

Buffalo Bayou and Tributaries Resiliency Study, Texas

Review of Completed Projects
Interim Feasibility Report

October 2020



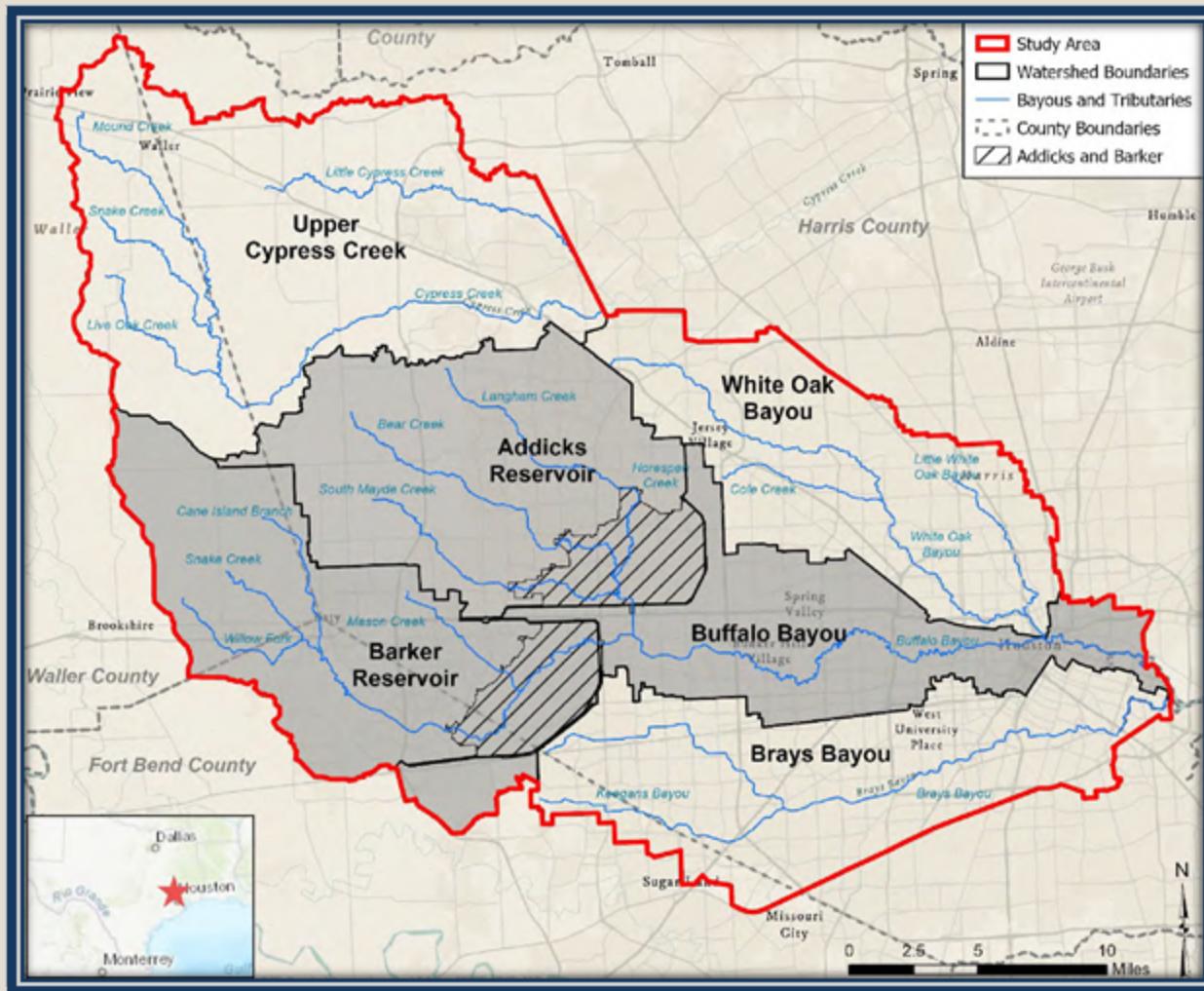
Photograph: Record breaking rainfall from Hurricane Harvey in 2017 caused catastrophic flooding in Houston. The above photograph shows a completely submerged Interstate 10 outside of Houston, Texas on August 26th, 2017.



**US Army Corps
of Engineers®**
Galveston District

What is the Interim Feasibility Report?

- Feasibility study of the Buffalo Bayou and Tributaries flood risk management system
 - Interim Report
 - Leads to Recommendation of Tentatively Selected Plan (TSP)
 - Purpose – “To evaluate changed conditions since the projects were constructed. The objective is to identify, evaluate and recommend actions to address the changed conditions, including potential modifications to the Buffalo Bayou System to reduce flood risks to people, property and communities.”
- What Does the Interim Report do?
 - Attempts to identify the problem
 - Provides study objectives
 - Establishes criteria for formulating alternatives
 - Identifies Alternatives
 - Provides initial evaluation of Alternatives
 - Changed Conditions Identified
 - Urbanization
 - Extreme Events/Increased Precipitation
 - Subsidence

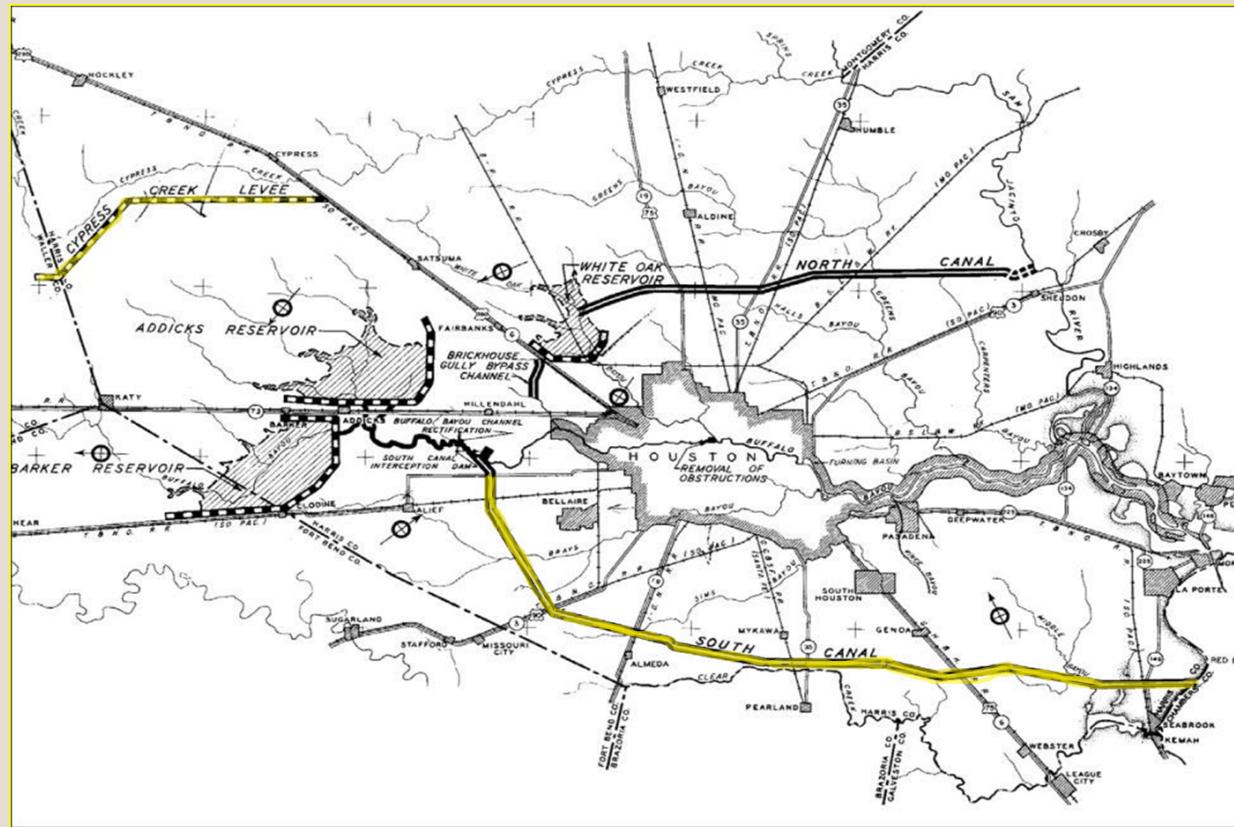


ALTERNATIVES

Table 3. Initial Evaluation of Alternatives

Alternative Plans	Description	Added Measures	In Focused Array	Notes
Alt 1: No Action	No plan is implemented because of this study	None	Yes	This forms the baseline for costs, benefits, and impact comparison. It aids in understanding how each plan functions compared to the baseline
Alt 2: Cypress Creek Dam and Reservoir	Store water on Cypress Creek by constructing a new dam and reservoir	\$2.1 to 2.9 billion	Yes	None
Alt 3: Addicks and Barker Reservoir Excavations	Increase storage capacity within each reservoir by deepening portions of the reservoirs	\$1.3 to 1.8 billion	No	This plan provides only localized benefits
Alt 4: Tunnels	Convey up to 20,000 cubic feet per second (cfs) of floodwaters through underground tunnels that would capture water at the dams and empty water into the Houston Ship Channel/Galveston Bay	\$6.5 to 12 billion	No	Tunnels provide comparable benefits as other alternatives but at a much higher cost
Alt 5: Diversions	Divert water from the Buffalo Bayou Watershed to Brays and/or the Brazos River	\$0.25 to 0.35 billion	No	Diversions present a high risk in long-term operation because Brays and/or the Brazos River may already be flooded
Alt 6: Buffalo Bayou Channel Improvements	Widen and deepen Buffalo Bayou from just below Addicks and Barker Dams to convey 15,000 cfs	\$1.0 to 1.25 billion	Yes	None
Alt 7: Nonstructural	Large-scale acquisition plan along Buffalo Bayou to convey 15,000 cfs	None	Yes	Mandatory to carry forward
Alt 8: Combined Plan (Alts 2 + 6)	Store water on Cypress Creek by constructing a new dam/reservoir AND widen and deepen Buffalo Bayou from just below Addicks and Barker Dams to convey 15,000 cfs (Alternatives 2 and 6)	\$3.0 to 4.25 billion	Yes	None

1940 Corps of Engineers Study Map



Bottom Line: Problems to be solved existed in 1940; they are not due to “changed conditions.”

Alternative 2: Cypress Creek Dam and Reservoir

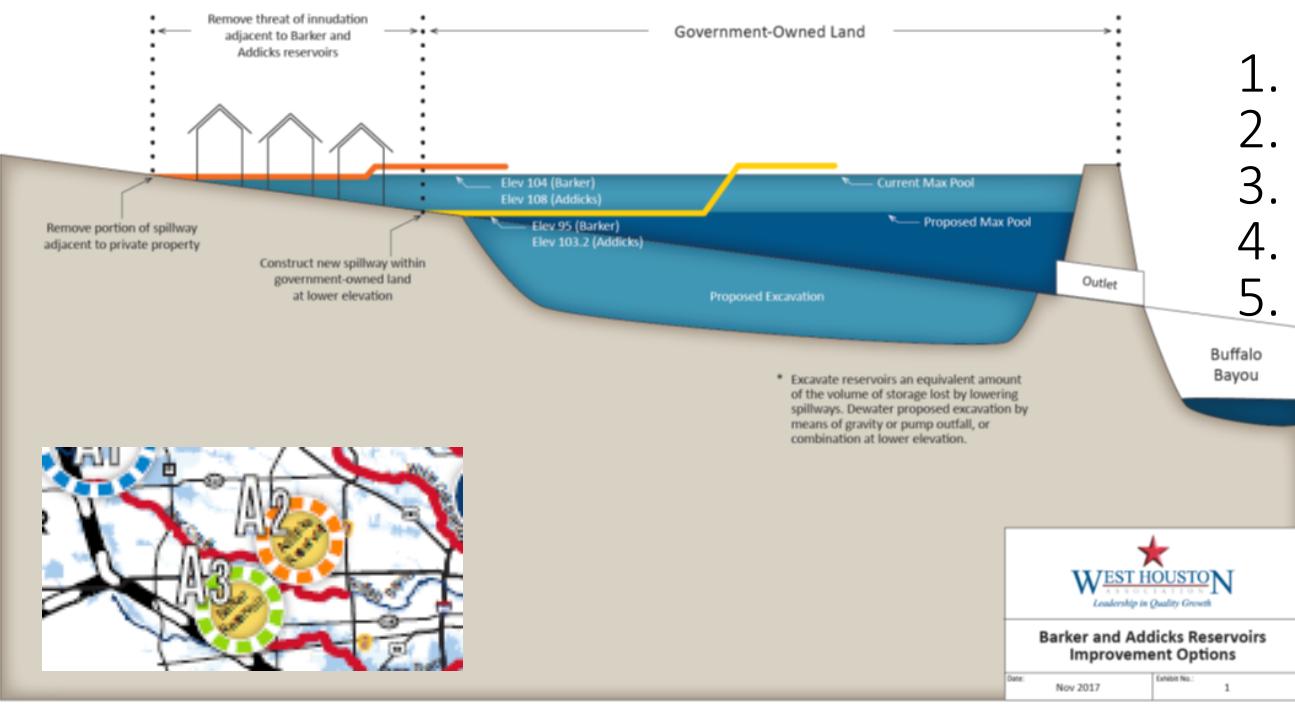
- Description: Store water on Cypress Creek by constructing a new dam and reservoir. New 190,000 acre-foot reservoir in the Cypress Creek watershed. One spillway into Cypress Creek and a second spillway into Addicks Reservoir watershed. A downstream control point on Cypress Creek just upstream of Tomball Parkway with a maximum flow of 2,800 cfs. A 30 foot high embankment that is 100 feet wide.
- Cost: \$2.1 to 2.9 billion (\$4.5 to \$6.1 billion with ancillary measures)
- Benefit cost ratio: 0.1
- Future action: Yes

Alternative 3: Addicks and Barker Reservoir Excavations

- Description: Increase storage capacity within each reservoir by deepening portions of the reservoirs
- Cost: \$1.3 to 1.8 billion
- Benefit cost ratio: 0.3
- Future action: None
- Study comments: Addicks and Barker excavations is not a primary anchor measure as it does not have enough impact to have significant effect. It is included as an ancillary or complementary measure that could be used in combination with the anchor measures.

A2-3. Restore & Improve Addicks & Barker Reservoirs

\$ 2.5 Billion



1. Start immediately
2. Addicks: 6 feet
3. Barker: 10 feet
4. Flood pool on gov. land
5. Lower dam failure risk

houstonstronger.net

Barker Reservoir Flood Risk Reduction and Park Project

The map illustrates the conceptual Phase 1 plan for the Barker Reservoir Flood Risk Reduction and Park Project. It shows the reservoir dam at the bottom, with a proposed low-flow outlet and an existing pond. A diversion channel is shown on the left. The project area is outlined in green, featuring a lake, wetlands, and a trail system. Labels include 'Canyon Gate Neighborhood', 'Westheimer Pkwy', 'Westpark Tollway', 'prop. low flow outlet', 'prop. overflow weir', 'bird watching tower', 'bird watching', 'wetland', 'lake', 'trail system', 'existing pond', 'dog park', 'restroom', 'playground', 'reservoir dam', 'overlook', 'site hill', 'mountain biking trails', and 'kite hill'. A legend titled 'Program' lists: Proposed Ponds: 3,800,000 sf, Trails: 7.0 miles, Dog Park: 350,000 sf, BMX Park: 422,000 sf, and Playground: 97,000 sf. An inset titled 'Environmental Ecosystem' shows 'Wetlands' and 'Prairie' with descriptions: 'Establishing wetland ecosystem to promote wildlife and biodiversity.' and 'Restoring the land to native prairie habitat, reminiscent of the once expansive Katy Prairie that existed in this area. Establish opportunities for recreation and education throughout this landscape.' A scale bar indicates distances from 0 to 1,000 feet.

Program

- Proposed Ponds: 3,800,000 sf
- Trails: 7.0 miles
- Dog Park: 350,000 sf
- BMX Park: 422,000 sf
- Playground: 97,000 sf

Potential future connection to Westheimer

Environmental Ecosystem

Wetlands

Establishing wetland ecosystem to promote wildlife and biodiversity.

Prairie

Restoring the land to native prairie habitat, reminiscent of the once expansive Katy Prairie that existed in this area. Establish opportunities for recreation and education throughout this landscape.

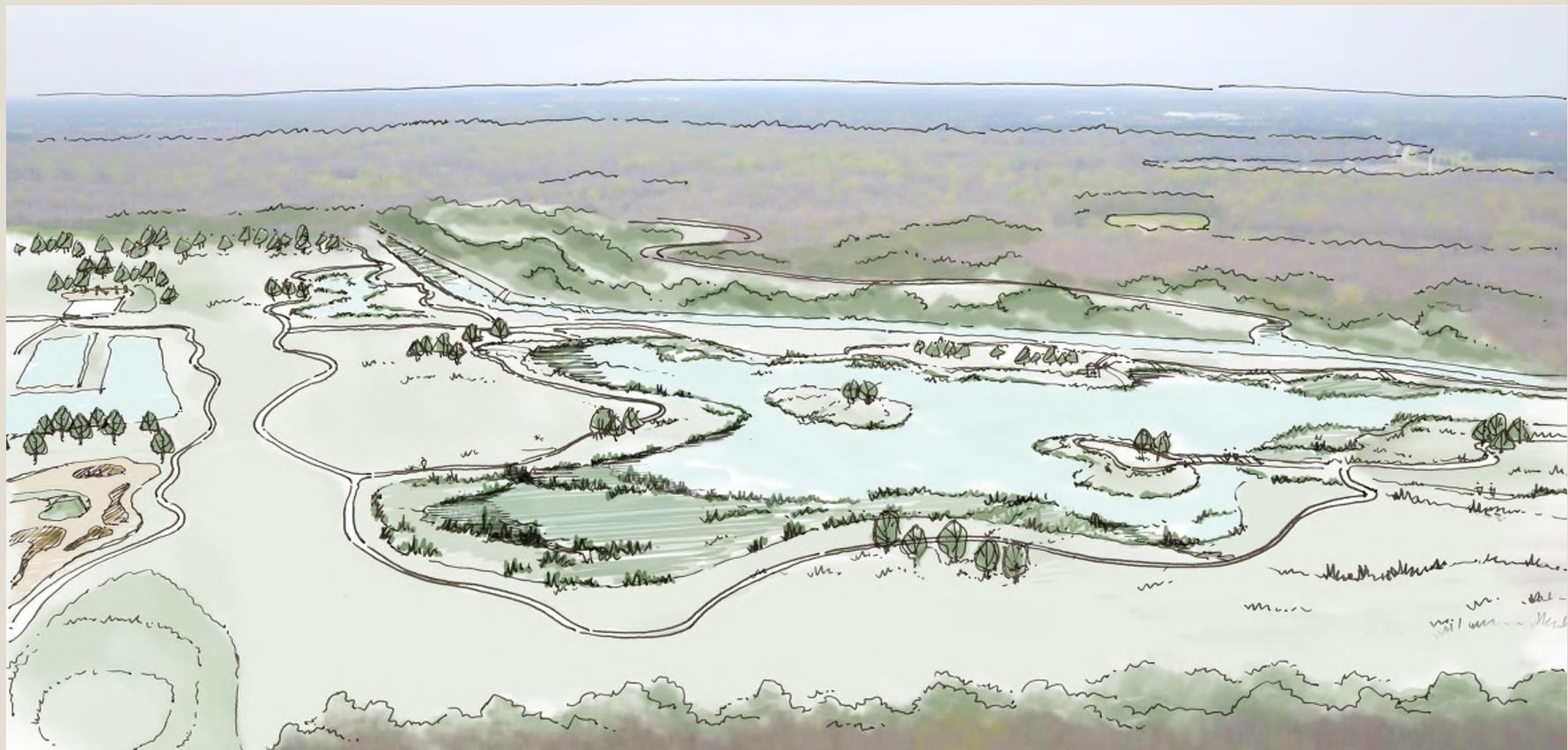
Exhibit 4
conceptual phase 1 plan

Houston, Texas
03/11/20

TBG - 1710-428-0027 - Roger Hines
1333 W Loop S, Ste 140, Houston, Texas 77027
The information shown is subject to change without notice.

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Barker Reservoir Flood Risk Reduction and Park Project – Westward View



Alternative 4: Tunnels

- Description: Convey up to 20,000 cubic feet per second (cfs) of floodwaters through underground tunnels that would capture water at the dams and empty water into the Houston Ship Channel/Galveston Bay. 34 miles of tunnel at a depth of 150 feet. 3 options evaluated
- Cost: \$6.5 to 12 billion
- Benefit cost ratio:
- Future action: None
- Study comments: Tunnels did not advance beyond initial screening due to the cost of this alternative.

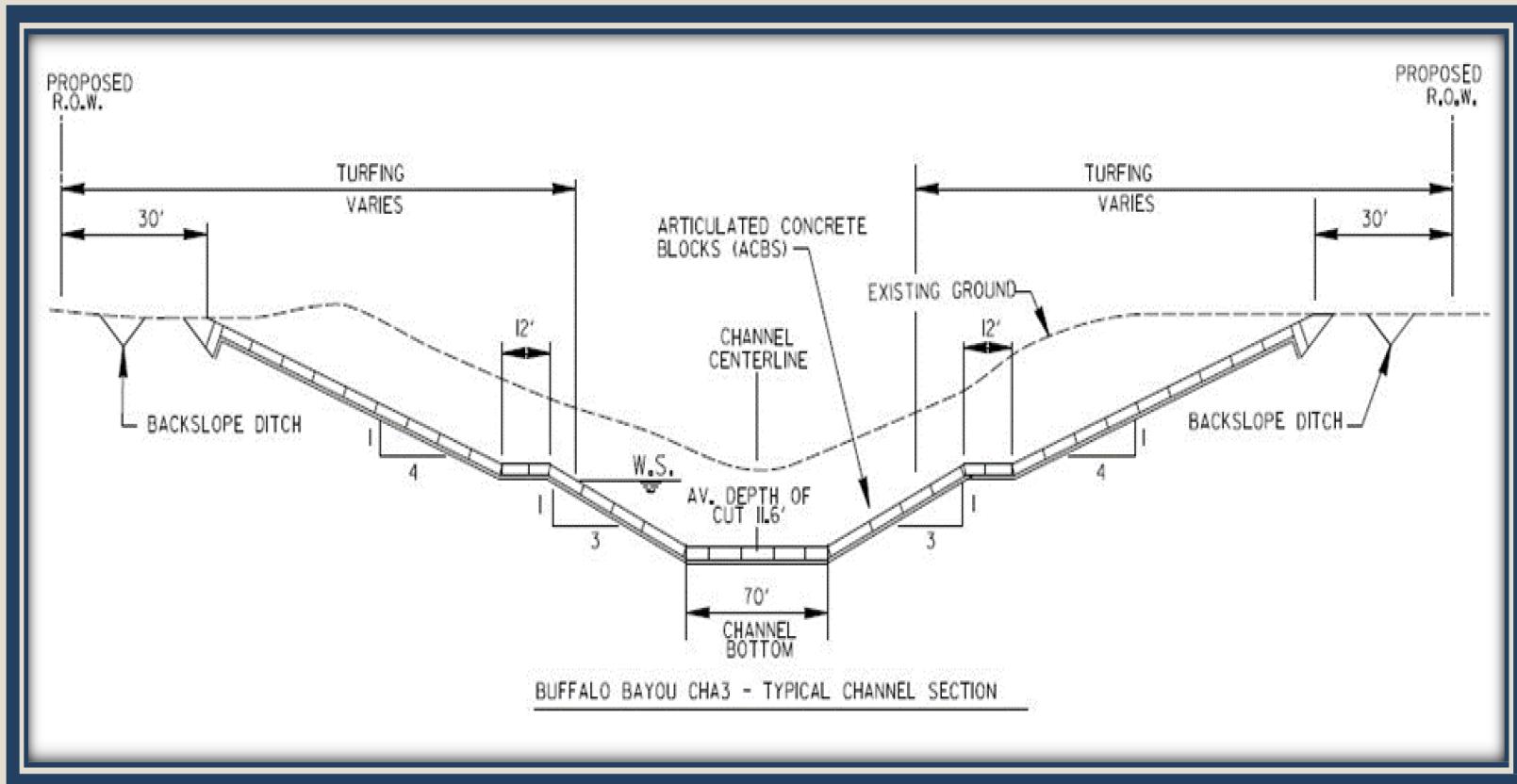
Alternative 5: Diversions

- Description: Divert water via a tunnel from the Buffalo Bayou from just below Addicks and Barker Dams to convey 15,000 cfs. Diversion to Brays Bayou or Brazos River.
- Cost: \$0.25 to 0.35 billion
- Benefit cost ratio:
- Future action: None
- Study comments: Diversions present a high risk in long-term operation because Brays and or the Brazos River may already be flooded.

Alternative 6: Buffalo Bayou Channel Improvements

- Description: Widen and deepen Buffalo Bayou from just below Addicks and Barker Dams to convey 15,000 cfs. Average deepening of 11.6 feet with a 230-foot wide channel with articulated concrete bottom and side slopes.
- Cost: \$1.0 to 1.25 billion (\$3.1 billion to \$4.1 billion with ancillary costs)
- Benefit cost ratio: 0.3
- Future Action: Yes

Cross Section of Buffalo Bayou Channel Improvement



Alternative 7: Nonstructural

- Description: Large-scale acquisition plan along Buffalo Bayou to convey 15,000 cfs
- Cost: \$2.3 billion
- Benefit cost ratio:
- Future action: Yes
- Study comments: Does not include acquisition of more than 24,000 parcels upstream of Barker and Addicks that are at or below the spillway crest elevation outside government owned land. Those parcels are an estimated \$10 billion and would have significant adverse impacts on upstream communities.

Alternative 8: Combined Plan (Alternatives 2 + 6)

- Description: Store water on Cypress Creek by constructing a new dam/reservoir AND widen Buffalo Bayou from just below Addicks and Barker Dams to convey 15,000 cfs (Alternatives 2 and 6)
- Cost: \$5.2 to 7.0 billion
- Benefit cost ratio: 0.2
- Future action: Yes
- Study comments:

CATASTROPHIC DAM FAILURE RISK

Please read pages 134 & 135 of the Interim Report – Dam Safety Formulation.

USACE Dam Safety Manual includes a “Dam Safety Action Classification System.”

Dams are classified on probability of failure and potential life safety, economic, environmental or other consequence.

Worst classification – Class I – Very High Urgency

“Dams where progression toward failure is confirmed to be taking place under normal operations and the dam is almost certain to fail under normal operations within a time frame from immediately to within a few years without intervention; or the combination of life or economic consequence with probability of failure is extremely high” – USACE DSAC Definition

6 Potential Failure Modes (PFM) have been identified for Barker and Addicks.

Barker and Addicks are currently classified a DSAC 1 (Urgent and compelling: unsafe)

2 of the 6 PFM's have not been addressed – both pose risk of catastrophic failure

TAKE AWAYS

1. Understand the importance of this Interim Report.
2. READ the Report.
3. Attend an Informational Session. (See Schedule)
4. Provide comments. (Deadline currently November 2, 2020)
5. Assist with developing a Houston Solution.