# Rebuilding 70-Year-Old Siphons for Longevity and Efficiency

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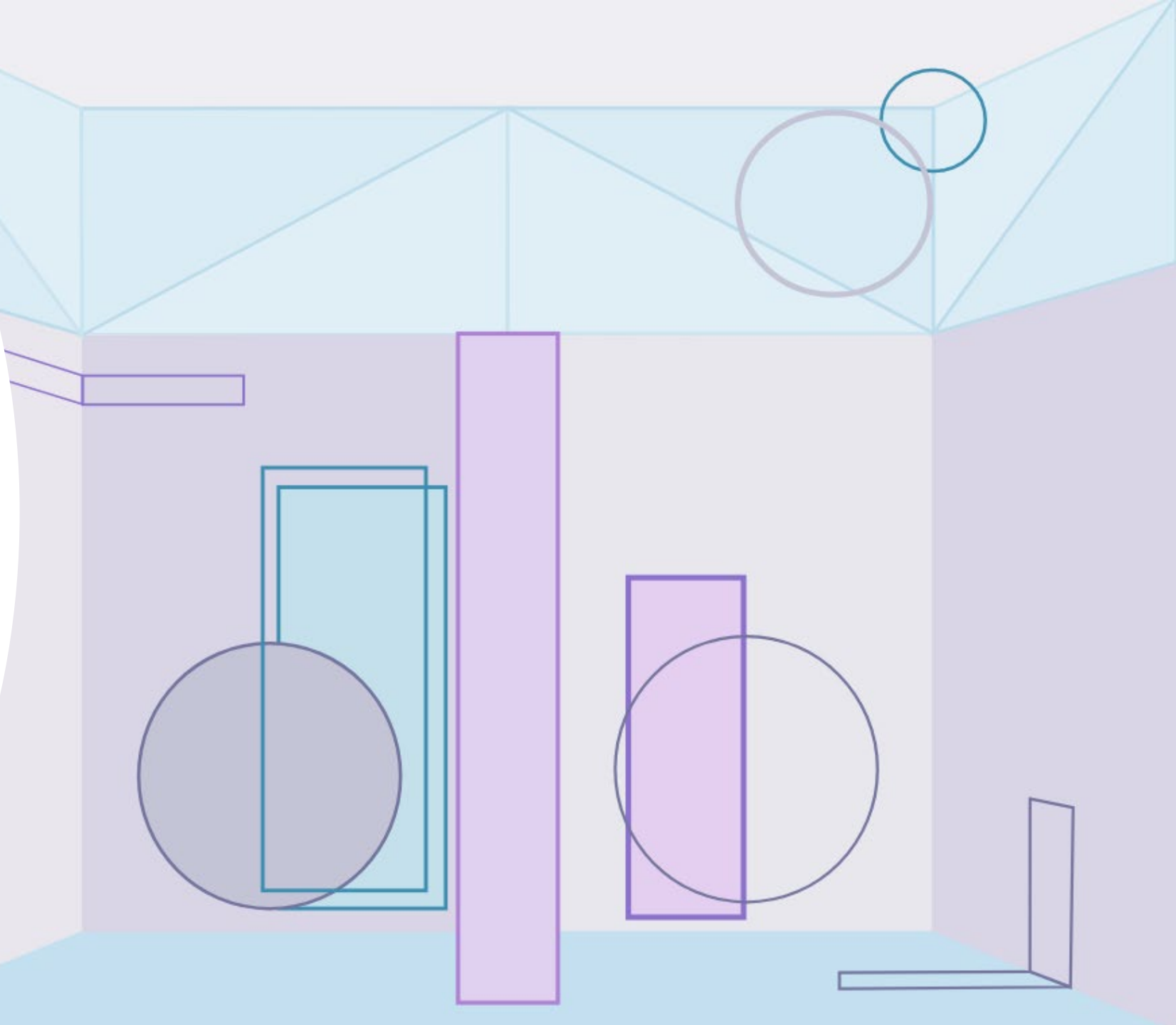


# OVERVIEW

- Background
- Planning Phase
- Design Considerations

# BACKGROUND

1940s Main and South Canals

1950s Lake Houston Pump Station

1960s East Canal

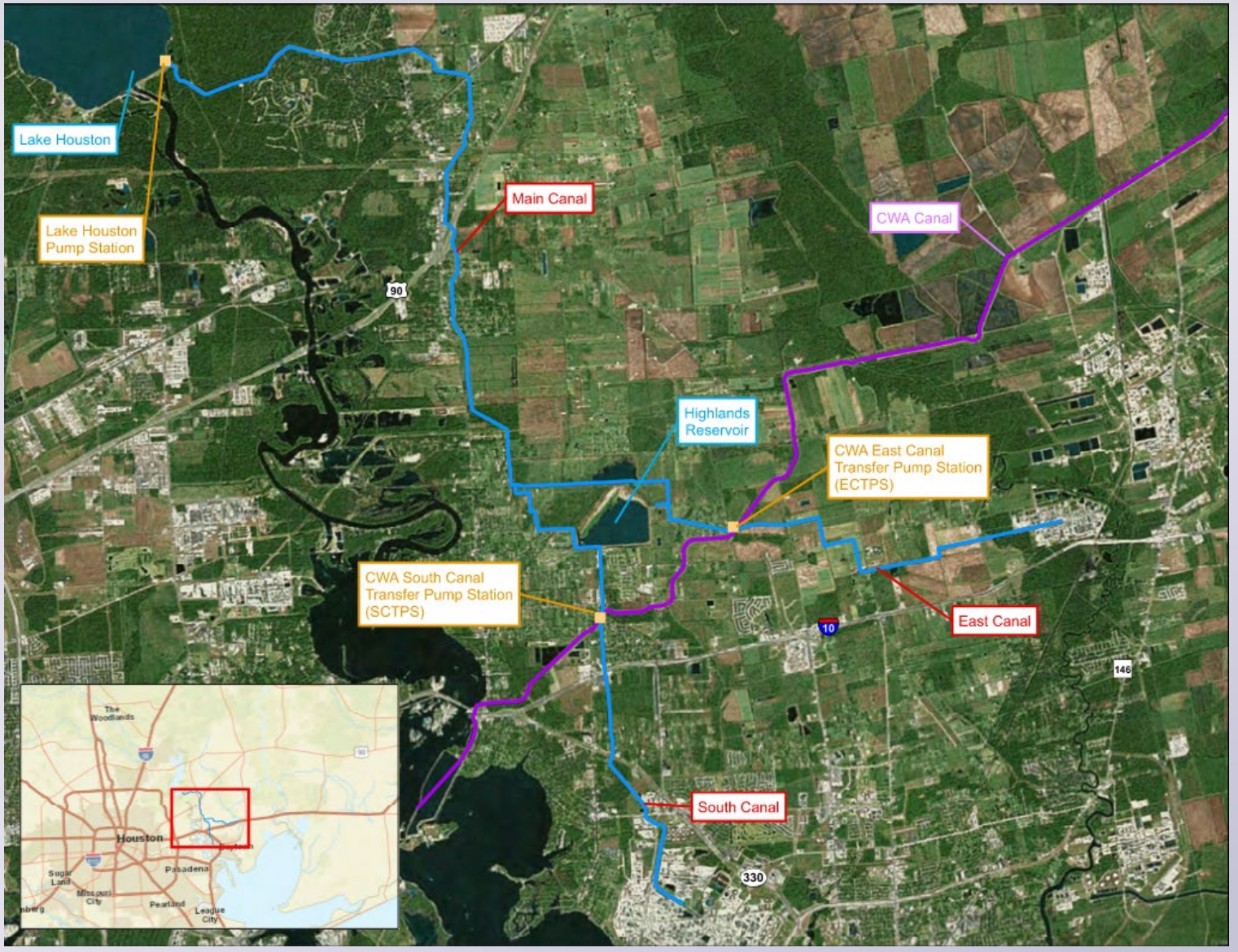
# BACKGROUND

| | |
|---|---|
| 1940s | Main and South Canals |
| 1950s | Lake Houston Pump Station |
| 1960s | East Canal |
| 1970s | South Canal Transfer Pump Station |
| 2016 | East Canal Transfer Pump Station |

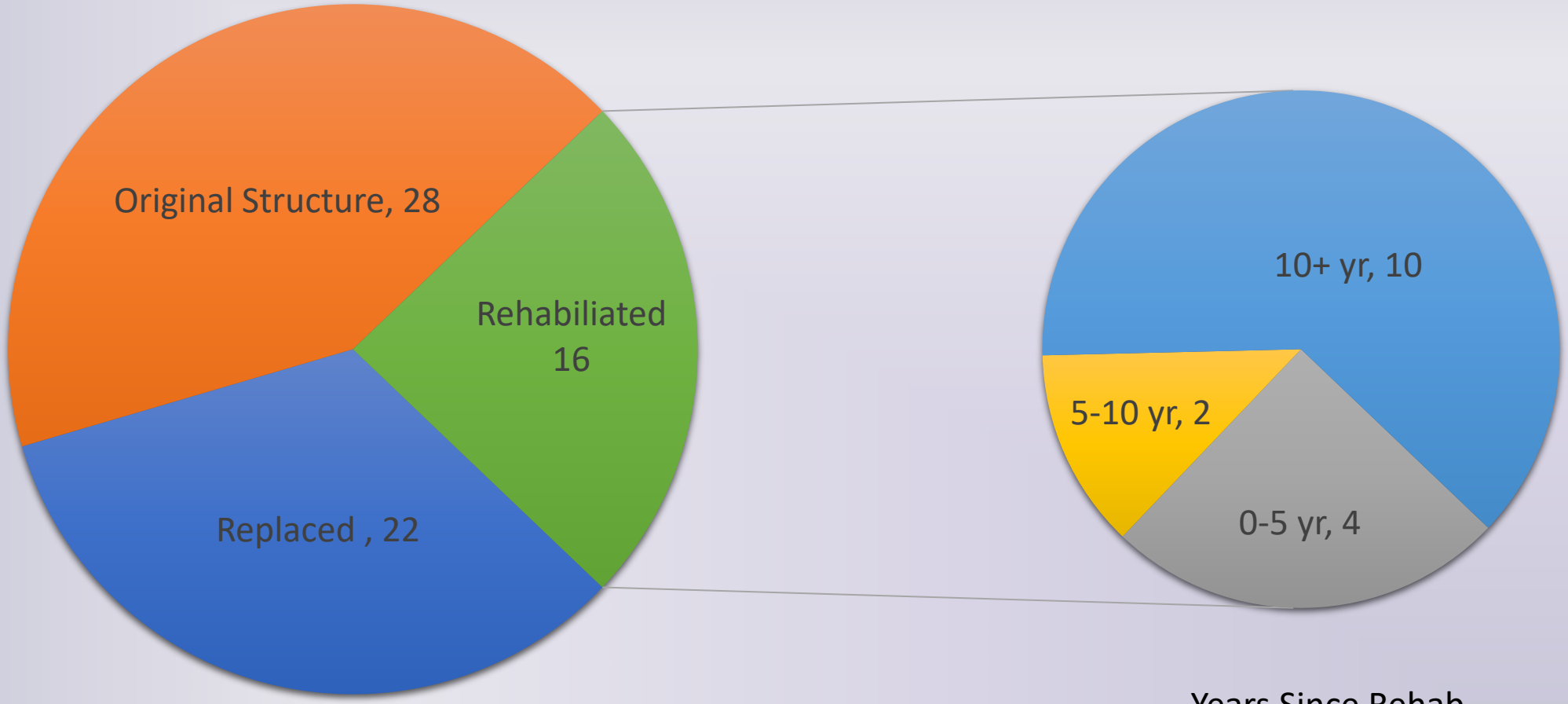
# BACKGROUND

Infrastructure

- 1,400 acre staging reservoir
- 27-miles of canal
- 60+ structures
- 3 pump stations
- 24/7/365 Operations



# BACKGROUND


Original Structure, 28
Rehabiliated 16
Replaced , 22
10+ yr, 10
5-10 yr, 2
0-5 yr, 4
Years Since Rehab

# BACKGROUND

Project Identification

Project Funding

10-Year Project Plan

# BACKGROUND

Project Identification

- In-house Condition Assessment
- Customer Demand/Canal Capacity

# BACKGROUND

Project Funding

- Rate Order
- Bonds
- R&R

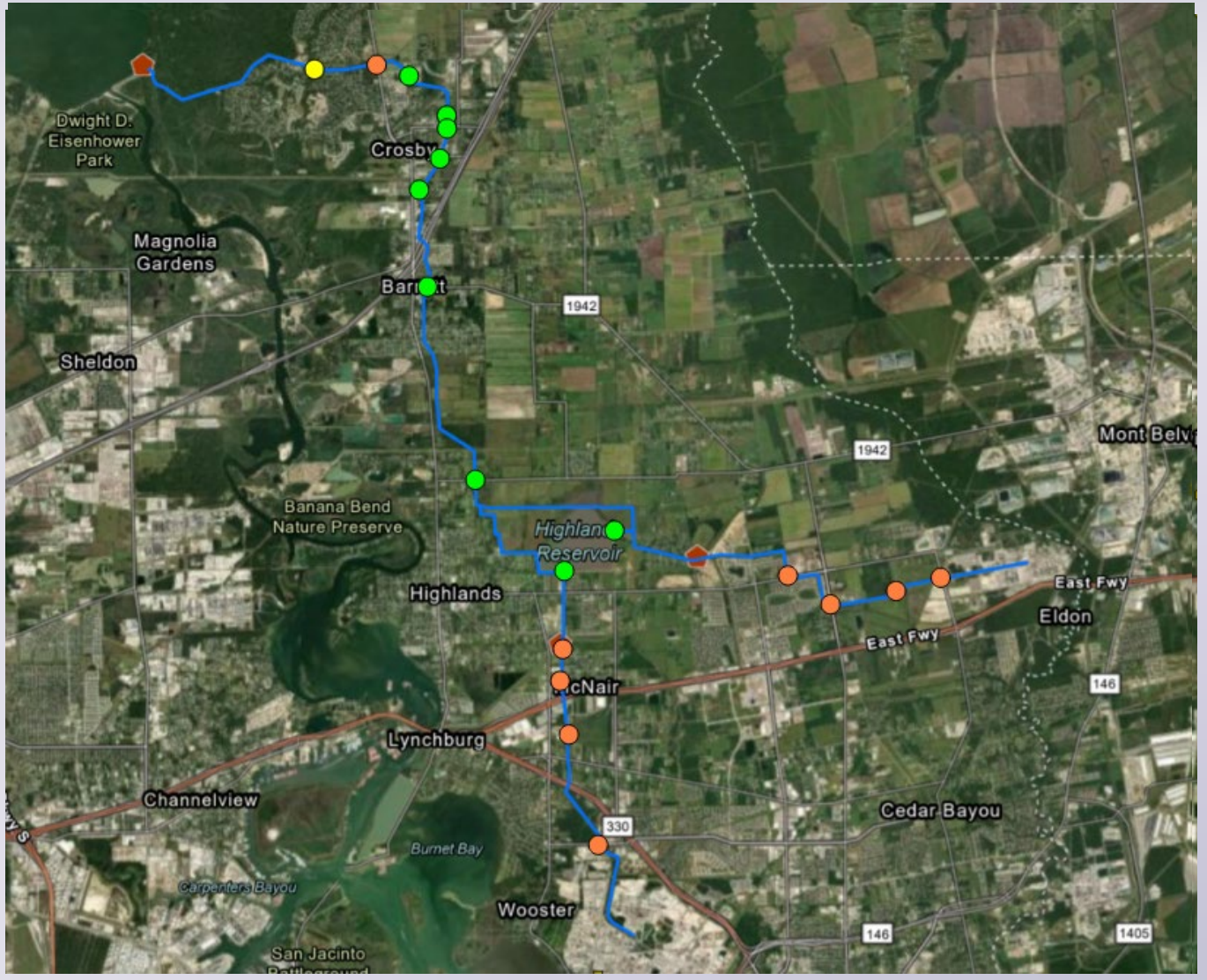
Siphon 29 Before

Siphon 29 After

# BACKGROUND

## 2015

Sjolander
HCFCD
Siphon 37
North Main
Siphon 7
Siphon 28
Siphon 31
Wallisville
Siphon 29



# PLANNING PHASE

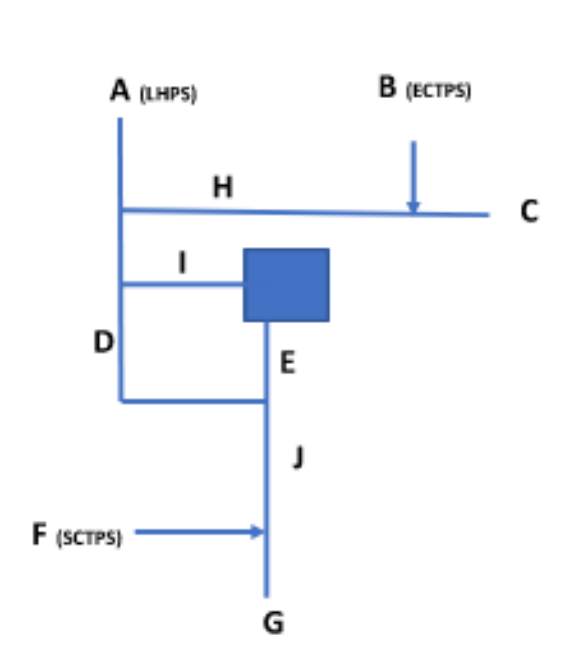
Hydraulic Modeling

- HEC-RAS vs. InfoWorks ICM
- In-house vs. Outsourced
- Upkeep

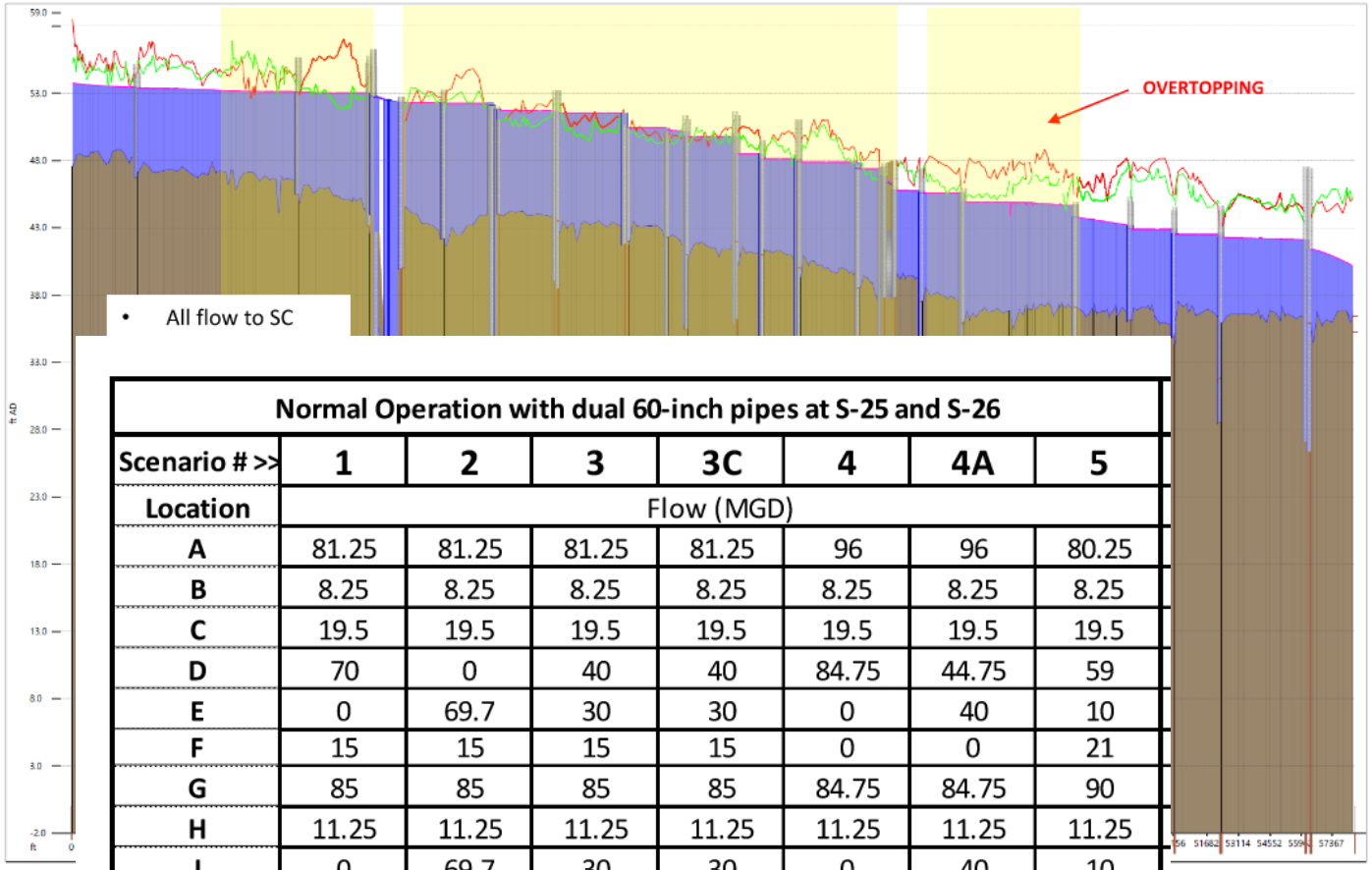
# PLANNING PHASE

## Hydraulic Modeling - Design

- Pipe/Culvert sizing
- Canal Capacity
- Construction Considerations




Scenario 4 – Main Canal (96 MGD)



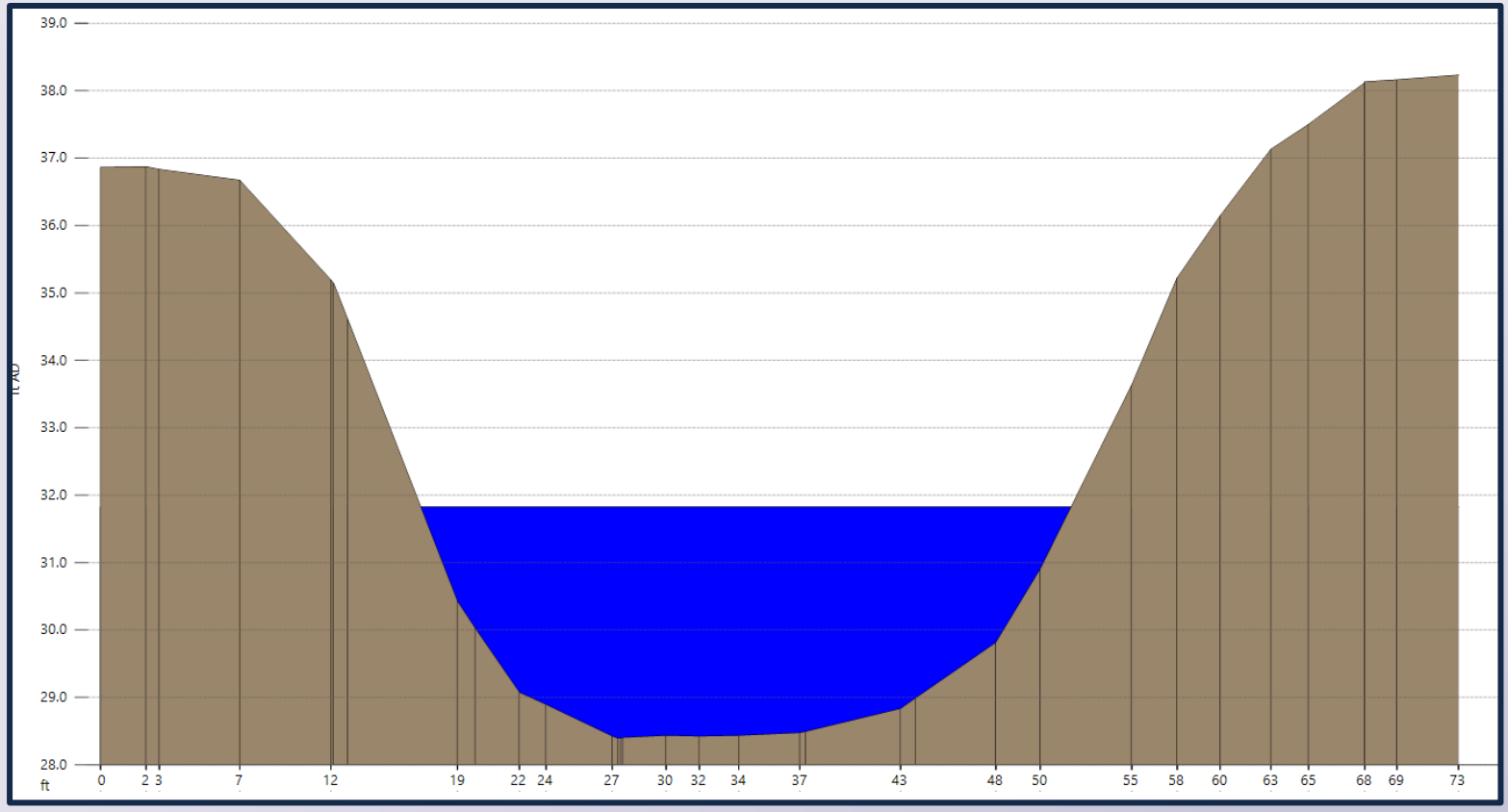

| Normal Operation with dual 60-inch pipes at S-25 and S-26 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Scenario # >> | 1 | 2 | 3 | 3C | 4 | 4A | 5 |
| Location | Flow (MGD) | | | | | | |
| A | 81.25 | 81.25 | 81.25 | 81.25 | 96 | 96 | 80.25 |
| B | 8.25 | 8.25 | 8.25 | 8.25 | 8.25 | 8.25 | 8.25 |
| C | 19.5 | 19.5 | 19.5 | 19.5 | 19.5 | 19.5 | 19.5 |
| D | 70 | 0 | 40 | 40 | 84.75 | 44.75 | 59 |
| E | 0 | 69.7 | 30 | 30 | 0 | 40 | 10 |
| F | 15 | 15 | 15 | 15 | 0 | 0 | 21 |
| G | 85 | 85 | 85 | 85 | 84.75 | 84.75 | 90 |
| H | 11.25 | 11.25 | 11.25 | 11.25 | 11.25 | 11.25 | 11.25 |
| I | 0 | 69.7 | 30 | 30 | 0 | 40 | 10 |
| J | 70 | 70 | 70 | 70 | 84.75 | 84.75 | 69 |

*3C denotes scenario run for bypass access culvert

# PLANNING PHASE

## Hydraulic Modeling - Operations

- Travel Time
- Water Surface Elevations
- Gate Operations



# PLANNING PHASE

## Hydraulic Modeling - Operations

- In-house projects
  - HCFCD-Wallisville
  - Siphon 6 SCADA
  - Project Identification for Levee Rehab

HCFCD-Wallisville Before

HCFCD-Wallisville After

# PLANNING PHASE

## Coordination Efforts

- Harris County – road closure approval, ultimate road ROW, conflicting projects, floodplain

Wallisville Before

Wallisville After

# PLANNING PHASE

## Coordination Efforts

- TxDOT – road closure approval, detour plans, conflicting projects

Siphon 7 Before

Siphon 7 After

# PLANNING PHASE

Coordination Efforts

- School Districts – road closures, detour plans, school calendar
- Emergency Responders – road closures, detour plans
- Other Cities – utility crossing, permitting jurisdiction

# PLANNING PHASE

## Utility Identification

- Early identification helps avoid design changes during construction
- Early coordination with utility owner if line needs to be re-located
- Accurate cost estimating
- Increased site safety

# PLANNING PHASE

Easement Identification

- Permanent Easements
- Temporary Construction Easements (TCEs)
- Long lead time if landowner is not cooperative
- Soft costs can be three to four times the land costs
- Sometimes more economical to modify design to avoid easement acquisition
- Contractors can sometimes have better success with landowner negotiation

# PLANNING PHASE

Preliminary Engineering Report

- Planning efforts are summarized into an engineering report
- Design efforts include 30% design drawings
- Design assumptions, modeling results, parameters, preliminary calculations
- Meeting notes
- Summary of agency coordination
- Potholing results
- Summary of recommendations
- Preliminary cost estimates

# DESIGN CONSIDERATIONS

Standardization

- Two Different Layouts
- Pipe Size & Material
- Access
- Structure Dimensions
- Riprap
- Staff Gauges
- SCADA Conduits

# DESIGN CONSIDERATIONS

<u>System Redundancy</u>

- Dual pipes

<u>Operation & Maintenance</u>

- Drop box sized to optimize access to pipes
- Pipe isolation allows staff to increase velocity through one pipe for cleaning.
- Slide gates provided at key structures along system
- Removable and lockable handrails

<u>Stop Logs</u>

- Structure is designed so that stop logs can fit multiple structures

# DESIGN CONSIDERATIONS

## SCADA Infrastructure

- Recent designs include pull boxes and conduits under the road
- Structures with gates include covered shed
- In-pipe flow meter is used at two locations
- In-channel flow measurement did not yield reliable results
- Level is measured using ultrasonic level instrumentation at multiple locations
- Gate actuators at select locations

- Preparation
- Standardization
- Operation

# QUESTIONS?

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