USACE GALVESTON DISTRICT
SUMMER 2017 STAKEHOLDER PARTNERING FORUM
BUFFALO BAYOU & TRIBUTARIES, HOUSTON, TEXAS
ADDICKS AND BARKER RESERVOIRS
DAM SAFETY MEGA PROJECT OVERVIEW

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"The views, opinions and findings contained in this report are those of the
authors(s) and should not be construed as an official Department of the Army
position, policy or decision, unless so designated by other official documentation."
Addicks and Barker Dams

- Background
- Project Status
- Critical Issues
BACKGROUND
**Project:** Buffalo Bayou, Addicks and Barker Dams  
**Location:** Houston, Texas  
**Program:** Dam Safety  
**Purpose:** Flood Risk Management  
**Phase:** Construction  
**Total Authorized Project Cost:** $129,883,340  
**Sponsor:** 100% Federal  
**Dam Safety Action Classification (DSAC):** DSAC 1  
**Dam Safety Issues:** High risk associated with seepage and piping beneath, around, and near the outlet works structure conduits and risks associated with auxiliary spillway flows and flows around the ends of the dams  
**Population at Risk:** 1.2 million  
**Potential Economic Consequences:** $60 billion

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**Addicks Dam**  
- **Dam Type:** Earth Embankment  
- **Max. Height:** 48.5-ft  
- **Max Pool Elevation:** 115-ft NAVD88  
- **Length:** 11.6 miles  
- **Outlet Works:** 5 – 8-ft x 6-ft gated conduits  
- **Watershed/Drainage Area:** 136 sq. mi.

**Barker Dam**  
- **Dam Type:** Earth Embankment  
- **Max. Height:** 36.5-ft  
- **Max Pool Elevation:** 108-ft NAVD88  
- **Length:** 13.6 miles  
- **Outlet Works:** 5 – 9-ft x 7-ft gated conduits  
- **Watershed/Drainage Area:** 130 sq. mi.
Early Houston Floods
31 May 1929, 1-2 June 1929 and 7-10 December 1935
Buffalo Bayou & Tributaries 1940’s Original Plan
Construction of Addicks and Barker Dams
1942-1948
## Dam Safety Action Classification (DSAC)

<table>
<thead>
<tr>
<th>Urgency of Action (DSAC)</th>
<th>Actions for Dams in This Class</th>
<th>Characteristics of This Class</th>
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<tr>
<td>Very High (1)</td>
<td>Take immediate action to avoid failure. <strong>Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures,</strong> including operational restrictions. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. <strong>Expedite investigations to support remediation</strong> using all resources and funding necessary. Initiate intensive management and situation reports.</td>
<td><strong>CRITICALLY NEAR FAILURE:</strong> Progression towards failure is confirmed to be taking place under normal operations. Dam is almost certain to fail under normal operations within a few years without intervention. <strong>OR EXTREMELY HIGH INCREMENTAL RISK:</strong> <strong>Combination of life and economic consequences with likelihood of failure is very high. USACE considers this level of life-risk to be unacceptable</strong> except in extraordinary circumstances.</td>
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**September 2009:** Issue Evaluation Study Team recommends classification be changed from DSAC 2 to DSAC 1  
**October 2009:** Dam Senior Oversight Group concurred with recommendation and changed classification to DSAC 1
Dam Safety Issues

Seepage and Piping Beneath, Around, and Near the Conduits

Outlet Structure

Auxiliary Spillway Flows and Flows Around the Ends of the Dams

Voids Beneath Conduits at Addicks Dam Generalized Locations

Note: Dashed areas represent GPR anomalies.
Interim Risk Reduction Measures

- **September 2010**
  - Polyurethane Grouting of Conduits & Parabolic Chute

- **April 2011**
  - Cementous Grouting of Conduits & Parabolic Chute

- **May 2011**
  - Granular Filter Around Ends of Conduits

- **August 2012**
  - Barker Gate Replacement
  - Gate Operators & Actuators
  - Emergency Generators & Lighting

- **June 2013**
  - Dam Safety Modification Report

- **July 2013**
  - EA & FONSI

- **October 2014**
  - Parabolic Chute Slab Steel Plate

**Steps Completed:***

1. Grouting of Conduits and Parabolic Chute
2. Granular Filter Around Ends of Conduits
3. Barker Gate Replacement
4. Parabolic Chute Slab Steel Plate
5. Gate Operators & Emergency Generators
6. Dam Safety Modification Study

**Completion Dates:**
- September 2010
- April 2011
- May 2011
- August 2012
- June 2013
- October 2014
Public Meetings

- 12 Feb 2010 Public Release
- 17 Feb 2010 Mtg 1
- 18 Feb 2010 Mtg 2
- 24 Feb 2010 Mtg 3
- 25 Feb 2010 Mtg 4
- 09 Nov 2010 Mtg 5
- 29 Oct 2014 Mtg 6
- 09 Mar 2016 Mtg 7
Social Media

Galveston District, U.S. Army Corps of Engineers
@GalvestonDistrict

HOUSTON (Sept. 14, 2016) - U.S. Army Corps of Engineers Galveston District and Houston County Flood Control District staff provide: Gary Wazma, Office of Management and Budget, with a tour of the ongoing construction at the Addicks and Barker reservoirs. The U.S. Army Corps of Engineers awarded a contract in the amount of $71.4 million to Granite Construction Company in 2015 for construction of new outlet structures at the dams in west Houston. Reservoirs posed construction earlier this year, but construction has resumed at the dams. Learn more about our projects at www.usace.army.mil.

Addicks and Barker Dams

More than 500 years ago, in response to devastating floods and induced subsidence in downstream Houston, the U.S. Army Corps of Engineers constructed the Addicks and Barker Reservoirs to provide flood protection and support water management for Houston and Harris County. The two reservoirs are part of the Harris County Flood Control District’s flood control system.

News: Addicks and Barker Dams Safety Program

The U.S. Army Corps of Engineers has a rigorous Dam Safety Program. As part of this program, the Corps undergoes extensive inspections at all dams categorized as high hazard potential. Addicks and Barker reservoirs are currently being inspected as part of the Corps’ biennial inspection and revenue requirements inspection. This inspection will consist of examining the structural integrity of the dam, including the evaluation of the dam’s hydraulic performance, foundation conditions, and overall dam safety.

News: Construction underway for the Addicks and Barker Dam Safety Program

Construction is underway for the Addicks and Barker Dam Safety Program, #AddicksBarker

News: Construction Contract

A construction contract has been awarded to Granite Construction Company in 2015 for construction of new outlet structures at the dams in west Houston. The Corps has determined that the old outlet structures no longer meet the safety criteria established for reservoirs. The new outlet structures will improve the existing outlet structures and help to ensure public safety and support local flood control and water management needs.

News: News by topic

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New Outlet Structures Design and Construction

Design Completion: May 2015
Contract Award: August 2015
Contractor: Granite
Construction Start: November 2015
Construction Completion: February 2020
Contract Award with Options: $71,981,540
Contract Modifications: $1,780,712
Current Contract Amount: $73,762,252
Addicks and Barker Dams 3-D Model of New Outlet Structures

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

**Addicks New Outlet Structure**
- Located within Existing Dam Embankment
- Approximately 400 Feet West from Existing Outlet Structure
- Three 10-Feet Diameter Steel Lined Conduits
- 10X10-Feet Rectangular Steel Gates at the Intakes

**Noble Road Cut-off Wall**
- 1,400-Feet long cement bentonite slurry cut-off wall
- Located along upstream embankment at Noble Road
- Will Address Seepage Issues at this Location
Addicks Dam Record Pools

Addicks Dam
Record High Pool
Elevation: 102.6 feet
Acre Feet: 123,067
Datum: NAVD 1988
Date: April 23, 2016

Addicks Dam
Previous Record High Pool
Elevation: 97.4 feet
Acre Feet: 65,264
Datum: NAVD 1988
Date: March 9, 1992
Barker Dam Record Pools

**Barker Dam Record High Pool**
- Elevation: 95.2 feet
- Acre Feet: 85,816
- Datum: NAVD 1988
- Date: April 23, 2016

**Barker Dam Previous Record High Pool**
- Elevation: 93.6 feet
- Acre Feet: 66,489
- Datum: NAVD 1988
- Date: March 6, 1992

NE Corner of Reservoir
Outlet Structure
George Bush Park
Westheimer Parkway
Addicks and Barker Dams Tax Day Flood Pools Emptied

Addicks Dam 5 July 2016

Barker Dam 7 July 2016
Addicks Dam New Outlet Structure and Cut-off Wall

A2 - Addicks Muds Slab for New Outlet Structure

A3 - Addicks New Outlet Channel Area

A2/A3 - Addicks Cofferdam, Primary Excavation and New Outlet Channel Area

A1 – Addicks Borrow Area and Haul Road

A2 - Addicks Cofferdam and Primary Excavation
Barker Dam New Outlet Structure and Cut-off Walls

B1 – Barker Noble Road Cut-off Wall

B2 – Barker Precast Yard

B3 - Barker Pedestrian Bridge & Path

B4 – Barker Cofferdam

B5 – Barker Borrow Area
CRITICAL ISSUES & RISK REALIZED

- Water level in reservoirs
- Cut-off wall permeability and strength
- Cofferdam unsuitable materials
- QA test lab
Critical Issues and Risk Realized

**QA Test Lab (Low Risk)**
- Contracting Officer terminated (T4C) QA Test Lab contract due to protest
- Utilized GPC as short term measure
- SWF currently providing field lab support and has established mobile field lab onsite
- ERDC QA Lab inspection conducted 23-24 May 17
- ERDC validation letter forthcoming

**Cofferdam Unsuitable Materials (Medium Risk)**
- Increase in quantities for directed excavation resulting in contract modifications
  - Addicks Dam: $540,000 and 27 additional calendars days
  - Barker Dams: $155,000
Critical Issues and Risk Realized

Water Levels in the Reservoirs (High Risk)

- 62% of Calendar Year 2016 Impacted by Weather
  - April 2016 Tax Day Flood Suspension of Work
    Primary Contributor (22 Apr 16 - 17 Jul 16)
    » Request for Equitable Adjustment negotiated for $637,243.65 and 97 calendar days
- Features resequenced outside reservoirs to progress construction
  - Addicks Outlet Channel Clearing and Grubbing
  - Fabrication of Precast Erosion Protection Blocks
  - Alternate access into Barker Borrow Area
- Investigated alternate borrow sources for completion of cofferdams
Critical Issues

Cut-off Wall QA/QC Deficiencies (High Risk)

- Detailed reviews of slurry batching/placement CQC processes did not identify significant deficiencies.
- Verification Drilling test results for compression and permeability did not match the results of the produced slurry sampling.
- Notice of QA/QC deficiencies issued on 4 May 17 due to the verification drilling results.
- Contractor evaluated alternative slurry mixes and performed trial batches.
- 75/25% (Slag/Cement Ratio) Mix Approved by Government for use under new structure at Addicks Dam on 27 Jul 2017.
- Contractor is of the opinion that SWG’s approval of the 75/25 cut-off wall mix for Addicks Dam is a variance from the specifications and considers this as direction by the Government.
- Resident Engineer informed Contractor we do not consider this direction and that they may proceed with installation of the Addicks cut-off wall.
- Installation of the Addicks cut-off wall to start the week of Aug 14th.
Questions

Addicks and Barker Dam Safety Program

Thank You