Dubuque Stormwater Climate Action Plan

Dubuque Stormwater Climate Action Plan

May 2nd, 2024

Team

Anthony Lamoreux

(Project Manager)

Focus Area: Civil Practice

Oversees: Delineation and Outflow of Basins

Maren Williams

Focus Area: Tailored

Oversees: Hydrology Design

Matthew Kliegl

Focus Area: Structures

Oversees: Climate Change Impacts

Tate Houser

Focus Area: Pre-Architecture

Oversees: Structural

Agenda

- Overview
- Estimating Climate Change Impact on Rainfall Events
- Evaluate Impacts of Stormwater Infrastructure
- Develop Adaptation Options
- Recommendations for Stormwater Climate Action Plan

Our Client

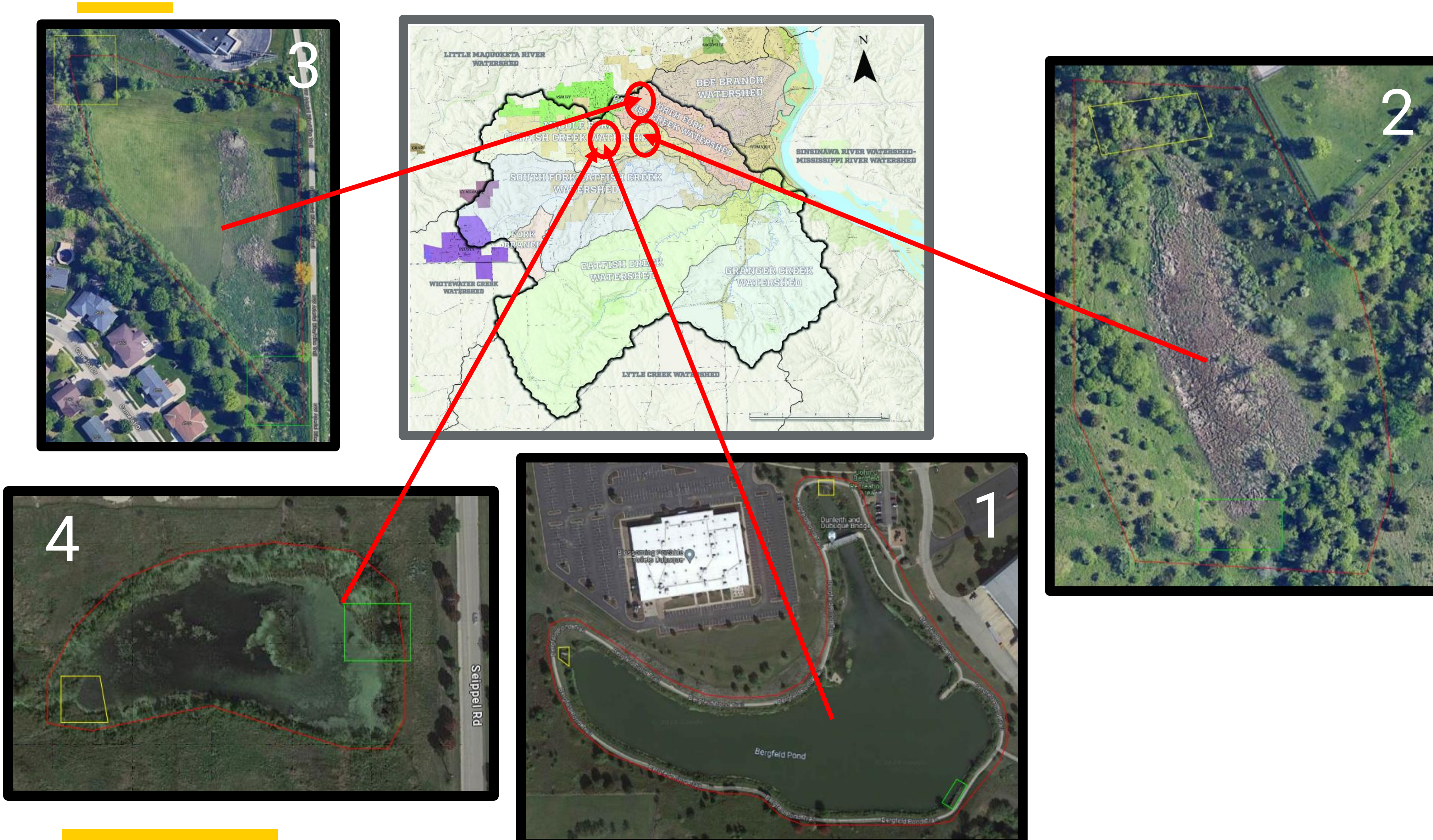
John Wiley

- Industrial Pretreatment Coordinator
- Water & Resource Recovery Center City of Dubuque

THE CITY OF DUBUQUE
Masterpiece on the Mississippi

CATFISH CREEK WATERSHED

Test Basin Locations



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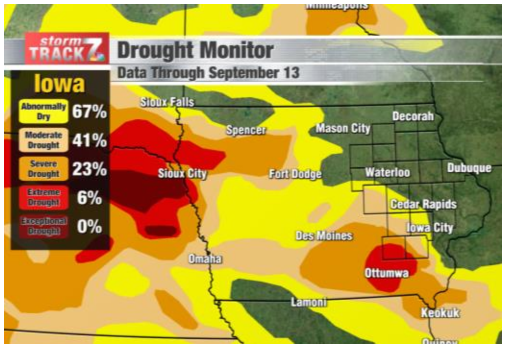
Stormwater Climate Action Plan Research



Lower Rainfall Frequency

Droughts are becoming more prevalent.

Rainfall events are happening less often.

Higher Rainfall Intensity

When it does rain, the storm has a higher intensity.

Storms are shorter.

Less Total Annual Rainfall

Because it rains less and storms aren't as long, there is less annual rainfall.

What is a Design Storm?

HYPOTHETICAL RAINSTORM EVENT

HEC-RAS

HEC-HMS

Design Recommendation

Iowa SUDAS Design Storm

24-hour 100-year storm

7.62 inches

0.32 inches/hour average

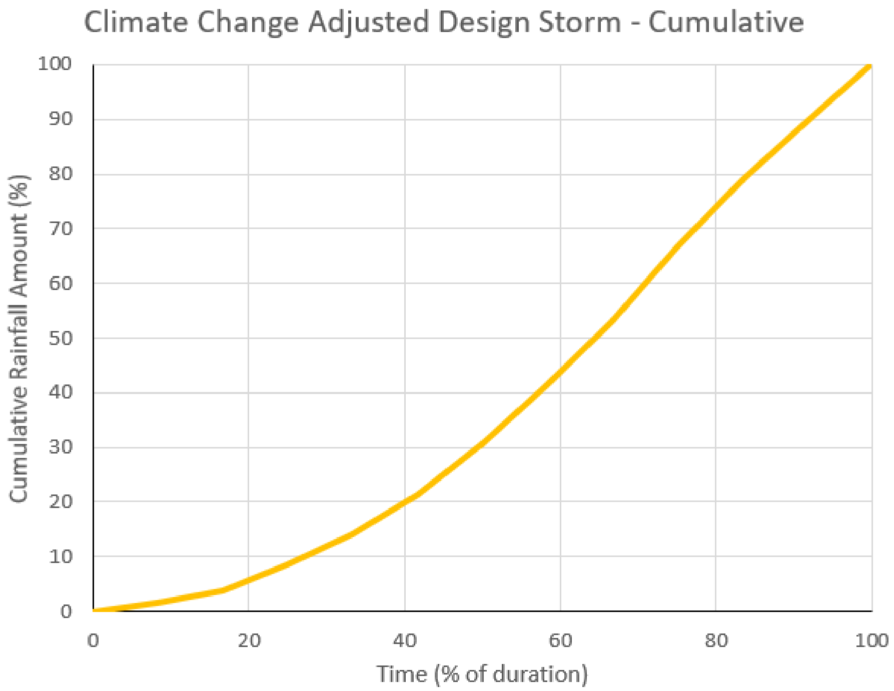
Climate Change Adjusted Design Storm (CCADS)

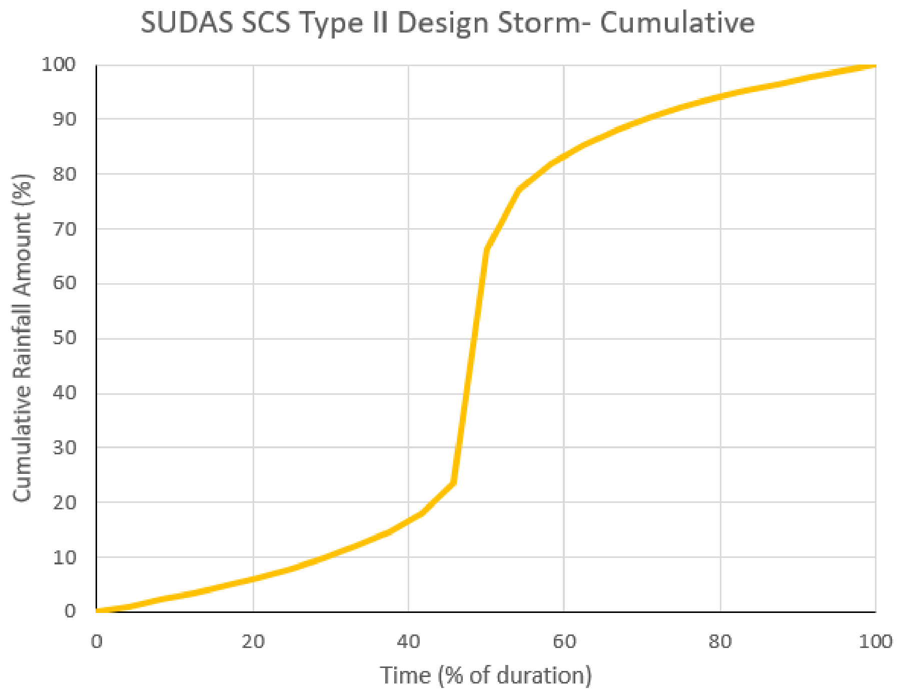
6-hour 100-year storm

5.98 inches

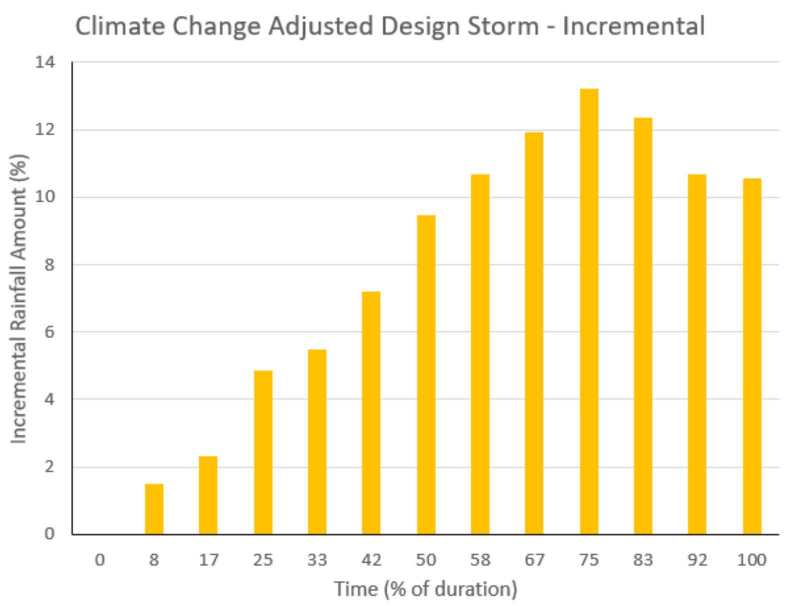
1.00 inches/hour average

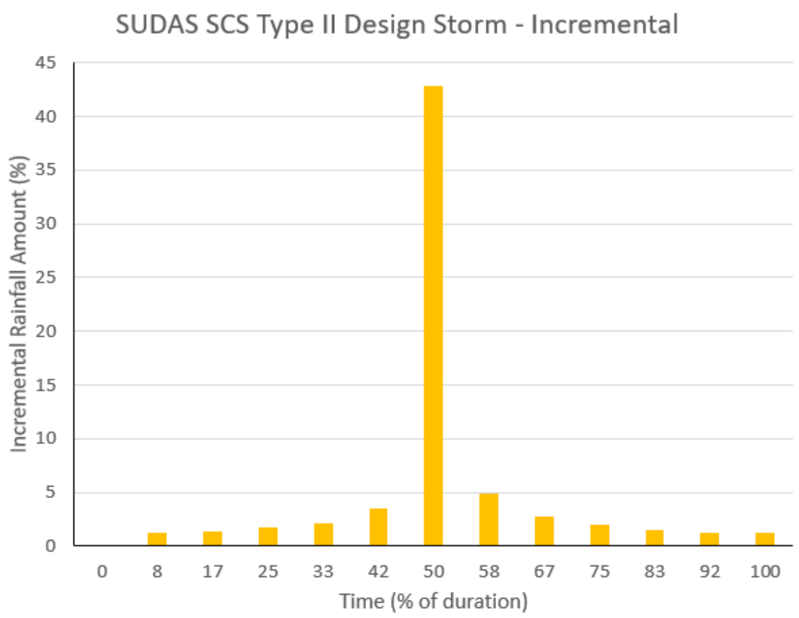
Comparison - Cumulative





Comparison - Incremental





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- Overview
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- **Evaluate Impacts of Stormwater Infrastructure**
- Develop Adaptation Options
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Project Scope

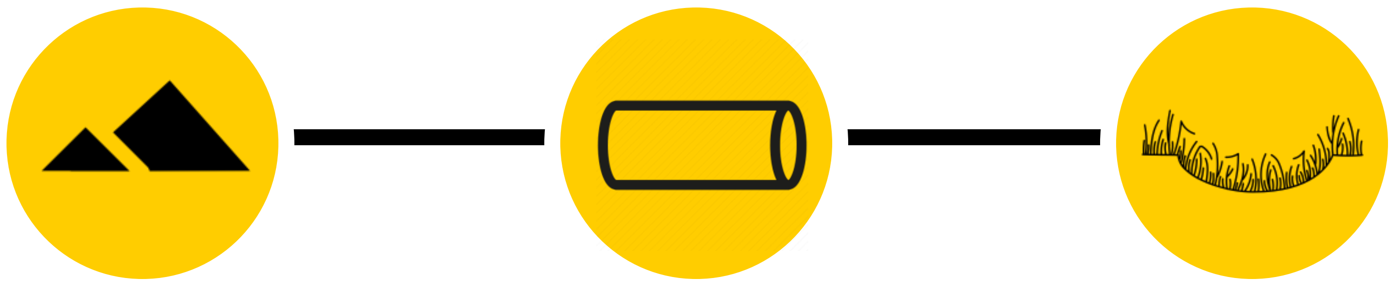



Gather → Estimate → Calculate → Evaluate → Recommend

Agenda

- Overview
- Estimating Climate Change Impact on Rainfall Events
- Evaluate Impacts of Stormwater Infrastructure
- **Develop Adaptation Options**
- Recommendations for Stormwater Climate Action Plan

Develop Adaptation Options



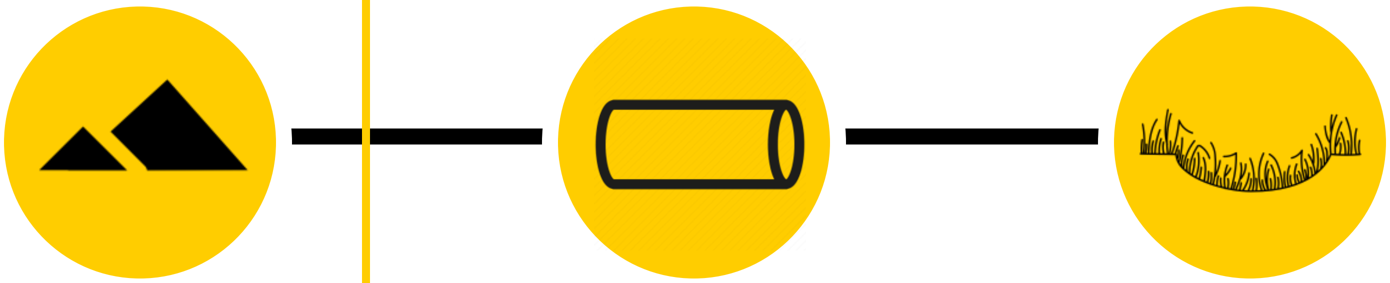
Option 1: Dam Modification

Option 2: Outlet Structure Redesign

Option 3: Stream Corridor Redesign

Alternative Locations

Develop Adaptation Options



Option 1: Dam Modification

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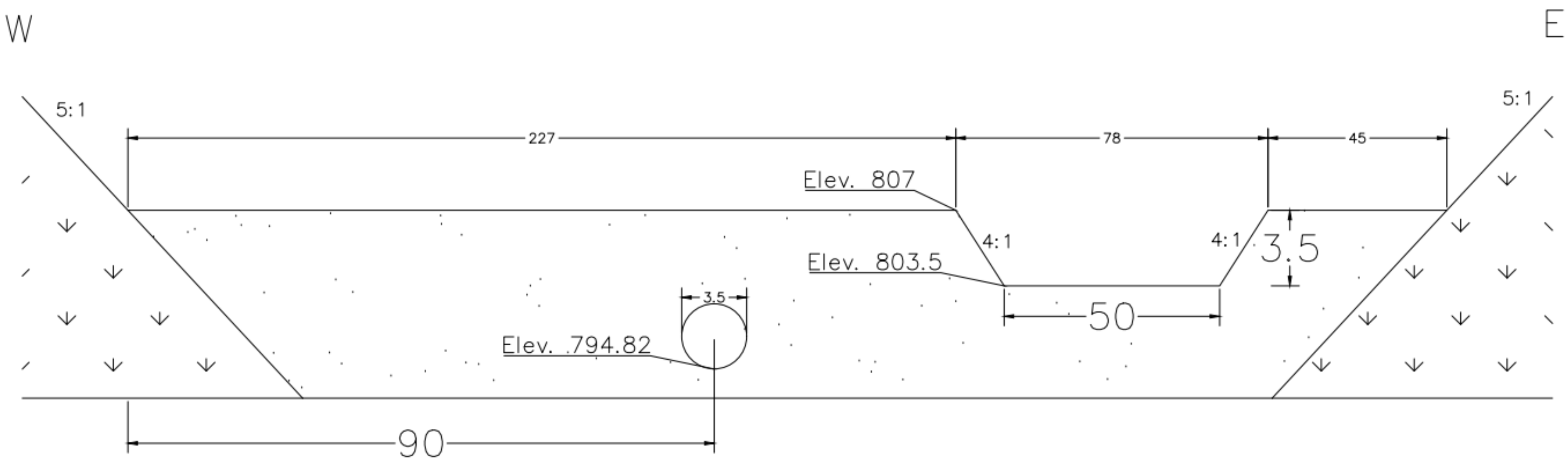
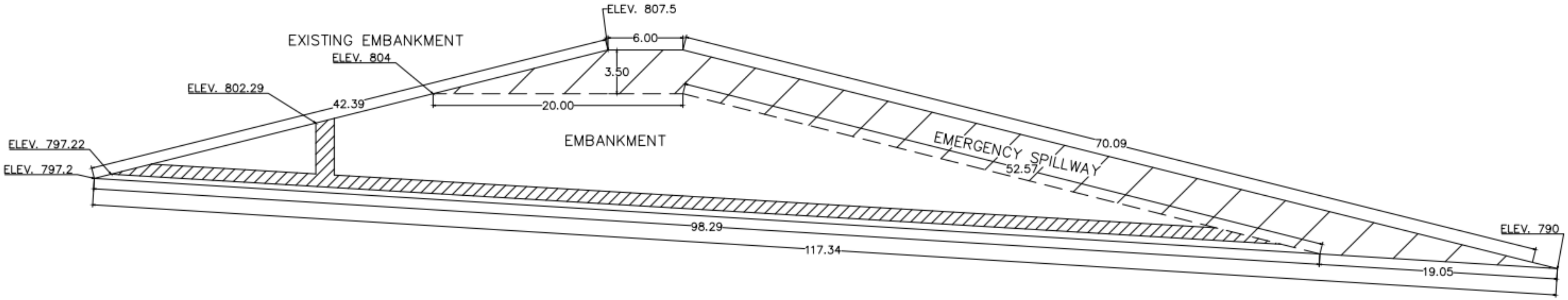
Option 3: Stream Corridor Redesign

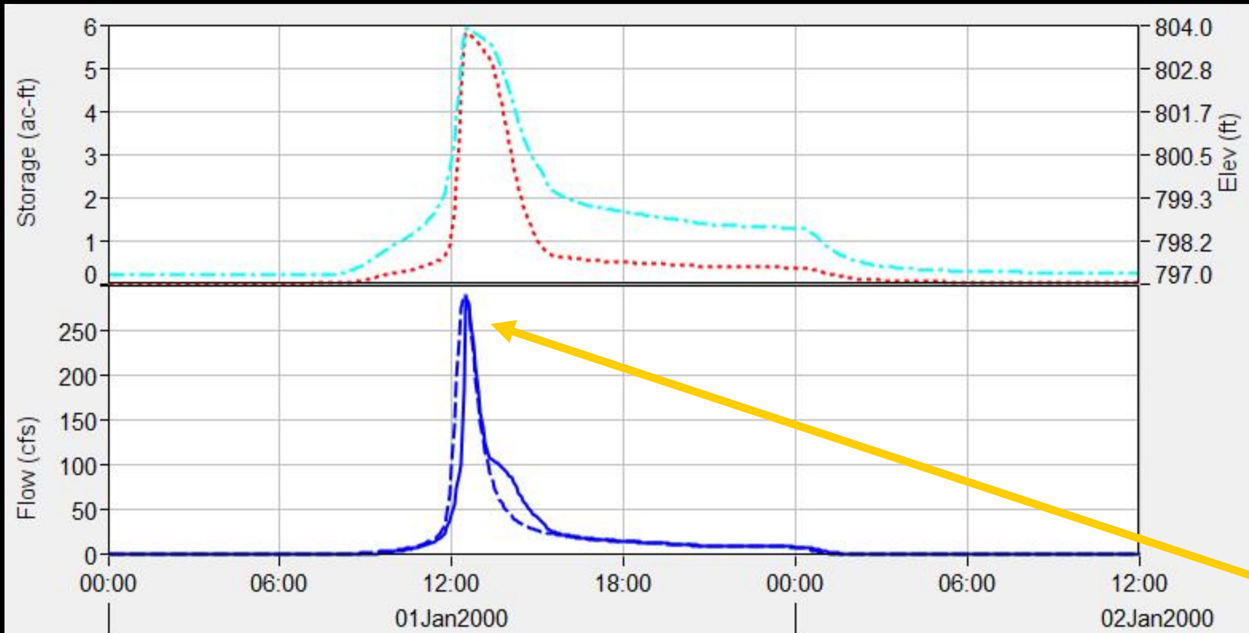
Redesigned Dam Front View



Redesigned Dam Profile



Existing Basin Performance



Run:CCADS Element:DIC2 Reservoir Result:Outflow

Run:CCADS Element:DIC2 Reservoir Result:Combined Inflow

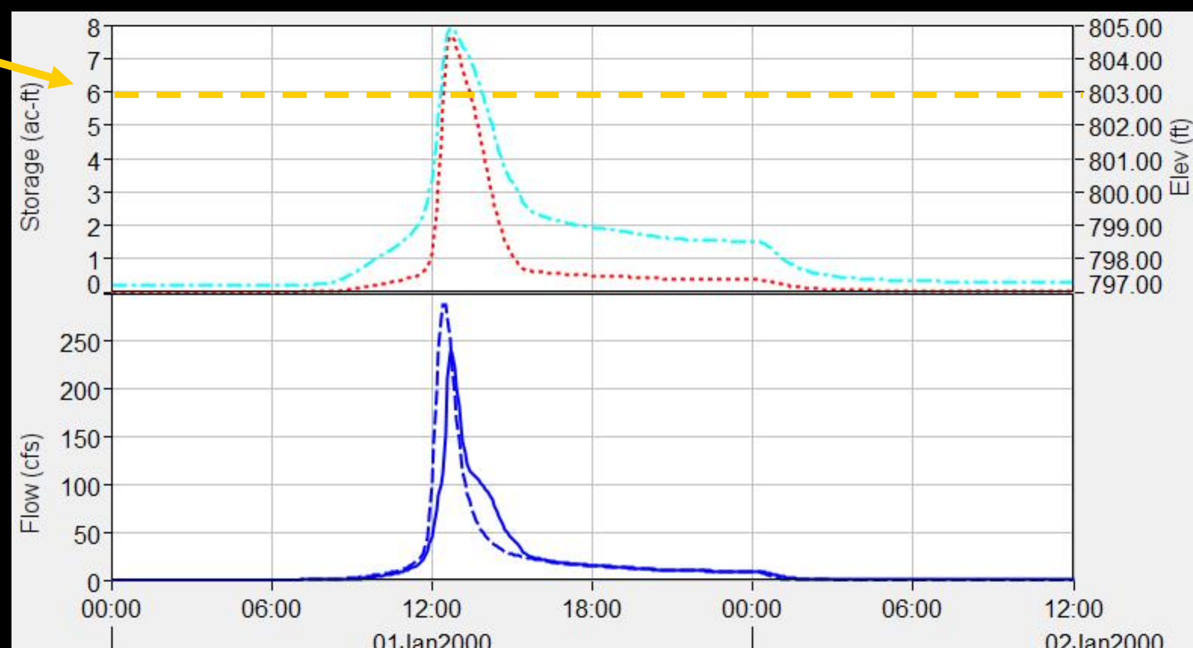
Run:CCADS Element:DIC2 Reservoir Result:Storage

Run:CCADS Element:DIC2 Reservoir Result:Pool Elevation

Outflow/Inflow Ratio = 1:1

Original Storage Level

Embankment Height Increase with Emergency Spillway



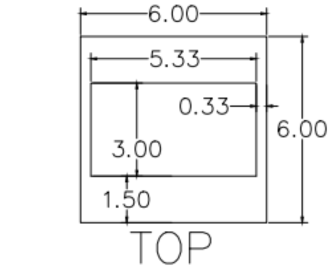
Develop Adaptation Options

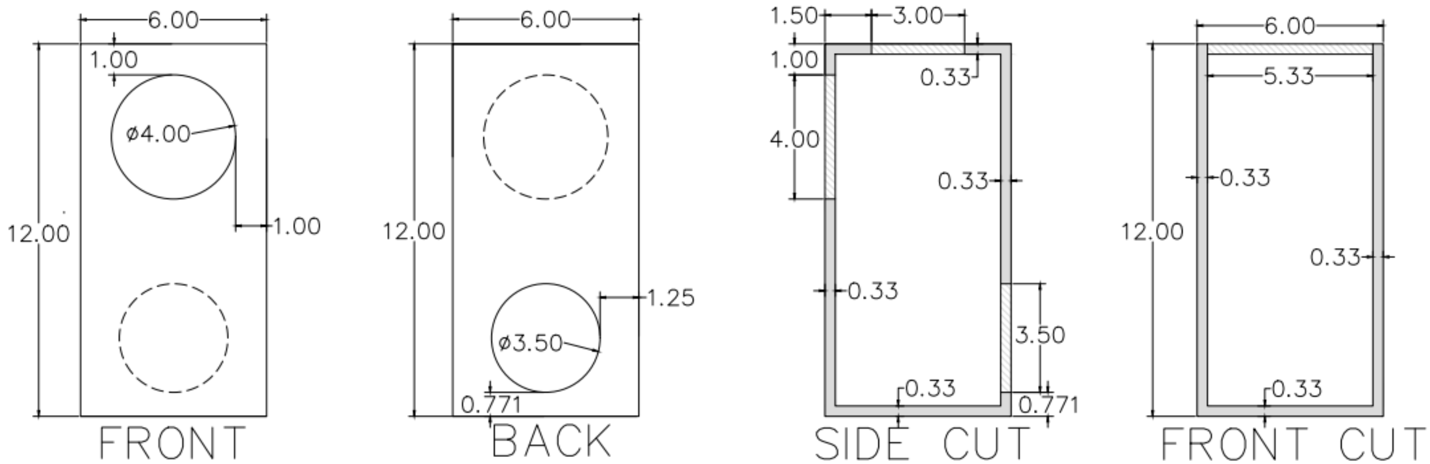
Option 1: Dam Modification

Option 2: Outlet Structure Redesign

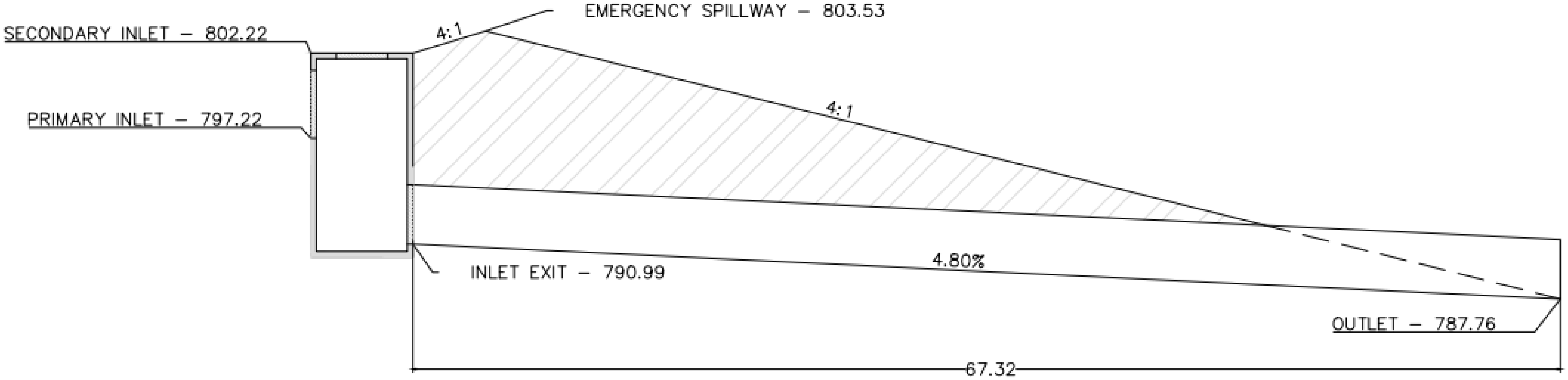
Option 3: Stream Corridor Redesign

Outlet Structure Drawing



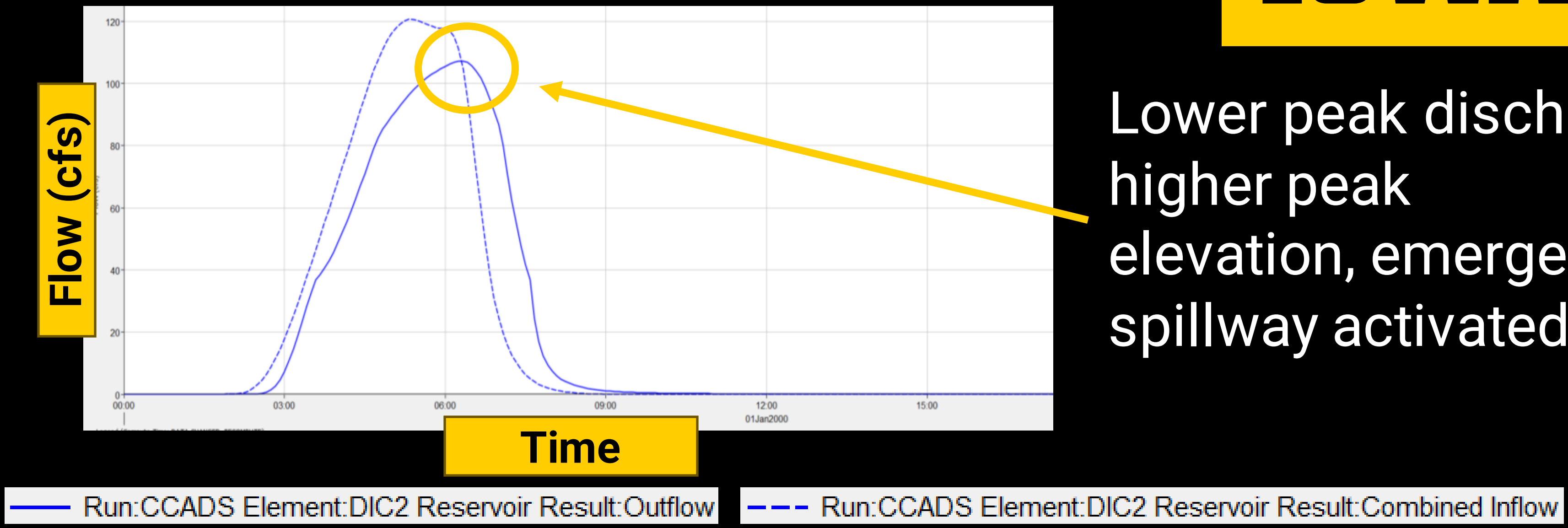


Outlet Structure Profile



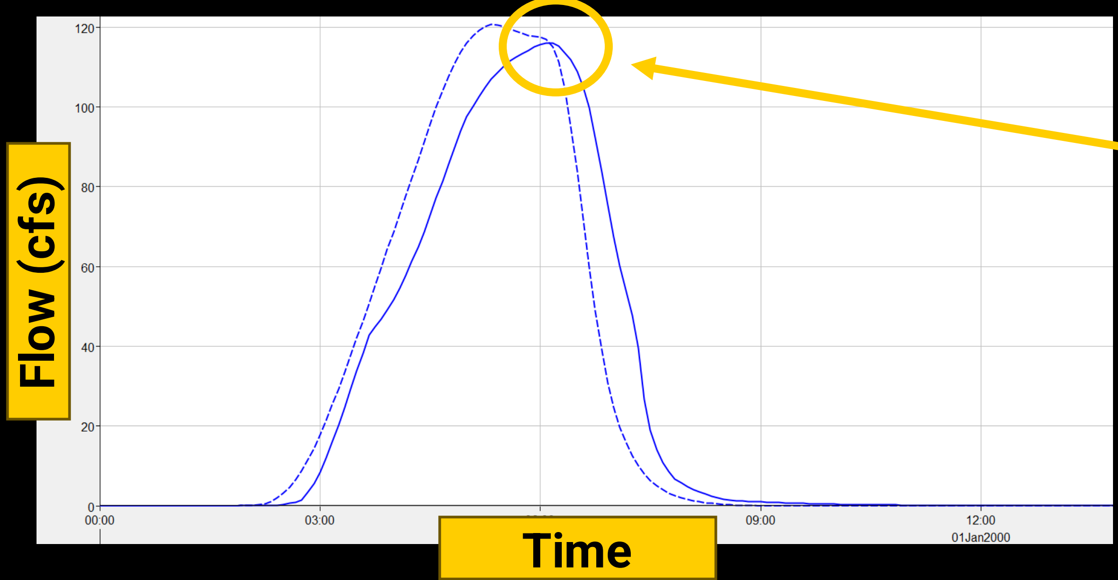
Current Outlet Structure

IOWA



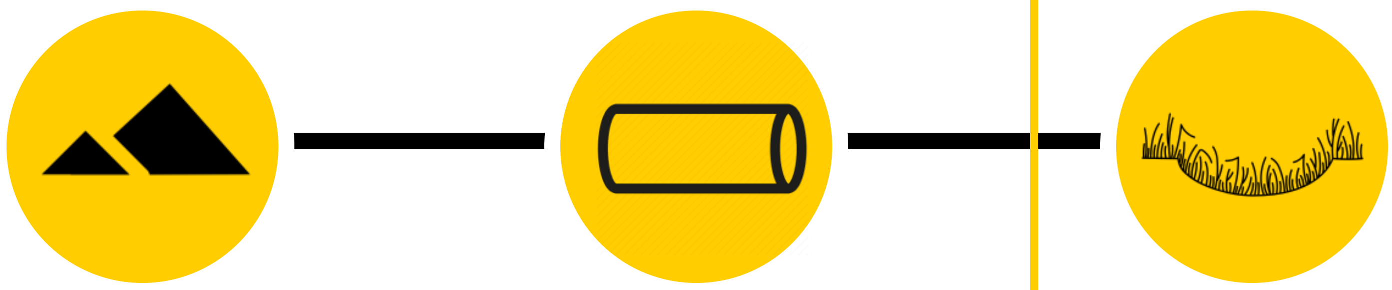
Lower peak discharge, higher peak elevation, emergency spillway activated

Redesigned Outlet Structure



Higher peak discharge, lower peak elevation

Develop Adaptation Options

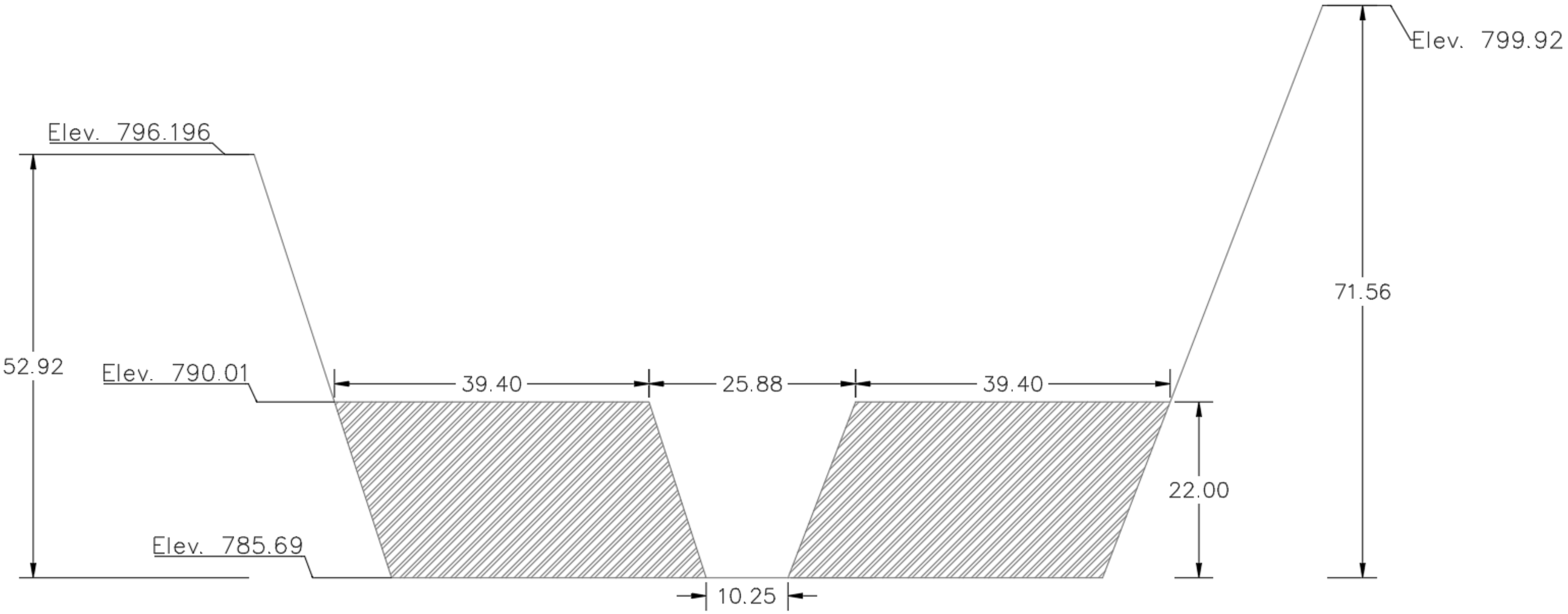


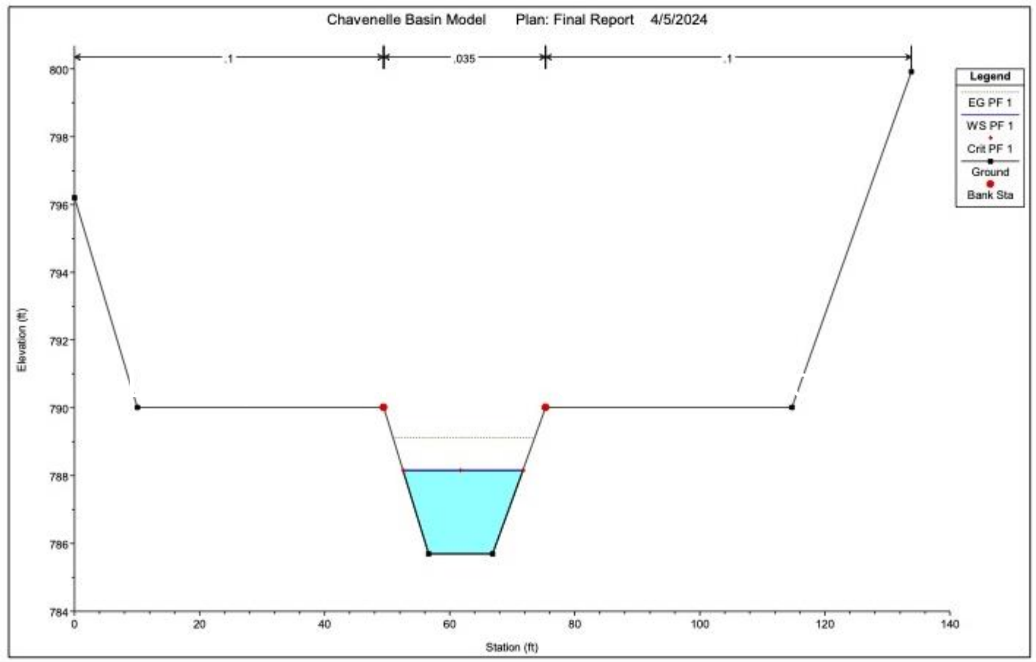
Option 1: Dam Modification

Option 2: Outlet Structure Redesign

Option 3: Stream Corridor Redesign

Channel Section





IOWA

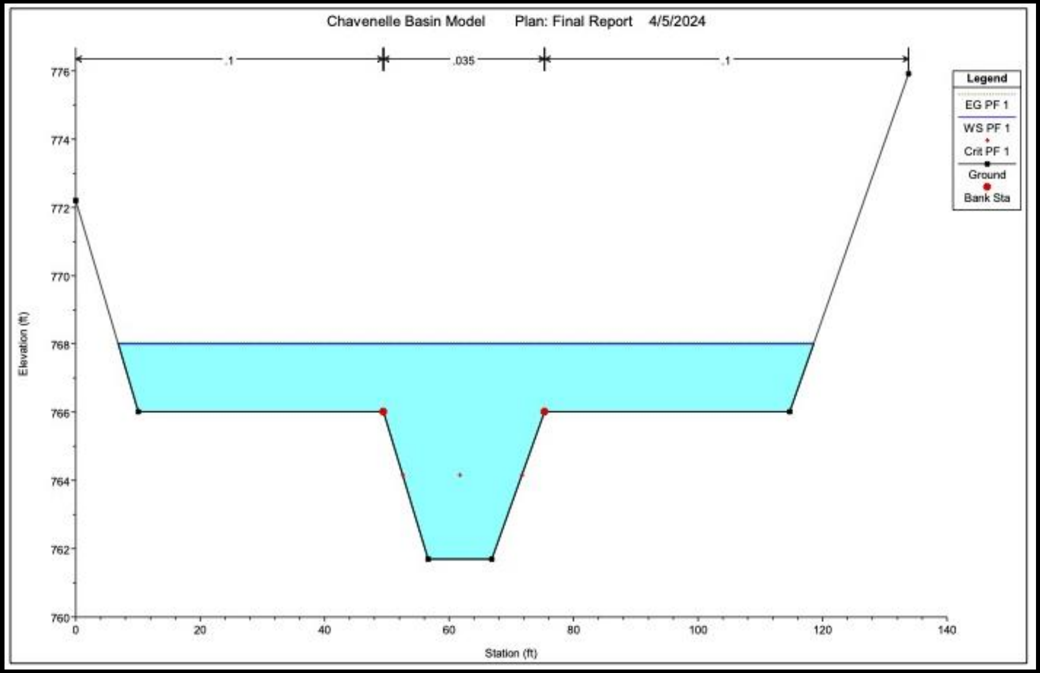
Downstream Reach Near Outfall

Roughness: +5.4%

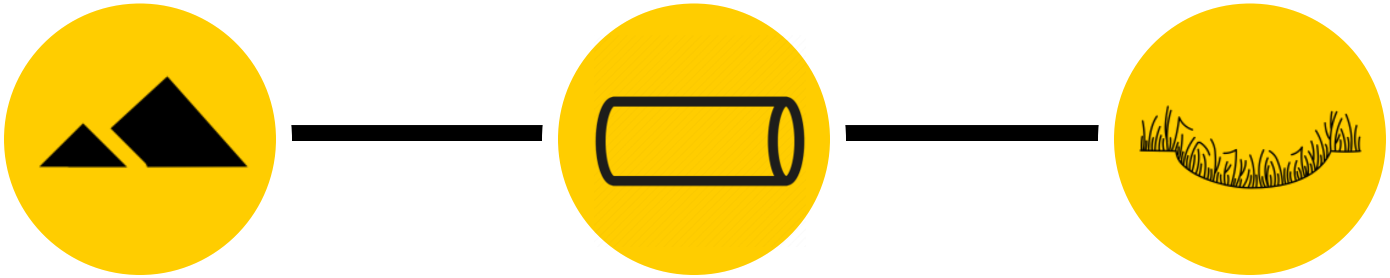
Area: +76.4%

Velocity: -55.1%

Downstream Reach Near Middle Fork Catfish Creek



Develop Adaptation Options



Option 1: Dam Modification

$213,600

Option 2: Outlet Structure Redesign

$181,750

Option 3: Stream Corridor Redesign

$220,750

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Case Study

Test Basins		Required Storage (acre-ft)		Available Storage Used (%)		Peak Inflow (cfs)		Peak Discharge (cfs)	
Basin #	Drainage Area (acres)	Iowa SUDAS	CCADS	Iowa SUDAS	CCADS	Iowa SUDAS	CCADS	Iowa SUDAS	CCADS
Basin 1	2656.0	38.0	49.0	73.8%	95.2%	1764.7	2665.3	1763.1	2653.7
Basin 2	115.2	5.8	5.4	111.5%	103.8%	288.7	120.6	285.7	117.6
Basin 3	358.4	71.1	69.1	84.7%	82.3%	806.2	391.8	158.9	153.5
Basin 4	864.0	8.9	13.4	54.0%	81.3%	467.1	886.2	466.7	882.8

Data Extrapolation

Drainage Area	Average Available Storage Used	Average Change in Peak Flows from SUDAS Design Storm to CCADS
Less than 500 acres	Iowa SUDAS: 98.1%	Inflow Change: -54.8%
	Climate Change Adjusted Design Storm: 93.1%	Outflow Change: -31.1%
Greater than 500 acres	Iowa SUDAS: 63.9%	Inflow Change: +70.4%
	Climate Change Adjusted Design Storm: 88.2%	Outflow Change: +69.8%

Action Plan

Action	Description	Frequency
Detention Basin Model	Phase 1: Test all basins with Climate Change Adjusted Design Storm. Phase 2: Monitor design storm prediction.	Initially Significant Change in Climate Predictions
Land Cover Study	Evaluate the land cover changes and calculate new curve numbers within the watershed.	10 years OR Significant Land Development
Inspection: Upstream and Downstream	Integrity inspection of reaches upstream and downstream of the detention basin.	10 years OR Heavy Rainfall Event (>1 in/hr for at least 1 hr)
Inspection: Field	Field inspection of the basin and hydraulic structure.	5 years
Maintenance: Structural	Address erosion and hydraulic structure issues.	Late Summer - Annual
Maintenance: Debris	Seasonal cleanup of debris at the basin.	Early Spring and Late Fall - Semiannual
Amend Design Standards	Amend storm sewer design standards to require an overland route capable of conveying the 500-year event.	Initially

Maintenance – Debris

Early Spring and Late Fall

Maintenance – Debris
Early Spring and Late Fall

Maintenance – Structural

Late Summer

Inspection (Basin)

Every 5 years

Inspection - Upstream and Downstream

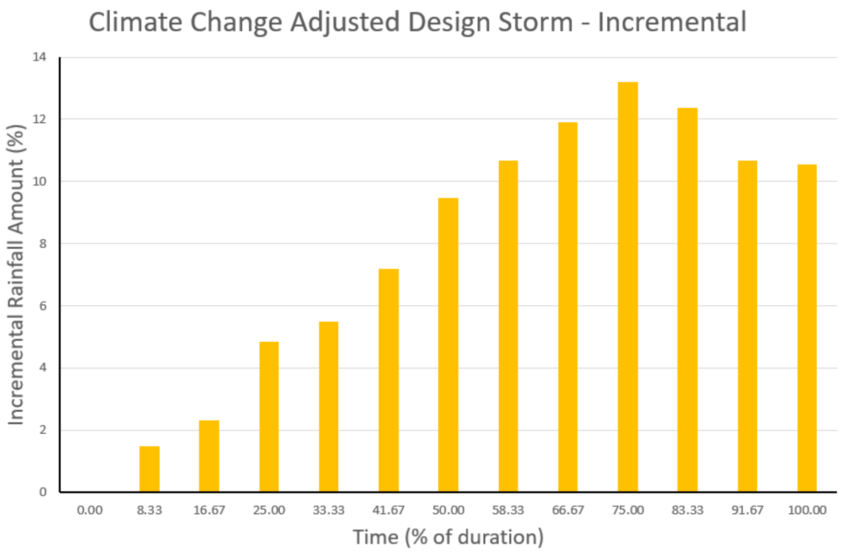
Every 10 years OR Heavy Rainfall Event (1.0 inch/hour for at least one hour)

Land Cover Study

10 years OR Significant Land Development

Detention Basin Model

Initially OR Significant Change in Climate Predictions



Phase 1

Phase 2

Dubuque Stormwater Climate Action Plan

Questions?

Team
Tate Houser
Anthony Lamoureux
Matt Kliegl
Maren Williams

The University of Iowa
Civil and Environmental Engineering

Dubuque Stormwater Climate Action Plan

Thank you

T.A.M.M
Tate Houser
Anthony Lamoureux
Matt Kliegl
Maren Williams

The University of Iowa
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