BUFFALO BAYOU AND TRIBUTARIES
FLOOD CONTROL PROJECT
ADDICKS & BARKER
DAMS & RESERVOIRS 101
PAST, PRESENT & FUTURE

*The views, opinions and findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation.*
Houston Average Annual Rainfall – 49.77 inches
ADDICKS, BARKER AND BUFFALO BAYOU WATERSHEDS
Early Houston Floods
31 May-2 June 1929 and 7-10 December 1935
Ungated Conduits at Addicks and Barker Dams

Jan. 20, 1945
CHANGES AND THEIR IMPACTS

Project Modifications
- Deletion of South Canal
- Deletion of Cypress Creek Levee
- Gating of the Structures

+ Downstream Changes
- Increased Development
- Decreased Releases

- + Upstream Changes
- Increased Development
- Increased Run-off
- More Rapid Run-off

= Results of Changes
- More Frequent Pools
- Faster Rising Pools
- Larger Pools
- Longer Lasting Pools
### Top Ten Pools – Addicks and Barker Reservoirs

#### Addicks Dam & Reservoir

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#### Statistics

- ADDICKS DAM & RESERVOIR:
  - 100 YR FEQ (9): 100.30
  - GOL (7): 95.00
  - MAX POOL (8): 108.00

- BARKER DAM & RESERVOIR:
  - 100 YR FEQ (9): 95.00
  - GOL (7): 95.00
  - MAX POOL (8): 104.00
So How Do We Work?

Mission
- Reduce the risk of flooding downstream on Buffalo Bayou in order to protect Houston and the Houston Ship Channel.

Important Numbers
- All rain after 2” is 100% runoff
- Buffalo Bayou is managed at 2000 CFS at the Piney Point USGS Gauge
- Water takes 8 hours to travel from the gates to Piney Point Gauge

When to Close the Gates?
- Whenever the threat of downstream flooding is imminent!
- Usually this means anything over 2” of rain upstream of the dams, and/or 1” below the dam falls.
The threat of rain in the forecast dictates the caution exercised in the opening and closing of gates to prevent flow over 2000 CFS at Piney Point.
Record Rain Fall Leads to Record Pools

- Fastest Rising Pool in 35 Year
- Flooding and Damaging Inflows
- All Major Roads in Both Addicks and Barker Flooded
Hurricane Harvey 24-29 August 2017
The Forecast Changes!

- Tropical Storm Harvey is forecast to track westward across the Caribbean Sea over the next 5 days and into Central America or the Yucatan Peninsula as shown.
- Beyond 5 days could continue westward over land or turn more northwestward and track into the Southern Gulf of Mexico.
- Storm poses no immediate threat to Southeast Texas but will need to monitored the next several days.

August 18th NOAA Briefing

August 23rd NOAA Afternoon Briefing

August 25th NOAA Afternoon Briefing
What Fell on Houston

The Single Greatest Rainfall Event in US History

Addicks and Barker Facts
- Record Pools
- Flooding around the north end of Addicks Reservoir
- First time in over 70 year history to release water while flooding occurring and still raining

Houston Average Annual Rainfall – 49.77 inches
Addicks and Barker Pool Levels

The reservoirs contained 149 Billion of the 1.2 Trillion Gallons that Fell on Harris County

Harvey (30 August 2017) – 30’ deep

Today
Addicks Dam Limits of Government Owned Lands
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Addicks and Barker Emergency Coordination Team

ABECT

Harris County Homeland Security & Emergency Management
Harris County Flood Control District
OEM
National Weather Service
TSA
US Army Corps of Engineers
USGS
Addicks and Barker Dams classified as DSAC II based on Screening Portfolio Risk Assessment

Issue Evaluation Study (IES) Team identifies technical issues concerning the safety of the dams and potential consequences to the City of Houston should the dams fail

Recommends classification be changed to DSAC I

Dam Senior Oversight Group changed classification to DSAC I
**Interim Risk Reduction Measures**

- **Grouting of Conduits and Parabolic Chute**
  - September 2010: Polyurethane Grouting of Conduits & Parabolic Chute
  - April 2011: Cementious Grouting of Conduits & Parabolic Chute
  - May 2011: Granular Filter Around Ends of Conduits
  - August 2012: Barker Gate Replacement
  - June 2013: Dam Safety Modification Report
  - July 2013: EA & FONSI
  - October 2014: Parabolic Chute Slab Steel Plate

- **Granular Filter Around Ends of Conduits**
- **Barker Gate Replacement**
- **Parabolic Chute Slab Steel Plate**
- **Gate Operators & Emergency Generators**
New Outlet Structures Design and Construction

Design Completion: May 2015
Contract Award: August 2015
Contractor: Granite Construction Company
Construction Start: November 2015
Construction Completion: October 2019
Contract Award with Options: $71,981,540
Contract Modifications: $370,000
Current Contract Amount: $72,351,540
Scheduled Progress: 15%
Actual Progress: 6%
Remarks: Rains have resulted in reservoir pools which have impacted progress of construction
Barker Dams New Outlet Structure

Approved Plan Consist of the Construction of A New
- Outlet Structure
- Parabolic Spillway
- Stilling Basin
- Outlet Channel
- Grouting & Abandoning the Existing Outlet Structure in Place

New Outlet Structure
- Located within Existing Dam Embankment
- Approximately 400 Feet North from Existing Outlet Structure
- Three 12-ft Diameter Steel Lined Conduits
- 12X12-ft Rectangular Steel Gates at the Intakes

Barker Reservoir

Noble Road Cut-off Wall
- 1,400-ft long cement bentonite slurry cut-off wall
- Located along upstream embankment at Noble Road
- Will Address Seepage Issues at this Location

Noble Road Cut-off Wall
- Located along upstream embankment at Noble Road
- Will Address Seepage Issues at this Location

US Army Corps of Engineers®
ADDICKS CONSTRUCTION UNDERWAY
The first release of water from Barker Dam’s new Water Control Structure occurred on 14 FEB 20 at 0930 with a release of approximately 300 cfs.
Purpose The study has two goals

- **Flood Risk Management:** Identify and recommend an alternative that reduce the risk of flooding along Buffalo Bayou and its tributaries and upstream and downstream of Addicks and Barker Reservoirs due to changed physical and economic conditions since construction of the project in the 1940s.

- **Dam Safety:** Reassess the integrity of Addicks and Barker Dams in light of changed hydrologic conditions and determine if and what measures are needed to address dam safety concerns.

A number of physical improvements and operational changes to the project have been implemented in response to steady growth of the Houston metropolitan area. However, the watershed continues to experience major flood events, including the most recent and most significant during Hurricane Harvey in 2017.
Study Process

What is NEPA?
- One of the nation’s oldest environmental laws
- Requires Federal agencies to consider and disclose the environmental and social effects of their proposed actions in a publicly available document.

What type of document will be prepared?
An Environmental Impact Statement (EIS) will be prepared and fully disclose the:
- Purpose and Need,
- Alternatives Considered,
- Baseline Conditions,
- Environmental Effects,
- Social Effects.

An EIS results in a Record of Decision (ROD)

What topics are being evaluated?
- Air Quality
- Climate Change
- Hydrology
- Water Quality
- Wetlands
- Fish and Wildlife Resources
- Recreation
- Traffic
- Land Use
- Cultural and Historic Resources
- Economics and Socioeconomics
- Noise
Buffalo Bayou Resiliency Study

Three primary problem areas have been identified.

1. Flooding downstream of the reservoirs on Buffalo Bayou
2. Flooding upstream of the reservoirs
3. Performance and risk issues related to flow around and over the uncontrolled spillways.

Goal: Improve the effectiveness of Addicks and Barker project and reduce the upstream and downstream flood risks along Buffalo Bayou and Tribs.

Potential Structural Measures
- Tunnels
- Bypass
- Diversion
- Levees
- New Reservoir/Dam
- Detention
- Channel Improvements
- Sedimentation Basin
- Increase Reservoir Storage
- Auxiliary Spillway Improvements
- Remove Dams
- Modify Existing Discharge Capacity
- Relocation of Auxiliary Spillway

Potential Non-Structural Measures
- Change Release Schedules in the Addicks and Barker Water Control Manual
- Buyout/Acquisition
- Dry/Wet Flood Proofing
- Flood Warning Systems
- Signage
- Public Education/Outreach about Risk
- Update Emergency Action Plan/Hazard maps

This is a living list of measures as its early in the study and many measures will be developed, analyzed, and compared for feasibility (both economic and performance).
## Management Measures Considered During Plan Formulation

### Storm Water Storage
- New Reservoirs/Dams*
- New Detention Basins
- Sedimentation Basins
- Increase Reservoir Storage*
- Levees/Floodwalls

### Storm Water Conveyance
- Bypass Channels
- Diversion Channels*
- Tunnels*
- Channel Improvements*

### Limit Exposure & Vulnerability
- Land Acquisition/Relocation
- Flood Proofing
- Warning Systems
- Raising a Structure in Place
- Update Emergency Action Plans and Hazard Maps

### Dam Safety
- Auxiliary Spillway Improvements
- Relocation of Auxiliary Spillway
- Modify Dam Operations
- Remove Dams

### Plan Formulation:
The process of building alternatives and eventual plans that meet study objectives while also avoiding any study constraints in order to achieve a complete and effective plan.

### Management Measure:
Generalized concept or approach that addresses one or more problems.

### Anchor Measure:
A management measure that serves as the basis for the alternative and contributes the greatest benefit to addressing a problem(s).

### Alternative:
Consists of either a stand-alone management measure or a combination of management measures as a means of addressing problems and objectives. For this study, alternatives would be either a stand-alone anchor measure or an anchor measure combined with other management measures.

### Alternatives Developed Around the Anchor Measure

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* Note: Each alternative may have additional non-anchor measures added to the alternative to further reduce risk.
Potential Storm Water Conveyance Measures

Structural measures that reduce the impacts of riverine flooding by improving how water moves through the drainage system.

Bypass and Diversion Channels
A channel that redirects river flows at a point upstream of a particular area and then discharge the flow back into the same river (bypass) or a separate nearby drainage system.

Tunnels
An underground floodway that diverts excess floodwaters from the surface into underground tunnel. The tunnels would then carry and discharge water.

Channel Improvements
Various measures that are undertaken to increase flow depths/widths and increase the overall carrying capacity and effectiveness.

Other Forms of Channel Improvement:
- Bridge modifications
- Add/Remove/Modify Culverts
- Weirs
Potential Storm Water Storage Measures

Note: These measures and locations are conceptual and subject to change during the formulation and technical analyses phase. Any combination of a subset of these measures could be included in the alternatives developed.
Potential Measures that Limit Exposure and Vulnerability

Nonstructural Measures reduce human exposure or vulnerability to a flood hazard without altering the nature or extent of that hazard.

- A **hazard** for this study refers to water associated with flooding within the Buffalo Bayou Watershed.
- An **exposure** is who or what would be impacted by the hazard.
- A **vulnerability** is how susceptible exposed people and properties are to damage or harm from the hazard.

Nonstructural Measures being considered:

- Land Acquisition
- Relocation
- Flood Proofing
- Warning Systems
- Raise Structure in Place
- Update Emergency Action Plans and Hazard Maps
Overview – Dam Safety Phase II

What was done in Phase I?
The Phase I Dam Safety Modification Study (DSMS) was completed in 2013. The DSMS identified solutions to address the primary dam safety concerns:

- Seepage and piping beneath, around, and near the outlet structures

In 2015, USACE awarded a $75 million contract to replace the outlet structures. Work should be completed in 2020.

Current Dam Safety Rating

DSAC 1: “Extremely High Risk”

This designation is based on a formula that accounts for the dam safety risks and potential consequences (life loss and property damages) downstream if something happened to the dam. When a dam protects a significantly populated area like Houston, the consequences of failure are much greater than if the dam was protecting farm or ranch land.

What is Phase II?
The Phase II Dam Safety Modification Evaluation will identify solutions to secondary dam safety concerns including:

- How will the dams respond to flow around the ends of the dams and/or over the auxiliary spillways?
- How does changing precipitation patterns affect the frequency of flow around the end or over the auxiliary spillways of the dams?

Addicks and Barker Dams are not in imminent danger of failing. The two dams are continuously monitored by full-time staff to ensure their structural integrity.
Questions

Addicks and Barker Dam Safety Program

Thank You