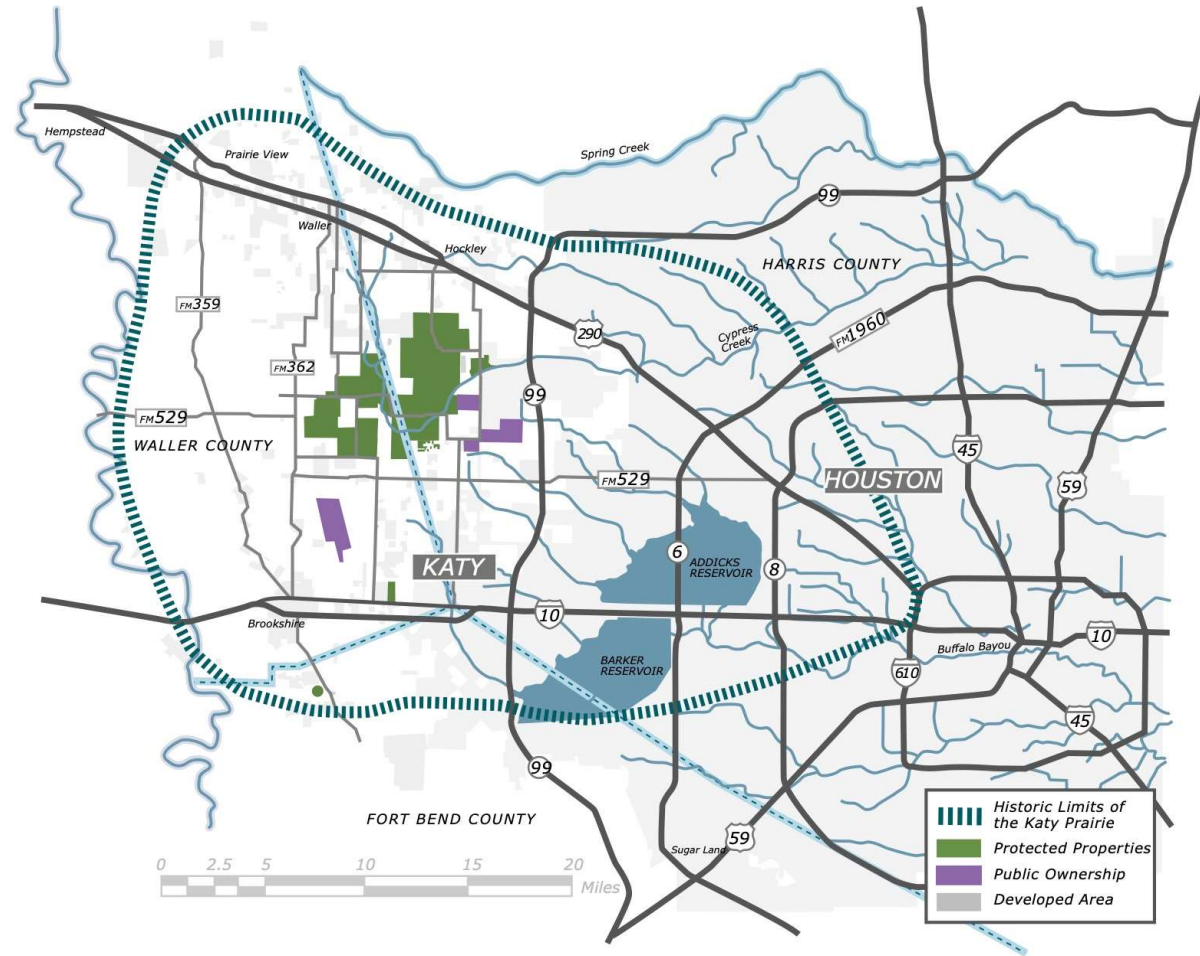


# KPC ALTERNATIVE CONCEPTS USACE BUFFALO BAYOU & TRIBUTARIES RESILIENCY STUDY



## STUDY AREA



# STUDY TEAM

## **MARK KLEIN**

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Katy Prairie Conservancy

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## The Problem

- How to increase storage capacity in Addicks Reservoir
- How to handle Hurricane Harvey level floodwaters
- How to mitigate for Cypress Creek Overflow
- How to reduce flooding upstream and downstream of the reservoirs

## The Challenge

How to maximize storage in Addicks Watershed to handle big storms (concept could work for both reservoirs although only Addicks Reservoir studied in depth)

How to mitigate Cypress Creek floodwaters from going into Addick Reservoir



# STUDY GOALS

**INCREASE REGIONAL RESILIENCY**

**REDUCE FLOODING UPSTREAM & DOWNSTREAM OF  
ADDICKS RESERVOIR**

**PROPOSE COMPREHENSIVE ALTERNATIVES FOR USACE'S  
BUFFALO BAYOU AND TRIBUTARIES RESILIENCY STUDY**

**WORK WITH NATURE, ENGINEER WITH NATURE**



# STUDY PRINCIPLES

Identify projects in Upper Cypress Creek and Addicks Watersheds that:

- are additive, decentralized, and distributed,
- provide redundancy and resiliency,
- can be replicated throughout the region
- use natural infrastructure and nature-based solutions
- complement existing flood reduction benefits





## NOTES TO STUDY RECOMMENDATIONS

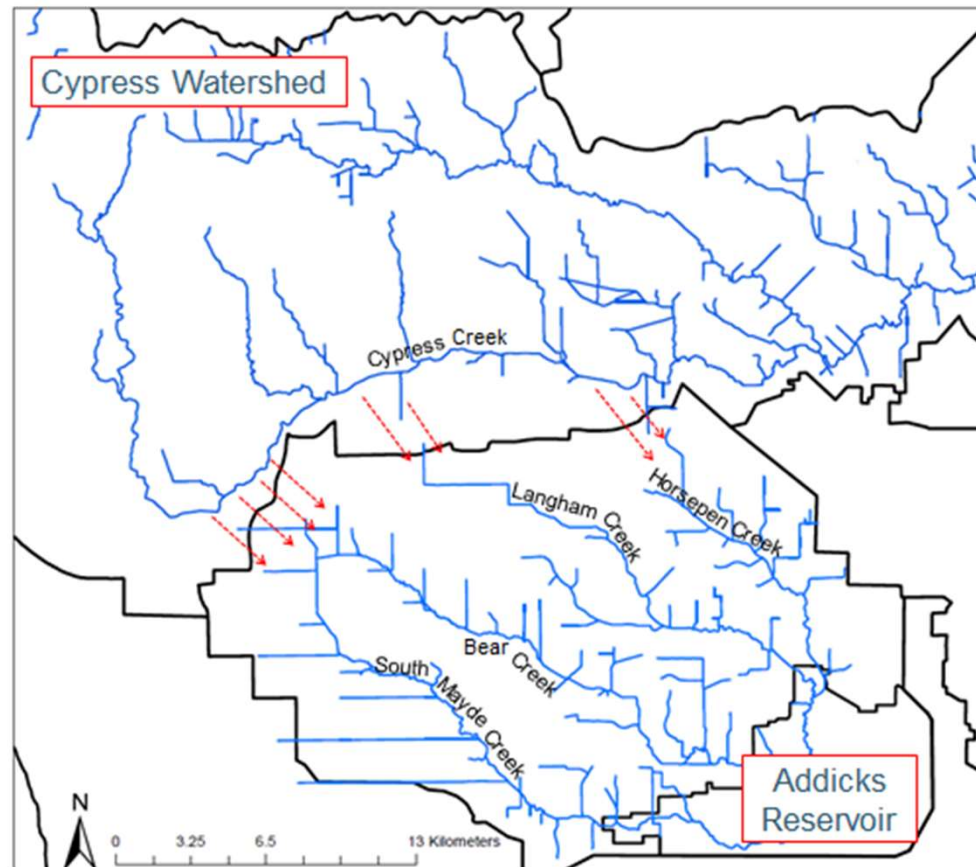
- High level concepts
- USACE's modeling information not available to "test" Corps' findings or to mirror their objectives
- No cost analysis completed
- Additional analysis needed

# AREA DRAINING TO ADDICKS RESERVOIR

Addicks Reservoir collects runoff from a 136-square mile area that includes the runoff from Horsepen, Langham, Bear and South Mayde creeks.

In addition, upper Cypress Creek frequently overflows and its floodwaters enter the Addicks Reservoir area (see red arrows), contributing to the amount of runoff water that is collected and stored in the Addicks Reservoir.

During Harvey, the Addicks Reservoir collected about 250,000 acre-feet of runoff water, including about 50,000 acre-feet of overflow from upper Cypress Creek.



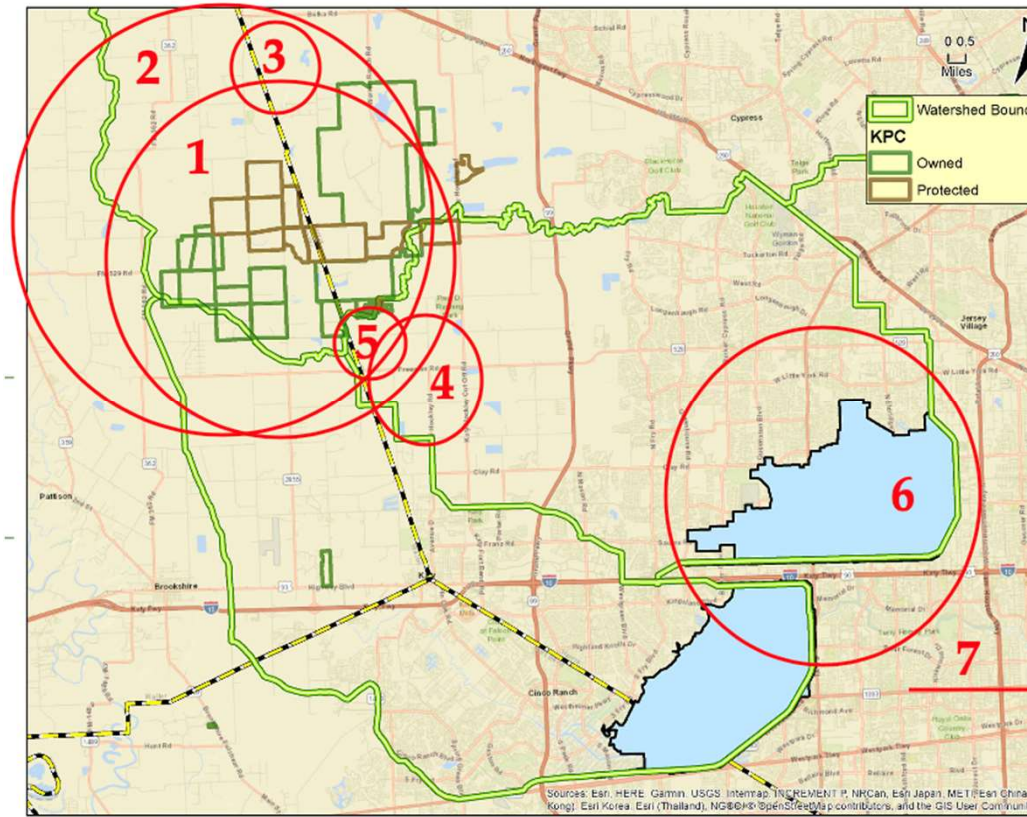
# STUDY ALTERNATIVES

## Upper Cypress Creek Watershed

1. Expanded/Restored KPC Preserve
2. Shallow Detention (Arcadis Concept)
3. Detention Areas along Cypress Creek

## Upper Addicks Watershed

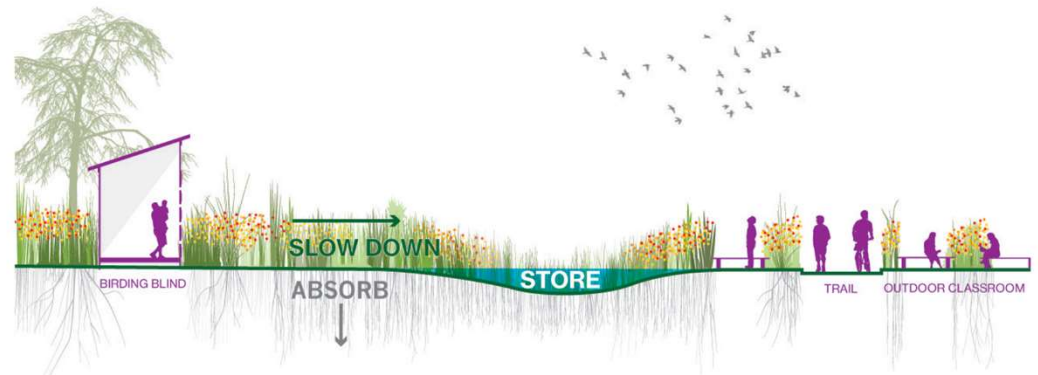
4. Retention Areas along Bear Creek and S. Mayde Creek
5. Medium Retention Areas
6. Excavation of Addicks Reservoir
7. Conveyance Tunnel from Addicks and/or Barker Reservoir



# ALTERNATIVES MAKE SENSE

## PROTECTING, EXPANDING, RESTORING THE KATY PRAIRIE

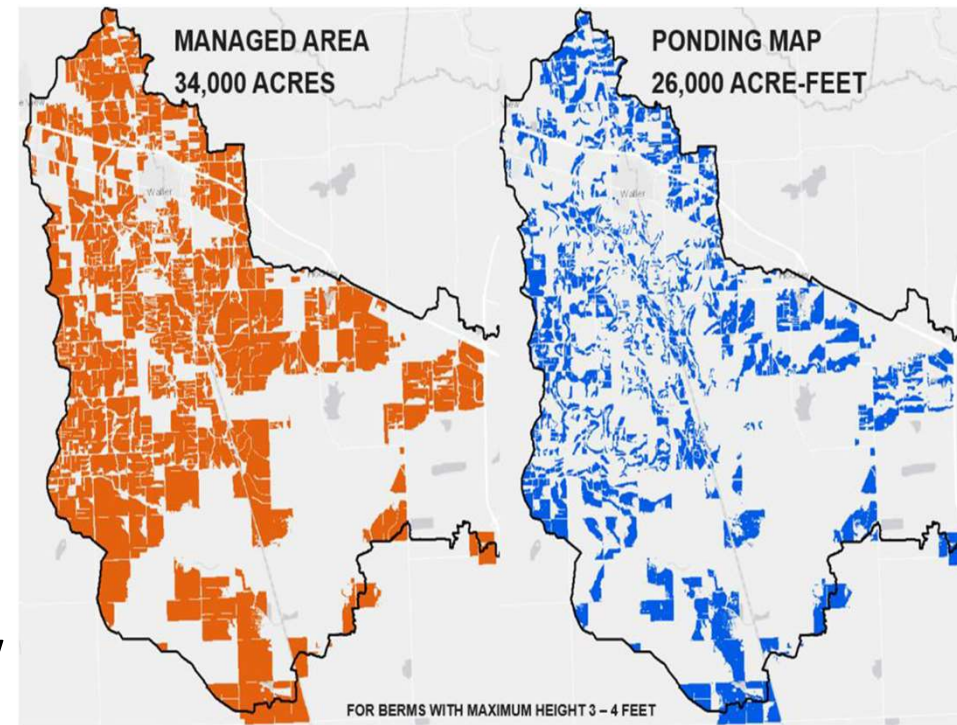
- Storage of up to nearly 10,000 ac-ft
- Great *head start* with existing protected lands and more land is available for protection
- Multiple benefits
  - Recreation, Wildlife Habitat, Agricultural Products
  - Improved Air / Water Quality, Carbon Sequestration
  - Economic Development through Tourism
- No environmental permits required



# ALTERNATIVES MAKE SENSE

## SHALLOW DETENTION IN UPPER CYPRESS CREEK

- Storage of up to 26,000 ac-ft
- Land available for protection
- Voluntary program; landowner owns and manages land
- Landowner receives payment for storing water
- Permanent detention obligation tied to land
- Conservation or flood easements may be placed on the land, reducing protection costs
- Does not require major environmental review
- Could be replicated in other watersheds



# ALTERNATIVES MAKE SENSE

## DETENTION ALONG CYPRESS CREEK



- Storage of 7,400 ac-ft
- Land available for protection
- Can offer a wildlife corridor and recreational amenities
- Enhanced water quality potential
- Beneficial use of floodways & floodplains
- Keeps people & property out of harm's way
- May require environmental permits



# UPPER CYPRESS ALTERNATIVES IMPACT

TOTAL ADDITIONAL STORAGE 17,000 – 33,000 ac-ft

## *Project 1*

50,000-acre preserve which includes 21,000 acres of restored prairie and wetlands

## *Project 2*

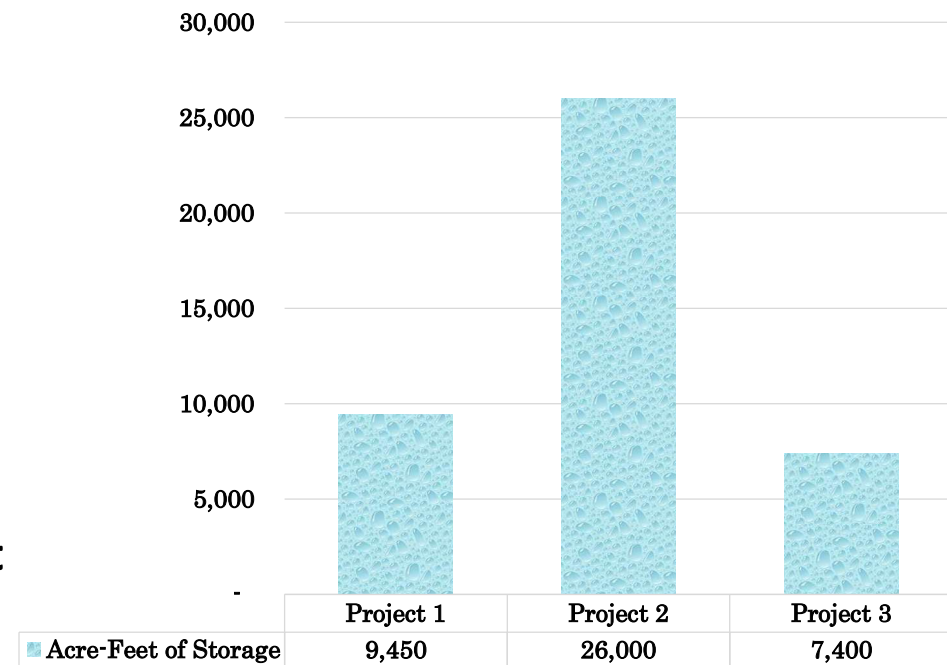
Shallow detention areas totaling 34,000 acres

## *Project 3*

Small detention areas totaling 370 acres

**Total Additional Storage = 17,000 – 33,000 ac-ft**

- Results in 40% Reduction in Overflows to Addicks [6,800 - 13,200 ac-ft]
- Storage totals account for site overlap of Projects 1 & 2



# ALTERNATIVES MAKE SENSE

## MEDIUM RETENTION IN UPPER ADDICKS WATERSHED



- Storage of up to 60,000 ac-ft of Cypress Creek overflows
- Undeveloped land available
- When dry, land can provide a major recreational amenity for the region
- Reduces floodwaters going into Addicks Reservoir on a 1 to 1 basis
- May require environmental permits

# ALTERNATIVES MAKE SENSE

## RETENTION ALONG BEAR & SOUTH MAYDE CREEKS

- Storage of up to 50,000 ac-ft
- Undeveloped land along creeks
- Offers wildlife corridor and recreational amenities
- Enhances water quality potential
- Beneficial use of floodways & flood plains
- Keeps people & property out of harm's way
- May require environmental permits



# ALTERNATIVES MAKE SENSE

## EXCAVATION OF ADDICKS RESERVOIR



- Depending upon excavation sites, 62,500 acre-feet (or more) of additional storage just for Addicks alone
- Uses existing government lands
- Excavation is above water table
- Create public amenities
- Environmental review likely



# ALTERNATIVES MAKE SENSE

## TUNNEL TO PROVIDE CONVEYANCE

- Uses underground right-of-way requiring little surface land acquisition
- Reduces downstream flooding along Buffalo Bayou, protecting downstream neighbors
- Relieves pressure on reservoirs
- Requires extensive time, planning, engineering, construction, and environmental reviews (includes lower dissolved Oxygen, increased solids, with no opportunity for natural attenuation, and very concentrated discharge)



# COMPREHENSIVE APPROACH TO FLOOD REDUCTION

## ALL PROJECTS

Reduce Addicks Reservoir flooding  
Can be combined or independent  
May be financed and come online as needed

## PROJECTS 1-3

Natural infrastructure requires  
lower operating costs;  
indirectly reduce water into  
Addicks Reservoir

## PROJECTS 4-6

Directly reduce water level in  
Addicks Reservoir



## PROJECTS 1-3

flood reduction benefits  
in Upper Cypress

## PROJECTS 4-6

flood reduction benefits in Addicks

## PROJECT 7

Increased Conveyance Capacity





**FOR MORE INFORMATION**  
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