Dubuque Stormwater Climate Action Plan

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Project Overview

Four regional detention basins in the Catfish Creek Watershed were studied to gauge climate change effects on Dubuque's rainfall. Historical and projected rainfall data were used to forecast future rainfall patterns. During basin analysis, DIC2 surpassed its storage capacity under the new Climate Change Adjusted Design Storm. In response to increasing rainfall intensity due to climate change, three adaptation options were developed for the DIC2 basin, along with city-wide recommendations in the Dubuque Stormwater Climate Action Plan.

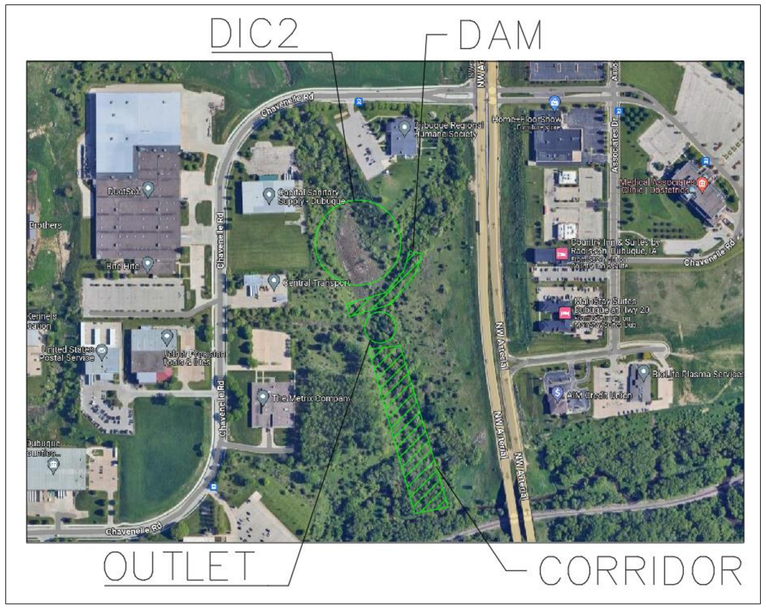

Figure 1. DIC2 Basin with basin area and adaptation options outlined.

Research

A climate study for Dubuque examined water infrastructure's capacity to manage present and future rainfall. Findings indicate rising rainfall intensity, reduced frequency, and overall volume decline in response to continued carbon emission release. Consequently, rainfall is projected to become more intense, shorter in duration, and less frequent.

Precipitation Days within the Month		
July		
1951-1975	1976-2000	2001-2023
10.2	10.1	9
Percent Change		-12.1%

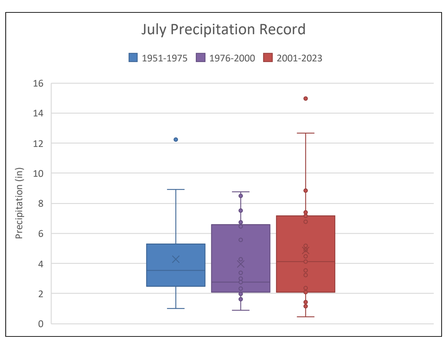

Figure 2. Rainfall analysis of Dubuque, IA during the month with the largest rainfall (July).

Adaptation Options

Three adaptation options were crafted for DIC2, intended for adaptation and application to other basins, considering their performance under the application of the Climate Change Adjusted Design Storm. Adaptation options must be further evaluated for effectiveness in each basin if implemented.

Dam Modification: increase in embankment height to allow for increased storage volume.

Outlet Structure Redesign: adjustment of structure hydraulics to balance attenuation in the basin and increased flows in the outlet structure.

Stream Corridor Redesign: redesign of the stream corridor to contend with increased velocities and erosion, along with creating a controlled floodplain.

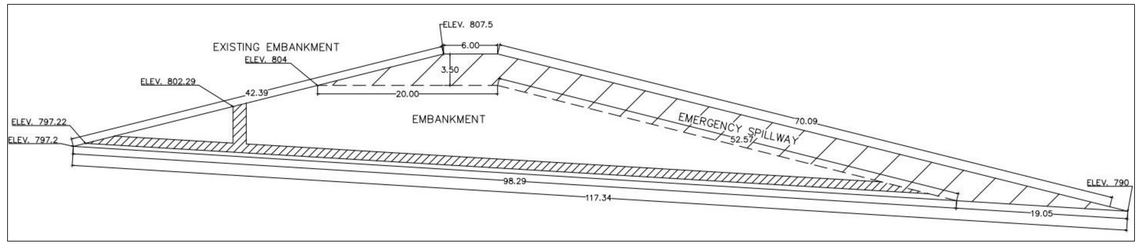

Figure 3. Dam modification profile.

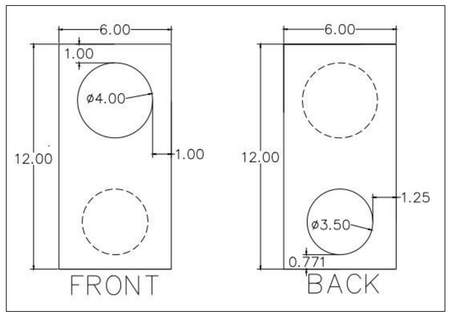

Figure 4. Outlet structure redesign front and back views.

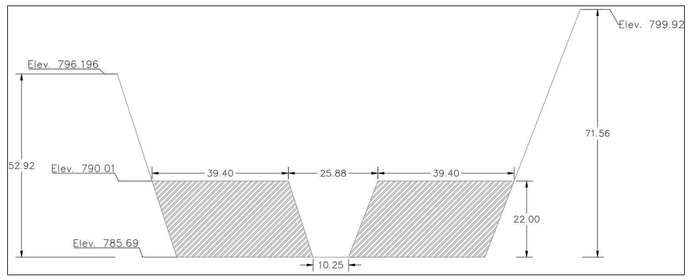

Figure 5. Stream corridor redesign channel section.

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

Figure 6. Action plan recommendations.

Dubuque Stormwater Climate Action Plan

The culmination of research and analysis on the four detention basins has facilitated the formulation of several actionable strategies. Acknowledging the imminent challenges posed by climate change, the creation of the Dubuque Stormwater Climate Action Plan aims to equip the City of Dubuque to confront forthcoming rainfall challenges proactively. These insights can be extrapolated city-wide to all detention basins, providing guidance on the preemptive measures Dubuque can undertake presently to increase resilience against climate change. By implementing these measures comprehensively, Dubuque can not only mitigate the impacts of climate change but also to pave the way for a more sustainable and resilient future for its residents.

Design Storm Characteristics	Iowa SUDAS SCS Type 2 Design Storm	Climate Change Adjusted Design Storm
Storm Type	100-year 24-hour Design Storm	100-year 6-hour Design Storm
Rainfall Amount (inches)	7.38 inches of rain over a 24 hour period	5.98 inches of rain over a 6 hour period
Rainfall Intensity (inches/hour)	0.31 inches/hour	1.0 inch/hour
Rainfall Volume	Greater Overall Volume	Less Overall Volume

Figure 7. Design storm comparison.