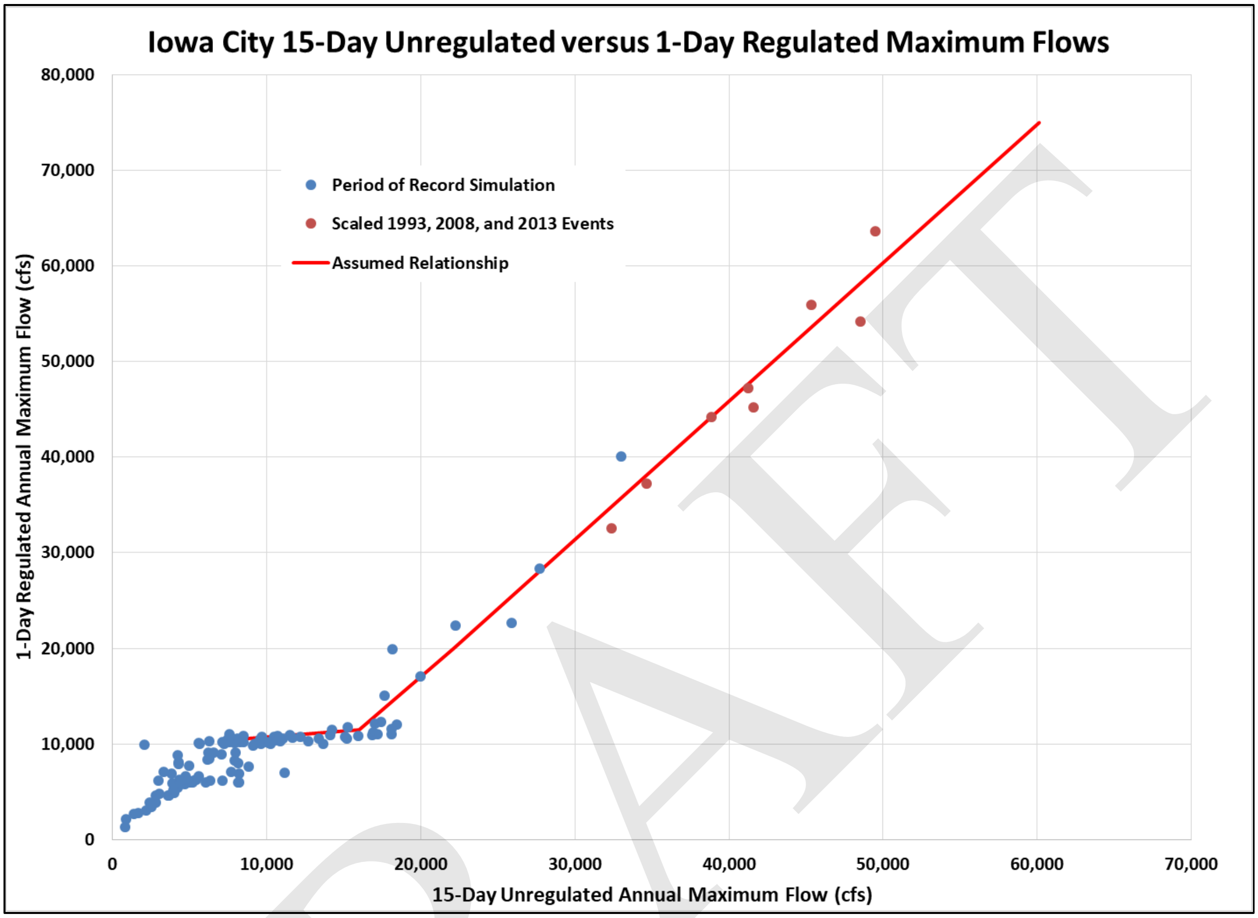


Figure B-16. Iowa River at Iowa City 15-Day Unregulated versus 1-Day Regulated Relationship – Existing Water Control Plan (Alternative 1)

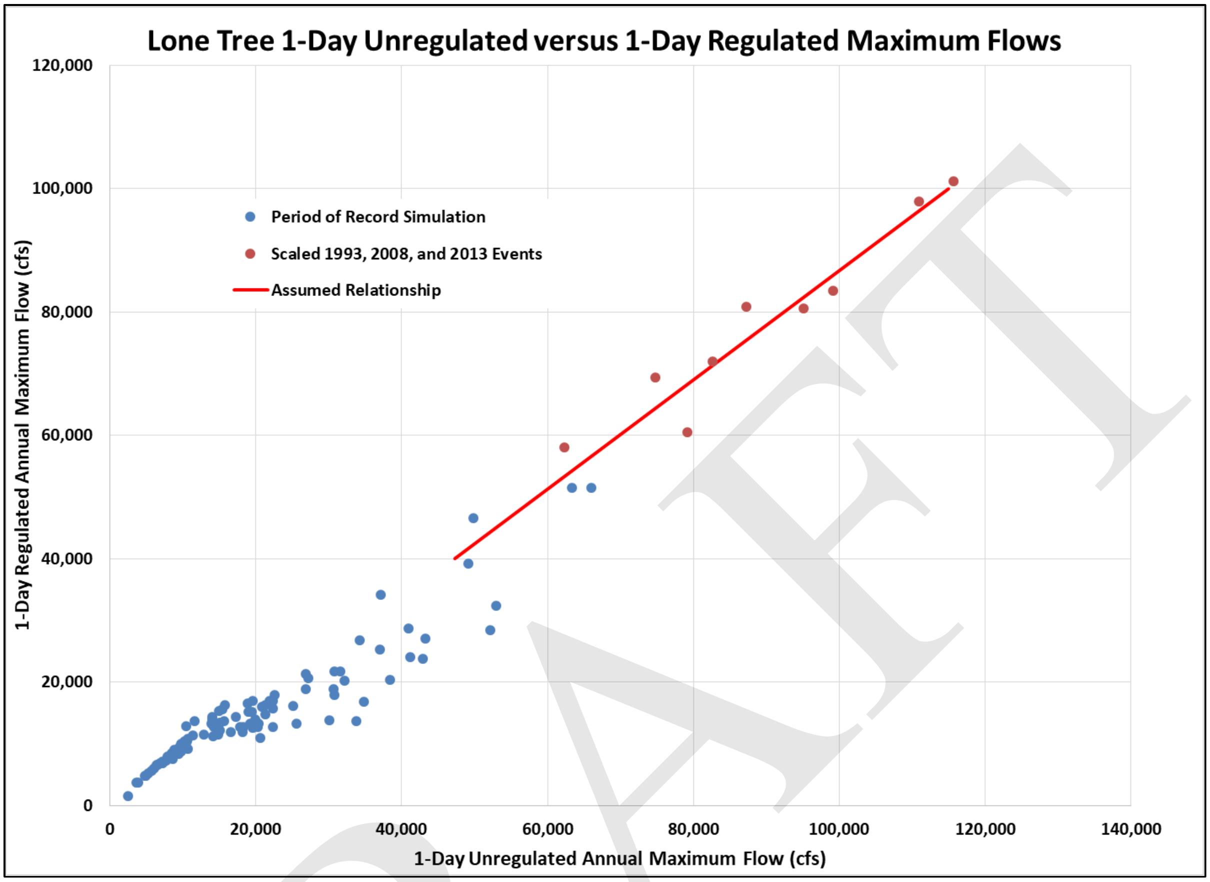


Figure B-17. Iowa River at Lone Tree 1-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)

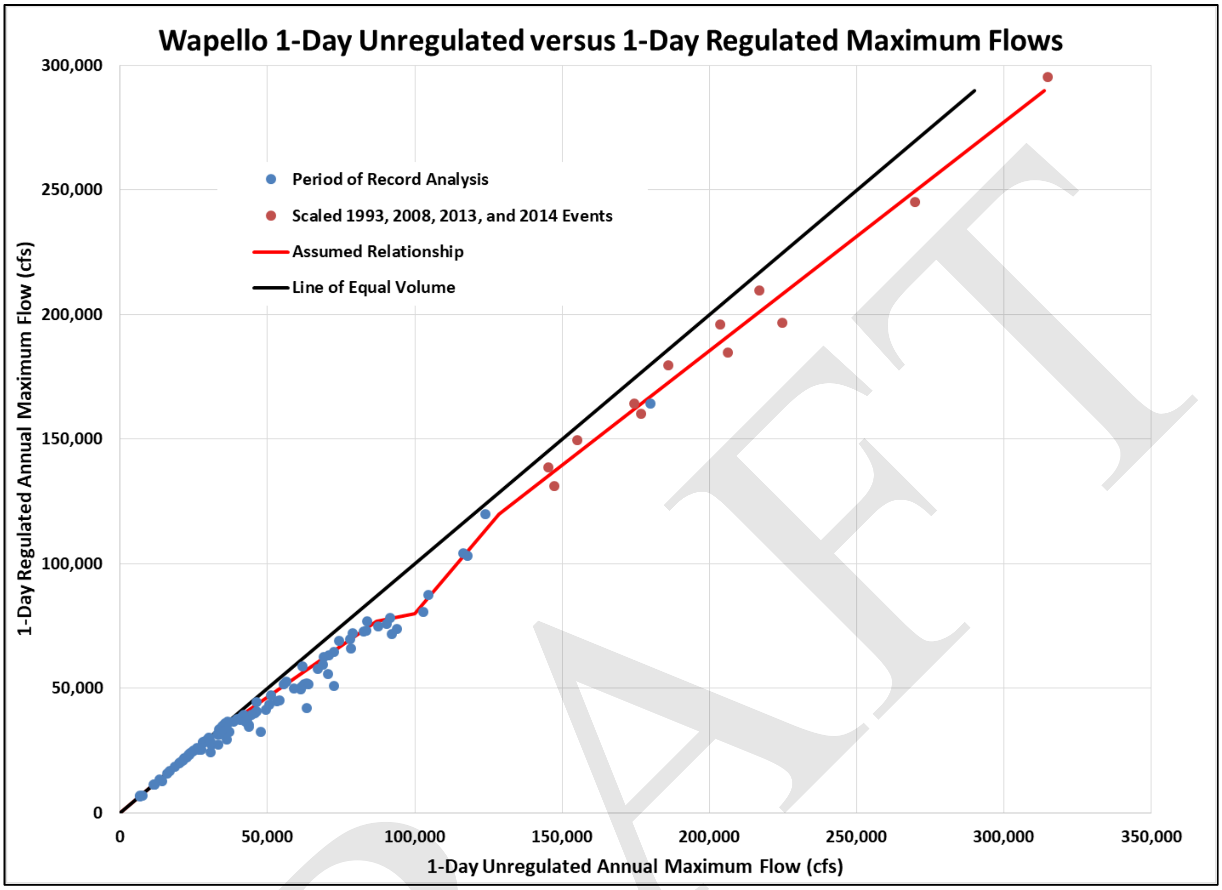


Figure B-18. Iowa River at Wapello 1-Day Unregulated versus 1-Day Regulated Relationships – Existing Water Control Plan (Alternative 1)

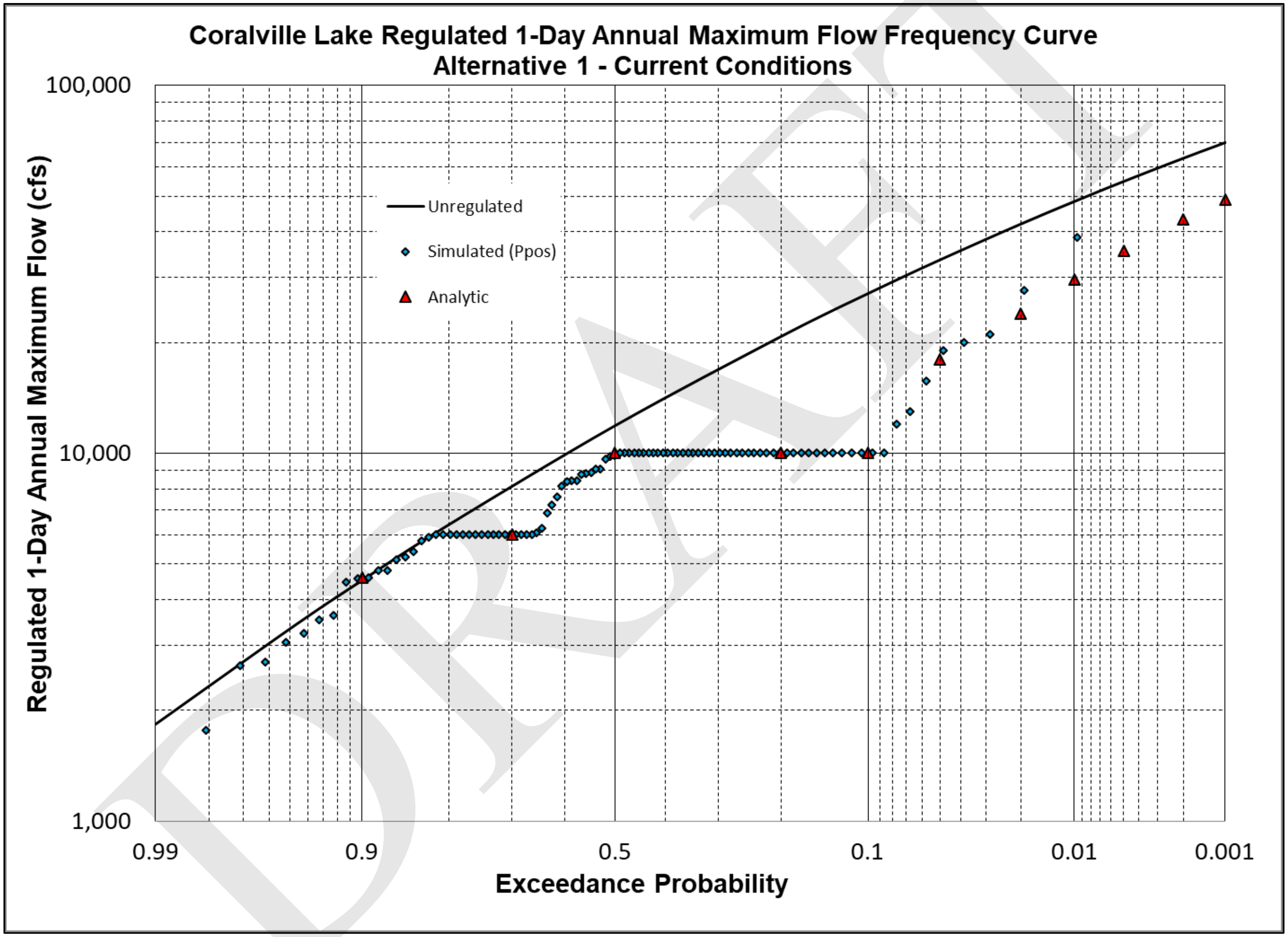


Figure B-19. Coralville Lake Regulated Flow Frequency Curve – Alternative 1, Existing Water Control Plans. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

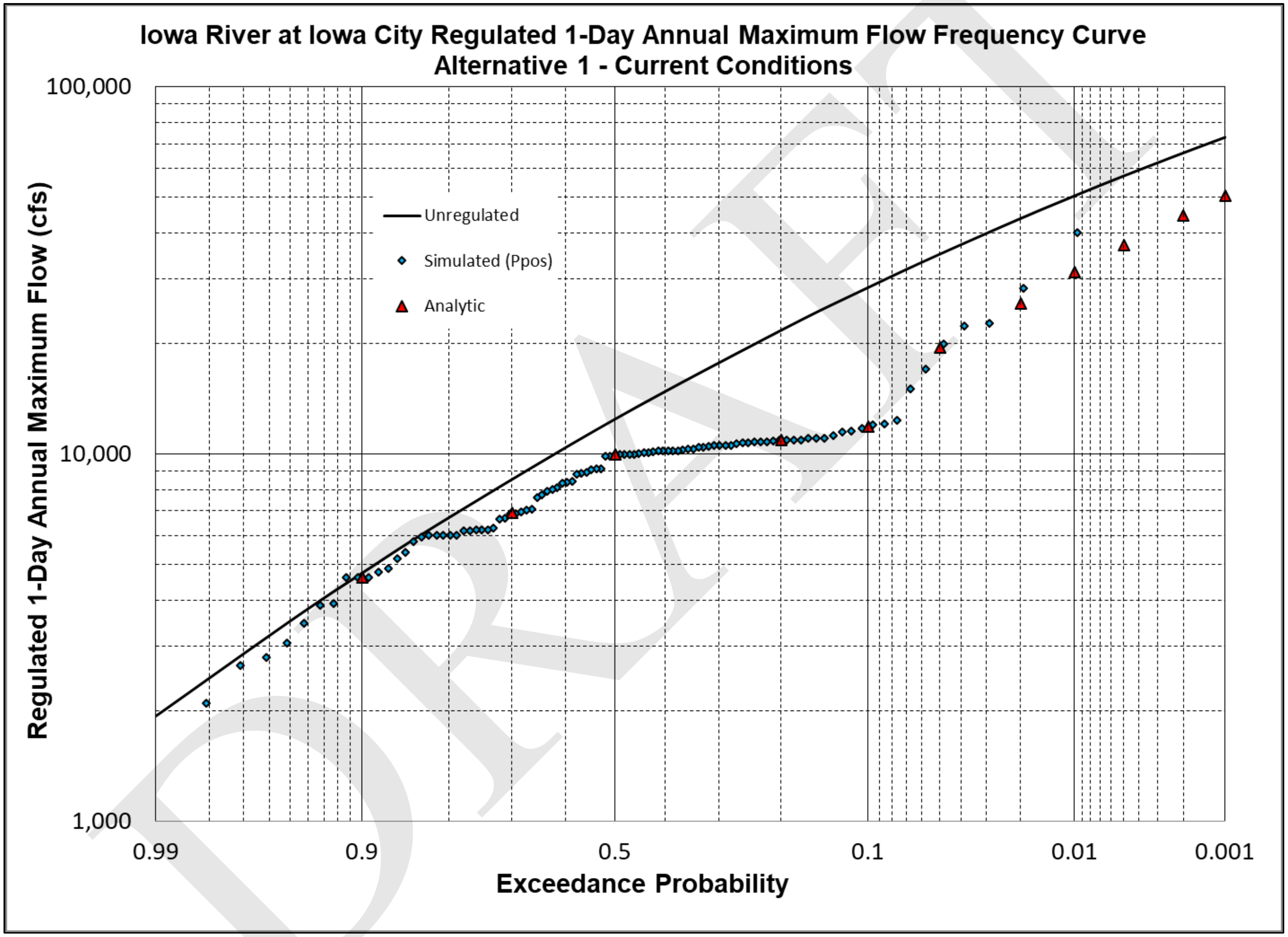


Figure B-20. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternative 1, Existing Water Control Plans. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

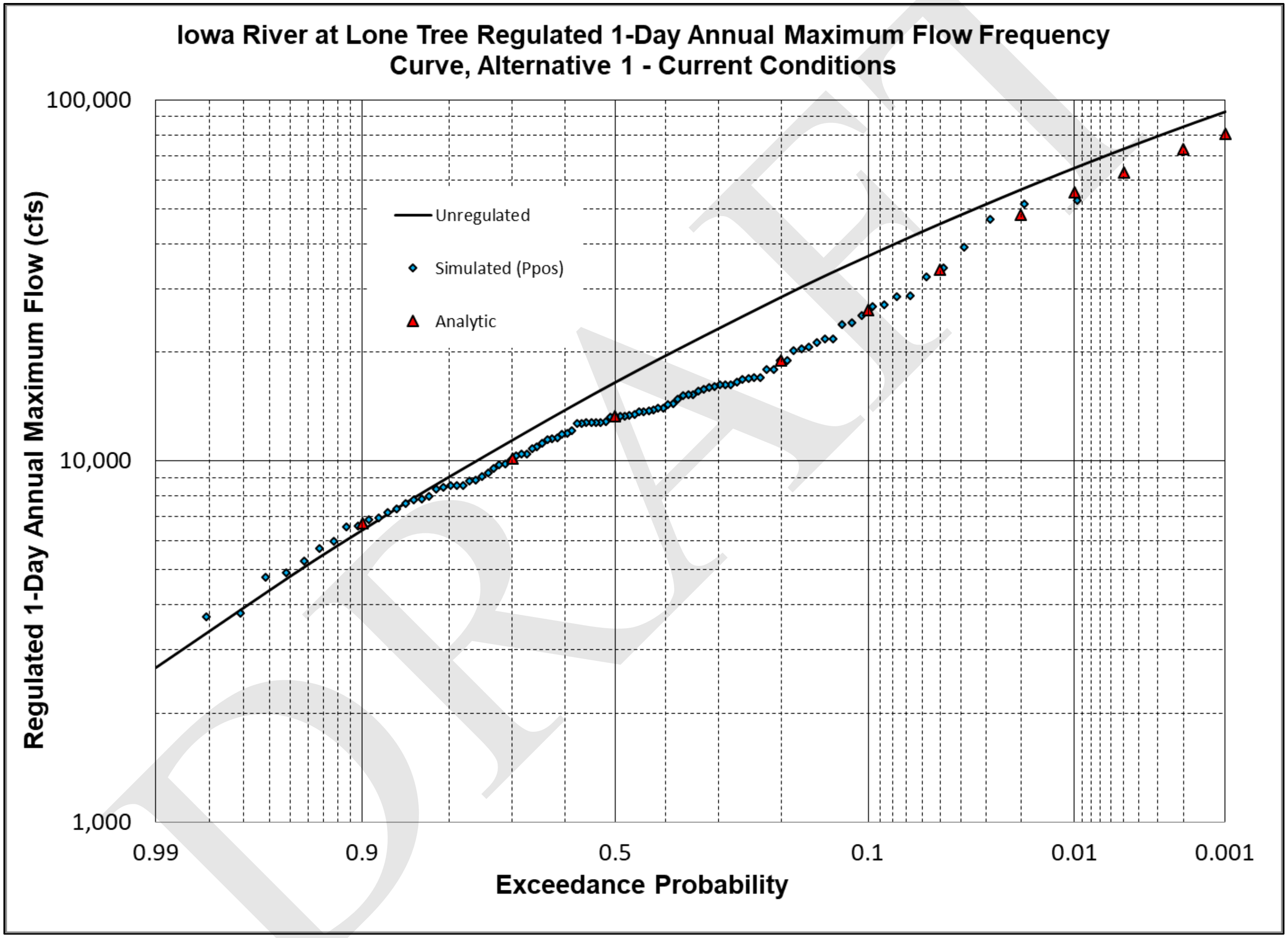


Figure B-21. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternative 1, Existing Water Control Plans. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

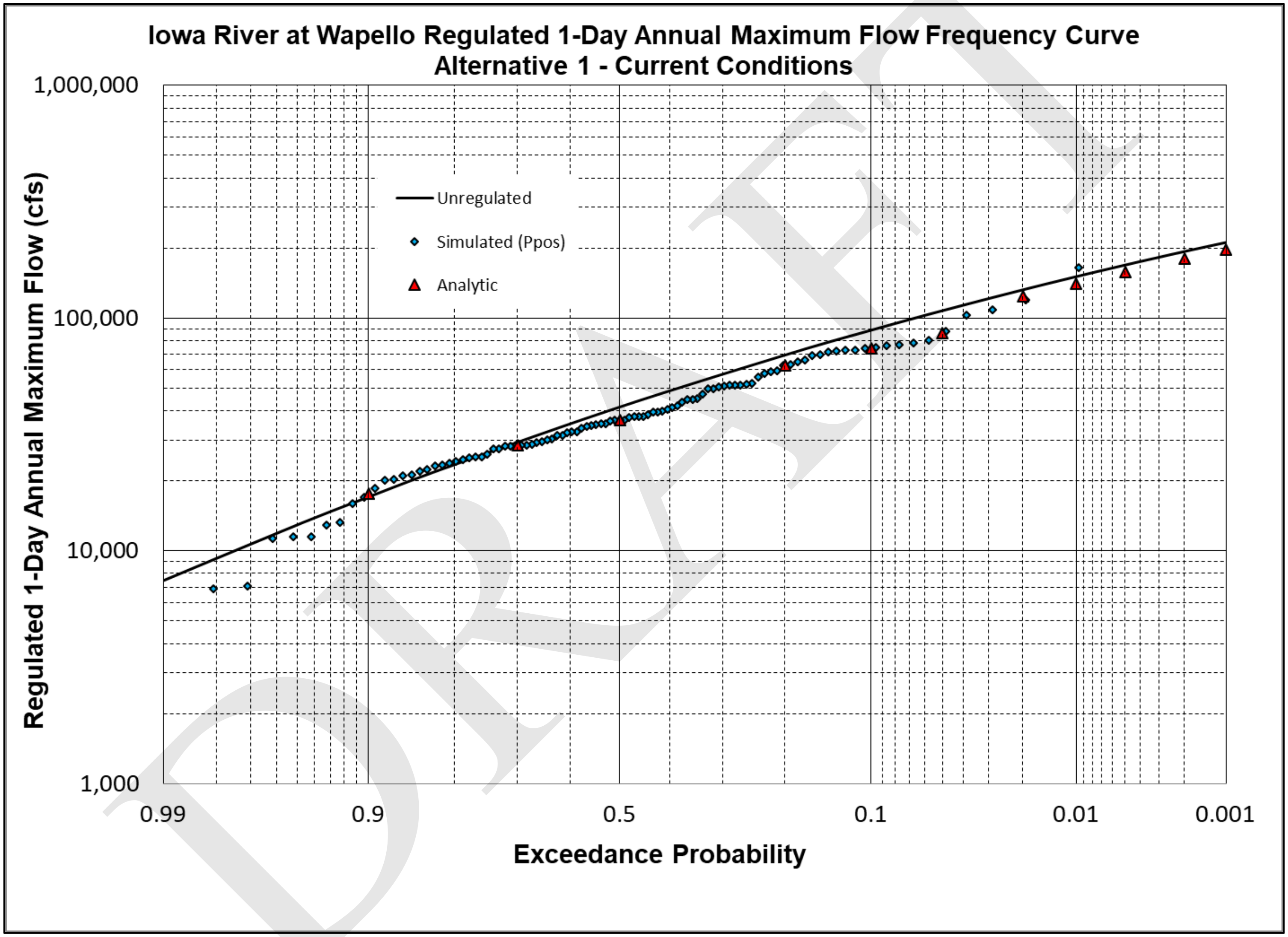


Figure B-22. Iowa River at Wapello Regulated Flow Frequency Curve – Alternative 1, Existing Water Control Plans. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

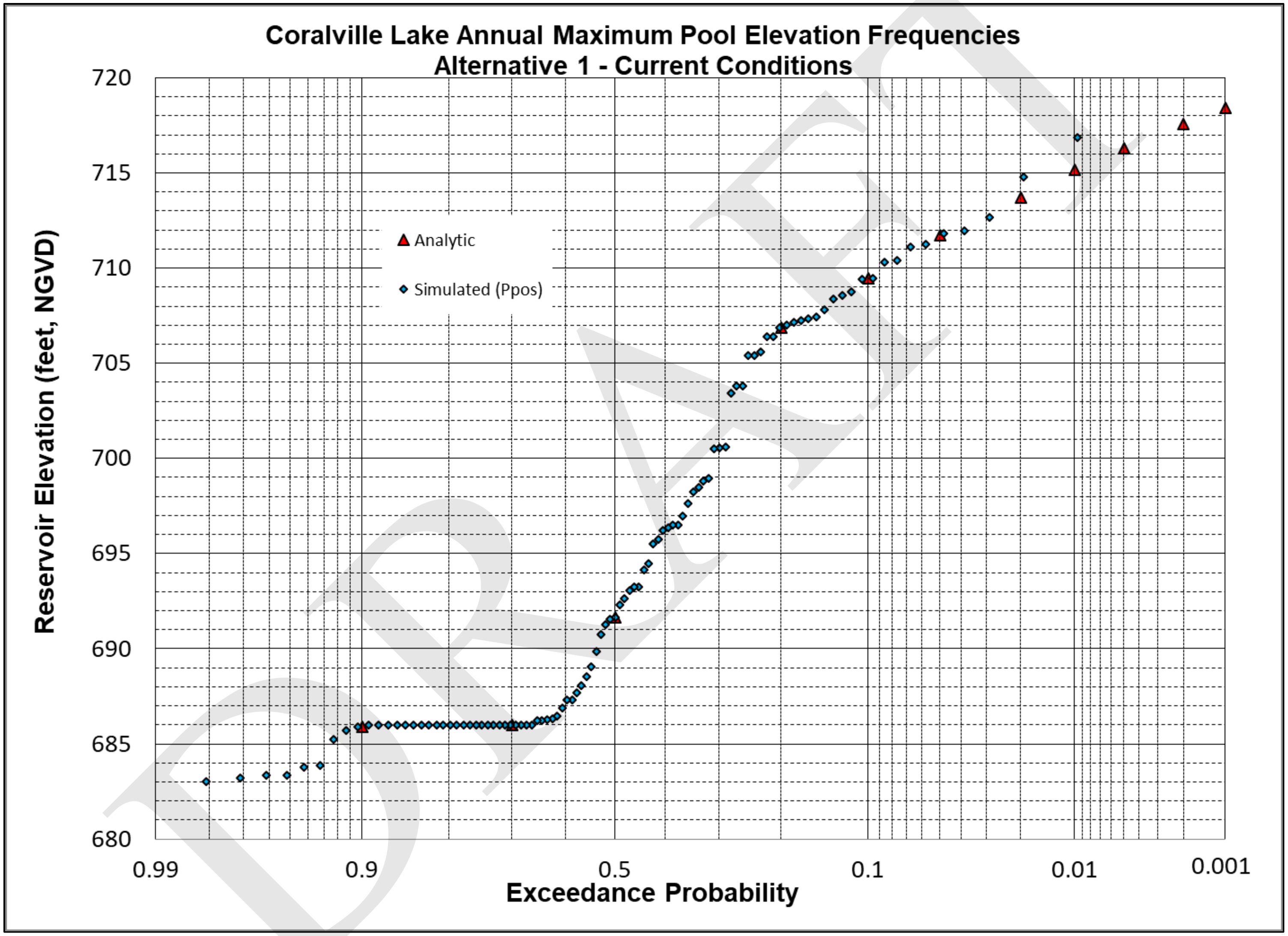
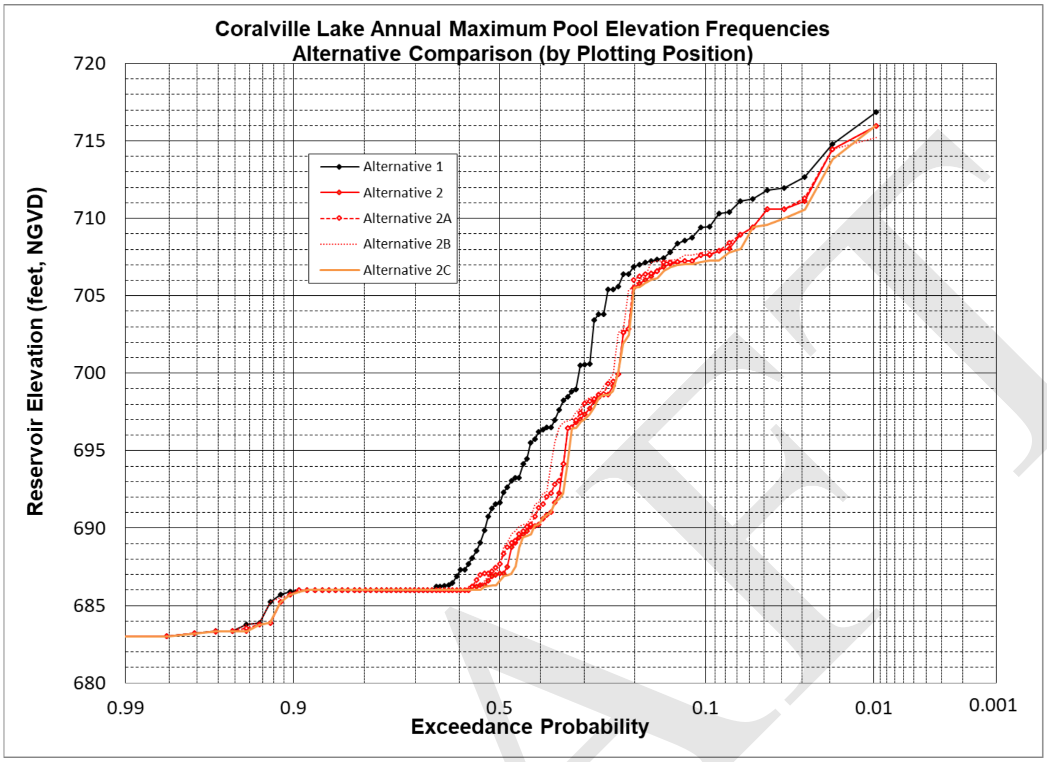


Figure B-23. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternative 1, Existing Water Control Plans. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).



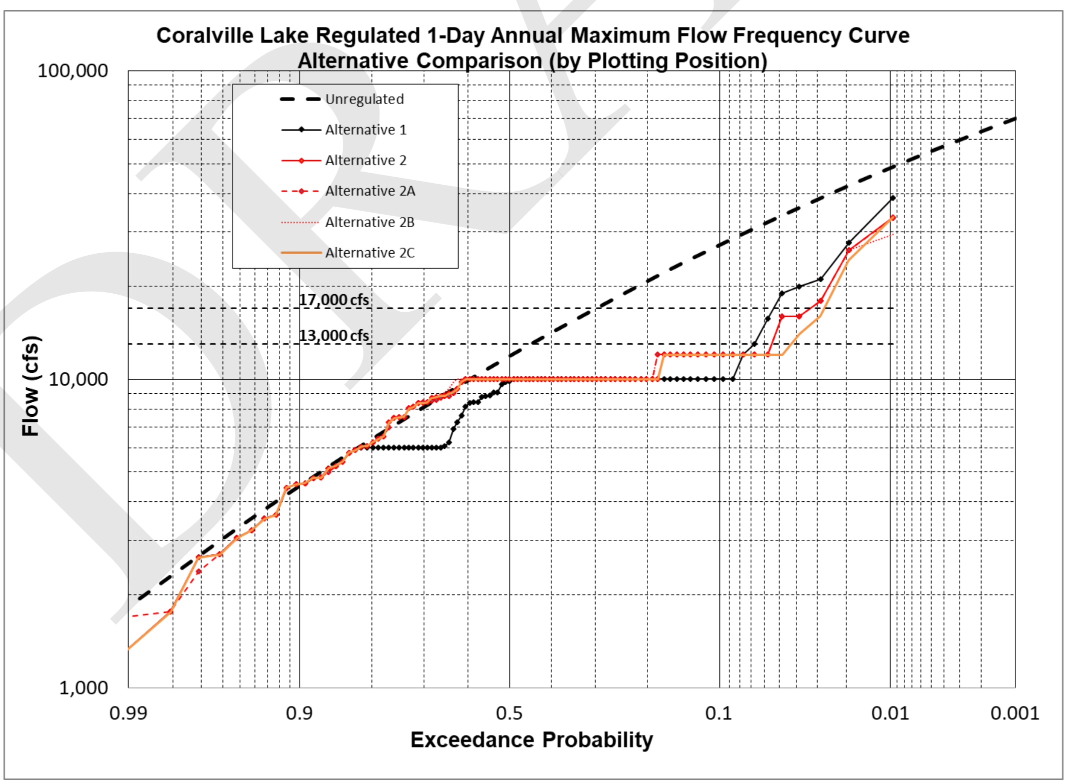
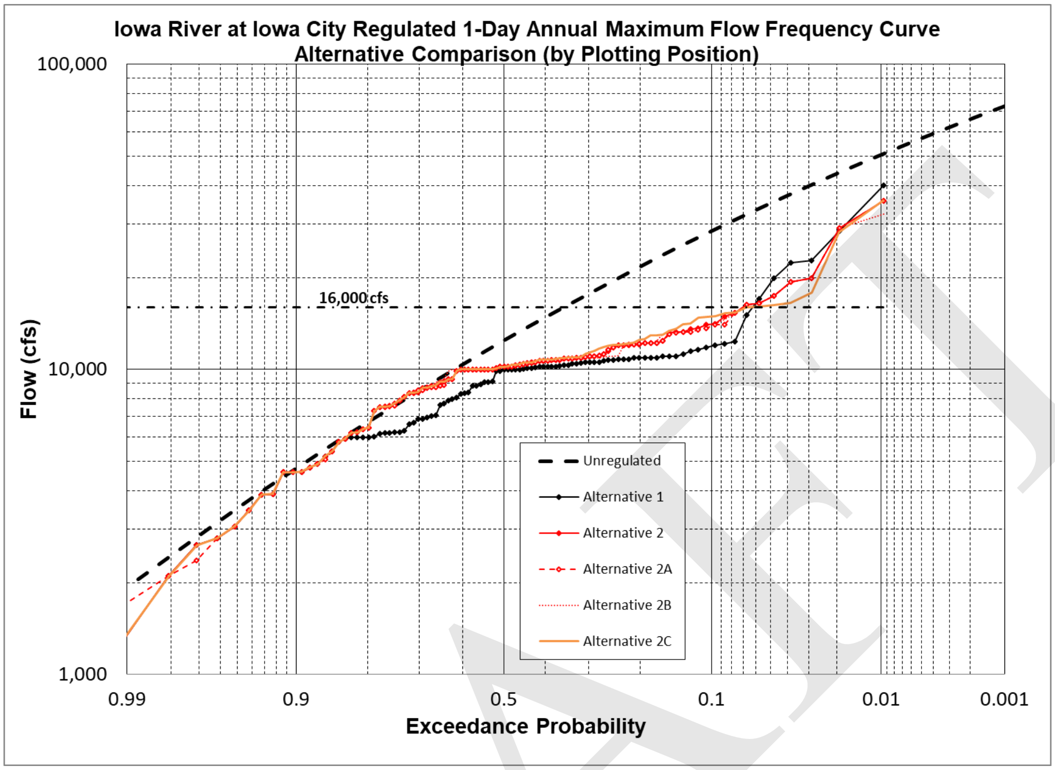


Figure B-24. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 2



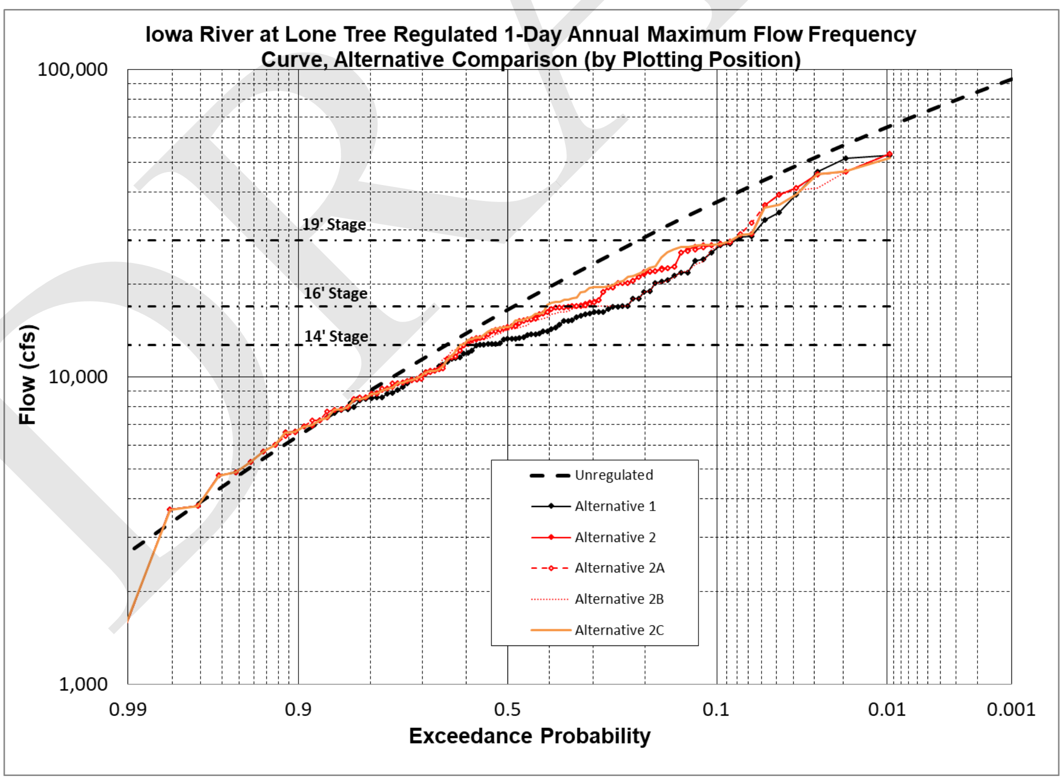
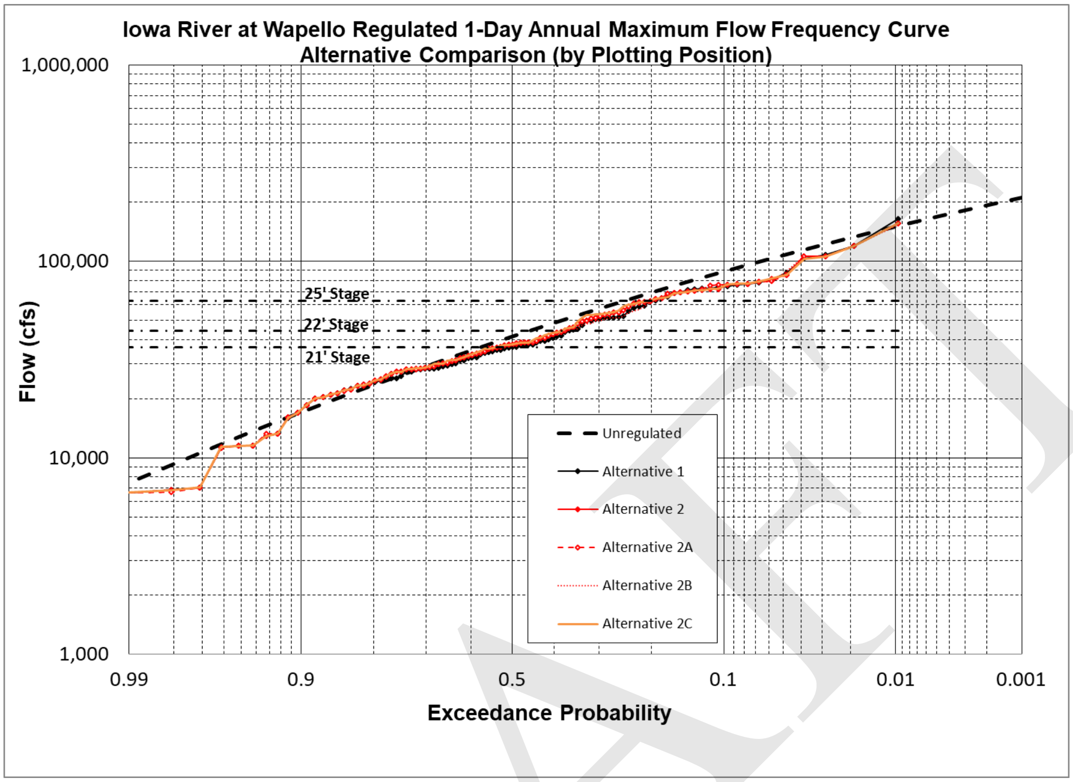


Figure B-25. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 2



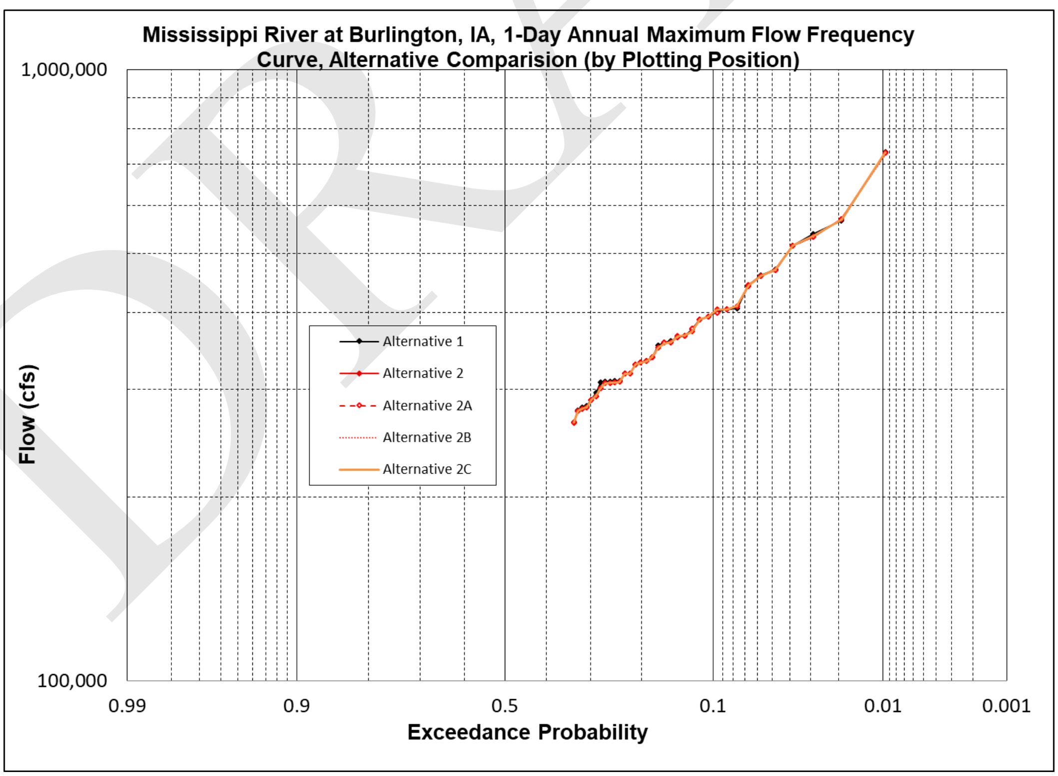


Figure B-26. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 2

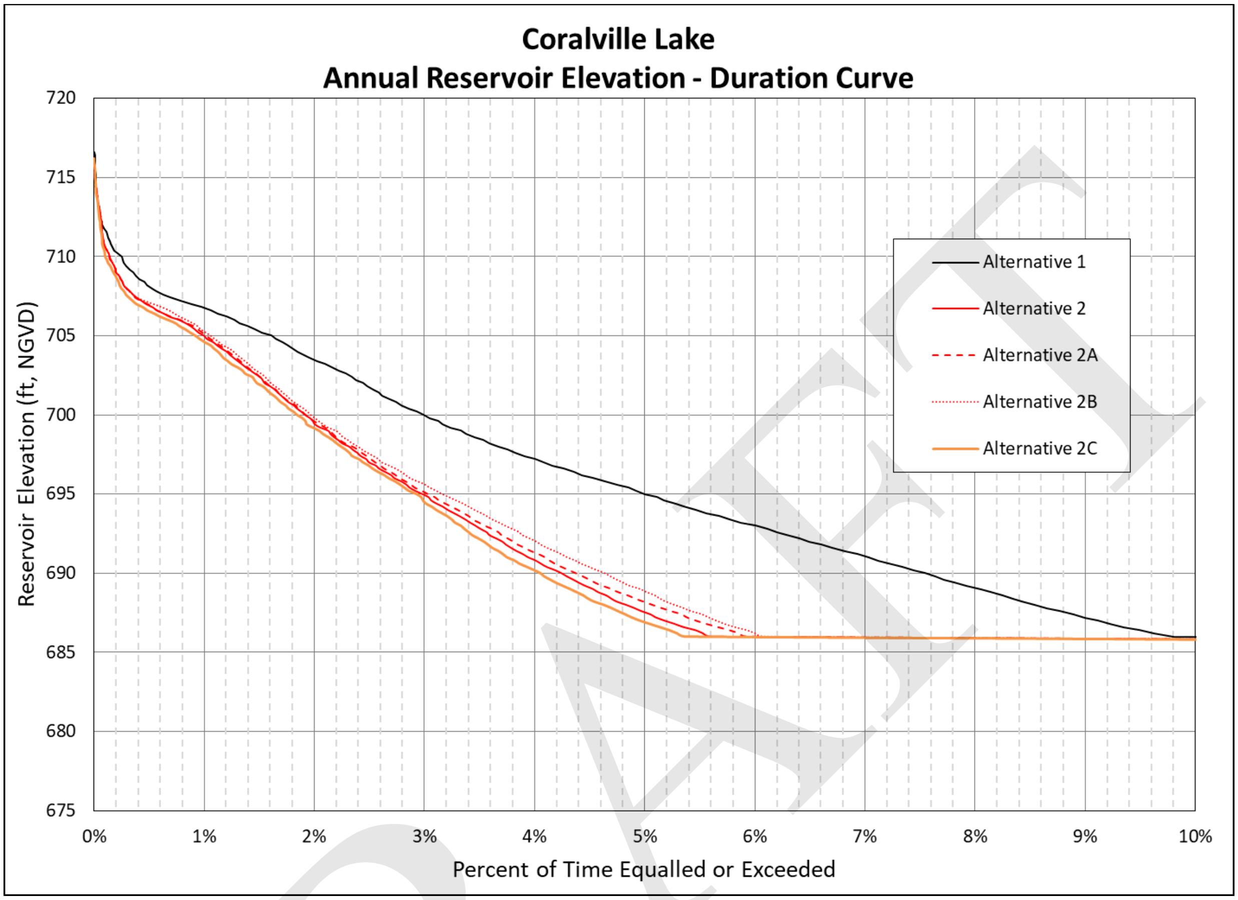
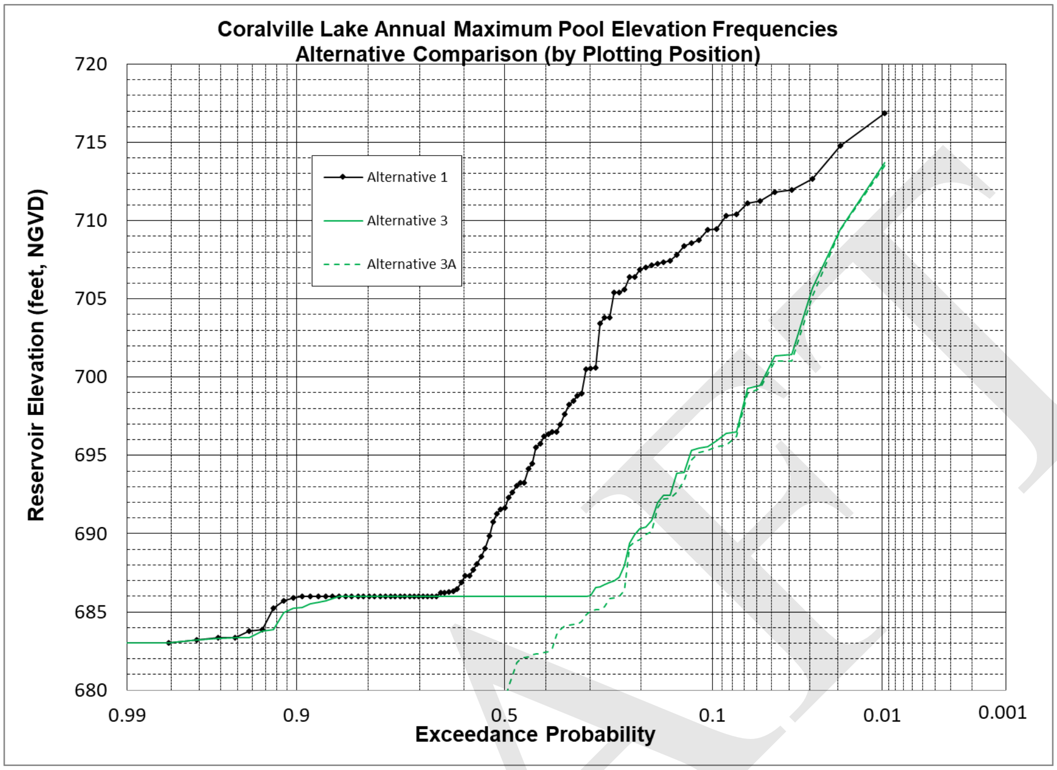


Figure B-27. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 2



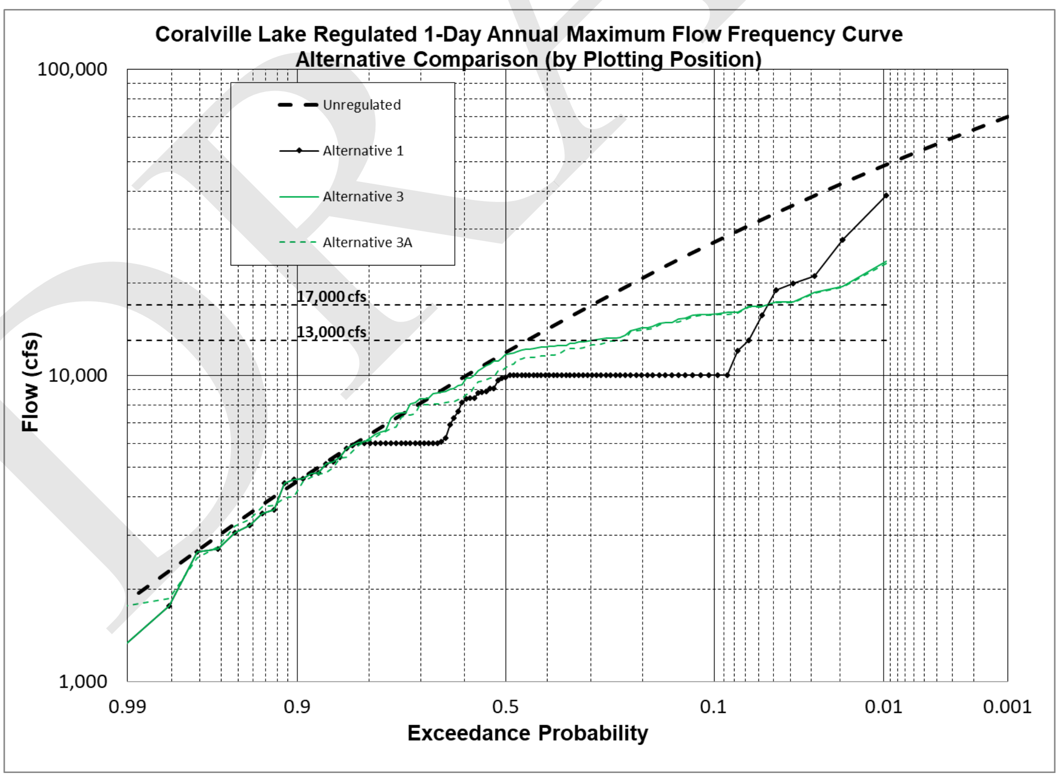
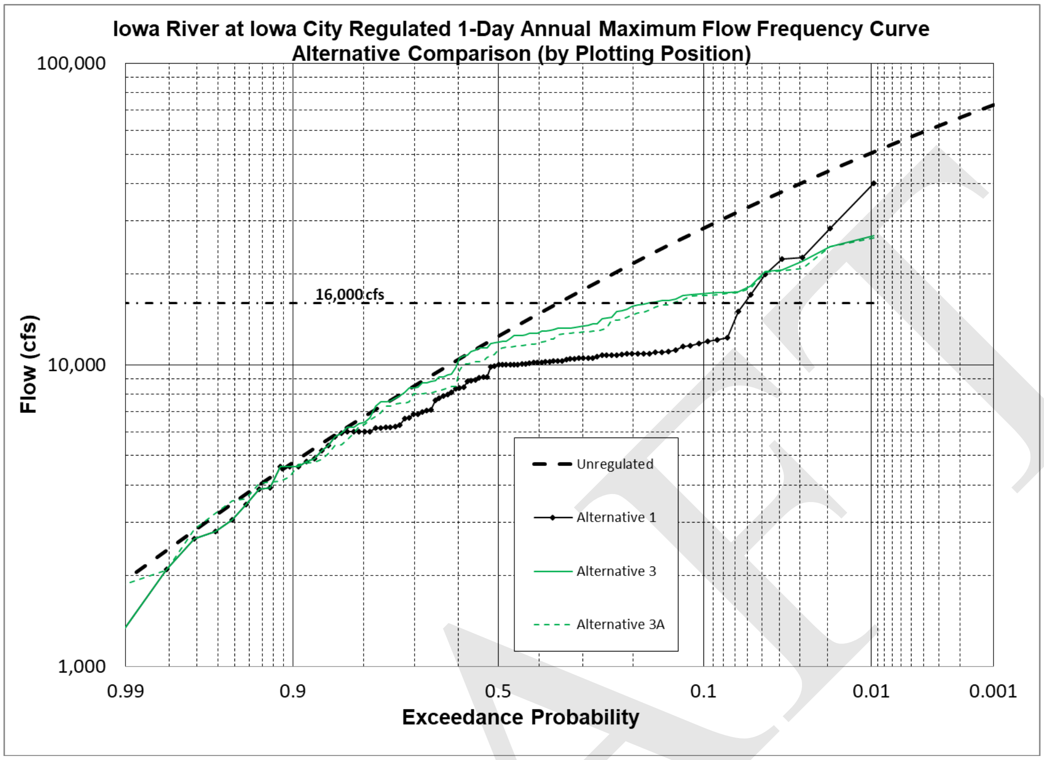


Figure B-28. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 3



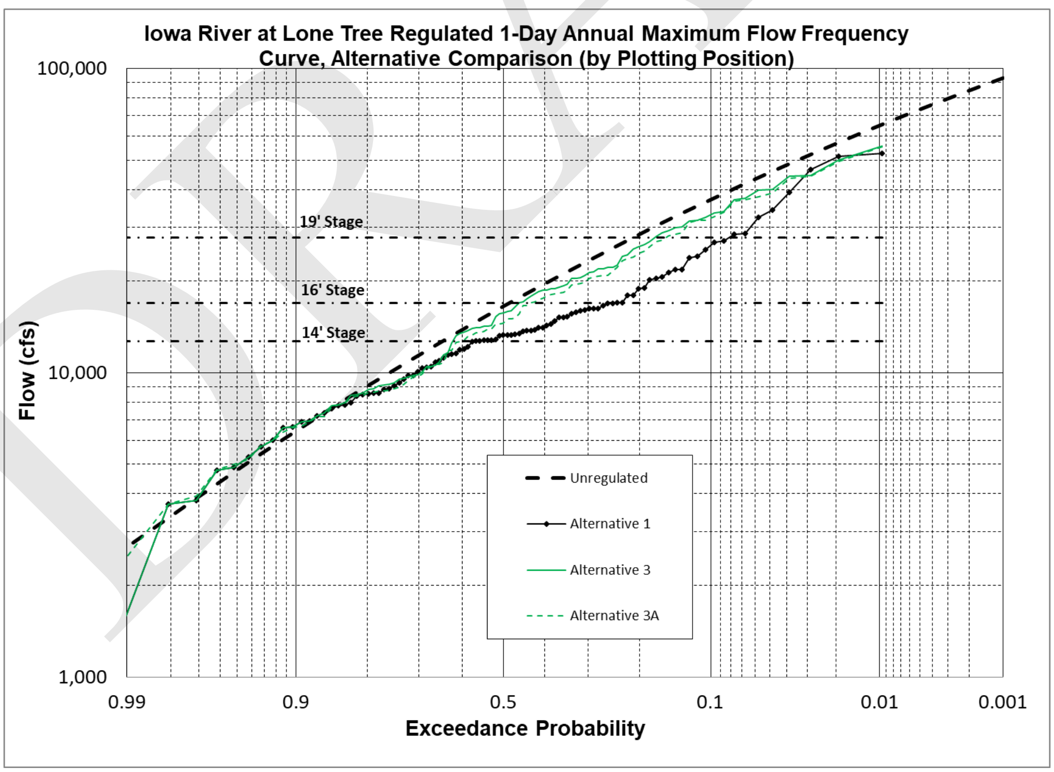
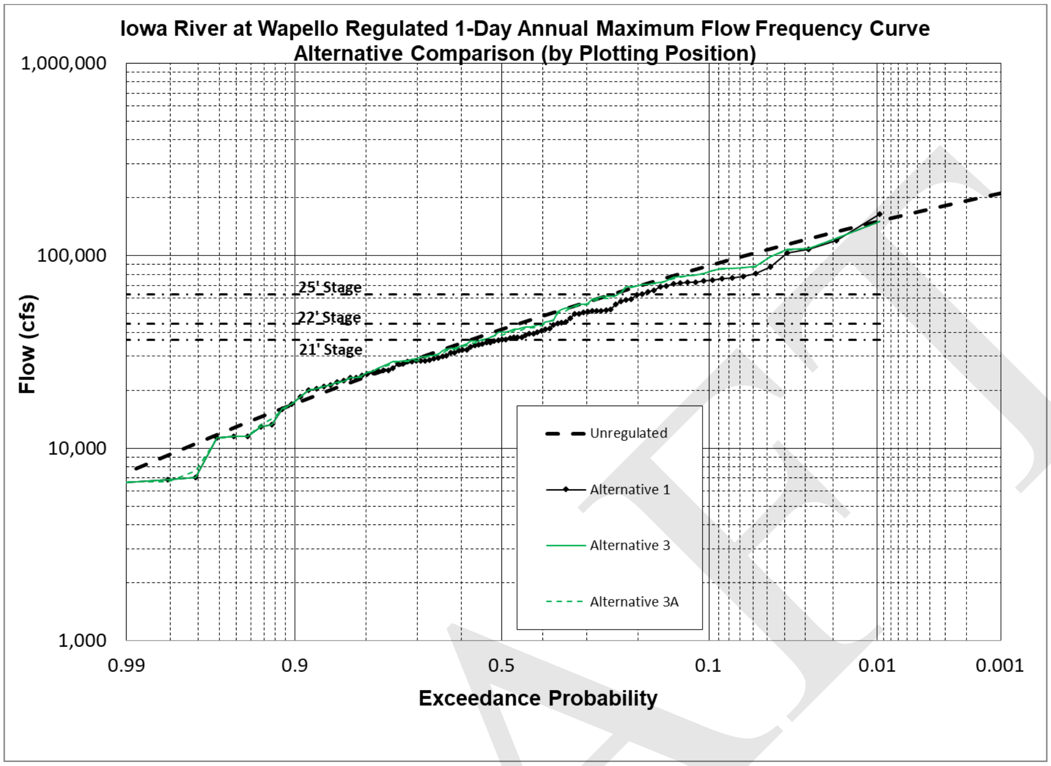


Figure B-29. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 3



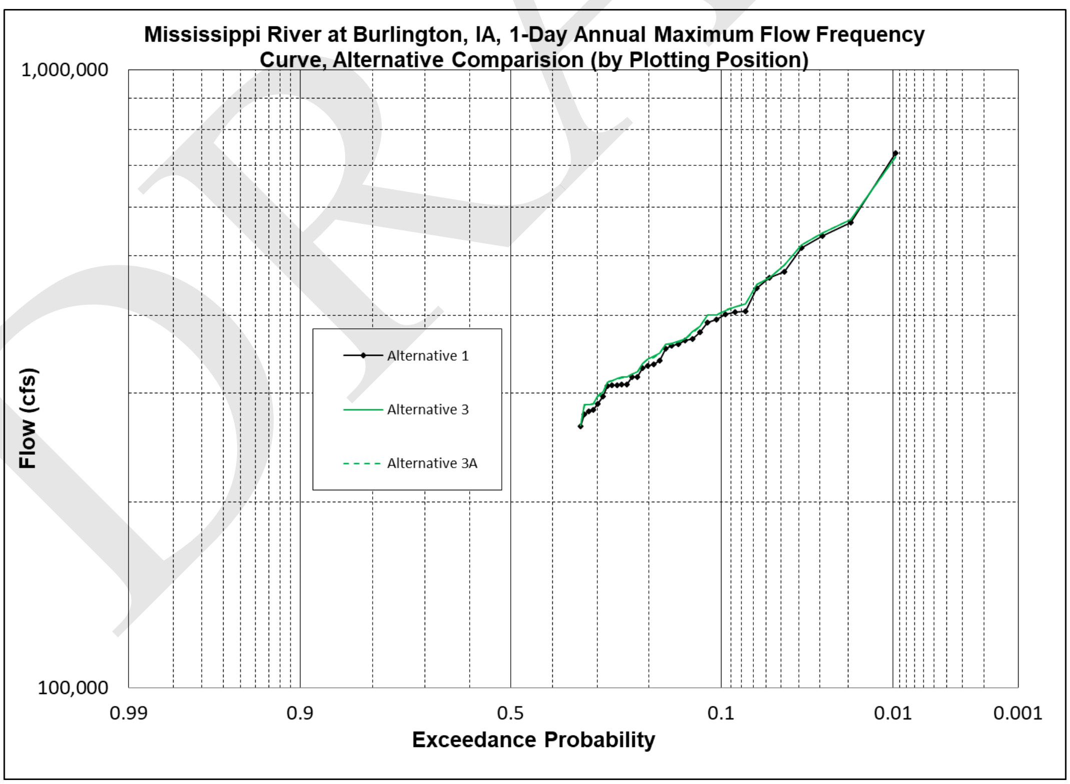


Figure B-30. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 3

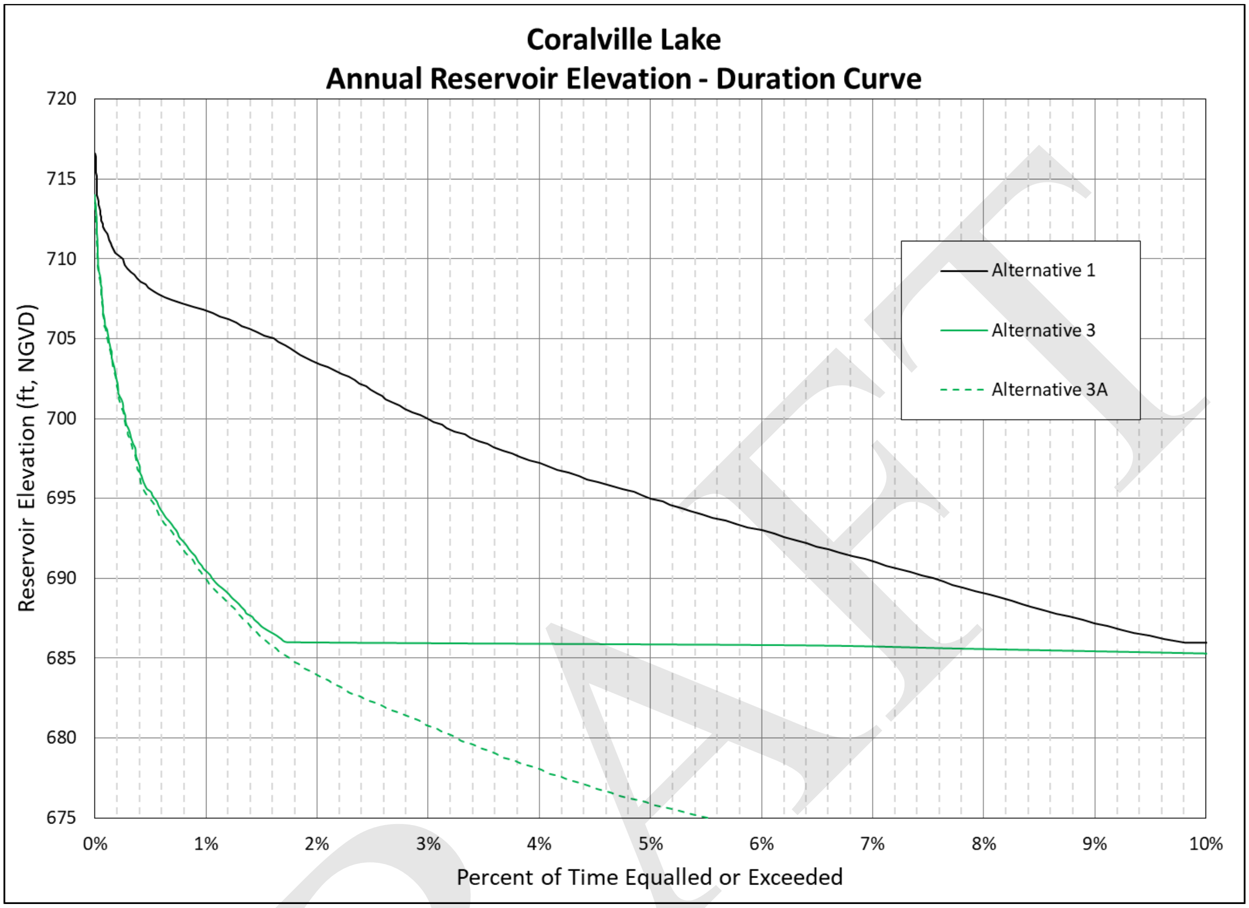
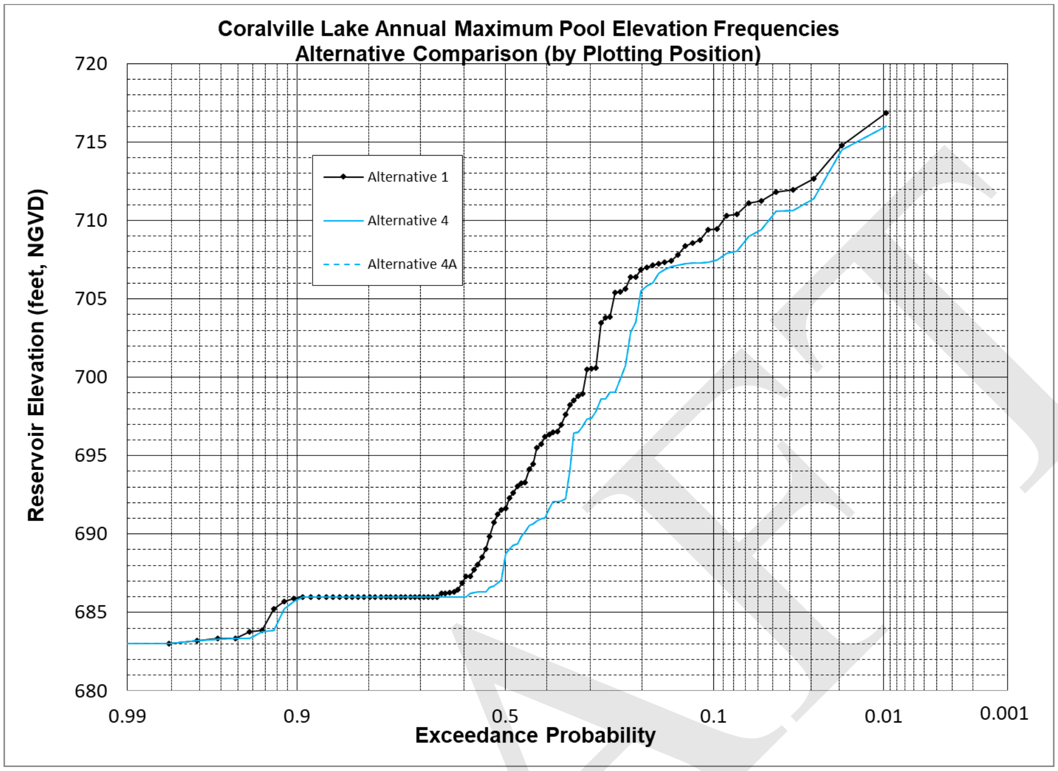


Figure B-31. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 3



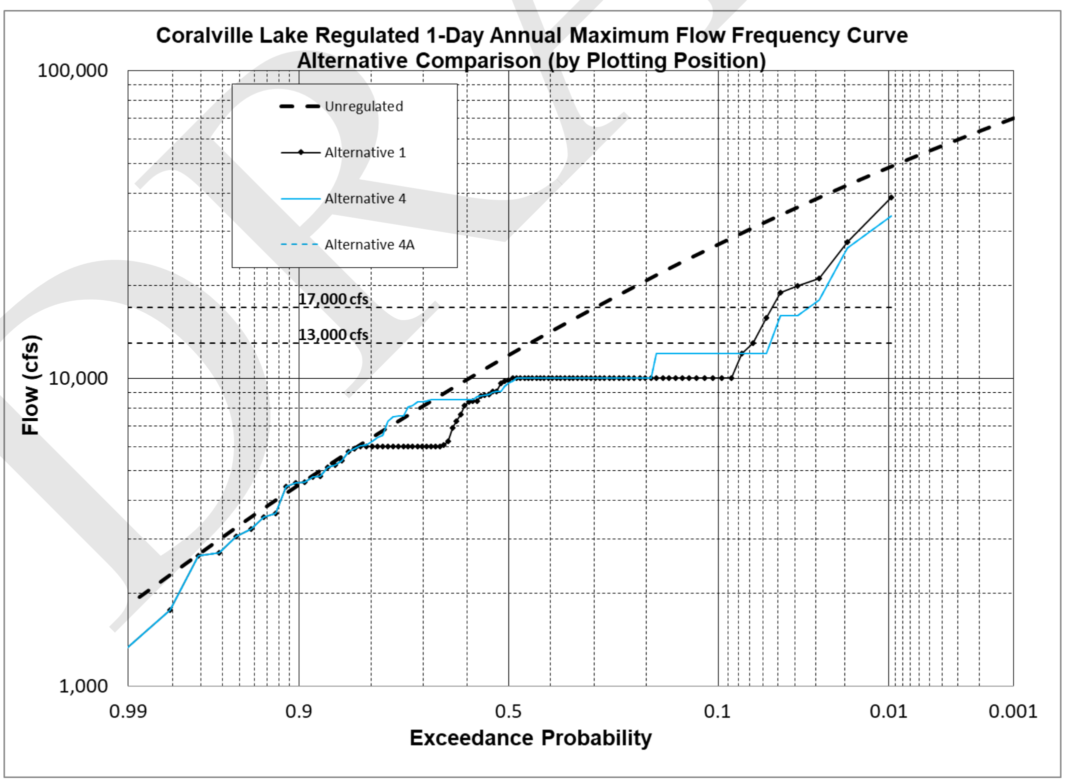
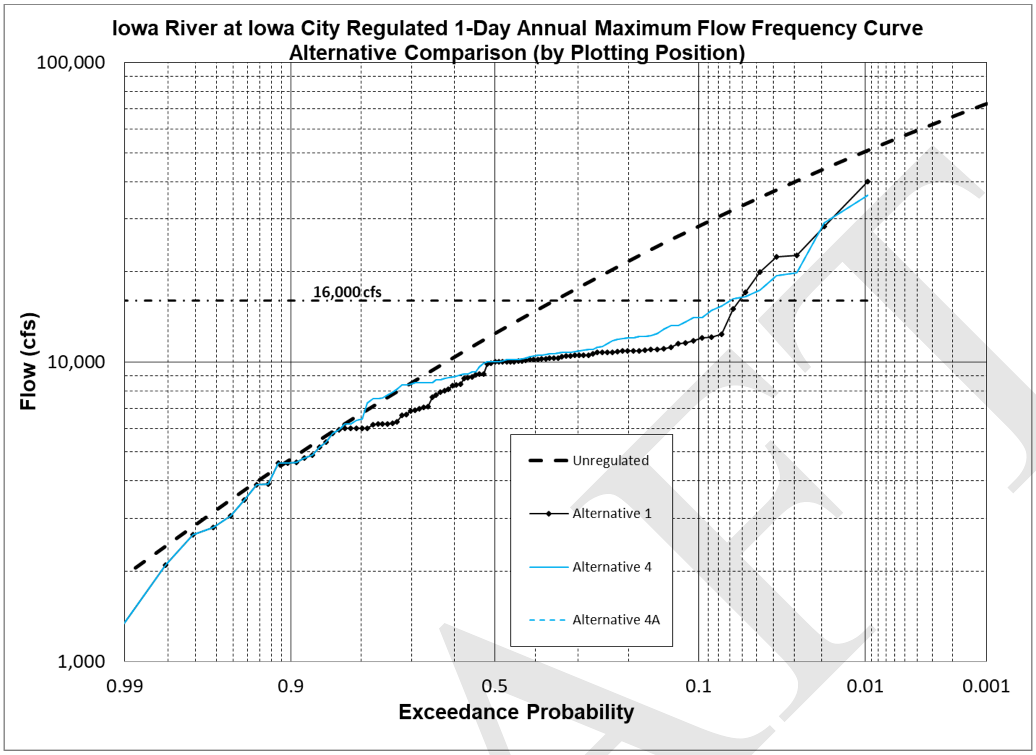


Figure B-32. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 4



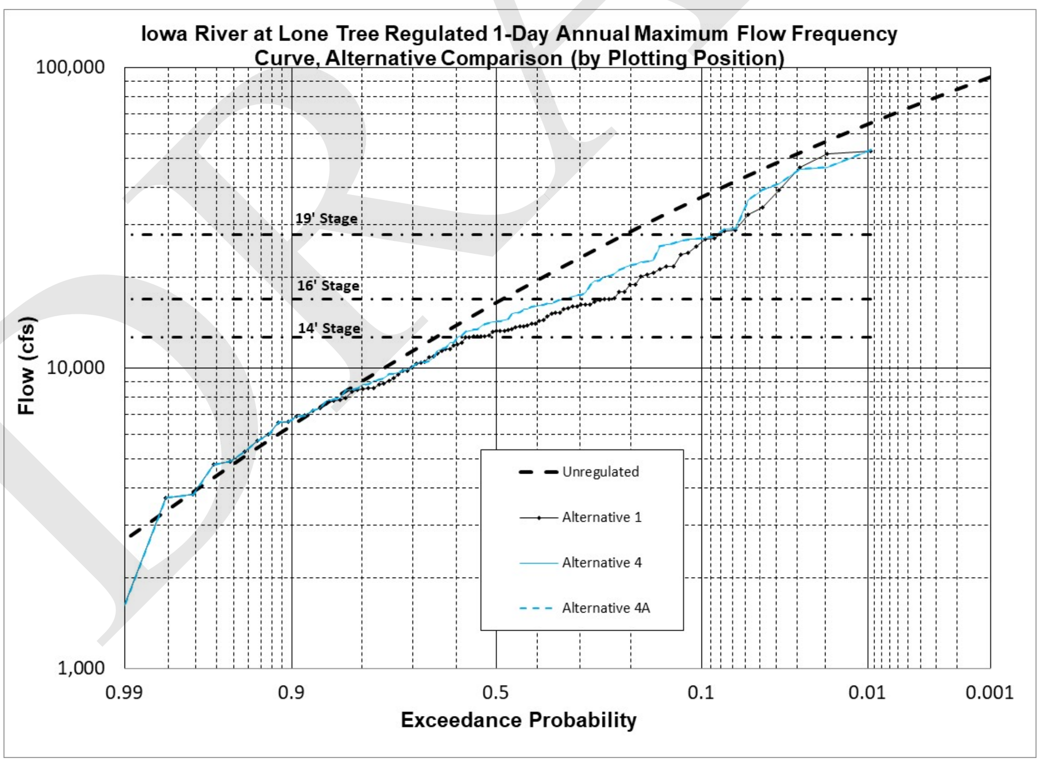
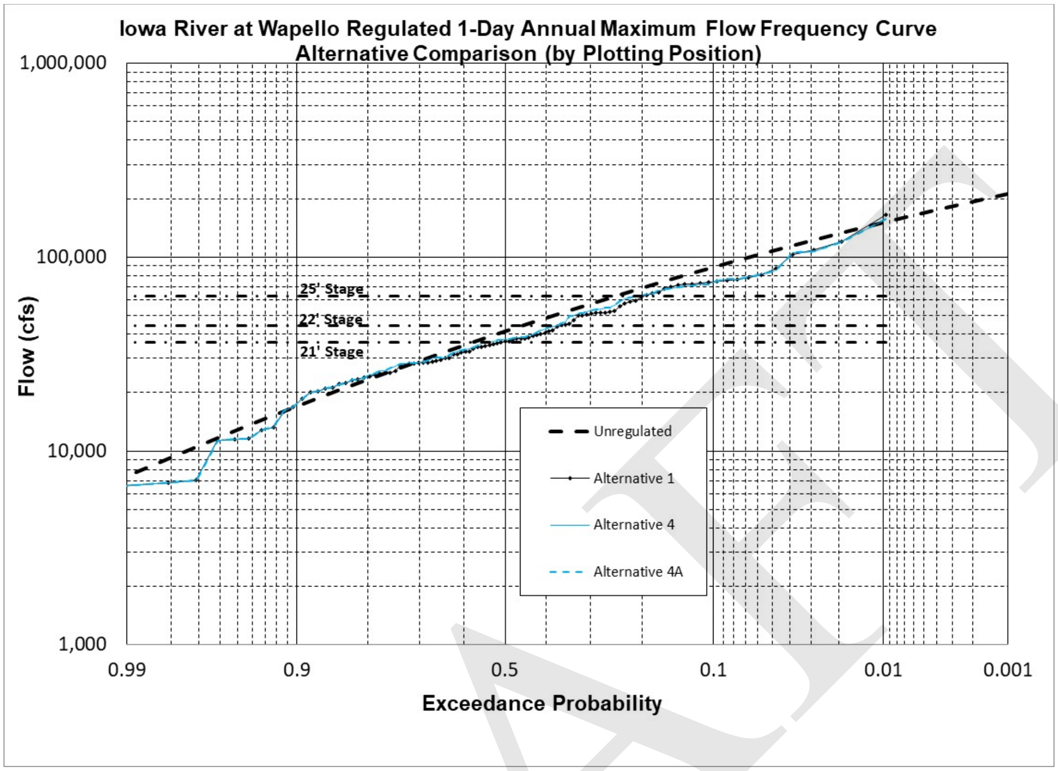


Figure B-33. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 4



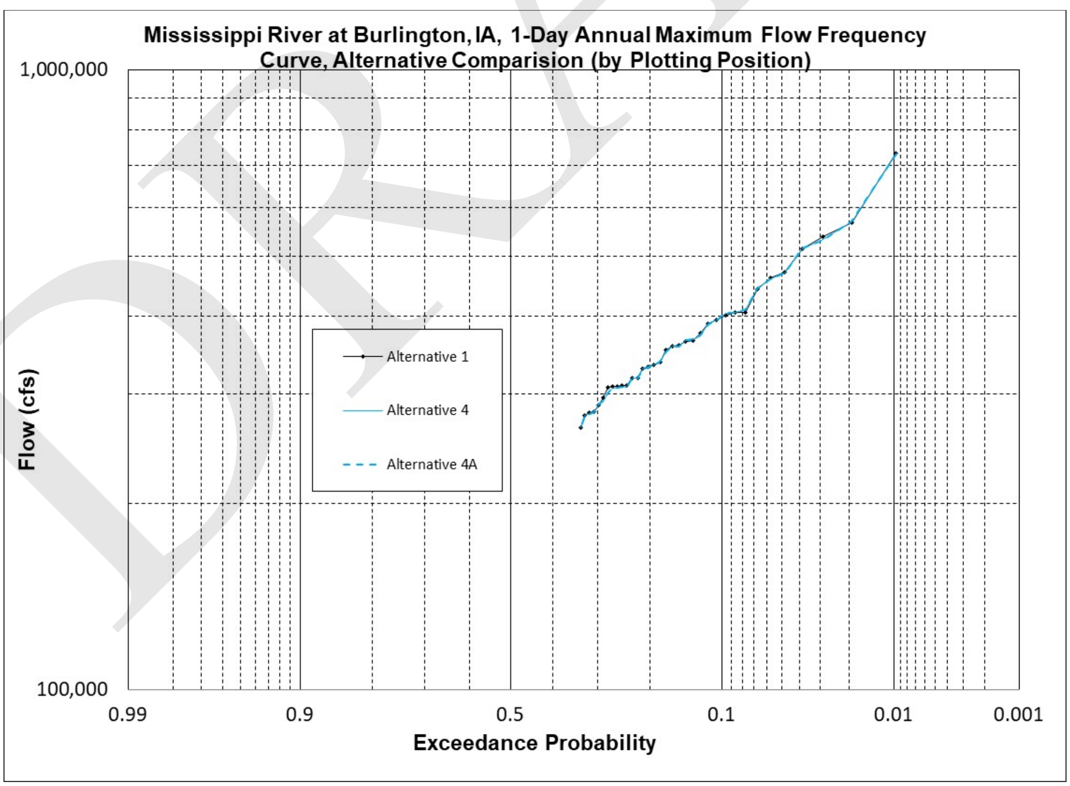


Figure B-34. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 4

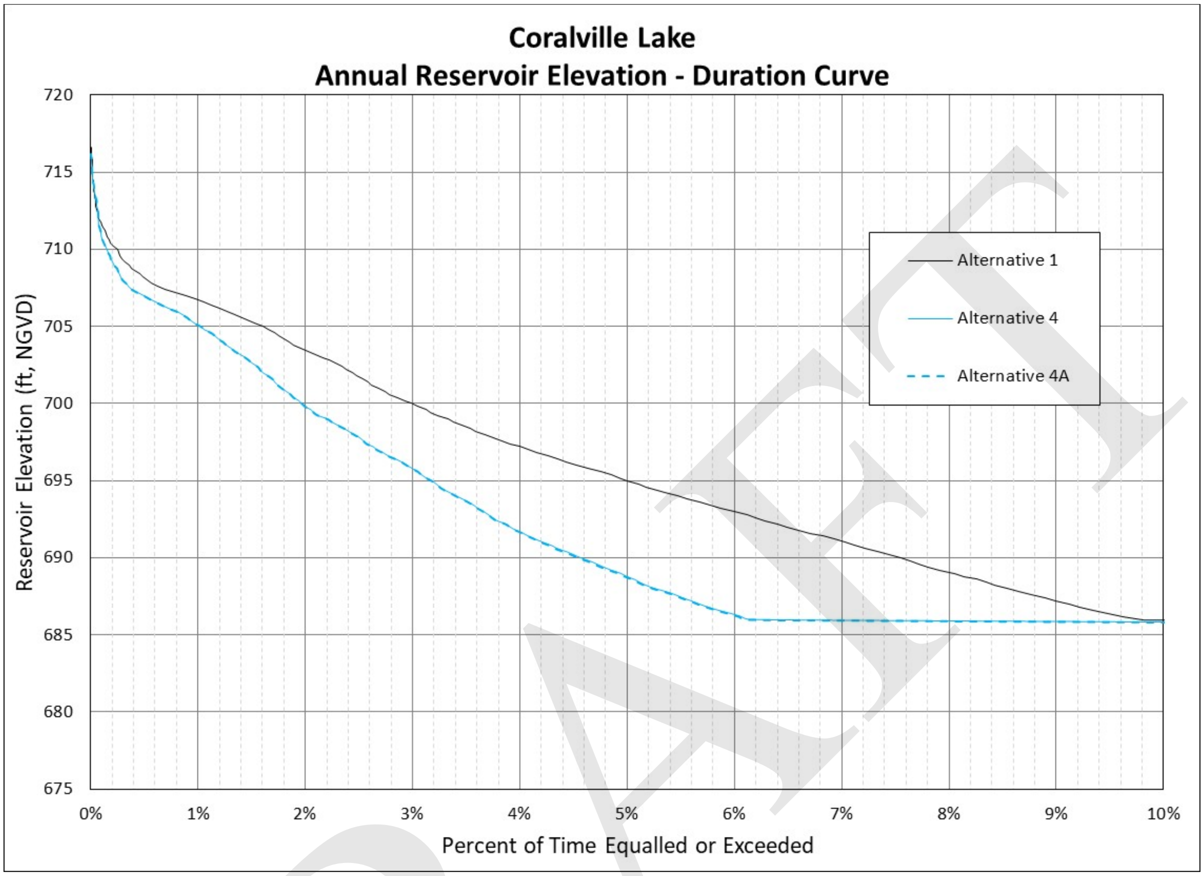
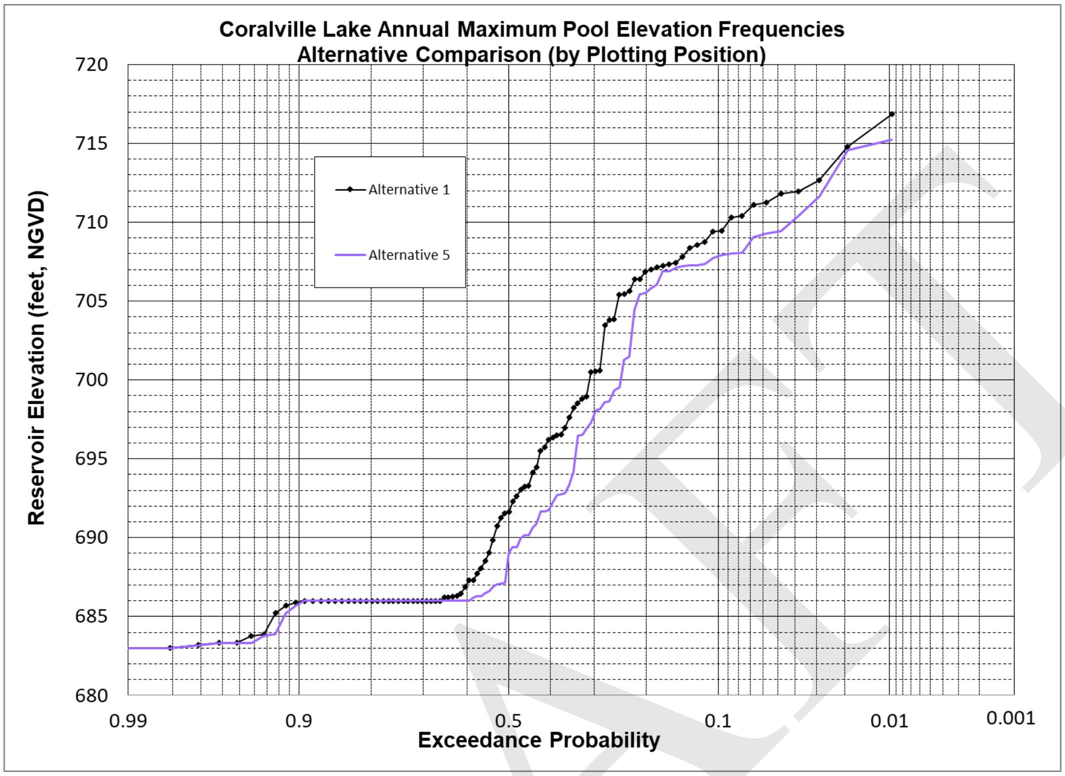


Figure B-35. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 4



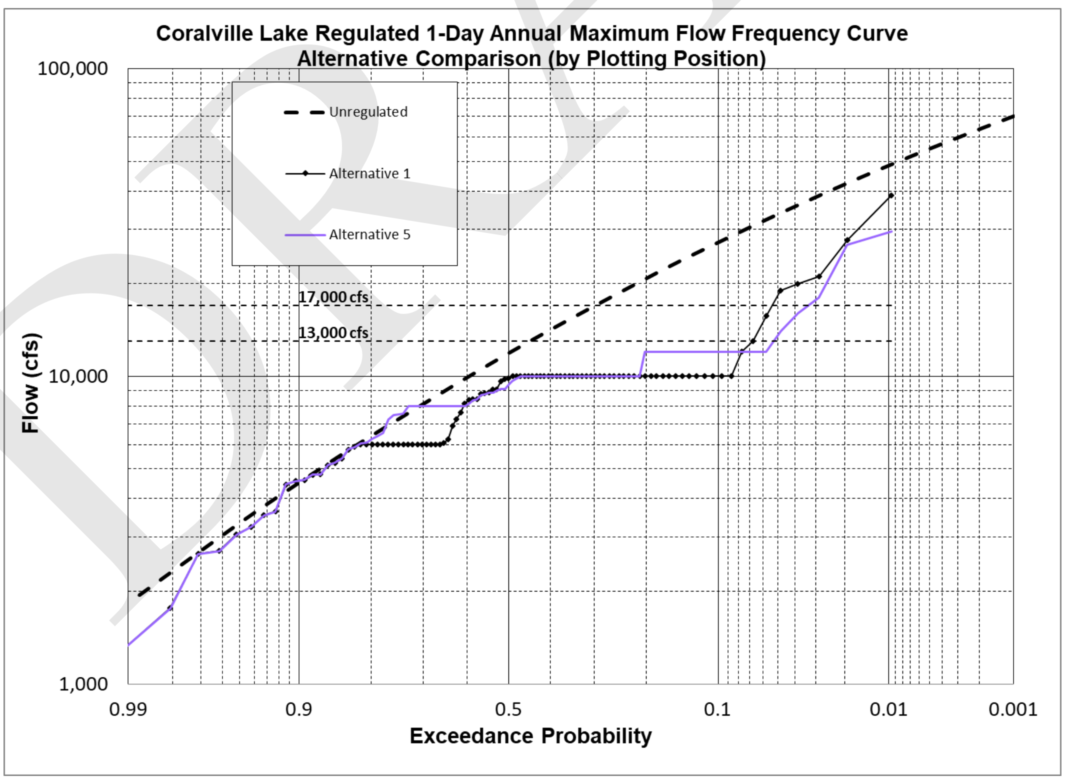
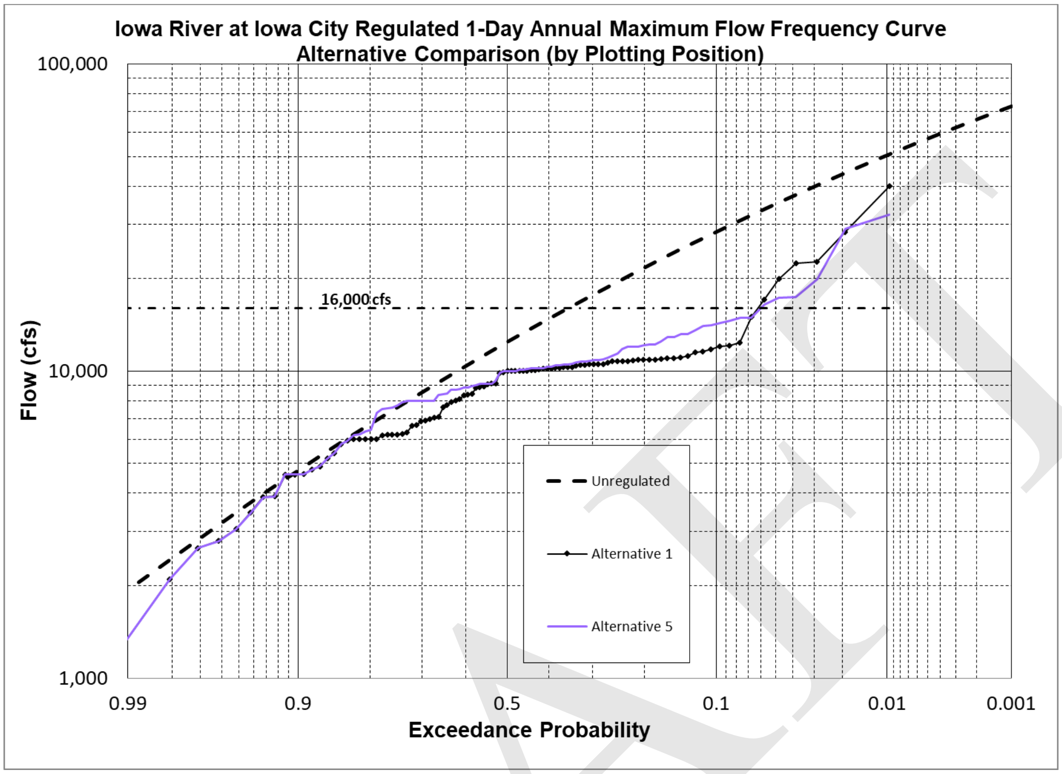


Figure B-36. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 5



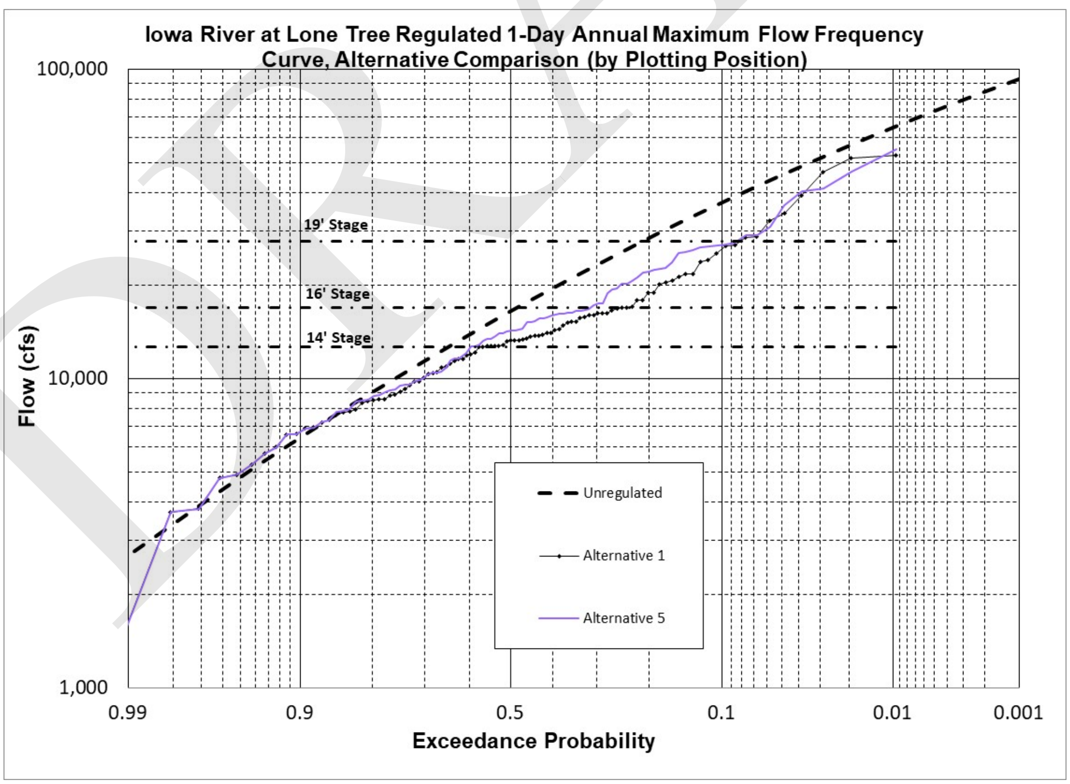
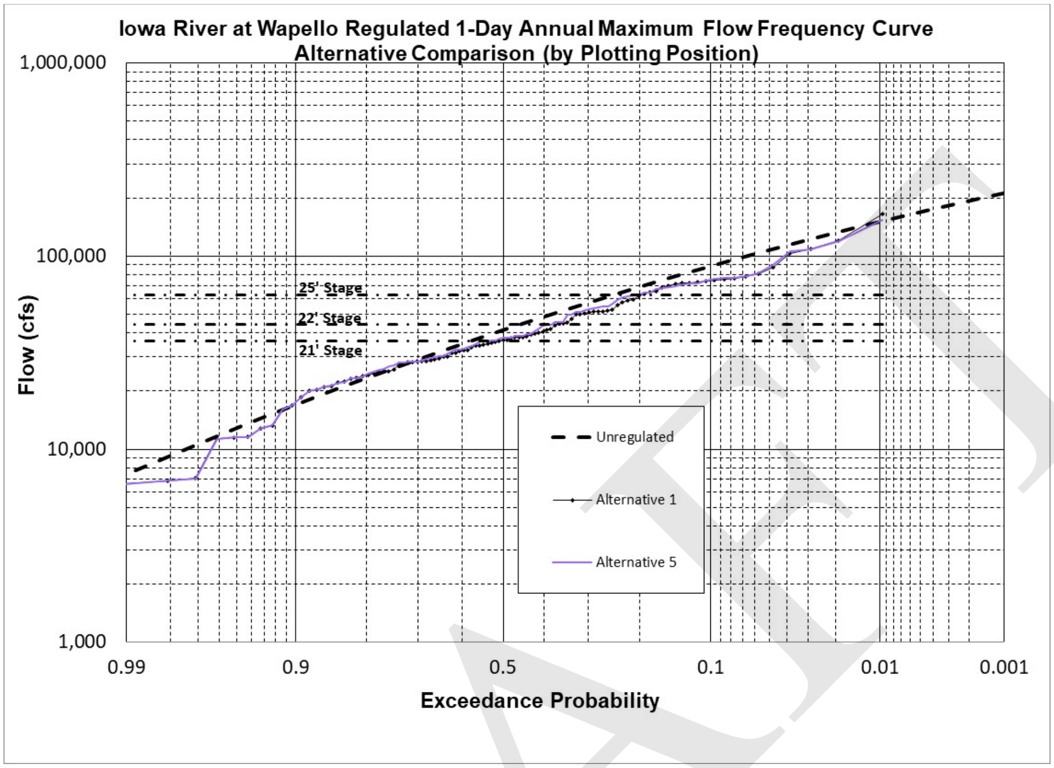


Figure B-37. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 5



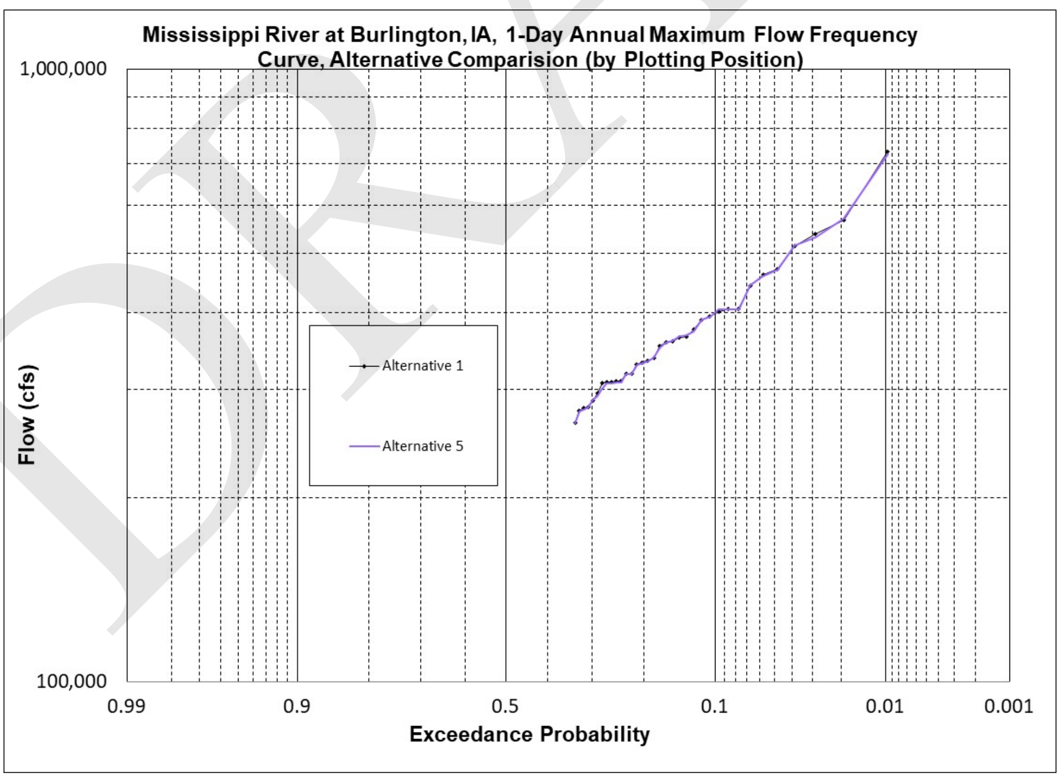


Figure B-38. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 5

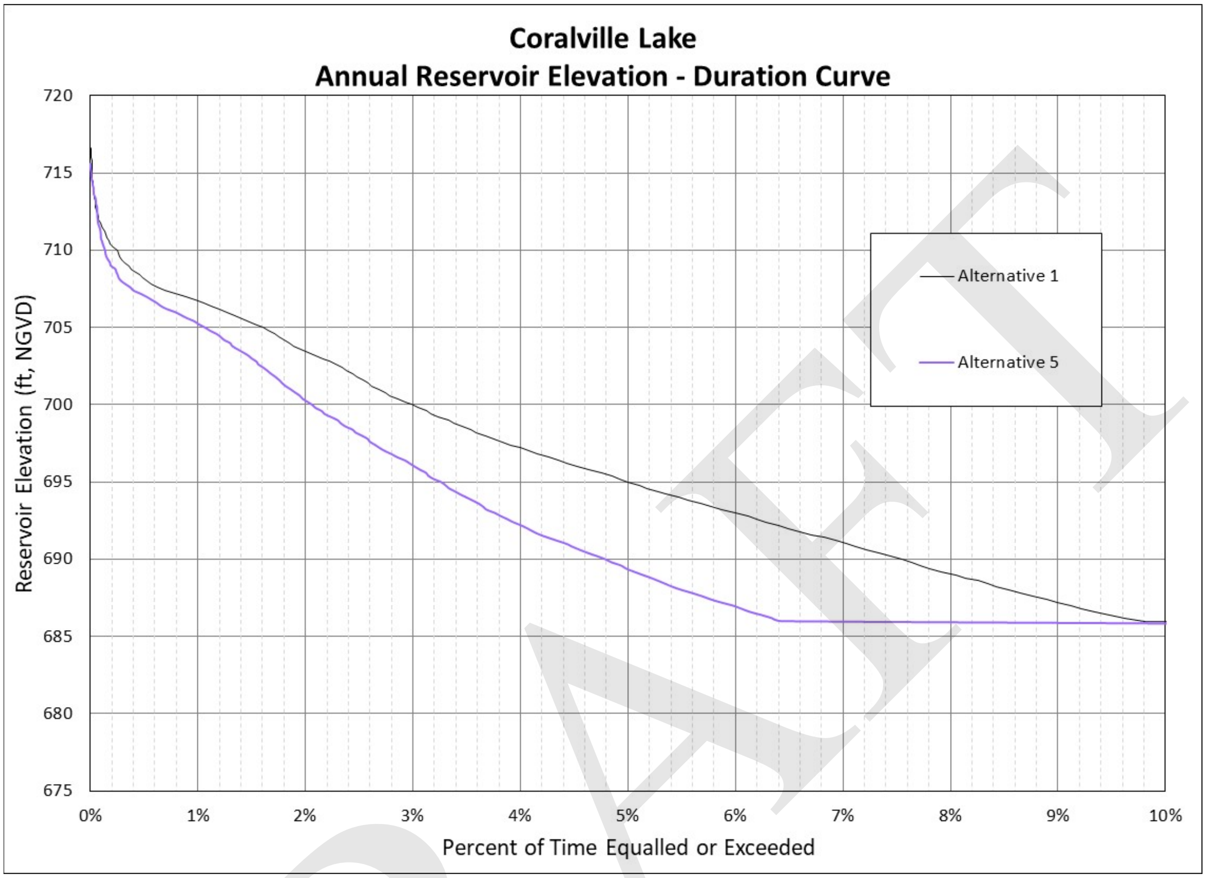
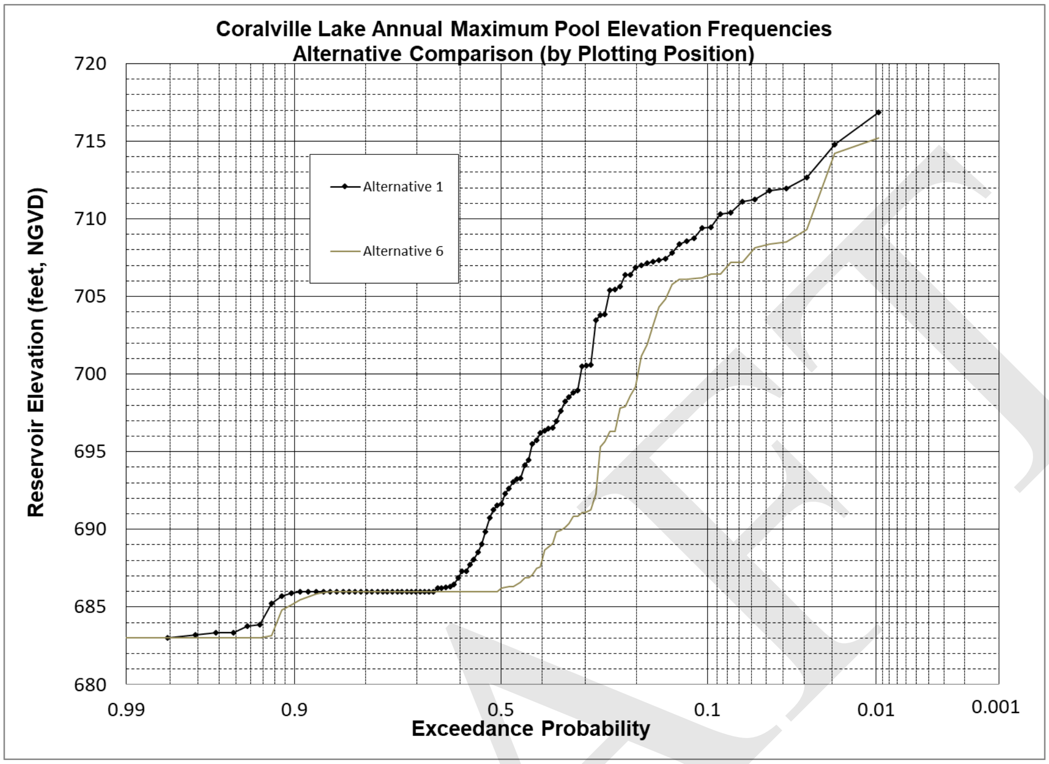


Figure B- 39. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 5



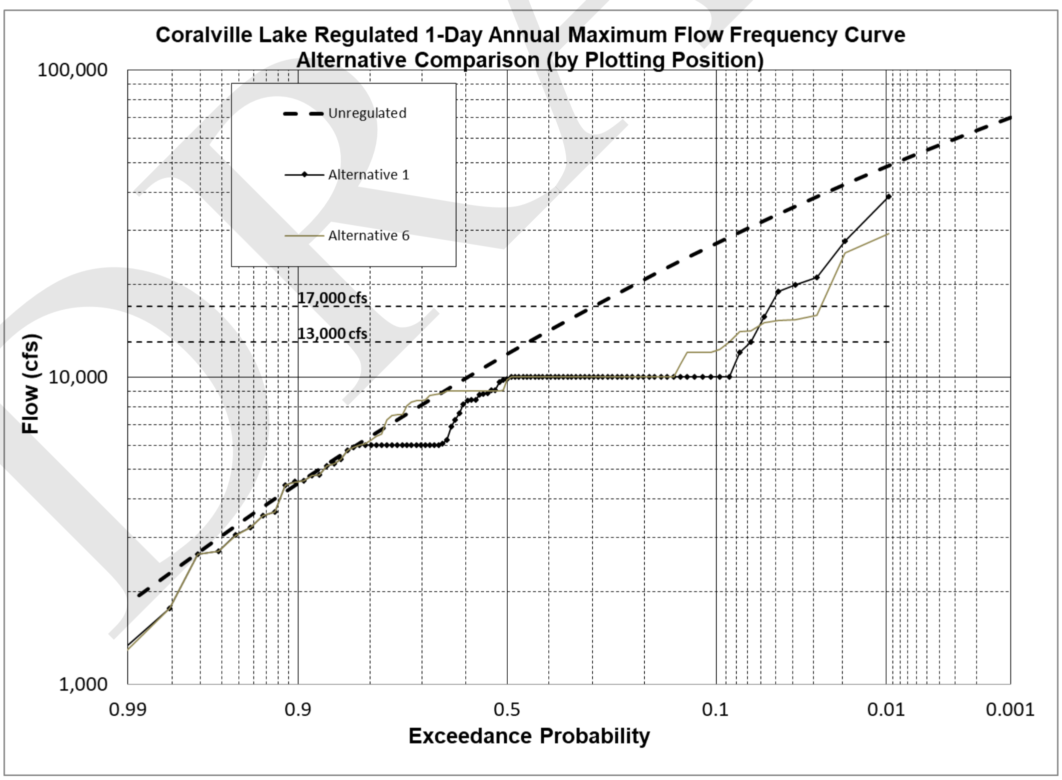
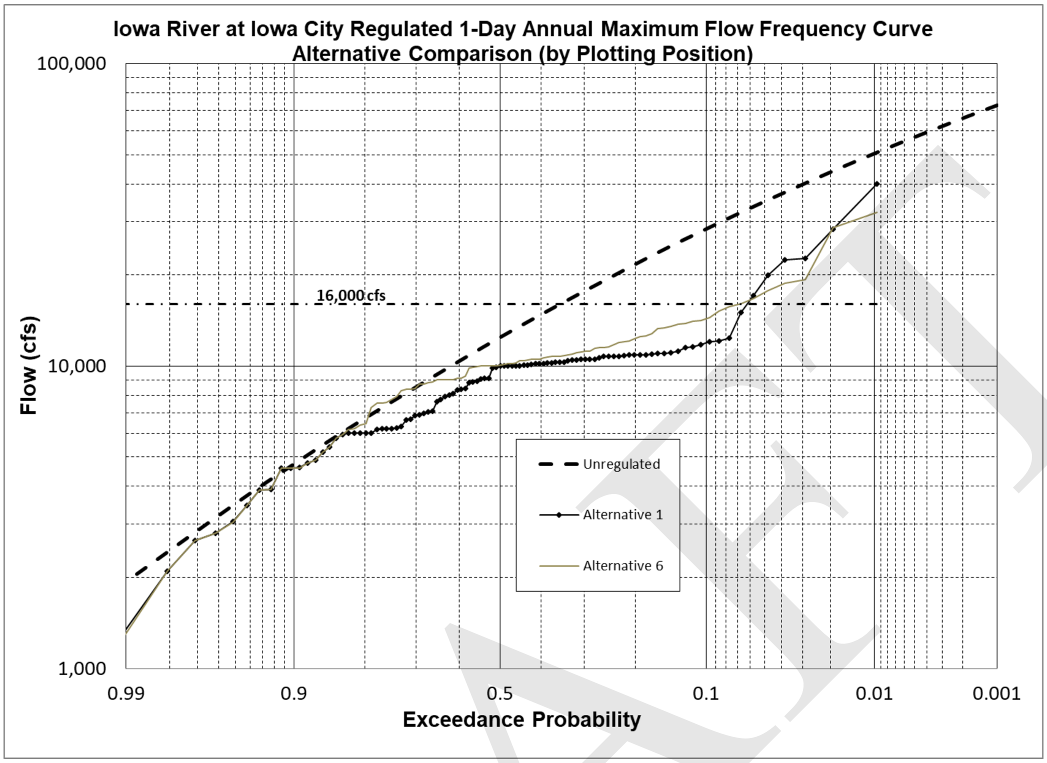


Figure B-40. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 6



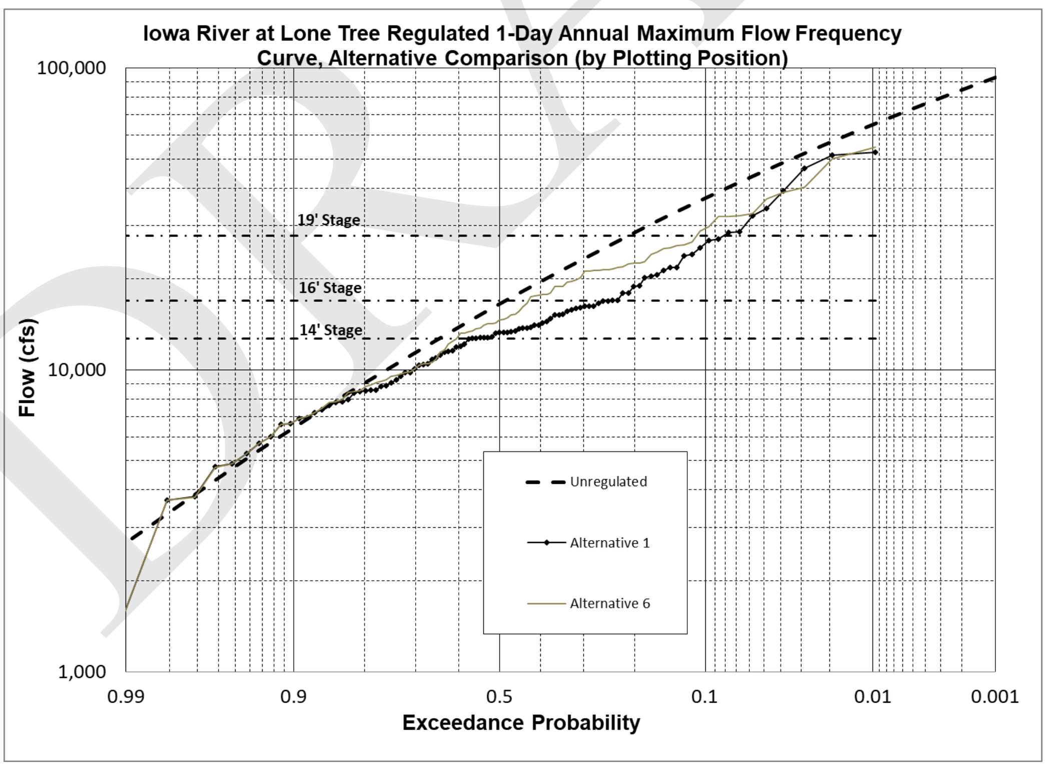
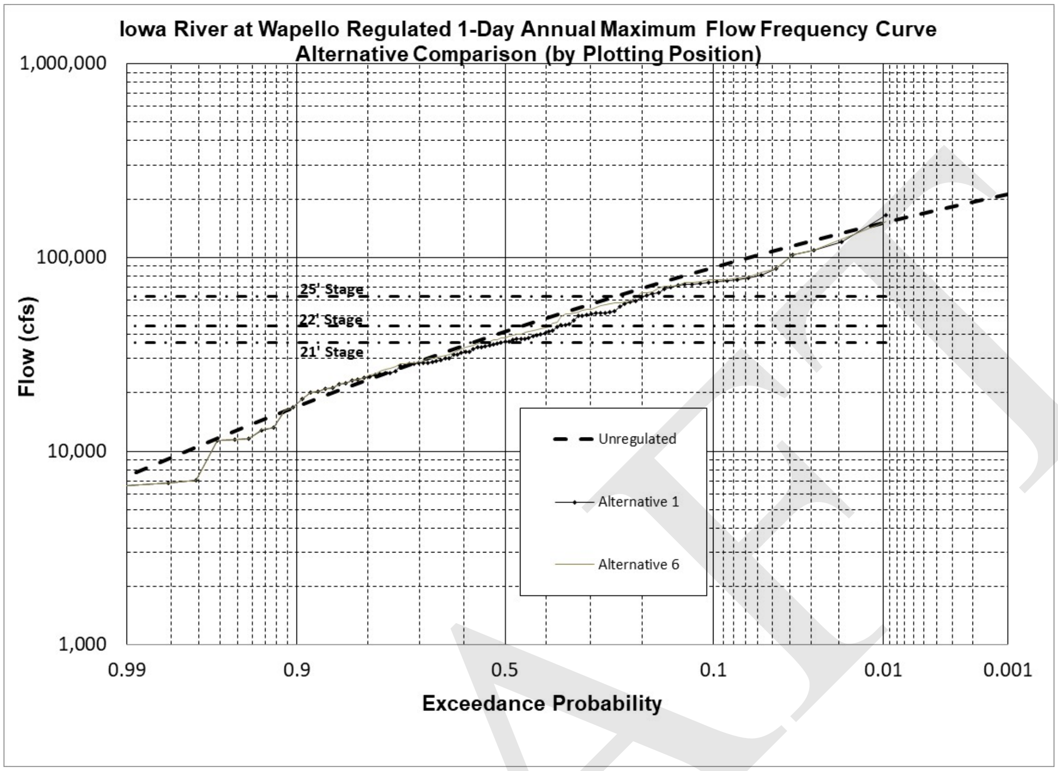


Figure B-41. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 6



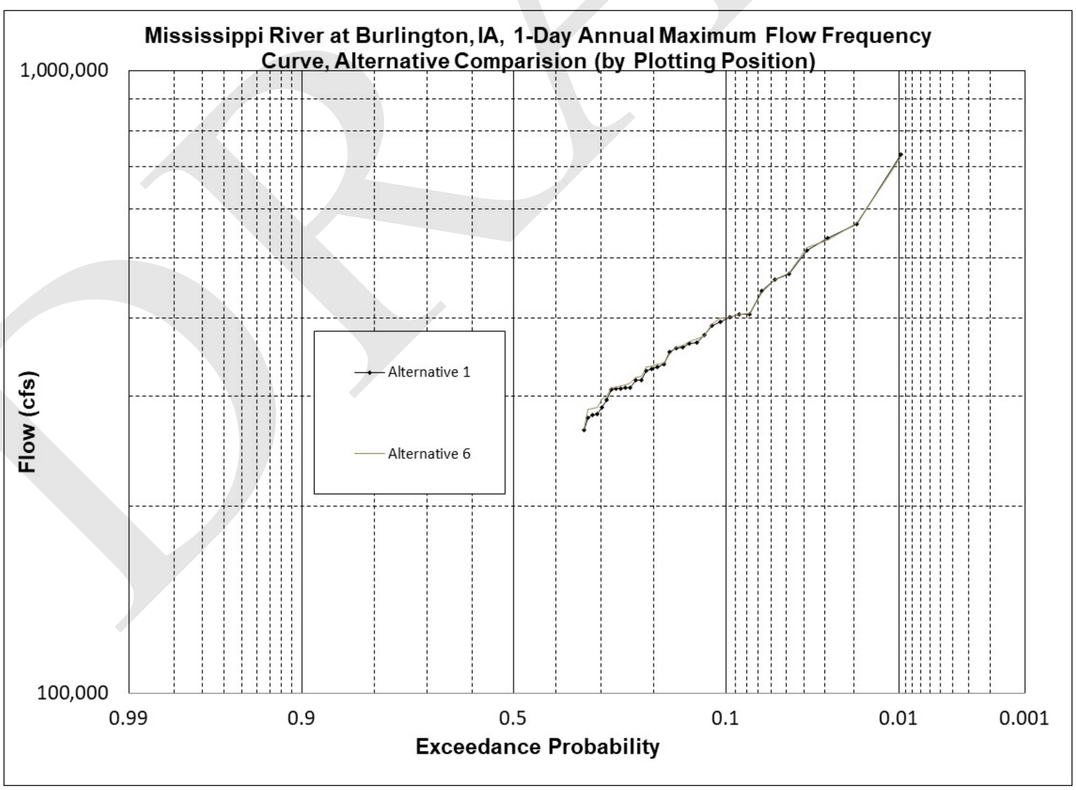


Figure B-42. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 6

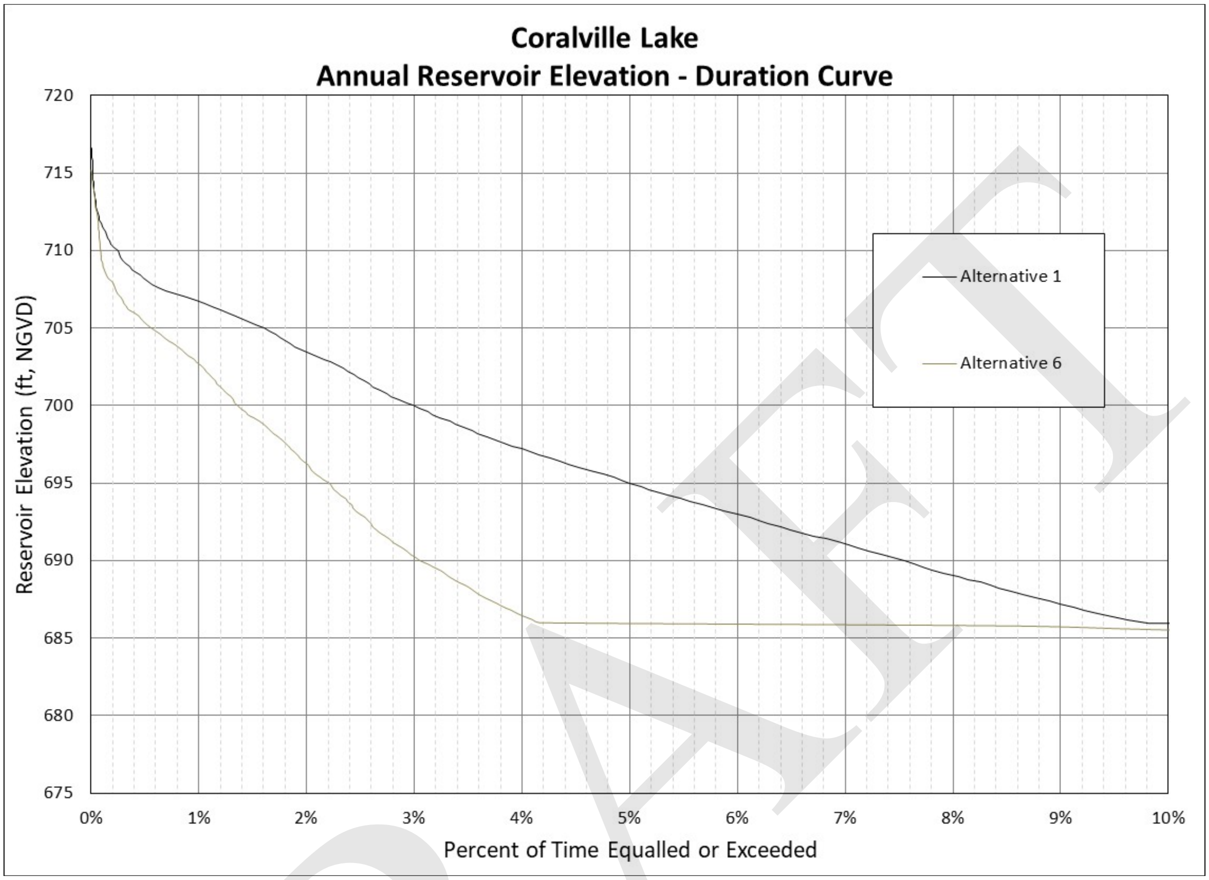
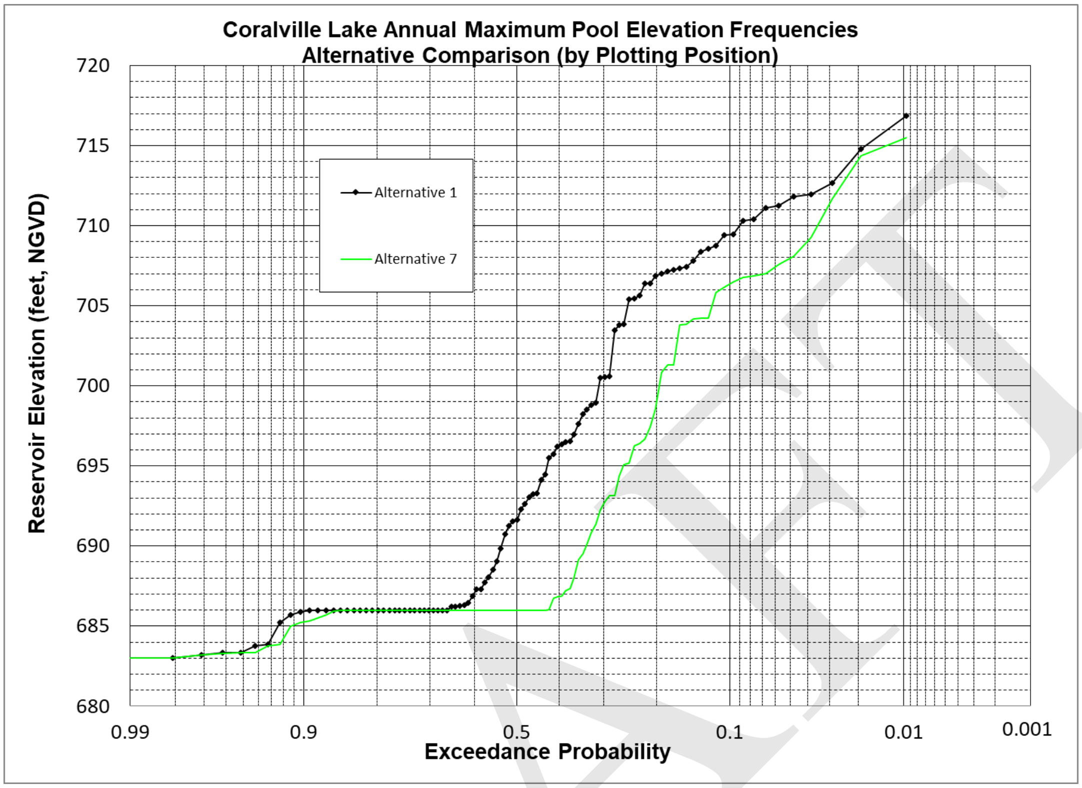


Figure B-43. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 6



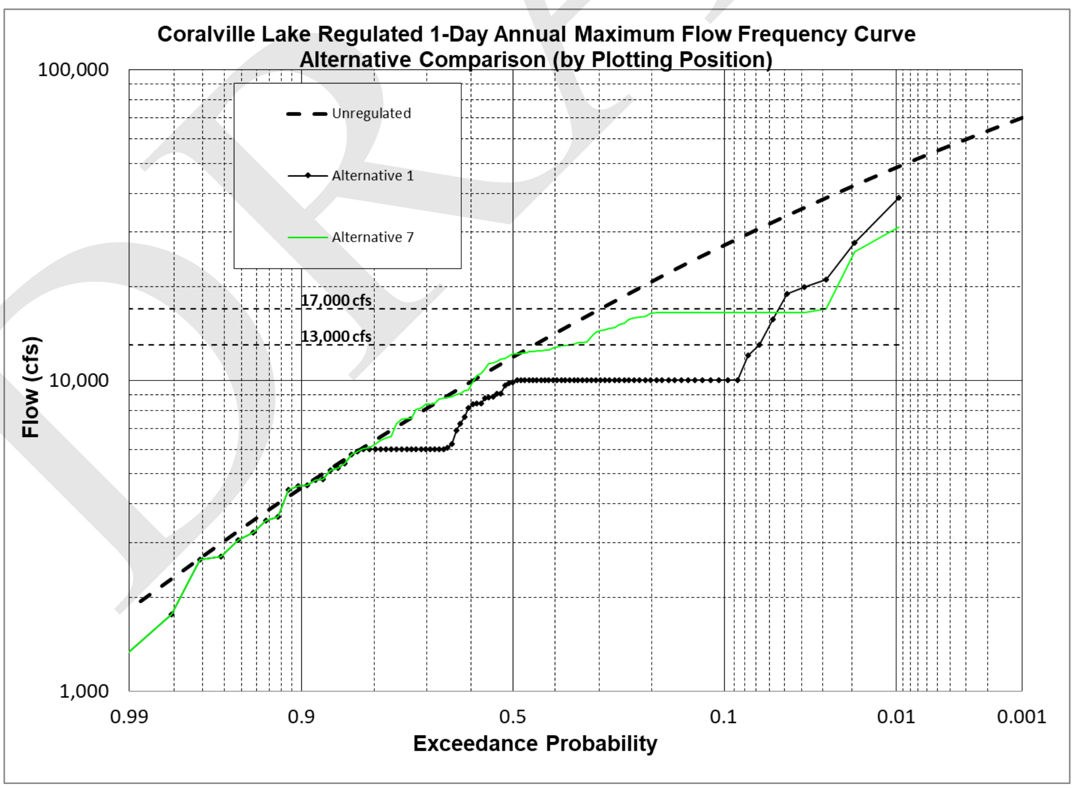
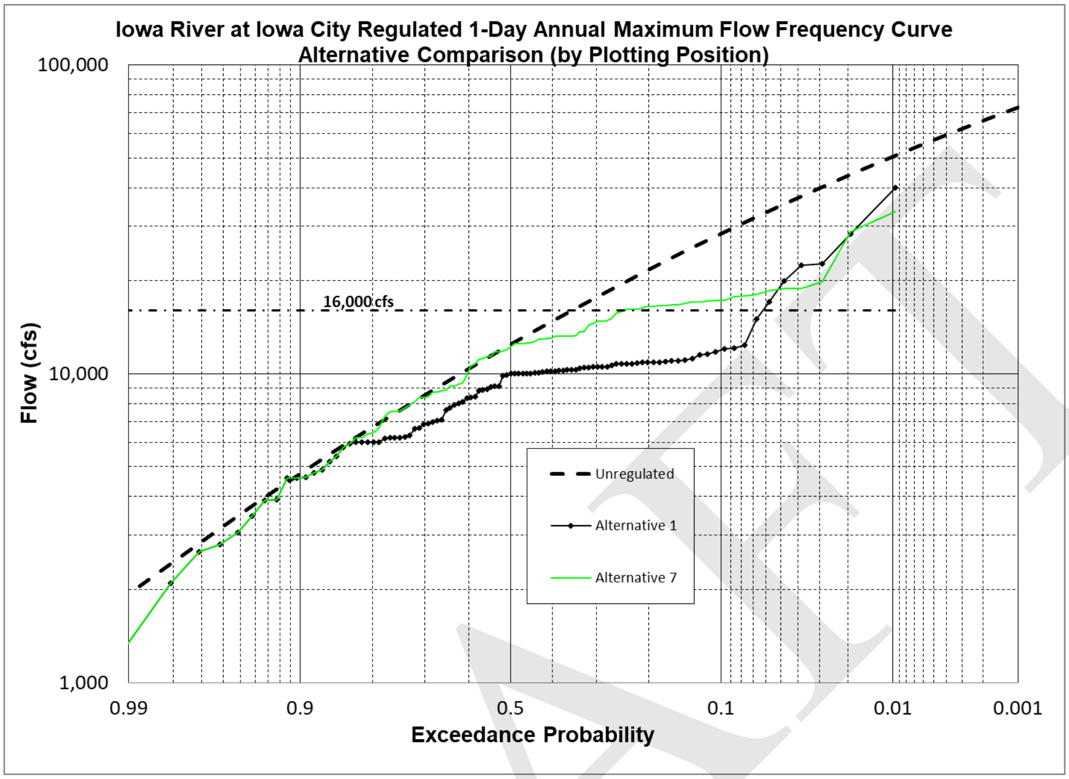


Figure B-44. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 7



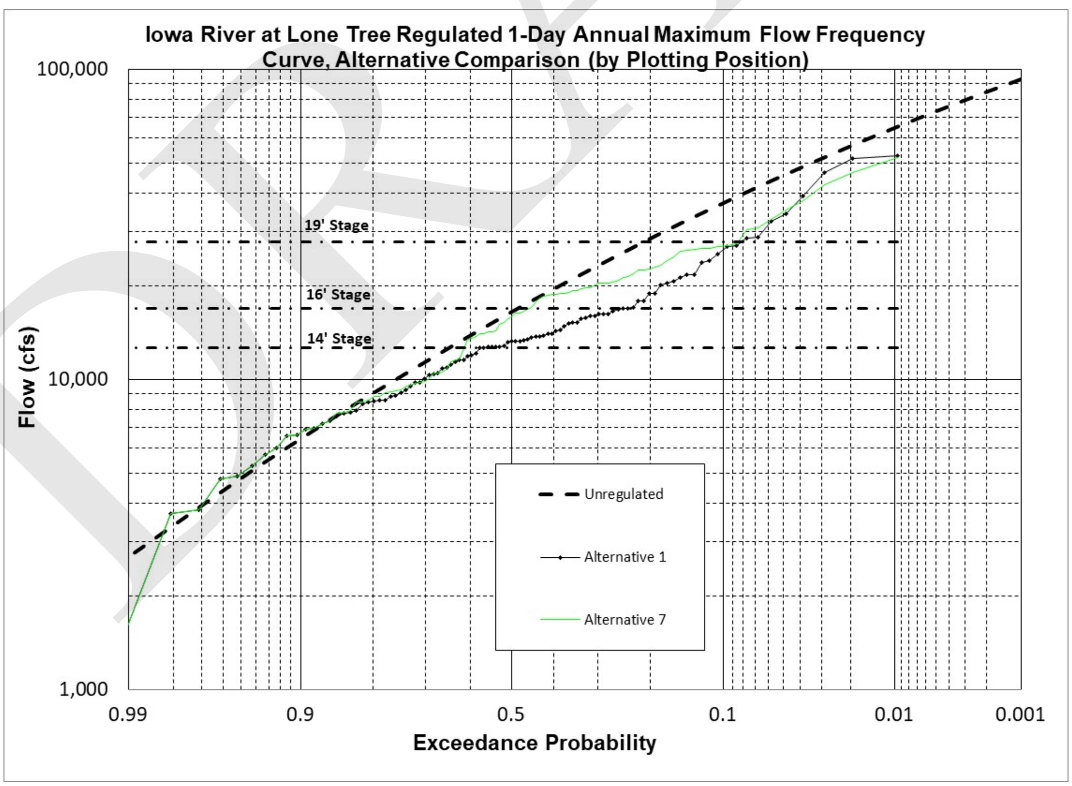
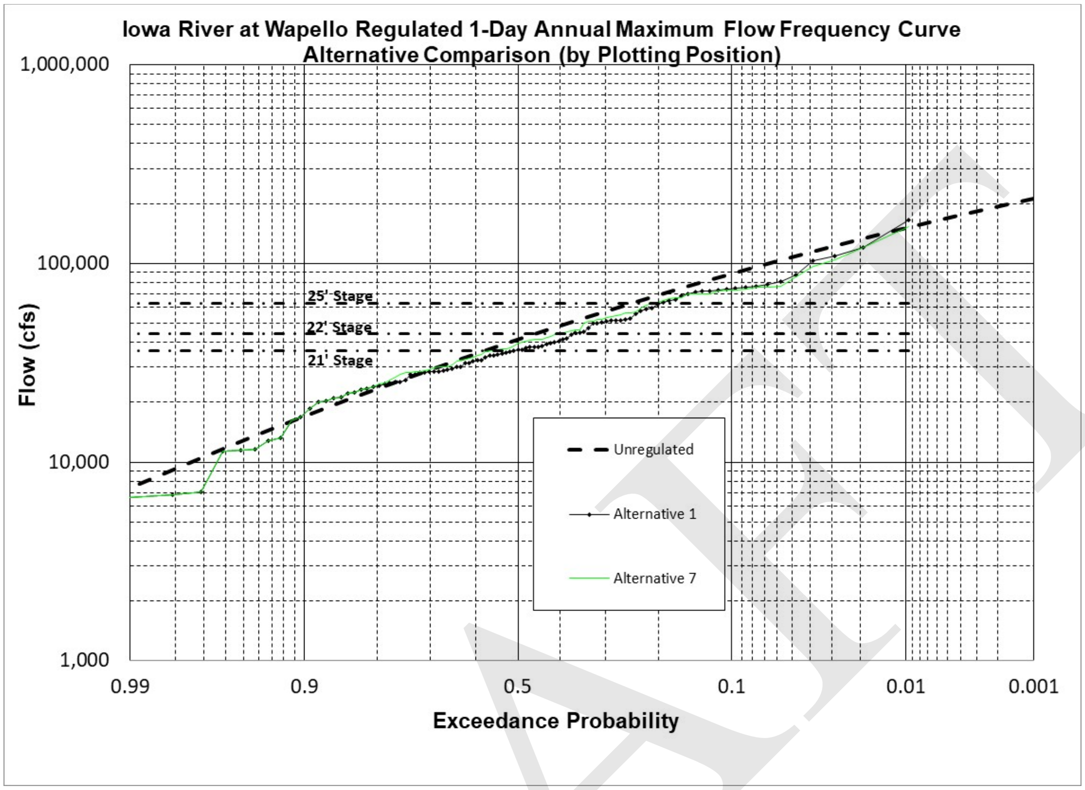


Figure B-45. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 7



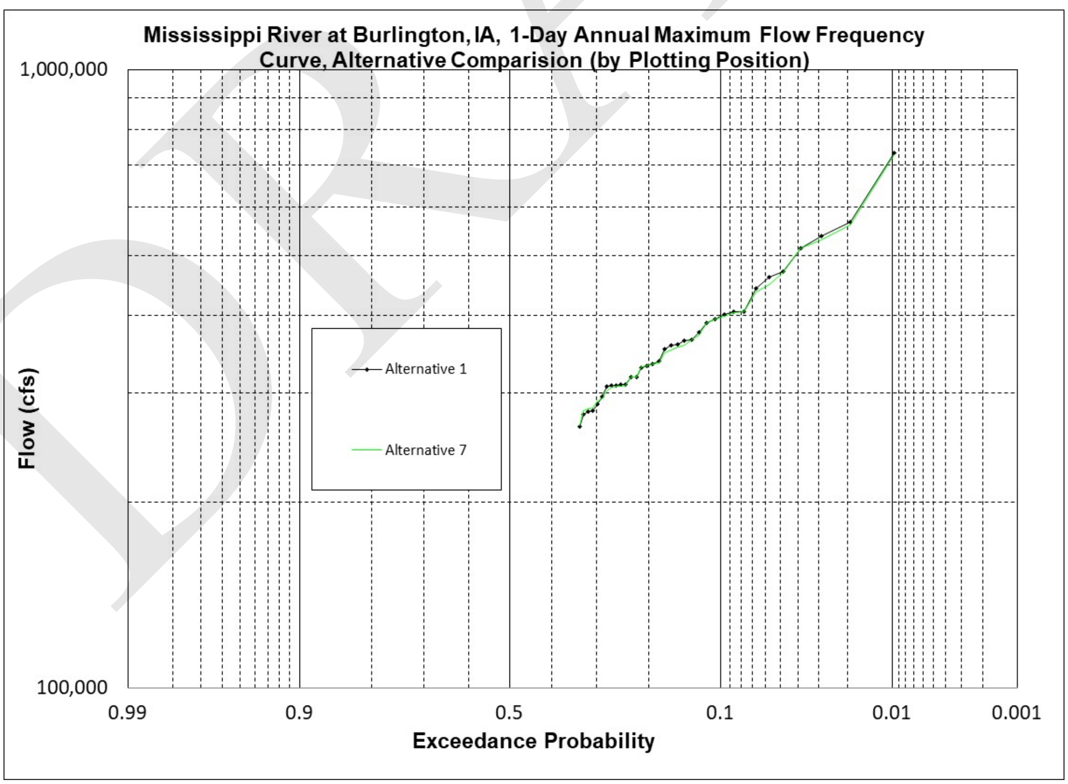


Figure B-46. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 7

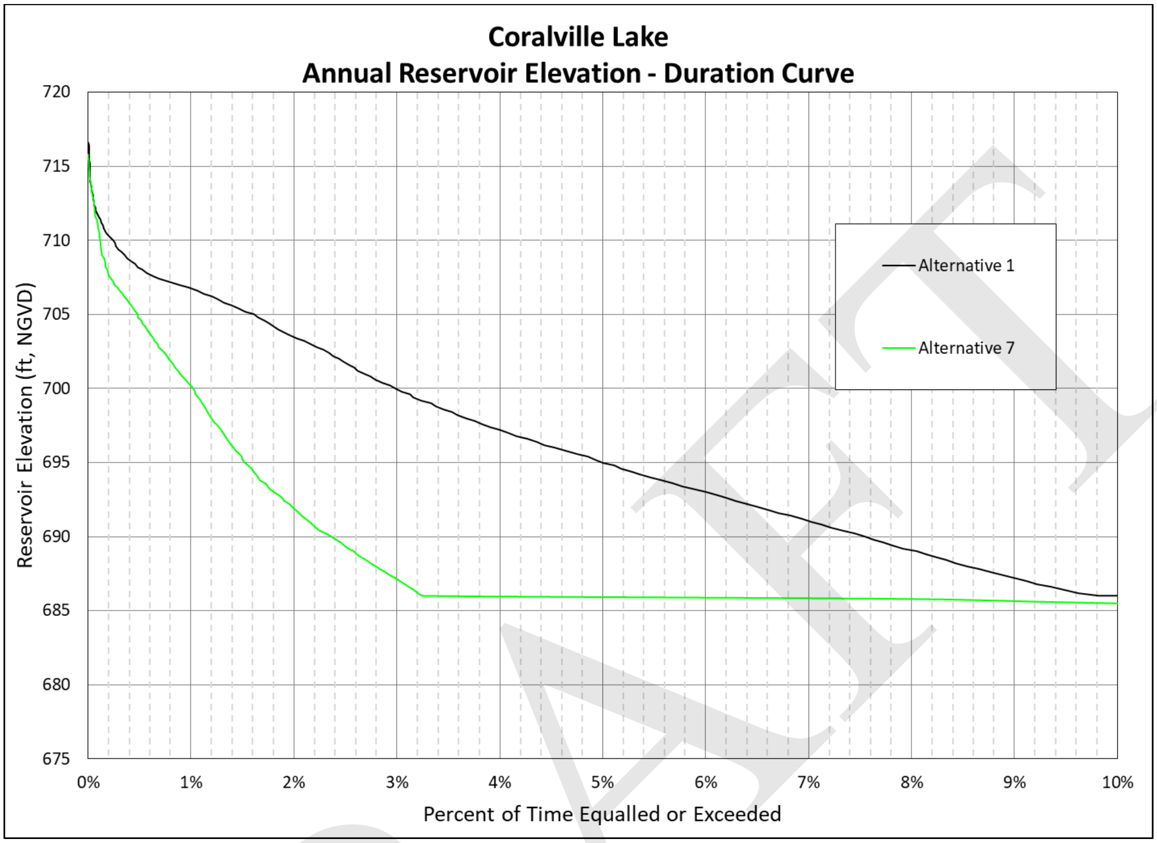
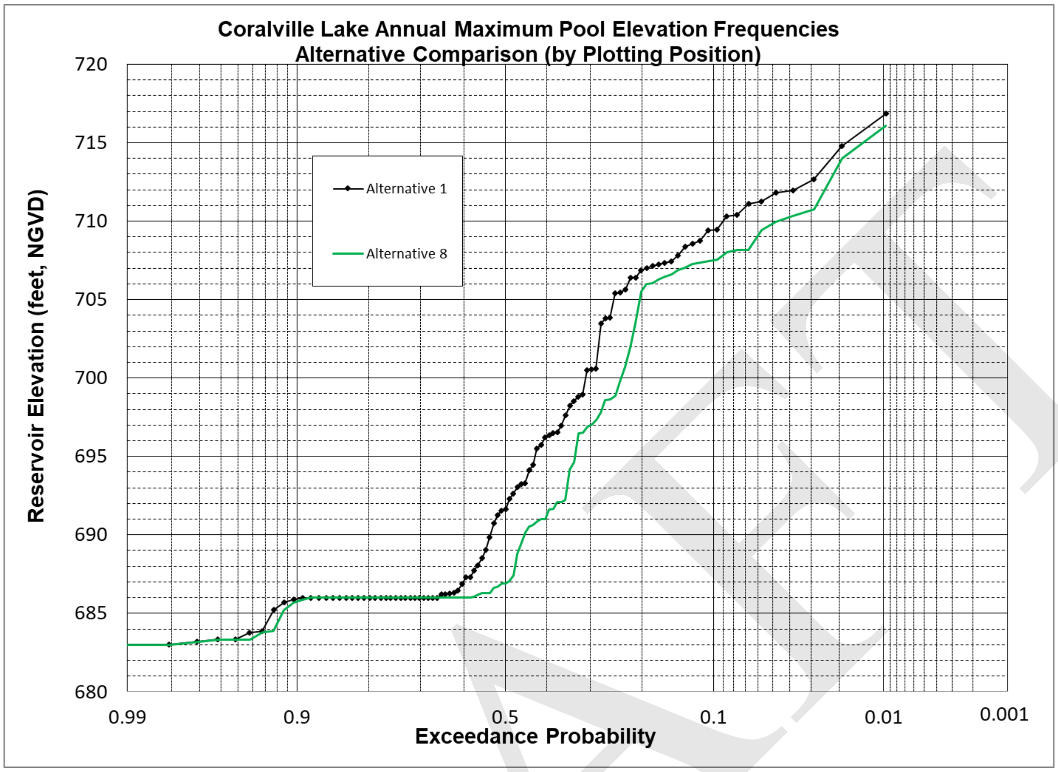


Figure B-47. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 7



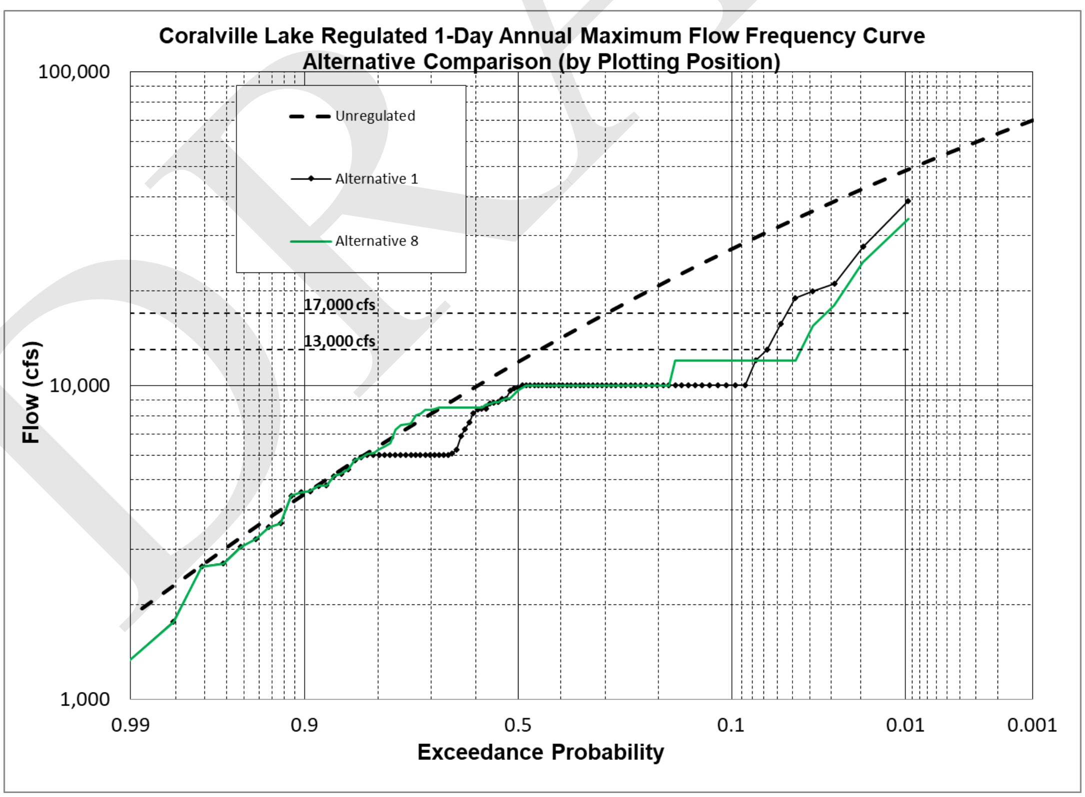
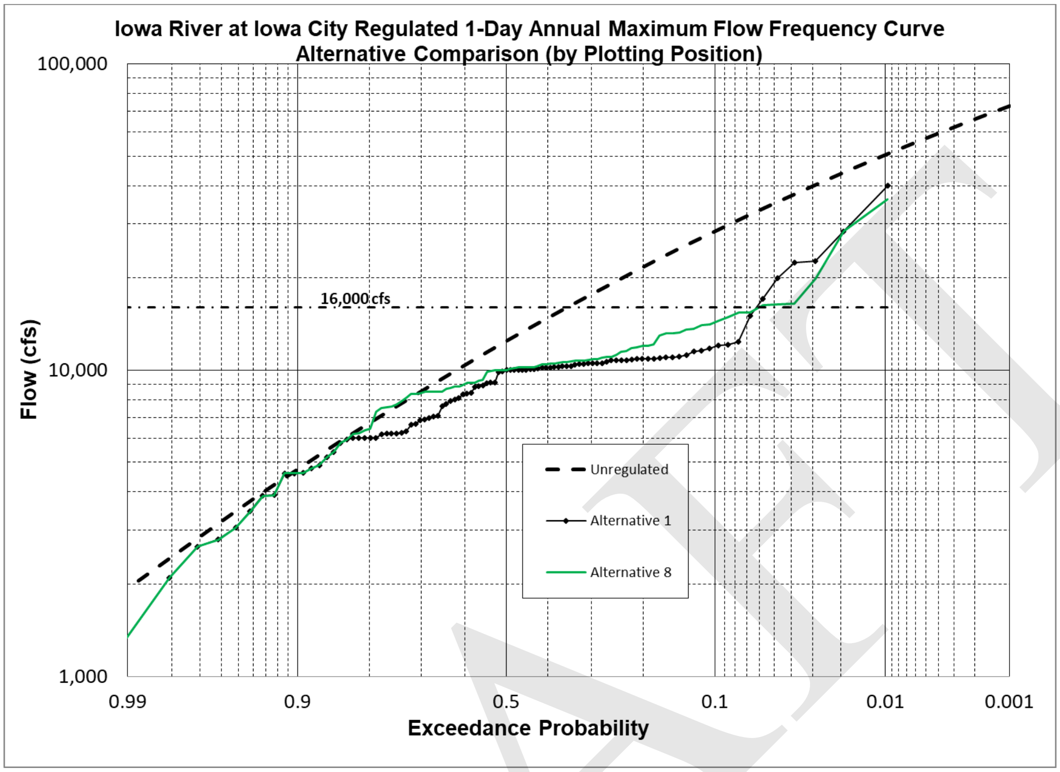


Figure B-48. Coralville Annual Maximum Pool Elevation and Regulated Flow Frequencies – Comparison of Alternatives 1 and 8



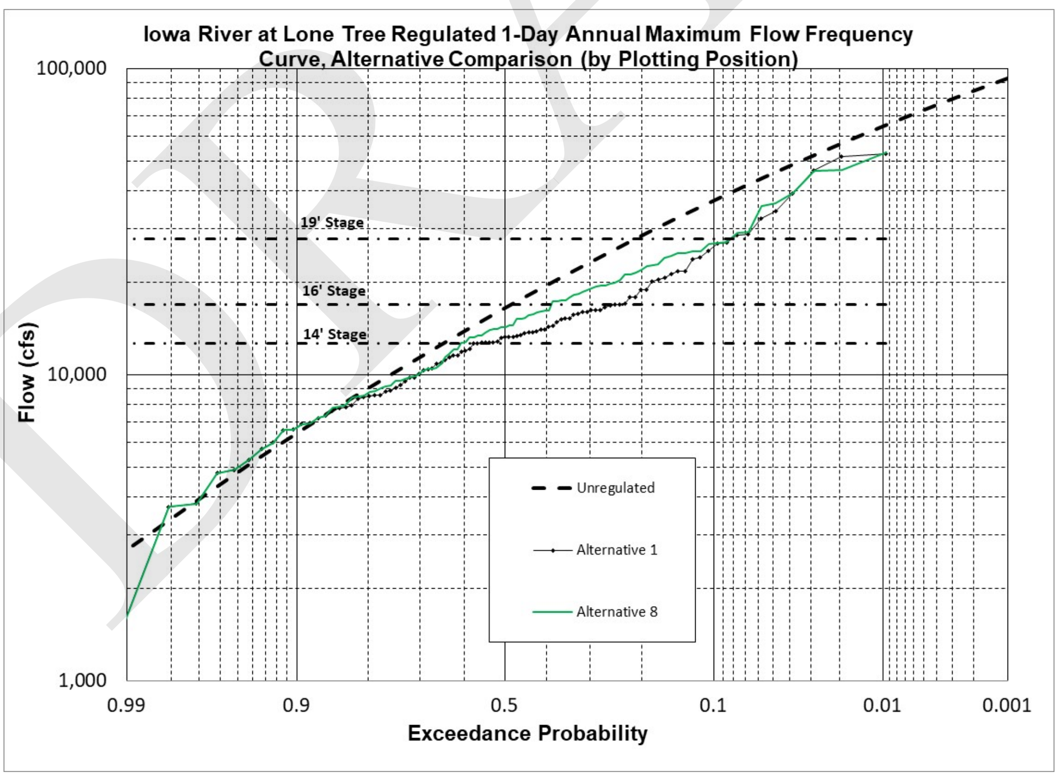
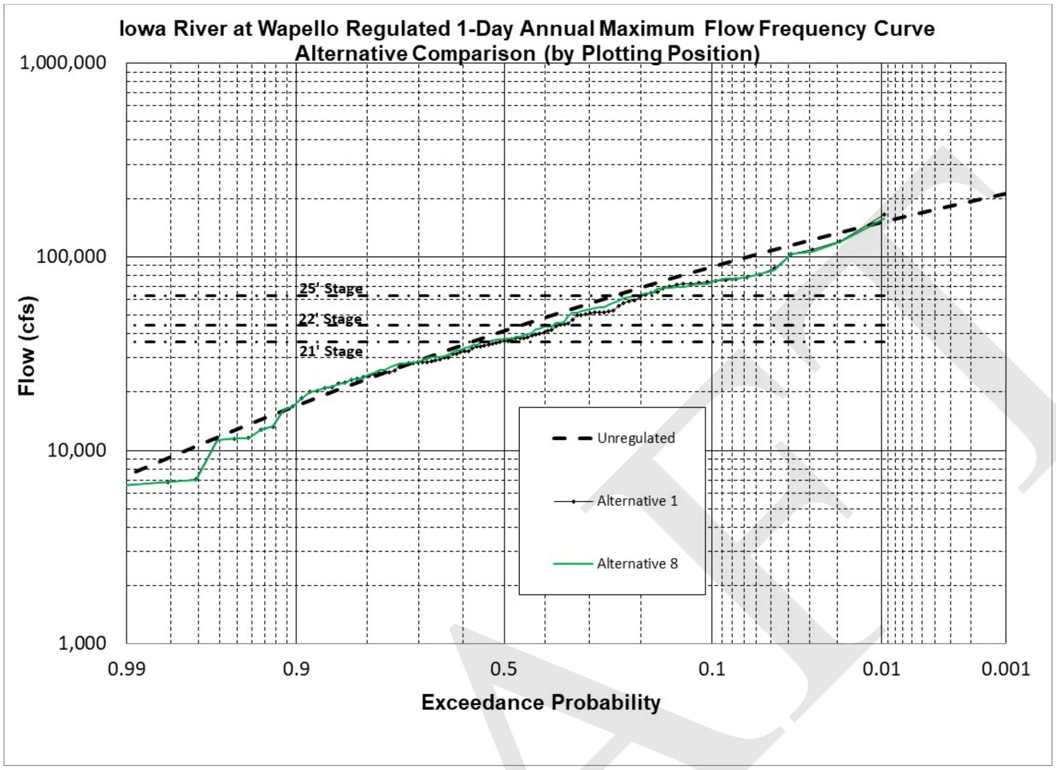


Figure B-49. Iowa City and Lone Tree Flow Regulated Annual Maximum Frequencies – Comparison of Alternatives 1 and 8



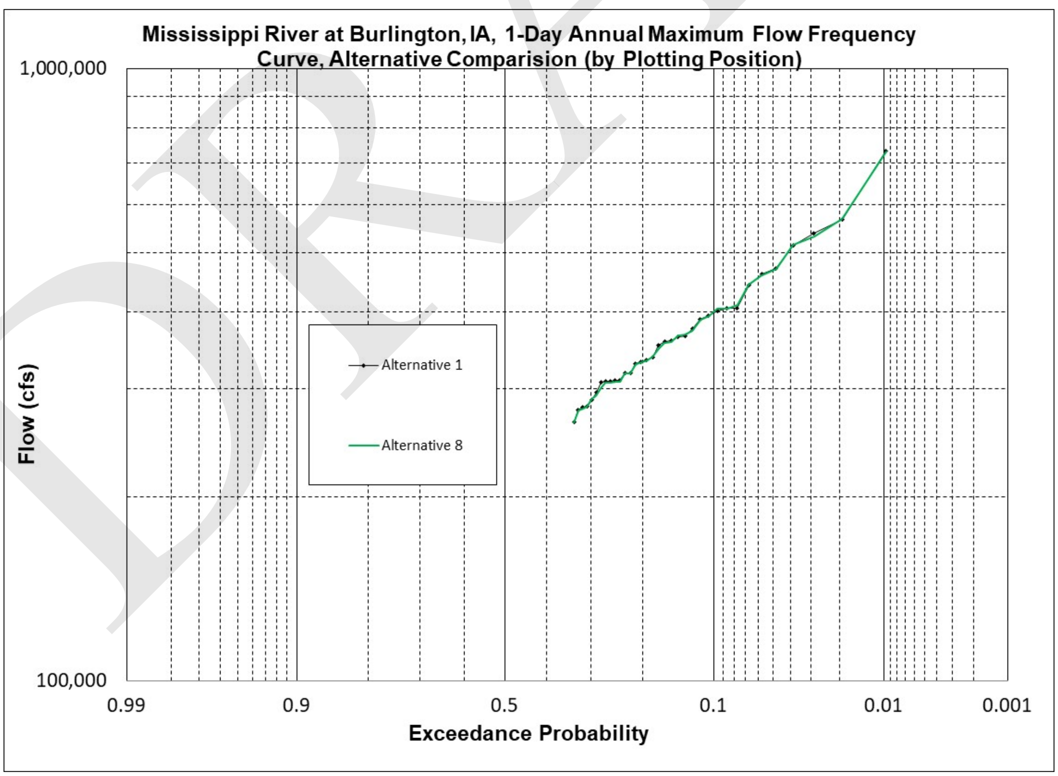


Figure B-50. Wapello and Burlington, IL, Regulated Annual Maximum Flow Frequencies – Comparison of Alternatives 1 and 8

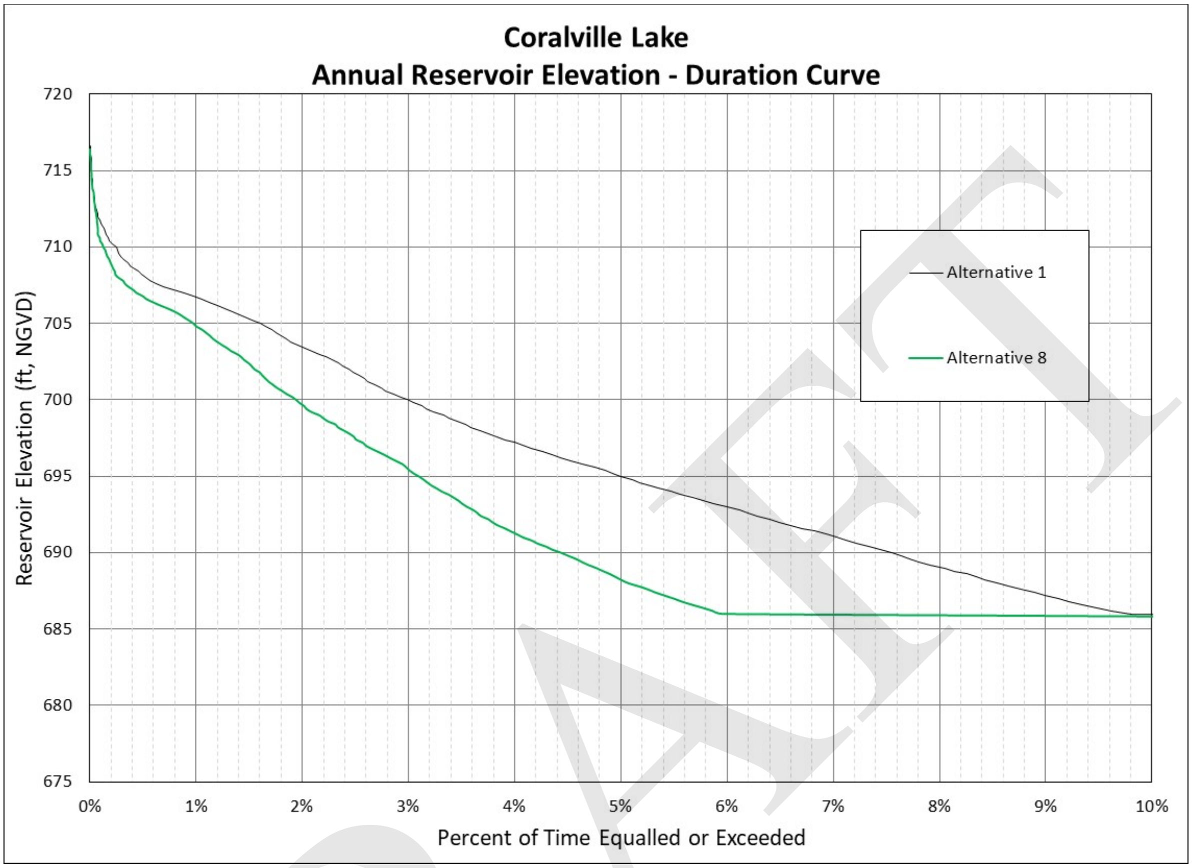


Figure B-51. Coralville Lake Annual Elevation-Duration Curves – Comparison of Alternatives 1 and 8

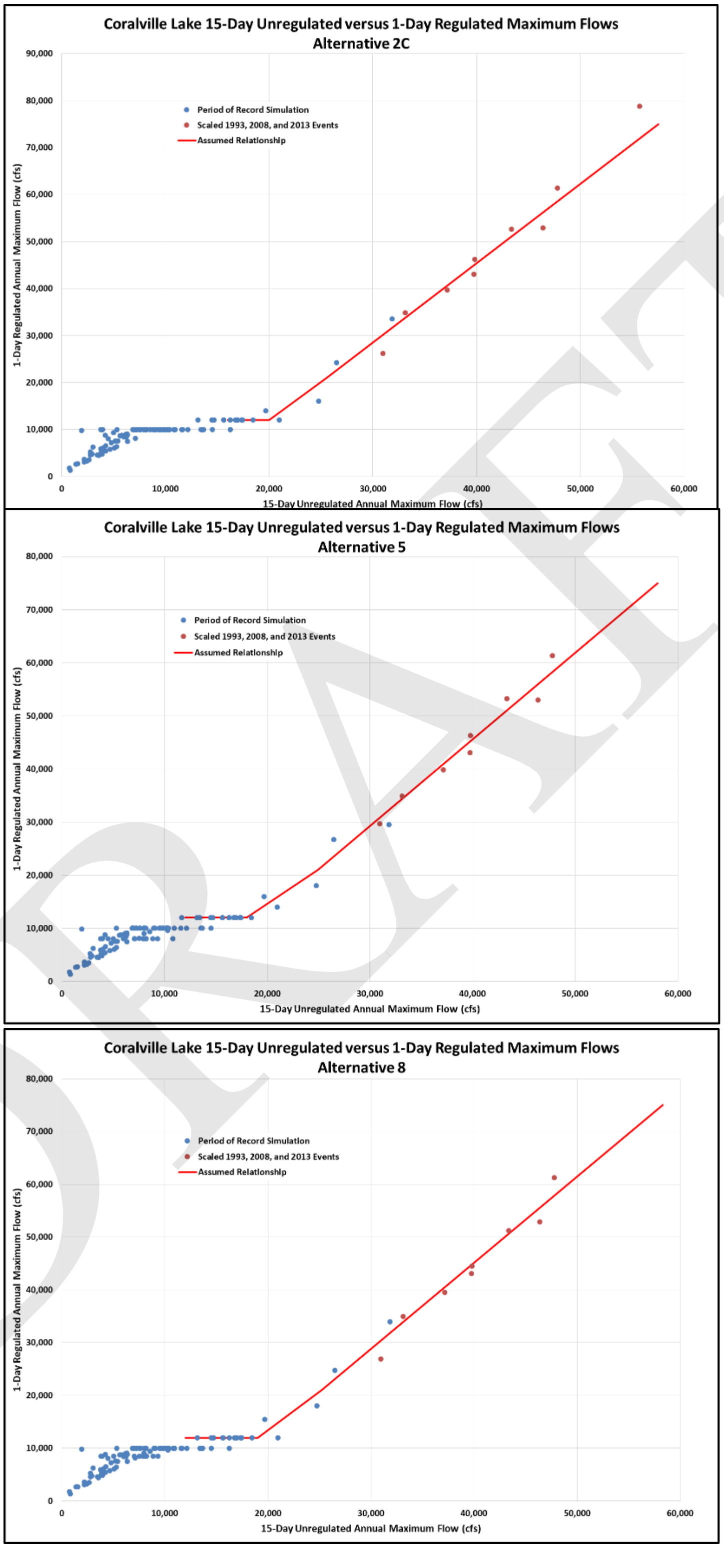


Figure B-52. Coralville Lake 15-Day Unregulated versus 1-Day Regulated Relationships – Alternatives 2C, 5 and 8

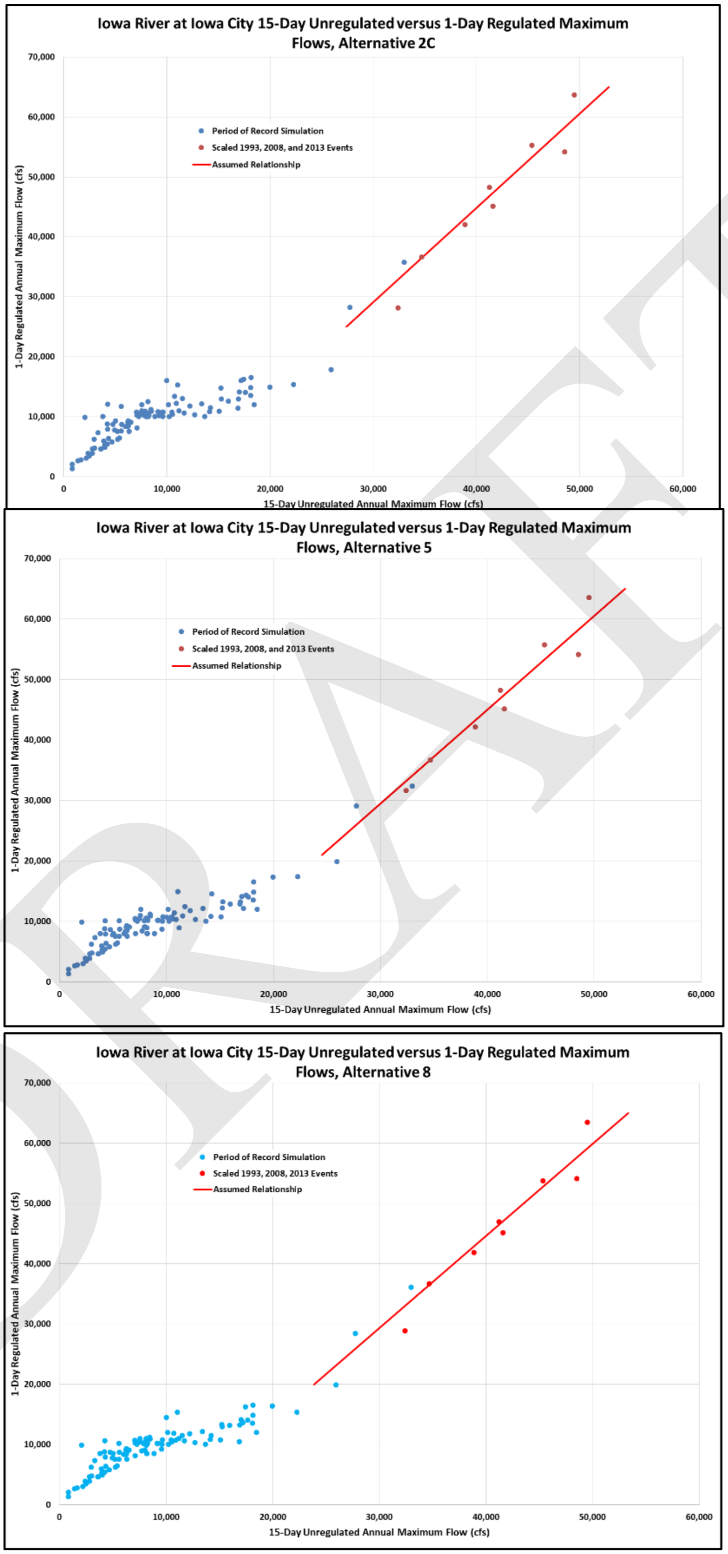


Figure B-53. Iowa River at Iowa City 15-Day Unregulated versus 1-Day Regulated Relationships – Alternatives 2C, 5 and 8

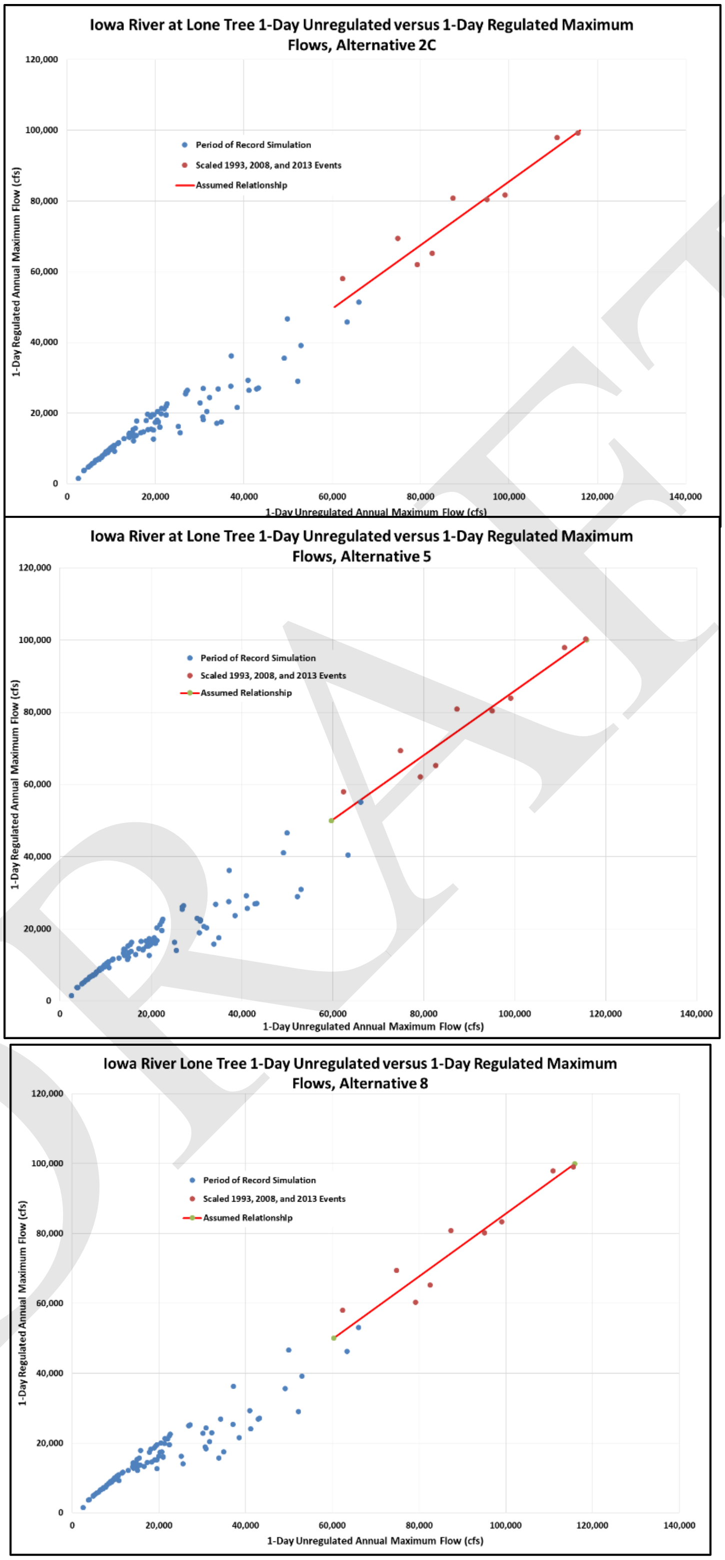


Figure B-54. Iowa River at Lone Tree 1-Day Unregulated versus 1-Day Regulated Relationships – Alternatives 2C, 5 and 8

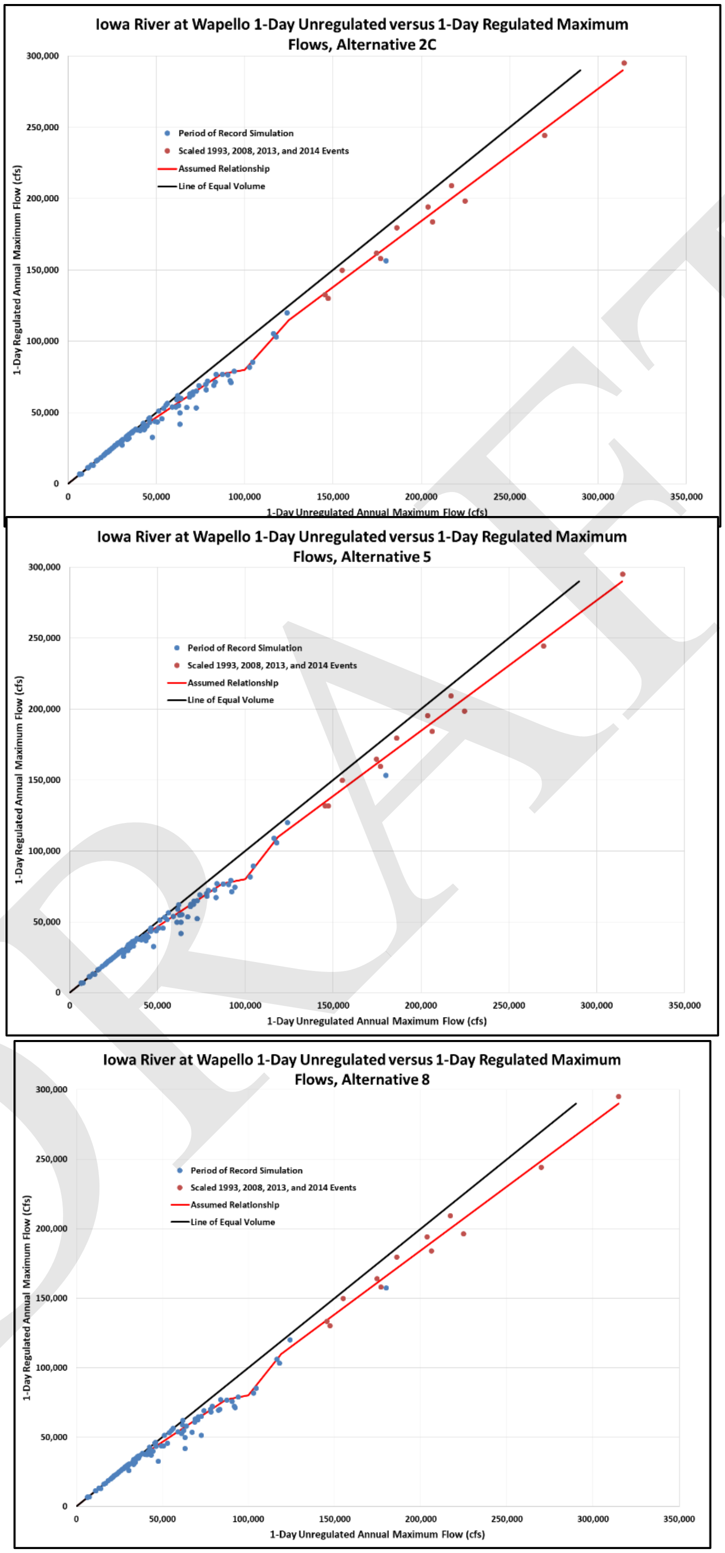


Figure B-55. Iowa River at Wapello 1-Day Unregulated versus 1-Day Regulated Relationships – Alternatives 2C, 5 and 8.

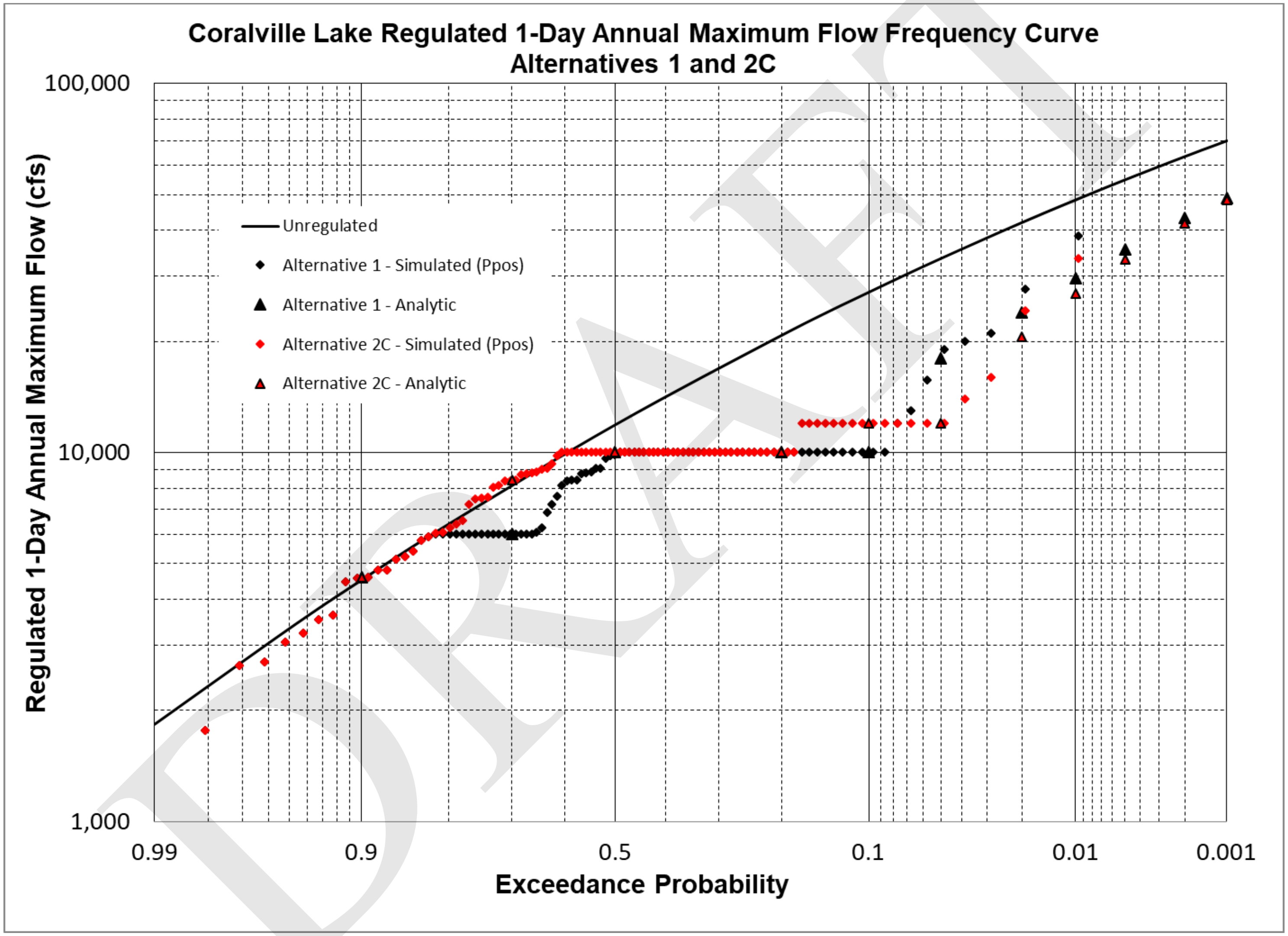


Figure B-56. Coralville Lake Regulated Flow Frequency Curve – Alternatives 1 and 2C. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

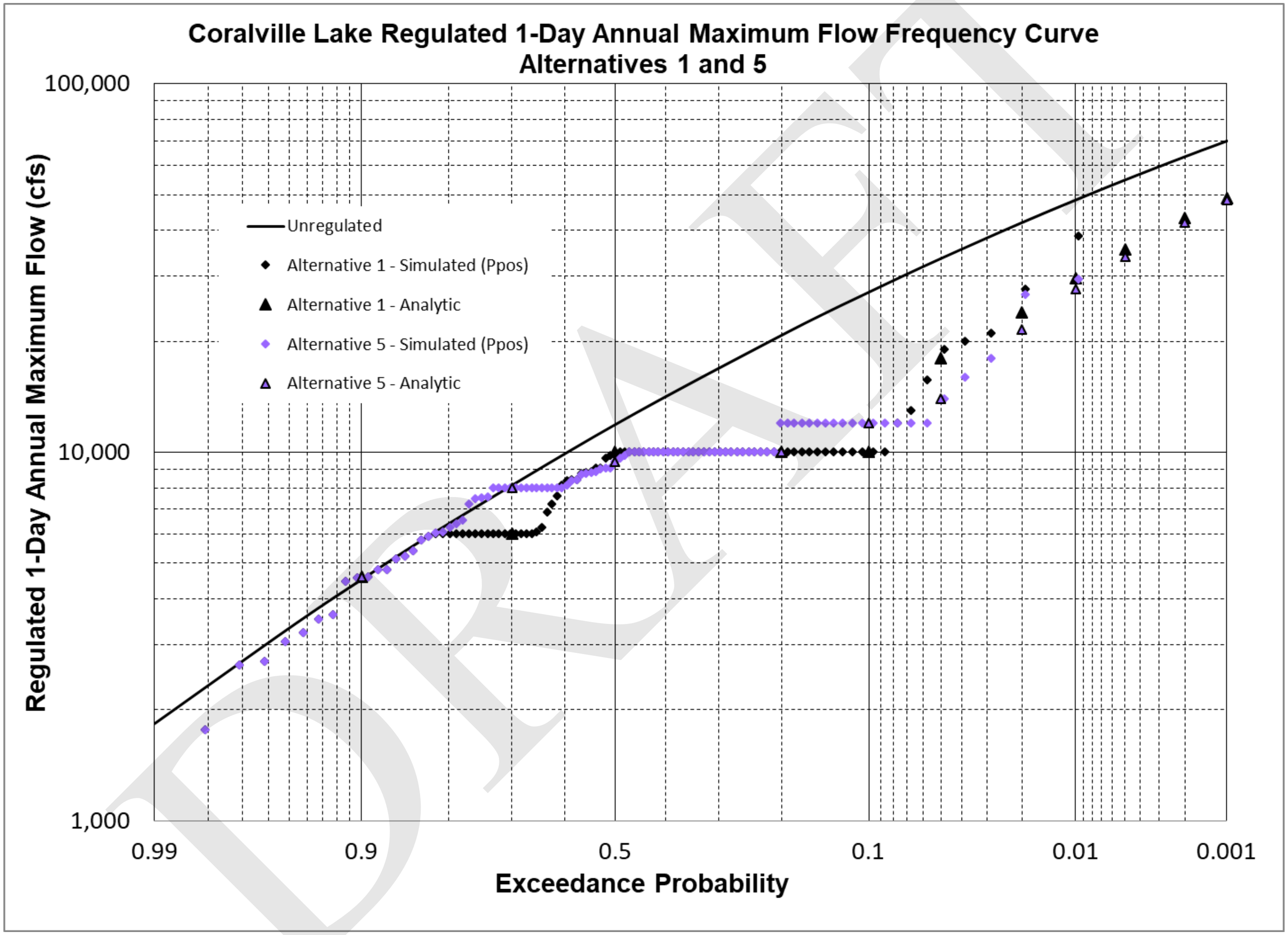


Figure B-57. Coralville Lake Regulated Flow Frequency Curve – Alternatives 1 and 5. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

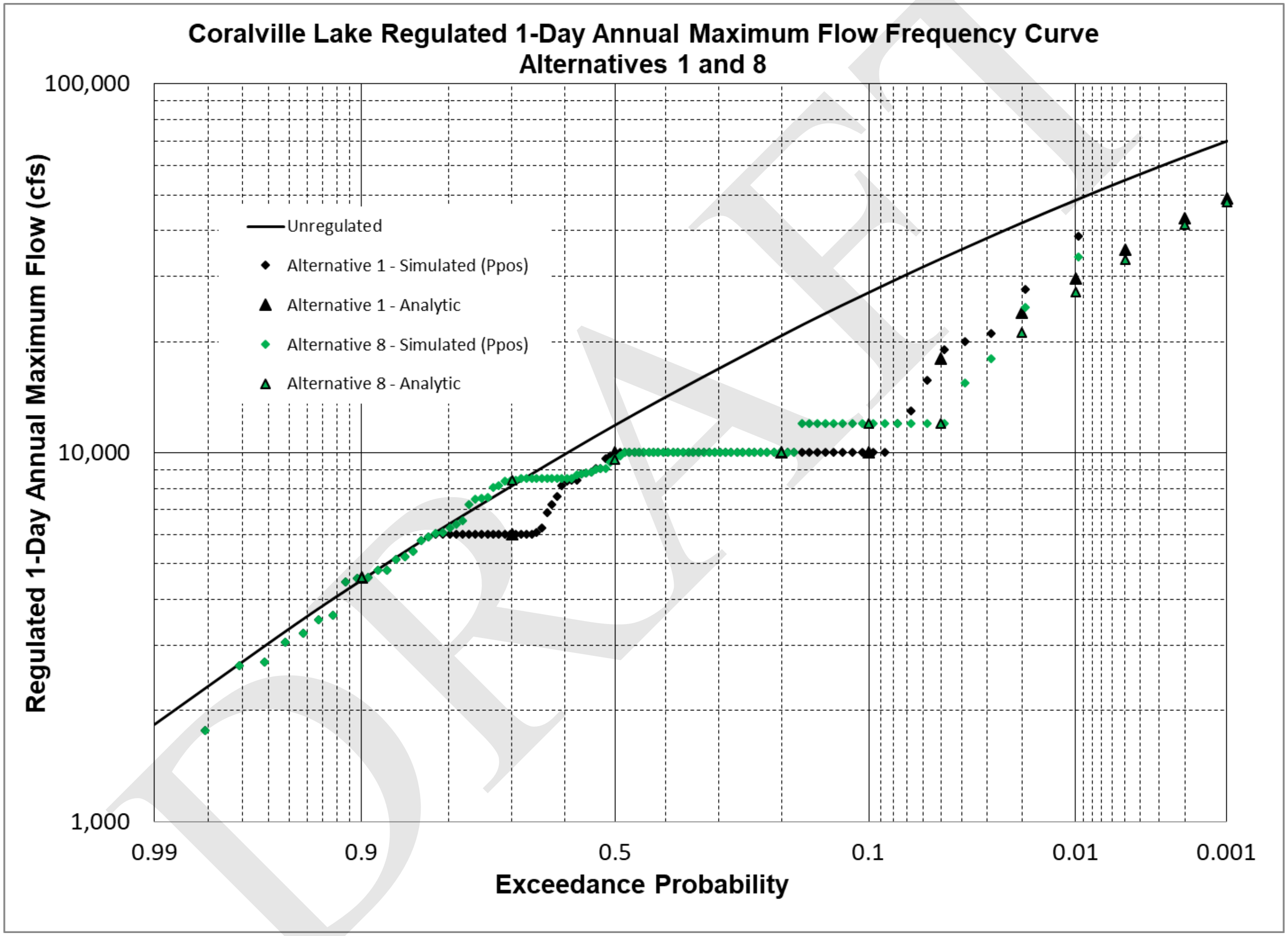


Figure B-58. Coralville Lake Regulated Flow Frequency Curve – Alternatives 1 and 8. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

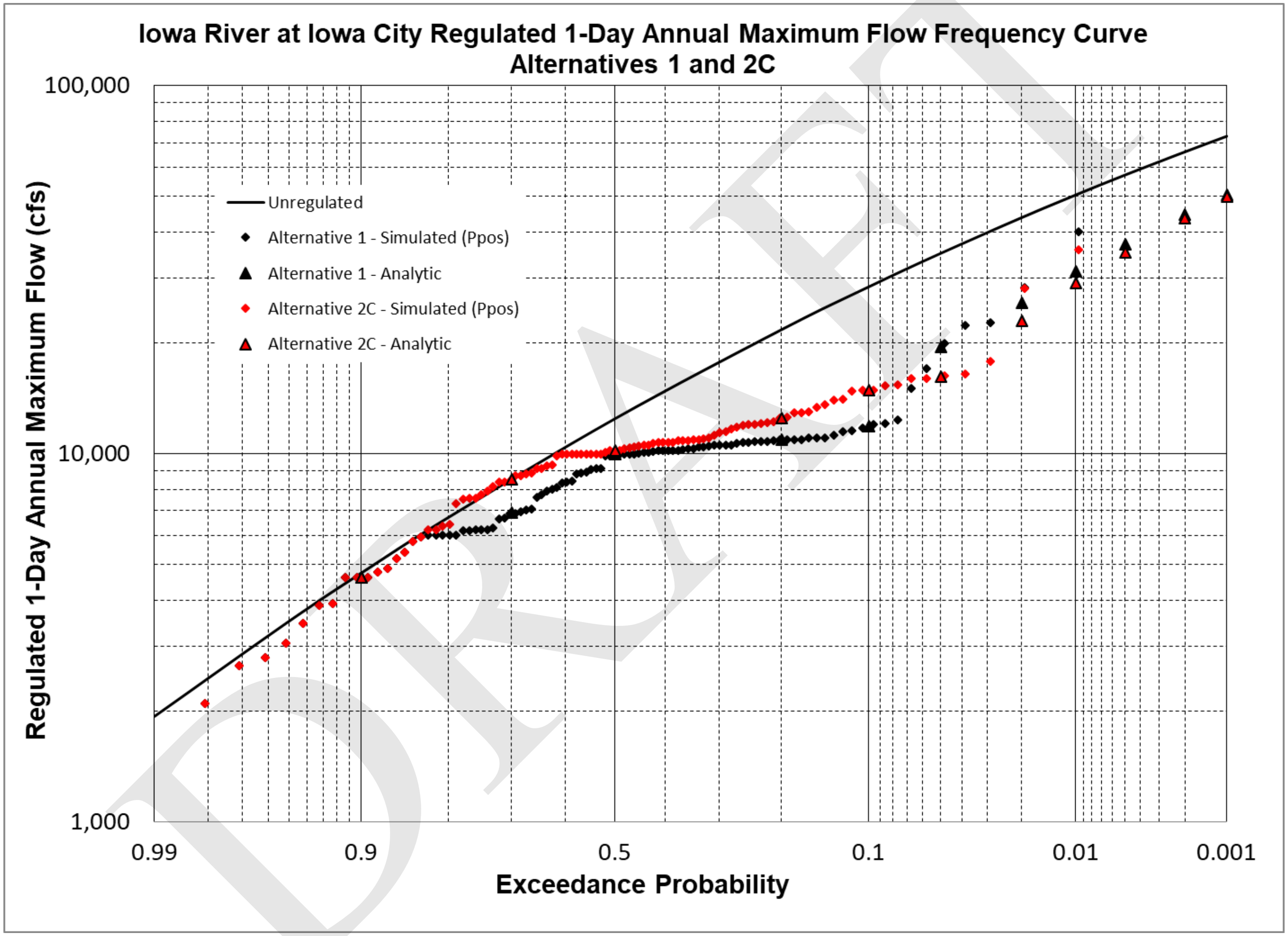


Figure B-59. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternatives 1 and 2C. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

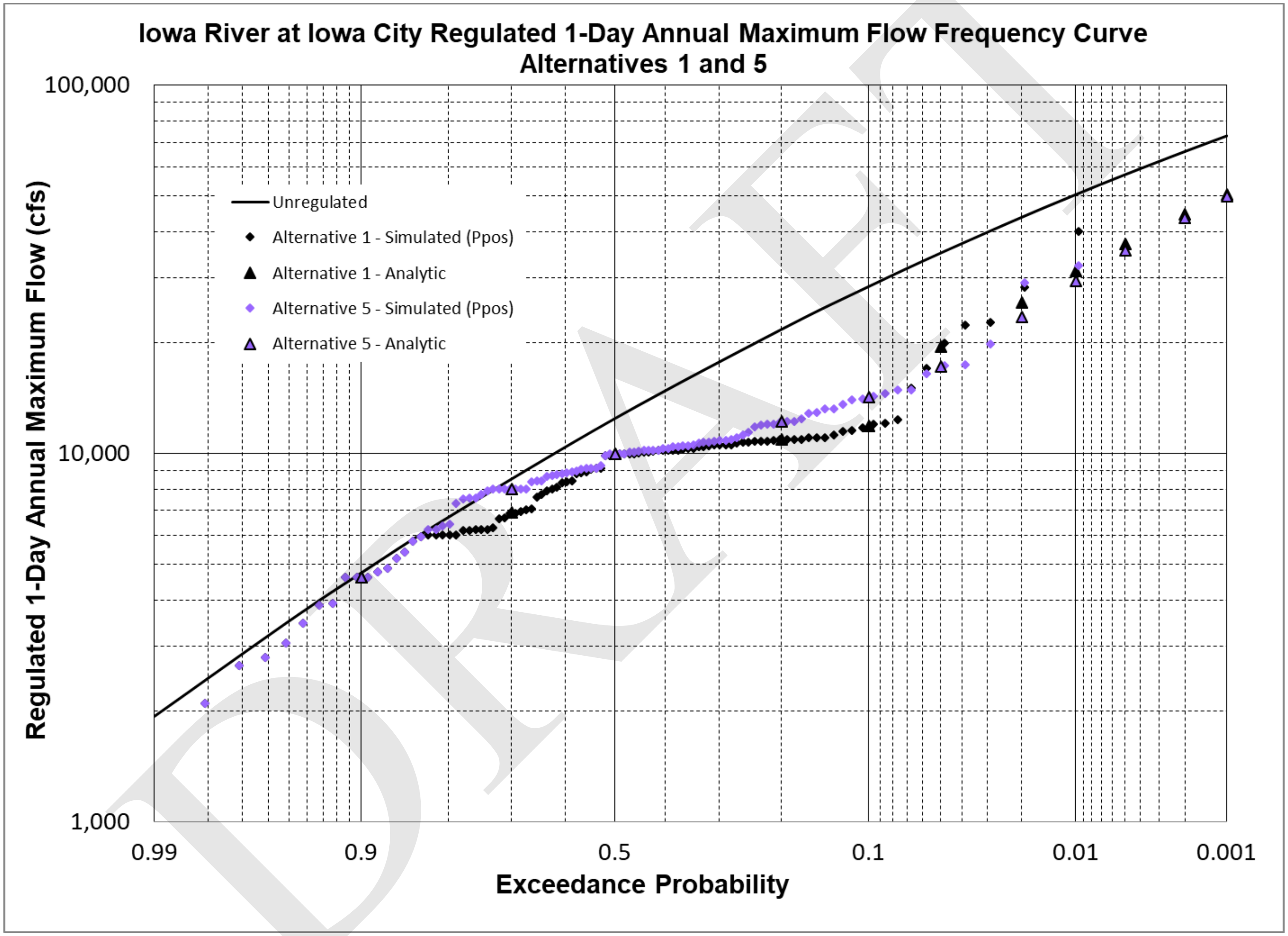


Figure B-60. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternatives 1 and 5. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

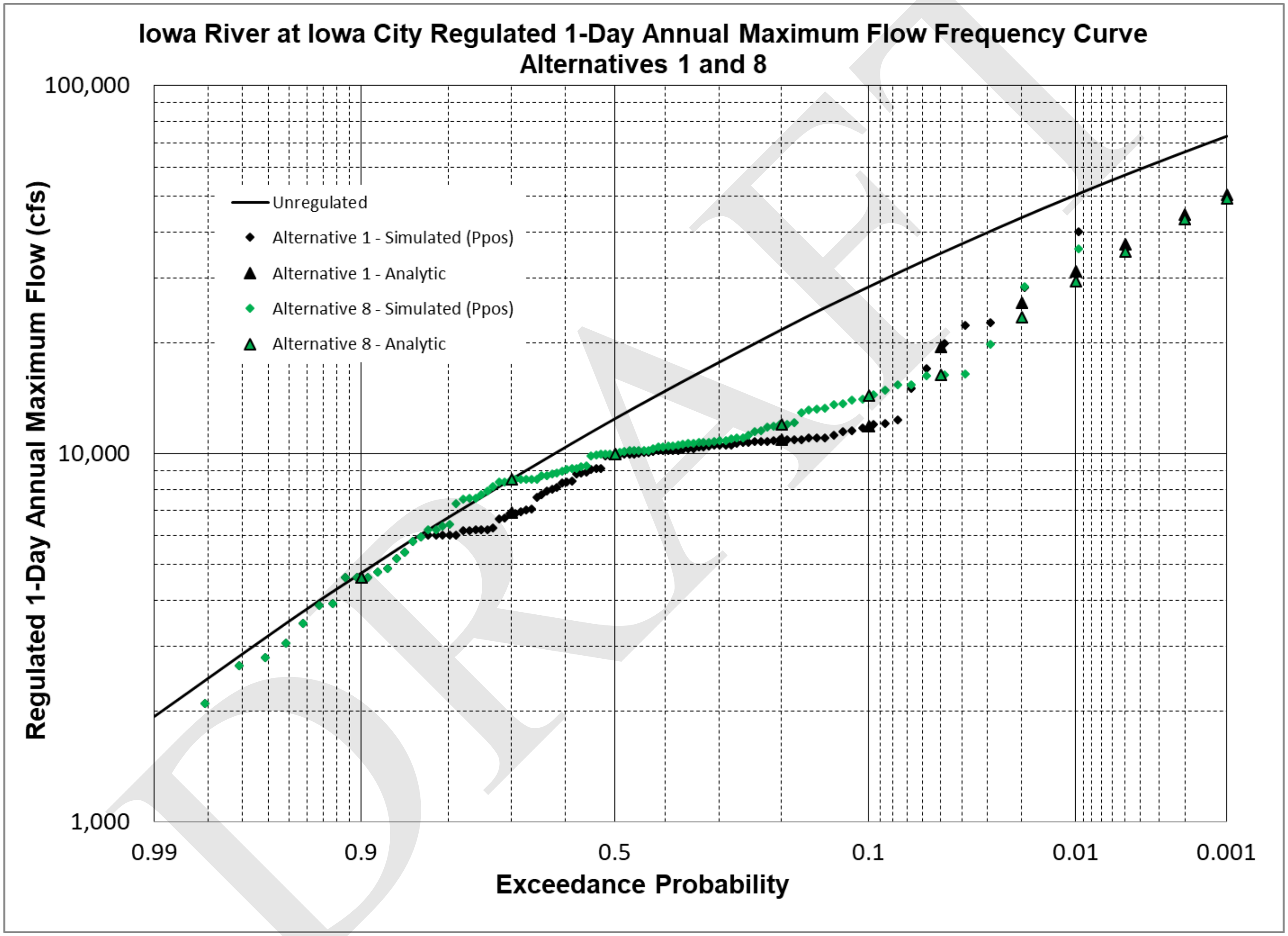


Figure B-61. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternatives 1 and 8. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

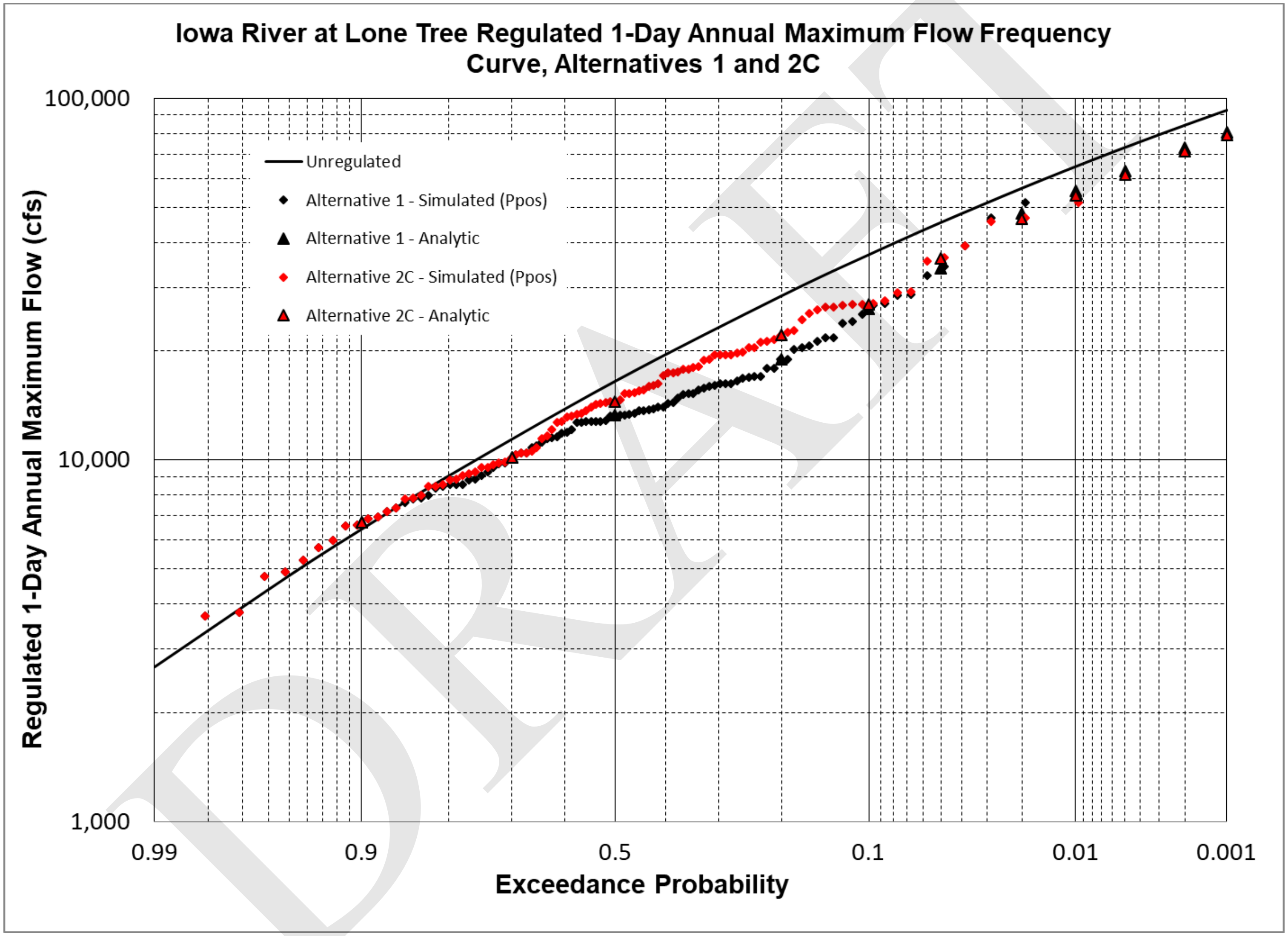


Figure B-62. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternatives 1 and 2C. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

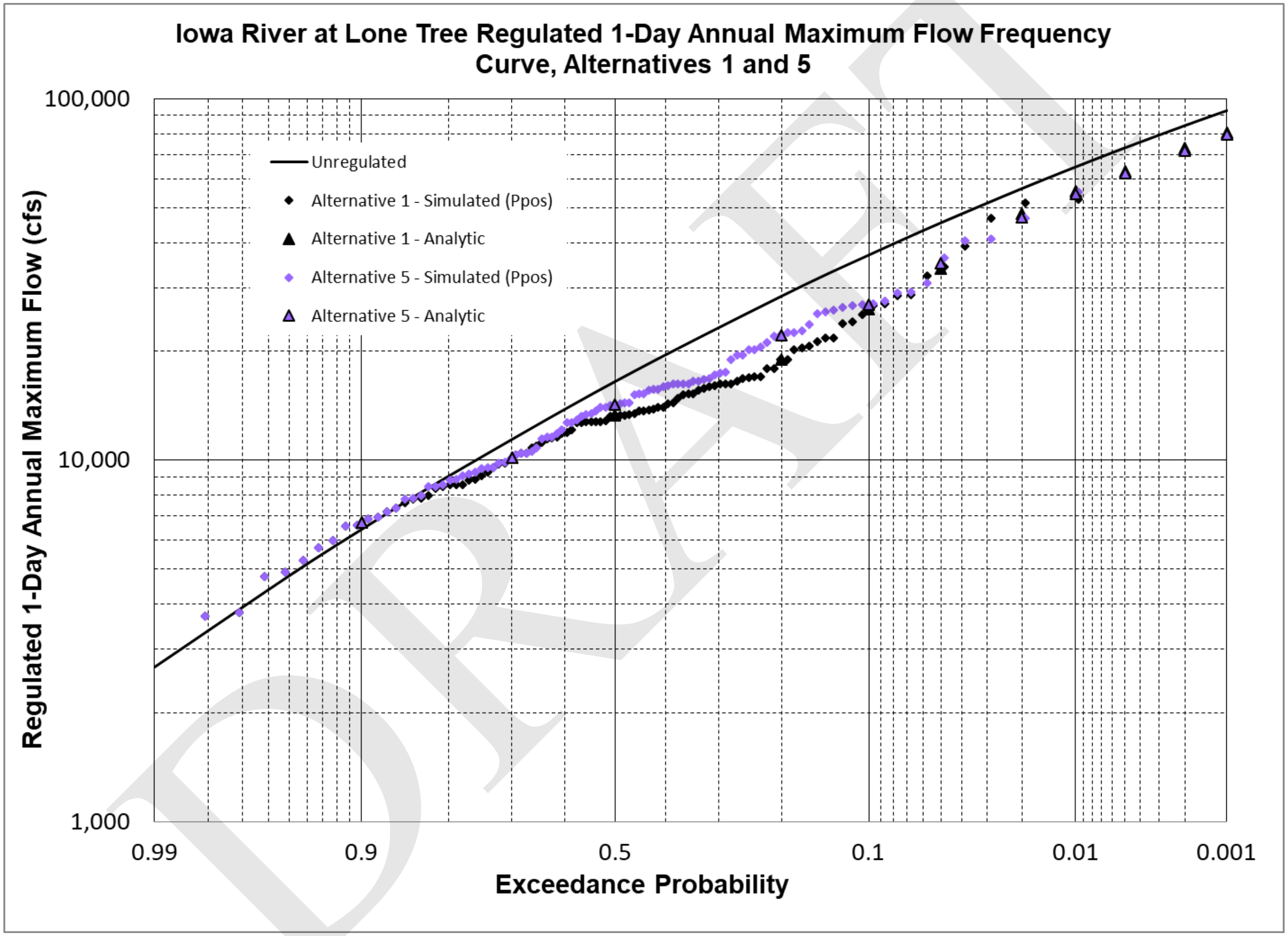


Figure B-63. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternatives 1 and 5. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

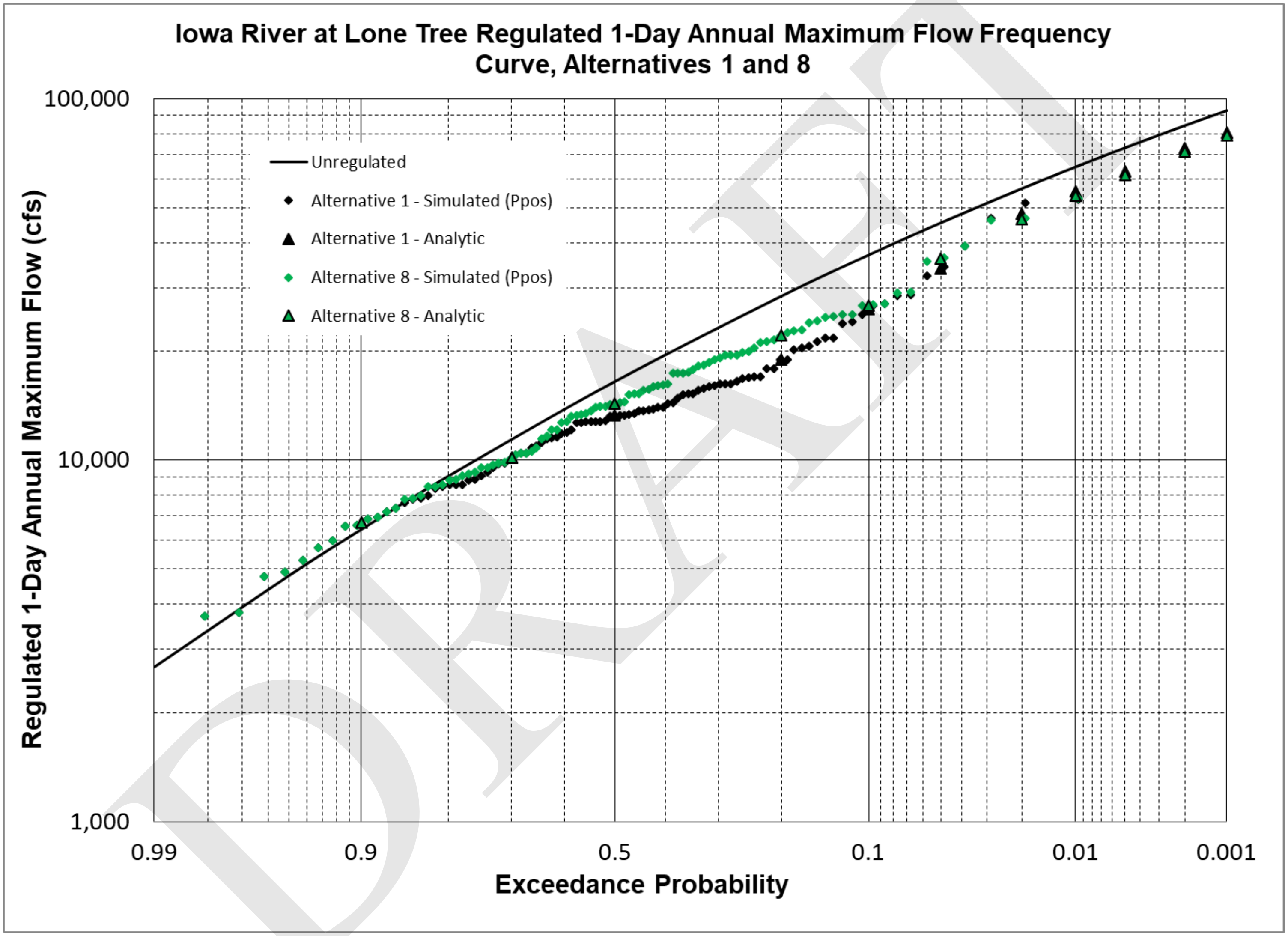


Figure B-64. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternatives 1 and 8. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

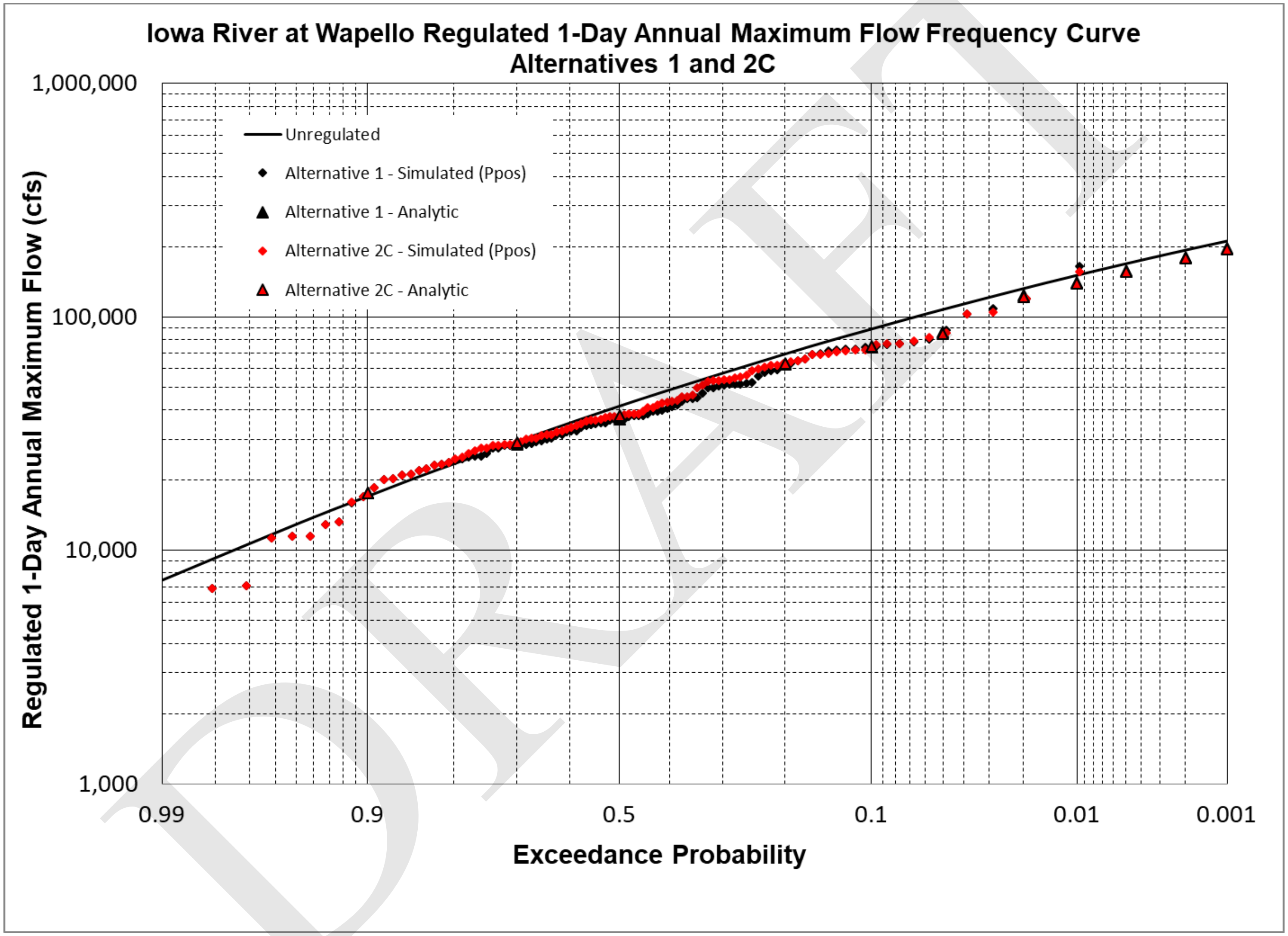


Figure B-65. Iowa River at Wapello Regulated Flow Frequency Curve – Alternatives 1 and 2C. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

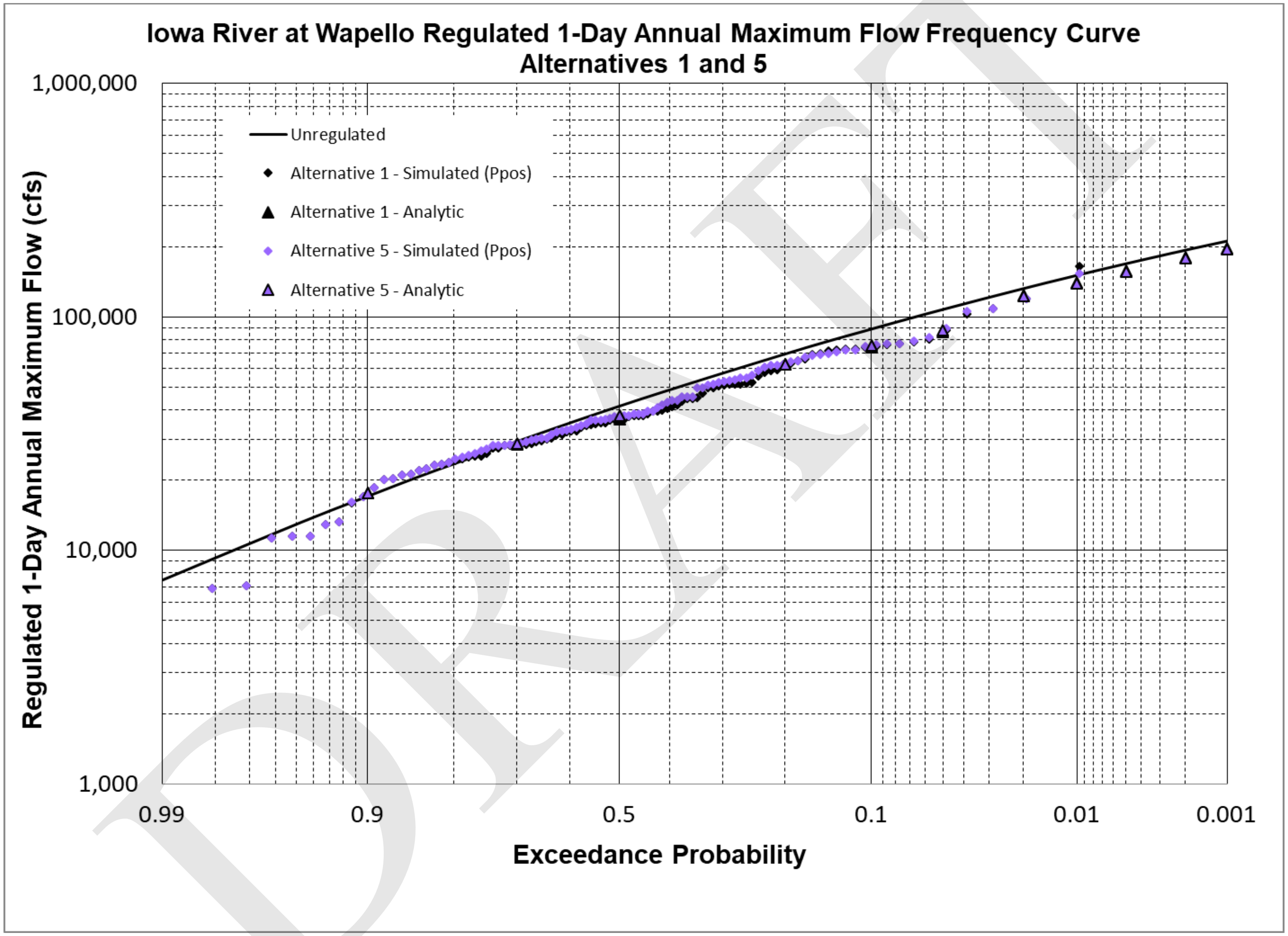


Figure B-66. Iowa River at Wapello Regulated Flow Frequency Curve – Alternatives 1 and 5. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

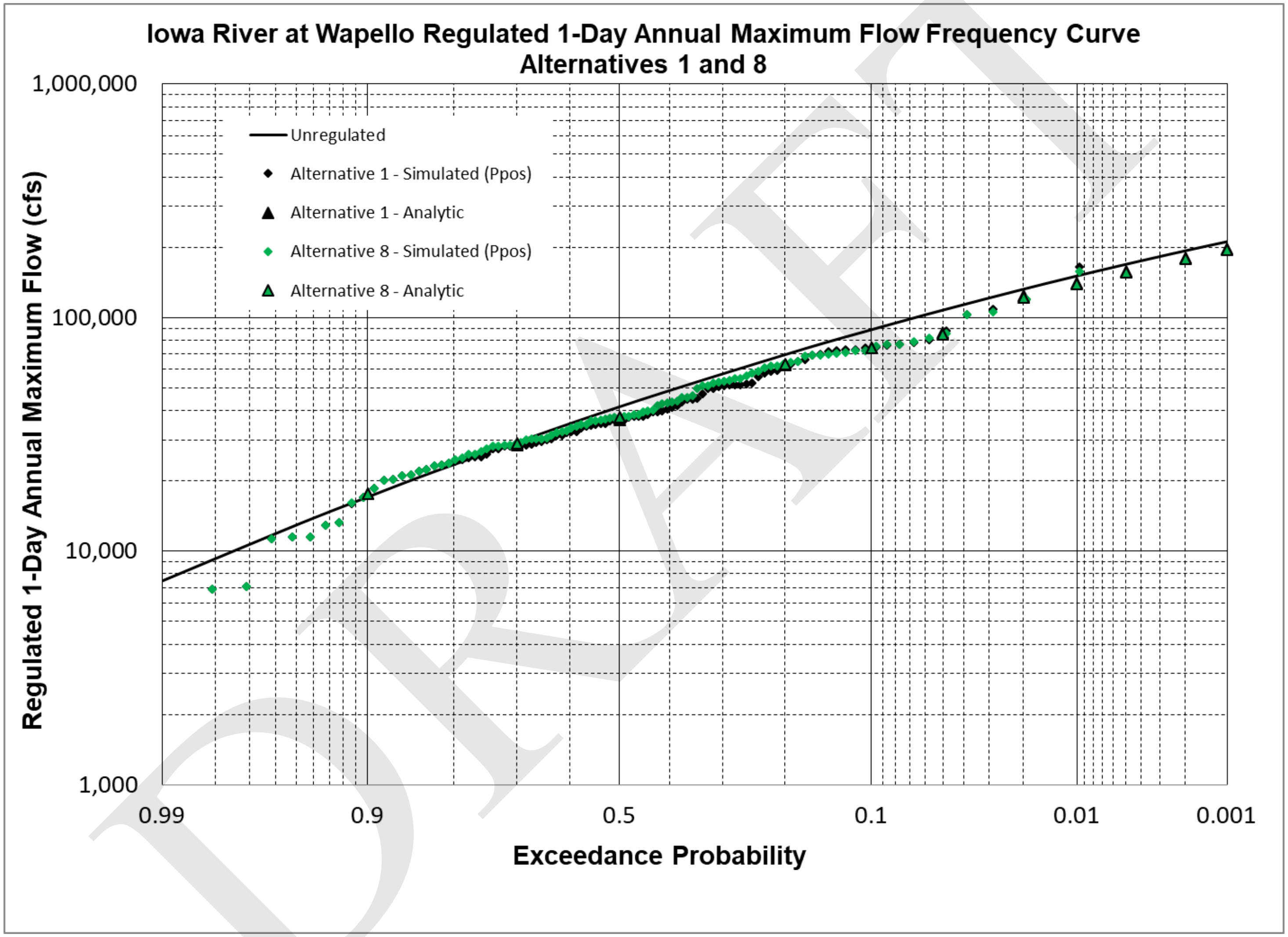


Figure B-67. Iowa River at Wapello Regulated Flow Frequency Curve – Alternatives 1 and 8. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

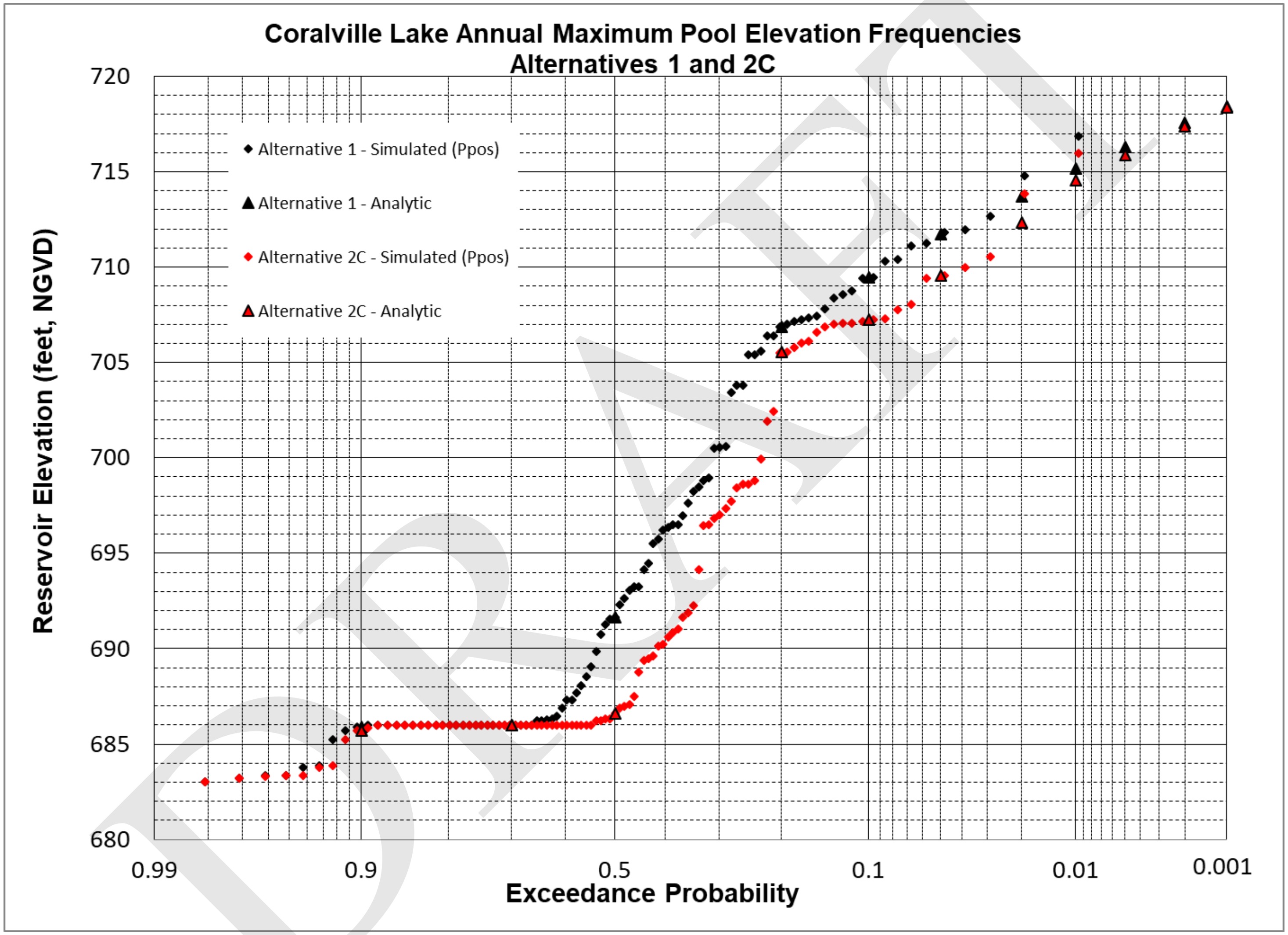


Figure B-68. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 1 and 2C. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

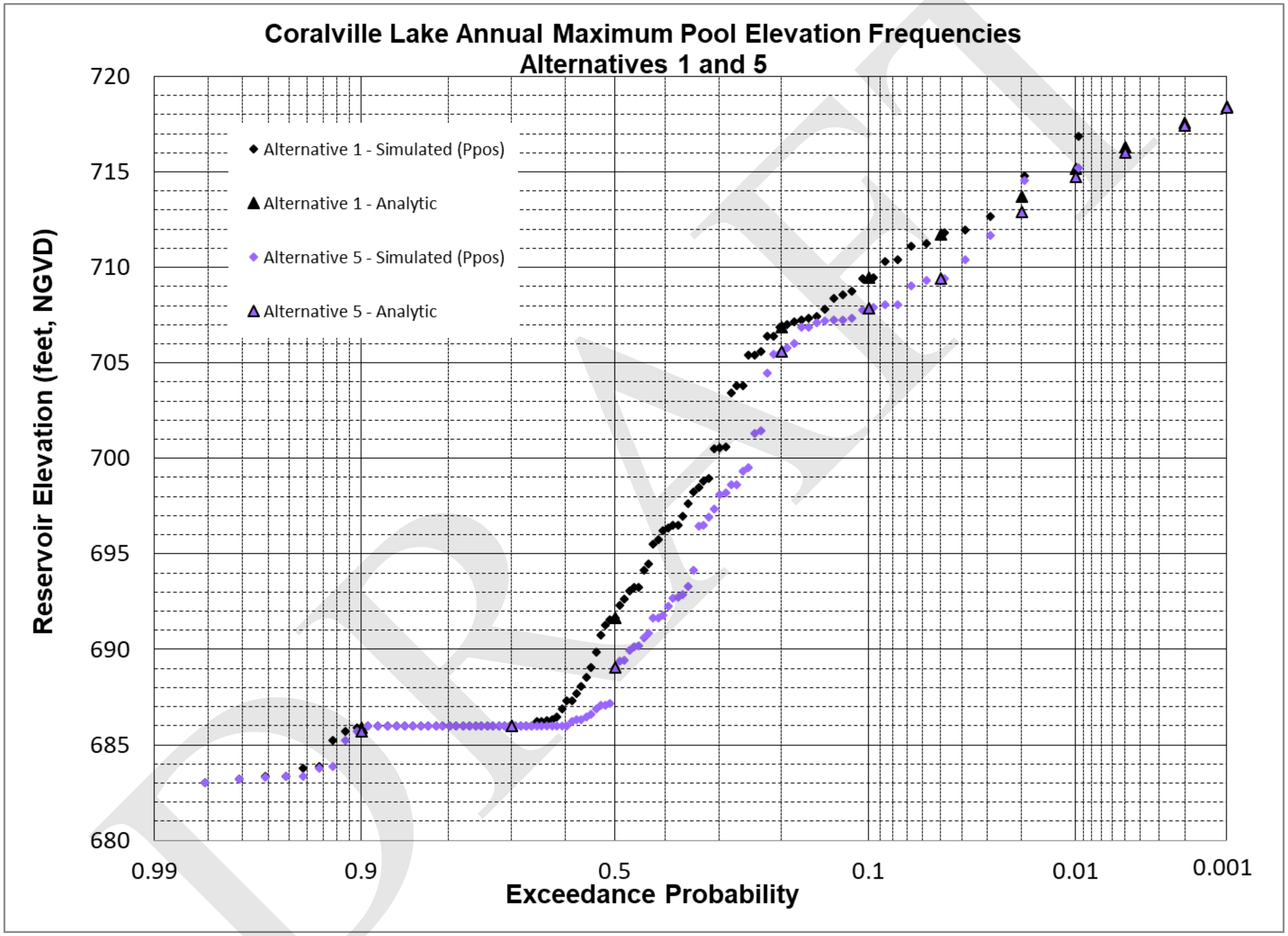


Figure B-69. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 1 and 5. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

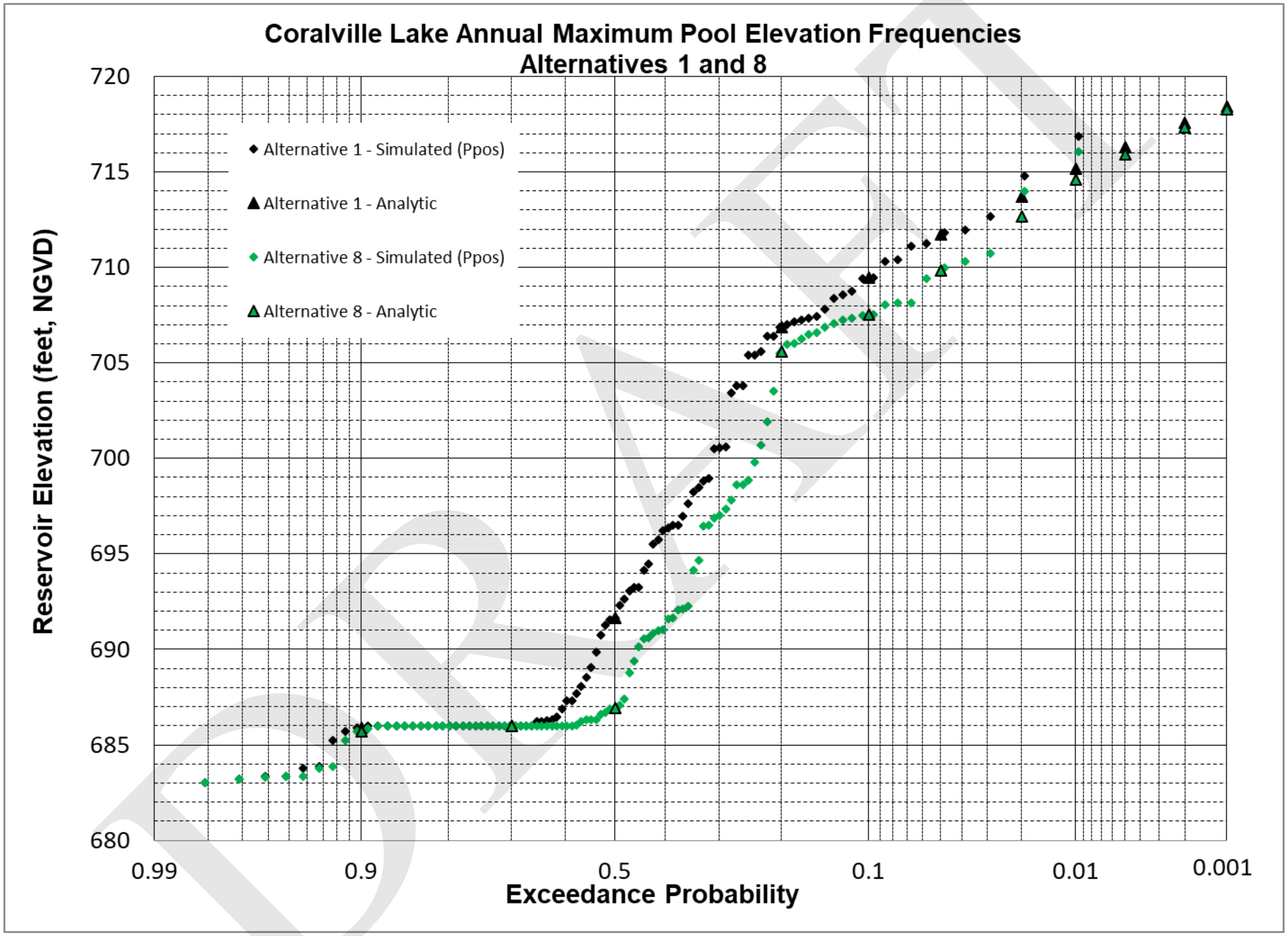


Figure B-70. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 1 and 8. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

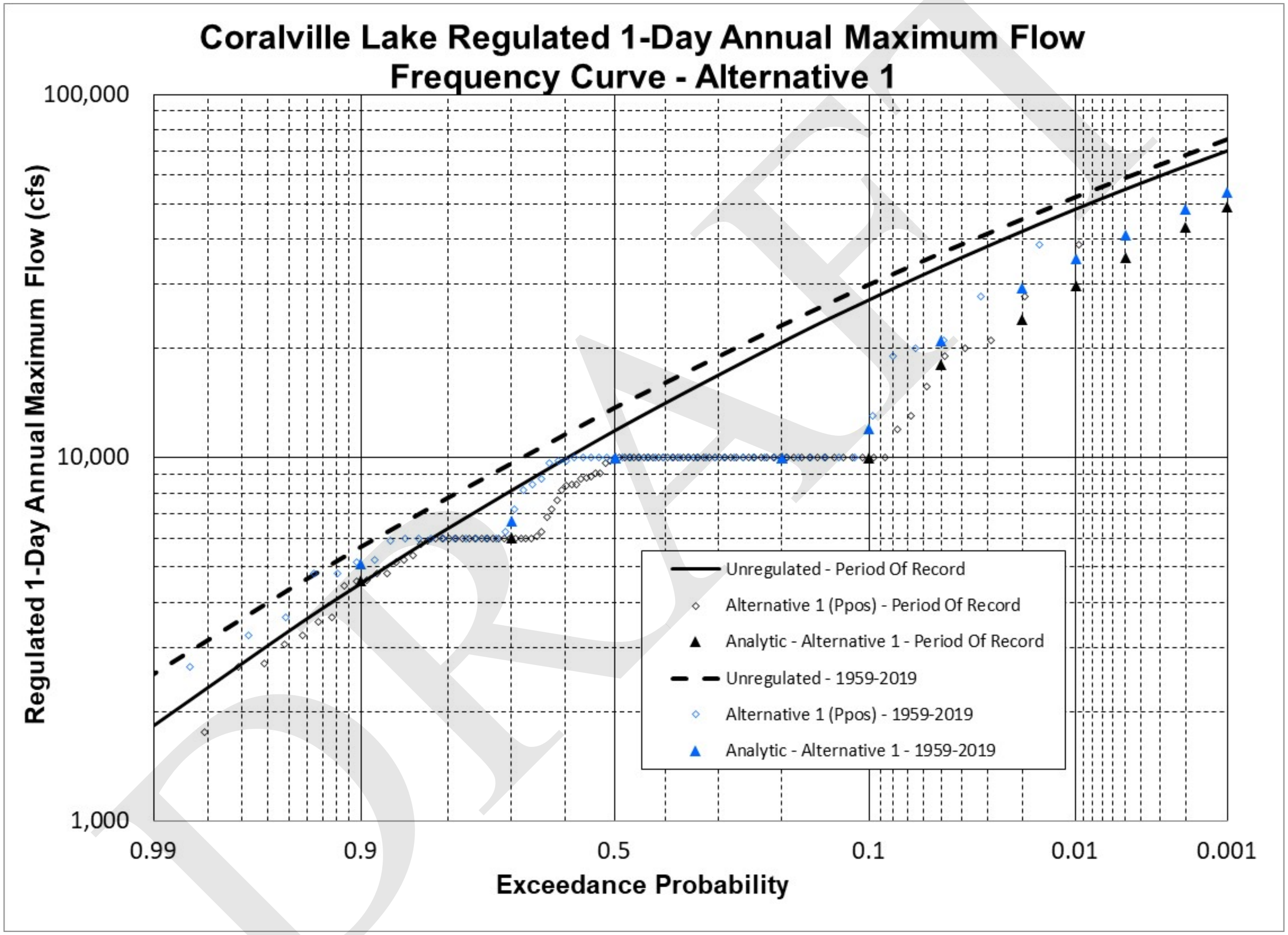


Figure B-71. Coralville Lake Regulated Flow Frequency Curve – Alternative 1. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

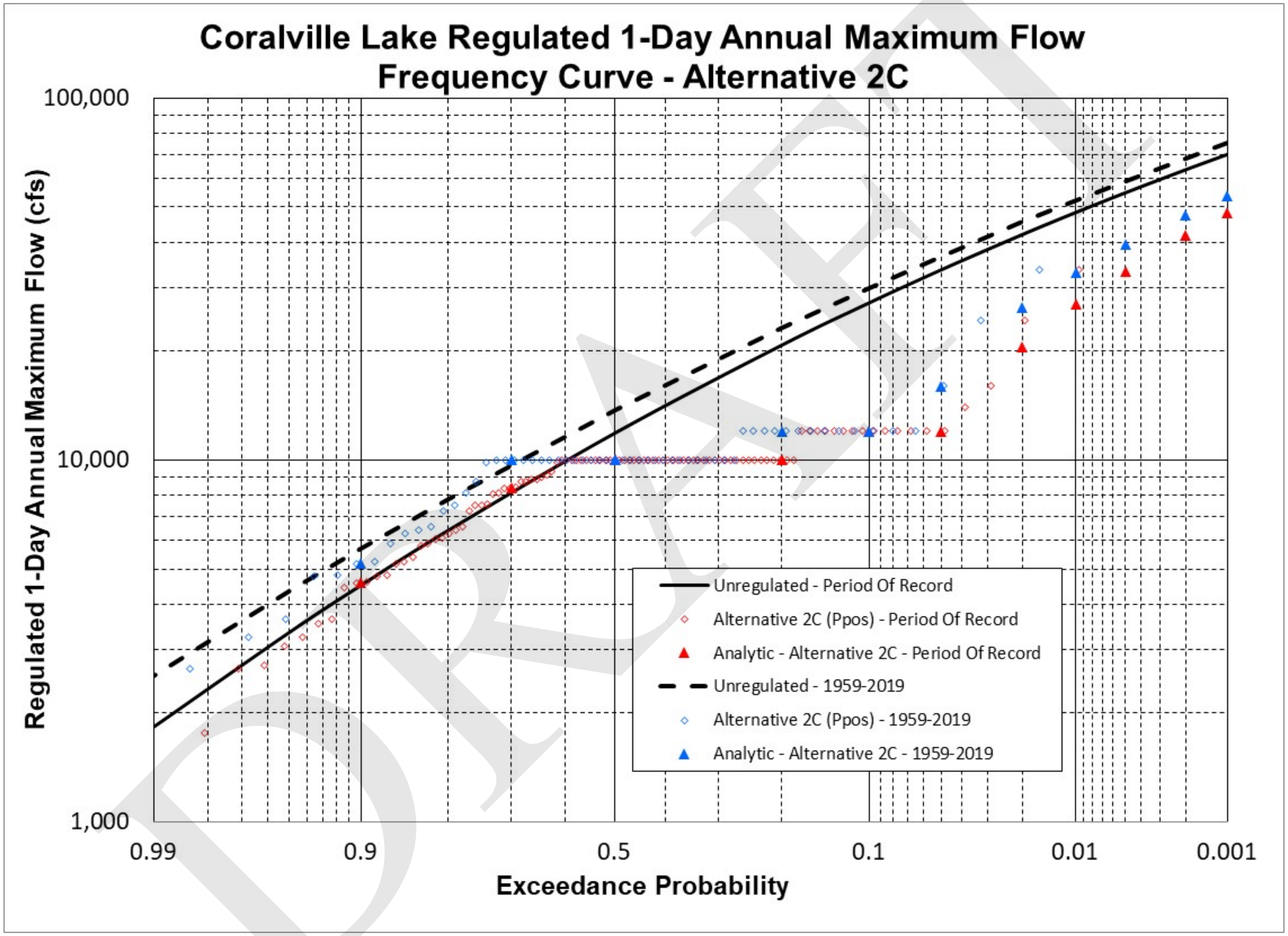


Figure B-72. Coralville Lake Regulated Flow Frequency Curve – Alternative 2C. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

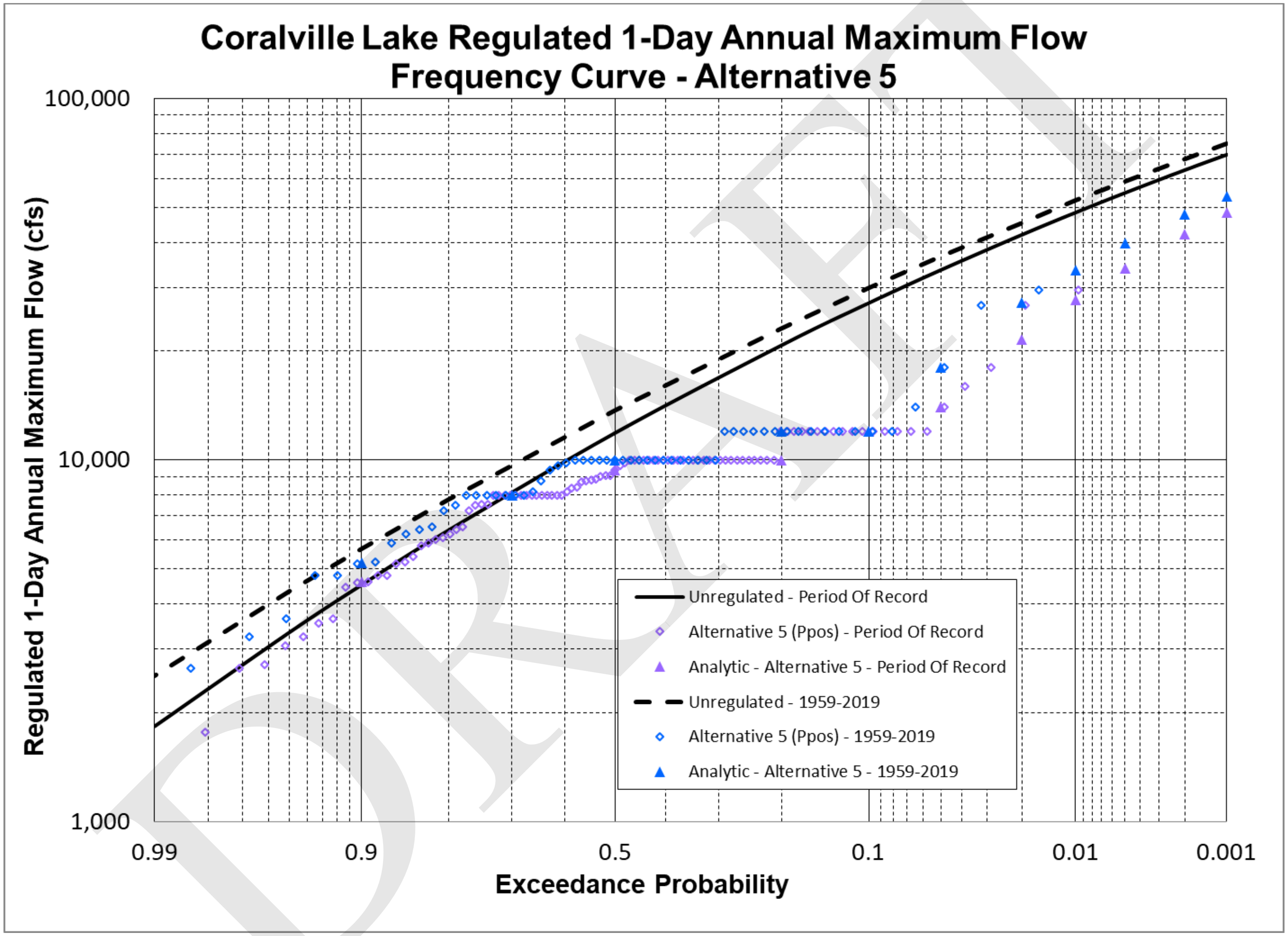


Figure B-73. Coralville Lake Regulated Flow Frequency Curve – Alternative 5. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

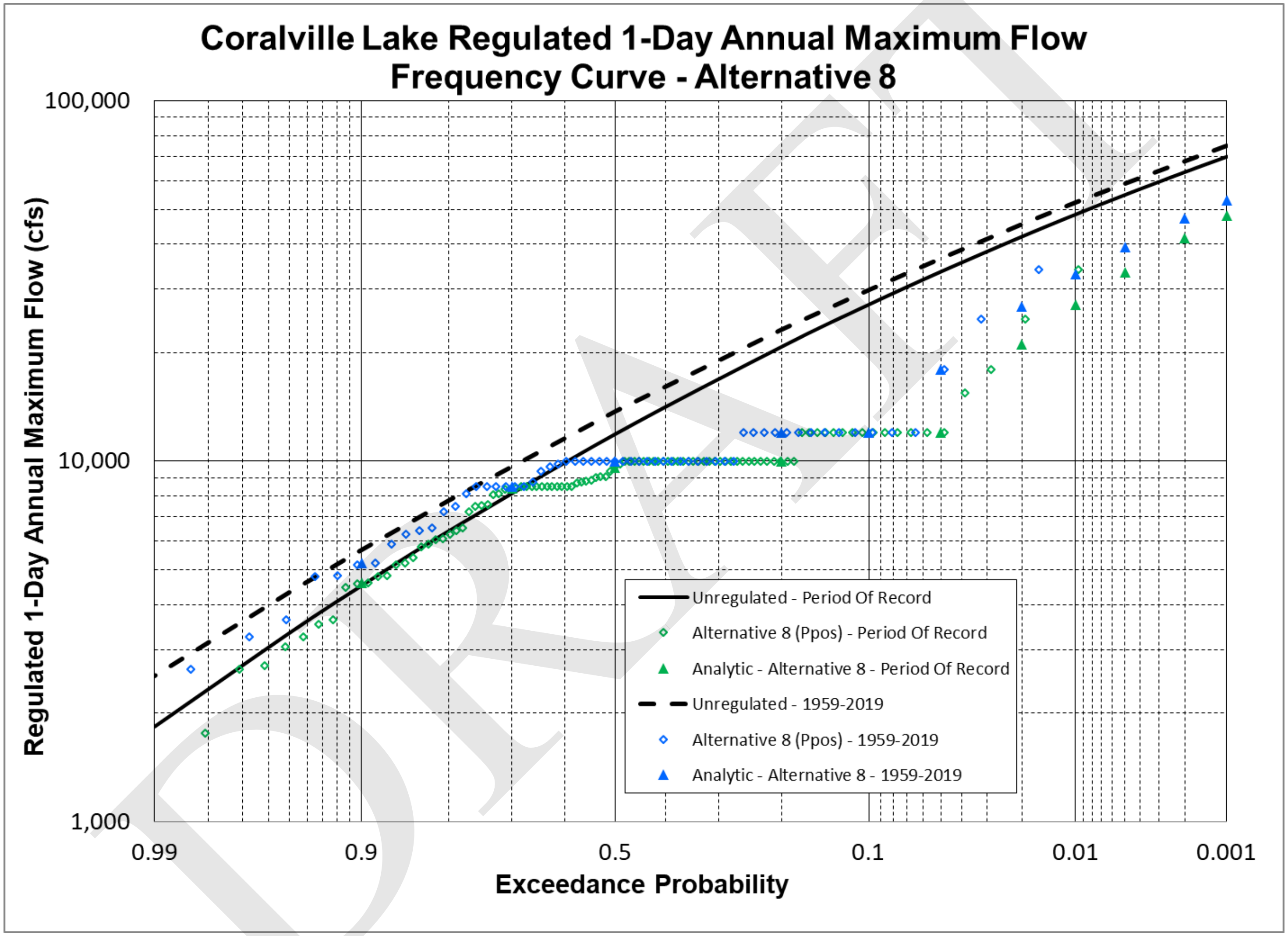


Figure B-74. Coralville Lake Regulated Flow Frequency Curve – Alternative 8. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

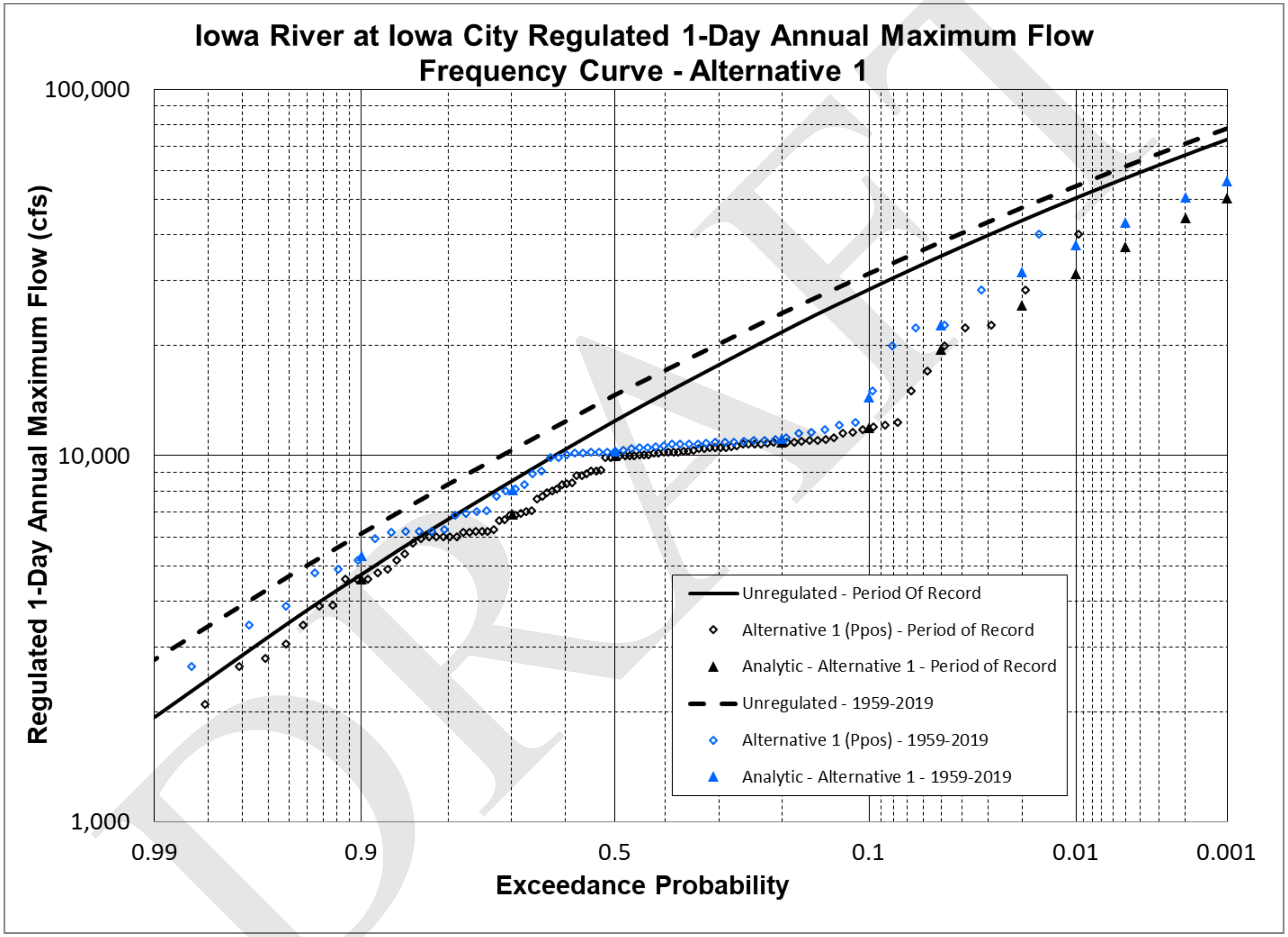


Figure B-75. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternative 1. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

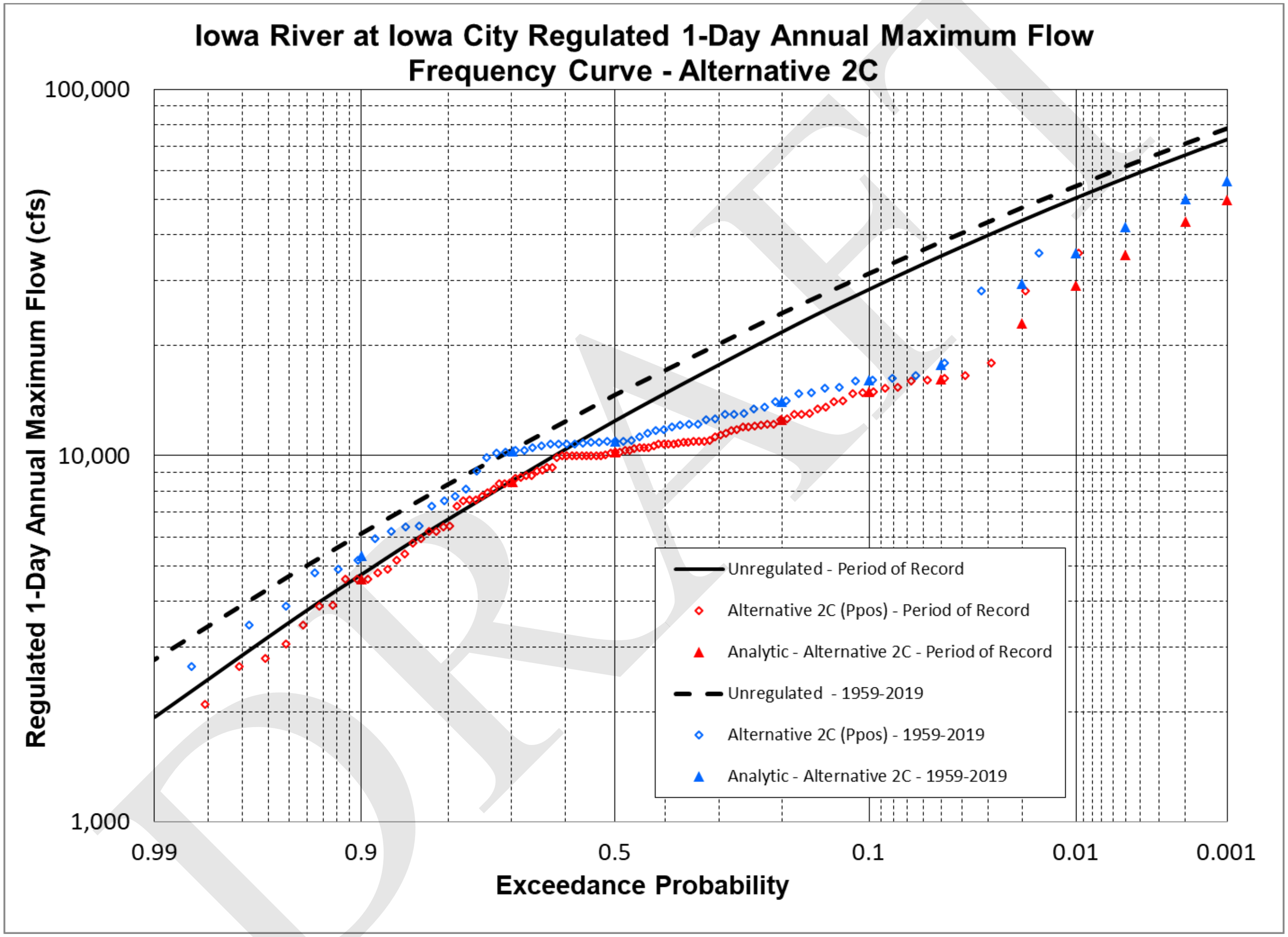


Figure B-76. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternative 2C. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

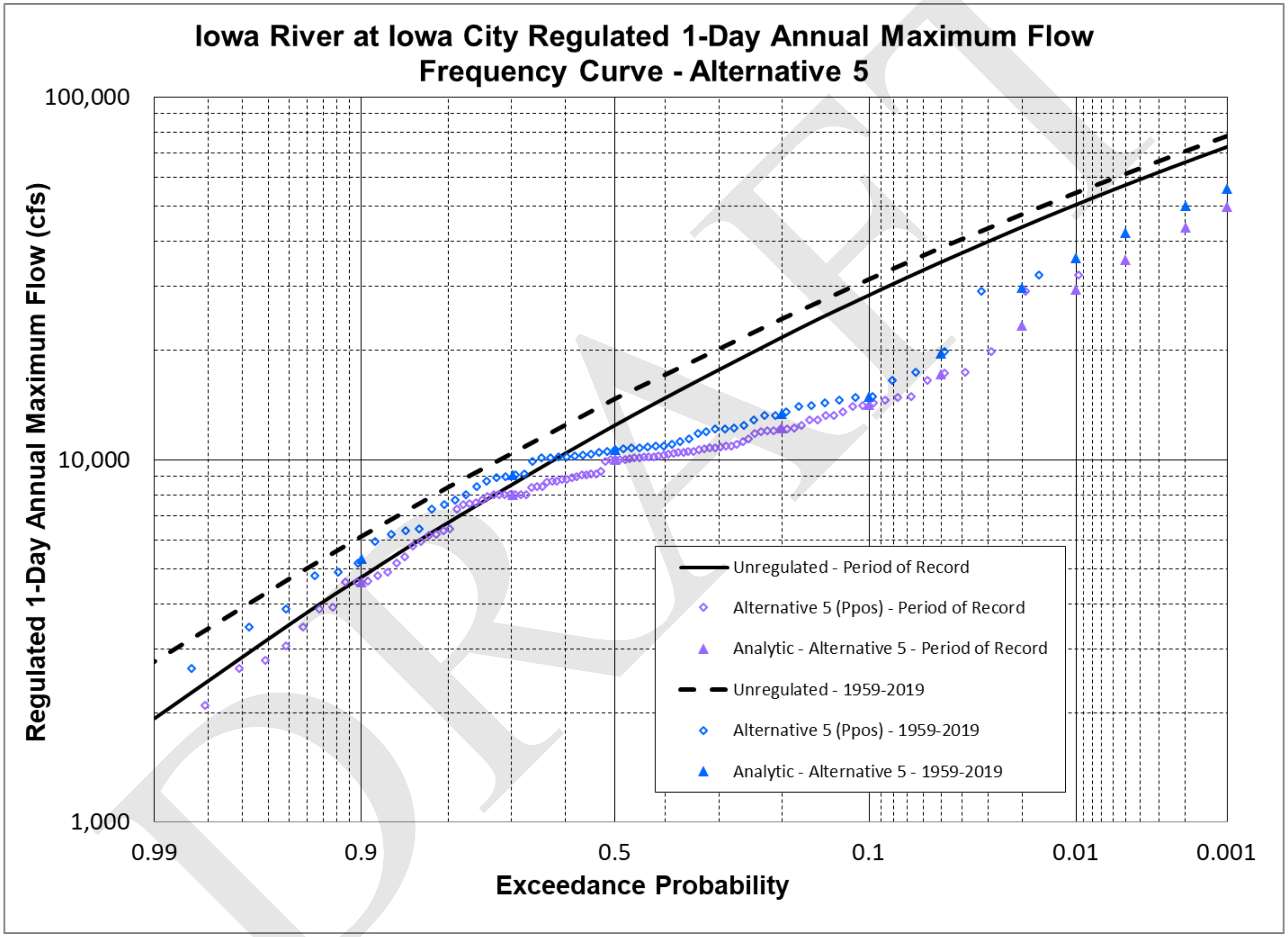


Figure B-77. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternative 5. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

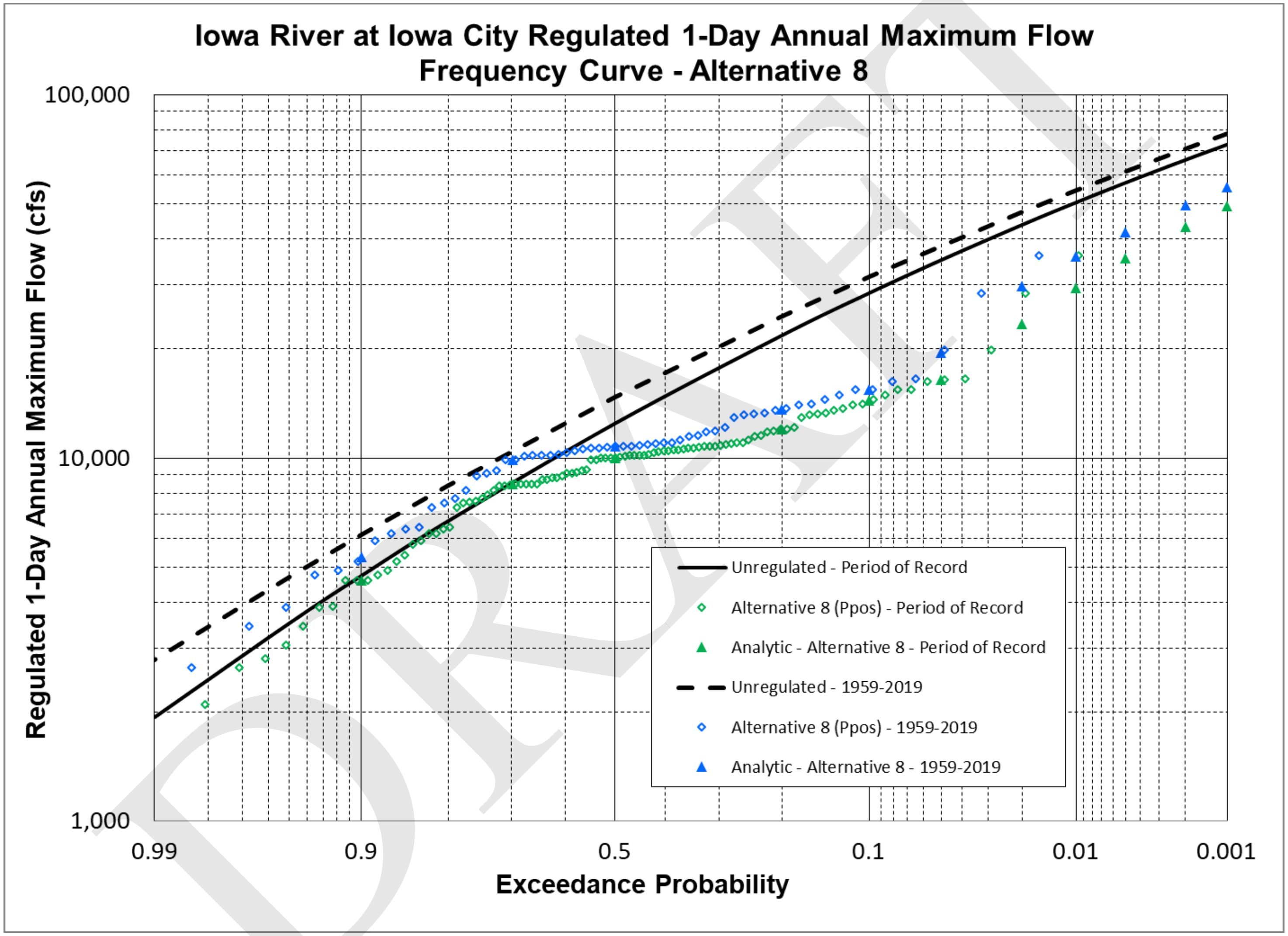


Figure B-78. Iowa River at Iowa City Regulated Flow Frequency Curve – Alternative 8. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

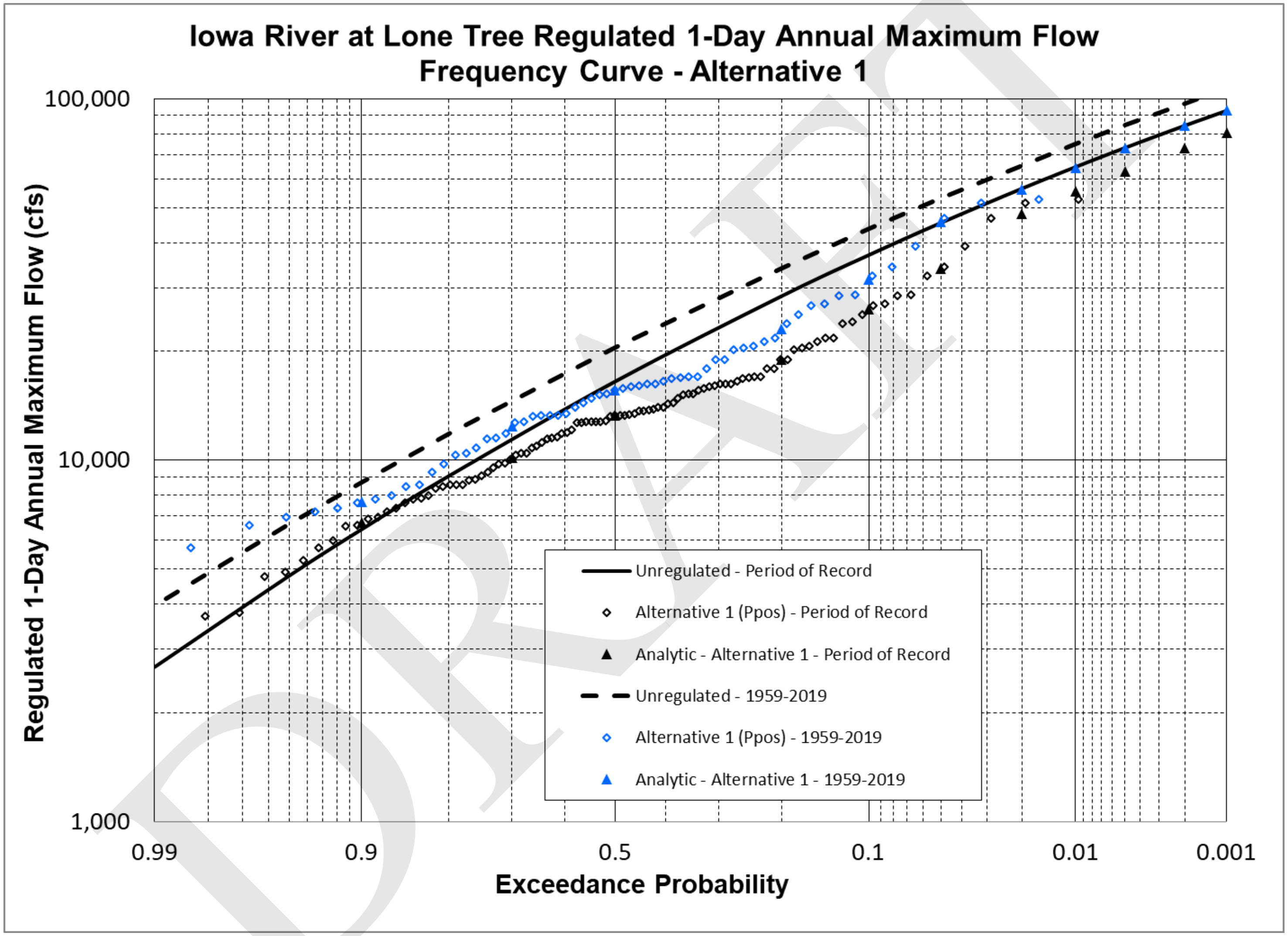


Figure B-79. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternative 1. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

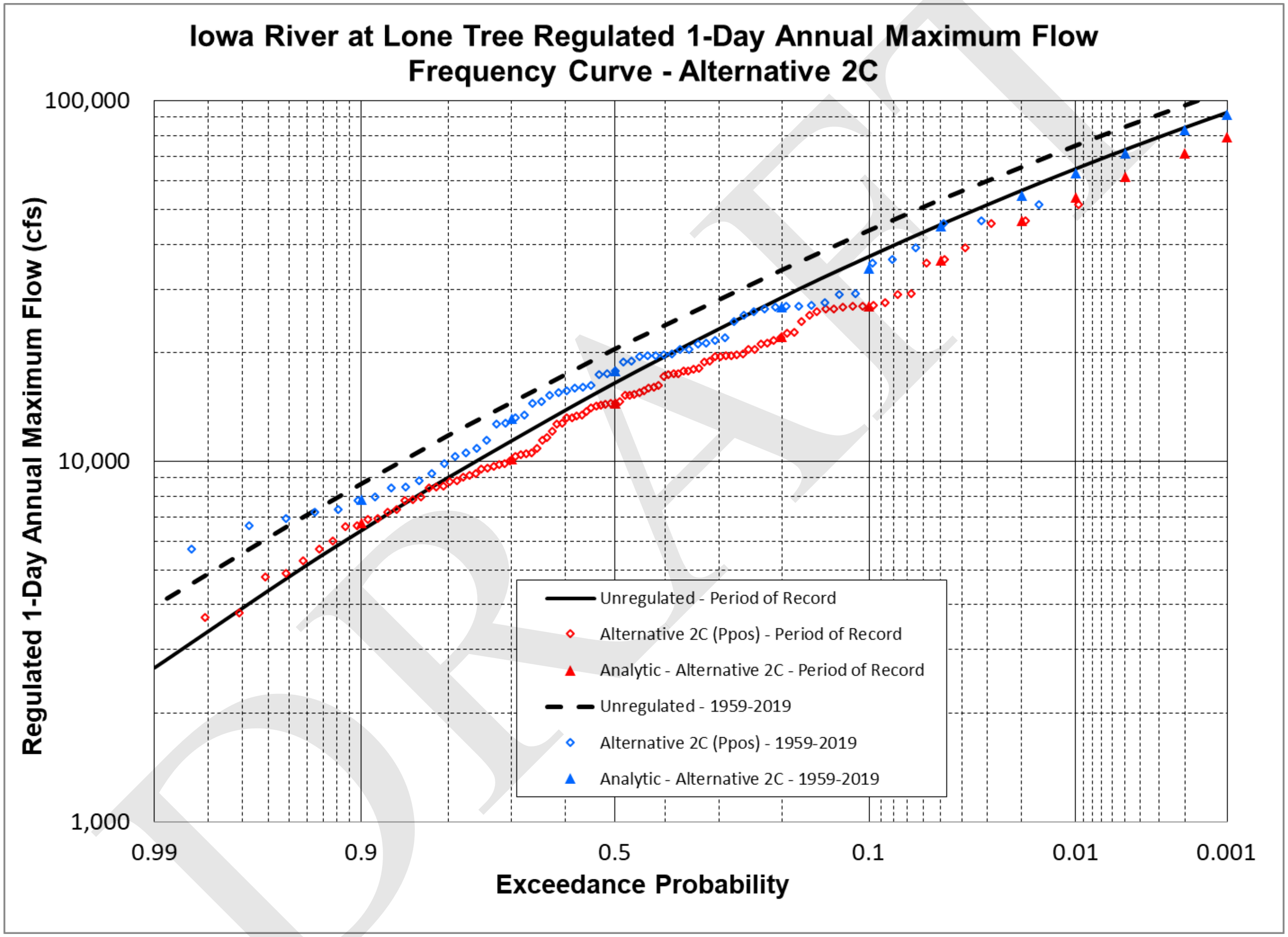


Figure B-80. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternative 2C. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

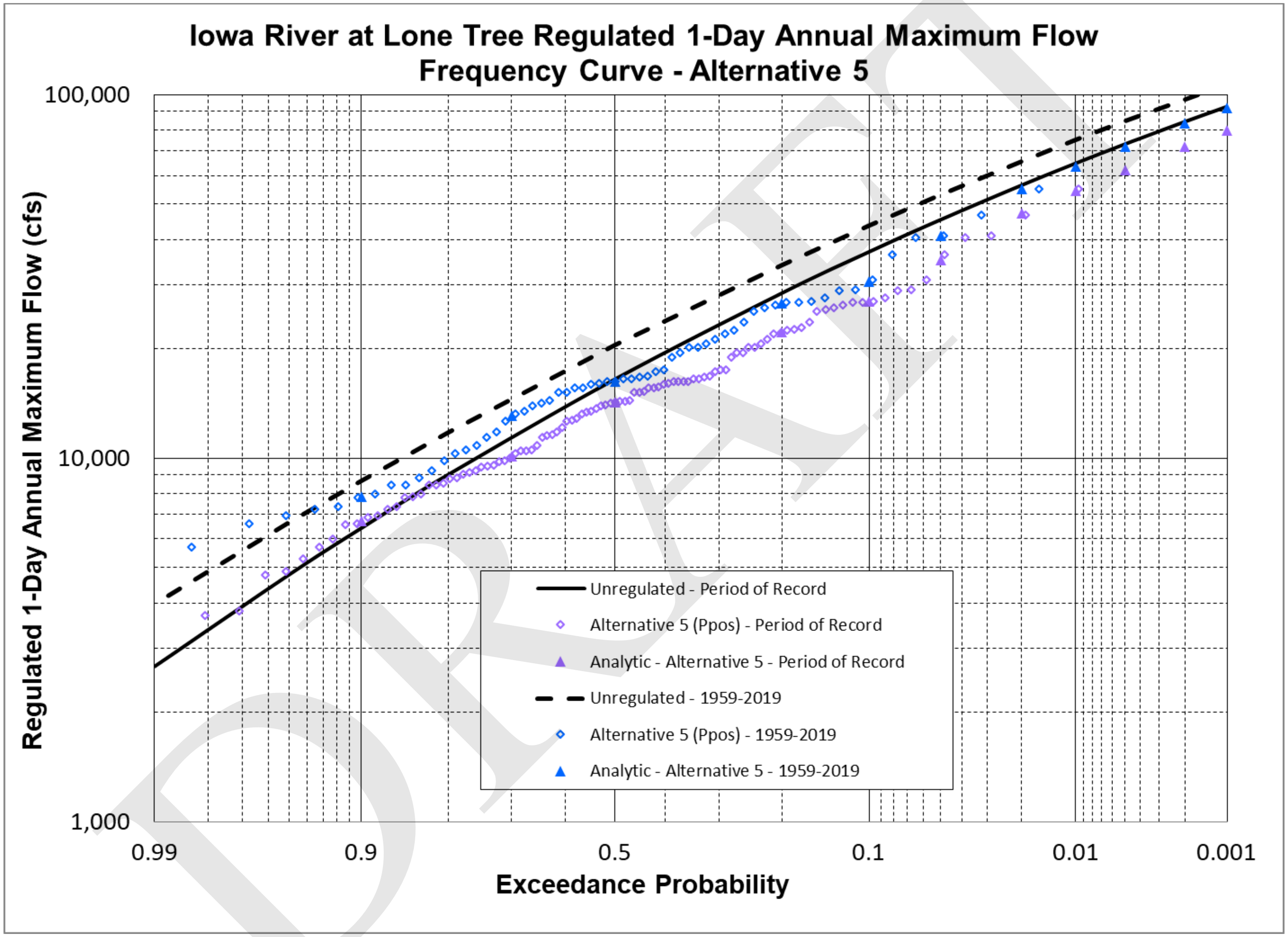


Figure B-81. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternative 5. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

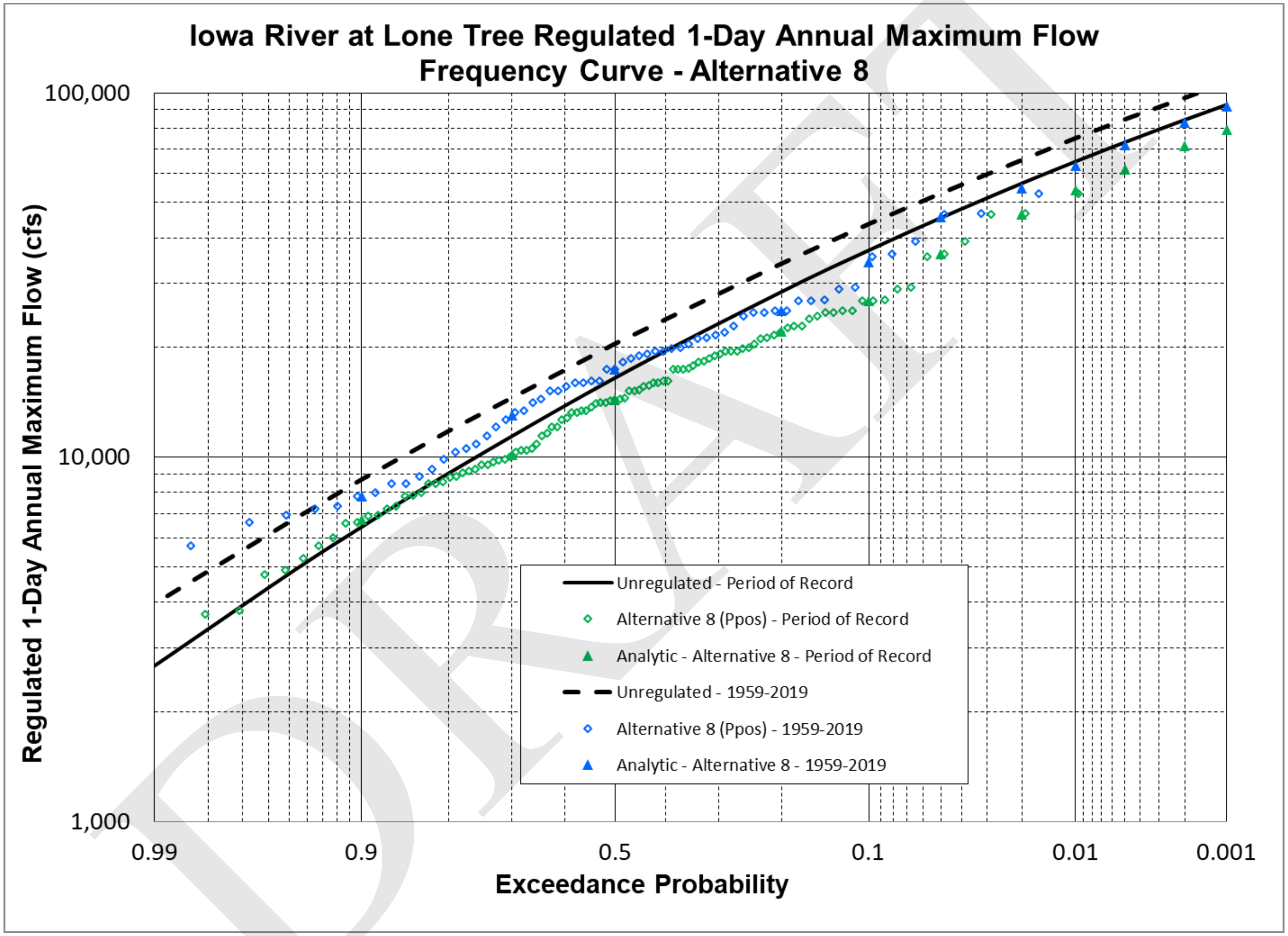


Figure B-82. Iowa River at Lone Tree Regulated Flow Frequency Curve – Alternative 8. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

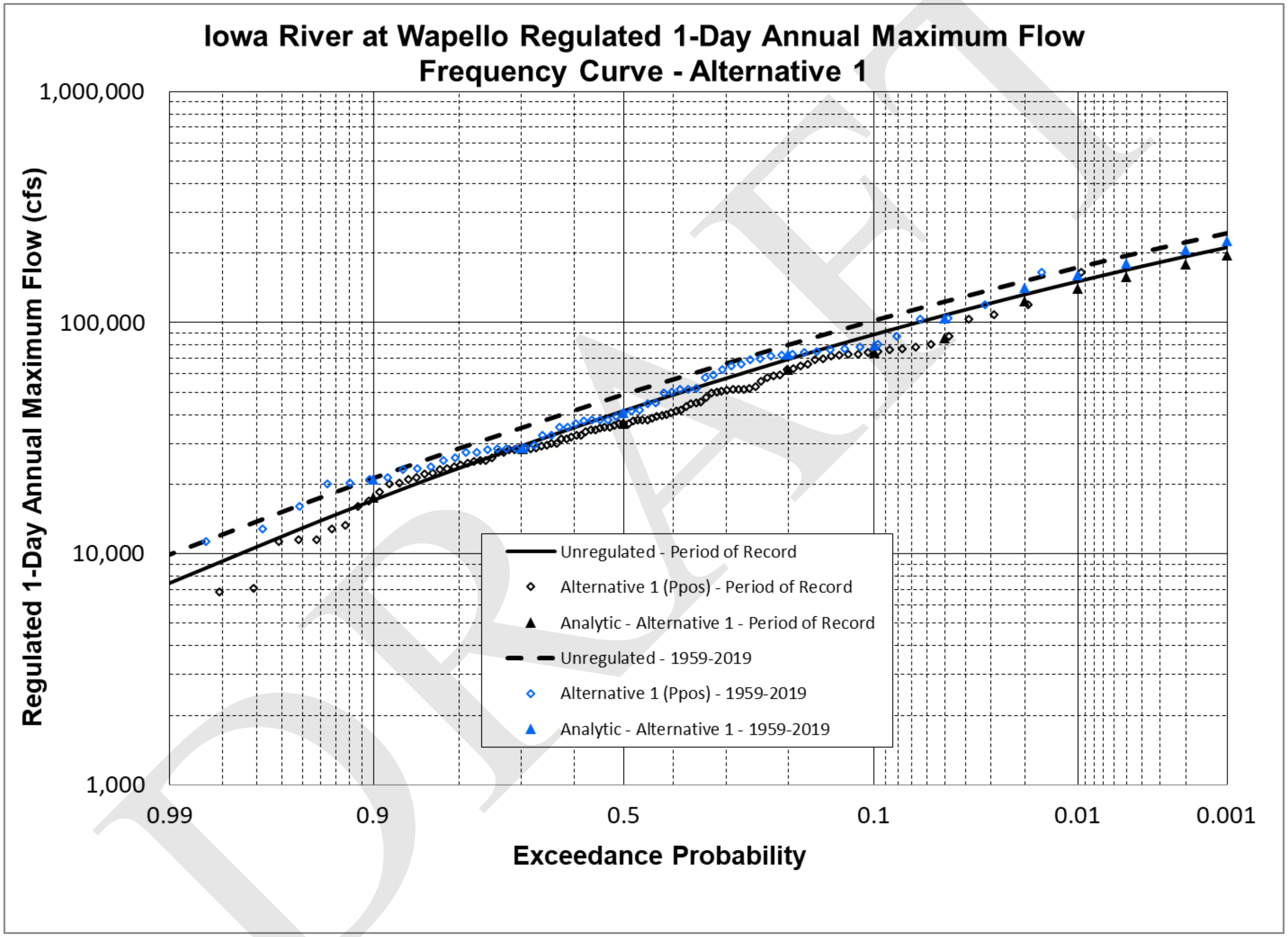


Figure B-83. Iowa River at Wapello Regulated Flow Frequency Curve – Alternative 1. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

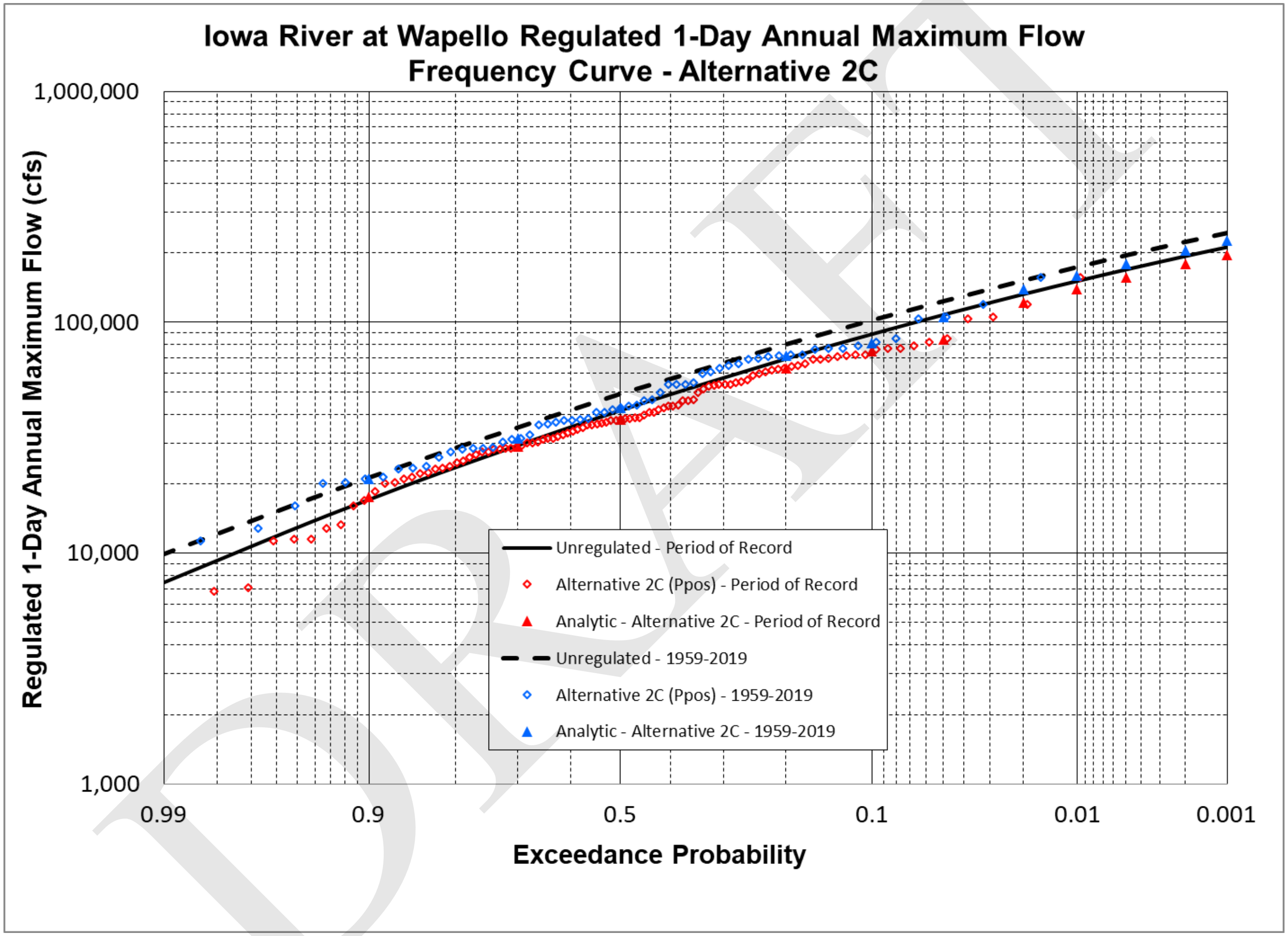


Figure B-84. Iowa River at Wapello Regulated Flow Frequency Curve – Alternative 2C. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

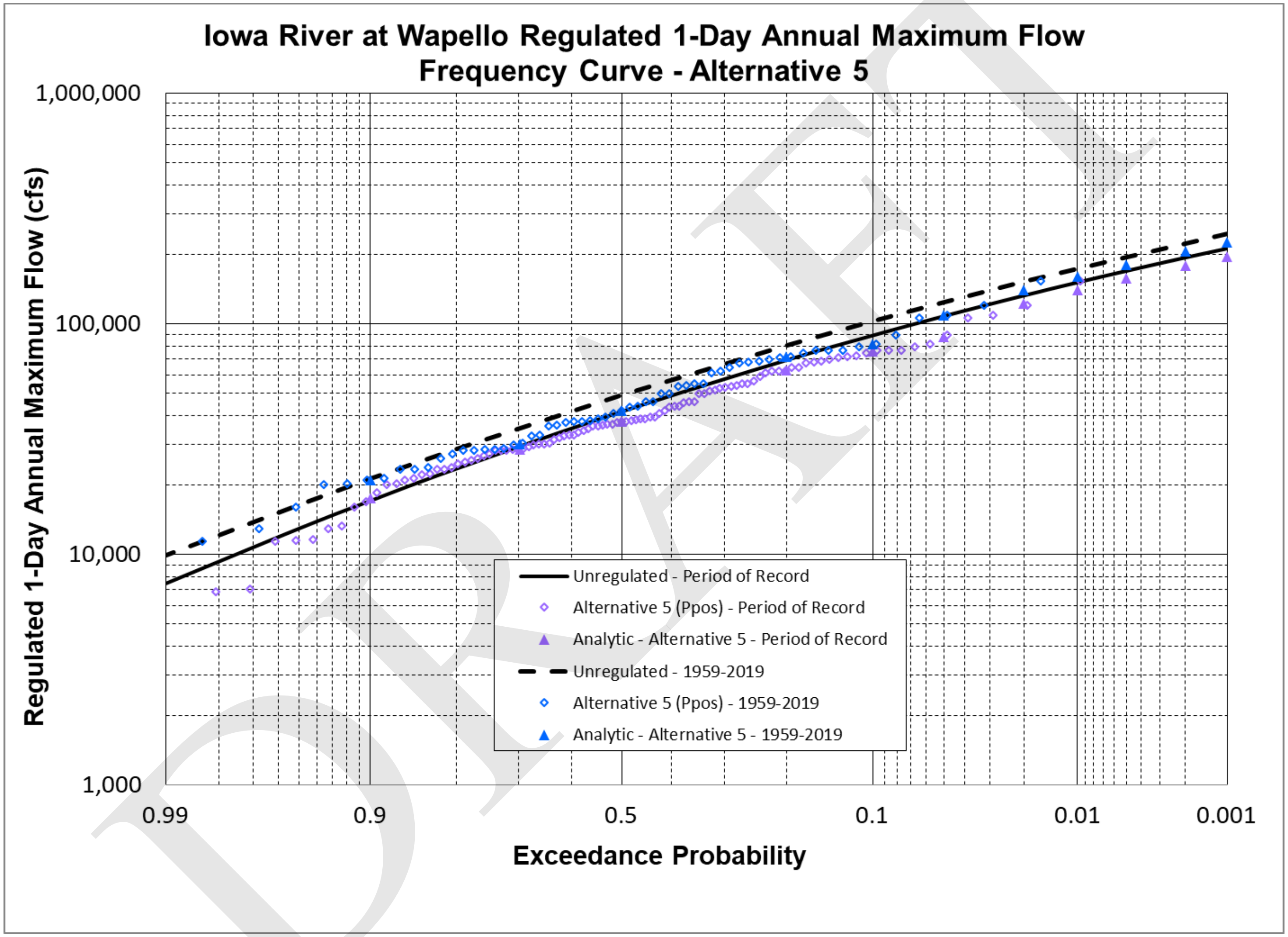


Figure B-85. Iowa River at Wapello Regulated Flow Frequency Curve – Alternative 5. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

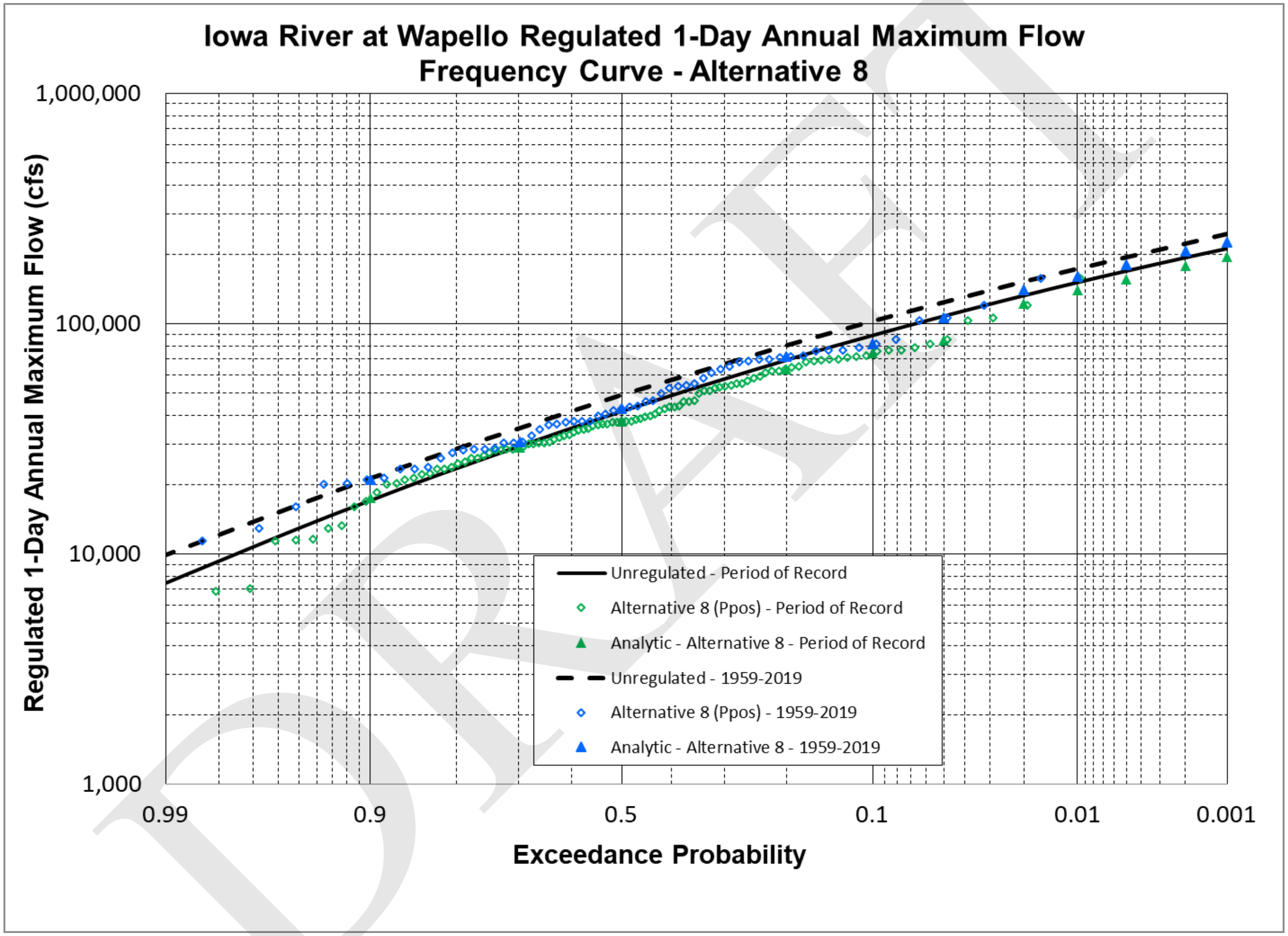


Figure B-86. Iowa River at Wapello Regulated Flow Frequency Curve – Alternative 8. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

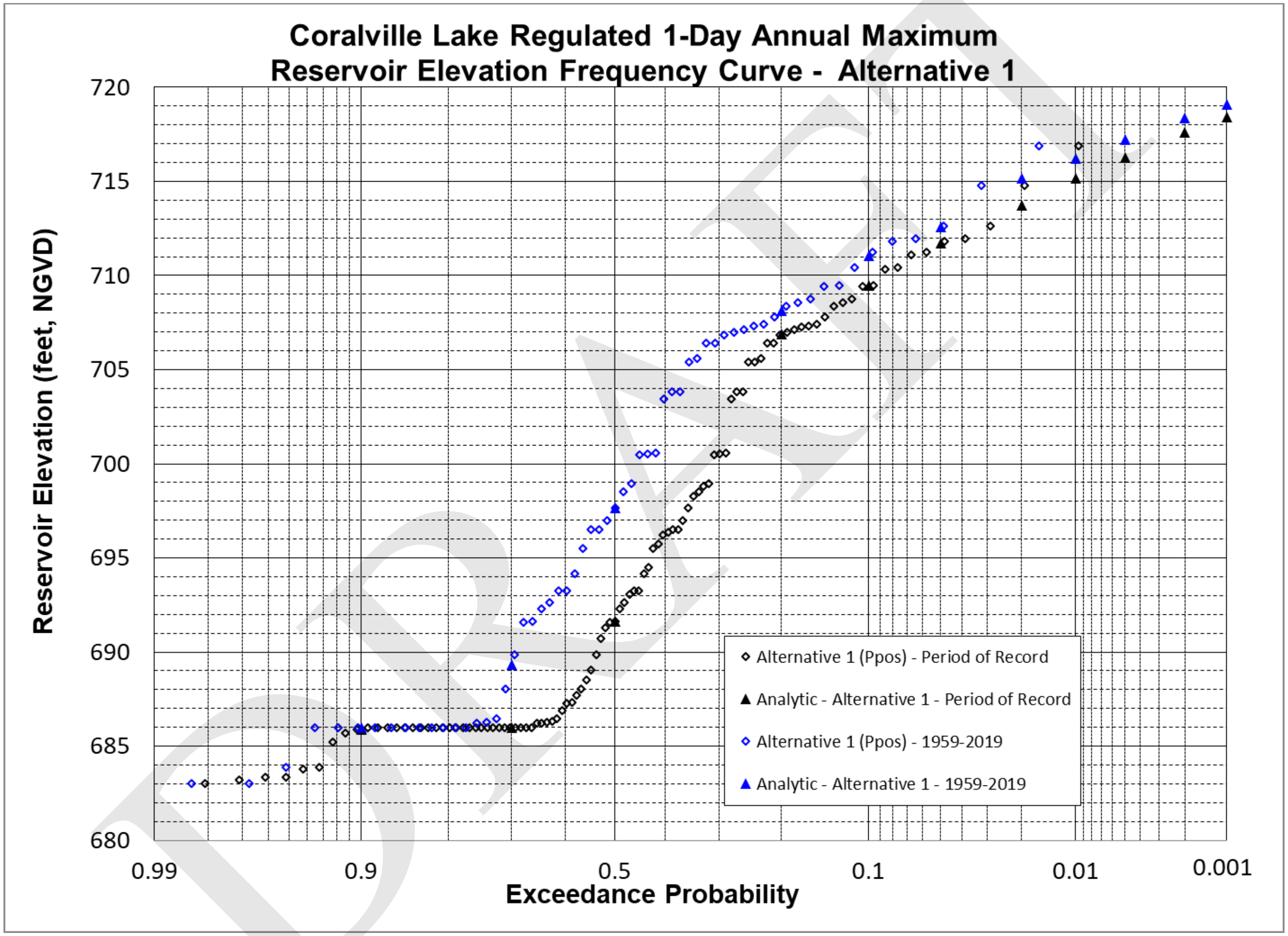


Figure B-87. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 1. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

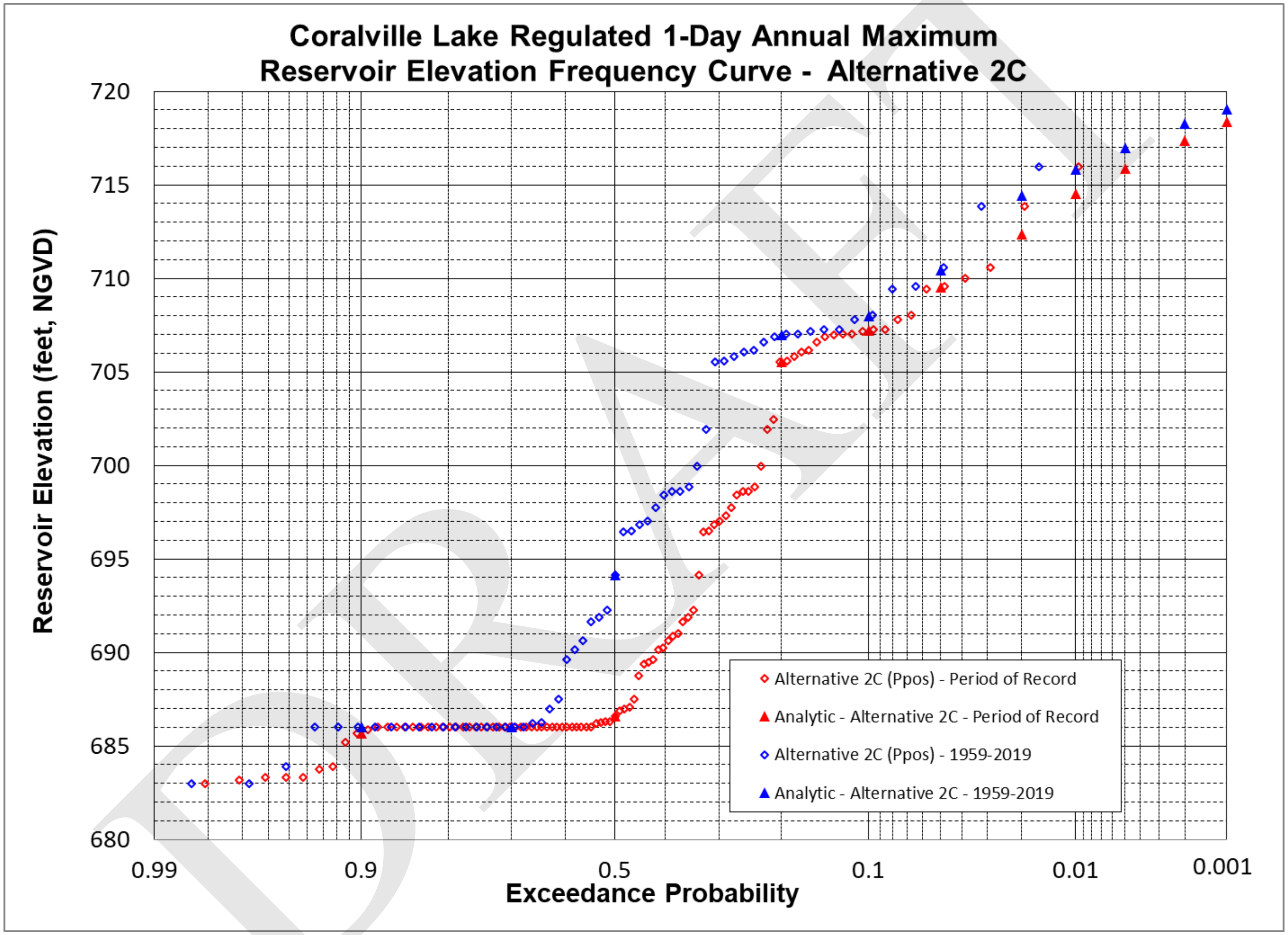


Figure B-88. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 2C. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

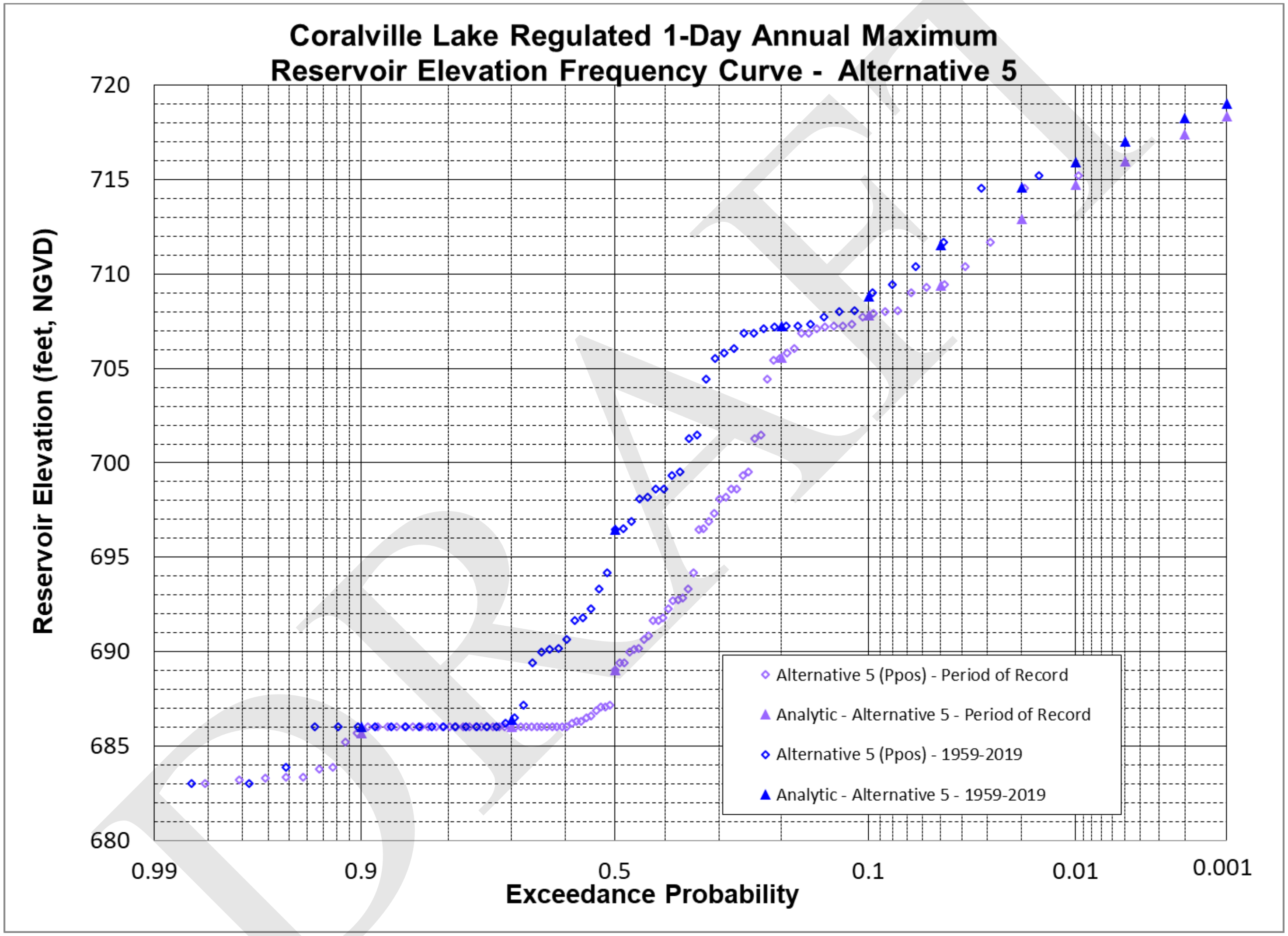


Figure B-89. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 5. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibell plotting position (Ppos).

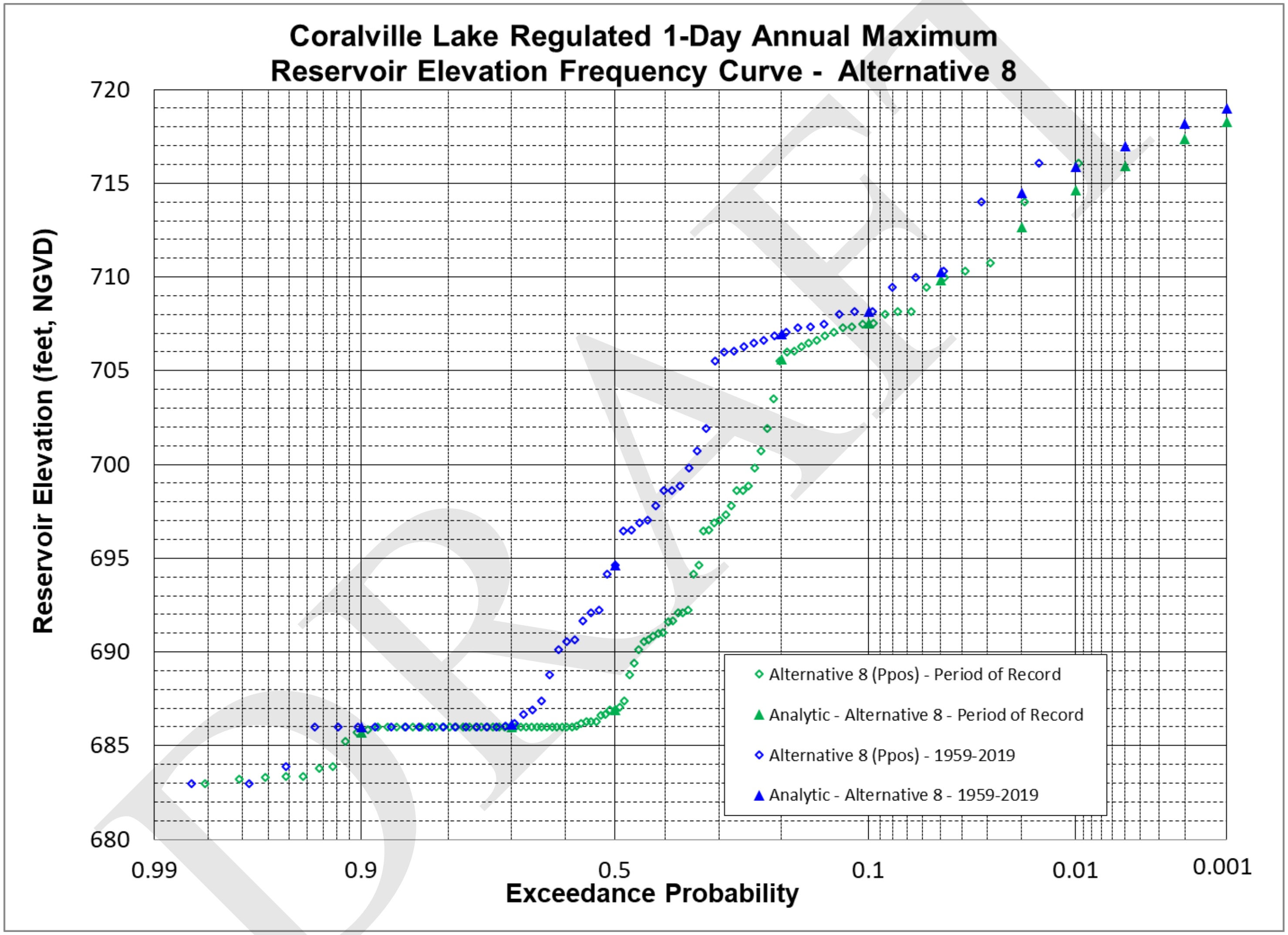


Figure B-90. Coralville Lake Annual Maximum Pool Elevation Exceedance Frequencies – Alternatives 8. Comparison of Period of Record (1917-2019) and 1959-2019 Curves. Exceedance probabilities for simulated events estimated using Weibull plotting position (Ppos).

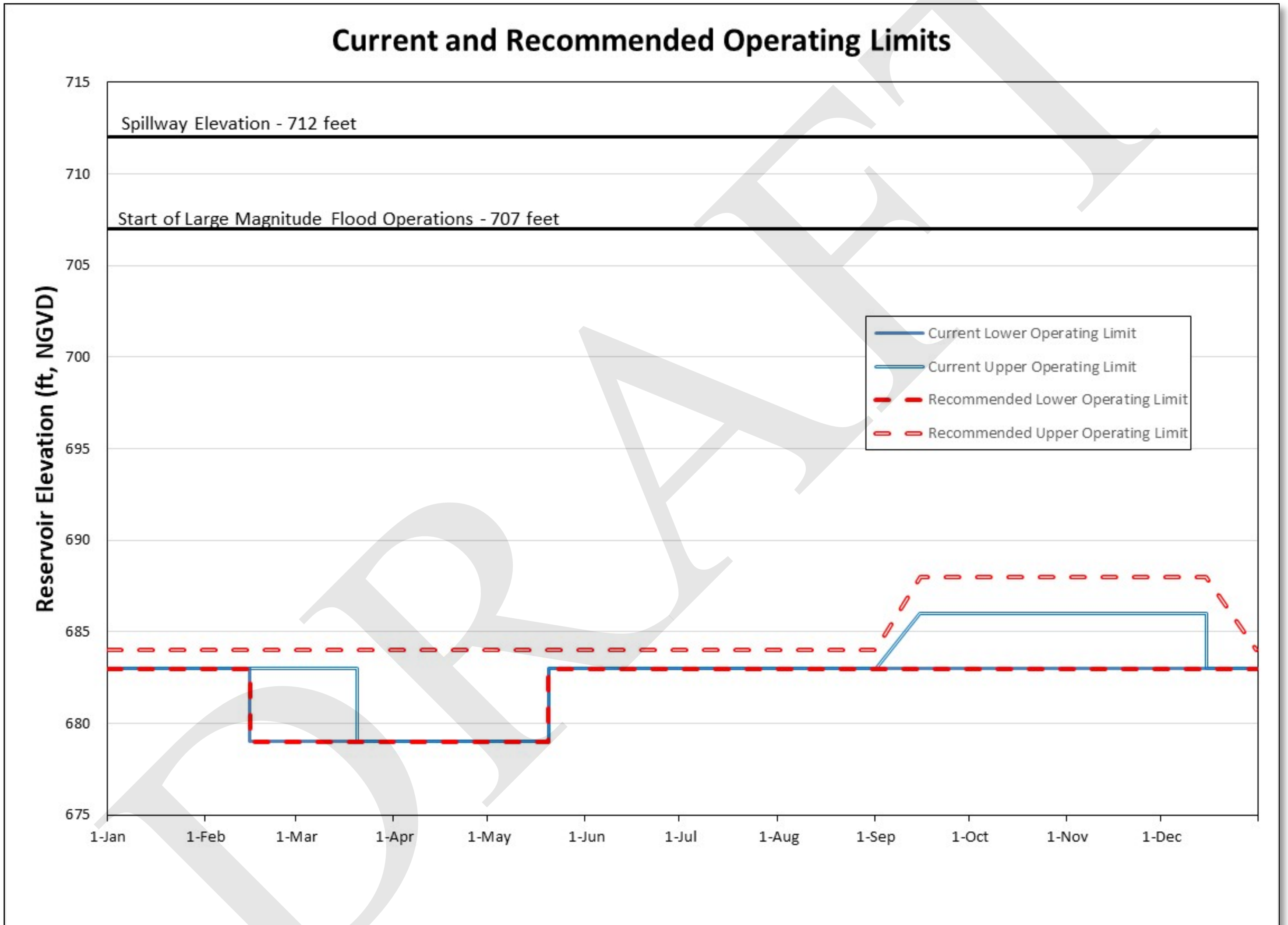


Figure B-91. Current and Recommended Operating Limits

CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX C

ECONOMICS

CORALVILLE LAKE WATER CONTROL
FEASIBILITY STUDY
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX C

ECONOMICS

I. FLOOD IMPACT ANALYSIS INPUT DATA

The Hydrologic Engineering Center-Flood Impact Analysis (HEC-FIA) model developed for the Iowa-Cedar River Basin Master Water Control Manual Study was based on HEC-FIA version 3.0.1. The HEC-Table EA-1 shows the required input data of the FIA model C-.

Table C-1: Input Data Required by Hydrologic Engineering Center-Flood Impact Analysis

Data Input	Source
Stream Alignment	HEC-RAS
Cross Sections	HEC-RAS
Storage Areas	HEC-RAS
Depth, Duration, Arrival Grids	HEC-RAS
Terrain Grid	Same used for HEC-RAS development
Impact Areas	Hydraulics & Hydrologic Engineering Branch
Boundaries	Counties, Census Blocks, States
Agricultural Data	Grid from National Agricultural Statistics Service (NASS), prices and yield from Purdue extension service crop budgets
Structure Data	HEC's National Structure Inventory (NSI)

II. FLOOD IMPACT ANALYSIS STRUCTURE INVENTORY

To estimate damages, HEC-FIA uses a point-based structure inventory. Hydraulic stage data are used to determine the flood depths at each structure, and structure depth-damage curves are used to estimate damages.

The structure inventory developed for the Iowa River Basin Master Water Control Manual Study was developed from nationwide the NSI version 2.0. NSI 2.0 is comprised of data from the Census Bureau, FEMA, and other sources; geospatial structure locations are distributed across the developed and agricultural areas of Census Bureau blocks (based on National Land Cover Database land cover definitions). Structure locations were visually checked for accuracy and moved when placement was incorrect. The national data are based on HAZUS methodology but are modified so that structures are only placed on developed areas of each census block.

The structure values in the dataset are in 2019 dollar values and the population is based on year 2017 Census Bureau data and are generated without an uncertainty distribution. The dollar values were indexed up to 2019 using an index of 1.05 based on the Engineering News-Record Building Cost Index. Table C-2 shows foundation heights for each structure occupancy type pulled from the Modeling, Mapping, and Consequence standard operating procedures.

Table C-2. Structure Inventory Foundation Heights

Structure Occupancy Type Name	Foundation Height
REL1	3 feet
RES1	2 feet
RES2	3 feet
All other	1 feet

III. FLOOD IMPACT STRUCTURAL ANALYSIS

To estimate structure damages, the HEC-FIA model relies on a structure inventory of georeferenced points that have ground surface elevation, foundation heights, and structure values. A depth grid is used to compute how high water will reach on each structure in the inventory. Based on the depth of flooding, HEC-FIA relies on depth-damage curves to compute damages. The depth-damage curves in HEC-FIA can be user-modified, but were left at the model defaults, which represent national averages for non-coastal riverine flooding and do not account for uncertainty. Further information about the structure inventory is found in Section II.

IV. FLOOD IMPACT AGRICULTURE ANALYSIS

To estimate agriculture damages, the HEC-FIA model extracts corn and soybean from a 2019 NASS land cover grid. The grid is a 30 meter resolution raster that has cells that represents each of the crop types. The agriculture compute in HEC-FIA requires three grids: depth, arrival, and duration. The depth grid computes how high water will reach on the crops, whereas the arrival grid determines how quickly (in hours) the flood depth reaches a threshold, in this case 2 feet. Finally, the duration grid determines how long (in hours) the depth of flooding exceeds a threshold, again 2 feet. The threshold of 2 feet was set as the point at which row crops would begin experiencing damages.

The crop budget in HEC-FIA was developed in support using the 2019 Purdue Crop Cost & Return Guide, which is published annually by the University of Purdue Agriculture Extension Service. The crop budget uses variable & fixed costs, crop yields, replanting rates, and duration damage curves by month that allow the model to determine damages by frequency.

V. FLOOD IMPACT ANALYSIS MODEL CALIBRATION

The HEC-FIA model utilized for the Iowa-Cedar River Basin Master Water Control Manual Study was sourced from the Rock Island District Corps Water Management System (CWMS) model. The CWMS model used was calibrated by evaluating damages caused by a 1/2 annual chance exceedance flood event, which was determined by the hydraulic modeling to cause a bank full type of flow scenario that should not cause any actual structure flooding damages. This event was used to identify structures that were incorrectly placed too close to the river channel. Those structures were moved to more reasonable locations based on aerial imagery until that bank full run resulted in no damages. Approximately 2 days were spent manually moving structure points to more accurate locations within each census block, concentrating the efforts on structures in the floodplain along the river. Despite the effort spent on spatially relocating structures, there were still residual structures located in erroneous locations. Consequently, the results for this study were further calibrated in GIS to ensure that damages began at an accurate flow/stage.

VI. FLOOD IMPACT ANALYSIS MODEL REACHES

The HEC-FIA model was split into the following five reaches:

1. Coralville Pool
2. Coralville
3. Iowa City
4. Loan Tree
5. Wapello

Each reach was modeled in HEC-FIA using depth, duration, and arrival grids generated by the Hydrology & Hydraulics engineer in HEC-RAS.

VII. FLOOD IMPACT ANALYSIS MODEL ALTERNATIVES

The HEC-FIA model was used to analyze the effects of four alternatives. for structure and agricultural damages. More detailed information about the differences between each of the alternatives can be found in the Main Report, Chapter III, *Formulation of Alternatives*. These four alternatives are:

1. Alternative 1 (Existing Conditions)
2. Alternative 2C
3. Alternative 5
4. Alternative 8

The structure inventory, agriculture data, and hydraulic grids for each of the three alternatives remained the same during each of the HEC-FIA model runs. The change in benefits (damages avoided) for each alternative was determined through the hydraulic frequency of each of the flows or stages occurring. Tables C-3, C-4, C- 5, and C-6, show the regulated 1-day flow and elevation frequencies for the four alternatives for the period of record 1917-2019. C-7, C-8, C-9, and C-10 show the regulated 1-day flow and elevation frequencies for the four alternatives for the period of record 1959-2019 which is a period of higher rainfall.

VIII. FLOOD IMPACT ANALYSIS MODEL RESULTS

The same array of flows and stages were run in HEC-FIA, but each alternative changed the frequency of the flows. As a result, the flow and stage frequencies were linearly interpolated to achieve consistent and comparable structure and agricultural benefits. Each of the economics results from the flow and stage runs were individually analyzed to determine spatial accuracy and ensure that damages begin at the correct flow or stage. The following tables and figures show the damage-frequency relationships for each of the alternatives and stages/flows.

Table C-3. Alternative 1 1917-2019 Existing Conditions Damage-Frequency Tables

Alt 1 - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.7	1.4143	-
0.9	1.1286	-
1.2	0.8429	-
1.3	0.7714	-
1.4	0.7000	-
1.7	0.6000	-
1.7	0.5750	-
2.0	0.5000	2,110
11.4	0.0875	4,760
11.9	0.0844	30,730
12.3	0.0813	34,870
13.3	0.0750	254,980
14.5	0.0688	354,560
16.0	0.0625	427,880
17.8	0.0563	590,980
20.0	0.0500	730,320
22.2	0.0450	855,860
25.0	0.0400	1,020,900
54.8	0.0182	1,928,400
102.7	0.0097	2,659,530
311.7	0.0032	3,597,800
559.2	0.0018	3,911,230
1000.0	0.0010	4,339,570
AVERAGE ANNUAL VALUE =		103,488

Alt 1 - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.2043	-
1.0	1.0250	1,590
1.2	0.8349	6,710
1.3	0.7874	9,200
1.4	0.7399	11,180
1.7	0.5911	36,810
1.8	0.5565	49,350
3.9	0.2549	95,220
11.2	0.0895	188,000
11.6	0.0862	207,120
12.1	0.0829	297,880
13.1	0.0762	479,400
14.4	0.0695	660,920
15.9	0.0629	842,440
17.8	0.0562	1,023,960
20.1	0.0497	1,202,241
22.3	0.0448	1,335,746
25.1	0.0399	1,469,251
56.0	0.0179	2,306,770
99.1	0.0101	3,379,180
292.0	0.0034	66,623,270
530.2	0.0019	208,121,510
1453.6	0.0007	419,726,330
AVERAGE ANNUAL VALUE =		976,116

Alt 1 - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1750	-
1.0	0.9880	1,660
1.4	0.7217	95,850
1.5	0.6523	159,770
1.7	0.5816	196,840
2.8	0.3558	478,010
3.3	0.3022	550,860
5.4	0.1851	709,670
13.7	0.0729	1,131,200
13.9	0.0720	1,134,520
14.1	0.0711	1,137,840
14.4	0.0693	1,144,480
14.8	0.0675	1,151,120
15.2	0.0657	1,157,760
15.7	0.0639	1,161,970
16.1	0.0621	1,169,940
16.6	0.0603	1,173,490
17.1	0.0584	1,179,790
33.1	0.0302	1,540,170
96.9	0.0103	2,107,640
338.9	0.0030	2,863,700
632.9	0.0016	3,161,450
5102.0	0.0002	3,670,480
AVERAGE ANNUAL VALUE =		433,989

Alt 1 - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1009	-
1.3	0.7827	1,530
2.1	0.4862	397,970
2.2	0.4503	574,070
2.5	0.4062	600,430
3.3	0.3016	782,830
3.8	0.2628	793,550
6.2	0.1610	1,195,720
20.4	0.0491	2,299,830
21.0	0.0477	4,110,330
21.5	0.0464	4,392,480
22.9	0.0438	4,692,360
24.3	0.0411	4,992,240
26.0	0.0385	5,292,120
27.9	0.0358	5,592,000
30.2	0.0332	7,535,660
32.8	0.0305	8,238,500
35.9	0.0279	8,768,060
62.5	0.0160	9,516,940
110.5	0.0090	13,943,600
341.0	0.0029	19,766,400
601.6	0.0017	34,340,300
2316.2	0.0004	39,118,060
AVERAGE ANNUAL VALUE =		998,841

Alt 1 - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
0.1	6.7000	-
3.0	0.3362	43,040
3.4	0.2967	63,980
5.1	0.1962	182,190
11.3	0.0886	421,500
22.0	0.0455	651,530
88.2	0.0113	1,318,840
295.5	0.0034	6,151,240
1000.0	0.0010	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		270,385

Table C-4. Alternative 2C 1917-2019 Damage-Frequency Tables

Alt 2C - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0895	-
1.0	0.9842	-
1.1	0.8789	-
1.2	0.8526	-
1.2	0.8263	-
1.4	0.7211	-
1.5	0.6875	-
2.0	0.5000	2,110
10.0	0.1000	4,760
20.7	0.0483	30,730
21.5	0.0465	34,870
23.2	0.0430	254,980
25.3	0.0395	354,560
27.7	0.0360	427,880
30.7	0.0326	590,980
34.4	0.0291	730,320
39.1	0.0256	855,860
45.3	0.0221	1,020,900
76.8	0.0130	1,928,400
132.0	0.0076	2,659,530
379.5	0.0026	3,597,800
622.0	0.0016	3,911,230
1987.8	0.0005	4,339,570
AVERAGE ANNUAL VALUE =		65,342

Alt 2C - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0795	-
1.0	0.9737	1,590
1.2	0.8616	6,710
1.2	0.8336	9,200
1.2	0.8056	11,180
1.5	0.6896	36,810
1.6	0.6265	49,350
2.3	0.4302	95,220
6.3	0.1586	188,000
7.3	0.1375	207,120
8.6	0.1164	297,880
13.1	0.0762	479,400
20.6	0.0485	660,920
22.7	0.0441	842,440
25.2	0.0396	1,023,960
28.5	0.0351	1,202,241
32.6	0.0307	1,335,746
38.2	0.0262	1,469,251
73.6	0.0136	2,306,770
122.1	0.0082	3,379,180
344.8	0.0029	66,623,270
581.2	0.0017	208,121,510
1619.5	0.0006	419,726,330
AVERAGE ANNUAL VALUE =		857,154

Alt 2C - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1750	-
1.0	0.9880	1,660
1.4	0.7217	95,850
1.5	0.6653	159,770
1.6	0.6139	196,840
2.3	0.4411	478,010
2.5	0.4016	550,860
3.5	0.2833	709,670
12.2	0.0818	1,131,200
12.3	0.0810	1,134,520
12.5	0.0803	1,137,840
12.7	0.0787	1,144,480
12.9	0.0772	1,151,120
13.2	0.0757	1,157,760
13.5	0.0742	1,161,970
13.8	0.0727	1,169,940
14.0	0.0712	1,173,490
14.3	0.0697	1,179,790
34.3	0.0292	1,540,170
110.6	0.0090	2,107,640
396.7	0.0025	2,863,700
713.6	0.0014	3,161,450
28148.1	0.0000	3,670,480
AVERAGE ANNUAL VALUE =		498,218

Alt 2C - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0920	-
1.3	0.7879	1,530
2.0	0.5000	397,970
2.2	0.4636	574,070
2.4	0.4188	600,430
3.2	0.3126	782,830
3.7	0.2732	793,550
6.0	0.1660	1,195,720
20.9	0.0478	2,299,830
21.5	0.0464	4,110,330
22.2	0.0451	4,392,480
23.6	0.0424	4,692,360
25.1	0.0398	4,992,240
26.9	0.0371	5,292,120
29.0	0.0344	5,592,000
31.5	0.0318	7,535,660
34.3	0.0291	8,238,500
37.8	0.0265	8,768,060
66.8	0.0150	9,516,940
116.8	0.0086	13,943,600
364.8	0.0027	19,766,400
631.5	0.0016	34,340,300
2721.4	0.0004	39,118,060
AVERAGE ANNUAL VALUE =		998,009

Alt 2C - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
0.4	2.7000	-
3.5	0.2873	43,040
3.9	0.2556	63,980
8.9	0.1118	182,190
22.4	0.0446	421,500
43.1	0.0232	651,530
121.7	0.0082	1,318,840
933.3	0.0011	6,151,240
10000.0	0.0001	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		160,138

Table C-5. Alternative 5 1917-2019 Damage-Frequency Tables

Alt 5 - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1118	-
1.0	0.9941	-
1.1	0.8765	-
1.2	0.8471	-
1.2	0.8176	-
1.4	0.7000	-
1.5	0.6706	-
5.0	0.2000	2,110
10.0	0.1000	4,760
11.4	0.0875	30,730
13.3	0.0750	34,870
20.0	0.0500	254,980
21.7	0.0461	354,560
23.8	0.0421	427,880
26.2	0.0382	590,980
29.2	0.0342	730,320
33.0	0.0303	855,860
38.0	0.0263	1,020,900
69.3	0.0144	1,928,400
122.8	0.0081	2,659,530
361.2	0.0028	3,597,800
608.7	0.0016	3,911,230
1987.4	0.0005	4,339,570
AVERAGE ANNUAL VALUE =		76,987

Alt 5 - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1059	-
1.0	0.9846	1,590
1.2	0.8560	6,710
1.2	0.8238	9,200
1.3	0.7917	11,180
1.6	0.6412	36,810
1.7	0.5875	49,350
2.5	0.3997	95,220
7.4	0.1353	188,000
9.1	0.1100	207,120
10.5	0.0949	297,880
12.8	0.0780	479,400
16.4	0.0611	660,920
20.7	0.0484	842,440
23.0	0.0435	1,023,960
25.8	0.0387	1,202,241
29.5	0.0339	1,335,746
34.4	0.0291	1,469,251
69.9	0.0143	2,306,770
117.8	0.0085	3,379,180
334.9	0.0030	66,623,270
572.0	0.0017	208,121,510
1593.8	0.0006	419,726,330
AVERAGE ANNUAL VALUE =		874,330

Alt 5 - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1750	-
1.0	0.9880	1,660
1.4	0.7217	95,850
1.5	0.6637	159,770
1.6	0.6098	196,840
2.3	0.4357	478,010
2.5	0.3978	550,860
3.5	0.2839	709,670
12.6	0.0795	1,131,200
12.7	0.0787	1,134,520
12.9	0.0778	1,137,840
13.1	0.0761	1,144,480
13.4	0.0744	1,151,120
13.7	0.0727	1,157,760
14.1	0.0710	1,161,970
14.4	0.0693	1,169,940
14.8	0.0676	1,173,490
15.2	0.0660	1,179,790
33.8	0.0296	1,540,170
105.3	0.0095	2,107,640
373.5	0.0027	2,863,700
681.6	0.0015	3,161,450
9870.1	0.0001	3,670,480
AVERAGE ANNUAL VALUE =		495,372

Alt 5 - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0973	-
1.3	0.7848	1,530
2.0	0.5000	397,970
2.2	0.4629	574,070
2.4	0.4172	600,430
3.2	0.3088	782,830
3.7	0.2687	793,550
6.0	0.1658	1,195,720
19.2	0.0521	2,299,830
20.4	0.0490	4,110,330
21.0	0.0476	4,392,480
22.3	0.0448	4,692,360
23.9	0.0419	4,992,240
25.6	0.0391	5,292,120
27.6	0.0362	5,592,000
30.0	0.0334	7,535,660
32.8	0.0305	8,238,500
36.1	0.0277	8,768,060
64.8	0.0154	9,516,940
114.2	0.0088	13,943,600
355.7	0.0028	19,766,400
621.7	0.0016	34,340,300
2646.6	0.0004	39,118,060
AVERAGE ANNUAL VALUE =		1,015,982

Alt 5 - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
0.4	2.7000	-
3.3	0.3012	43,040
3.8	0.2649	63,980
7.3	0.1373	182,190
22.3	0.0449	421,500
35.9	0.0278	651,530
112.1	0.0089	1,318,840
346.4	0.0029	6,151,240
10000.0	0.0001	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		184,778

Table C-6. Alternative 8 1917-2019 Damage-Frequency Tables

Alt 8 - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0895	-
1.0	0.9842	-
1.1	0.8789	-
1.2	0.8526	-
1.2	0.8263	-
1.4	0.7211	-
1.5	0.6833	-
5.0	0.2000	2,110
10.0	0.1000	4,760
20.7	0.0484	30,730
21.4	0.0467	34,870
23.0	0.0434	254,980
24.9	0.0401	354,560
27.2	0.0368	427,880
29.8	0.0335	590,980
33.1	0.0302	730,320
37.1	0.0269	855,860
42.3	0.0236	1,020,900
72.9	0.0137	1,928,400
128.4	0.0078	2,659,530
386.8	0.0026	3,597,800
639.6	0.0016	3,911,230
2359.6	0.0004	4,339,570
AVERAGE ANNUAL VALUE =		67,184

Alt 8 - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0795	-
1.0	0.9737	1,590
1.2	0.8616	6,710
1.2	0.8336	9,200
1.2	0.8056	11,180
1.5	0.6882	36,810
1.6	0.6167	49,350
2.6	0.3897	95,220
7.3	0.1377	188,000
8.6	0.1166	207,120
10.3	0.0973	297,880
13.9	0.0720	479,400
20.2	0.0494	660,920
22.2	0.0451	842,440
24.5	0.0408	1,023,960
27.5	0.0364	1,202,241
31.2	0.0321	1,335,746
36.0	0.0277	1,469,251
70.7	0.0141	2,306,770
119.4	0.0084	3,379,180
346.6	0.0029	66,623,270
589.9	0.0017	208,121,510
1799.4	0.0006	419,726,330
AVERAGE ANNUAL VALUE =		870,028

Alt 8 - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1750	-
1.0	0.9880	1,660
1.4	0.7217	95,850
1.5	0.6637	159,770
1.6	0.6098	196,840
2.3	0.4349	478,010
2.5	0.3965	550,860
3.6	0.2811	709,670
12.3	0.0811	1,131,200
12.4	0.0803	1,134,520
12.6	0.0796	1,137,840
12.8	0.0781	1,144,480
13.0	0.0767	1,151,120
13.3	0.0752	1,157,760
13.6	0.0737	1,161,970
13.8	0.0722	1,169,940
14.1	0.0707	1,173,490
14.4	0.0693	1,179,790
34.0	0.0294	1,540,170
109.2	0.0092	2,107,640
388.3	0.0026	2,863,700
700.5	0.0014	3,161,450
16170.2	0.0001	3,670,480
AVERAGE ANNUAL VALUE =		495,044

Alt 8 - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0920	-
1.3	0.7879	1,530
2.0	0.4977	397,970
2.2	0.4616	574,070
2.4	0.4171	600,430
3.2	0.3117	782,830
3.7	0.2726	793,550
6.1	0.1647	1,195,720
20.9	0.0478	2,299,830
21.5	0.0465	4,110,330
22.1	0.0452	4,392,480
23.5	0.0425	4,692,360
0.0	0.0399	4,992,240
26.8	0.0373	5,292,120
28.9	0.0347	5,592,000
31.2	0.0320	7,535,660
34.0	0.0294	8,238,500
37.4	0.0268	8,768,060
65.7	0.0152	9,516,940
115.3	0.0087	13,943,600
360.9	0.0028	19,766,400
628.8	0.0016	34,340,300
2778.7	0.0004	39,118,060
AVERAGE ANNUAL VALUE =		998,867

Alt 8 - Coralville Pool		
	-	-
0.37	2.7000	-
3.4	0.2900	38,950
3.9	0.2580	57,900
7.9	0.1272	165,030
20.7	0.0484	381,210
36.9	0.0271	594,900
117.5	0.0085	1,234,140
367.2	0.0027	6,049,840
10000.0	0.0001	17,608,330
100000.0	0.0000	70,857,040
AVERAGE ANNUAL VALUE =		168,045

Table C-7. Alternative 1 1959-2019 Damage-Frequency Tables

Alt 1 - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.7	1.4125	-
0.9	1.1625	-
1.1	0.9125	-
1.2	0.8500	-
1.3	0.7875	-
1.6	0.6212	-
1.7	0.5909	-
2.0	0.5000	2,110
10.0	0.1000	4,760
10.3	0.0972	30,730
10.6	0.0944	34,870
11.3	0.0889	254,980
12.0	0.0833	354,560
12.9	0.0778	427,880
13.8	0.0722	590,980
15.0	0.0667	730,320
16.4	0.0611	855,860
18.0	0.0556	1,020,900
28.1	0.0355	1,928,400
53.2	0.0188	2,659,530
172.7	0.0058	3,597,800
277.7	0.0036	3,911,230
707.9	0.0014	4,339,570
AVERAGE ANNUAL VALUE =		148,282

Alt 1 - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.2000	-
0.9	1.0527	1,590
1.1	0.8966	6,710
1.2	0.8575	9,200
1.2	0.8185	11,180
1.5	0.6556	36,810
1.6	0.6068	49,350
2.8	0.3549	95,220
7.7	0.1305	188,000
8.7	0.1151	207,120
10.0	0.1000	297,880
10.7	0.0938	479,400
11.4	0.0876	660,920
12.3	0.0814	842,440
13.3	0.0753	1,023,960
14.5	0.0691	1,202,241
15.9	0.0629	1,335,746
17.6	0.0568	1,469,251
27.8	0.0360	2,306,770
47.2	0.0212	3,379,180
143.9	0.0069	66,623,270
237.8	0.0042	208,121,510
581.3	0.0017	419,726,330
AVERAGE ANNUAL VALUE =		1,840,364

Alt 1 - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1415	-
1.0	1.0062	1,660
1.2	0.8136	95,850
1.3	0.7654	159,770
1.4	0.7173	196,840
2.0	0.4880	478,010
2.2	0.4469	550,860
3.1	0.3237	709,670
8.7	0.1149	1,131,200
8.8	0.1133	1,134,520
9.0	0.1117	1,137,840
9.2	0.1085	1,144,480
9.5	0.1053	1,151,120
9.8	0.1021	1,157,760
10.0	0.0997	1,161,970
10.1	0.0987	1,169,940
10.2	0.0977	1,173,490
10.3	0.0968	1,179,790
17.0	0.0590	1,540,170
44.6	0.0224	2,107,640
144.4	0.0069	2,863,700
238.6	0.0042	3,161,450
570.7	0.0018	3,670,480
AVERAGE ANNUAL VALUE =		586,590

Alt 1 - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.2776	-
1.2	0.8254	1,530
1.8	0.5471	397,970
2.0	0.4971	574,070
2.2	0.4614	600,430
2.7	0.3767	782,830
2.9	0.3453	793,550
4.0	0.2510	1,195,720
11.7	0.0851	2,299,830
12.2	0.0816	4,110,330
12.8	0.0782	4,392,480
14.0	0.0712	4,692,360
15.6	0.0643	4,992,240
17.5	0.0573	5,292,120
19.9	0.0503	5,592,000
21.1	0.0474	7,535,660
22.3	0.0448	8,238,500
23.8	0.0421	8,768,060
35.0	0.0286	9,516,940
53.8	0.0186	13,943,600
144.9	0.0069	19,766,400
228.1	0.0044	34,340,300
496.8	0.0020	39,118,060
AVERAGE ANNUAL VALUE =		1,388,972

Alt 1 - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0811	-
2.3	0.4326	43,040
2.7	0.3754	63,980
4.3	0.2325	182,190
7.3	0.1364	421,500
14.5	0.0690	651,530
45.4	0.0220	1,318,840
162.0	0.0062	6,151,240
10000.0	0.0001	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		281,908

Table C-8. Alternative 2C 1959-2019 Damage-Frequency Tables

Alt 2C - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0750	-
1.0	0.9917	-
1.1	0.9083	-
1.1	0.8875	-
1.2	0.8667	-
1.3	0.7833	-
1.3	0.7625	-
2.0	0.5000	2,110
5.0	0.2000	4,760
10.7	0.0938	30,730
11.4	0.0875	34,870
13.3	0.0750	254,980
16.0	0.0625	354,560
20.0	0.0500	427,880
21.2	0.0471	590,980
22.6	0.0443	730,320
24.1	0.0414	855,860
25.9	0.0386	1,020,900
41.2	0.0243	1,928,400
68.4	0.0146	2,659,530
209.2	0.0048	3,597,800
394.8	0.0025	3,911,230
737.6	0.0014	4,339,570
AVERAGE ANNUAL VALUE =		109,514

Alt 2C - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0680	-
1.0	0.9855	1,590
1.1	0.8981	6,710
1.1	0.8762	9,200
1.2	0.8544	11,180
1.3	0.7685	36,810
1.3	0.7470	49,350
1.8	0.5549	95,220
3.9	0.2568	188,000
4.8	0.2093	207,120
5.6	0.1786	297,880
8.0	0.1253	479,400
11.9	0.0844	660,920
18.3	0.0546	842,440
20.9	0.0478	1,023,960
22.1	0.0452	1,202,241
23.5	0.0426	1,335,746
25.0	0.0400	1,469,251
37.9	0.0264	2,306,770
59.0	0.0170	3,379,180
171.2	0.0058	66,623,270
262.1	0.0038	208,121,510
606.7	0.0016	419,726,330
AVERAGE ANNUAL VALUE =		1,559,895

Alt 2C - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1179	-
1.0	0.9980	1,660
1.2	0.8271	95,850
1.3	0.7844	159,770
1.3	0.7417	196,840
1.7	0.5769	478,010
1.9	0.5344	550,860
2.3	0.4270	709,670
6.6	0.1524	1,131,200
6.6	0.1506	1,134,520
6.7	0.1487	1,137,840
6.9	0.1450	1,144,480
7.1	0.1413	1,151,120
7.3	0.1376	1,157,760
7.5	0.1339	1,161,970
7.7	0.1302	1,169,940
7.9	0.1265	1,173,490
8.1	0.1228	1,179,790
17.2	0.0581	1,540,170
52.7	0.0190	2,107,640
164.8	0.0061	2,863,700
261.2	0.0038	3,161,450
621.0	0.0016	3,670,480
AVERAGE ANNUAL VALUE =		659,414

Alt 2C - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.1814	-
1.2	0.8444	1,530
1.7	0.5850	397,970
1.9	0.5300	574,070
2.1	0.4782	600,430
2.6	0.3854	782,830
2.8	0.3510	793,550
4.0	0.2477	1,195,720
11.5	0.0872	2,299,830
11.9	0.0837	4,110,330
12.5	0.0803	4,392,480
13.6	0.0733	4,692,360
15.1	0.0664	4,992,240
16.8	0.0594	5,292,120
19.1	0.0524	5,592,000
20.8	0.0482	7,535,660
22.1	0.0453	8,238,500
23.5	0.0425	8,768,060
35.4	0.0282	9,516,940
55.6	0.0180	13,943,600
152.5	0.0066	19,766,400
234.3	0.0043	34,340,300
511.4	0.0020	39,118,060
AVERAGE ANNUAL VALUE =		1,413,226

Alt 2C - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
1.3	0.7735	-
2.8	0.3632	43,040
3.2	0.3164	63,980
5.0	0.2000	182,190
16.9	0.0592	421,500
26.1	0.0383	651,530
62.8	0.0159	1,318,840
200.0	0.0050	6,151,240
10000.0	0.0001	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		204,782

Table C-9. Alternative 5 1959-2019 Damage-Frequency Tables

Alt 5 - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.2000	-
0.9	1.0571	-
1.1	0.9143	-
1.1	0.8786	-
1.2	0.8429	-
1.4	0.7000	-
1.5	0.6500	-
2.0	0.5000	2,110
5.0	0.2000	4,760
10.4	0.0958	30,730
10.9	0.0917	34,870
12.0	0.0833	254,980
13.3	0.0750	354,560
15.0	0.0667	427,880
17.1	0.0583	590,980
20.0	0.0500	730,320
21.4	0.0468	855,860
23.0	0.0435	1,020,900
36.5	0.0274	1,928,400
77.5	0.0129	2,659,530
203.1	0.0049	3,597,800
305.6	0.0033	3,911,230
746.5	0.0013	4,339,570
AVERAGE ANNUAL VALUE =		121,740

Alt 5 - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1211	-
1.0	1.0125	1,590
1.1	0.8975	6,710
1.2	0.8687	9,200
1.2	0.8399	11,180
1.4	0.7269	36,810
1.4	0.6969	49,350
2.0	0.4961	95,220
5.2	0.1937	188,000
6.3	0.1600	207,120
7.9	0.1262	297,880
10.7	0.0934	479,400
12.1	0.0826	660,920
13.9	0.0719	842,440
16.4	0.0611	1,023,960
19.9	0.0503	1,202,241
21.2	0.0471	1,335,746
22.7	0.0441	1,469,251
35.1	0.0285	2,306,770
57.0	0.0175	3,379,180
166.2	0.0060	66,623,270
258.0	0.0039	208,121,510
602.7	0.0017	419,726,330
AVERAGE ANNUAL VALUE =		1,589,028

Alt 5 - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1179	-
1.0	0.9980	1,660
1.2	0.8271	95,850
1.3	0.7844	159,770
1.3	0.7417	196,840
1.9	0.5192	478,010
2.1	0.4800	550,860
2.5	0.3935	709,670
9.5	0.1048	1,131,200
9.9	0.1012	1,134,520
10.0	0.0996	1,137,840
10.2	0.0982	1,144,480
10.3	0.0969	1,151,120
10.5	0.0956	1,157,760
10.6	0.0943	1,161,970
10.8	0.0930	1,169,940
10.9	0.0917	1,173,490
11.1	0.0904	1,179,790
22.1	0.0452	1,540,170
50.5	0.0198	2,107,640
156.9	0.0064	2,863,700
252.5	0.0040	3,161,450
602.7	0.0017	3,670,480
AVERAGE ANNUAL VALUE =		609,900

Alt 5 - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.2189	-
1.2	0.8370	1,530
1.8	0.5695	397,970
1.9	0.5169	574,070
2.1	0.4716	600,430
2.6	0.3807	782,830
2.9	0.3469	793,550
4.1	0.2457	1,195,720
11.2	0.0891	2,299,830
11.6	0.0861	4,110,330
12.0	0.0831	4,392,480
13.0	0.0772	4,692,360
14.0	0.0712	4,992,240
15.3	0.0652	5,292,120
16.9	0.0593	5,592,000
18.7	0.0533	7,535,660
20.6	0.0486	8,238,500
22.0	0.0454	8,768,060
34.2	0.0293	9,516,940
55.2	0.0181	13,943,600
150.6	0.0066	19,766,400
232.8	0.0043	34,340,300
497.0	0.0020	39,118,060
AVERAGE ANNUAL VALUE =		1,433,538

Alt 5 - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
0.4	2.4063	-
2.5	0.4012	43,040
2.9	0.3455	63,980
4.8	0.2064	182,190
12.8	0.0784	421,500
22.0	0.0454	651,530
58.4	0.0171	1,318,840
200.0	0.0050	6,151,240
10000.0	0.0001	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		255,291

Table C-10. Alternative 8 1959-2019 Damage-Frequency Tables

Alt 8 - Coralville		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1545	-
1.0	1.0333	-
1.1	0.9121	-
1.1	0.8818	-
1.2	0.8515	-
1.3	0.7667	-
1.4	0.7000	-
2.0	0.5000	2,110
5.0	0.2000	4,760
10.4	0.0958	30,730
10.9	0.0917	34,870
12.0	0.0833	254,980
13.3	0.0750	354,560
15.0	0.0667	427,880
17.1	0.0583	590,980
20.0	0.0500	730,320
21.5	0.0466	855,860
23.2	0.0432	1,020,900
38.3	0.0261	1,928,400
80.0	0.0125	2,659,530
211.2	0.0047	3,597,800
324.4	0.0031	3,911,230
789.8	0.0013	4,339,570
AVERAGE ANNUAL VALUE =		120,296

Alt 8 - Iowa City		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.0826	-
1.0	0.9929	1,590
1.1	0.8979	6,710
1.1	0.8741	9,200
1.2	0.8504	11,180
1.3	0.7570	36,810
1.4	0.7337	49,350
2.0	0.4963	95,220
4.7	0.2109	188,000
5.6	0.1777	207,120
6.7	0.1496	297,880
10.1	0.0985	479,400
11.6	0.0862	660,920
13.5	0.0739	842,440
16.3	0.0615	1,023,960
20.1	0.0498	1,202,241
21.4	0.0468	1,335,746
22.8	0.0438	1,469,251
35.5	0.0282	2,306,770
57.7	0.0173	3,379,180
172.8	0.0058	66,623,270
266.9	0.0037	208,121,510
634.0	0.0016	419,726,330
AVERAGE ANNUAL VALUE =		1,570,289

Alt 8 - Loan Tree		
YEAR	FREQUENCY	VALUE
	-	-
0.9	1.1179	-
1.0	0.9980	1,660
1.2	0.8271	95,850
1.3	0.7844	159,770
1.3	0.7417	196,840
1.8	0.5685	478,010
1.9	0.5231	550,860
2.6	0.3868	709,670
7.0	0.1436	1,131,200
7.0	0.1421	1,134,520
7.1	0.1405	1,137,840
7.3	0.1374	1,144,480
7.4	0.1344	1,151,120
7.6	0.1313	1,157,760
7.8	0.1282	1,161,970
8.0	0.1251	1,169,940
8.2	0.1220	1,173,490
8.4	0.1189	1,179,790
16.7	0.0600	1,540,170
52.0	0.0192	2,107,640
161.7	0.0062	2,863,700
257.6	0.0039	3,161,450
614.0	0.0016	3,670,480
AVERAGE ANNUAL VALUE =		643,125

Alt 8 - Wapello		
YEAR	FREQUENCY	VALUE
	-	-
0.8	1.2053	-
1.2	0.8397	1,530
1.7	0.5794	397,970
1.9	0.5280	574,070
2.1	0.4781	600,430
2.6	0.3850	782,830
2.9	0.3504	793,550
4.1	0.2468	1,195,720
11.4	0.0877	2,299,830
11.8	0.0844	4,110,330
12.3	0.0811	4,392,480
13.4	0.0744	4,692,360
14.8	0.0677	4,992,240
16.4	0.0610	5,292,120
18.4	0.0544	5,592,000
20.4	0.0490	7,535,660
21.7	0.0461	8,238,500
23.2	0.0431	8,768,060
35.1	0.0285	9,516,940
55.2	0.0181	13,943,600
150.6	0.0066	19,766,400
234.3	0.0043	34,340,300
511.4	0.0020	39,118,060
AVERAGE ANNUAL VALUE =		1,418,683

Alt 8 - Coralville Pool		
YEAR	FREQUENCY	VALUE
	-	-
1.1	0.9100	-
2.7	0.3696	43,040
3.1	0.3209	63,980
5.0	0.2000	182,190
17.7	0.0564	421,500
26.5	0.0378	651,530
61.2	0.0164	1,318,840
200.0	0.0050	6,151,240
10000.0	0.0001	17,749,110
100000.0	0.0000	71,079,770
AVERAGE ANNUAL VALUE =		208,508

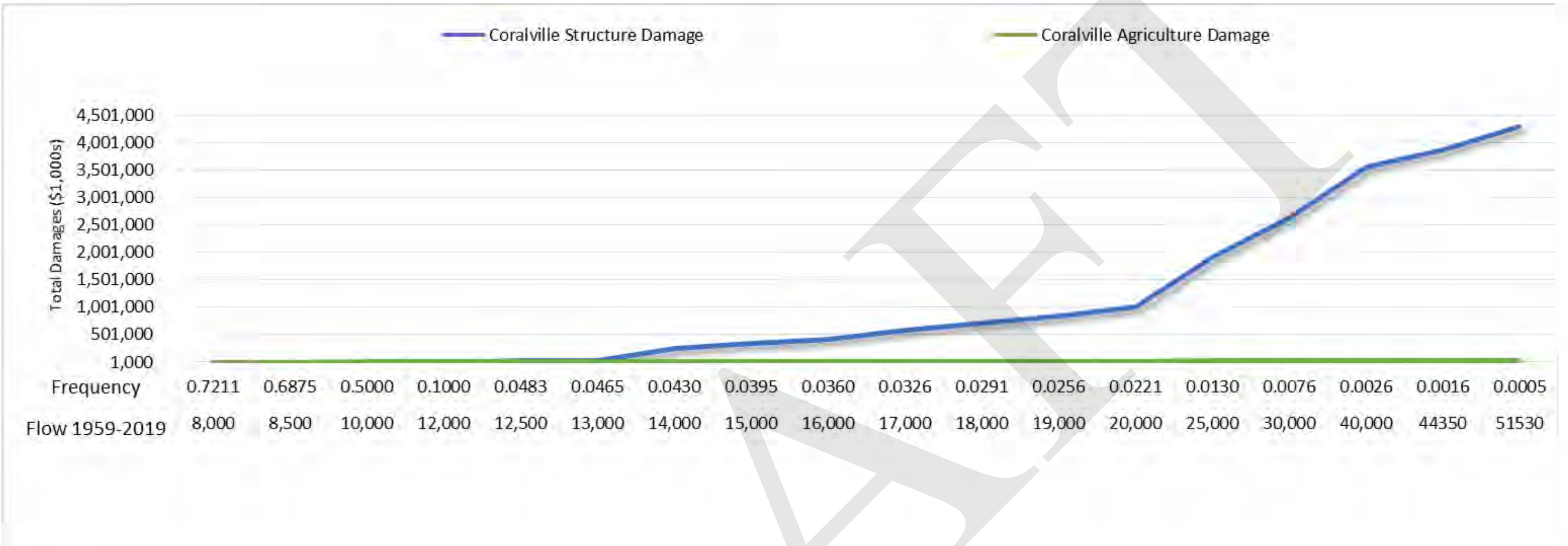


Figure C-1. Alternative 2C 1917-2019 Coralville Reach Damage-Frequency

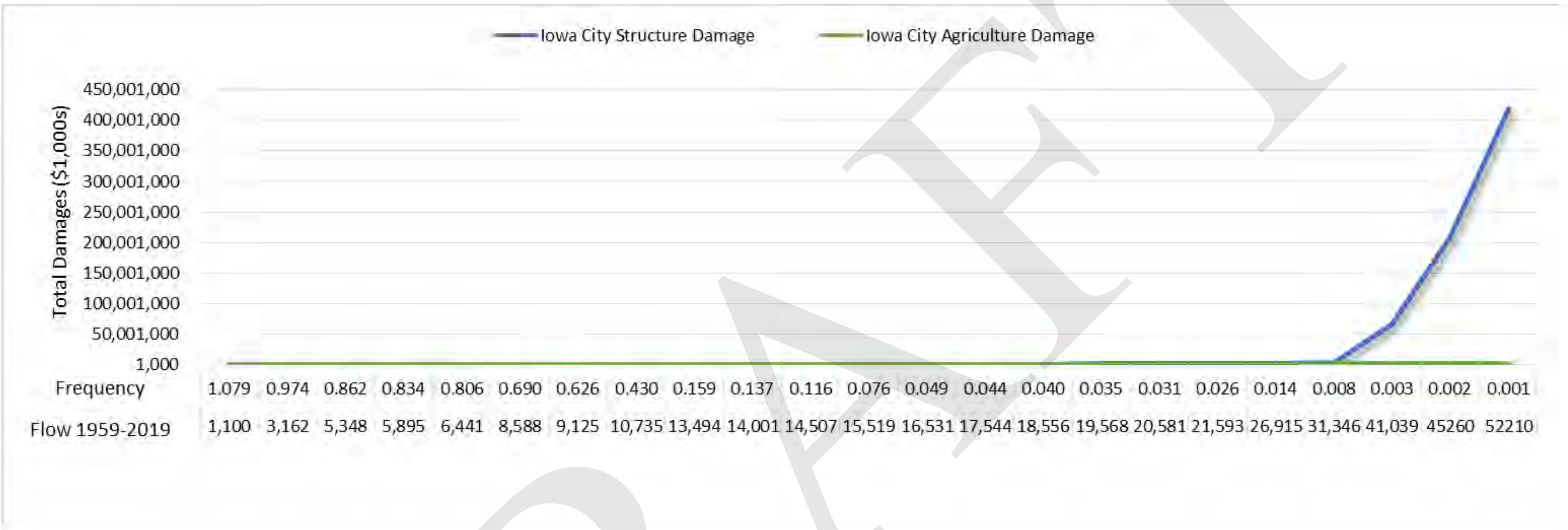


Figure C-2. Alternative 2C 1917-2019 Iowa City Reach Damage-Frequency

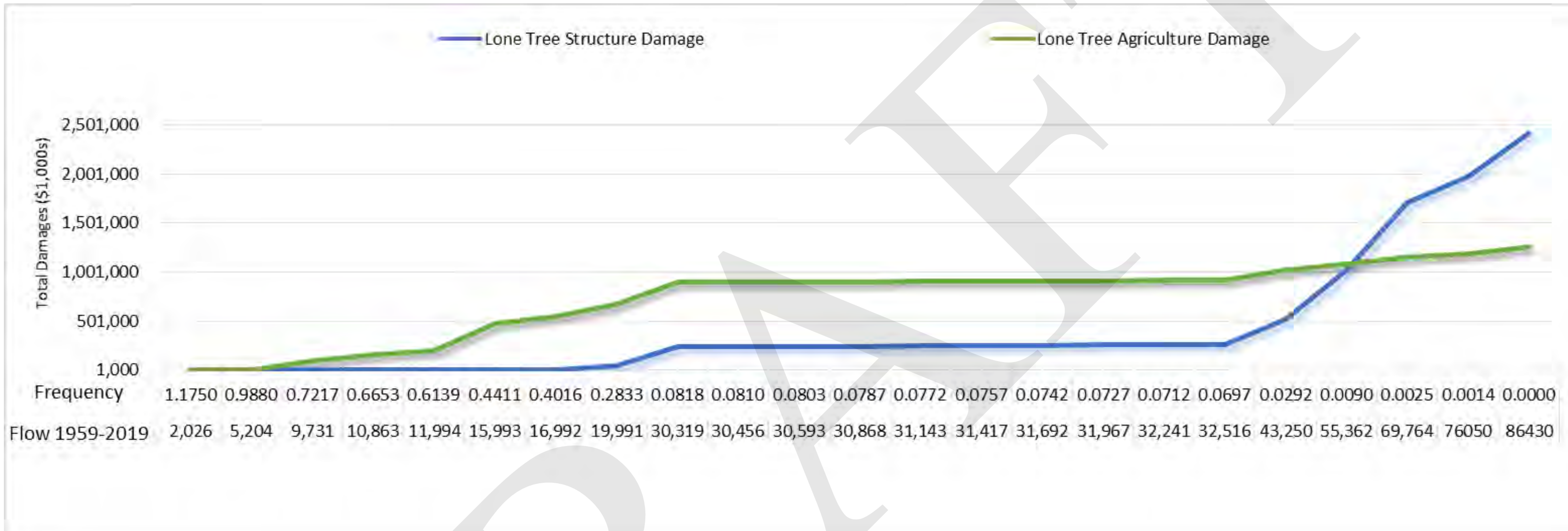


Figure C-3. Alternative 2C 1917-2019 Iowa City Reach Damage-Frequency

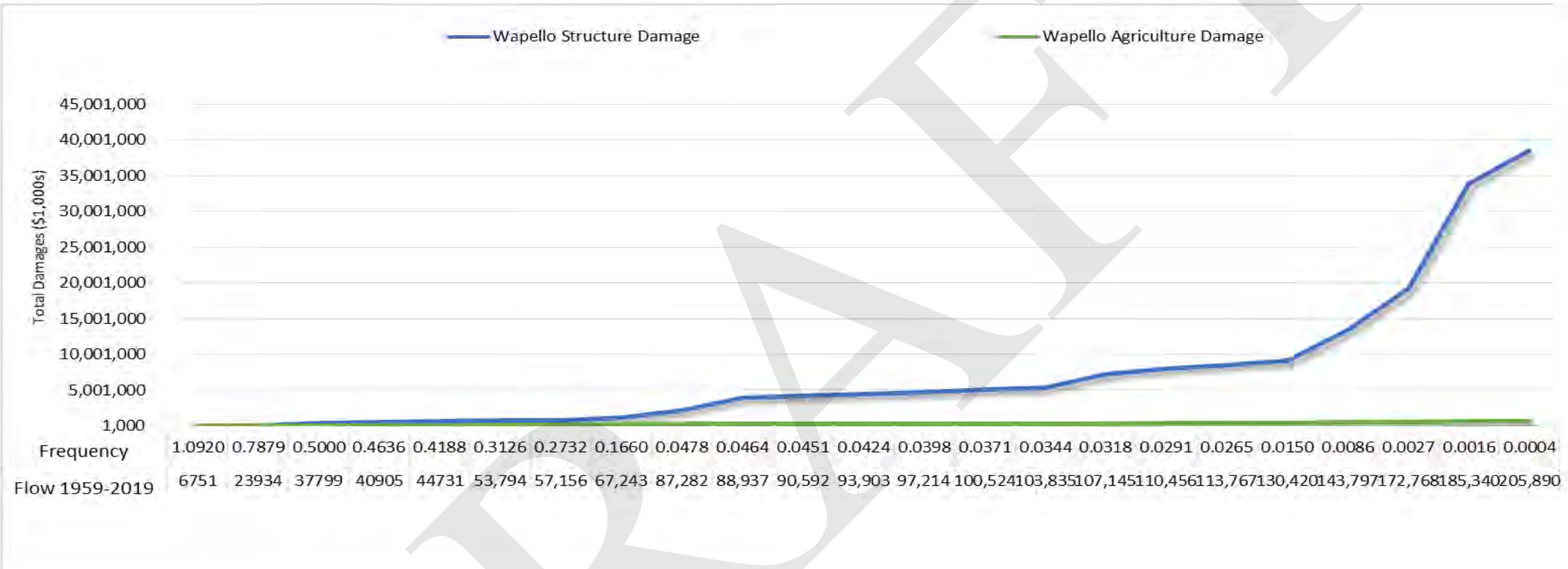


Figure C-4. Alternative 2C 1917-2019 Wapello Reach Damage-Frequency

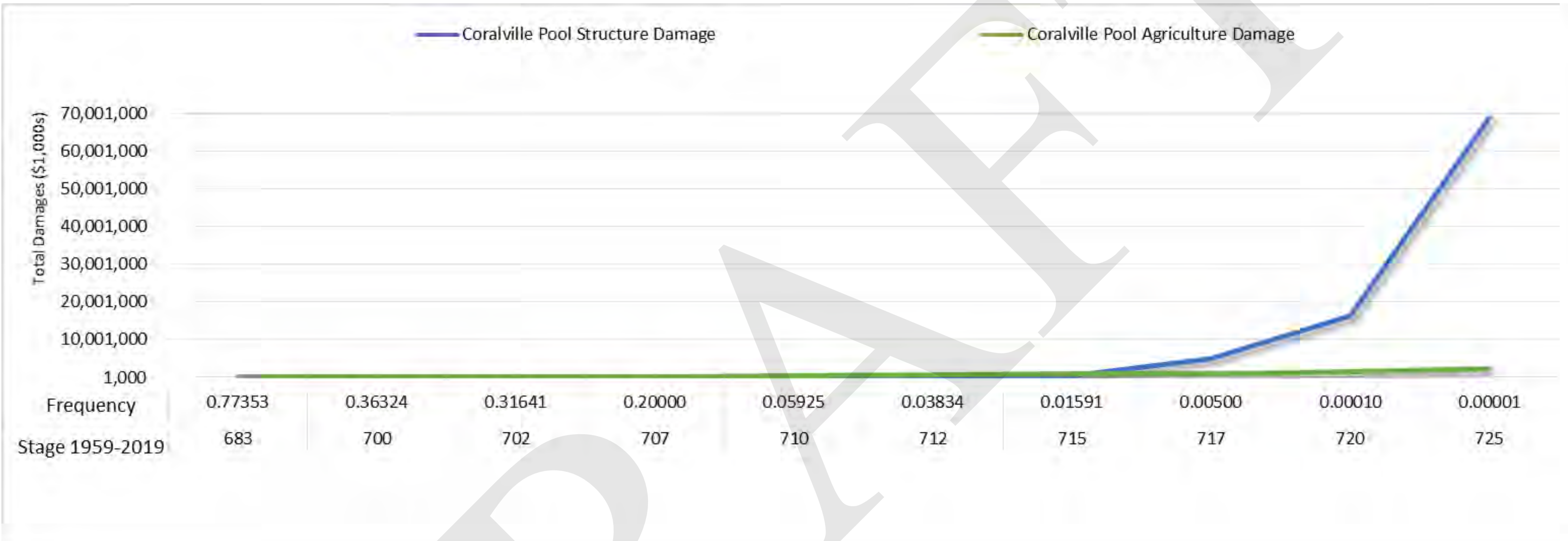


Figure C-5. Alternative 2C 1917-2019 Coralville Pool Reach Damage-Frequency

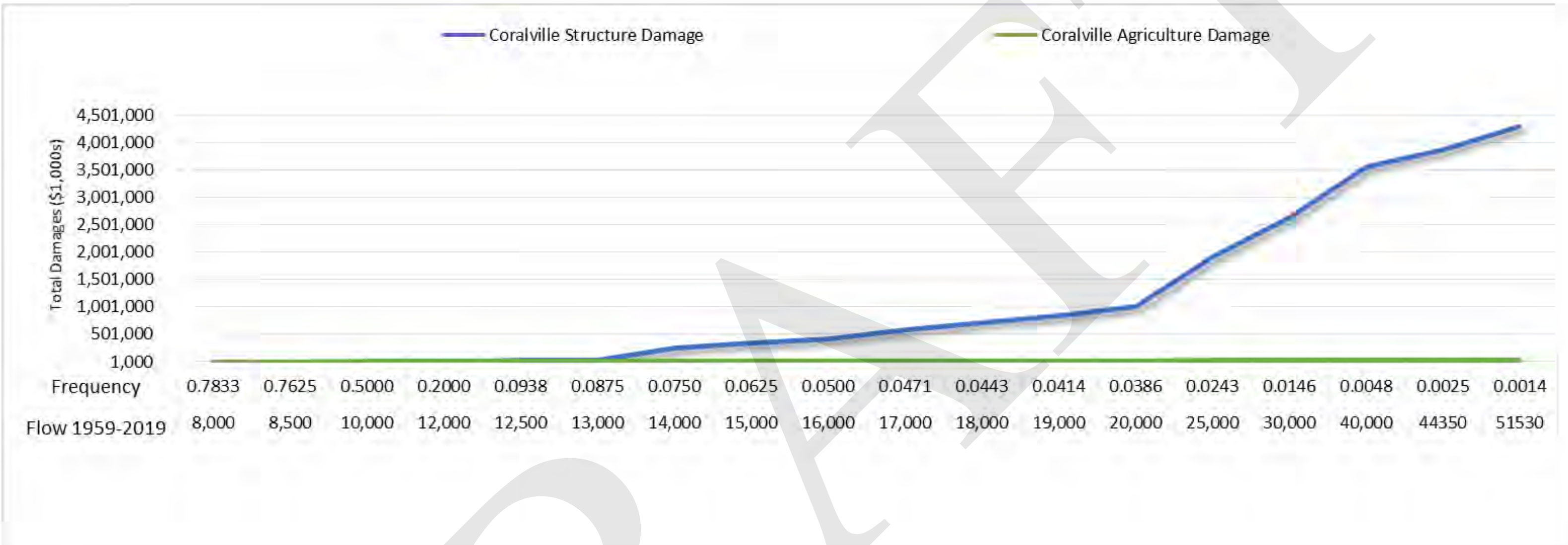


Figure C-6. Alternative 2C 1917-2019 Coralville Reach Damage-Frequency

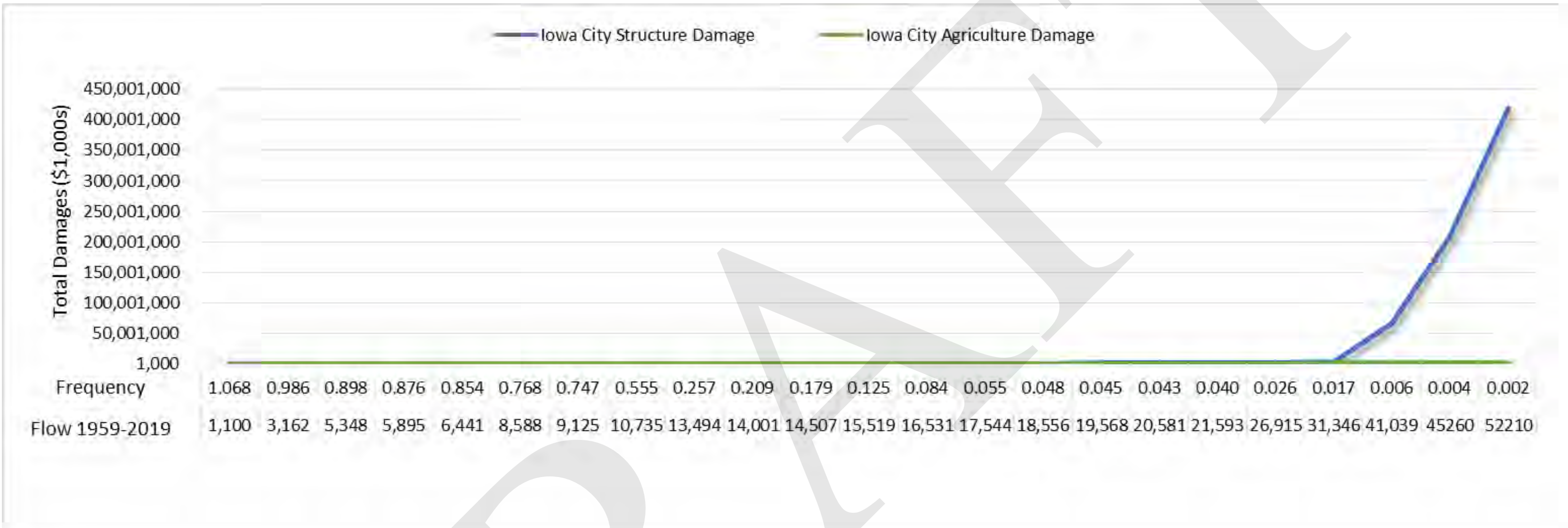


Figure C-7. Alternative 2C 1959-2019 Coralville Reach Damage-Frequency

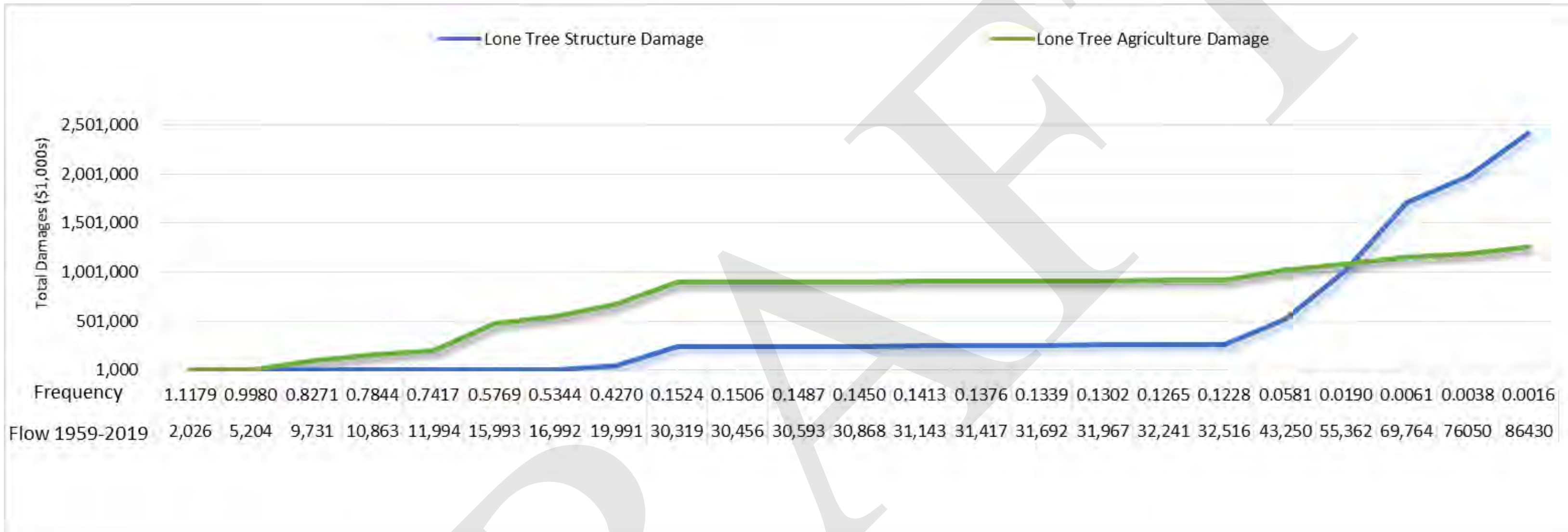


Figure C-8. Alternative 2C 1959-2019 Lone Tree Reach Damage-Frequency

Figure C-9. Alternative 2C 1959-2019 Wapello Reach Damage-Frequency

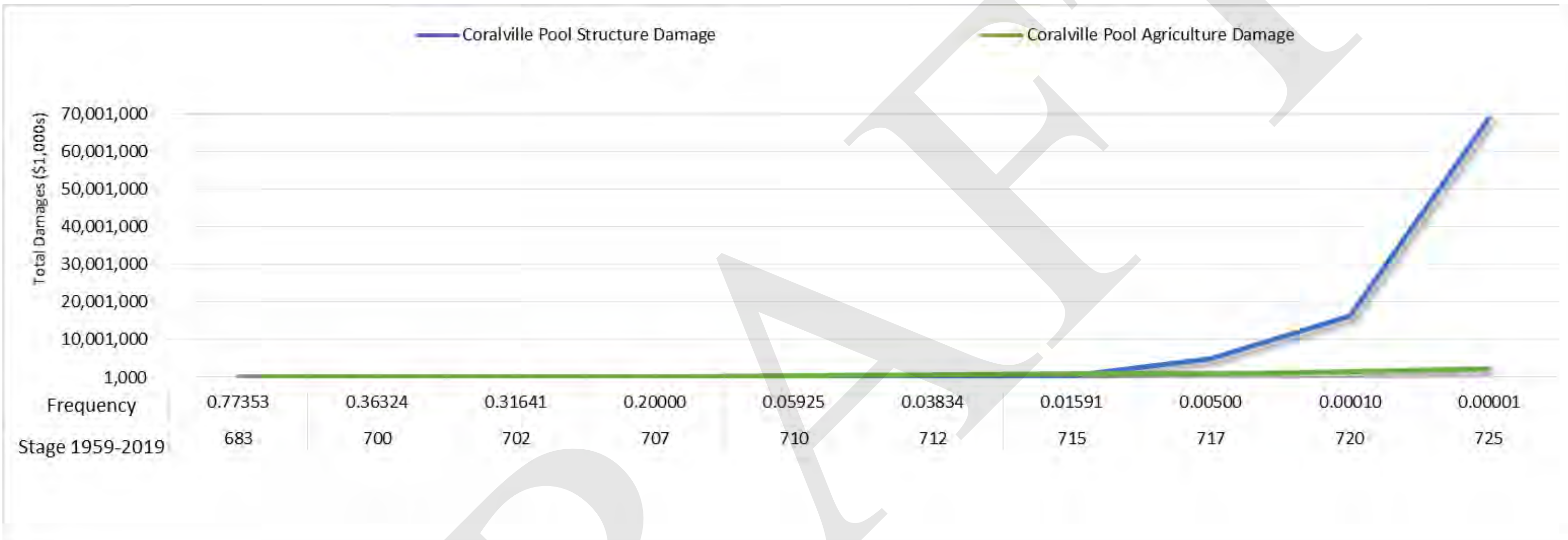


Figure C-10. Alternative 2C 1959-2019 Coralville Pool Reach Damage-Frequency

IX. FLOOD IMPACT ANALYSIS ALTERNATIVE COMPARISON

The results from the HEC-FIA modeling showed Alternative 2C reduced average annual damages (AAD) more than Alternatives 1, 5 and 8 for the full period of record (1919-2019) and the abbreviated wetter period (1959-2019) for the overall system as well as in 3 of the 5 damage reaches Studied. Average Annual Damages were slightly higher in the Lone Tree reach under Alternative 2C than any of the other alternatives considered including Alternative 1. In the Wapello reach, while AAD in Alternative 2 C were slightly higher than Alternative 1, they were lower than alternatives 5 and 8. However, flood damages in the Wapello reach are influenced to a much greater degree by the Cedar River which is uncontrolled, than by the operation of Coralville Reservoir. Additionally, much of the agricultural land in the Wapello reach has been converted from production to conservation land as offered through the federal Conservation Reserve Program (CRP). Moreover, since Alternative 2C provides for a higher maximum allowable release than either alternatives 1, 5 or 8, there is flexibility to respond to potential future upward trends in precipitation and streamflow. Table C-11 shows the summary tables for the full record 1917-2019 and Table C-12 show the period of higher rainfall 1959-2019.

Table C-11. Average Annual Damage Alternative Comparison (1917-2019)

	Coralville	Iowa City	Lone Tree	Wapello	Coralville pool	Cumulative Total
	Average Annual Damages ($)					
Alt 1 1917-	103,000	976,000	434,000	999,000	270,000	2,782,000
Alt 2C 191	65,000	857,000	498,000	998,000	160,000	2,578,000
Alt 5 1917-	77,000	874,000	495,000	1,016,000	185,000	2,647,000
Alt 8 1917-	67,000	870,000	495,000	999,000	180,000	2,611,000
	Coralville	Iowa City	Lone Tree	Wapello	Coralville pool	Cumulative Total
	Average Annual Damages Reduced (From Existing Flows)					
Alt 2C 191	38,000	119,000	(64,000)	1,000	110,000	204,000
Alt 5 1917-	26,000	102,000	(61,000)	(17,000)	85,000	135,000
Alt 8 1917-	36,000	106,000	(61,000)	0	90,000	171,000
	Coralville	Iowa City	Lone Tree	Wapello	Coralville pool	Cumulative Total
	Percentage (%) Average Annual Damages Reduced (From Existing Flows)					
Alt 2C 191	58%	14%	-12.85%	0.10%	68.75%	7.91%
Alt 5 1917-	34%	12%	-12.32%	-1.67%	45.95%	5.10%
Alt 8 1917-	54%	12%	-12.32%	0.00%	50.00%	6.55%

Table C-12. Average Annual Damage Alternative Comparison (1959-2019)

	Coralville	Iowa City	Lone Tree	Wapello	Coralville pool	Cumulative Total
	Average Annual Damages ($)					
Alt 1 1959	148,000	1,840,000	587,000	1,389,000	282,000	4,246,000
Alt 2C 195	110,000	1,560,000	659,000	1,413,000	205,000	3,947,000
Alt 5 1959	122,000	1,589,000	610,000	1,434,000	255,000	4,010,000
Alt 8 1959	120,000	1,570,000	643,000	1,419,000	209,000	3,961,000
	Coralville	Iowa City	Lone Tree	Wapello	Coralville pool	Cumulative Total
	Average Annual Damages Reduced (From Existing Flows)					
Alt 2C 195	38,000	280,000	(72,000)	(24,000)	77,000	299,000
Alt 5 1959	26,000	251,000	(23,000)	(45,000)	27,000	236,000
Alt 8 1959	28,000	270,000	(56,000)	(30,000)	73,000	285,000
	Coralville	Iowa City	Lone Tree	Wapello	Coralville pool	Cumulative Total
	Percentage (%) Average Annual Damages Reduced (From Existing Flows)					
Alt 2C 195	35%	18%	-11%	-2%	38%	7.58%
Alt 5 1959	21%	16%	-4%	-3%	11%	5.89%
Alt 8 1959	23%	17%	-9%	-2%	35%	7.20%

CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX D

CORRESPONDENCE AND PUBLIC MEETINGS

CORRESPONDENCE

CHESTER J. CULVER
GOVERNOR

OFFICE OF THE GOVERNOR

PATTY JUDGE
LT. GOVERNOR

July 20, 2010

Lieutenant General Robert Van Antwerp
Commanding General, USACE
Headquarters, US Army Corps of Engineers
441 G. Street, NW
Washington, DC 20314-1000

Dear Lt. General Van Antwerp,

The floods of 2008 and 2010 in Iowa provide vivid reminders of the complex factors impacting the ability of the U.S. Army Corps of Engineers (USACE) to conduct day-to-day operations of the water storage capacities of each of our state's reservoirs. Much of the analyses underlying the Water Control Activities of the USACE are premised on decades-old technologies and assumptions about Iowa's hydrology. Based on our recent cooperative efforts with USACE, and in light of uncontrolled releases at Saylorville Reservoir, and new reports of technical problems as to the pneumatic crest gate at that dam, we believe that a review of these complex practices would be beneficial to all parties involved.

We have USACE-controlled dams in Iowa that have reached beyond their half-lives without a comprehensive review of their operations. What may have been defined as "normal" 30 years ago might be quite unusual today. In light of the changing Midwestern weather patterns, I believe it is imperative to the safety and well-being of Iowans that plans put in place for the facilities and operations be carefully reviewed. I understand there have been changes to pieces of the plans over the years, but I believe that all stakeholders, at all levels, will benefit from a comprehensive review of existing operations.

As such, on behalf of the State of Iowa, I request a meeting with division and regional USACE members from the Rock Island, Omaha and Kansas City districts, and from USACE headquarters. Representatives of affected state and local governments as well as representatives of our Congressional delegation should also participate in this meeting. The intent of this meeting would be for all parties to come to a better understanding of, at least, the following matters: the restrictions and limitations under which the USACE must operate; the conditions necessary to deviate from those restrictions and limitations; and, any existing variances concerning which all parties may not now be aware.

STATE CAPITOL DES MOINES, IOWA 50319 515.281.5211 FAX 515.281.6611 WWW.GOVERNOR.STATE.IA.US

I pledge to work together with the USACE on funding strategies for this effort.

In addition to the requested deviation plans and policies that I seek from your agency, you should know that I am sending a letter to President Obama requesting that he include in his FY12 Budget Request funding for USACE to conduct comprehensive plan reviews for each of the USACE-managed reservoirs within Iowa.

Thank you in advance for your anticipated cooperation, and best wishes.

Sincerely,

Chester J. Culver
Governor, State of Iowa

CJC/drb

Cc:
The Honorable Barack Obama
Senator Tom Harkin
Senator Charles Grassley
Congressman Tom Latham
Congressman Bruce Braley
Congressman Dave Loebsack
Congressman Leonard Boswell
Congressman Steve King
Jo Ellen Darcy

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
WASHINGTON, D.C. 20314-1000

JUL 28 2010

Honorable Chester J. Culver
Governor
State of Iowa
State Capital
Des Moines, Iowa 50319

Dear Governor Culver:

Thank you for your letter of July 20, 2010, concerning operations of U.S. Army Corps of Engineers reservoirs in Iowa. I would also like to thank you for your call yesterday.

Corps reservoirs have reduced peak floods in Iowa and have greatly minimized flooding in the communities located below the reservoirs and in downstream areas. We operate these reservoirs in accordance with water control plans that were developed to meet their congressionally authorized purposes. During development of these water control plans, local, state and Federal agencies with water resources responsibilities and the public reviewed and provided comments to help ensure the projects would meet their objectives. The primary purpose of these reservoirs is flood risk management for areas below the lakes. Other purposes include low flow augmentation, fish and wildlife management, and recreation. Saylorville Lake is also operated to provide water supply for areas below the reservoir. As you point out, many variables have changed since the last in-depth review of these plans including stakeholders, land-use, and possibly quantity/frequency of precipitation. We welcome a meeting with state and Corps representatives to discuss current operations and potential future studies. As we discussed yesterday, we will work to set this meeting up in Iowa, during the month of August 2010.

As you may know, this year we have authorized deviations from the water control plans on Rock Island District Reservoirs on three separate occasions in order to minimize flood risks associated with uncontrolled reservoir releases. Deviations were also approved for the Water Control Plan for the Rathbun Dam in Kansas City District. If an in-depth review of the reservoir regulation manuals is pursued, the process would include economic evaluation of alternative water control strategies, public reviews, evaluation of real estate requirements, assessment of environmental impacts and compliance with the National Environmental Policy Act (NEPA) and other applicable laws. The process would likely take approximately two years to complete and would cost between $1 million and $2 million per dam/reservoir. The Corps has gained new information during the recent flood events which would aid in updating these plans.

Funding to undertake these investigations will be considered with the multiple needs throughout the Country when developing the Administration's Budget.

Additionally, the Corps executes a comprehensive dam safety program consisting of instrumentation reviews, field inspections, and engineering evaluations to ensure that all of its dams are designed, constructed, operated, and maintained as safely and effectively as reasonably possible. Interim Risk Reduction measures have been approved for Rathbun Dam to aid the Corps in managing risks until permanent actions are approved and implemented.

We understand the importance of the flood control provided by Corps reservoirs to Iowans and appreciate your commitment to raise these issues on their behalf. I look forward to working with you as we address these issues.

Warmest regards!

Sincerely,

R. L. Van Antwerp
Lieutenant General, US Army
Chief of Engineers

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, ROCK ISLAND DISTRICT
PO BOX 2004 CLOCK TOWER BUILDING
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF

January 2, 2019

[redacted] Regional Planning and Environmental Division North (RPEDN)

SEE DISTRIBUTION LIST

The U.S. Army Corps of Engineers (Corps), Rock Island District (District), is initiating an update to the Iowa River Master Reservoir Regulation Manual (Regulation Manual). With this letter, the District would like to ask for your agencies' input to help with the District's environmental analysis and invite you to the upcoming Annual Cooperators Meeting on January 10, 2019. If you are unable to attend the Annual Cooperators Meeting, the District is planning public scoping open houses to informally discuss the potential updates to the Regulation Manual on February 26 and 27, 2019. Your participation in this process can greatly enhance the District's planning efforts.

The Annual Cooperators Meeting is January 10th, 2019 at the ISU Extension & Outreach Building, Johnson County at 3109 Old Highway 218 South, Iowa City, Iowa from 8:30 am to 4:00 pm.

The comments collected at the scoping meetings, as well as agency, comments will help the District formulate alternatives and help address any environmental impacts associated with any Regulation Manual updates. The District anticipates preparing an environmental assessment to document our decision making process dealing with the Regulation Manual updates.

The Regulation Manual is critical for the operation of the Coralville Reservoir, as it outlines the operational plans to meet all the reservoir's congressionally mandated purposes. This manual defines downstream control points and triggers, release amounts, allowable adjustments, and other measurable factors within certain conditions while allowing for emergency response flexibility. Regulation manuals also ensure the operations of reservoirs conform to laws and applicable Corps rules. The last update for the Iowa River Master Reservoir Regulation Manual occurred in 2001. The District is evaluating the Regulation Manuals based on the authorized operating purposes of flood risk management, low-flow augmentation, and fish and wildlife stewardship.

Regulation manuals are reviewed periodically due to changes in hydrology, sedimentation, and land use. Changes in physical and economic conditions related to changes in flood frequencies, ongoing reservoir sedimentation, and changes in downstream land use necessitate the need for alterations in the Iowa River Master Reservoir Regulation Manual. Regulation Manual alterations may offer opportunities to reduce peak annual reservoir and downstream river levels, especially during large floods; improve the reliability of drought operations; and reacquire lost conservation storage due to sedimentation.

This project is in the planning stage, exploring possible modifications to normal flood risk management operations. Possible modifications at the reservoir could include:

- altering downstream stage constraints to reflect current conditions,
- altering the allowable growing season maximum release, measured in cubic feet per second,
- switching to higher outflows sooner, to reduce the probability of uncontrolled, large magnitude spillway flows,
- altering the conservation pool elevation,
- altering the trigger stage elevation as it relates to Mississippi River gage levels, and/or
- other, presently unidentified alterations.

If your agency is unable to attend the Cooperators Meeting or Public Scoping Meetings, please provide comments on this project with respect to concerns, or anticipated effects on, any resources within your agency's jurisdictional oversight.

If you have any questions concerning this study or would like to request additional information, please call Ms. Bre Popkin of our Environmental Compliance Branch, telephone: [redacted] or write to the address above, ATTN: Environmental Compliance Branch (Bre Popkin).

Sincerely,

BOWERS.MARY.SUE.1231238928

Digitally signed by BOWERS.MARY.SUE.1231238928
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=BOWERS.MARY.SUE.1231238928
Date: 2019.01.02 14:38:13 -06'00'

On Behalf of
Howard D. Goldman
Operations Manager, Coralville Lake

DISTRIBUTION LIST

Mr. Kraig McPeek, Field Supervisor
U.S. Fish and Wildlife Service
1511 47th Avenue
Moline IL 61265

Mr. Josh Tapp
Environmental Services & Technology Div
U.S. Environmental Protection Agency
Region VII
11201 Renner Blvd.
Lenexa KS 66219

Mr. Joe Summerlin
Environmental Services & Technology Div
U.S. Environmental Protection Agency
Region VII
11201 Renner Blvd.
Lenexa KS 66219

Mr. Larry Gullett, Director
Johnson County Conservation
2048 Hwy 6 NW
Oakford IA 52322

Mr. Chuck Gipp, Director
Iowa Department of Natural Resources
Wallace State Office Building
502 East 9th Street, 4th floor
Des Moines IA 50319-0034

Mr. Bruce Trautman, Deputy Director
Iowa Department of Natural Resources
Wallace State Office Building
502 E 9th Street
Des Moines IA 50319-0034

Mr. Mark Vitosh, District Forester
Iowa Department of Natural Resources
3109 Old Highway 218 S
Iowa City IA 52246

Chad Dolan
Lake Darling Fisheries
Iowa Department of Natural Resources
110 Lake Darling Rd
Brighton IA 52540

Mary Beth Stevenson, Eastern Basin Coordinator
Iowa Department of Natural Resources
323 Stanley Hydraulics Laboratory
Iowa City IA 52242-1585

Mr. Seth Moore
Iowa Department of Natural Resources
Wallace State Office Building
502 E 9th Street
Des Moines IA 50319-0034

Paul Sleeper
Lake Macbride Fisheries
Iowa Department of Natural Resources
3525 HWY 382 NE
Solon IA 52333

Mr. Nate Hoogeveen
Iowa Department of Natural Resources
Wallace State Office Building
502 E 9th Street
Des Moines IA 50319-0034

Martin Konrad
Iowa Department of Natural Resources
Wallace State Office Building
502 E 9th Street
Des Moines IA 50319-0034

Deborah Quade
Field Office 6 - SE Iowa
1023 W. Madison
Washington IA 52353

Kent Ralston, Executive Director
Johnson County MPO
410 E. Washington St.
Iowa City IA 52240

From: Popkin, Breann K CIV USARMY CEMVP (US)
Bcc: [redacted]
Subject: Coralville Cooperators Meeting- Iowa River Master Reservoir Regulation Manual (UNCLASSIFIED)
Date: Thursday, January 3, 2019 8:55:00 AM
Attachments: 06DEC2018 - Coralville Water Control Plan Update Coor ltr.pdf

---

CLASSIFICATION: UNCLASSIFIED

Greetings,

The U.S. Army Corps of Engineers (Corps), Rock Island District (District), is initiating an update to the Iowa River Master Reservoir Regulation Manual (Regulation Manual). The District would like to ask for your agencies' input to help with the District's environmental analysis and invite you to the upcoming Annual Cooperators Meeting on January 10, 2019. If you are unable to attend the Annual Cooperators Meeting, the District is planning public scoping open houses to informally discuss the potential updates to the Regulation Manual on February 26 and 27, 2019. Your participation in this process can greatly enhance the District's planning efforts.

Please see attached letter for more information.

Thank you,

Bre Popkin, Biologist
MVR Environmental Compliance
USACE-RPEDN- Rock Island
[redacted]

CLASSIFICATION: UNCLASSIFIED

From: Stone, Kelly
To: [redacted]
Subject: [Non-DoD Source] Re: Coralville Water Control Plan Update Open House February 26 & 27 (UNCLASSIFIED)
Date: Saturday, February 23, 2019 1:27:40 PM

Bre -

Thank you for the invitation.
I am sorry, but I will not be able to attend.
Please keep in mind that any changes proposed for areas in the flood plain (mapped or unmapped) made need approval of the Iowa DNR and the local community.
I will be available to answer questions about making applications for approval as the proposals take shape.

Sincerely,
Kelly

[redacted]

Kelly M. Stone, P.E.| Flood Plain Management Engineer

Iowa Department of Natural Resources

502 E. 9th St., Des Moines, IA 50319

[redacted]

DNR Home   www.iowadnr.gov <Blockedhttp //www.iowadnr.gov>

Flood Plain Home floodplain.iowadnr.gov <Blockedhttp //floodplain.iowadnr.gov>

On Thu, Jan 24, 2019 at 3 58 PM Popkin, Breann K CIV USARMY CEMVP (US)[redacted] > wrote

CLASSIFICATION UNCLASSIFIED

Greetings,

The U.S. Army Corps of Engineers (Corps), Rock Island District (District), is initiating an update to the Coralville Lake Water Control Plan Update (Plan). With this letter, the District would like to ask for your input to help with the District's planning process and invite you to the
open house events on February 26 and 27, 2019. Your participation in this process can greatly enhance the District's planning efforts.

Website link Blockedhttps //www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Coralville-Lake-Water-Control-Plan-Update/

Facebook Blockedhttps //www.facebook.com/RockIslandDistrictUSACE/

Thank you,

Bre Popkin, Biologist
MVR Environmental Compliance
USACE-RPEDN- Rock Island
[redacted]

CLASSIFICATION UNCLASSIFIED

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Kelly

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Kelly M. Stone, P.E.| Flood Plain Management Engineer

Iowa Department of Natural Resources

502 E. 9th St., Des Moines, IA 50319

P 515-725-8312 | F 515-725-8202 | Toll Free 1-866-849-0321

DNR Home   www.iowadnr.gov <Blockedhttp //www.iowadnr.gov>

Flood Plain Home floodplain.iowadnr.gov <Blockedhttp //floodplain.iowadnr.gov>

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Facebook Blockedhttps //www.facebook.com/RockIslandDistrictUSACE/

Thank you,

Bre Popkin, Biologist
MVR Environmental Compliance
USACE-RPEDN- Rock Island
[redacted]

CLASSIFICATION UNCLASSIFIED

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Illinois-Iowa Ecological Services Field Office
Illinois & Iowa Ecological Services Field Office
1511 47th Ave
Moline, IL 61265-7022
Phone: (309) 757-5800 Fax: (309) 757-5807

In Reply Refer To: February 13, 2020
Consultation Code: 03E18000-2020-SLI-0779
Event Code: 03E18000-2020-E-01829
Project Name: Iowa River Basin Master Reservoir Regulation Manual

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies any federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat if present within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the Service if they determine their project “may affect” listed species or critical habitat.

Under 50 CFR 402.12(e) (the regulations that implement Section 7 of the Endangered Species Act) the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally. You may verify the list by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation and completing the same process you used to receive the attached list. As an alternative, you may contact this Ecological Services Field Office for updates.

Please use the species list provided and visit the U.S. Fish and Wildlife Service's Region 3 Section 7 Technical Assistance website at - http://www.fws.gov/midwest/endangered/section7/s7process/index.html. This website contains step-by-step instructions which will help you determine if your project will have an adverse effect on listed species and will help lead you through the Section 7 process.

For all wind energy projects, please contact this field office directly for assistance, even if no federally listed plants, animals or critical habitat are present within your proposed project or may be affected by your proposed project.

Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) and Migratory Bird Treaty Act (16 U.S.C. 703 et seq), as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, see our Eagle Permits website at http://www.fws.gov/midwest/midwestbird/EaglePermits/index.html to help you determine if you can avoid impacting eagles or if a permit may be necessary.

We appreciate your concern for threatened and endangered species. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Illinois-Iowa Ecological Services Field Office
Illinois & Iowa Ecological Services Field Office
1511 47th Ave
Moline, IL 61265-7022
(309) 757-5800

Project Summary

Consultation Code: 03E18000-2020-SLI-0779

Event Code: 03E18000-2020-E-01829

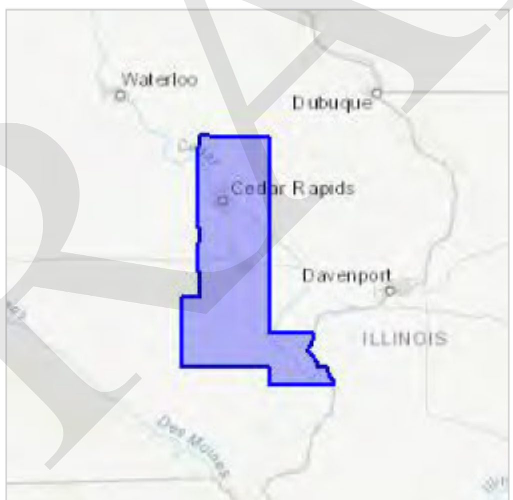
Project Name: Iowa River Basin Master Reservoir Regulation Manual

Project Type: LAND - FLOODING

Project Description: Reservoir Regulation manuals consist of operational parameters defining how, and when, water is stored and released. These include a schedule of releases, conservation pool levels to be maintained during non-flood or drought conditions, and downstream water level constraints. The Recommended Plan would result in a revised Regulation Manual and updates to the Coralville Lake Water Control Plans and Manuals.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/41.68581663039983N91.60022892736919W



Counties: Johnson, IA | Linn, IA | Louisa, IA | Washington, IA

Endangered Species Act Species

There is a total of 9 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Clams

NAME	STATUS
Higgins Eye (pearlymussel) *Lampsilis higginsii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5428	Endangered
Sheepnose Mussel *Plethobasus cyphyus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6903	Endangered
Spectaclecase (mussel) *Cumberlandia monodonta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7867	Endangered

Insects

NAME	STATUS
Rusty Patched Bumble Bee *Bombus affinis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9383	Endangered

Flowering Plants

NAME	STATUS
Eastern Prairie Fringed Orchid *Platanthera leucophaea* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/601	Threatened
Prairie Bush-clover *Lespedeza leptostachya* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4458	Threatened
Western Prairie Fringed Orchid *Platanthera praeclara* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1669	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

The following FWS National Wildlife Refuge Lands and Fish Hatcheries lie fully or partially within your project area:

FACILITY NAME	ACRES
Port Louisa National Wildlife Refuge	10,000

Port Louisa National Wildlife Refuge
10728 County Road X61
Wapello, IA 52653-9477
(319) 523-6982

https://www.fws.gov/refuges/profiles/index.cfm?id=33630

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

Due to your project's size, the list below may be incomplete, or the acreages reported may be inaccurate. For a full list, please contact the local U.S. Fish and Wildlife office or visit https://www.fws.gov/wetlands/data/mapper.HTML

FRESHWATER EMERGENT WETLAND

- PEM1A

FRESHWATER POND

- PABF
- PABFh
- PABG
- PABGh
- PABKx

LAKE

- L1UBH
- L1UBHh
- L1UBHx
- L2UBG
- L2UBGh
- L2USA
- L2USAh
- L2USC
- L2USCh

Regional Planning and Environmental
Division North (RPEDN)

SEE DISTRIBUTION LIST (Enclosure 1)

The U.S. Army Corps of Engineers, Rock Island District (District), is revising its Coralville Reservoir Water Control Plan (Project; Enclosure 2). The present letter identifies a preferred Project alternative, outlines the rationale behind this choice, and requests your comment on the District's historic property effects determination, pursuant to Section 106 of the National Historic Preservation Act (NHPA).

The District impounded the Iowa River by a congressionally-authorized Civil Works project, Coralville Dam (authorized in 1938). The dam is located on the Iowa River, 83.3 miles above its mouth and 5 miles upstream of Iowa City, Iowa. The dam and lake are primarily in Johnson County with portions extending upstream into Linn and Iowa counties. The Cedar River, its largest tributary joins the Iowa River downstream of the dam. The Iowa-Cedar basin is a tributary to the Mississippi River. The projects' authorized purposes are to provide primary benefits in flood risk management (FRM) and low flow augmentation for downstream flows form the Iowa and Mississippi Rivers; and secondary benefits for fish and wildlife management, and recreation.

The Project seeks to update the Coralville Reservoir Water Control Plan, which was last modified in 2001. Water control plans outline the operational plan to meet all the reservoir's congressionally mandated purposes by constraining water release locations, triggers, release amounts, allowable adjustments, and other measurable factors within certain conditions while allowing for emergency response flexibility.

Federal Undertaking

The District has determined that this Project is an Undertaking with potential to cause effects to historic properties and as a consequence requires a determination of effect within the Area of Potential Effect (APE).

APE

This Project's APE is defined as the elevations of active management between the conservation pool (683 NGVD) the full flood pool (712 NGVD) of Coralville Reservoir and the associated downstream corridor. The footprint of the Project's APE is the same as the

Proposed Water Control Plan Alterations

The No Action Alternative is the existing Water Control Plan. Thirteen major alternatives were considered, but Alternative 2c is considered most hydraulically sound, cost effective and environmentally beneficial, and least environmentally damaging. An engineering comparison of various hydraulic-modeling measures assisted in selection of the proposed alternative, with the goal being to find operational parameters which would lessen the severity of flooding. Alternative 2c improves upon the present Water Control Plan in terms of flood event frequency and duration by nearly every hydraulic modeling measure.

The proposed changes to the existing plan are presented in Enclosure 3. Alternative 2c's operating parameters are within the range of outflows of the existing Water Control Plan. The upper (full flood pool) and lower (conservation pool) range of operating elevations remain the same as within the existing plan. The primary difference between the two plans are the triggers and timing of the flow releases.

Existing Cultural Resources and Surveys

Archeological surveys, testing, and excavations overlapping the APE include archeological work anticipatory to original Coralville project construction and compliance work prior to subsequent developments. Surveys and sites information are summarized in Coralville's Historic Property Management Plan (HPMP).

There are 411 recorded archaeological sites on Coralville Reservoir fee-titled lands. They are located in impounded areas, along the lake's periphery, and on adjacent uplands. There is one confirmed National Register of Historic Places (NRHP)-listed or eligible archeological site (13JH272) and 38 sites are recommended for testing to assess NRHP eligibility. There are 300 archeological sites that are recommended or determined ineligible, and the remaining 72 archaeological sites have no associated NRHP eligibility recommendation.

Thirteen sites around the lake have yielded or are likely to contain human remains. These include 10 mounds or mound groups (13JH1, 13JH3, 13JH6, 13JH331, 13JH343, 13JH519, 13JH1303-1304, 13JH1443-1444), a corner of one historic cemetery (the Alt/Wein Cemetery; 13JH1365), and isolated prehistoric-aged human remains from the Sandy Beach site (13JH43; habitation/scatter; Middle Archaic and Woodland era site components) and Woodpecker Cave (13JH202; Middle and Late Archaic, Early to Late Woodland eras and Great Oasis site components). There are no identified Traditional Cultural Properties at Coralville Lake or on Coralville downstream corridor property.

In addition to archeological resources, inventoried architectural buildings and structures at Coralville Lake include NRHP-listed resources at Lake Macbride State Park, contributing to the Multiple Property listing "Civilian Conservation Corps (CCC) Properties in Iowa State Parks: 1933-1942" (McKay 1989). These CCC-constructed resources include the superintendent's stone residence, a frame maintenance building, a set of portals, a culvert, and a limestone footbridge. Non-contributing resources include a refectory, a pit vault latrine, a shelter, the bathhouse, and archeological remnants of limestone stairs (13JH1083).

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Iowa City and the present Iowa State Capitol. Several other inventoried architectural resources are NRHP-ineligible (Hoosier Creek bridges 52-00250 and 52-00170; Krieger Farmhouse 52-05039).

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Historic Properties Determination

The preferred alternative, Alternative 2c, maintains the same flood pool elevations and all proposed maximum flow rates are within rates already utilized. There are no construction features associated with Alternative 2c. Implementation of Alternative 2c is expected to have no measureable impacts on historic properties as compared to the existing Water Control Plan. Implementation of Alternative 2c is not expected to affect historic properties or those sites which have not been assessed for their NRHP eligibility. In addition, site 13JH272, the 10 mounds/mound groups, and the 1 historic cemetery are located outside/above the APE elevations (683-712 NGVD) and will not be impacted by this Project. Architectural historic properties will not be impacted by the Project as compared to the existing Plan. Those archeological sites that have yet to be evaluated or are undetermined regarding their NRHP eligibility, will not be impacted by the Project for the same reasons noted above. For these reasons, the District proposes a ***No Adverse Effect*** determination for this Project.

Consulting Parties Invitation and Request for Comment

The District invites consulting parties to:

- comment on or contribute to identification efforts including definition of the APE and the District's determination of effect, all as per 36 CFR 800.5(a-b).
- provide information regarding concerns with issues relating to the potential effects of this undertaking on historic properties and, particularly, the tribes' concerns with identifying properties that may be of religious and cultural significance to them and may be eligible for the NRHP [36 CFR 800.4(a)(3-4)].

Concerns about confidentiality [36 CFR 800.11(c)] regarding locations of properties can be addressed under Section 304 of the NHPA which provides withholding from public disclosure the location of properties under several circumstances, including in cases where it would cause a significant invasion of privacy, impede the use of a traditional religious site by practitioners, endanger the site, etc.

Please respond within 30 days of receipt of this letter. The point of contact for this project is Mr. James Ross of our Environmental Compliance Branch a [redacted], by e-mail: [redacted], or in writing to our address, ATTN: Environmental Compliance Branch (James Ross).

Sincerely,

for

Jodi K. Creswell
Chief, Environmental Planning Branch (RPEDN)

Enclosures (3)

DISTRIBUTION LIST

Cheyenne River Sioux Tribe
Mr. Steve Vance, THPO
PO Box 590
Eagle Butte, SD 57625

Citizen Potawatomi Nation
Dr. Kelli Mosteller, THPO
1601 S Gordon Cooper Drive
Shawnee OK 74801

Crow Creek Sioux Tribe
Mr. Darrell Zephier, THPO
PO Box 50
Ft. Thompson, SD 57339

Flandreau Santee Sioux Tribe
Mr. Garrie Killsahundred, THPO
PO Box 283
Flandreau, SD 57028

Forest County Potawatomi Community
Mr. Michael LaRonge, THPO
5320 Wensaut Ln.
P.O. Box 340
Crandon, WI 54520

Fort Peck Assiniboine & Sioux Tribes
Mr. Darrell Youpee, THPO
501 Medicine Bear Road
PO Box 1027
Poplar, MT 58255

Ho-Chunk Nation
Mr. Bill Quackenbush, THPO
PO Box 667
Black River Falls, WI 54615

Iowa Tribe of Kansas and Nebraska
Mr. Lance Foster, THPO
3345 B Thrasher Rd.
White Cloud, KS 66094

Iowa Tribe of Oklahoma
Mr. Eagle McClellan, Cultural Preservation Director
335588 E. 750 Rd.
Perkins, OK 74059

Kickapoo Tribe in Kansas
Mr. Cirtis Simon, NAGPRA Director
1107 Goldfinch Rd
Horton, KS 66439

Kickapoo Tribe of Oklahoma
Mr. Kent Collier, NAGPRA Coordinator
PO Box 70
Mcloud, OK 74851

Lower Brule Sioux Tribe
Mr. Brian Molineaux, Archeologist
PO Box 187
Lower Brule, SD 57548

Lower Sioux Indian Community
Ms. Cheyanne St. John, THPO
339527 Res. Highway 1
Morton, MN 56270

Meskwaki Nation
Mr. Johnathan Buffalo
Director, Historic Preservation Department
303 Meskwaki Road
Tama, IA 52339

Oglala Sioux Tribe
Ms. Trina Lone Hill, THPO
PO Box 129
Kyle, SD 57752

Omaha Tribe of Nebraska
Mr. Thomas Parker, THPO
PO Box 368
Macy, NE 68039

Osage Nation
Dr. Andrea A. Hunter, THPO
627 Grandview
Pawhuska, OK 74056

Otoe-Missouria Tribe
Ms. Elsie Whitehorn, THPO
8151 Hwy 177
Red Rock OK 74651

Ponca Tribe of Nebraska
Mr. Shannon Wright, Jr., THPO
PO Box 288
Niabrara, NE 68760

Ponca Tribe of Oklahoma
Ms. Halona Cabe, THPO
20 White Eagle Dr.
Ponca City, OK 74601

Prairie Band Potawatomi Nation
Ms. Hattie Mitchell, NAGPRA Representative
16281 Q Road
Mayetta, KS 66509

Prairie Island Indian Community
Mr. Noah White, THPO
5636 Sturgeon Lake Road
Welch, MN 55089

Rosebud Sioux Tribe
Mr. Russell Eagle Bear, THPO
PO Box 809
Rosebud, SD 75770

Sac and Fox Nation of Missouri in Kansas and Nebraska
The Honorable Tiauna Carnes
305 North Main Street
Reserve, KS 66434

Sac and Fox Nation of Oklahoma
Historic Preservation Department
P.O. Box 230
Drumright, OK 74030

Santee Sioux Tribe of Nebraska
Mr. Duane Whipple THPO
108 Spirit Lake Avenue West
Niobara, NE 68760

Sisseton-Wahpeton Oyate
Ms. Dianne Desrosiers, THPO
P.O. Box 907
Sisseton, SD 57262

Shakopee Mdewakanton Sioux Community of Minnesota
Mr. Leonard Wabasha, Director, Cultural Resources Dept.
2330 Sioux Trail NW
Prior Lake, MN 55372

Spirit Lake Tribe
Dr. Erich Longie, THPO
PO Box 359
Fort Totten, ND 58335

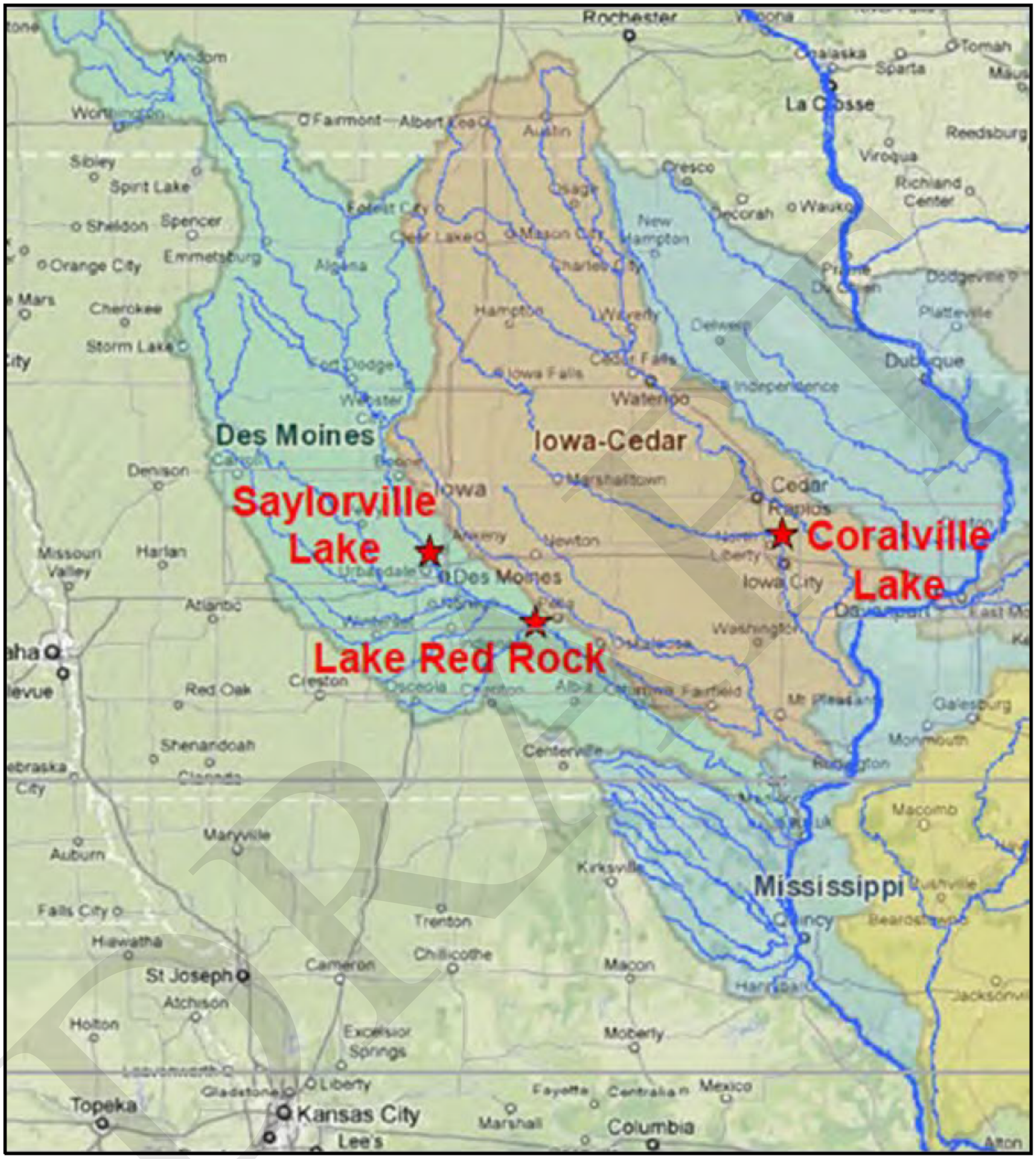
Standing Rock Sioux Tribe
Mr. Jon Eagle, THPO
Administrative Service Center
North Standing Rock Ave.
Ft. Yates, ND 58538

Winnebago Tribe of Nebraska
Mr. Randy Teboe, THPO
PO Box 687
Winnebago, NE 68071

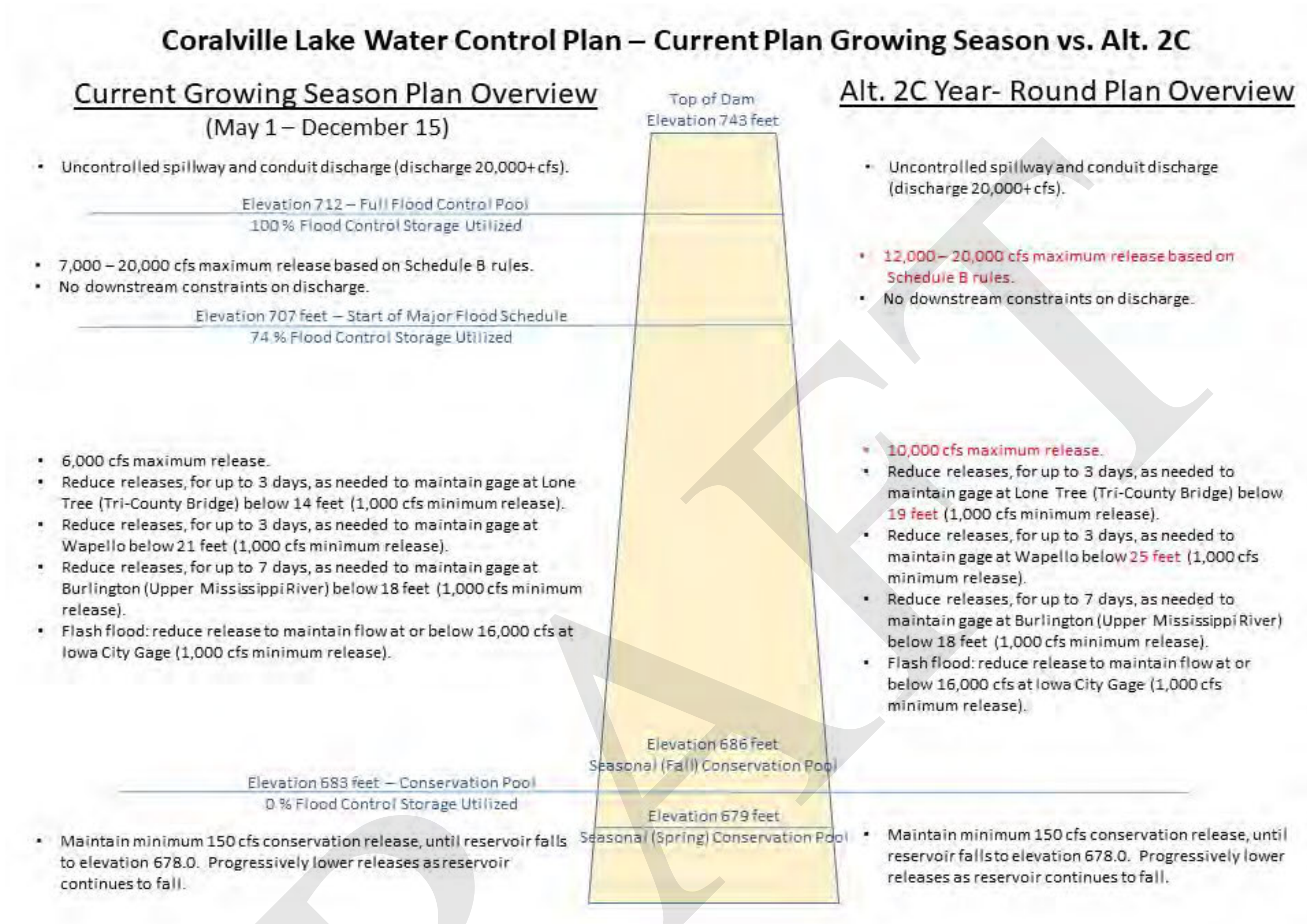
Yankton Sioux Tribe
Mr. Kip Spotted Eagle, THPO
P.O. Box 1153
Wagner, SD 57380

Iowa State Historic Preservation Office
Ms. Heather Gibb
Interim State Historic Preservation Officer
600 E. Locust
Des Moines, IA 50319-0290

Office of the State Archaeologist
Dr. John Doershuk
700 CLSB
University of Iowa
Iowa City, IA 52242

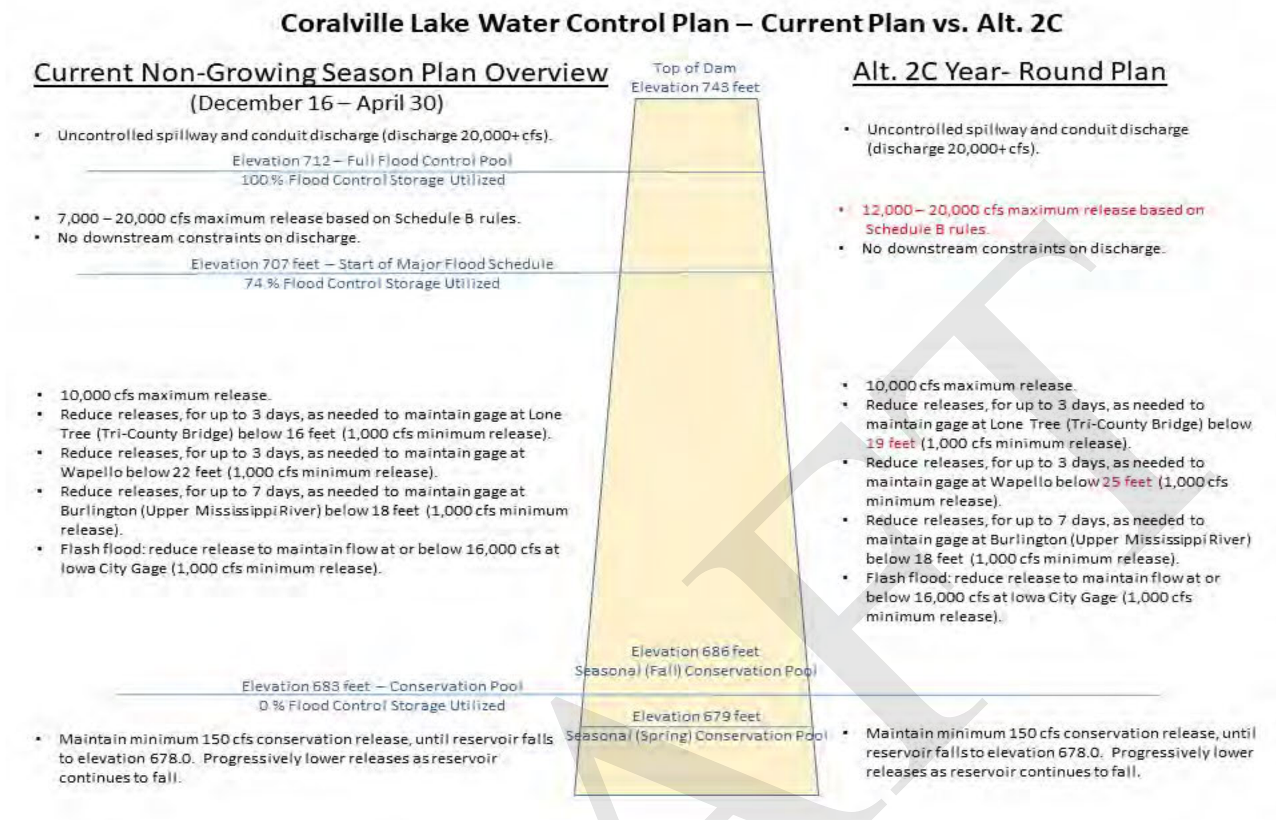


Coralville Lake in relation to the Iowa-Cedar and Des Moines River basin watersheds.



Current Plan compared to Alternative 2c, Coralville Lake Growing Season.

Red are changes from current plan.



Current Plan compared to Alternative 2c, Coralville Lake Non-Growing Season.

Red are changes from current plan.

This notification is a receipt that your request for comment by the Iowa State Historic Preservation Office (SHPO) has been received.

Date Received: **7/9/2020** 30 Day Period: **8/8/2020**

Agency: **COE** SHPO R&C #: **200700037**

ROCK ISLAND DISTRICT - PROPOSED REVISION OF EXISTING CORALVILLE RESERVOIR WATER CONTROL PLAN - LAST MODIFIED IN 2001 - JOHNSON, LINN, AND IOWA COUNTIES - DRAFT AMENDMENT - NO ADVERSE EFFECT DETERMINATION

Be advised that the successful conclusion of consultation with the SHPO does not fulfill the agency's responsibility to consult with other parties who may have an interest in properties that may be affected by this project. Nor does it override the sovereign status of federally recognized American Indian Tribes in the Section 106 consultation process.

SHPO will make comments and recommendations according to our responsibility defined by Federal law pertaining to the Section 106 process. If you have contacted the SHPO for technical assistance, we will provide comments and recommendations based on best practices and the information available in your submission. Should you not receive comments by the end of the 30-Day Period, please contact me at the number or email below, referencing the R&C # above.

Should you have any questions please contact me at the number or email below, referencing the R&C # above.

SHPO Review & Compliance Coordinator
[redacted]

From: [redacted]
To: [redacted]
Subject: [Non-DoD Source] Re: Coralville Reservoir Water Regulation Plan Update (UNCLASSIFIED)
Date: Tuesday, July 14, 2020 11:50:59 AM

Hello Jim, The Crow Creek Sioux Tribal Historic Preservation Office has reviewed the Coralville Reservoir Water Control Plan in Johnson County Iowa, Our office agrees with the determination of " No Adverse Effect " for the project. Thank you. Merle Marks
----- Original Message -----
From: "james s ross" <[redacted]
Sent: Thursday, July 9, 2020 1:46:41 PM
Subject: FW: Coralville Reservoir Water Regulation Plan Update (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Everyone,

I apologize but I submitted the original letter with an error. I neglected part of the APE definition. Please review the attached corrected version. Everything else still applies. Sorry or the confusion. Thanks,

Jim Ross
Chief, MVR Environmental Compliance Section
USACE-RPEDN-Rock Island
[redacted]

-----Original Message-----
From: Ross, James S CIV CEMVP CEMVD (US)
Sent: Thursday, July 9, 2020 11:21 AM
Subject: Coralville Reservoir Water Regulation Plan Update (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Greetings,

The U.S. Army Corps of Engineers, Rock Island District (District), is revising its Coralville Reservoir Water Control Plan (Project). The attached correspondence package identifies a preferred Project alternative, outlines the rationale behind this choice, and requests your comment on the District's historic property effects determination, pursuant to Section 106 of the National Historic Preservation Act (NHPA).

The District impounded the Iowa River by a congressionally-authorized Civil Works project, Coralville Dam (authorized in 1938). The dam is located on the Iowa River, 83.3 miles above its mouth and 5 miles upstream of Iowa City, Iowa. The dam and lake are primarily in Johnson County with portions extending upstream into Linn and Iowa counties. The Cedar River, its largest tributary, joins the Iowa River downstream of the dam. The Iowa-Cedar basin is a tributary to the Mississippi River. The projects' authorized purposes are to provide primary benefits in flood risk management (FRM) and low flow augmentation for downstream flows form the Iowa and Mississippi Rivers; and secondary benefits for fish and wildlife management, and recreation.

The draft Project document with integrated environmental assessment is scheduled to be released for public review in the August/September time frame. We would like your comments about impacts to historic properties in order to integrate them into the Project planning and insure our compliance with Section 106 of the NHPA. The District would like to receive your comments within 30 days of this e-mail and please submit them electronically as we are not working in the office. Hard copies of this correspondence and Project documents will be provided to you upon our return to the office. Please don't hesitate to contact me if you have questions.

Jim Ross
Chief, MVR Environmental Compliance Section USACE-RPEDN-Rock Island
[redacted]

CLASSIFICATION: UNCLASSIFIED
CLASSIFICATION: UNCLASSIFIED

From: Bill L. Quackenbush
To: [redacted]
Cc: Samson Falcon; Marlon E. WhiteEagle
Subject: [Non-DoD Source] FW: Coralville Reservoir Water Regulation Plan Update (UNCLASSIFIED)
Date: Wednesday, July 29, 2020 8:00:44 AM
Attachments: Enclosures.pdf
Corrected 09Jul2020 - Coralville Water Control Plans SHPO tribal other consultation.pdf

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Good morning James Ross,

Thank you for contacting the Ho-Chunk Nation of Wisconsin regarding your proposed undertakings known to us as the Coralville Reservoir Water Regulation Plan Update Project. The Ho-Chunk Nation does not have any known S106 questions or concerns with your proposed project within the APE of those given areas described within the documents we received, at this time. We do wish to remain as a consulting parting for this proposed undertaking.

If you encounter archaeological resources and/or other items of cultural interest discovered by this project's undertakings, please stop the project in that location and contact the necessary parties needed.

Respectfully,

Bill Quackenbush
Tribal Historic Preservation Officer
Ho-Chunk Nation of Wisconsin
-----Original Message-----
From: Ross, James S CIV CEMVP CEMVD (US) [redacted]
Sent: Thursday, July 9, 2020 1:47 PM
Subject: FW: Coralville Reservoir Water Regulation Plan Update (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

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Chief, MVR Environmental Compliance Section USACE-RPEDN-Rock Island
[redacted]

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Sent: Thursday, July 9, 2020 11:21 AM
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CLASSIFICATION: UNCLASSIFIED

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Chief, MVR Environmental Compliance Section USACE-RPEDN-Rock Island
[redacted]

CLASSIFICATION: UNCLASSIFIED
CLASSIFICATION: UNCLASSIFIED

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING - PO BOX 2004
ROCK ISLAND, IL 61204-2004

REPLY TO
ATTENTION OF

July 9, 2020

Regional Planning and Environmental
Division North (RPEDN)

SEE DISTRIBUTION LIST (Enclosure 1)

The U.S. Army Corps of Engineers, Rock Island District (District), is revising its Coralville Reservoir Water Control Plan (Project; Enclosure 2). The present letter identifies a preferred Project alternative, outlines the rationale behind this choice, and requests your comment on the District's historic property effects determination, pursuant to Section 106 of the National Historic Preservation Act (NHPA).

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The Project seeks to update the Coralville Reservoir Water Control Plan, which was last modified in 2001. Water control plans outline the operational plan to meet all the reservoir's congressionally mandated purposes by constraining water release locations, triggers, release amounts, allowable adjustments, and other measurable factors within certain conditions while allowing for emergency response flexibility.

Federal Undertaking

The District has determined that this Project is an Undertaking with potential to cause effects to historic properties and as a consequence requires a determination of effect within the Area of Potential Effect (APE).

APE

This Project's APE is defined as the elevations of active management between the conservation pool (683 NGVD) the full flood pool (712 NGVD) of Coralville Reservoir and the associated downstream corridor. The footprint of the Project's APE is the same as that of the existing water control plan.

Proposed Water Control Plan Alterations

The No Action Alternative is the existing Water Control Plan. Thirteen major alternatives were considered, but Alternative 2c is considered most hydraulically sound, cost effective and environmentally beneficial, and least environmentally damaging. An engineering comparison of various hydraulic-modeling measures assisted in selection of the proposed alternative, with the goal being to find operational parameters which would lessen the severity of flooding. Alternative 2c improves upon the present Water Control Plan in terms of flood event frequency and duration by nearly every hydraulic modeling measure.

The proposed changes to the existing plan are presented in Enclosure 3. Alternative 2c's operating parameters are within the range of outflows of the existing Water Control Plan. The upper (full flood pool) and lower (conservation pool) range of operating elevations remain the same as within the existing plan. The primary difference between the two plans are the triggers and timing of the flow releases.

Existing Cultural Resources and Surveys

Archeological surveys, testing, and excavations overlapping the APE include archeological work anticipatory to original Coralville project construction and compliance work prior to subsequent developments. Surveys and sites information are summarized in Coralville's Historic Property Management Plan (HPMP).

There are 411 recorded archaeological sites on Coralville Reservoir fee-titled lands. They are located in impounded areas, along the lake's periphery, and on adjacent uplands. There is one confirmed National Register of Historic Places (NRHP)-listed or eligible archeological site (13JH272) and 38 sites are recommended for testing to assess NRHP eligibility. There are 300 archeological sites that are recommended or determined ineligible, and the remaining 72 archaeological sites have no associated NRHP eligibility recommendation.

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Please respond within 30 days of receipt of this letter. The point of contact for this project is Mr. James Ross of our Environmental Compliance Branch at [redacted], by e-mail: [redacted], or in writing to our address, ATTN: Environmental Compliance Branch (James Ross).

CONCUR

NAME

DATE 8/5/2020

Sincerely,

ROSS.JAMES.S.1231088128 Digitally signed by ROSS.JAMES.S.1231088128 Date: 2020.07.09 13:33:25 -05'00'

Jodi K. Creswell
Chief, Environmental Planning Branch (RPEDN)

Enclosures (3)

PUBLIC MEETINGS INFORMATION

Corps to Host Public Open House Events for Coralville Lake Water Control Plan Update

The U.S. Army Corps of Engineers, Rock Island District is in the process of revising the Coralville Lake Water Control Plan Update and is hosting two open house events to explain the process and gather input from the public.

Times and locations for the open house events are as follows:

• Tuesday, February 26, 2019
Iowa State Extension Office, 317 Van Buren St., Wapello, IA 52653
4-7 p.m. (Presentation at 5:30 p.m.)

• Wednesday, February 27, 2019
Iowa City Public Library, 123 South Linn St., Iowa City, IA
52240 4-7 p.m. (Presentation at 5:30 p.m.)

Presentations will be offered live on the Rock Island District's Facebook page at https://www.facebook.com/RockIslandDistrictUSACE/ starting at around 5:30 p.m. each day.

For more information visit:
https://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Coralville-Lake-Water-Control-Plan-Update/

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PUBLIC NOTICE

U.S. ARMY CORPS OF ENGINEERS **BUILDING STRONG®**

Date: January 22, 2018
Contact: U.S. Army Corps of Engineers, Rock Island District
Benjamin DeRoo [redacted]

Public Input Sought on Coralville Lake Water Control Plan Update

The U.S. Army Corps of Engineers, Rock Island District is initiating an update of the Coralville Lake Water Control Plan.

Water control manuals provide guidance for the operation and management of water storage for an individual reservoir or system of reservoirs. USACE periodically updates the manuals in order to keep abreast of changing conditions, legislation and other relevant factors. Water control plans are contained within water control manuals for all projects under the supervision of USACE. The plan's primary goal is to define normal operations of a water control structure. Water control plans ensure the operations of reservoirs conform to laws and applicable USACE rules.

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Presentation 5:30 p.m.
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Jan. 29, Feb. 5, 12, 19, 26, 2019_5t

STATE OF IOWA

COUNTY OF DES MOINES } SS.

I, Sean Lewis, being first duly sworn, depose and say that I am the Advertising Director of The Hawk Eye Company, a corporation, printers and publishers of The Hawk Eye, a newspaper of general circulation published in said County, and that the attached notice was published five times in said newspaper on 01/29/2019, 2/5/2019, 2/12/2019, 2/19/2019 and 2/26/2019.

The first publication being on the 29th day of January, 2019.

Sworn and subscribed before me, a Notary Public in and for said County, on the 29th day of January, 2019.

Cynthia Marie Anderson

Notary Public in and for Des Moines County

NOTARIAL SEAL IOWA

CYNTHIA MARIE ANDERSON
COMMISSION NUMBER 814122
MY COMMISSION EXPIRES
DECEMBER 5, 2021

PCmedia
PRESS-CITIZEN MEDIA
PART OF THE USA TODAY NETWORK

CORALVILLE LAKE PROJECT
2850 PRAIRIE DU CHIEN RD NE

IOWA CITY IA 522407820

AFFIDAVIT OF PUBLICATION

State of Wisconsin

County of Brown, ss.:

The undersigned, being first duly sworn on oath, states that the Iowa City Press Citizen, a corporation duly organized and existing under the laws of the State of Iowa, with its principal place of business in Iowa City, Iowa, the publisher of

Iowa City Press Citizen

newspaper of general circulation printed and published in the City of Iowa City, Johnson County, Iowa, and that an advertisement, a printed copy of which is attached as Exhibit "A" and made part of this affidavit, was printed and published in Iowa City Press Citizen on the following dates:

Ad No.	Start Date:	Run Dates:	Cost:
0003354869	1/30/19	01/30/19, 02/06/19, 02/13/19, 02/20/19, 02/27/19	$215.35

Copy of Advertisement
Exhibit "A"

Kevin [illegible]

Subscribed and sworn to before me by said affiant this

27th day of February, 2019

[signature]

Notary Public

11/9/22

Commission expires

KAZOUA YANG
NOTARY PUBLIC
STATE OF WISCONSIN

# of Affidavits: 1

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PROOF OF PUBLICATION

STATE OF IOWA, LOUISA COUNTY, ss:

I, Mike Hodges publisher of the THE WAPELLO REPUBLICAN a Weekly Newspaper, published and printed in said County, and of general circulation therein, do solemnly swear that a notice, of which the annexed is a true copy, was published in said paper, on the 7 day of Feb, 2019

Subscribed and sworn to by Mike Hodges before me this 7 day of Feb, 2019

Printer's Fee $ 31.62

NOTARIAL SEAL IOWA
KRISTIN E HENNING
Commission Number 811618
My Commission Expires
July 17, 2021

D-46 Kristin E. Henning

My Commission Expires July 17 2021

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12-5-4
January 31, 2019
February 7, 2019
February 14, 2019
February 21, 2019

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Printer's Fee $ 31.62

Kristin E. Henning

My Commission Expires July 17 2021

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Commission Number 811618
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NOTARIAL SEAL IOWA

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KRISTIN E HENNING
Commission Number 811618
My Commission Expires
July 17, 2021

Kristin E Henning
My Commission Expires July 17 2021

From:	Bruce
To:	PublicInvolvement
Subject:	[Non-DoD Source] Feb. 27 , Public Meeting
Date:	Tuesday, March 5, 2019 10:34:20 AM

Dear Sir:

1. Not a very good place to have such a meeting.
   A. To small a room
   B. Downtown Iowa City- No parking!
   C. In my opinion, the best place you had a meeting was at South Slope Telephone Co-op.

2. How and what conditions am I Impacted by water levels.
   A. Spring level 679'
      I used to boat from Sandy Beach to I-380 bridge. Totally impossible now.
      I have even seen shallow water boats get stuck in that area.
      Spring fishing in that area used to be hot and now unreachable.
   B. Conservation level 683'.
      We used to maintain a Slalom Course and Jump above Mid-River Marine (actually we maintained them at previous level of 680').
      When it got so silted in we moved down to Jolly Roger's (Bobber's- Scales Point).
      Then the Ski Club moved to Cedar Rapids and became the Five Seasons Team.
      Now to boat between McBride spillway and I-380 bridge a person has to know where the channel is.
      The 2 private dock area's between Scales Point and Mid-River are not useable because of silt.
      The private dock by Twin View Heights is getting that way.
      The Sandy Beach Ramp, the big boats can not or should not use it anymore.
   C. Duck level 686'
      This is a very good level! You can boat and fish and dock everywhere.
   D. Flood level 690'
      Sandy Beach road becomes impassible. Bad news for the school kids.
      Sandy Beach Ramp not really useable.
   F. Flood level 700'
      Sandy Beach ramp parking lot under water.
      At this level and above, the area between McBride spillway and I-380 bridge experience high erosion.

3. Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River.

A. I do appreciate you not dropping the ice down on the bottom in the spring. That action eliminates a lot of dead fish on the shores in the spring.

B. I do believe you would make the Marina owners and a lot of fishermen happier, if you if went from the Spring level to the Conservation a couple weeks sooner.

4. Environmental concerns, comments or observations related to reservoir operations or Iowa river flows.

A. Erosion, erosion, and sedimentation! The sides of the lake are falling in, making the lake wider and shallower.

B. The lake used to recognized as a good Bass fishing lake. I believe sedimentation has ruined that. Only bottom feeders like catfish and carp can survive.

5. Alternatives or actions you believe should be evaluated as part of study.

A. Rip Rapping! The area below Twin View Heights is an excellent example of what rip rap will do for the lake.

B. Dredging, to slow and too expensive. Too bad we can not predict when a drought year is coming! Drain the lake, take 10 derricks, and 200 trucks, work them 24/7 to dig the lake out!

Catch you later,
Bruce Mulford

February 27, 2019

US Army Corp of Enginners
Rock Island District

Public comment period

ARMY CORP DAMN OPERATION COMMENTS

1) I think it is a mistake to hold the Coralville reservoir back for months while all other streams and rivers are running full. 1993 it was held back for a month or more. Every year we have experienced flooding, the river is being held back to prevent "downstream" flooding. When that threat passes, the reservoir is often threating to go over the spillway, then the Corp has no storage capacity left and is at the mercy of the next big storm and has no choice but to jack the discharge, or lose "control". I think it would be best to let out some reasonable amount during those periods of chosen minimal flow. I hate to see those times when the Iowa is shut off to minimize flooding on the Cedar or the Mississippi. It usually means the likelihood of a flood immediately downstream of the dam is likely. I would suggest having a discharge of 5,000 to 8,000 cfs. over that period of minimal flow. I think a significant release during those periods would make a difference on whether there is flooding immediately downstream or not. When the Mississippi is running 500,000 cfs and the Missouri is running 200,000 cfs; I do not see how holding back the Iowa can make that much of a difference for those water sheds. Perhaps one area could be spared flooding with a continual release of water.

2) I think another area where the operation on the dam~~s~~ could be improved would be acknowledging unusually wet years and getting water out of the reservoir to accommodate anticipated high water. Have a plan B. Take this year, heavy snow fall over the winter and an unusually wet fall last year; looks like a high probability for spring flooding. Preparing the reservoir for the likelihood of a lot of water should mean a draw down now and not in the spring. I believe the winter pool elevation is unnecessary. Ideally, better flood control would have the reservoir is already drawn down before winter and to be ready to accept the spring snow melt and rains. It seems more often than not, the Corp can't get to it's spring target pool elevation. I do not think the current operation plan is reflective of the changed weather patterns. Some of the reasons for keeping pool

elevations have changed, such as the city of Iowa City no longer getting their drinking water from the river.

3) The Corp should make flood control the number one purpose of the dam. After all, it was built under a flood control act. Is the Corp in the recreation business or flood control? I think it is time to commit to flood control. I think a wise operation of the damn for flood control would be to keep the reservoir empty. Gates could be kept open to allow a discharge of10,000 cfs. maximum until a certain decided upon pool elevation was reached, and then if necessary at that time, to opened the gates further. This would mimic the natural rhythms of the river also would naturally scour the reservoir and alleviate the sedimentation problem. If a pool develops from heavy rains, you have boating. If not, you have more fishing, canoeing and riverside camping.

It should be noted, adopting item 3 will satisfy items 1) and 2).

The reservoir is a beautiful area and maybe would be seen as even more so in its natural state, with the river winding its way through presently submerged lime stone bluffs. The reservoir would still be an area for recreation, but of a little different character. Fishing, swimming, and canoeing would become the norm with boating only in unusually wet periods. I do not think it would diminish the RV business and maybe that business would increase by developing primitive camping along the now natural river.

L Southwick

Loren Southwick

[redacted]

From:	Donnie Orr
To:	PublicInvolvement
Subject:	[Non-DoD Source] Columbus Junction Elevations
Date:	Wednesday, February 27, 2019 2:56:14 PM
Attachments:	City of Columbus Junction Highway 92 Flood Elevations.docx

These are the same elevations that I included on my comment sheet, a lot more legible here however. Thank You for the information you presented. Any questions feel free to contact our department.

Donnie Orr
Chief of Police
Columbus Junction Police Dept.
[redacted]

From: Dan Dolezal
To: PublicInvolvement
Subject: [Non-DoD Source] More Questions than Answers
Date: Thursday, February 28, 2019 10:21:44 AM

Unfortunately I was unable to attend either of the sessions on the future of the reservoir. I wish some of the comments had been posted so I wouldn't be asking questions you've probably already addressed.

I live in the Sandy Beach area and I am used to having Sandy Beach Road closed at least twice a year – which isn't a real big deal to me. However when the question of what should be done comes up, the first though that pops to mind is dredging. I'm sure you've heard that quite a bit, especially when item 2 in your list mentions silt build-up. In the spring before Memorial Day, it is my understanding that there is only 2 to 3 feet of water above the lake bottom (silt) between Sandy Beach and Bobbers or whatever it is called now. It is common for boats to get stuck there in the spring. I've been up to my knees is muck (back in the 80's) rocking a boat out of there.

My question(s) for you are:

1) Is dredging a feasible option?
2) Where would the waste material go?
3) How much would it increase capacity?
4) How long before the process has to be done again?
5) What can be done upstream (if anything) to mitigate silt?

I'm assuming dredging would have to be done all the way up to the I-380 bridge given that is the first dry ground that appears in the spring when the lake is down.

To my knowledge, nothing has been done with the lake since it was built. My father even mentioned the feasible lifespan of the flood protection back in the 60's when we boated there as a family.

I wish you luck in whichever plan(s) are chosen.

Thanks,
Dan Dolezal
Solon

From: Debby MCKIM
To: PublicInvolvement
Subject: [Non-DoD Source] Coralville reservoir project, public input
Date: Thursday, February 28, 2019 12:12:06 PM

I’m so glad to see this happening, asking for public opinion,. I have watched the reservoir for the last 40 years and the answer seems so simple to me. Costly but simply. A good percentage of the year, parts of the res are very very low,. Obviously it’s being filled in each year by flood waters, so it doesn’t hold as much. Why not dig some of it back out during low water times? There are several access points that would be very easy to get equipment into to dredge it back out so it will hold more, consequently increasing it’s ability to prevent flooding downriver. Thank you for your time. Debby McKim

Sent from Mail <Blockedhttps://go microsoft.com/fwlink/?LinkId=550986> for Windows 10

From: cliff
To: PublicInvolvement
Subject: [Non-DoD Source] reservoir Levels
Date: Thursday, February 28, 2019 12:09:31 AM

There is no reason not to lower the reservoir levels, when it appears snow levels and rain in the spring can cause problems.

But it appears we wait until the Mississippi Is to high and no water can be released which will exasperate the flooding as the Des Moines and iowa rivers meet.
The fish will survive and they are much less expensive than the millions of damage caused by not using the Dam for what it was originally intended.
Cliff pirnat

Sent from Mail for Windows 10

From: Robinson, Jill R
To: PublicInvolvement
Subject: [Non-DoD Source] correction to info submitted at Iowa City Coralville Lake open house 2-27-19
Date: Thursday, February 28, 2019 12:10:52 PM

I mis-stated, on both the questionnaire and form #87 tagged to the maps, the level at which water enters my home proper. Correct info for impacts at my place, 4395 Camino del Rio SE in Iowa City, using the Iowa City gauge (and as best as I can tell when I've been able to get back home after previous flood events):

- 22', driveway under water, can't access property by car
- 25', water in outbuildings and crawlspace of home
- 29', water in living space of home

Sorry about that! Once we go over 22', 25' is the number I always hope we stay under, but it's not into my actual living space until 29'.

Thanks for the event last night and for all your good work– Jill

Jill Robinson (she/her/hers)
Program Coordinator
Equal Opportunity and Diversity

University of Iowa
202 Jessup Hall
Iowa City, IA 52242
[redacted]

From: Scott Stepanek
To: PublicInvolvement
Subject: [Non-DoD Source] Water levels
Date: Saturday, March 2, 2019 8:50:39 AM

In regard to the fall conservation pool of 686 feet above sea level. I would like to see the lake level dropped to 679 at the formation of the first ice. The migrating birds no longer can use the 686 foot level when there is ice on the lake. Is there a reason that the lake is dropped to 683 after the fall migrating season instead the 679 level for spring flooding?

Sent from my Galaxy Tab A

From: [redacted]
To: PublicInvolvement
Subject: [Non-DoD Source] Questionnaire
Date: Saturday, March 2, 2019 1:21:05 PM

Comments from presentation at Iowa City Library on Feb. 27.

--I found out about the presentation from the newspaper and thought it was very good--presenter was clear and info was understandable.

--We live at Idyllwild which was severely impacted by the 08 flood. All residents were displaced for many months, up to a year. So when the reservoir level gets high enough that the spillway begins to enter the conversation, our collective anxiety level is very high.

--Recreation purposes are nice (we had a boat on the res. for many years) but should always be lowest priority.

--Major flood control should be the highest priority with the goal to never top the spillway. As it nears the top like it did this past year, many people lose sleep worrying about it, planning evacuation, etc.

Thanks for the presentation, please continue them. And thanks for asking for our feed-back.

Tammi and Gordon Craft
133 Pentire Circle, IC

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

Purpose: Public input is essential to the Coralville Lake Water Control Plan Update. The project team is interested in hearing your comments below. Questions are provided for example only. Please don't let the questions limit your response and we appreciate any feedback that you could provide us. Additional information is available on the project website.

Coralville Lake Water Control Plan Website:
https://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Coralville-Lake-Water-Control-Plan-Update/

(Optional)
Name/Organization: Christine and Marvin Hochstedler

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

- How, and under what conditions, are you impacted by water levels (either flood or drought) along the Iowa River
- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River
- Environmental concerns, comments or observations related to reservoir operations or Iowa River flows
- In regards to the way water is managed at Coralville Lake, recommendations on problems and/or opportunities that should be evaluated as part of the study
- Alternatives or actions you believe should be evaluated as part of the study.

First of all the dam was not built for recreational use! It was built for flood control. and we have many times been the victims of controlled flooding. We live just downstream from the dam. Our road and home are flooded at 13,000 cfs. We also have to mandatory evacuate, which is very costly. We would like to see the growing season outflow raised from 6000 cfs to 8000 cfs. Also lake level kept at 679 ft to allow more storage capacity. We are very concerned with the elevation 707 ft as the start of major flood schedule, we have seen that this level is usually too late to prevent a flood. We would like to see 700 ft be the major flood schedule. Also when major flood schedule is reached all year long the outflow should start at 10,000 cfs, not 7000 cfs 1 May - 15 Dec.

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

When possible we believe the raising/lowering of the cfs release from the dam should be done in increments. This would help with river bank erosion.
We've been told dredging the lake is cost prohibitive. Would it be possible to dredge parts of the Iowa River below the dam? I believe this has been done on the Mississippi River.

Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting?
email

Do you feel your comments or concerns are valued by USACE?
NO
Too many years we have given input and nothing has changed. We are still hopeful though.

Based on your experience today, do you have any suggestions for how we could improve public meetings? I felt the meeting at the Iowa City Public Library Feb 27, 2019 was informative and productive. I look forward to the next meeting when the new plan will be revealed. Please ensure that I am notified.

The Comment Period ends March 15, 2019. Comments may be submitted via mail, email or fax to the US Army Corps of Engineers at:

U.S. Army Corps of Engineers, Rock Island District
Clock Tower Building – PO Box 2004
Attn: PD-E, 2nd Floor
Rock Island, IL 61204-2004
Fax: 309-794-5883
Email: PublicInvolvement@usace.army.mil

From: Emilie Hoppe
To: PublicInvolvement
Subject: [Non-DoD Source] Amana Colonies Impt to Consider
Date: Tuesday, March 5, 2019 3:11:03 PM

Regarding the The Coralville Lake Water Control/ PLan Update.

Hi

My name is Emilie Hoppe. I previously worked as a director of the Amana Society, Inc. and have been following the process of CLMP changes/ updates since it was begun.I attended the Wed. Feb. 27 meeting at the Iowa City Public Library.

While I am not employed by the Amana Society, Inc. I am a shareholder and thus, I am part owner of the farmland and enterprises of the Amana Society along with the other shareholders.

I have lived in the Amana Colonies very nearly all my life, the last 35 years I've lived on the edge of West Amana within 2/3 of a mile of the Iowa River and so I am very, very familiar with the river and its ways. I have also been a long time observer of the Iowa River. For the past 15 years I have gotten in the habit of checking your website and River Gages for information about Coraville Lake operations/ releases/ plans for releases. Especially during flood times.

Please remember the Amana Colonies are a National Historic Landmark. The forest is an important part of that designation. The Mill Race Canal, the Amana Woolen Mill are both important historic landmarks. They must be considered when making any operational change or lake level change at Coralville. My question is - has the National Park Service been contacted?

First I must state emphatically - that Iowa River flooding has gotten worse since we moved to West Amana, three decades ago. The number of flooding events, the scope and length of those events have increased. We also see more "minor" events of high water on the River than we have in the past.

After doing some analysis we have to conclude that increasing the conservation pool level in 1992-93 has made flooding worse in Iowa County. The flooding seems to occur sooner than it might have and last longer than it might have.

Even minor flood events have impacts here - and I see many more dead or dying (yellow and sickly) trees in the River Bottom along the Iowa than I have seen in decades past. Also
- there is much more reed canary grass. Reed canary grass which is almost impossible to deal with has taken low lying areas below West Amana, South Amana, High Amana and Middle Amana. The reed canary grass is choking out trees and native plants.
- the layer of top soil has been removed. The layer of top soil appears to be gone - or nearly gone in fields south of West Amana.
- more sand deposits. Along the river there are many more pockets of sand. These get transferred to higher ground during minor flood events.
- damage to the Amana Mill Race. The Mill Race canal provides MUCH needed food protection. It was there unharmed for many generations but in the last 20 years there has been frequent damage from very high water. In 2014 the the entire control structure was swept away resulting in $200,000 damage. In 1993 long sections of the levee "blew out" and were washed out requiring requre.
These levees protect from Iowa River flooding and also allow for water to be routed from hillsides to the river bottom.
Additionally the Amana Society, Inc. and the Amana Service Co. have worked to save / protect their hydro system plant in the villager of Amana and their electric energy plant in Middle Amana from high water. A berm was built around the energy plant.

But frequent flooding - and even minor floods that last a long time down here in the Colonies - have negative impacts to our forest, to our farm, to the Mill Race canal and to the long term status as a National Historic Landmark. Here are my thoughts:

The basic (683) Conservation Pool level should not be raised. It should be lowered - or at a minimum - maintained at the current 683 ft. level.

Maximum flood storage should be kept available for the inevitable heavy rainfalls, periods of increased rainfall upstream and snow melt that will occur, in the spring and the fall . So that water can pass through rather than back up and stand in the Iowa River valley upstream of the dam.

Conditions should always override non- flexible dates. The dates in the current plan are simply not useful, practical or predictive of events for those upstream or downstream.

707 ft. starts the "major flood event schedule" this is far too high. By the time water has reached that level at the Lake, upstream areas have been significantly impacted and the potential for quickly escalating flooding and damage downstream has increased.

Lowering that number makes good sense and is a practical way to both ease flooding upstream and to help prevent a bad situation for downstream communities.

Furthermore, given the increased accuracy of weather forecasting, I believe that discharge above 6,000 (10,000 cfs during non-growing season) should be enacted based on current lake levels AND forecasted precipitation - not just on current lake levels. Taking forecasted weather predictions for rainfall into account when making these decisions is practical and possible. It makes good sense considering the advancement in weather prediction accuracy in the past few years.

It's our observation that management plan changes/ amendments which resulted in the raising of the lake level/ pool maintenance level have had a negative impact upon Iowa County, the Amana Colonies, Amana Farms and Forestry – and to the management of the lake and the Iowa River as a whole. Lowering the pool maintenance level should be considered.

Flash Flood target discharges: The current Regulation Plan includes guidance for reducing Coralville reservoir releases to potentially limit combined discharges with two downstream Creeks for flash flood situations.

Of course - Downstream flood management needs to remain in the plan. However if water discharge is managed for maximizing storage within the pool during the entire year, backing discharge off to help mitigate flood events downstream will be less risky in relation to the impounded water problems created and exacerbated by continued precipitation.

The Army Corps must consider upstream land - as well as downstream - when making decisions and we have not seen much evidence of this in the plan that is currently used. Upstream impacts are not even mentioned! We do exist up here and there is an impact when flow is restrict at the dam.

To protect upstream and downstream communities I strongly urge that the Army Corps:

- Lower the level of the conservation pool. Lower the autumn/ winter hold level.

- Lower the level of the conservation pool during the spring and early summer to increase capacity for snow melt/ spring/ early summer rainfalls.

- Increase the maximum release to 12,000 – 14,000 cfs.

- Lengthen spring/ early summer increased release to July 15.

- Or eliminate the seasonal 6,000 cfs maximum entirely and make it 10,000 cfs year —round or 10,000 cfs for July to– December nd 12,000 - 14,000 cfs for December to July.

- Lower the “Normal flood control operation” levels from forecasted pool level to 700 feet.

- Lower the Major flood operation to 700 feet. In other words start releasing more water sooner.

Th Thank you for allowing us to comment. Thank you for seeking our input and I appreciate the fact that you are seeking input. My prayer is that you listen to upstream stakeholders as well as downstream stakeholders when making your decisions.

Emilie Hoppe

[redacted]

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CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

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https://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Coralville-Lake-Water-Control-Plan-Update/

(Optional)
Name/Organization: Two Rivers L+DD

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

- How, and under what conditions, are you impacted by water levels (either flood or drought) along the Iowa River
- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River
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Please see attached letter dated 3-5-19.

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting?

Email

Do you feel your comments or concerns are valued by USACE?

We sure hope so

Based on your experience today, do you have any suggestions for how we could improve public meetings? Wasn't it put in the local papers?

The Comment Period ends March 15, 2019. Comments may be submitted via mail, email or fax to the US Army Corps of Engineers at:

U.S. Army Corps of Engineers, Rock Island District
Clock Tower Building – PO Box 2004
Attn: PD-E, 2nd Floor
Rock Island, IL 61204-2004
Fax: 309-794-5883
Email: PublicInvolvement@usace.army.mil

Two Rivers Levee & Drainage Association

March 5, 2019

U.S. Army Corps of Engineers, Rock Island District
Clock Tower Building – Box 2004
Attn: PD-E, 2nd Floor
Rock Island, Il 61204-2004

To Whom It May Concern:
Thank you for the opportunity to respond with suggestions and comments regarding the Coralville Lake Water Control Plan Update.
Our concerns and suggestions are the following:

- When discussing impacts, it is not only what can be seen from a road, boat or aircraft. Impacts can be almost invisible – such as a rising water table. In our area, the more water against our levee system, the longer we have seep water that we have to pump back into the river. The higher that elevation of river is – the higher the water table on the land side and the more water we need to pump – and for a longer period of time. An example was August 20 thru Nov. 16, 2018. Our pumping station along the main stem river – the Mississippi – is one of 5 stations in our District. Due to the high water, this one stations electric bill through this timeframe was over $71,855.00. We pumped almost 24/7 and this does not include diesel fuel at a tanker of fuel each week- for just this one station. Needless to say, we blew our budget. These are the impacts to our landowners who are raising families on farms in the area. Some of these farms have been in the family for over 100 years.
- When looking out into the future weather forecasts, it is imperative we begin looking out more than 24 hours. More time is needed for preparations and response.
- Siltation of the Iowa River, from Wapello to the Mississippi River, needs to be taken into consideration when releasing additional water flow.
- Consider adding an additional monitoring point at Keithsburg.
- Schedule needs to be adjusted to meet growing season set by Federal Crop Insurance: Dates should reflect growing season of March 20 to June 30.
- Last, but not least, if the pool elevation schedule states operation "holding at 683" (or whatever number stated in the schedule), that is what it should be held at –no more.

Again, as major stakeholders in this endeavor, we thank you for reviewing our comments and suggestions. We sincerely hope they will be taken into serious consideration before any changes are made.

Respectfully,
Two Rivers Levee & Drainage District

Two Rivers Levee & Drainage District
Vicki Stoller, Administrator

Two Rivers Levee & Drainage 5601 205th Street, Mediapolis, Iowa 52637 • Phone: (319) 937-6667 FAX: (319) 937-6668

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

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(Optional)
Name/Organization: Gerald Alan Dunn

Address: [redacted]

Email: ______ **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

- How, and under what conditions, are you impacted by water levels (either flood or drought) along the Iowa River
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I have been Duck Hunting the Corralville Res since the late 60s Where ever I walk in it is always to deep to Retrier my ducks. It should be onty Two-Feet deeper than Normal regular Summer pool. More than that is dangeruose.

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting?

Do you feel your comments or concerns are valued by USACE?

Based on your experience today, do you have any suggestions for how we could improve public meetings?

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(Optional)
Name/Organization: David S Williams, Maureen Doyle

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

- How, and under what conditions, are you impacted by water levels (either flood or drought) along the Iowa River
- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River
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From Dam 12000 per affects road access
to home, Emergency Management lets us know
to move out. Year 18000 per from Dam
on edge of coming into home no other
river of creeks factor in, once over spill
way we really get wet.
Change pool level dont maintain do
like in Des Moines Salerville + Red Rock
new plan would help

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting? Newspaper

Do you feel your comments or concerns are valued by USACE?
Yes, effects of people on Floodplain

Based on your experience today, do you have any suggestions for how we could improve public meetings? More information better, More time to get ready For Flooding

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Clock Tower Building – PO Box 2004
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Wapello - 26 Feb 2019

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

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(Optional)
Name/Organization: [illegible]

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

- How, and under what conditions, are you impacted by water levels (either flood or drought) along the Iowa River
- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River [illegible]
- Environmental concerns, comments or observations related to reservoir operations or Iowa River flows [illegible]
- In regards to the way water is managed at Coralville Lake, recommendations on problems and/or opportunities that should be evaluated as part of the study [illegible]
- Alternatives or actions you believe should be evaluated as part of the study. [illegible]

[illegible]

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

[illegible]

Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting? [illegible]

Do you feel your comments or concerns are valued by USACE? [illegible]

Based on your experience today, do you have any suggestions for how we could improve public meetings? [illegible]

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(Optional)
Name/Organization: Jeff Henke

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

[redacted]

Potential topics of discussion (topics provided as example only):

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We live in the Bottoms and water [illegible]
[illegible]
Wapello gauge [illegible] ft
We [illegible] to the [illegible]
[illegible] water [illegible]
[illegible] Wapello gauge over 23 ft

This [illegible] replacement
[illegible] they had to [illegible] about [illegible]
28.5 ft North of [illegible]
[illegible] a detour

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

At 24' we are patrolling the levee. Over 25' we patrol twice a day. sustained level of 25' or more we start having spots with [illegible]

Water is backing into the bottoms through the [illegible] starting at 21'

Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting?

email

Do you feel your comments or concerns are valued by USACE?

Based on your experience today, do you have any suggestions for how we could improve public meetings?

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(Optional)
Name/Organization: [illegible]

Address [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

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[illegible]

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

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Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting?

____

____

Do you feel your comments or concerns are valued by USACE?

____

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____

Based on your experience today, do you have any suggestions for how we could improve public meetings? ____

____

____

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(Optional)
Name/Organization: Donnie Orr, Chief Col Jct Police Dept

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

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Hwy 92 26.8 on North side of highway
27.2 covers Highway 92
Locust Street covered at 23.1 (Monkey Run Bridge)
25.0' Co. Rd G-36 covered with water
These levels using National Weather Service gauge
& updated action levels

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

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(Optional)
Name/Organization: [redacted] T Mark Huston, Mayor

Address: ______

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

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- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River
- Environmental concerns, comments or observations related to reservoir operations or Iowa River flows
- In regards to the way water is managed at Coralville Lake, recommendations on problems and/or opportunities that should be evaluated as part of the study
- Alternatives or actions you believe should be evaluated as part of the study.

City of Columbus Junction needs as much advance notice as possible. Coordination between Cedar River levels and Coralville discharge

CORALVILLE LAKE WATER CONTROL PLAN UPDATE QUESTIONNAIRE

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Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:

How did you hear about today's public meeting?

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Do you feel your comments or concerns are valued by USACE?

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Based on your experience today, do you have any suggestions for how we could improve public meetings? ____

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The Comment Period ends March 15, 2019. Comments may be submitted via mail, email or fax to the US Army Corps of Engineers at:

U.S. Army Corps of Engineers, Rock Island District
Clock Tower Building – PO Box 2004
Attn: PD-E, 2nd Floor
Rock Island, IL 61204-2004
Fax: 309-794-5883
Email: PublicInvolvement@usace.army.mil

From:	Sheryl Janaszak
To:	PublicInvolvement
Subject:	[Non-DoD Source] coralville lake comments
Date:	Saturday, March 9, 2019 10:11:57 AM

keep level at 679 all year start increasing outflow to 10,000 at 700 instead of 707 start spring outflow to 8,000 instead of 6,000 dredge the lake decrease the 7 day to 3 days for the Mississippi river in the spring don't worry so much about the fish the lake can be restocked

From: [redacted]
To: PublicInvolvement
Subject: Web Input
Date: Sunday, March 10, 2019 9:18:09 PM

The following comment was submitted via the Rock Island District website.

Name/Organization Chuck Masko
Address:
[redacted]

Email [redacted]
Phone
Comments Curious as to how the impacts of sedimentation were measured. e.g. considerable erosion along swisher creek within the flood storage elevation levels has probably put a lot of cubic yards of sediment in the lower pool, but has left an equal amount of "new space" within the banks of the creek.

In over 25 years at our residence on Cou Falls Rd, we have only had standing water "in the backyard" a couple times (93, 08) when water level is over the spillway. Anecdotally, we have seen an increase in frequency of the creek overflowing its banks during heavy rains. It appears to take less of a rain than it previously did to make that happen. It would be nice to see some cause/effect analysis on why that is (specific to new development? tiling? changes in ground cover?)

If the updated plan doesn't change or raises release rates, that would be best from our perspective. I would prefer not to see an increase in the time periods or frequency of higher pool levels, as it kills more of the deep rooted vegetation that help slow erosion along the creek.

Thanks for requesting input. email me if you have any questions re these comments.

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HTTP_ORIGIN: Blockedhttps://www.mvr.usace.army mil
HTTP_TRUE_CLIENT_IP: 208.126.78.240

From: Christine Hochstedler
To: PublicInvolvement
Subject: [Non-DoD Source] Coralville Reservoir outflow
Date: Monday, March 11, 2019 10:34:27 AM

I live just below the Coralville Reservoir on the Iowa River. I follow the outflows from the dam since I am directly impacted.

I see on today's outflow graph that going to 10,000 cfs has been delayed despite the fact that the "plan" states the reservoir is supposed to be at 679 ft by March 20th. Instead the reservoir is heading towards 700 ft.

Please explain to me why the outflow is being lowered and lowered a lot. And please explain the different outflow levels that are forecasted to be.

I know as well as all my neighbors that once the reservoir level reaches 700 ft there is a good chance we will flood. We are only at the beginning of the snow melt and spring rains.
This is not a good sign for us!

If the Corps had worked earlier to lower the reservoir to the level it should be at this time of year I believe there would have been more storage.

I would appreciate answers to my questions.

Thank you,
Christine Hochstedler

From: Becky Hall
To: PublicInvolvement
Subject: [Non-DoD Source] Input
Date: Tuesday, March 12, 2019 12:50:07 PM

Our home is at [redacted]. Please contact us if there is a threat of eminent flooding in the Parkview Terrace area. Looking at the Flood maps online, our home will be on a small island at 27' flood level and will have water in it soon after that. We understand that you have to balance flooding south of us, but I am glad to see that today the river level is higher and you are making room in the Coralville Lake for the coming input. Yesterday the river was the lowest I had seen it in a long time and that was worrisome. We understand that you are trying to do your best, thank you, keep it up, you got us through since 2008. I agree with others in our neighborhood that the new Park Rd bridge will help, but if the new Coralville flood gate on Rocky Shore is closed, we are in trouble.
Thank you for listening to us,
Becky and Bob Hall
[redacted]

From:	[redacted]
To:	PublicInvolvement
Subject:	Web Input
Date:	Wednesday, March 13, 2019 11:00:26 AM

The following comment was submitted via the Rock Island District website.

Name/Organization	Amana Colonies Historical Site
Address:	PO Box 28 Amana US 52203
Email	[redacted]
Phone	[redacted]
Comments	We would strongly encourage that you study the effects of this plan on the upstream Historic Resources, including, but not limited to the Amana Mill Race. We have seen significant negative impact on this defining feature of the Amana Colony NHL with the Coralville Dam, in particular in the years 2008 and 2013, resulting in millions of dollars of repair work. In addition, we believe a Section 106 review is warrented here. Laura Hoover Amana Colonies Historic Sites Foundation Amana, IA

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HTTP_TRUE_CLIENT_IP: 66.43.218.97

From:	noreply@dma.mil
To:	PublicInvolvement
Subject:	Web Input
Date:	Wednesday, March 13, 2019 8:06:17 PM

The following comment was submitted via the Rock Island District website.

Name/Organization	Adda Sayers
Address:	[redacted]
Email	
Phone	
Comments	Our family farm is west of Marengo IA on the north side of the Iowa River. Flooding of our family land has increased significantly over the years. According to my father, before Coralville dam was constructed, our land never was flooded, none of it. This past year we had at least 50 acres under flood water, the most we have ever had flooded. It is now far to expensive to carry flood insurance on this part of the farm so if crops are growing and the land floods, we loose that income. As an active participant in the family operation during planting and harvest, and a recipient of income from the family farm, losses associated with flooding can be significant. Keeping the lake level high during the summer for recreational use has resulted in the increased flooding. Raising levels higher will only result in more flooding on our family farm and more loss of income, income which is minimal already. Perhaps the lake should be dredged so that lake levels can be reduced and recreational use can continue. I certainly hope you consider the many farmers along the river who are loosing income from the Coralville dam and it's impact on flooding upstream.

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From:	noreply@dma.mil
To:	PublicInvolvement
Subject:	Web Input
Date:	Wednesday, March 13, 2019 5:16:18 PM

The following comment was submitted via the Rock Island District website.

Name/Organization	Larry&Nancy Beyer DOB as Koszta Farm Corp.
Address:	[redacted]
Email	
Phone	
Comments	Engineers We live and farm on the flood plain above the Coralville Lake and dam. The family has been doing this since 1943 before the dam was built. Over the years, we have watched our operation shrink in size as the resivior has slowed the cfs of the river velocity down and let it silt in. We are very concerned that you are only looking at the effects of your plan below the dam, and not caring what happens to our livelihood above the dam. Over the years, we have watched the water elevation and the outflow (cfs) of the reservoir. As the backwaters surround our home and crops, and the reservoir fills, we will not dry out until you increase the cfs when the storage is full. We encourage you to also consider what the effects of controlling the cfs does to our livelihood when it is filled to capacity. We encourage you to also consider in your plan, what the effects of controlling the cfs outflow does to the ecosystem above the reservoir. We would incourage you to also consider what the effects of controlling the cfs does to our livelihood.

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[redacted]

March 14, 2019

U.S. Army Corps of Engineers
Rock Island District
Clock Tower Building
P.O. Box 2004
Rock Island, IL 61204-2004

Dear Corps of Engineers,

We understand that you are accepting comments concerning the Coralville Lake Water Control Plan.

We are landowners and farmers who live 3 miles west of Marengo on the south side of the Iowa River bottom. At age 67, Charlie has lived along our road his entire life. As his wife, I have lived here since 1984, as well as being a life-long Marengo resident who has family property along the Iowa River on the east side of town. While there was periodically serious flooding in our neighborhood during Charlie's youth, we believe that it has been more severe in the past 27 years since the lake level was raised.

Of course, in 1993, 2008 and 2013 there has been historic flooding for us and elsewhere, but also in so many other years. Recently, in 2017 our fields and road flooded more than 5 times and in September 2018 the water went up and down 3 times preventing us from harvesting one field completely and really messing up harvest in many other fields along the road. The road east of our house was impassable for 3 weeks. It seems that when the flood stage gets around 15' the road goes under water and has stayed there for long periods of time. Last year, we did not have enough rain here to cause flooding, so we believe it was from heavy rains upstream that had nowhere to go because of high lake levels at Coralville. When we suffer from flooding at this stage it can cause damage of up to 1,000 acres for us and Charlie's brother and nephew. We also have a cow-calf operation and have suffered damage to hay bales, corn stalk bedding bales, fences, and livestock; not to mention the struggle to care for them in flooding conditions.

The flooding also causes a great deal of damage to the Iowa County gravel roads that travel along the river, disrupts mail delivery and affects home owners and values not involved in farming. We have neighbors who have had to vacate their homes.

Although we did not make it to the public meeting because we did not know about it, we have looked over the Power Point presentation online and it appears to us that you are concerned about flooding downstream, but not upstream, which directly impacts us. This is not a localized problem. It is happening to many people we know in Iowa and Benton counties.

We would appreciate it if you would hold a public meeting in Marengo or elsewhere so the Iowa, Benton, and Tama Counties areas may express our views on the upstream problems. As I write this, we are once again experiencing terrible flooding.

We understand that you have rules and guidelines to control water levels probably all the way to the Gulf. Similarly to the Amana Colonies, we would like to see the lake level lowered and more water released at times during the year when forecasts and actual rainfall show a need to help both upstream and downstream flooding. The weather forecasting abilities are much better than in 1992. We think that a more flexible policy is in order to reflect those abilities.

If you have any questions, please contact us at the above address, at [redacted] or at [redacted]

Sincerely,

Ann Bigbee and Charlie Scott

From: Jon Childers [mailto [redacted]
Sent: Thursday, March 14, 2019 4:57 PM
To: Heddlesten, Anthony D CIV USARMY CEMVP (USA) [redacted]
Subject: [Non-DoD Source] Input for USACE New Manual

Hello Mr. Heddlesten-

Thank you in advance for considering my email as the Corp begins the process of rethinking its control manual and procedures Coralville Dam. I'm sure you've heard a lot of negative comments, and I assure you that, while I'm presenting information on some of the negative impacts we've felt over the years in the Amana Colonies and Iowa County, I do not approach with communication with any anger or malice, but in a spirit of hopeful solutions that will benefit everyone along the river.

The Amana Colonies have been very dependent on the Iowa River since its founding in 1855. Our millrace canal was constructed in the 1860s to supply power to the Amana and Middle Amana Woolen Mills as well as a calico works and various craft shops that serviced the mills. The millrace fed off the Iowa River between West and South Amana and ran back in between Amana and East Amana. That the Iowa River meanders through our villages, dividing us north and south, we too feel how the Iowa River runs through the 'middle' of our lives. A hydro plant had been in use from the early 1900s until the 1980s. Today, the hope has been for us to utilize this power source to create renewable energy. The ups and downs of the river make it hard to find the consistence to regulate the water in the millrace.

I remember the 1990s when the landowners along the Iowa River were given funds to cover any future flooding that might have occurred. It seemed like a good deal at the time, but the impact to our part of the Iowa River Valley, and I'm sure others as well, has been tremendously negative.

First, the Amana Colonies, land and communities, were named a National Historic Landmark in 1965, and our designation is very precious to us. Yet, we are monitored continuously by the State Historic Preservation Office to ensure we are not in violation of our designation. Visual corridors, proper historic preservation practices, and some other general rules must be followed. It is difficult for me as the historian of our community to work diligently to help in the fight to keep our community compliant with this all-important designation while seeing parts of our historic essence retaining flood damage every year or every other year.

The historic millrace canal has been damaged and fortified over the years at great expense. It has also helped alleviate additional damage to our villages, particularly Middle Amana and Amana. As one of the few original canals yet in operation in the Midwest, it is a culturally significant structure and should not be vulnerable to this kind of abuse. Similarly, Price Creek backs up when the reservoir does. This causes considerable damage, and much potential damage, to additional historic sites and to modern facilities and infrastructure.

I managed the Amana Colonies RV Park for many years. There were at least four considerable floods that impacted those facilities, giving rise to customers' fears that returning to the Amanas for a visit may be filled with additional trepidation. This impacts the park financially. Special berms had to be built after the 1993 flood to protect the Amana Woolen Mill, the Amana Furniture Shop, along with some other local businesses. After the floods of 2008, the Amana Society's generation plant in Middle Amana, near Whirlpool Corporation, also saw the addition of a berm to protect it during high water. The plant itself had water throughout the building during the floods of 1993, and now it regularly has flooded parking lots during rain events. Back in Amana, the floods of 2008 crept into Amana from the Iowa River, over a mile to the south, to debilitate our historic train depot. The building itself was mostly original and had been in use by our local professional theatre. No flood insurance and water standing in it for weeks took this incredible piece of Amana and Iowa history and reduced it to a dilapidated mess.

The Amana Forests are the largest private timber reserve in the state and employee two full-time foresters to maintain its distinctive character. As a resource for this part of Iowa, it regularly suffers from flooding, which causes the advance of invasive species that cost the Amana Society, Inc. considerable amounts of money eradicate. Even more of an economic impact is seen by the loss of row crop and cattle production by the Amana Society, Inc.'s farms. Last year, we had perfect conditions for crops until it began to rain in the fall. Water stood noticeable in fields over a mile north of the river. The yields were expectedly compromised, and rising insurance premiums and lower payouts don't come anywhere near the profitability of just being able to farm with no hassle. Some of the water between the Homestead River bridge and CRANDIC train line near Amana stood for over a month. How can this be? How can the Corp control the water better? I'm sure there will be a better answer soon. There are literally thousands of acres in the Amanas that are affected by continuous flooding. Financially, we are having a hard time finding profitability with these continuous conditions. We lose sales to flooding at the same time we're incurring costs to deal with them year after year.

The economic impact coupled with the loss, and potential future loss of historic structures like the furniture shop, Woolen Mill (and the prospective new Millwright Hotel that is being built in the historic part of the woolen mill) a nearly unbearable. I ask on behalf of the Amana people, our heritage, and our future, to please consider the best options for controlling the river in the future.

Respectfully,

Jon M. Childers, Executive Director
Amana Heritage Society
PO Box 81
Amana, IA 52203

From:	Carole Denzler
To:	PublicInvolvement
Subject:	[Non-DoD Source] Coralville Reservoir levels
Date:	Friday, March 15, 2019 9:50:03 AM

My family has farmed the river valley near Marengo for over 100 years. Yes, The land flooded and immediately receded, now it does not. We don't want anyone up or down stream flooded. However, we have been flooded many times this last decade. Marengo can't handle having the reservoir raised. Lower the lake drastically in fall and winter to remove some silt and to receive spring melt and rains. This is just good common sense! Please listen to our concerns. Carole Denzler, [redacted]

From:	Kinsey, Joni L
To:	PublicInvolvement
Subject:	[Non-DoD Source] Comment about Coralville Lake Water Control Plan
Date:	Thursday, March 14, 2019 4:37:19 PM

Dear Army Corps of Engineers (and whomever else this may concern),

We live in the Parkview Terrace subdivision (also known locally as "Mosquito Flats") in Iowa City. Our neighborhood flanks the Iowa River and City Park and was devastated in the 2008 flood. Our home did not flood, but we are one of only a few that did not. The river, normally a quarter mile from our house, crested about 10 feet (laterally) from our front door). The flood was a catastrophic experience for everyone in our neighborhood.

All of us who remain in Parkview Terrace (we were not offered a buyout), are terrified of future flooding, especially since so many levies, elevated berms, streets and walkways have been installed since the 2008 floor that will change the water dynamics in a future flood in ways that we can't predict. The water will have to go somewhere, and with it blocked now from so many areas that it flooded in 2008, we know we are even more vulnerable than before.

We need concrete plans and action to insure that EVERY effort to anticipate high water-- and to prevent it when humanly possible--is taken. In 2008 it did not take a hydrological engineer to recognize that the large snowpack that winter meant the Coralville Reservoir level should have been dramatically lowered BEFORE the thaw and spring rains arrived. Everyone knew there would be unusual amounts of inflow due to melting. No one could have anticipated the enormous amount of rain that we got that spring, but the lake level could have been lowered before that happened. We strongly believe that this action would have significantly lessened the severity of the flood that ultimately did such catastrophic damage.

Especially in light of the increasing sediment build up in Coralville Reservoir and the lake's decreased capacity it is IMPERATIVE that the holding requirements and water release schedule for the lake be adjusted to better anticipate each spring's unique circumstances and the new cyclical severe weather we are now experiencing. Slavishly relying on outdated data and schedules that are not nimble enough to respond to current (and anticipated) conditions--and AS THEY CHANGE--is foolhardy and unacceptable.

We trust that reforms to enable water release based on real time and circumstances are being considered and will be implemented. If this does not happen we will hold the U.S. Army Corps of Engineers responsible for the losses we will suffer in future floods.

Sincerely,
Wayne and Joni Fields

Wayne and Joni Fields
[redacted]

From:	Dan Holderness
To:	PublicInvolvement
Subject:	[Non-DoD Source] Coralville Lake Water Control Plan Update - Comments
Date:	Friday, March 15, 2019 3:30:06 PM

Thank you for giving us this opportunity to submit comments on the Coralville Lake Water Control Plan Update.

General statement: The City of Coralville is located on the Iowa River 5 river miles downstream from the USACE Coralville Reservoir. We have completed more than $65 million of flood mitigation projects since the 2008 Iowa River Flood. These improvements include a combination of permanent height flood walls, permanent height earthen berms, and a combination of permanent flood walls with removable flood wall panels. The protection height chosen was the 2008 flood + 1 foot.

Based on the above information, our comments are as follows:

1. We support increased outflow rates at earlier calendar dates to increase or preserve flood storage volumes within the Coralville Reservoir.
2. We can withstand 18,000 CFS outflows with several days' notice. We can withstand higher outflows with additional notice.
3. We believe that downstream conditions from the Coralville Reservoir have changed since the most recent Water Control Plan update to safely allow increased outflow rates.
4. We hired a consultant to create a Flood Operations Manual for us based on our flood mitigation improvements. This manual will be forwarded to Chris Trefry, Chief, Water Control Section of the Rock Island District of the USACE.

We believe the USACE has done a good job of managing the Coralville Reservoir over the years. However, we also believe changes in downstream conditions will allow the Water Control Plan to be updated to better serve Eastern Iowa and middle Mississippi River citizens.

Again, thank you for the opportunity to comment on the Coralville Lake Water Control Plan Update. Please don't hesitate to contact me with questions on this information.

Dan Holderness, P.E.
City Engineer
City of Coralville, IA
1512 7th Street
Coralville, IA 52241
[redacted]

****NOTICE: Please update all City of Coralville contacts to use the @coralville.org email domain****

I was surprised to find out that there was a meeting held on February 27th to discuss the Coralville Dam Control Plan to Change. I would think that landowners on both sides of the Iowa River should have been informed of this meeting so that they can hear our opinion on controlling the water level.

Our family has been on this farm for over 100 years and have seen the impact of the Iowa River. When Coralville Dam was first thought of, the Corps of Engineers told landowners that it was to control flooding from the Iowa River. Even though we seen flooding before it never seemed to stick around as it does today. Today it seems like it is weeks or even months before the water level rescinds and the river gets back into its banks. Allowing Coralville to fill up has caused the river basin to silt in causing the river to spread out when excess water comes from upstream. The creeks that feed into the water start backfilling and then cause more flooding issues on land over a mile away. Thousands of acres of fertile farm ground completely covered by water. That is now more of a common site than not.

Every year with spring thaws and rains, we anticipate flooding is going to happen. So why not use a little more common sense and start letting more water out below the dam before flooding actually happens. Especially when rains are forecasted and warmer temperatures are predicted. Keeping Coralville full seems like it is to please those that enjoy boating and fishing. If continued flooding and farm ground cannot be productive, we will see a long term disaster for everyone.

The Amana Colonies are not the only ones who have suffered with the increase in the water level at the Coralville Dam. It has affected all those living close to the river from Iowa City to Marshalltown. Farm crops damaged and completely lost, soil loss affecting crop yields, and homes and other properties also having issues from extended flooding periods.

If there would be any more meetings, I would hope that more people are made aware of the when and where, so we can attend and voice our opinion.

Dale Johnson, [redacted]

From:	noreply@dma.mil
To:	PublicInvolvement
Subject:	Web Input
Date:	Thursday, March 14, 2019 6:07:59 AM

The following comment was submitted via the Rock Island District website.

Name/Organization	[redacted]
Address:	[redacted]
Email	[redacted]
Phone	[redacted]
Comments	My family has farmed on the Iowa river between Marengo and Belle Plain for over 125 years. I have watched As more and more farmland along a particular road has changed from agricultural to wetlands as the land is flooded every spring. Last fall we saw flooding that resulted in crops having to be removed very late with little or sometimes no value as the result of flooding which I don't remember ever happening before. My brother farms that land and every year he loses acres to flooding as well as top soil erosion with flood waters. Prior to coralville lake the land flooded very seldom. I would hope there could be a balance to save as muc h crop land which feeds our nation and recreational use. We only have so much land and as a consumer I want to be able To buy products produced from corn and beans as well as the beef that grazes on the land. Thank you for considering my comments and asking for input. I know our family farm is small but it still feeds people in our state and nationally.

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HTTP_TRUE_CLIENT_IP: 108.160.226.28

From: [redacted]t
To: PublicInvolvement
Subject: [Non-DoD Source]
Date: Friday, March 15, 2019 9:14:51 AM

Just got this info about raising the conservation pool level yesterday, so this is a quick note. I have lived and farmed on the Iowa River west of Marengo for more than thirty years. My parents owned and farmed the land before me. It is amazing how many times in one year the Iowa River floods the farms and houses upstream, many times we have had to take boats to our house to check it until the river goes down. This seems to happen more and more often. I don't understand why the flood gates cannot be left open in the winter to let all the water out before the spring rains and thaws happen. Just this last week they could have been opened up, all this rain was predicted and we know that all the heavy snow would be melted. Would of made sense to me to be a little proactive and opened the gates. It seems to me that no one cares for the farmers and land owners that live upstream, no one gets nervous until it effects the Iowa City houses. The farms have been upstream for hundreds of years, but no one cares until the floods present a problem for the BIG cities, not any of the small towns and families upstream.
As I understand the reservoir was built to manage the floods, it sure does, you manage to flood us a lot. Please do not raise the pool level.

Respectfully,
Dianne K. Stephan Nolte
[redacted]

[redacted]

From: Herman, Nancee
To: PublicInvolvement
Cc: [redacted]
Subject: [Non-DoD Source] Coralville Lake water control plan
Date: Friday, March 15, 2019 8:35:23 AM

I feel that Coralville Lake should be dredged to allow for more water intake and not flood the farmers above the lake. Consideration of the livelihood of the farmers above the lake should be taken much higher than the boaters using Coralville Lake. According to my father, lifetime farmer with lands butting up to Iowa River in Iowa County, once Coralville was put in, the river changed course and became much more uncontrolled above the lake. I'm fairly certain that people using Coralville Lake would not like a cut in their pay to accommodate others fun time, as what happens when lands above the dam become flooded to ensure reservoir capacity.

Best Regards,

Nancee Herman
Sayers Century Farm LLC member

-----Original Message-----
From: Bruce Trumpold [[redacted]
Sent: Friday, March 15, 2019 2:35 PM
To: Heddlesten, Anthony D CIV USARMY CEMVP (USA) [redacted]
Subject: [Non-DoD Source] Coralville Lake Water Control Plan Update - Amana Society Inc. comments

Mr. Heddlesten,

Please find attached a letter containing information and comments from the Amana Society, Inc. in regards to the Coralville Lake Water Control Plan Update. Thank you for the opportunity to have some input. I have also attached for your reference a questionnaire that we completed back in 2016 in regards to the operation of the Coralville Reservoir.

Please review and let me know if you have any questions or comments.

Bruce Trumpold

Secretary/Treasurer

Amana Society, Inc.

[redacted]

[redacted]

IOWA 1855

AMANA

SOCIETY, INC.

March 15, 2019

Anthony Heddlesten
U.S. Army Corps of Engineers, Rock Island District
Rock Island, IL 61204

Mr. Heddlesten,

Thank you for the opportunity to provide comments on the upcoming Coralville Lake Water Control Plan Update. We appreciate the Army Corps of Engineers devoting resources to study and update the plan.

On behalf of the Amana Society, Inc. and its wholly-owned subsidiaries Amana Farms, Inc. and Amana Society Service Company the following comments are submitted in regards to the Coralville Lake Water Control Plan Update.

We would begin by supporting and reiterating the information we submitted to the Corps of Engineers in a 2016 questionnaire regarding the operation of the Coralville Reservoir. The concerns and information in that questionnaire have, if anything, become more severe and frequent. I have included a copy of that 2016 questionnaire for your reference.

Although included in the 2016 questionnaire, we want to emphasis again that the pooling of flood waters on our property has resulted in very evident loss of plant and tree diversity due to very heavy siltation. The siltation has rendered much of our river bottom land nearly useless for anything – except growing Canary Grass. The loss of diverse habitat is very visible in large sections of our land that are virtual wastelands void of any trees. That same siltation and stagnant water has caused severe damage to our cropland in those same areas. In many cases making it almost impossible to successfully farm although we must continue to insure and pay taxes on that property.

Another area of emphasis mentioned in the 2016 questionnaire is the impact of flooding on local utilities and services. The back-up of streams and other tributaries of the Iowa River cause a real risk to electrical and sanitary sewage treatment facilities for the Amana Colonies. Water coverage of electrical equipment and local sewage collection and treatment facilities is a frequent concern as water backs up against the Coralville Reservoir pool. Both services are critical to the safety and well-being of the area residents.

506 39th. Ave., Amana, IA 52203 | P.O. Box 189
P (319) 622-7500 | amanasociety.com

IOWA 1855
AMANA
SOCIETY, INC.

In addition to the impacts mentioned in the 2016 questionnaire, it is important to note that as a major landowner in the Amana Colonies Historic Landmark, the preservation and protection of our historic land and features is of prime importance. In addition to the general landscape within the Historic Landmark the Amana Millrace and Indian Fish Weir are two very important historic structures that should receive special mention. Both have been severely impacted by previous floods and high pool levels and are at great risk of future destruction. The Amana Millrace is at great risk due to erosion of the levees from flood waters and uncontrolled water flow during high pool levels in addition to siltation in and around the canal. It is also important to note that the Amana Millrace levee is providing substantial flood protection for businesses and residential areas of the historic portions of the Amana Colonies. The Fish Weir has already suffered severe siltation and while still in existence, is now buried under several feet of silt/sand and is no longer visible.

In regards to the impact on National Historic National Landmark properties, ***we request a Section 106 of the National Historic Protect Act review*** in conjunction with the Iowa State Historic Preservation Office to determine and mitigate any further damage to critical features of the Landmark.

In consideration of the above information, we would request the following adjustments to the water control plan.

- Increase the maximum release level to 12,000 – 14,000 cfs.
- Lower the level of the conservation pool and pool levels overall whenever possible and certainly **do not** raise the conservation pool level.
- Increase the amount and length of time of the standard and seasonal releases whenever possible and remove maximum release amounts during times that it would not negatively affect downstream areas.
- Lower major flood control pool levels to below 700 to allow more water to be released sooner during anticipated flood conditions. In addition, in years of increased forecasted flood risk, the pool levels be lowered to below standard flood control levels as determined by water already in the watershed and forecasted rain/snow melt.
- In addition to levels in the watershed, the inclusion of forecasted rain or snow melt should be included in flood pool or release adjustment calculations in all circumstances.

506 39th. Ave., Amana, IA 52203 | P.O. Box 189
P (319) 622-7500 | amanasociety.com

IOWA 1855
AMANA
SOCIETY, INC.

Finally, the Amana Society would also request that the Army Corps of Engineers re-evaluate the 1982 flowage easement agreements. Although it was deemed to be "final" at the time, we believe that there is clear evidence that the frequency and level of flooding in that easement area has been more frequent and had a much larger negative impact than anyone could have anticipated.

Thank you again for the opportunity to provide input on this matter.

Sincerely,

Bruce Trumpold
Amana Society, Inc.
Secretary/Treasurer
[redacted]

506 39th. Ave., Amana, IA 52203 | P.O. Box 189
P (319) 622-7500 | amanasociety.com

2016

Stakeholder Questions for Coralville Reservoir Operation

From the AMANA SOCIETY, Inc., Amana Farms and Forestry . The Amana Society owns the farmland, timber and the Amana Society Service Co. which provides electric and water utilities to the entire seven villages area. Additionally the Amana Society owns and operates the Amana Woolen Mill which is now being renovated for a hotel. That project investment is significant.

1. Iowa River impact levels: For your responses to the following questions, please specify the river gage location(s) you typically monitor, and whether you reference stage, elevation, and/or flow.
    a. During rising water, what do you consider to be the first minor impact(s) and when do those occur (i.e., agriculture, roads, bridges, buildings, other infrastructure)?
    b. During rising water, what do you consider to be the first critical impact(s) and when do those occur?
    c. Do you anticipate changes to impact levels based on recent or future planned modifications (i.e., improvements to infrastructure, etc.)?

The Amana Society Farms and Forestry monitors both the river gage at Marengo and the level of the Coralville lake. We also closely monitor the discharge rate at the dam, forecasted discharges and the weather. We consider the forecasted level of the Iowa River, the duration of time the river is forecasted to be above flood stage, the forecasted pool and discharge rates at the dam to attempt to determine the likely impact on us.

A) • First critical impact is normally the need to move cattle out of the typically affected areas along on the Iowa River.
• During normal crop growing season, we may set up pumps in order to save crops in low lying areas.
• Need to regulate water entering the Mill Race canal to avoid damage to the levees.

B) • Remove livestock, machinery in all low lying areas.
• Whirlpool Inc. sees water advance upon parking areas.
• Water rises along Highway 220 between South Amana and West Amana. Water rises south of Amana along Highway 151. Risk to bridges and roadways is a concern.
• Water places at risk Amana Society Service Co. power plant east of Whirlpool
• Monitor Mill Race levees, overflows, spillways. In high water we experience levee breaks / damage to levees. In 2014 summer flooding , for example, the entire control structure was swept away resulting in over $200,000 of damage.
• Price Creek flooding - experience flooding of the Amana Colonies RV Park offices, residences near Price Creek in Amana. The Amana Colonies RV Park offices have been flooded multiple times.

We need also consider the duration of flooding in Iowa County. Lengthy periods of flooding in Amana has led to damage – some of which is beyond repair to cropland, forest land and forests. Whatever can be done to keep the water moving through rather than standing here should be considered.

Long term impacts include loss of top soil and loss of forests. Flood waters wash over once productive fields and meadows depositing sand/ silt – when water recede sand/ silt deposits remain. Lengthy periods of flood (and the duration and level of flooding has increased in the past ten years) have damaged mature trees, kept seedlings from growing and have harmed the forest ecosystem. Loss of topsoil and loss of trees/ meadow, prairie grasses has allowed for the growth of invasive species such as reed canary grass.

Another long term impact - Loss of "fall" on the tail race/Price Creek resulting in loss of production at the Amana hydroelectric plant located at the Amana Woolen Mill.

C) We have placed an earthen berm around the Power Plant. The Amana Colonies Historic Sites Foundation has reinforced canal levees at great expense. How these modifications will cope with raising water in is a concern.

2. Seasonal constraints: The current Regulation Plan contains seasonal targets for growing season (May 1) and non-growing season (December 15) maximum flows and downstream stage constraints. Are those dates still valid and/or can flexibility be added based on conditions? (see 2nd page of fact sheet for schedule details)

It's the Amana Society's view that any time water can be discharged from the Coralville lake/ dam and not negatively impact downstream areas, it should be done regardless of the time of year/date. That way maximum storage is available for the inevitable heavy rainfalls, periods of increased rainfall upstream and snow melt that will occur, and water can pass through rather than back up and stand in the Iowa River valley upstream of the dam.

Conditions should always override non-flexible dates. The dates in the current plan are simply not useful, practical or predictive of events for those upstream or downstream.

3. Major Flood: The current Regulation Plan specifies that the Major Flood Schedule target reservoir releases and abandonment of downstream constraints begin when the lake level reaches elevation 707 ft. Can or should that level be raised or lowered? (see 2nd page of fact sheet for schedule details)

707 ft. is too high. By the time water has reached that level at the Lake, upstream areas have been significantly impacted and the potential for quickly escalating flooding and damage downstream has increased.

Lowering that number makes good sense and is a practical way to both ease flooding upstream and to help prevent a bad situation for downstream communities.

We maintain that if higher discharges were allowed at any time downstream areas are not significantly affected, then the "Major flood stage" event would occur less frequently.

Furthermore, given the increased accuracy of weather forecasting, we believe that discharge above 6,000 (10,000 cfs during non-growing season) should be enacted based on current lake levels AND forecasted precipitation - not just on current lake levels.

It's our observation that management plan changes/amendments which resulted in the raising of the lake level/ pool maintenance level have had a negative impact upon Iowa County, the Amana Colonies, Amana Farms and Forestry – and to the management of the lake and the Iowa River as a whole. Lowering the pool maintenance level should be considered.

Flash Flood target discharges: The current Regulation Plan includes guidance for reducing Coralville reservoir releases to potentially limit combined discharges with two downstream Creeks for flash flood situations.

a. Reservoir releases are reduced when the combined reservoir release with Rapid Creek discharge is expected to exceed 12,000 cfs. Is this target still valid? Please give information regarding current impacts as applicable.
b. Reservoir releases are reduced when the combined reservoir release, Rapid Creek discharge, and Clear Creek discharge are expected to exceed 16,000 cfs. Is this target still valid? Please give information regarding current impacts as applicable.

Downstream flood management certainly needs to remain in the plan. However if water discharge is managed for maximizing storage within the pool during the entire year, backing discharge off to help mitigate flood events downstream will be less risky in relation to the impounded water problems created and exacerbated by continued precipitation.

4. Are there opportunities for potential changes to the Regulation Plan that you would like to see investigated or addressed?

   To protect upstream and downstream communities we advocate:
   - Lower the level of the conservation pool. Lower the autumn/winter hold level.
   - Lower the level of the conservation pool during the spring and early summer to increase capacity for snow melt/spring/early summer rainfalls.
   - Increase the maximum release to 12,000 – 14,000 cfs.
   - Lengthen spring/early summer increased release to July 15.
   - Or eliminate the seasonal 6,000 cfs maximum entirely and make it 10,000 cfs year-round or 10,000 cfs for July to December and 12,000 - 14,000 cfs for December to July.
   - Lower the "Normal flood control operation" levels from forecasted pool level to 700 feet.
   - Lower the Major flood operation to 700 feet. In other words start releasing more water sooner.

March 15, 2019

To: Corps of Engineers
email: publicinvolvement@usace.army.mil

To whom it may concern:

I am writing you in regards to a new control plan for the management of the CoralvilleDam/Lake that you have been discussing.

As a farmer and have been for 42 years, farming is not easy and along the Iowa River which the Coralville Dam/Lake impacts is near impossible to farm. In fact we had to give up farm ground because it either has flooded or when the river is up the water comes up from underneath and saturates the soil so much you can not farm it.

Back in the 1940's and 1950's when this project was brought to the attention to everyone living along the Iowa River, farmers and residents of Iowa County went to all your meetings and stated that by putting in the dam, you will flood us out. Your response was it will never back up that far on the Iowa River to effect you. Guess what, it has. Have you looked at how many farmers still live along the river? Very, very few if any in Iowa County.

Another question I have is, when did the Coralville Dam/Lake become a recreational lake instead of a flood control program? Who gave permission for people to build below the dam since it was a flood zone?

It would of also been nice to have the two previous meetings you had, published in the local papers instead of papers not effected by the Iowa River.

My proposal is this:

1. By no means do I want to flood people out below the dam. So why can't the gates to the dam be open all year around so the water can flow as naturally as it can. Once the river is to a certain height, below the dam, then close the gates down and keep it at that level. At least some water will be flowing from above and help us out.
2. If the lake would get low and dry out in places, then dredge it out so it could hold more water then it does now.

Respectfully submitted,

Cynthia R. Ballard

Cindy Ballard
[redacted]

To: the Army Corps of Engineers
Re: Update to the Current Coralville Lake Water Control Plan

I've lived in a historic home in the Amana National Historic Landmark since 2001, and have owned the structure since 2004. Over the years I've become familiar with the Coralville Lake Water Control Plan/Master Reservoir Regulation Manual and the operation of the dam.

Any update to the Coralville Lake Water Control plan needs to account for the increasing flood events, and protect the National Historic Landmark of the Amana Colonies as well as the downstream communities. Since I've been a property owner in Amana the level of the dam has risen to major flood level (above 707ft) a few times. In 2008 my historic house was substantially threatened when the pool level came close to the top of the levees surrounding the historic Amana Woolen Mill area.

Section 7-05 for normal flood control states, “The basic objective is to release the maximum permissible outflow as limited by the conduit capacity and the other constraints outlined in this section”. When the projected level of the Coralville dam is below 707ft the Army Corps of Engineers appears to observe the downstream constraints as enumerated in the plan, but I've seen them not 'release the maximum permissible outflow' to reduce the pool level as quickly as possible. This approach may compound a potential major flood scenario. Much more serious is when the pool level is projected to exceed the major flood level of 707ft. Section 7-05 states: “The major flood pool level is 707.0 feet, NGVD or a forecast exceeding elevation 707.0 feet. Above this level, the emergency regulation Schedule B, Table C-2, will be followed, and all other constraints will be disregarded.” On several occasions when the forecast level has exceeded 707ft the Corps has demonstrated a reluctance to abide by this section of the plan and switch over to schedule B and its higher outflow levels. On one occasion when I contacted the corps they stated they were waiting to confirm the 707ft forecast level would be exceeded before they increased the outflows. Last year, the Corps denied that the regulations mandate a change to schedule B when the pool level forecast exceeds 707.0ft—and the pool level rose to 710.93ft. The language in section 7-05 and other similar sections is simple: the major flood constraint is invoked and emergency regulation Schedule B is to be followed when the pool level is at 707ft, **OR a forecast projects the level to be above 707.0ft.** The language is “or”, NOT “and”!

These recurring major flood events threaten the Amana National Historic Landmark and downstream communities with substantial potential damage and destruction. According to exhibit A in the operation manual it was assumed the 712ft spillway crest of the dam would be reached once every 30 years. The 712 ft spillway crest was exceeded in both 1993 and 2008 allowing unregulated outflow, and was almost reached again in 2018 (710.93 ft!) . To meet these increasing threats the Army Corps of Engineers should be aggressive in reducing the pool level particularly after they forecast a level of 707.0ft—and NOT wait for more information before they change to schedule B and increase outflows. The Master Reservoir Regulation Manual/Coralville Lake Water Control Plan should also be amended to allow for more aggressive action to mitigate potential damage and destruction:

- The plan needs to be amended for borderline situations where reducing forecast outflows for a downstream constraint causes the forecast pool level to exceed 707.0ft. It does not make sense for the dam to operate under normal operational constraints with the knowledge this course of action will accelerate the dam into a major flood emergency, and may increase property damage. Unless there is substantial evidence that the excursion above 707.0ft will be minor and transitory (ie; the pool level will remain well below 712ft), the operational plan should mandate NOT reducing the outflow for the downstream constraint, and should require switching to schedule B for major flood events (even though a revised forecast may not show the level exceeding 707.0ft in the short-run)

- Increase both normal and major flood event outflow levels: The current maximum normal operation outflow level of 6000CFS only hastens and exacerbates a major flood emergency. The Army Corps of Engineers should be allowed to increase the outflow level above 6000CFS before the pool level reaches 707.0ft if it is likely a major flood event will occur. Allowable Schedule B outflows should also be increased to mitigate the potential for exceeding the 712ft spillway.
- Reduce the major flood stage level below 707.0ft. 707.0ft is already at 74% of flood control storage utilization! Reducing it just 1 or 2 ft may add substantial 'buffering' and mitigate the potential for exceeding the 712ft spillway.
- Recreational interests should have substantially less priority to protecting the Amana Historic Landmark and downstream communities

Thank you for addressing these points:

David Forbes
[redacted]

From:	[redacted]t
To:	PublicInvolvement
Subject:	[Non-DoD Source] Management Plan for Coralville Lake/Dam
Date:	Friday, March 15, 2019 10:21:11 AM

To: US Army Corps of Engineers, Rock Island District

I live on a farm very close to the Iowa River and am now preparing to move out of my home for the fourth time, in recent years, because of the flooding.

My father farmed this land starting in the 1950's, before the Coralville Dam was built. There would be some temporary flooding but never the volume or repetition that occurs now and waters receded in a couple days. Since the Dam was constructed, flooding has increased tremendously (in volume and occurrence) and takes a couple weeks to recede and to make it possible to return home.

I am imploring you to not raise the conservation pool level of the lake as it was in 1992, and that you lower the lake level in spring to allow for more flood water storage and to keep the lake level lower through the months typical of flooding (June/July would be two months to consider). Starting flood measures sooner, by releasing more water sooner, would allow the water to move through rather than back up in Iowa County and then flood downstream areas later.

No one wants to see Iowa City/Coralville or downstream communities endangered by floods either, but I believe management of the dam can be improved tremendously to keep the flood damages minimized.

Please make a serious attempt to address this huge problem and find the right solution to minimize this terrible flooding. Communities, farmers, businesses, and the people who live in these affected areas should be considered above the lesser population of recreational interests.

I would add that I didn't know of this plan until today online and wonder why everyone was not notified of the meetings and if it was publicized, in what way?

Sincerely,
Joanne Slockett
[redacted]

Sent from my iPad

Purpose: Public input is essential to the Coralville Lake Water Control Plan Update. The project team is interested in hearing your comments below. Questions are provided for example only. Please don't let the questions limit your response and we appreciate any feedback that you could provide us. Additional information is available on the project website.

Coralville Lake Water Control Plan Website:
https://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Coralville-Lake-Water-Control-Plan-Update/

(Optional)
Name/Organization: **The Nature Conservancy Iowa**

Address: [redacted]

Email: [redacted] **Phone:** [redacted]

Potential topics of discussion (topics provided as example only):

- How, and under what conditions, are you impacted by water levels (either flood or drought) along the Iowa River
- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River
- Environmental concerns, comments or observations related to reservoir operations or Iowa River flows
- In regards to the way water is managed at Coralville Lake, recommendations on problems and/or opportunities that should be evaluated as part of the study
- Alternatives or actions you believe should be evaluated as part of the study. **Feedback is essential to evaluating and improving our meeting strategy. Please share your thoughts on today's meeting:**

The Nature Conservancy has a few environmental concerns regarding the Coralville Lake control or regulation manual update. In general, TNC recommends managing water flows that more closely mimic natural seasonal flows that can provide better environmental outcomes, spring flood pulses are especially important for many species and should significantly reduce the ability of the reservoir to manage flood events. See Des Moines River Sustainable River report and literature review.

I. Delay and minimize the spring draw down to provide shelter and habitat for hibernating species, spawning fish and help mitigate drops in dissolved oxygen. Consider maintaining the non-growing season conservation pool of 683 to 686 ft (if not constrained by risks of flooding) instead of the current spring drawdown to 679. At 679 the additional 4 feet of storage only represents a small portion of actual flood storage, less than 4%. If downstream areas in the floodplain are threatened a more sustainable approach would be to provide funding for them to move out of the floodplain as climate predictions indicate that flooding will only get worse in the coming decades. As this happens the ability for Coralville Lake to regulate flooding will be greatly diminished.

a. As partners in the Des Moines River SRP Workshop pointed out radical changes in flows and pool elevations were identified as very detrimental to mussel populations, particularly when entering cold periods, as well as likely detrimental to certain herps (especially turtles and frogs). It would be beneficial to build some flexibility in this plan given that mussels and other taxa are most vulnerable to exposure mid-December through February, and rapid drawdowns in pool elevation and/or river levels during the winter should be avoided if at all possible by delaying and minimizing spring draw down. This could also provide higher water levels and better habitat for fish spawning and DNR's stocking of games species like walleye.

II. Based on the success of the SRP recommendations in the Des Moines River we suggest to restore a more "natural" hydrologic regime, and greater variability in target pool elevations to provide better waterfowl habitat and mud-flats which can allow for increases in denitrification processes.

   a. For the purposes of waterfowl, a slow and relatively steady drawdown of water levels throughout the growing season is best for managing smartweed and other waterfowl forage. A drawdown by mid-July allows for vegetative establishment prior to the fall rise, or the period after October (ideally, mid-October) when these marginal areas are inundated to benefit fall migratory waterfowl. Exposed mudflats in late July, August and September benefit migratory shorebirds. Framed in terms of current operational targets, we recommend to elevate the current "normal" pool target by ~6" during the spring and early summer (from 683 to 683.5 by July 1), and then allow for a gradual drawn down starting in mid-July. Gradual drawdown (1" or 2" / week) to 682.5 or slightly below normal pool by September 1 to gradually expose mudflats. This level would be held until the end of the September, allowing plants to become established that serve as forage for waterfowl when inundated by the fall rise

III. Additionally, TNC is concerned about the National Weather Service's recommendations to raise the minor and major flood heights along the lower Iowa from Lone Tree to Wapello. The lower valley of the Iowa-Cedar is the most ecological diverse area left in Iowa and includes important flood plain, prairie, and oak savanna habitat important for reptiles, amphibians and waterfowl. Additionally, this area has a lot of outdoor recreation utilization. While these habitats have evolved with flooding there is an increase in the frequency of high magnitude floods and the seasonality of the floods is shifting to later times in the growing season and disturbs natural ecosystem processes. Our main concerns are

   a. Indian Slough near Wapello. The main access road is under water at 14 ft at the Wapello gauge. Also, summer and fall flooding can negatively impact the well-managed lowland oak savanna

b. Significant flood impacts begin to occur around 21 feet at Millrace Flats and approximately 22.5 feet at Wapello Bottoms (Wapello Gauge). Any potential increases to the height of control points at Wapello would dramatically impact these areas by changing the hydrology with increased flood events, creating a higher water table, etc. These potential changes would negatively impact the quality of habitat in these areas by favoring the growth of undesirable vegetation, increasing silt deposition, limiting equipment access for habitat management purposes, and result in reduced public use of these areas.

c. Conesville Marsh Complex: This complex contains high quality wetland habitat on private and public lands and is critical habitat for migratory birds. High water on the Iowa River will close the flap gate structure at that outlet of the marsh where it discharges into the Iowa River. Water backs up in the marsh when if the gates remain closed for an extended period of time. Prolonged high-water levels in this wetland complex during the growing season will lead to the loss of food and cover for migratory birds and other wetland wildlife, including T&E species. The exact level at which the Iowa River impacts the flap gates is currently unknown. Additional observations and surveys are necessary to quantify the impact

How did you hear about today's public meeting? _From a co-worker and Facebook_

Do you feel your comments or concerns are valued by USACE?
__TNC and USACE have a history of collaboration and partnership which includes working with the Army Corps of Engineers on the Sustainable River Program to find sustainable solutions to river health. Recent collaborations include working with partners to identify environmental flow requirements for the Des Moines River, and develop hypotheses for alternative water management that might establish more natural flow regimes and/or reservoir conditions to enhance multiple benefits within the program area. _

Based on your experience today, do you have any suggestions for how we could improve public meetings? ____

____

____

____

The Comment Period ends March 15, 2019. Comments may be submitted via mail, email or fax to the US Army Corps of Engineers at:

U.S. Army Corps of Engineers, Rock Island District
Clock Tower Building – PO Box 2004
Attn: PD-E, 2nd Floor
Rock Island, IL 61204-2004
Fax: 309-794-5883
Email: PublicInvolvement@usace.army.mil

From:	noreply@dma.mil
To:	PublicInvolvement
Subject:	Web Input
Date:	Friday, March 15, 2019 10:08:03 AM

The following comment was submitted via the Rock Island District website.

Name/Organization Terri Chait/[redacted]
Address:
[redacted]

Email [redacted]
Phone [redacted]
Comments I am on the Board of Directors of the Idyllwild Condominiums Owners Association and own some condos in Idyllwild. This neighborhood development consists of 92 condos built between Taft Speedway and Foster Road in Iowa City. The closest edge of the development is less than 150 feet from the Iowa River. The location was revised to be in a flood plain after the flood maps were redrawn following the flood of 1993.

Our development was not flooded by the river when the river rose to 23.13 in the fall of 2018. We believe we may be able to withstand an additional foot without taking protective measures.

We feel that we would benefit by the Corps of Engineers taking these steps:
1. Manage to the big floods, not so much to the small ones.
2. Increase outflow earlier to attempt to keep more capacity in the reservoir.
3. Manage the water more aggressively as the reservoir reaches 700 feet.

The Idyllwild community works with James Kliewer from Hart Frederick to manage our water issues. He will likely send a communication on our behalf. Additionally, in light of the current high water situation and the Johnson County's request to the Corps to increase outflow over the next few days, we will send another comment (after the deadline) to let you know what effect that had with us.

Thank you so much for asking.

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HTTP_TRUE_CLIENT_IP: 173.28.213.163

From:	noreply@dma.mil
To:	PublicInvolvement
Subject:	Web Input
Date:	Friday, March 15, 2019 4:29:10 PM

The following comment was submitted via the Rock Island District website.

Name/Organization	Mary Murphy
Address:	[redacted]
Email	
Phone	
Comments	To Whom It May Concern: I reside at [redacted] in the neighborhood of [redacted] at the back of the neighborhood. Prior to my family's purchase of our home in 2001, we first researched to see if the house had been physically impacted by the 1993 flood and discovered it had not been. This fact was a major factor in our deciding to purchase the property at [redacted]. Our house was not within the 500 year flood plain in 2001 prior to our purchasing it, and this fact remains true today. Further, our house did not flood during the 2008 flood, and we were not offered a buyout. Going forward, the fair and right course of action would be to prioritize homes such as ours over recreational activities so, for example, water shouldn't be left in the reservoir for boaters at the expense of property owners during a potential flood event if it increases existing property owners risk. I am content with the risk I bought but do not appreciate "flood protection" upstream of me that takes property that should hold water when the rivers rise so that this property no longer stores flood water. It would not be fair or right to alter my home's risk going forward (or the risk of similarly situated other folks) so I would ask that your future plans not increase in any way my home's flood risk or others in our position. Overall, the Coralville Reservoir seems to often work as it should. There does seem to be a lack of understanding, including on the part of some governmental officials, about what it is intended to do, what it does, how much storage there is, and what is an emergency so it might be beneficial to provide training or education to government officials and the public at large.

Thank you for the opportunity to comment. If you have any questions, please contact me.

Sincerely,

Mary Murphy

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From: Woodruff, Steven [redacted]
Sent: Tuesday, March 19, 2019 11:58 AM
To: Goldman, Howard D CIV USARMY CEMVR (US) [redacted]
Cc: Wuebker, Jonathan D CIV USARMY CEMVR (US) [redacted]
Subject: [Non-DoD Source] IRWU comments for USACOE conservation pool

Dee,

Under normal conditions, I would like to request that the winter draw-down be delayed until March 1st. Historically the winter draw-down takes effect December 15. I would like to hold the water level at 686 till March 1st to protect the Herps (ie. Blanding Turtles) and Amphibians as much as possible from exposure while over-wintering at HWU.

Any questions, please give me a call.

Take Care,

SDW

Steven Woodruff | Natural Resource Biologist
|C 319-330-7013|
Iowa River Wildlife Unit
51 Escort Ln., Iowa City, IA 52240
[redacted]

Land Classification	Goal 1 Comments - Reduce Future Flood Risk	District's Response
Agricultural	Fields impacted at elevation 708. Keep levels below this.	
Agricultural	Fields impacted at elevation 708. Keep levels below this.	
Agricultural	Fields impacted at elevation 708. Keep levels below this.	
Citical Infrastructure	Back-up of Price Creek. Affects storm water drainage; high levels can impact sewage treatment lagoons. Keep reservoir at conservation level as much as possible. Consider lowering conservation.	
Critical Infrastructure	When the reservoir is backed up to point where it reaches highway 151, the lagoons are in peril from erosion to their levees.	
Infrastructure	[redacted], Airstrip is 1/3 to 1/2 under water at 710 elevation.	
Agricultural	[redacted], Flooding impacts farmland. No particular elevation provided.	
Infrastructure	[redacted] - at stage 697, gas tanks and parking lots go under water.	
Infrastructure	[redacted] - access to docks, parking lots, campsites impacted at elevation 705. Keep water lower than 705.	
Commercial	At 700' loss of income was $23,818 for these businesses. Would like to see major flood operations begin at 698 or 700'. Increase length of spring drawdown.	
Recreation	689 campground is under water, Bobbers underwater at 701, Bobbers building impacted at 712	
Conservation	Bruce Mulford - losing land and trees, would like riprap in this area.	
Infrastructure	Roads are impacted in this area at high lake levels. (level unknown)	
Infrastructure	2860 PDC Rd, El 679 impacts appx 45% of docks due to sedimentation. Move to conservation pool earlier in spring if possible.	
Infrastructure	2860 PDC Rd, EL 696 parking lot goes under water & docks need to be adjusted. Keep levels below 696.	
	[redacted], 13000 cfs evacuation required, leave 683 all summer.	
Residential	[redacted], 13000 cfs impact to home and access, Recommend: 8000 growing season release, 679 pool, major flood schedule begin at 700, 10000 cfs off season release, incremental releases to reduce erosion, dredging	
Residential	[redacted] (second form), 13000 cfs impacts home and access, set 700 as major flood, keep lake 679-683 all year	
Residential	[redacted], 22 feet, 12000 cfs in yard. 15500-16000 cfs in home, House was retrofitted in 1993 to handle these flows	
Residential	[redacted] 2008 flooded this neighborhood "idylwild", 2018 flooded Taft Speedway	
	[redacted], Indicated impact but was not able to define it, 2 comment cards received for this address.	
	[redacted], Flood impacts occur when spillway is overtopped.	
Residential	[redacted], At El. 656 in June 2008, home was impacted.	
	[redacted], Run as dry reservoir, lower major discharge schedule below 707, impacted by anything over 10,000 CFS	
Residential	[redacted], at 22' can't access home (Iowa City gage), at 25' water enters home, Lower conservation pool, Rivergages.com needs to be improved (availability issues)	
Residential	[redacted], Affected by flooding, lose access to home, no particular river elevation identified.	
Residential	[redacted], 12000 cfs access lost, 18000 cfs enters home	
Conservation	U/S from Pechman Ck, Highwater eroding banks, looking for assistance with riprap to shore up river bank.	
Conservation	[redacted], At 13.6' on the lone tree gage, wetlands are recharged. More water at these levels would be useful.	
Residential	[redacted] 2008 flood was 4-6" of water in second floor of house. Keep water levels below 21' when possible. Lone Tree gage.	
Infrastructure	Hills Hunting Club, 24154 220 St - water impacts the club. No elevation provided.	
Conservation	At an unknown stage on the Lone Tree gage, the Iowa River closes the levee district flapgate and makes it difficult to manage marsh water levels	
Agricultural	Farm fields flood (no specific elevation provided)	
	One of the first areas to flood. (no specific elevation provided)colum	
	Columbus Junction would like more prep time when possible.	
Infrastructure	26.8' water is on north side of highway, 27.2' water covers highway 92, 23.1' locus street covered at Monkey Run Bridge, 25.0' CR G-36 covered	
Critical Infrastructure & Conservation	Between 19 & 20' on the Wapello gage, major flooding is washing out a water control structure and indian slough is being cut off by an oxbow	
Conservation	Millrace Flats is impacted at 21 feet on the Wapello gage. Current plan is good here for habitat.	
	Jim McCaw - lower water levels and drain reservoir faster to lower impacts in Marengo area.	
	Unknown location, but "Marengo Resident", Drain reservoir after October	
Infrastructure & Agricultural	Water over roads on Highway 212 North of Marengo. Levee systems west of Marengo are not being maintained. Crop damages are a total loss and once good farm land is becoming swamp land.	
Agricultural	[redacted] (different owner), Farm ground floods at 16'	
Infrastructure	16.5' at Marengo road floods (KK Ave)	
	Flood impacts here. No specific elevation provided.	
	At 15.5' on the Marengo gage, flood impacts property.	
Agricultural	At 14.5' on Marengo gage, farm land is flooded.	
	At 15.5' on the Marengo gage, flooding impacts this property.	

	Flood impacts occur here. No specific elevation given. Dredge & lower pool.	
	No specific location given other than west Amana to Chelsea and the Marengo Area. Impact to crops and farmers becoming trapped on their land and the need to move	
	Request to lower pool levels to reduce flooding here.	
Agricultural	Belle Plaine, IA, Farmer sold 90+ acres of farm land. Would like to see lake as a dry pond.	
Agricultural	O Ave @ P Ave - USACE installed a culvert in this area that affects crops at anything above 2' on Tama gage. Culvert needs to be increased in size.	
Critical Infrastructure	At 20' water reaches the base of the levee and erosion could start.	
Conservation	At 22 feet on the Wapello gage, habitat management is affected at Wapello Bottoms WMA.	
Residential	[redacted], Water impacts home at 26 ft on Wapello Gage, they have land near to the cross levee as well that is affected at 23', Due to bridge replacement, important that water stays below 28.5' so they have an access route to home. Detour bridge closes at 28.5'	
	Between 28 and 30 feet at Wapello, Louisa 11 will overtop in this area.	
Agricultural	At 23.5' water gets backed up through breach enough to flood crops	
Agricultural & Conservation	At 21' cross levee breach is inundated flooding out fields & habitat.	
Conservation	At 16' on wapello gage, existing breach overflows and habitat areas begin to flood.	
Conservation	Impacts to Horseshoe bend wildlife area between 16 and 20 feet at the wapello gage. Inundation can be useful during the right season, but detrimental during others. Coordinate impacts on wildlife in this area.	
Conservation	At 24' on the Wapello gage, spillways are overtopped at Lake Odessa and then detrimental habitat impacts are realized in the area.	
	Dave Whittaker has ice jam data from this area he is willing to share with the group.	
	Mayor would like to see dredging near Oakville to lower water levels.	
Conservation	At 24' at Wapello gage, concrete spillway overtops. Recommended minimizing # of overtoppings for habitat reasons.	
Recreation	Snively campground is impacted when Odessa spillways are overtopped. Affected by Iowa & Mississippi.	
Agricultural	Bobette Benson, [redacted]-Get water through as quickly as possible at the lowest crest possible downstream. Sustained high water takes off front plots and prevents access to our property due to the road being under water from both directions. Left up long enough-water gets in our rural home and we have to evacuate animals and equipment. If 21' is the point Coralville looks at cutting back for us why wouldn't it be better to use 19' or 20'?	
Agricultural	Jeff Henke, [redacted]-We live in the bottoms and water can back up to our place if it remains high. Wapello Gauge over 26 ft. We own ground close to the break in the cross levee. Water backs up to it quick and closes the road. Wapello Gauge over 23 ft. This coming year with the bridge replacement on Hwy 99 of Wapello, Hwy 61 is closed at 28.5 ft north of Wapello. 99 will not be available as a detour. At 24' we are patrolling the levee. Over 25' we patrol twice a day.	
Recreational	Hills Hunting Club, 24154 220th St Conesville IA-Our water level is affected by Iowa River Level.	
Critical Infrastructure	Donnie Orr, Chief Columbus Junction Police Department, 232 Second St Columbus Junction, IA 52738-Hwy 92, 26.8 on north side of highway. 27.2 covers Highway 92. Locust Street covered at 23.1 (Monkey Run Bridge). 25.0' Co. Rd 6-36 covered with water. These levels using National Weather Service Guage and updated action levels.	
[redacted]	River Stage @ 21' floods home - 2008 4-6" on 2nd floor - recommendation not to go above 21'	
[redacted]	Lone Tree gauge @ 19' - when the lone tree gauge hits 19 feet at my home, water will enter my basement windown and ruin my furnance and water heater causing 4-5 thousand in damages. - Recommend keeping the river below 19' as often as possible so the river will not impact property. Also, need to explain why cuts happen online.	
[redacted]	Tri county lone tree gauge - when @ 21' I am at risk of losing my house. Would love to see tri county gauge never go above 20' In 2008 I lost my house to flood waters. 4-6" of water on 2nd level of my house. All the farm land around me was ruined. I had to guy my house down to the studs and re-build.	
[redacted]	My wet land complex is recharged by river @ 13.6 ft (Lone tree guage) Would like to see scheduled discharges in November at 14ft.	
Oakville	Need to dredge the Iowa river	
Oakville	Ice jam, has historical data to share	
[redacted]	river stage elevation of 708 - backs up creek into field - recommend keeping the water level in resevoir lower.	
[redacted]	river gauge at 16-20 ft impacts habitat.	
Louisa	Wapello gauge at 20' impacts base of levee and at 21' water goes over cross the levee (breach)	
Louisa	Wapello guage at 23.5 floods crops	
Louisa	Wapello guage at 28-30 ft overtops Louisa 11 levee district	
Hwy 92	26.8' on north side of highway 27.2 covers highway 92; locust street covered at 23.1' 25' co rd G36 covreed with water	
Columbus Junction	Needs as much advance notice as possible. Coordinate between Cedar River levels and Coralville Discharge.	

[redacted]	Road and home flood at 13,000 cfs and are forced to evacuate. Would like to see the growing season outflow raised from 6,000 cfs to 8,000 cfs and lake level kept at 679 ft. We are very concerned with the elevation 707 ft and would like to see 700 ft the major flood schedule. Recommend all year 10,000 cfs, not 7,000 cfs.	
Amana Colonies	The basic 683 pool level should not be raised. 707 ft starts the major flood event schedule. This is far too high. By the time water has reached that level at lake, upstream areas have have been significantly impacted. Discharge above 6.000 (10,000 in non-growing season) should be enacted based on current lake levels and forecasted precipitiation. Recommend increasing maximum release to 12,000 to 14,000 cfs. Eliminate the seasonal 6,000 cfs maximum entirely and make it 10,000 cfs July to December and 12,000 - 14,000 cfs for December through July.	
[redacted]	Lower the normal level to 700ft and lower the major flood operation to 700 ft and start releasing more water sonner.	
[redacted]	Iowa city gauge @ 22' driveway under water; @ 25' water in outbuildings and crawlspace of home; @ 29' water in living space of home	
	Description of various levels. Spring level at 679 elevation - Sandy Beach to I 380 bridge totally impossible to pass through and many boats get stuck. Flood level @ 690 - Sandy Beach road becomes impassible; and @ 700 Sandy Beach parking lot under water.	
[redacted]	at 27' home will be on a small island and and any more water will be in the home.	
Marengo Agriculture [redacted]	Flooding on family land has increased significantly over the years. Keepin gthe lake level high during the summer for recreational use has resulted in the incresed flooding.	
[redacted]	12000 cfs effecdts road access to home and Emergency Management lets us know to move out. Recommend changing pool level.	
[redacted]	family has farmed the river valley near Marengo for over 100 years. The land has flooded in the past and immediately receded. However, now the water does not receed. Recommend lowering the lake pool.	
City of Coralville	Supports the following: increased outflow rates at earlier calendar dates to increase or preserve flood storage volumes within the Coralville Resevoir; We can withstand 18,000 cfs outflow with several days notice. We can withstand higher outflows with additional notice. We believe that downstream conditions from the Coralville Reserboir have changed since the most recent Water Control Plan update to safely allow increased outflow rates. We hired a conultant to create a flood operations manual for us based on our flood mitigation improvements.	
Amana Society Inc.	Recommend the following adjustments to the Water Control Plan: Incrase the maximum release level to 12,000 - 14,000 cfs; lower the level of the conservation pool and pool levlels overall whenever possible and certainly don not rais the conservation pool level. Increase the amount and length of time of the standard and seasonal releases whenever possible and remove maximum release amounts druing times that it would not negatively affedt downstream areas. Lwer major flood control pool levels to 700 to allow more water to be released sonner during anticipatd flood conditions. In addition, in years of increased forecasted flood risk, the pool levels be lowered to below standard flood control levels as determined by water already in the watershed and forecasted rain/snow melt. In addition to levels in the watershed, the inclusion of forecasted rain or sno melt should be included in flood pool or relese adjustment calculations in all circumstances.	

Land Classification	Goal 2 Comments - Improve Low Flow Augmentation Reliability	District's Response
	No comments were received under this Goal.	

Land Classification	Goal 3 Comments - Promote Fish and Wildlife Sustainability	District's Response
Indian Slough Wildlife Area	Around 19' to 20' major flooding washing out water control	
Port Louisa	Wapello River gauge @ 24' appoximately - once the spillways are overtopped, water flows into Odessa and the Louisa Div, Which can have detrimental impacs on habitat that is managed for migratin waterfowl.	Thank you for providing feedback.
Lone Marsh WMA, Conesville, IA	Lone Tree River gauge - High water on the Iowa river closes the levee district flapgte plus hampers drainage and management of marsh.	
Odessa wildlife Area, Wapello	Wapello +Mississippi @ New Boston (around 24' at Wapello) - overtopping of concrete mat spillways installed by USACE as part of HREP project. Recommendation: Keep control point at Wapello low enough to minimize impacts to Odessa Wildlife Aea Spillways.	
10728 CR x 61 in Wapello	River gauge at Wapello 16' to 20' - Horseshoe Bend Division is 2600 acres with infrastructure, roads public access and habitat managed in wet prairie , wetlands and forest.	
[redacted]	Lone Tree River gauge - recommendation to recharge wetlands	
Millrace Flats WMA	Wapello @ 21' - impacts habitat and habitat management beginners at 21 ft. Recommend existing trigger points	
Wapello Bottoms WMA	Wapello - Impacts habitat and habitat management of levels above 22' recommend maintaining existing trigger points.	
	I would like to see the lake level dropped to 679 at the formation of the first ice. The migrating birds no longer can use the 686 foot level when there is ice on the lake.	Please see Chapters 3 and 6 for descriptions of the alternative. You suggested was taken into consideration in developing the proposed operating band found in Chapter 6.
The Nature conservancy Iowa 505 5th Ave #930, Des Moines	Delay and minimize the spring drawdown to provide shelter and habitat for hibernating species, spawning fish and help mitigate drops in dissoved oxygen. Consider maintaining the non-growing season conservation pool of 683-686 ft. (if not constrained by the risk of flooding) insstead of the current spring drawdown to 679. At 6 79 rhw additional 4 ft of storage only represents a small portion of actual flood storage, less than 4%. If the downstream areas in the floodplain are threatened a more sustainable approach would be to provide funding for them to move out of the floodplain as climate predcictions indicate that flooding will only get worse in the coming decades. As this happens the ability for Coralville Lake to regulate flooding will be greatly diminished. Based on the success of the SRP recommendations in the Des Moines River, we suggest to restore a more "natural " hydrolgic regime, and a greater variabiltiy in the target pool elevations to provide better waterfowl habitat and mud flats which can allow for increases in denitrification processes. We recommed to elevate the current normal pool target by 6" during spring and early summer from 683 to 683.5 by July 1 and then allow for a gradual drawn down starting in mid july. Gradual drawdown 1" to 2"/week to 682.5 or slighlty below nomal pool by September 1.	Thank you for your suggestion. This suggestion was considered in developing the proposed operating band, found in Chapter 6 of the main report. The proposed operating band would provide options for natural resources benefits. We look forward to discussing these further during the upcoming development of the Iowa River SRP.
Iowa River Wildlife Unit	would like to request the winter drawdown be delayed until March 1. Historically, the winter drawdown takes effect December 15th. I would like to hold the water level at 686 until March 1 to protect the Herps (ie /blanding Turtles) and Amphibians as much as possible from exposure while over wintering at HWU.	Discussion of the alternatives' impacts to herps can be found in Chapter 5 of the main report. Your comment was considered in developing the proposed operating band, found in Chapter 6 of the main report.

Land Classification	Goal 4 Comments -Promote Enhancement of Recreational Features	District's Response
[redacted]	River stage impact @ 697 floods parking lot	
Snively Campground, Louisa	Recommend keeping water below spillway level - Comment "Difficult because the Mississippi overtips the Odessa spillway. Our campground floods making it expensive to replace GFIs and closing the campground.	
[redacted]	River gauge @ 689 campground lost recommend gate charge	
[redacted]	River stage impact @ 679 - Cannot use 45% of docks due to sedimentation if held into boating season - recommend going to conservation pool earlier in spring if conditions allow	
[redacted]	River stage impact @ 696 - Business parking lot goes under water. Significant man hours involved to adjust docks as well. Recommend making gate adjustments earlier to mitigate major flood events.	
Scales Pointe Campground, 1850 Scales Bend Rd NE - North Liberty	Fall pool should be raised 1.8' or can't get out and about	
	River gauge @ 700 causes significant loss of income. Recommend gate change earlier. 707 is to high for deviation…should lower to 698 t0 700 if outlook is bad.	
Hills Hunting Club, 24154 220 St, 52739	Our water level is effected by the Iowa River	

Land Classification	Goal 5 Comments -Accommodate Other Stakeholder Interests	District's Response
general	Shore land errosion - loss of land and trees - recommend rip rap	
[redacted]	June 2008 @ 656	
[redacted]	Idyllwild	
[redacted]	Idyllwild - 2008 flood was devastating - major flood control should be USACE highest priority	
Sandy Beach area	General comments on the feasibility of dredging	
Two Rivers Levee & Drainage District	Schedule needs to be adjusted to meet growing season set by Federal Crop Insurance - Dates should reflect growing season of march 20 through June 30; pool elevation schedule states that operation holding at 683' and should remain this and no more.	Thank you for your input. Growing season considerations were including in alternatives analysis, found in Chapter 3 of the main report.
	keep levels at 679 all year; start increasing outflow to 10,000 at 700 instead of 707; start spring outflow to 8,000 instead of 6,000. recommendation to dredge the lake; decrease the 7 day to 3 day for the Mississippi river in the spring.	Please see Chapter 3 of the main report for all alternatives.
[redacted]	Comment- Curious as to how the impacts of sedimentation were measured. E.g. considerable ersosion along swisher creek within the flood storage elevation levels has probably put a lot of cubic yards of sediment in the lower pool, but has left an equal amount of new space within the banks of the creek.	Information about sedimentation can be found in Chapter 2.R of the main report
[redacted]	Increase both normal and major flood event outflow levels; The current maximum normal operation outflow level of 6,000 cfs only hastens and exacerbates a major flood emergency. The Army Corps of Engineers should be allowed to increase the outflow level above 6,000 cfs before the pool level reaches 707 if it is likely a major flood event will occur. Allowable Schedule B outflows should also be increased to mitigate the potential for exceeding the 712ft spillway. Reduce the major flood stage level below 707ft. This is already at 74% of flood control storage utilization. Reducing 1 or 2 feet may add sabstantial buffering and mitigate the potential for exceeding the 712 spillway.	Please see Chapter 3 of the main report for all alternatives considered.
[redacted]	"I'm imploring you to not raise the conservation pool level as it was in 1992"	
[redacted]	Idyllwild condominiums - "we feel that we would benefit by the Corps of Engineers taking these steps:" Manage to big floods, not so much small ones, Increase outflow earlier to attempt to keep more capacity in the reservoir; and manage the water more aggressively as the reservoir reaches 700 ft.	
[redacted]	We are very concerned that USACE is only looking at the effects of the plan below the dam and not caring what happens to our liveihood above the dam.	
[redacted]	I am writing concerning management of the pool level on Coralville lake. I would like to encourage USACE to lower the level or at least keep it the same. Definitely, do not consider raising it.	
[redacted]	Crop damages, Run Reservoir like you own it; and look at the whole picture.	

CORALVILLE LAKE WATER CONTROL FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

APPENDIX E

DISTRIBUTION LIST

The District sent emails to elected officials, state and Federal agencies, tribes, and interested citizens and parties announcing the project report's availability. Those citizens or groups not having an email address were sent a postcard describing the Project and included comment instructions and a link to the report's website.

State of Iowa and U.S. Elected Officials

Kim Reynolds	Governor of the State of Iowa
Ms. Abby Finkenauer	US House of Representatives 1^{st} Congressional District
Ms. Ashley Hinson	US House of Representative 1st Congressional District Elect
Mr. Grant Ewing	Congressman Dave Loebsack Staff 2^{nd} Congressional District
Mr. Robert Sueppel	Congressman Dave Loebsack Staff 2^{nd} Congressional District
Dr. Mariannette Miller-Meeks	US House of Representatives 2^{nd} Congressional District Elect
Ms. Sherry Kuntz	Senator Chuck Grassley Staff
Ms. Penny Vacek	Senator Chuck Grassley Staff
Ms. Carol Olson	Senator Chuck Grassley Staff
Mr. John Kaufmann	Senator Chuck Grassley Staff
Mr. Michael Farr	Senator Joni Ernst Staff
Mr. Joe Krenzelok	Senator Joni Ernst Staff
Mr. Sam Pritchard	Senator Joni Ernst Staff
Mr. Clarke Scanlon	Senator Joni Ernst Staff

Local Elected Officials

Tim Kemp	Mayor, Hills
Terry Donahue	North Liberty
Bruce Teague	Mayor, Iowa City
Adam Thompson	Administrator, Ely
Brad G. Hart	Mayor, Cedar Rapids
John Lundell	Mayor, Coralville
Mickey Coonfare	Mayor, Shueyville
Steve Stange	Mayor Solon
Christopher Taylor	Mayor, Swisher
Steve Berner	Mayor, Tiffin
Julie Heindel	Administrator, Columbus Junction
Shawn Mayne	Mayor, Wapello
Adam Rabe	Mayor, Marengo

Federal Agencies

Paul Taylor	Regional Administrator, FEMA Reg 7
Mike LaPietra	Federal Highways Administration, Environmental Services
Amanda DeJong	State Executive Dir., USDA
Joe Summerlin	USEPA - Region 7
Josh Tapp	USEPA - Region 7
Kraig McPeek	Ecological Services, USFWS

Doug Helmers	Partners for Fish and Wildlife Program, USFWS
Jon Hubbert	State Conservationist, USDA NRCS
Kevin McCall	State Resource Conservationist, USDA NRCS
Jason McVay	U.S. Geological Survey, Iowa City

State and Local Agencies

Kayla Lyon	Director, IADNR
Alex Moon	Deputy Director, IADNR
Joe Larscheid	Fisheries, IADNR
Todd Bishop	Wildlife, IADNR
Kurt Levetzow	Supervisor, Field Office 6 IADNR
Mark Vitosh	District Forester, IADNR
Paul Sleeper	Fisheries, Lake McBride, IADNR
Scott Gritters	Fisheries, IADNR
Chad Dolan	Fisheries, IADNR
Seth Moore	Sovereign Lands, IADNR
Kelly Poole	T&E Species, IADNR
Steve Woodruff	Hawkeye Wildlife Mgt Unit, IADNR
Kelly Stone	Water Resources, IADNR
Scott Ralston	Floodplains, IADNR
Nate Hoogeveen	Rivers, IADNR
Chris Kahle,	Floodplain Mapping, IADNR
Josh Balk	Basin Coordinator, NE IA, IADNR
Kyle Ament	Basin Coordinator Central IA, IADNR
Steve Konrady	Basin Coordinator Western IA, IADNR
Christine Schwake	Clean Water, IADNR
Jennifer Kurth	Water Quality, IADNR
Allen Bonini	Watershed Improvement, IADNR
Bill Cappuccio	Floodplain mapping, IADNR
Ron Puettmann	Lake McBride Park Manager, IADNR
Dan Kendall	Water Monitoring IADNR
Glenn Harman	Rivers Program IADNR
Karen Kinkead	Fisheries, IADNR
Rebecca Krogman	Fisheries, IADNR
Ryan Hupfeld	Fisheries, IADNR
Nick Rocca	Lake McBride State Park, IADNR
Tom Basten	Parks, IADNR
Dave Kutz	Wildlife, IADNR
Chris Mack	Fisheries, IADNR
Rhonda Folwer	Snowmobile & ATV Program Coordinator, IADNR
Joyce Flinn	Director, IA Homeland Security
Scott Marler	Director, Iowa DOT
Jim Armstrong, P.E.	District 5 Engineer, Iowa DOT
Jim Schnoebelen, P.E.	District 6 Engineer, Iowa DOT
Larry Gullett	Director, Johnson County Conservation Board
Brad Freidhof	Conservation Program Mgr. Johnson County Conservation Board

Kent Ralston	Executive Director, Johnson County Metropolitan Planning Organization
John Benson	Chief of Staff, Iowa Homeland Security
Laura Hoover	Amana Colonies Historical Site
Jon Childers	Executive Director, Amana Heritage Society
Bruce Trumpold	Secretary/Treasurer, Amana Society

Non-Governmental Organizations

Rob Manes	State Director, The Nature Conservancy
Gretchen Benjamin	Sustainable Rivers Program, The Nature Conservancy
Dale Maxson	Eastern Iowa Land Steward, The Nature Conservancy
Nicholas Longbucco	The Nature Conservancy Iowa
Jim Trepka	Group Chair, Sierra Club, Iowa City Area Group
Tamra Elliot	Land Manager, MNRA, University of Iowa
Witold Krajewski	Director, Iowa Flood Center University of Iowa
Nathan Young	Associate Director, Iowa Flood Center University of Iowa
Jeff Harney	Facilities Management, University of Iowa
Dave Conrads	University of Iowa
Tamara Lewis	University of Iowa
Meredith Caskey A R;	University of Iowa
Jay Gorsh	University of Iowa
Ryan Anthony	University of Iowa
Holly Anthony	University of Iowa
Ken Carroll	Kirkwood Community College
Zac Hall	Kirkwood Community College

Tribes

Mr. Steve Vance	THPO, Cheyenne River Sioux Tribe
Dr. Kelli Mosteller	THPO, Citizen Potawatomi Nation
Mr. Darrell Zephier	THPO, Crow Creek Sioux Tribe
Mr. Garrie Killsahundred	THPO, Flandreau Santee Sioux Tribe
Mr. Michael LaRonge	THPO, Forest County Potawatomi Community
Mr. Darrell Youpee	THPO Fort Peck Assiniboine & Sioux Tribes
Mr. Bill Quackenbush	THPO, Ho-Chunk Nation
Mr. Lance Foster	THPO, Iowa Tribe of Kansas and Nebraska
Mr. Eagle McClellan	Cultural Preservation Director, Iowa Tribe of Oklahoma
Mr. Cirtis Simon	NAGPRA Director, Kickapoo Tribe in Kansas
Mr. Kent Collier	NAGPRA Coordinator Kickapoo, Tribe of Oklahoma
Mr. Brian Molineaux	Archeologist, Lower Brule Sioux Tribe
Ms. Cheyanne St. John	THPO, Lower Sioux Indian Community
Mr. Johnathan Buffalo	Director, Historic Preservation Department, Meskwaki Nation
Ms. Trina Lone Hill	THPO, Oglala Sioux Tribe
Mr. Thomas Parker	THPO, Omaha Tribe of Nebraska
Dr. Andrea A. Hunter	THPO, Osage Nation
Ms. Elsie Whitehorn	THPO, Otoe-Missouria Tribe
Mr. Shannon Wright, Jr.	THPO, Ponca Tribe of Nebraska

Ms. Halona Cabe	THPO, Ponca Tribe of Oklahoma
Ms. Hattie Mitchell	NAGPRA Representative, Prairie Band Potawatomi Nation
Mr. Noah White	THPO, Prairie Island Indian Community
Mr. Russell Eagle Bear	THPO, Rosebud Sioux Tribe
The Honorable Tiauna Carnes	Sac and Fox Nation of Missouri in Kansas and Nebraska
	Historic Preservation Department, Sac and Fox Nation of Oklahoma
Mr. Duane Whipple	THPO, Santee Sioux Tribe of Nebraska
Ms. Dianne Desrosiers	THPO, Sisseton-Wahpeton Oyate
Mr. Leonard Wabasha	Director, Cultural Resources Dept, Shakopee Mdewakanton Sioux Community of Minnesota
Dr. Erich Longie	THPO, Spirit Lake Tribe
Mr. Jon Eagle	THPO, Standing Rock Sioux Tribe
Mr. Randy Teboe	THPO, Winnebago Tribe of Nebraska
Mr. Kip Spotted Eagle	THPO, Yankton Sioux Tribe
Ms. Heather Gibb	Interim SHPO, Iowa State Historic Preservation Office
Dr. John Doershuk	Office of the State Archaeologist

Emergency Management

Josh Humphrey	Iowa County Emergency Manager
Dave Wilson	Johnson County Emergency Manager
Travis Beckman	Deputy Johnson County Emergency Manager
Marissa Reisen	Washington County Emergency Manager
Brian Hall	Louisa County Emergency Manager
Greg Parker	Johnson County Engineer
Ed Bartels	Assistant Johnson County Engineer
Kevin Braddock	Johnson County Maintenance Supervisor
Jacob Thorius	Washington County Engineer
Larry Roehl	Louisa County Engineer
Josh Busard	Johnson County Planning & Floodplain Management
John Peterson	President of Amana Society, Inc.
Emilie Hoppe	Amana Society Director
Ron Knoche	Iowa City Director of Public Works
Jason Havel	Iowa City Engineer
Larry Weber	University of Iowa
Lynne Finn	Associate VP, Director of Facilities Management, University of Iowa
Mike Hartley	Emergency Management, University of Iowa
Ellen Habel	City of Coralville
Dan Holderness	Engineer, City of Coralville
Eric Fisher	Streets Superintendent, City of Coralville
Kevin Trom	City Engineer, Shive-Hattery Engineering, City of Hills
Jody Bailey	Watershed Coordinator, English River Watershed Management Authority Kalona, IA
Ryan Schlabaugh	English River Watershed Management Authority, City of Kalona
Jeff Carey	Public Works, City of Columbus Junction
Todd Salazar	Public Works, City of Columbus Junction
Steve Tomfeld	Public Works, City of Columbus Junction

Mike Delzell	Public Works Director/City Clerk, City of Wapello
Bobbi Benson	City of Wapello
Jeff Henke	City of Wapello
Bob Siddell	Fire Chief, Solon Fire Department
Glen Heims	Fire Chief Swisher Fire Department
Brian Detert	Fire Chief/Tiffin Public Works, Tiffin Fire Department
Jacob Nicholson	Iowa Homeland Security & Emergency Management
Vicki Stoller	Two Rivers Levee & Drainage District

Interested Parties

Bruce Mulford
Loren Southwick
Donnie Orr
Dan Dolezal
Debby McKim
Cliff Pirnat
Jill Robinson
Scott Stepanek
Tammi and Gordon Craft
Christine and Marvin Hochstedler
Gerald Alan Dunn
David Williams and Maureen Doyle
Bobette Benson
Jessica Brooks
Hills Hunting Club
T Mark Huston
Sheryl Janaszak
Chuck Masko
Christine Hochstedler
Becky & Bob Hall
Larry & Nancy Beyer
Ann Bigbee & Charlie Scott
Carole Denzler
Wayne & Joni Fields
Dale Johnson
Vicki Davidson
Adda Sayers
Dianne K. Stephan Nolte
Nancee Herman
Cindy Ballard
David Forbes
Joanne Slockett
Terri Chait
Mary Murphy
Jeff Henke

Media

The District sent a press release to Coralville planning area, regional, and state-wide media outlets. Additionally, information about the public review and upcoming meetings is posted on the District's homepage, https://www.mvr.usace.army.mil/.