Houston's Northeast Water Purification Plant Expansion helps achieve regional groundwater conversion requirements

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carollo

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Marcel Khouw, PE – CHRWA Representative
Lindsay Kovar, PE – NFBWA Representative

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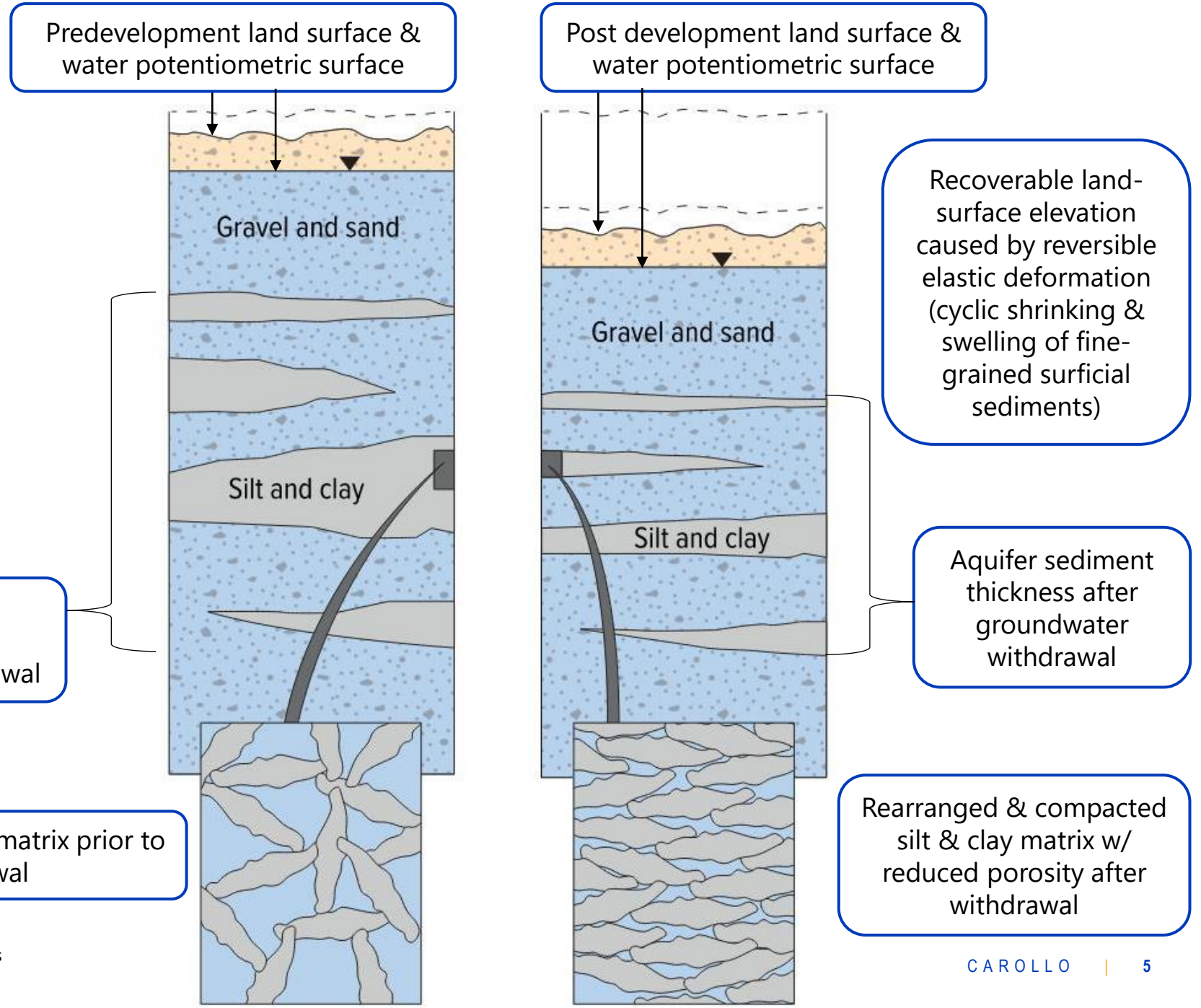
Agenda

1. Groundwater Subsidence
2. Project Overview, Highlights, & Lessons Learned
3. Closing Thoughts, Answer Questions

01

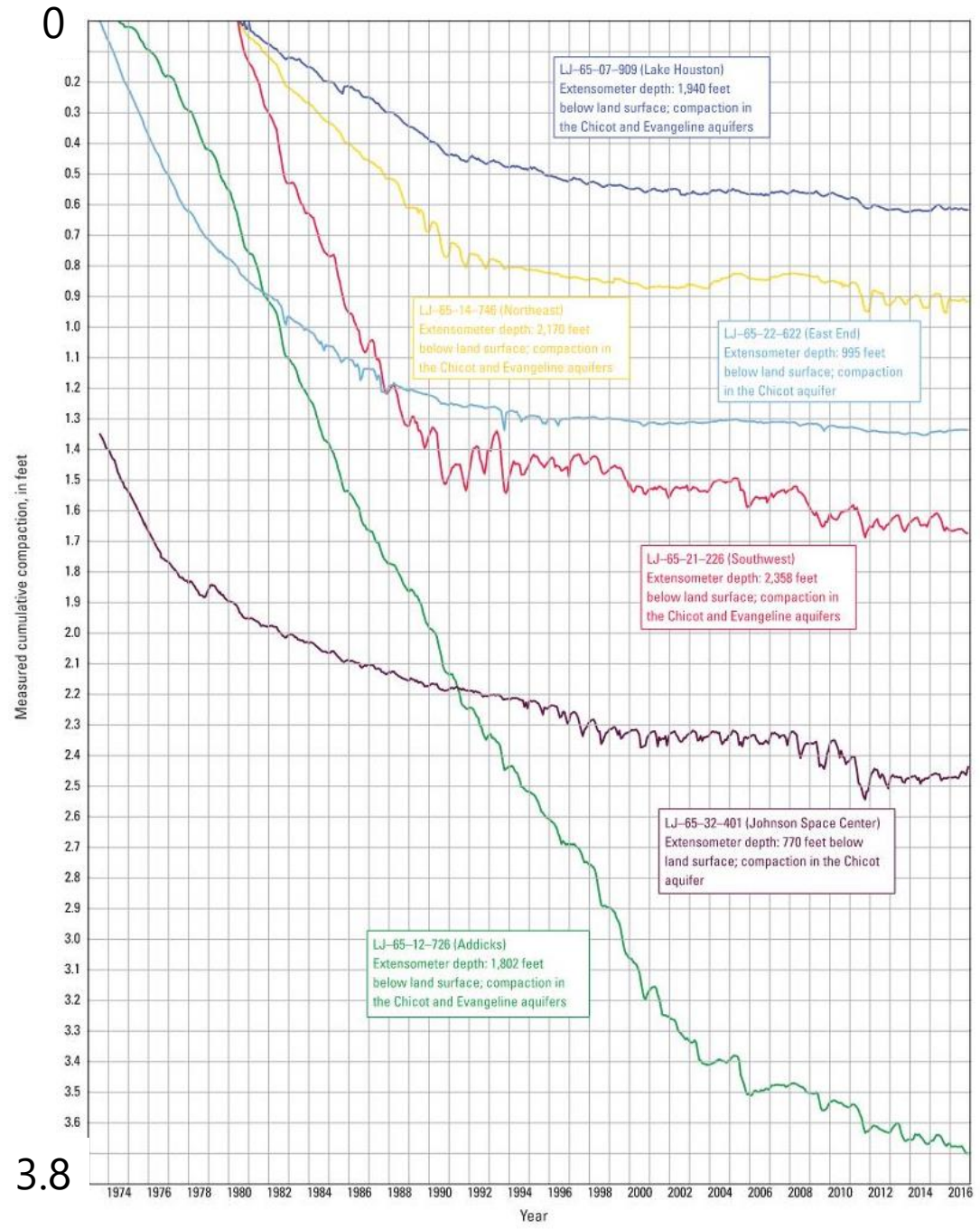
Groundwater Subsidence

Long-term groundwater withdrawals lead to irreversible land surface subsidence

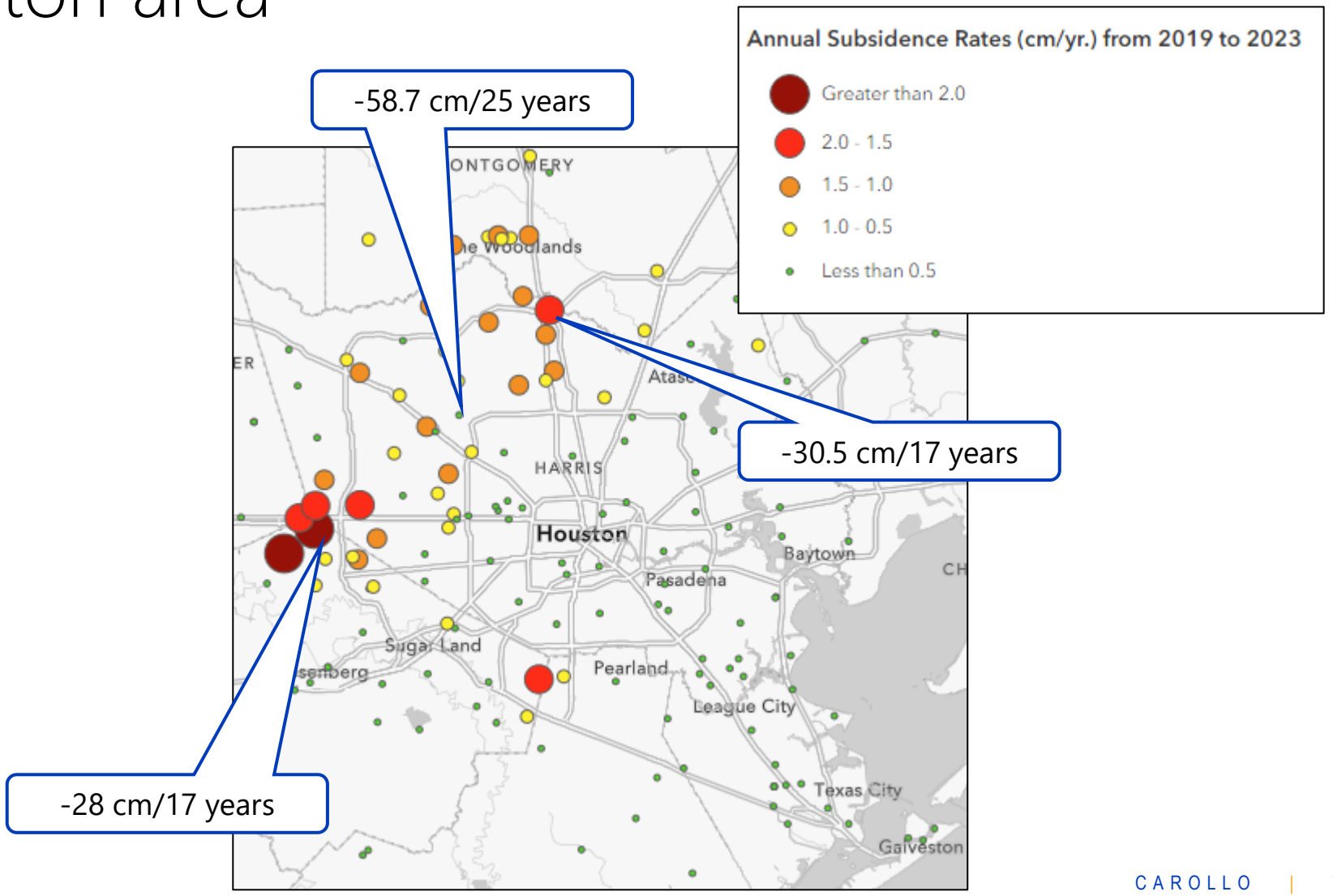


Source: USGS, 2017 "Water-Level Altitudes 2017 and Water-Level Changes in the Chicot, Evangeline, and Jasper Aquifers and Compaction 1973–2016 in the Chicot and Evangeline Aquifers, Houston- Galveston Region, Texas"

Aquifer compaction has been observed throughout the region



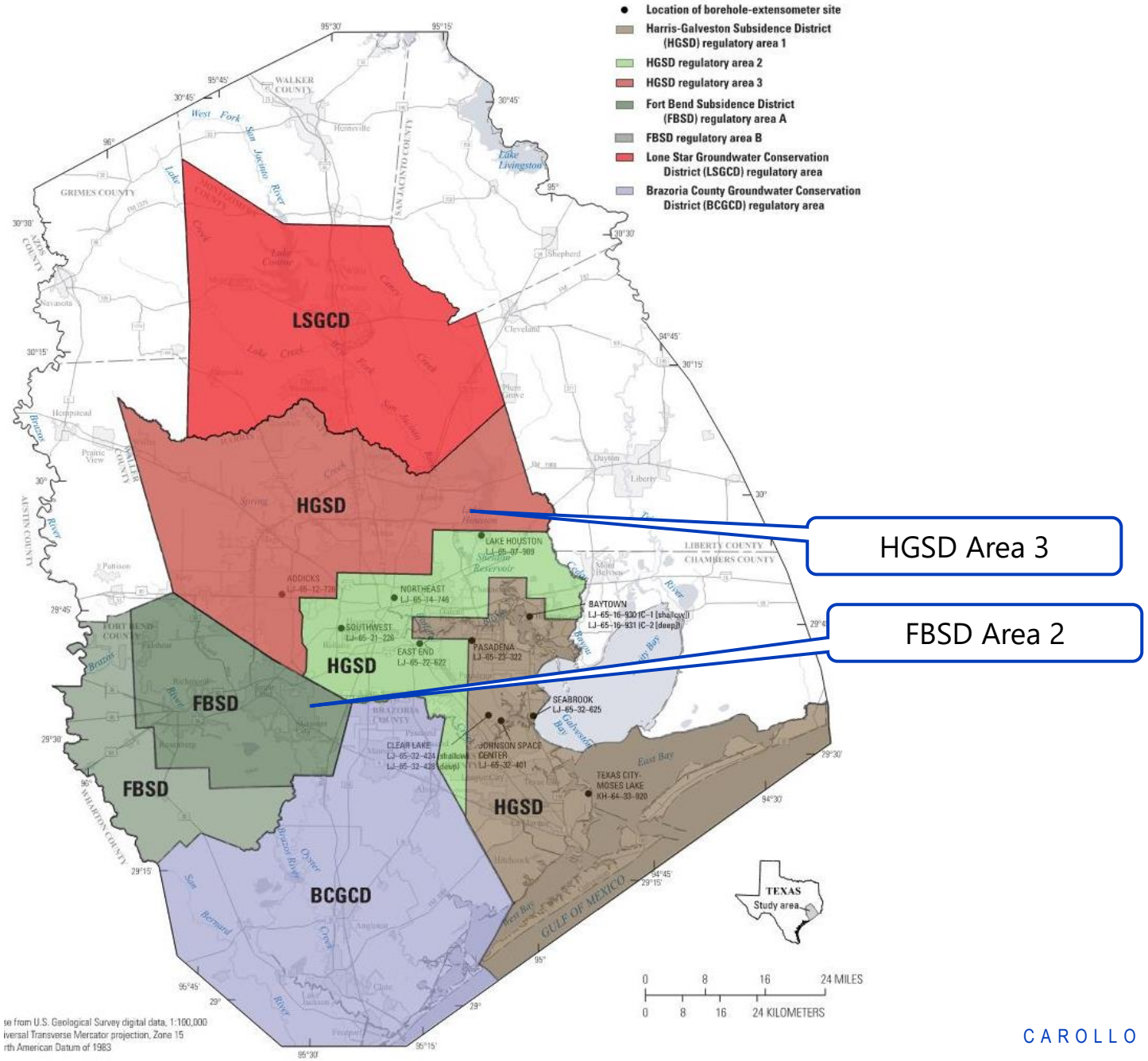
Decades of land subsidence have occurred throughout the greater Houston area



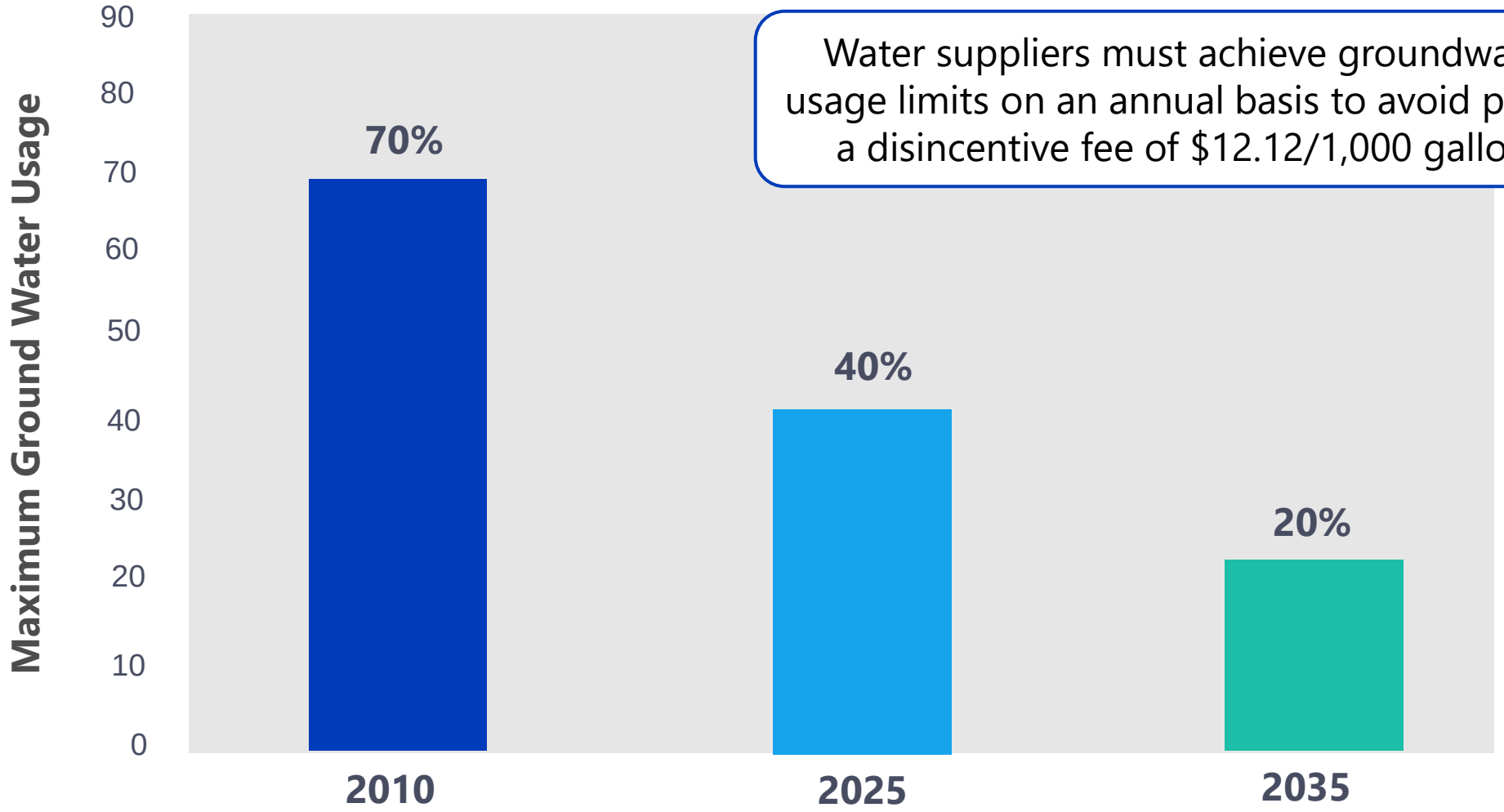
Multiple agencies have jurisdiction over groundwater management

HARRIS-GALVESTON SUBSIDENCE DISTRICT

FORT BEND SUBSIDENCE DISTRICT



Subsidence regulations drive the need for expansion

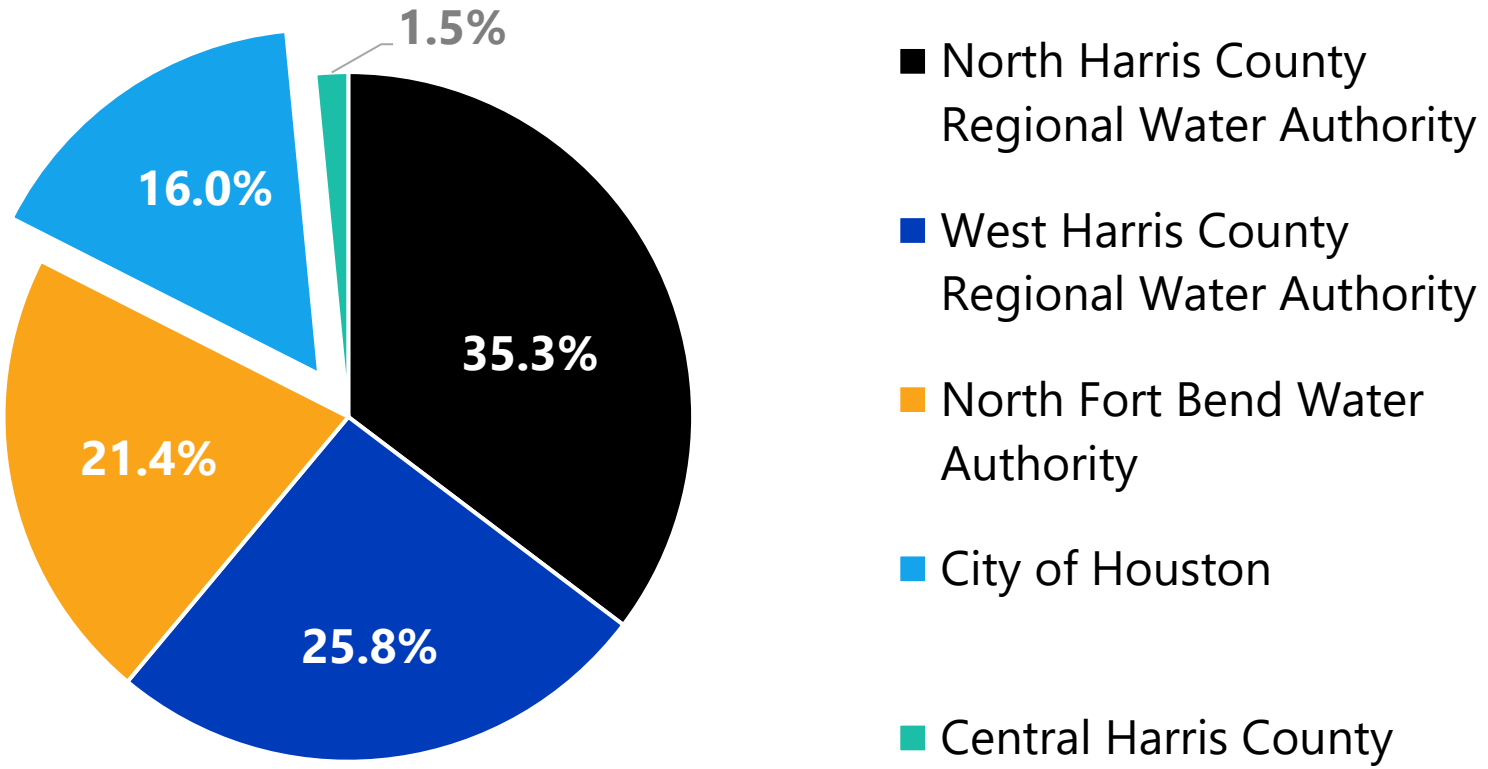


02

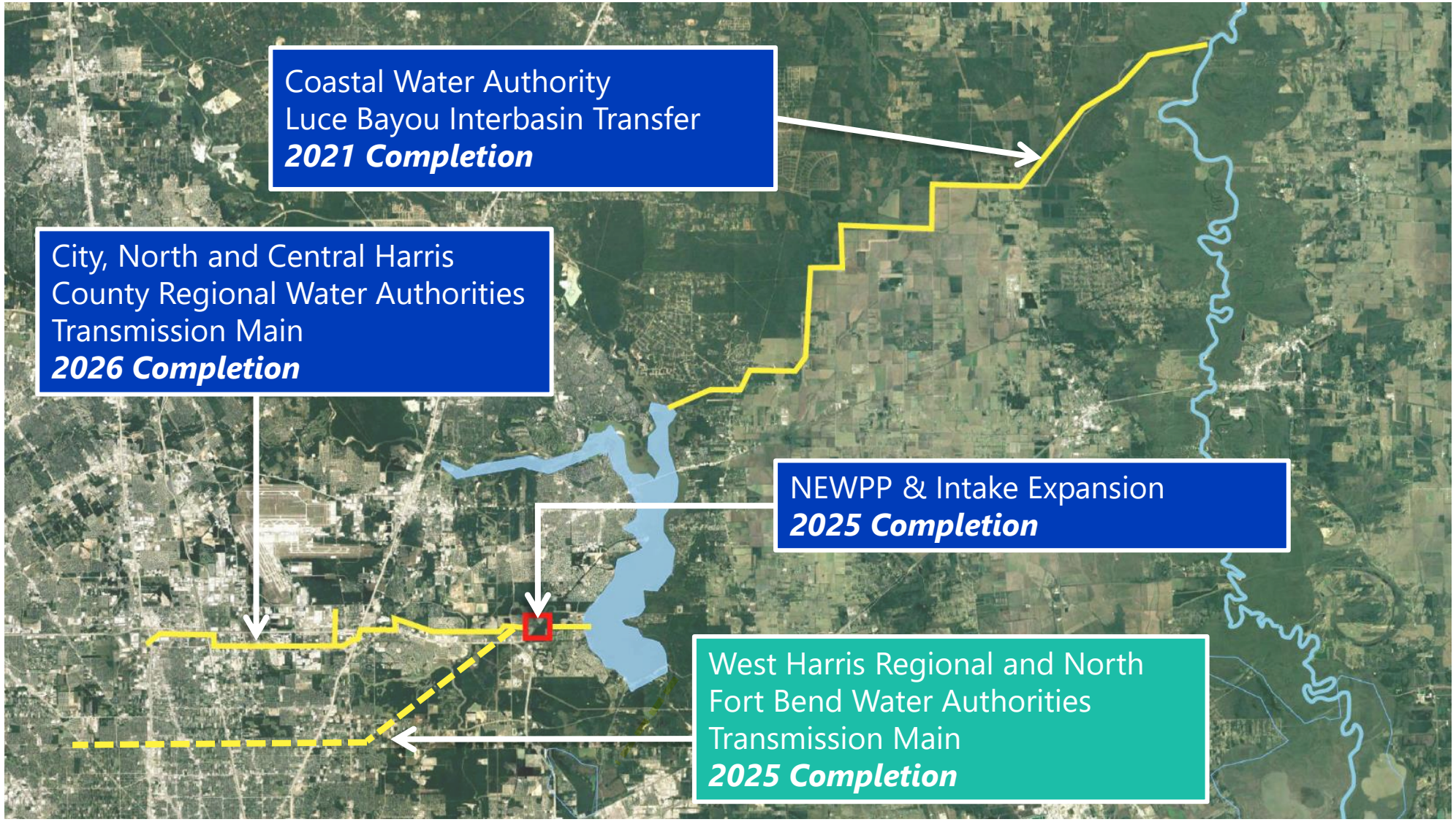
Project Overview, Highlights, & Lessons Learned

Houston is delivering the project on behalf of Authority partners

COST AND CAPACITY SHARE



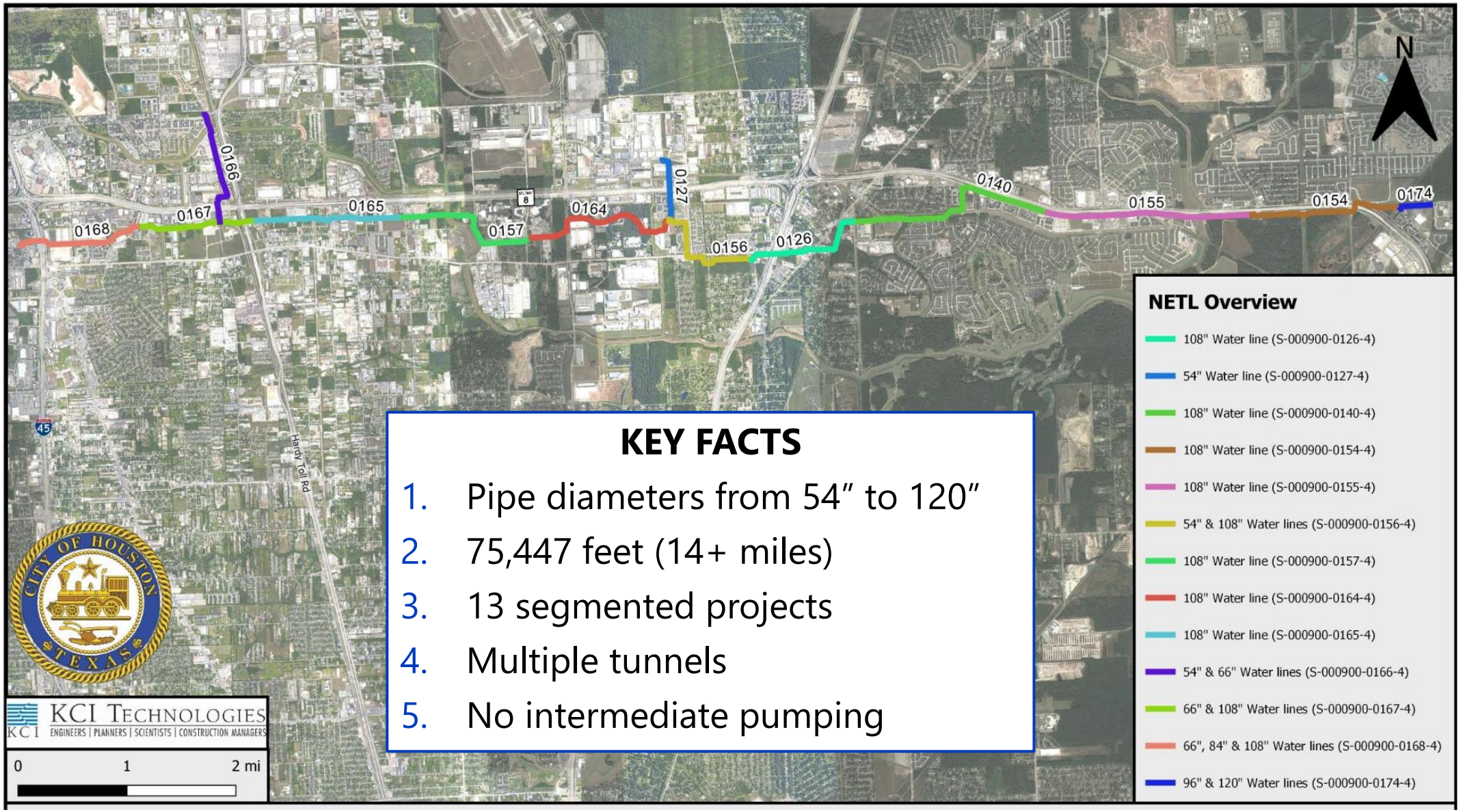
NEWPP Expansion: One piece of a $5+ billion puzzle



Luce Bayou Interbasin Transfer

1. Coastal Water Authority (CWA) Project
2. Pump Station can transfer up to 500 MGD from Trinity River to Lake Houston
3. 3 miles of dual 96-inch diameter pipelines
4. 23.5 miles of canals

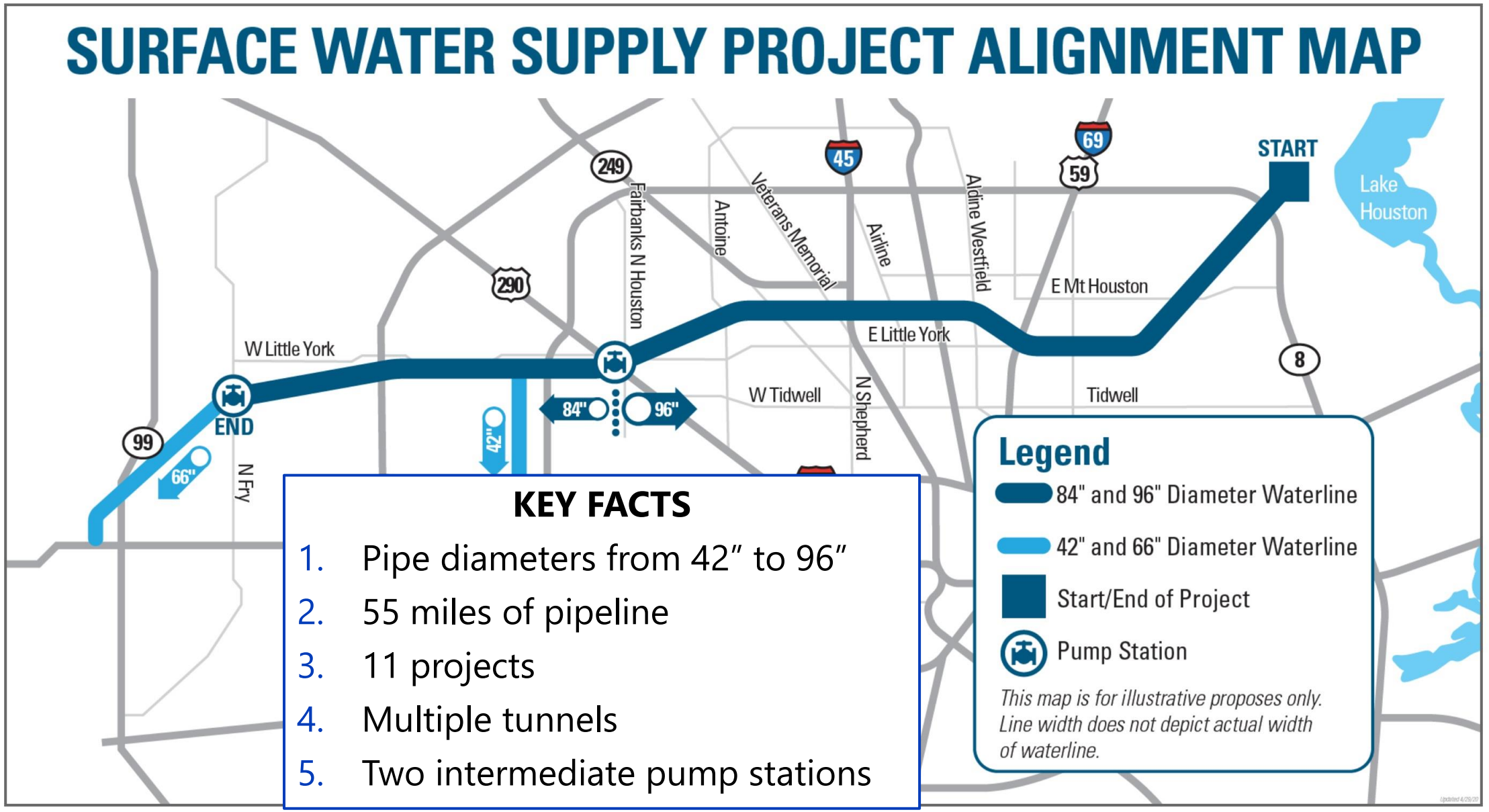
City/NHCRWA/CHRWA Northeast Waterline (NETL)



KEY FACTS

1. Pipe diameters from 54” to 120”
2. 75,447 feet (14+ miles)
3. 13 segmented projects
4. Multiple tunnels
5. No intermediate pumping

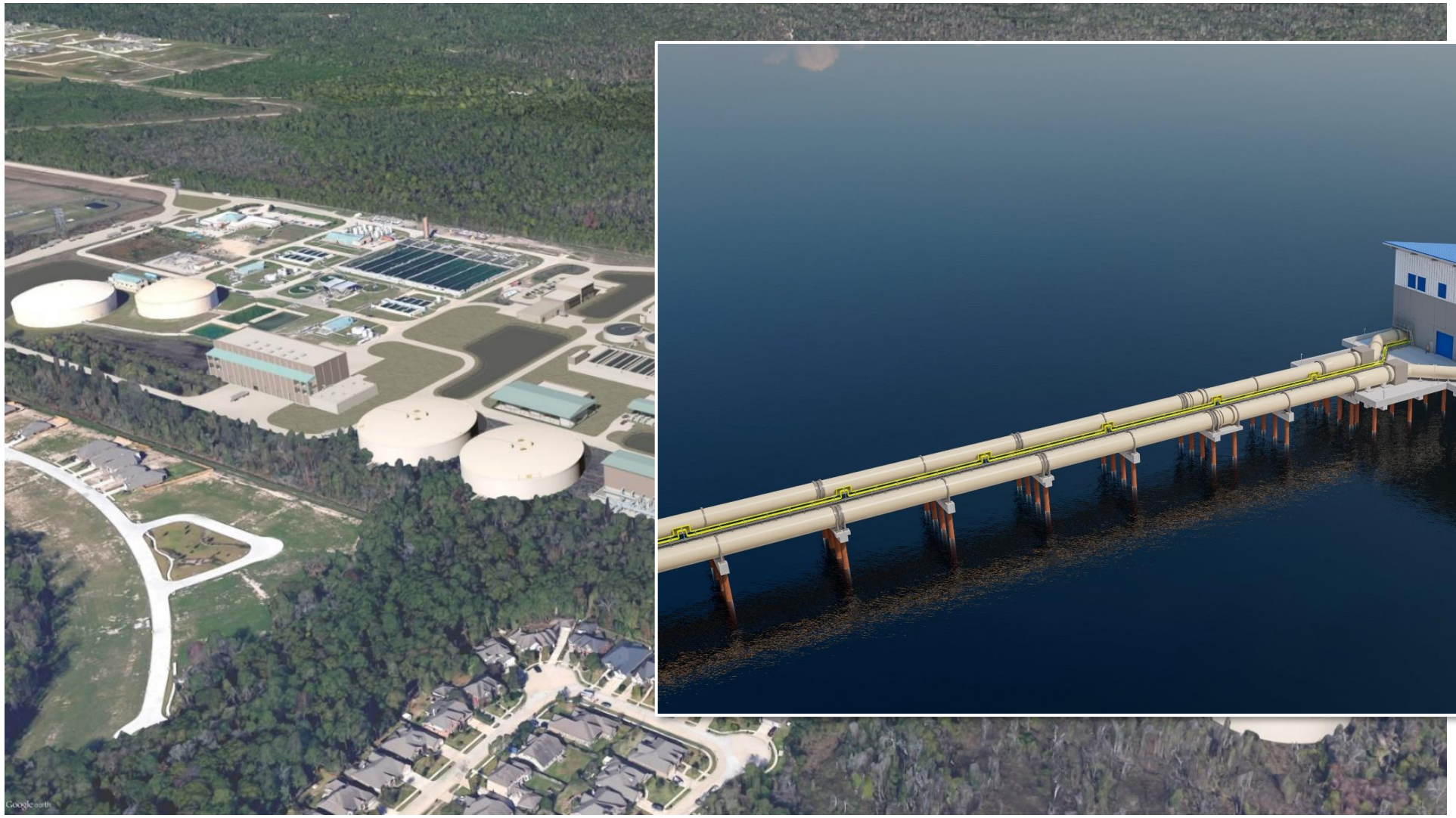
WHCRWA/NFBWA Waterline



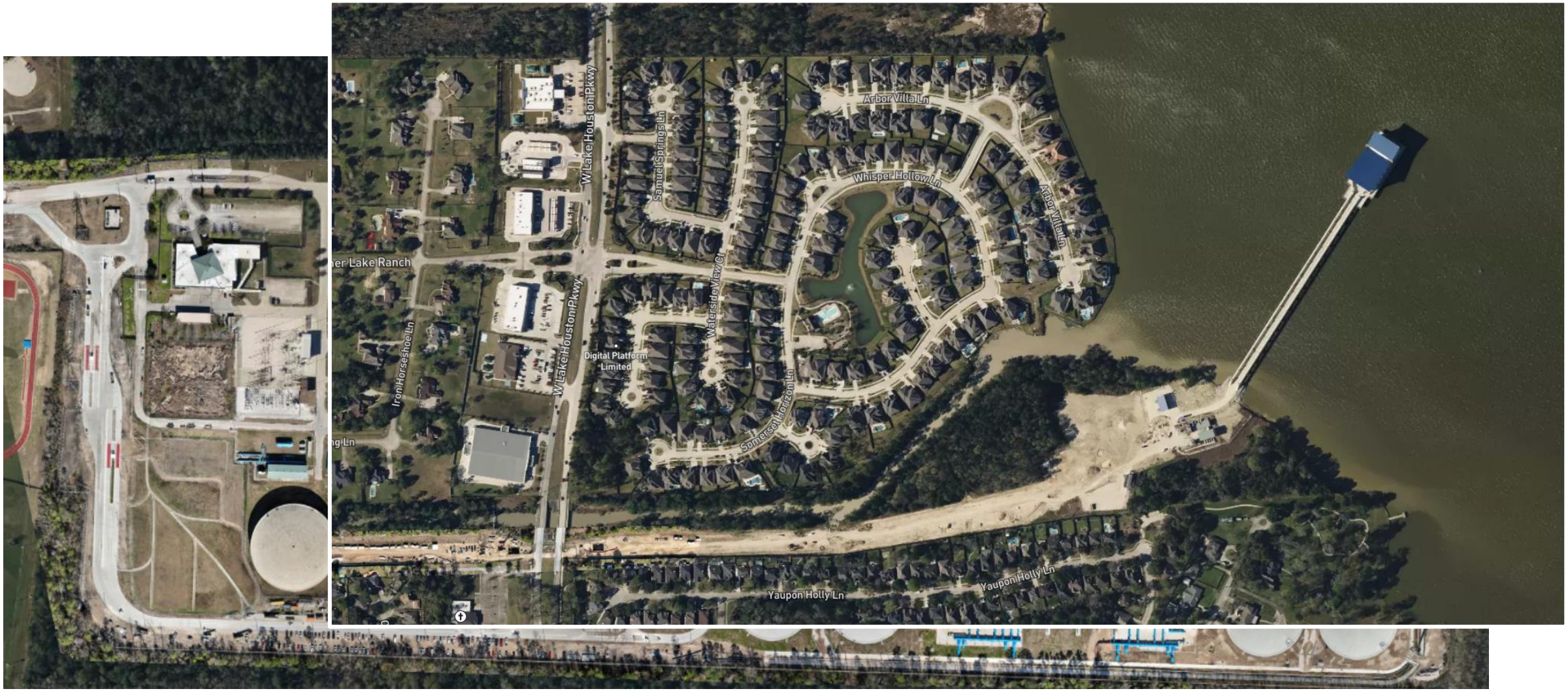
KEY FACTS

1. Pipe diameters from 42” to 96”
2. 55 miles of pipeline
3. 11 projects
4. Multiple tunnels
5. Two intermediate pump stations

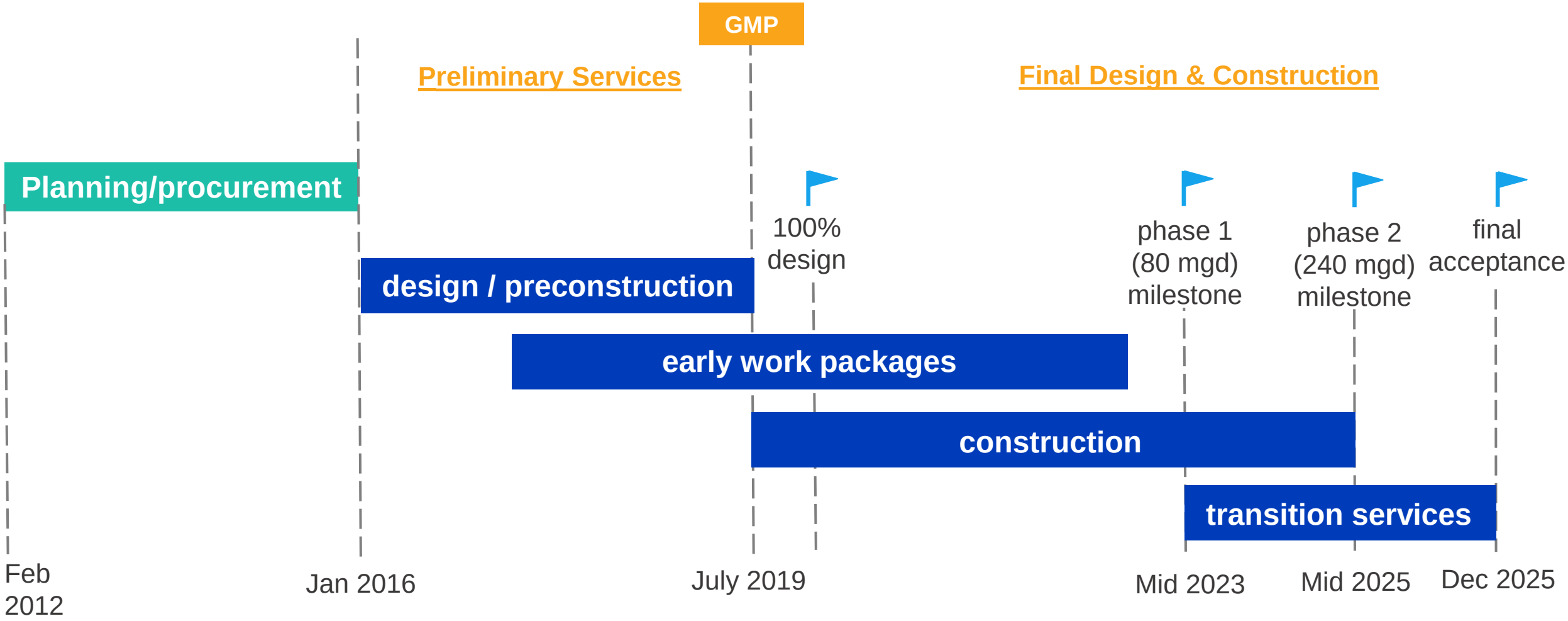
When complete, the NEWPP will be capable of producing 320 MGD, 365 days a year



The project is nearing completion



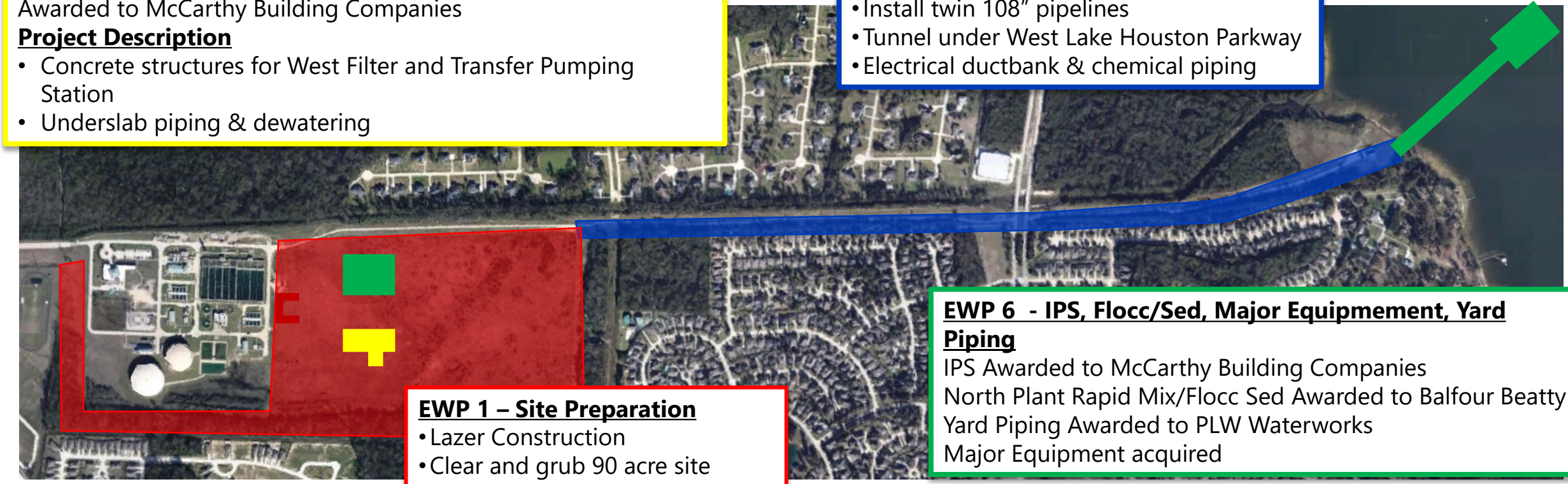
Over 13 years to reach the finish line



Early work packages progressed critical path work

EWP 2 – Phase 1 Filter/Transfer Pump Station Structures
Awarded to McCarthy Building Companies
Project Description
- Concrete structures for West Filter and Transfer Pumping Station
- Underslab piping & dewatering

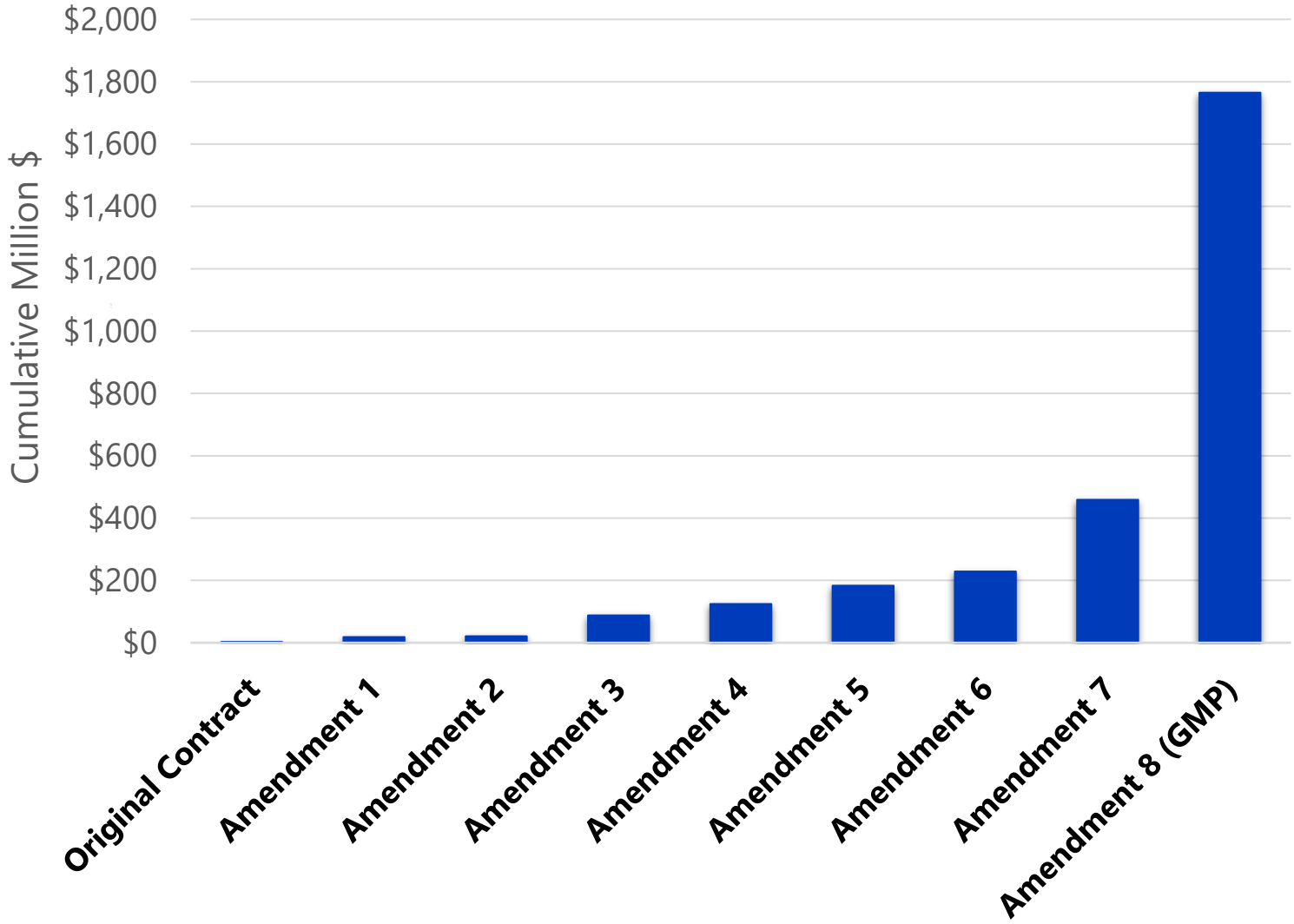
EWP 4 – Raw Water Pipelines
Awarded to Barnard Construction
Project Description
- Install twin 108" pipelines
- Tunnel under West Lake Houston Parkway
- Electrical ductbank & chemical piping



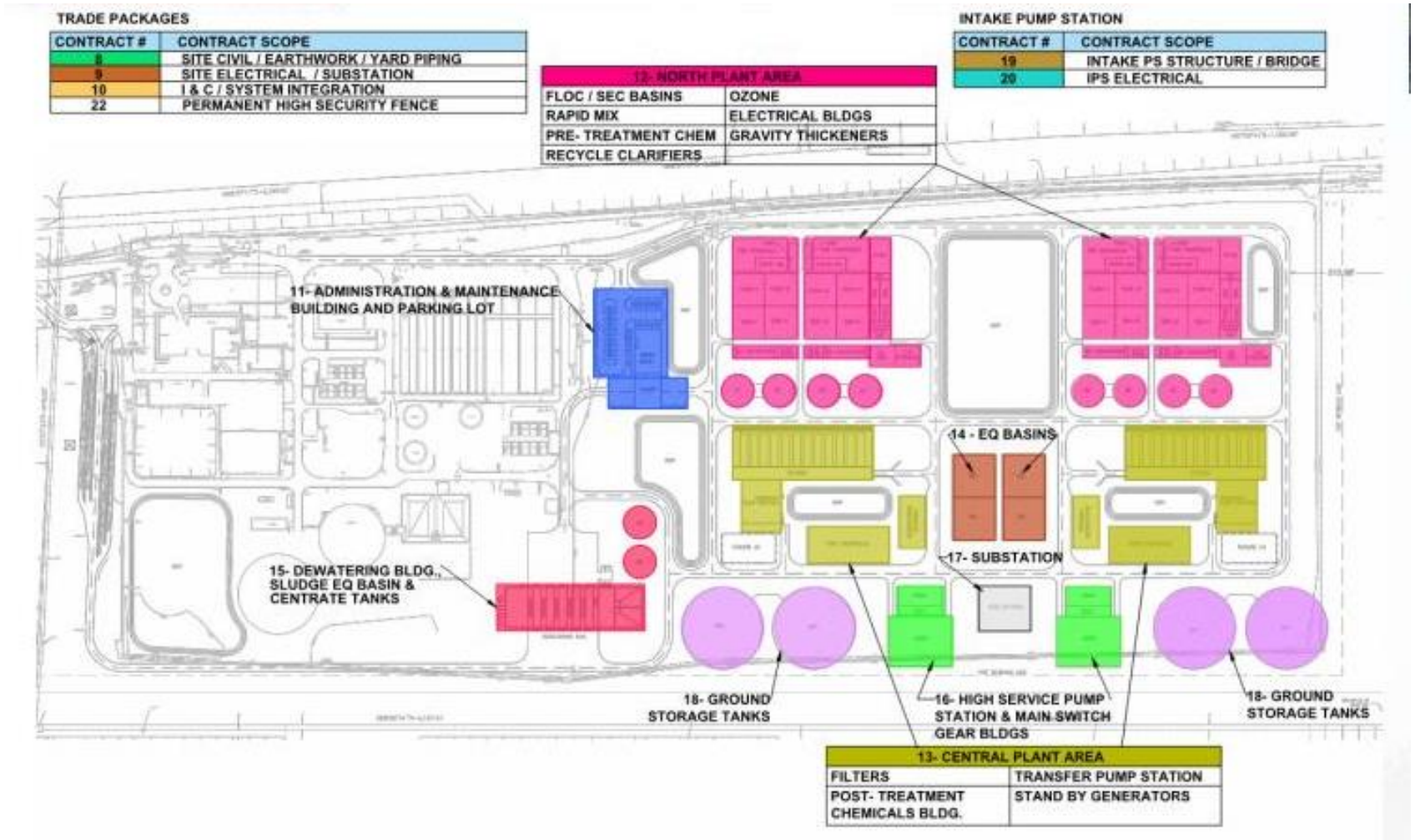
EWP 1 – Site Preparation
- Lazer Construction
- Clear and grub 90 acre site
- Reshape site for Stormwater
- Roads, fence, logistics
- Temporary Power
- Trailer City office complex
- Utilities relocations, spoil removal

EWP 6 - IPS, Flocc/Sed, Major Equipmement, Yard Piping
IPS Awarded to McCarthy Building Companies
North Plant Rapid Mix/Flocc Sed Awarded to Balfour Beatty
Yard Piping Awarded to PLW Waterworks
Major Equipment acquired

Multiple amendments to the DB agreement were negotiated along the way



Project was divided into multiple subcontract packages



Alberici

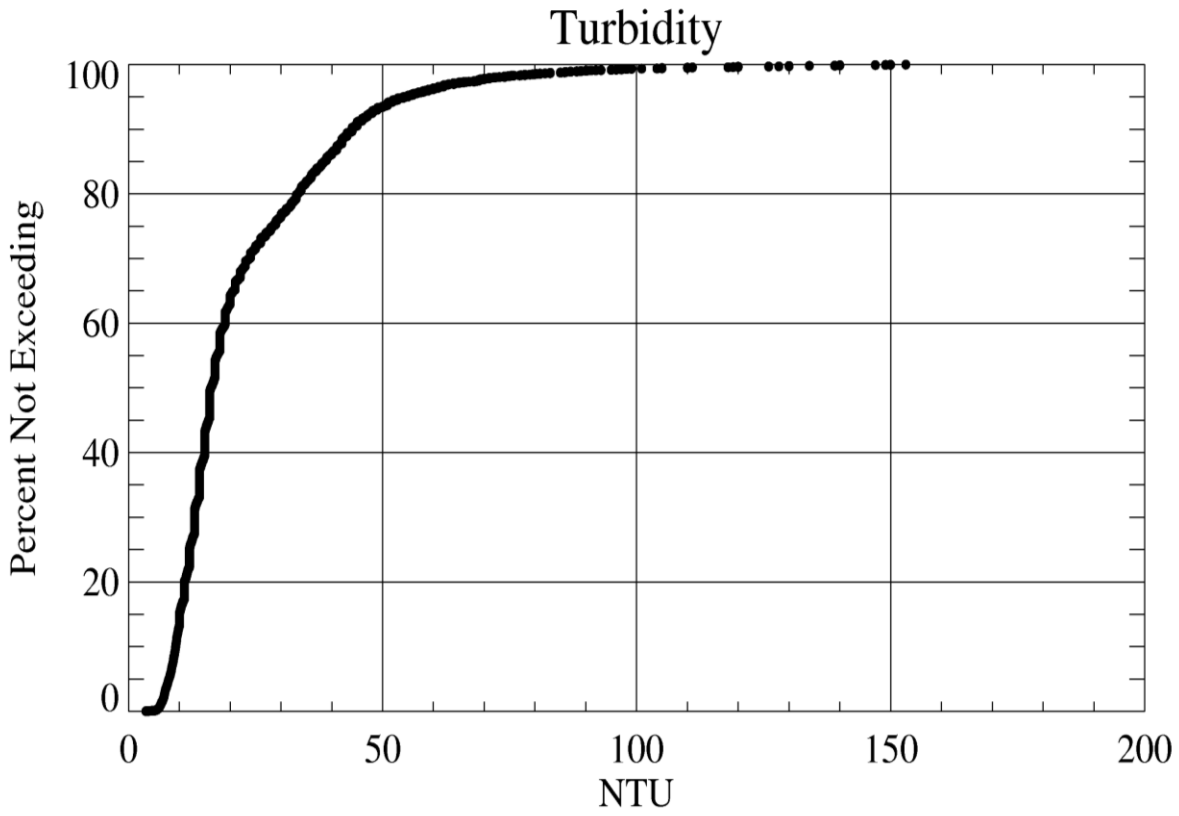
Balfour Beatty

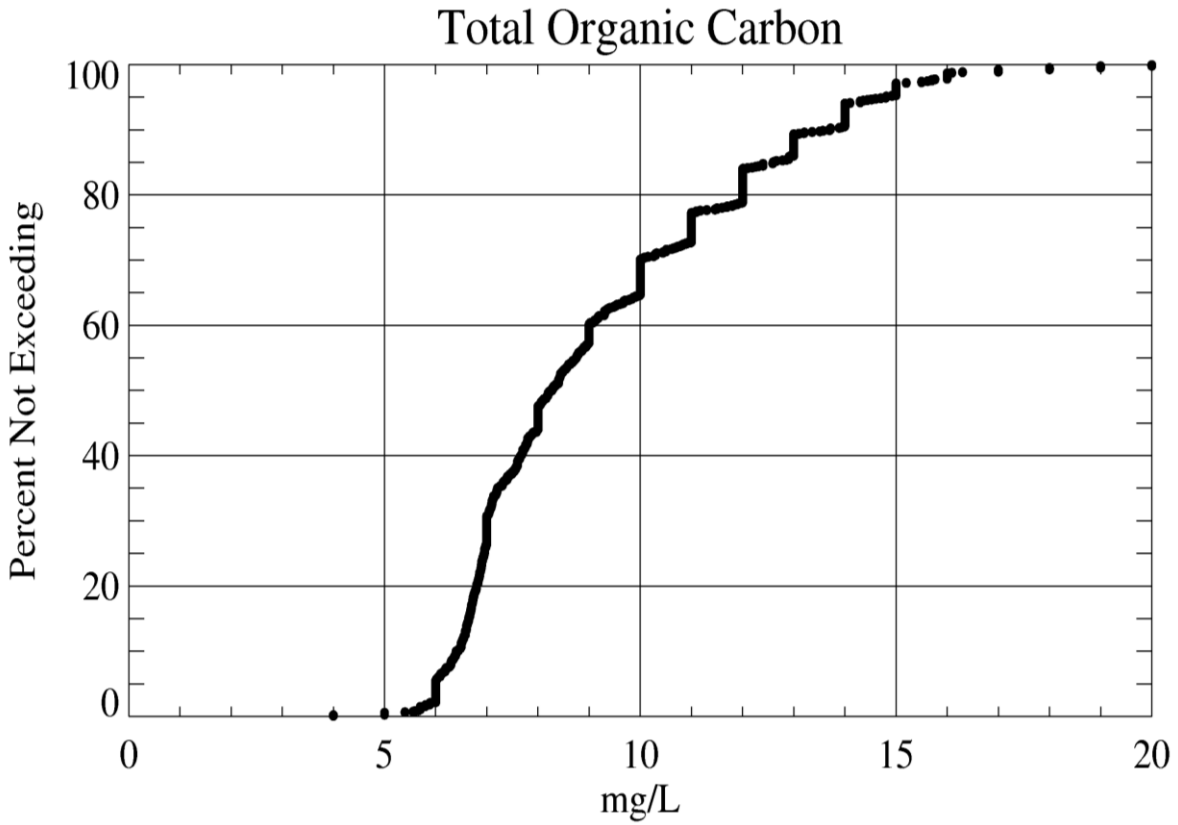
BARNARD
People building for People.

McCARTHY

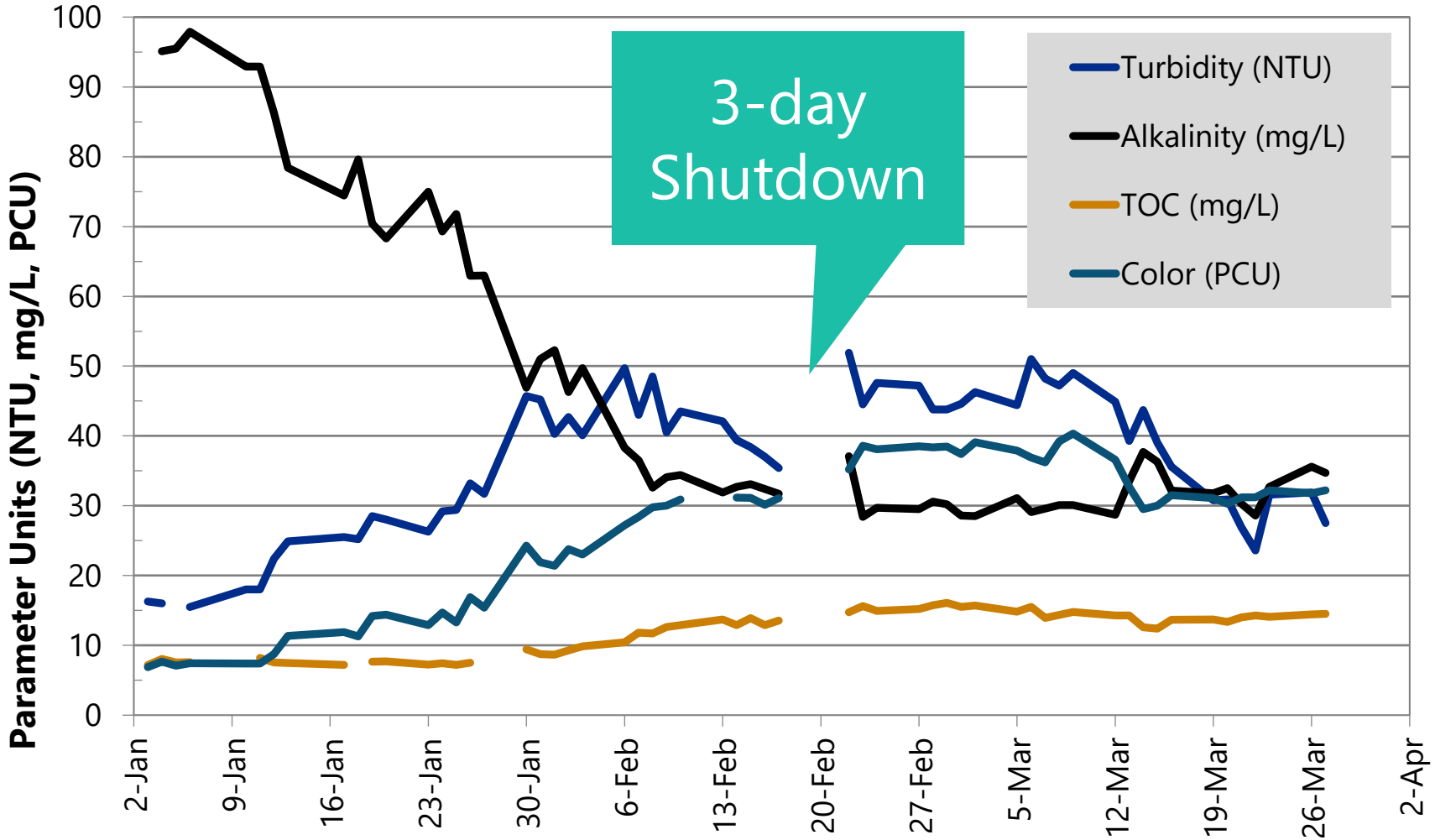
webber

Lake Houston water is challenging to treat

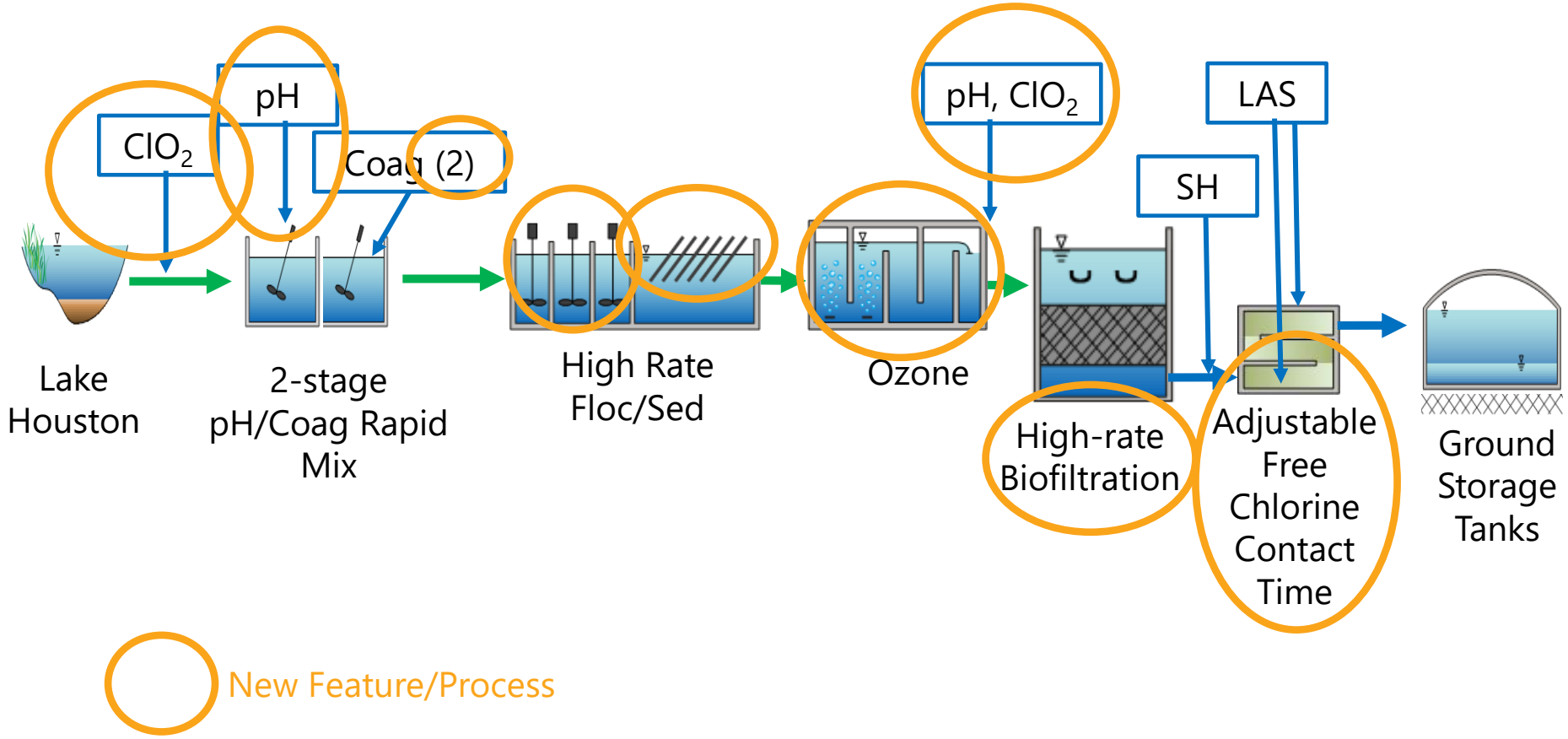




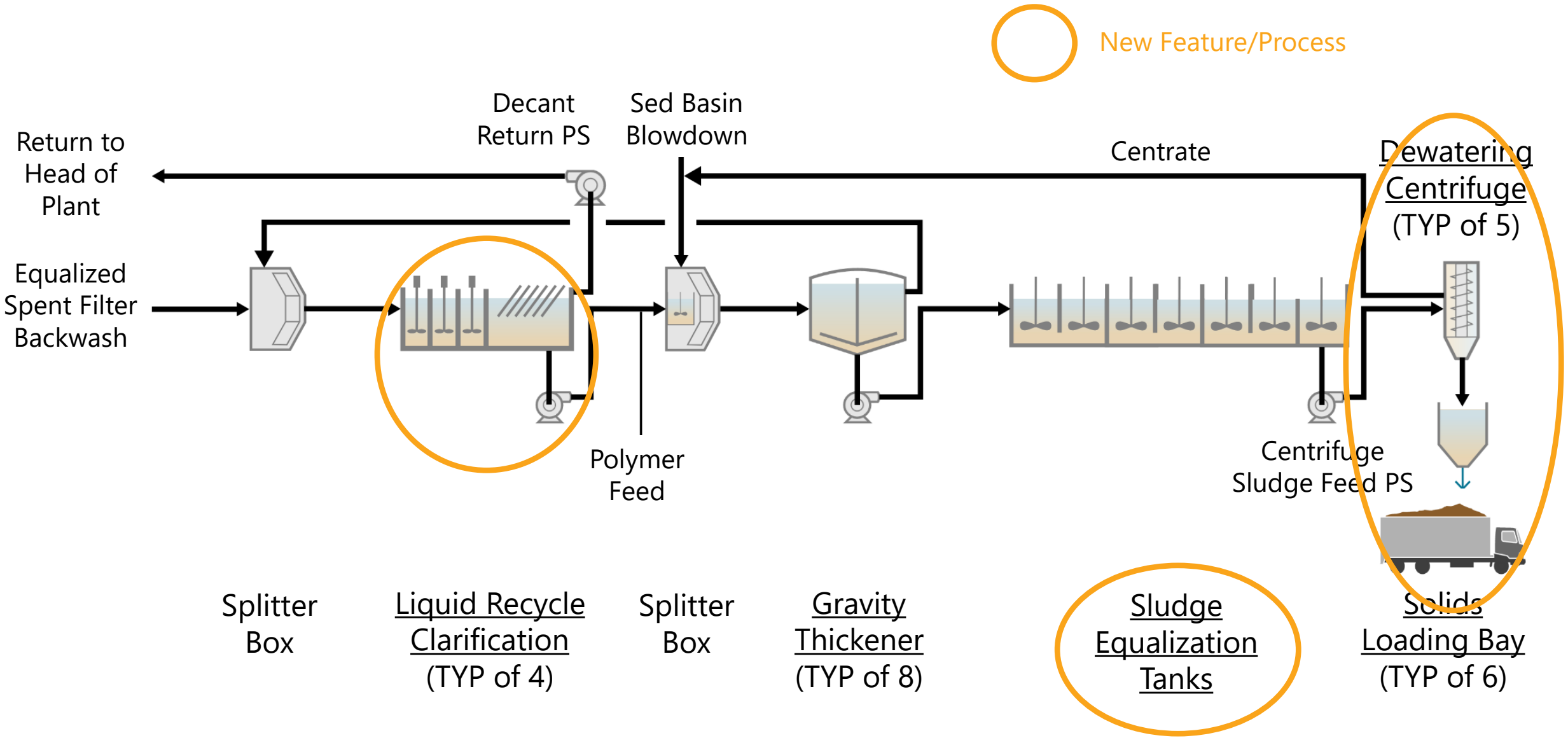
Rapidly changing quality and facility limitations led to a plant shutdown in 2012



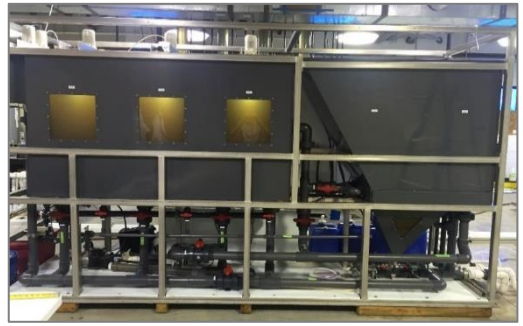
Treatment facilities are enhanced to better treat challenging water



Expansion solids facilities were also enhanced



18 months of piloting helped establish and then validate process performance & design criteria



ClO_2

Floc/Sed Skid

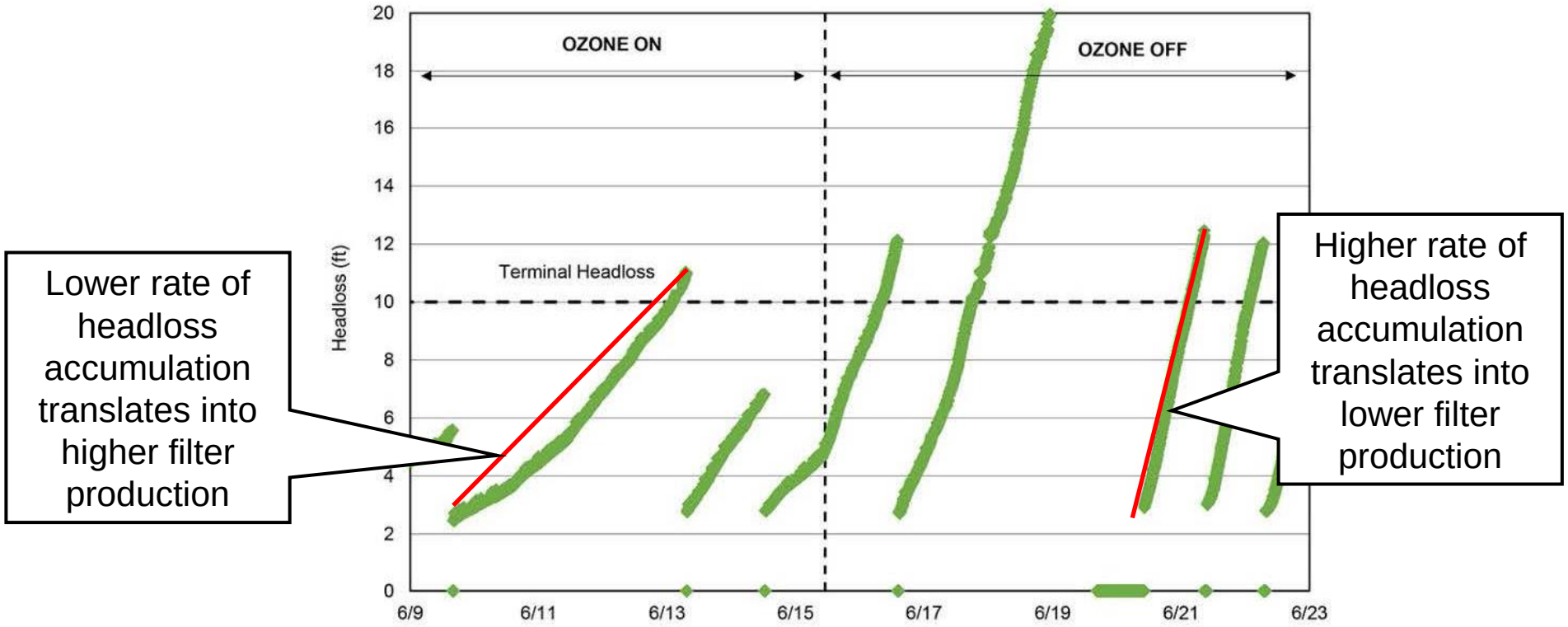
Ozone Skid

ClO_2

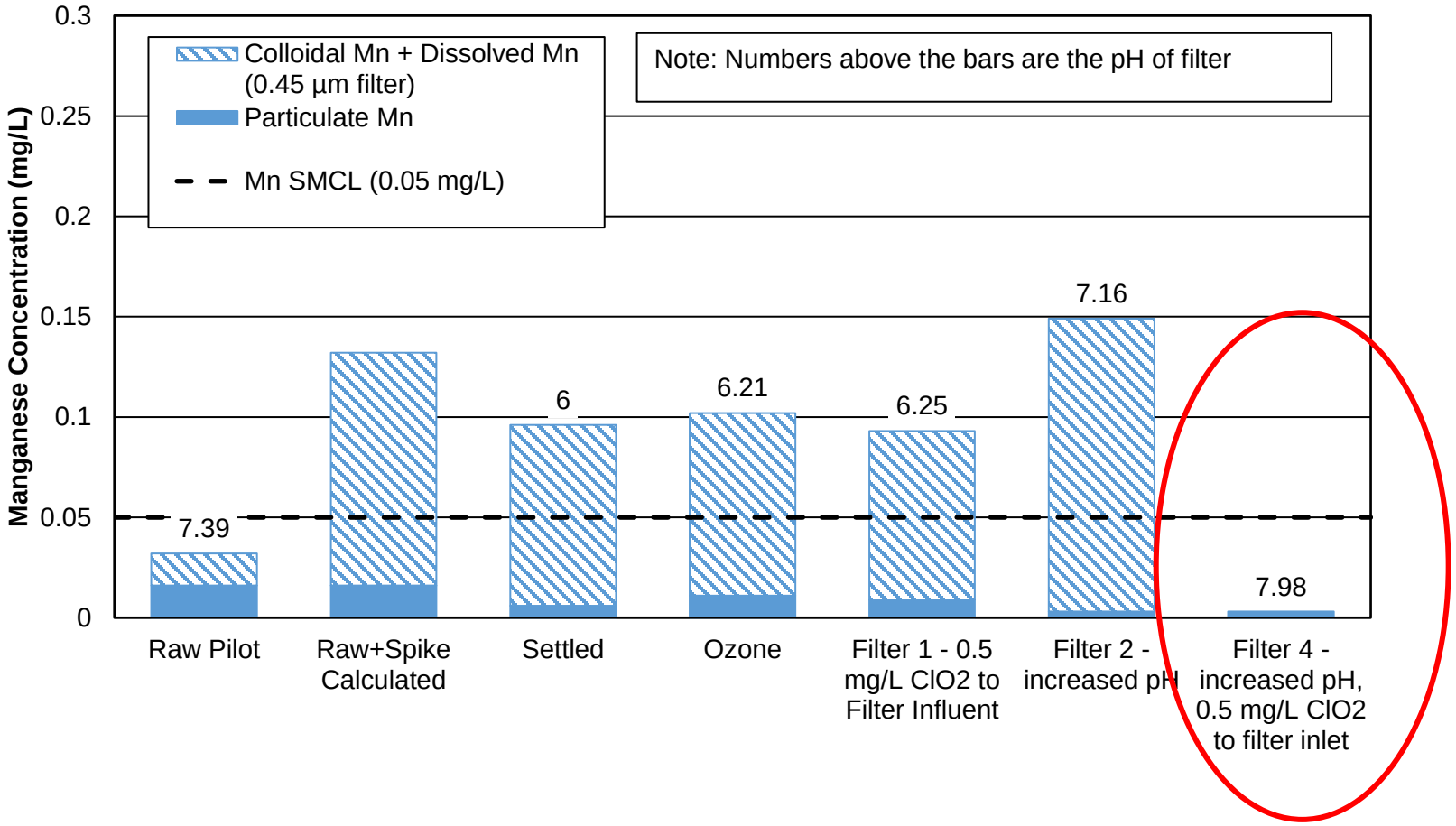
Filtration Skid

ClO2 Generator

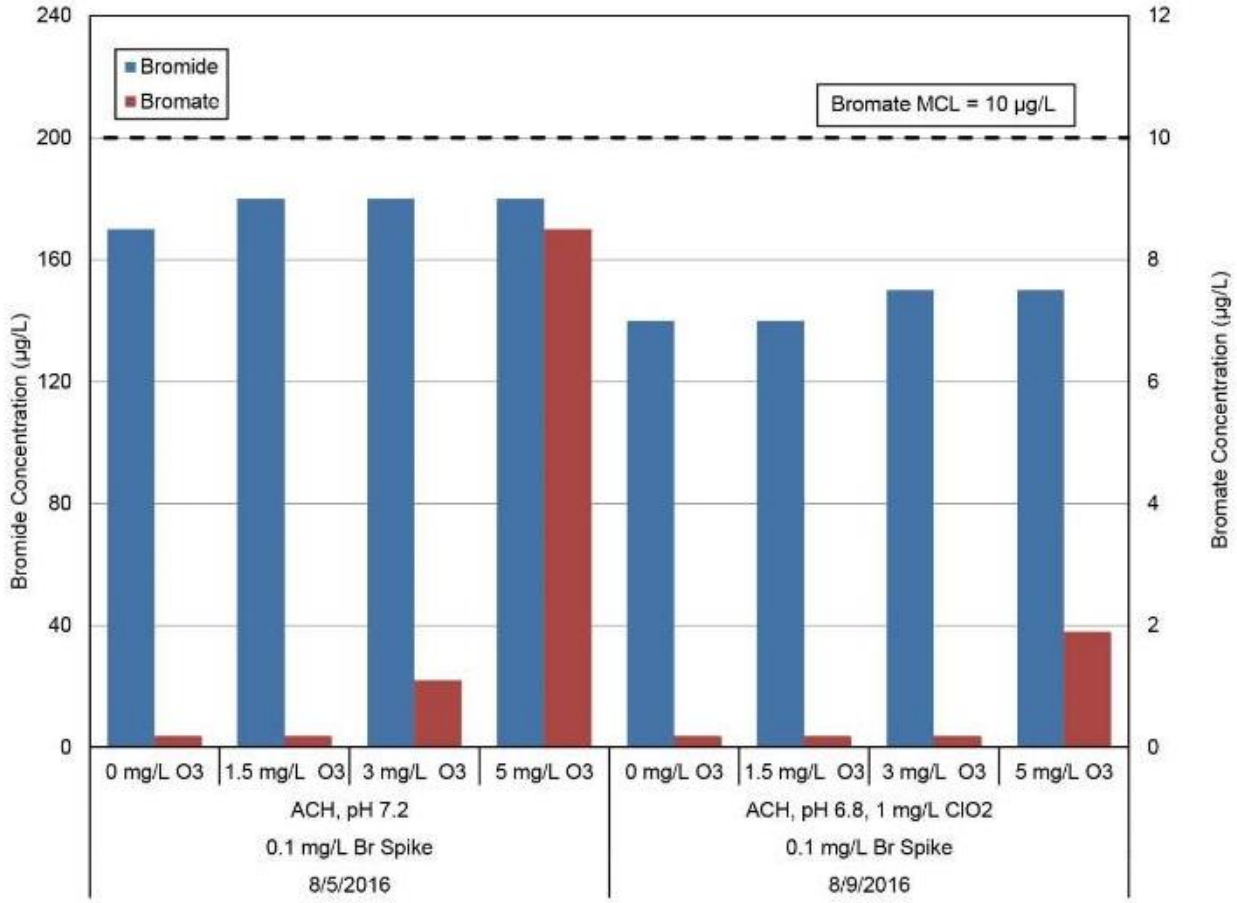
Ozone improved filterability and allowed for a higher filter loading rate (8.0 gpm/sf)



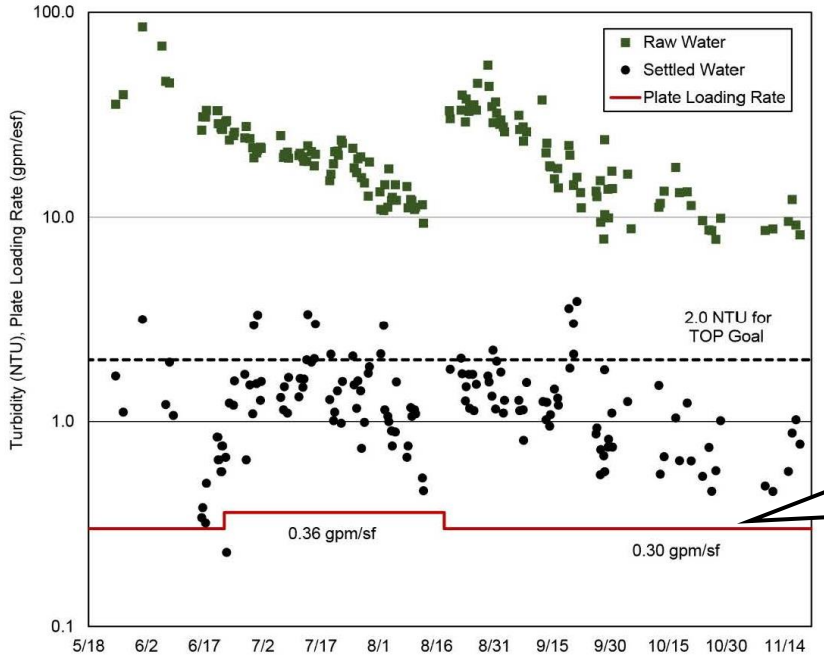
pH adjustment + ClO2 feed upstream of filtration improves manganese removal



Chlorite can mitigate bromate formation

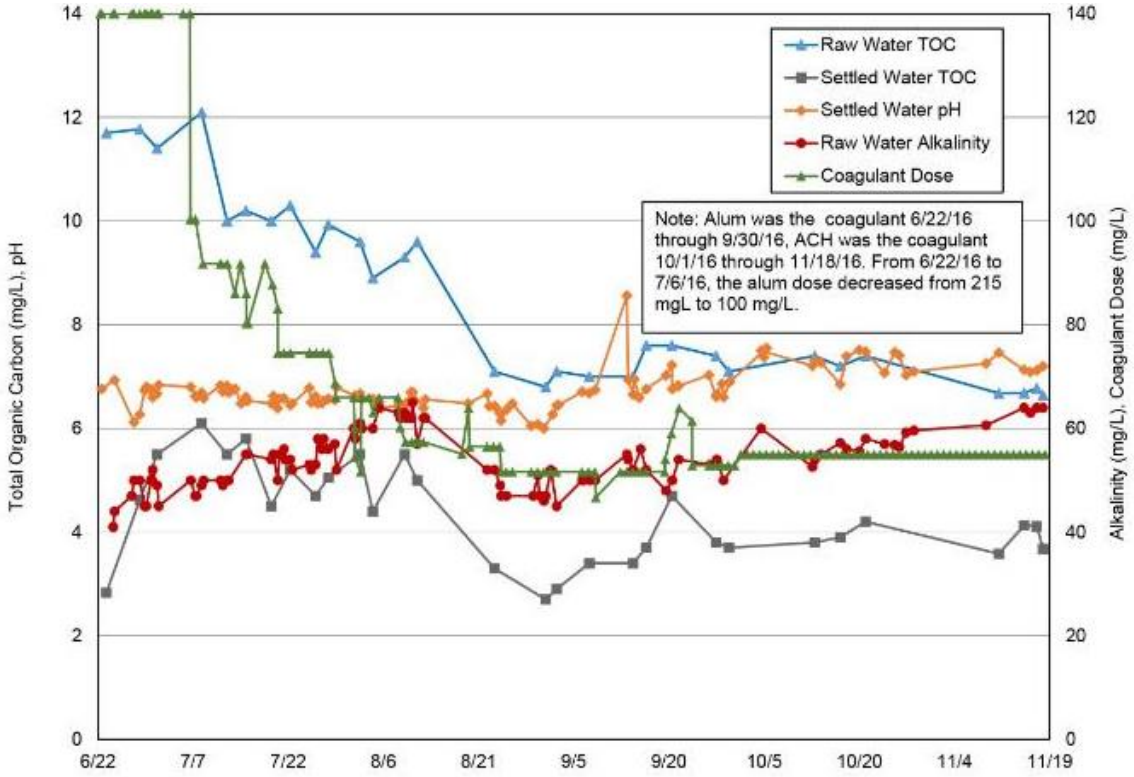


Demonstration scale testing established lamella plate settler performance



Provisional rate of 0.33 gpm/esf approved by TCEQ

Plate settler testing validated TOC removal goals



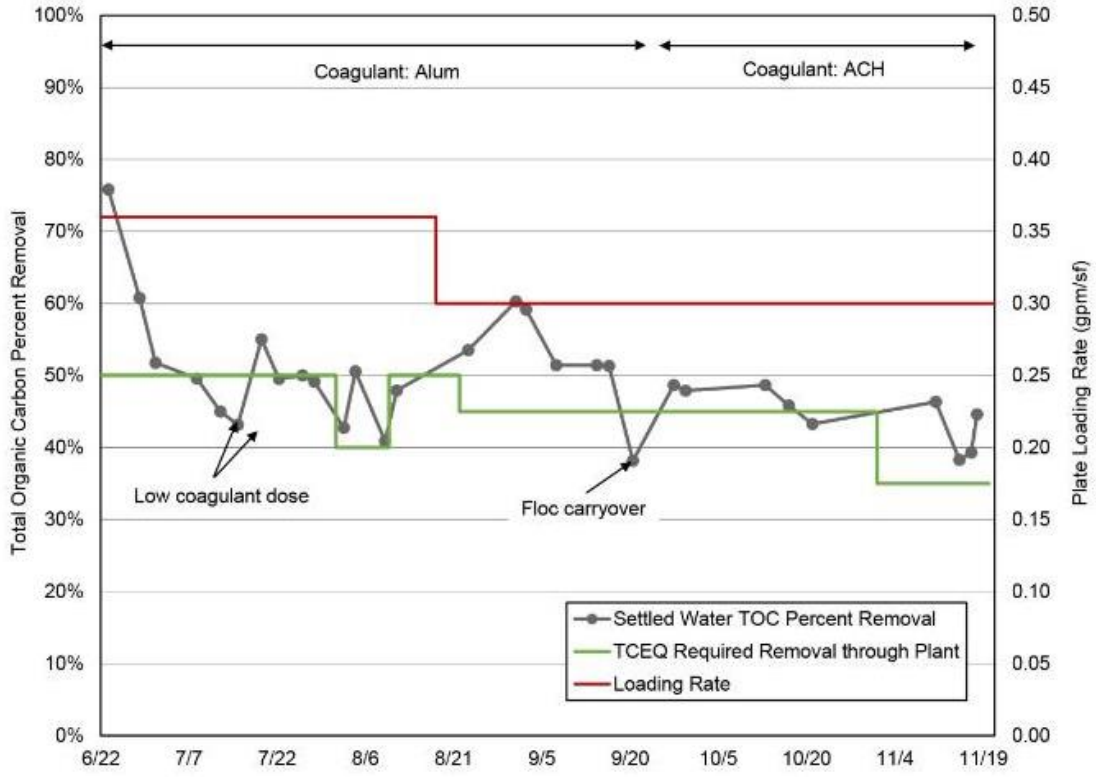
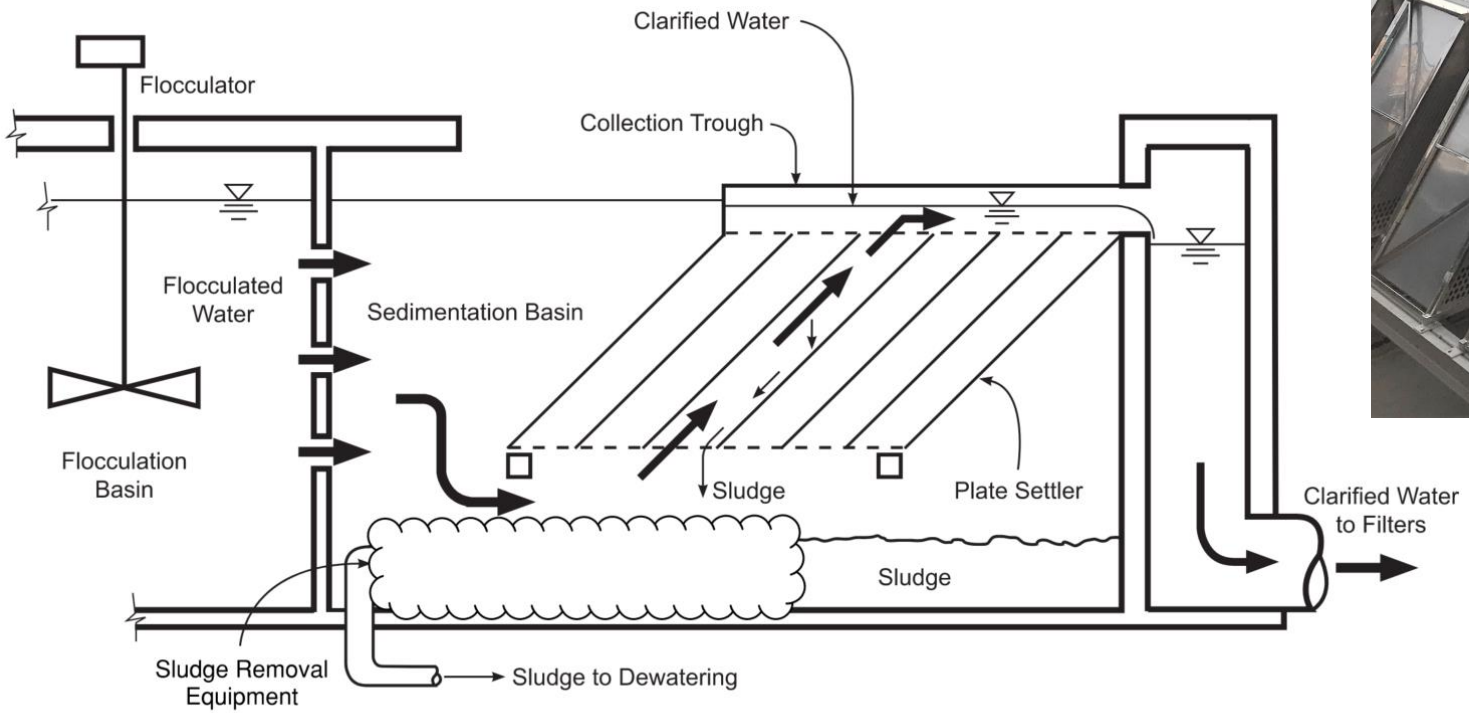
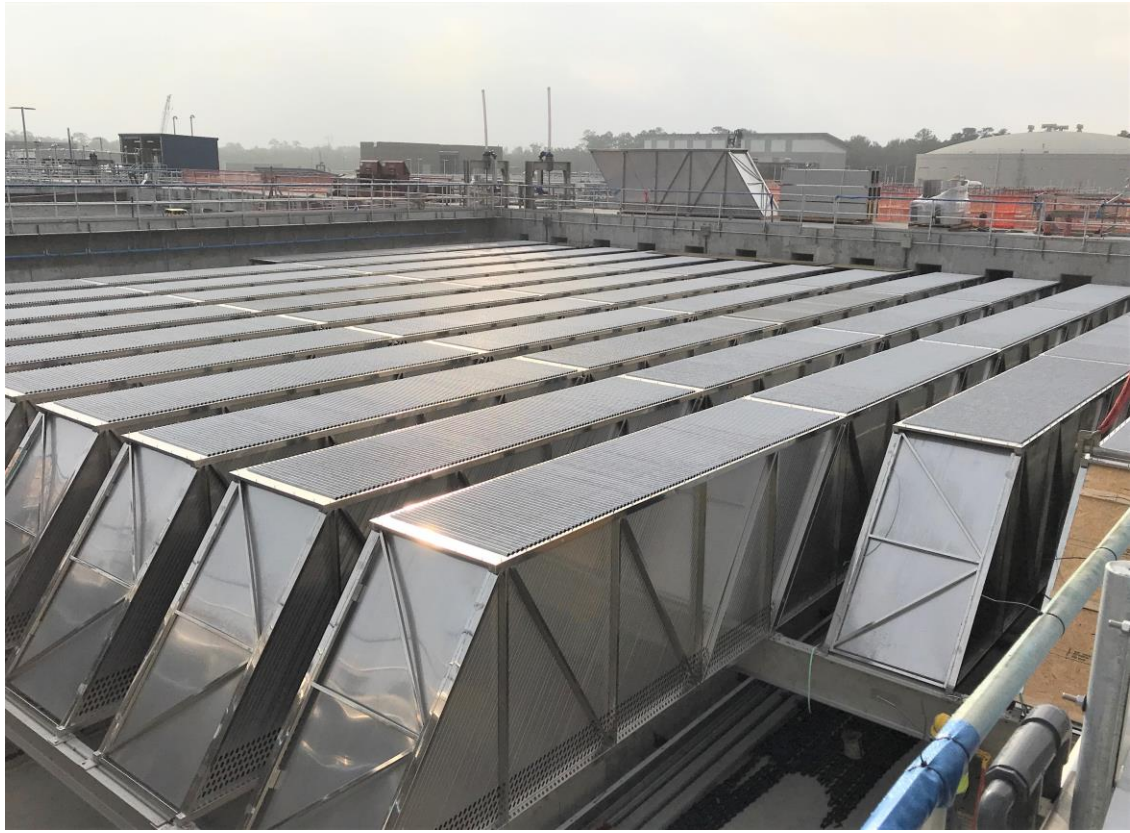


Plate settlers achieve proven performance in a smaller footprint

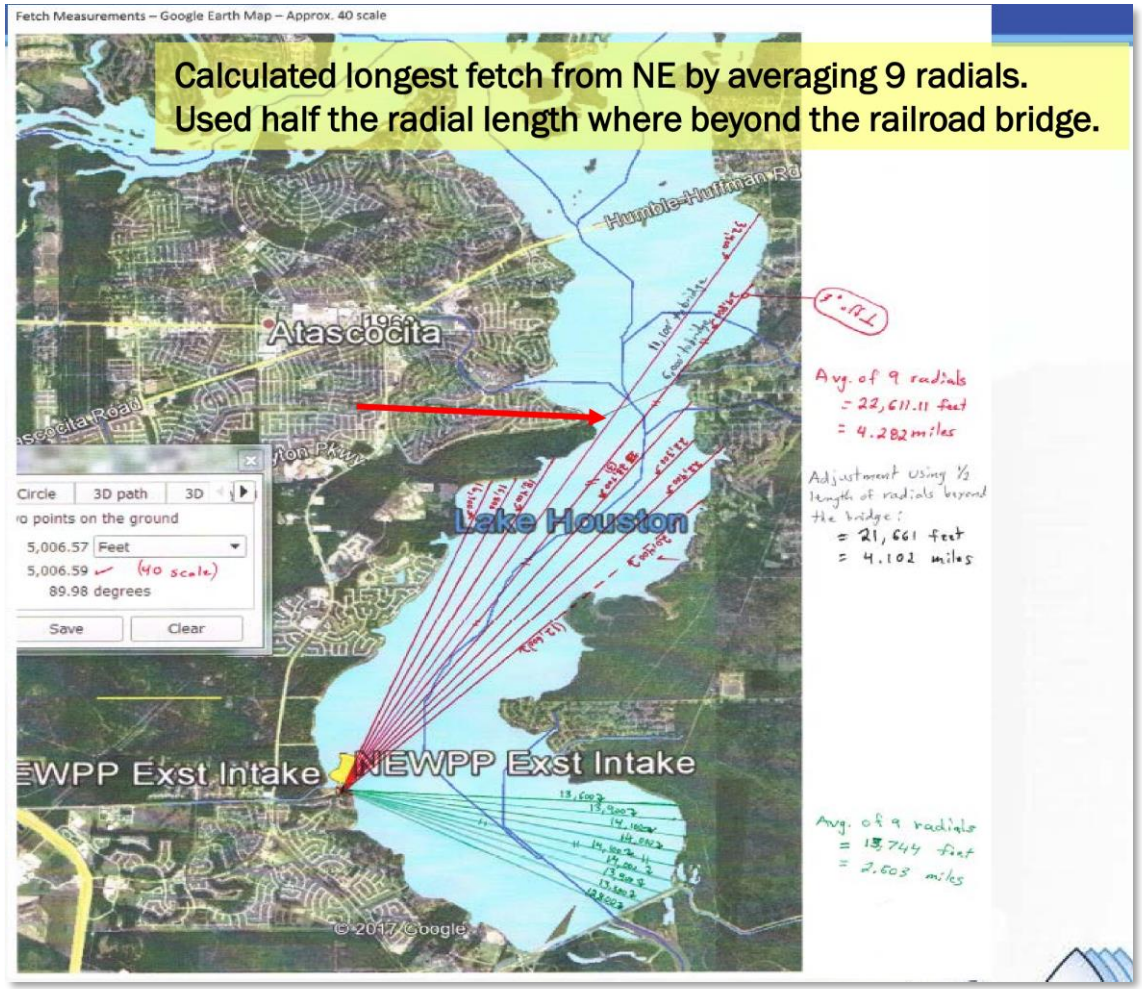




Surface loading rate designed for 0.2 gpm/esf @ 95 %efficiently (TCEQ permitted up to 0.33 gpm/sf)

Hurricane Harvey reset flooding expectations

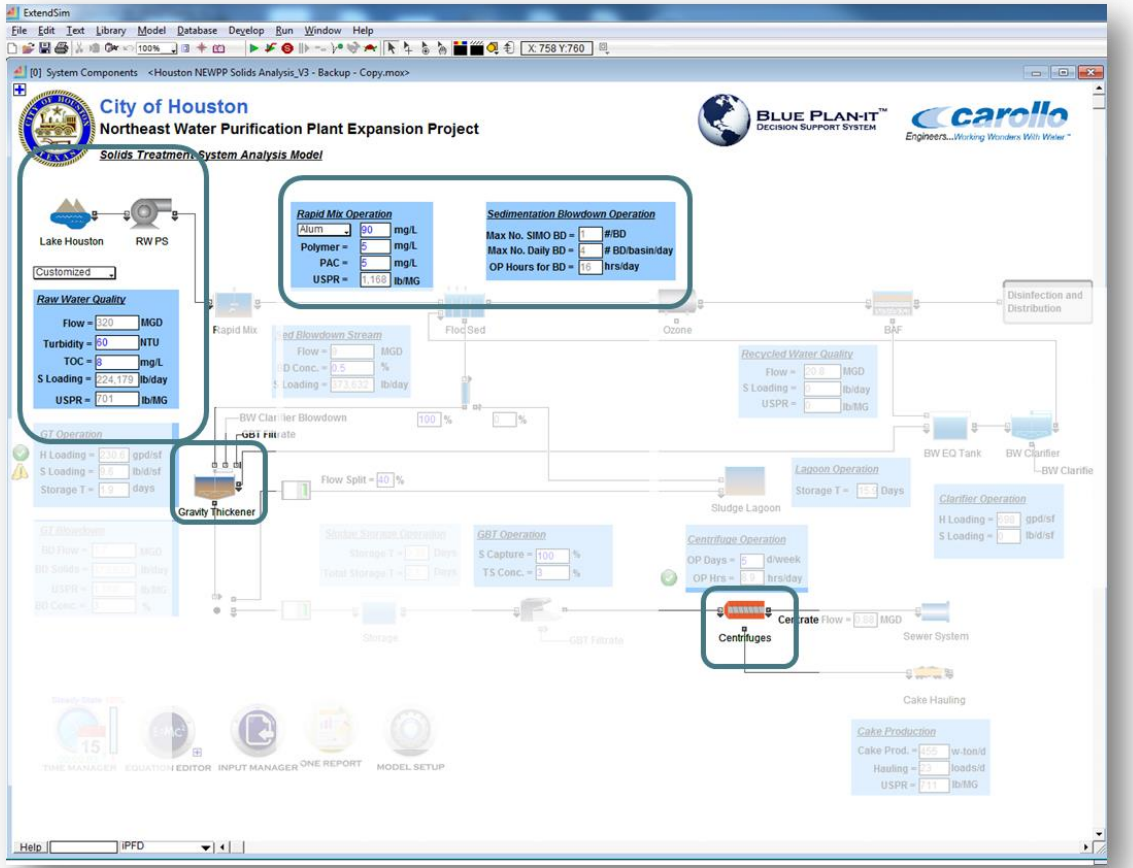
And led to design modifications



Digital twin model of plant benefits operations

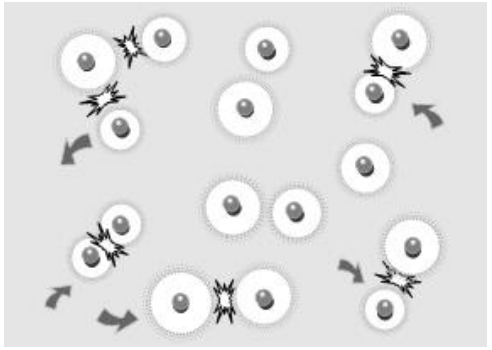
- **Dynamic** simulation model replicates processes & treatment at new plant
- **Predictive** features allow for proactive operations by forecasting chemical usage, solids handling, and effects of taking components off-line for scheduled maintenance
- **Training** is enhanced by running through “what-if” scenarios in the model

BLUE PLAN-IT®
DECISION SUPPORT SYSTEM



Zeta meter is a great tool for optimizing coagulation

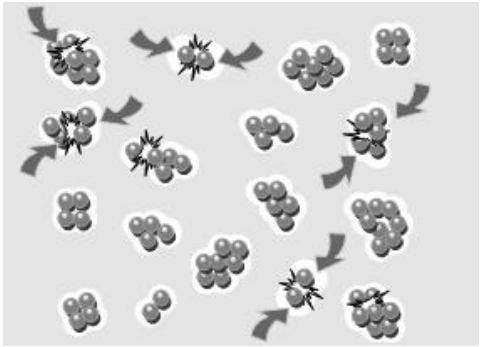
Charged particles repel each other at low zeta potential



Coagulant

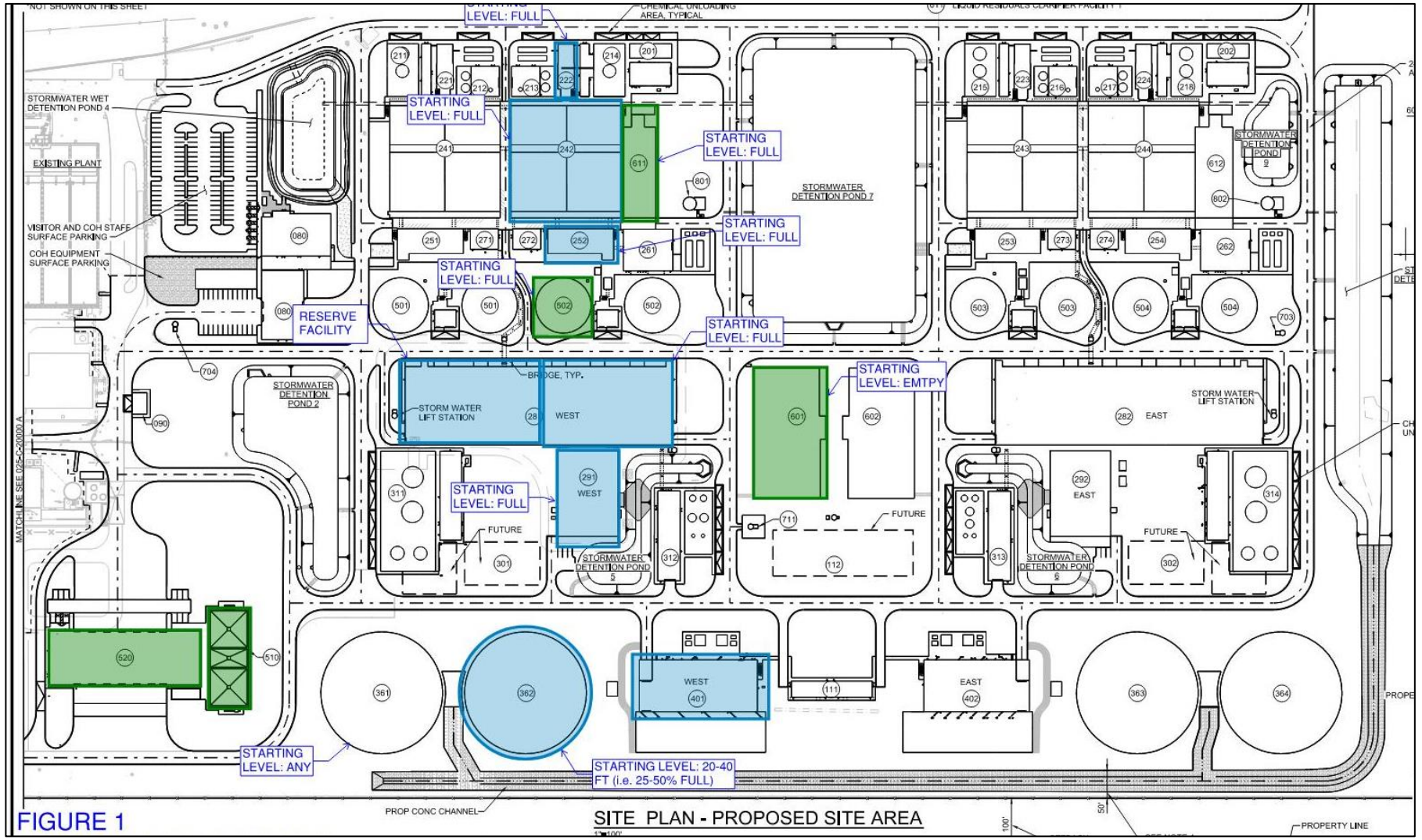
As zeta moves closer to zero

Uncharged particles collide and aggregate at higher zeta potential



Zeta meter measures the magnitude of repulsive forces

Facilities must be commissioned and performance validated beforehand



LEGEND

- LIQUIDS PROCESSES
- SOLIDS PROCESSES

NOTE: DOES NOT SHOW AUXILARY PROCESSES

TCEQ Step 2 Requirements must be satisfied before pumping water to distribution

Conventional Surface Water Plant (SWTP) Use Checklist (Step 2)

Texas Commission on Environmental Quality
Water Supply Division
Plan Review Team MC-159
P.O. Box 13 087, Austin, Texas 78711-3087

Public Water System I.D. No._____
TCEQ Log No. P-_____

The following list is required for approval of use regarding a newly constructed conventional surface water plant that has just finished construction and is ready to be put online and send water to distribution. The SWTP may not go online until final approval is given. Failure to submit the following items may delay project approval. Copies of the rules may be obtained from Texas Register, 1019 Brazos St, Austin, TX, 78701-2413, Phone: (512) 463-5561 or downloaded from the website: http://www.tceq.texas.gov/rules/indxpdf.html

Please note that after construction, the SWTP must be started and ran to determine the finished water quality. During this time, no water from the plant is allowed to go to distribution. Samples must be taken to satisfy Item No. 1. After samples are taken, the plant must remain off-line until final approval by TCEQ.

1. ☐ Provide a physical and chemical analysis of the finished water. The analyses for the water after any post-treatment (including blending) must be submitted to an accredited laboratory for chemical analyses. (See below)
2. ☐ If blending is used, please submit final blending report showing compliance to all maximum contaminant levels (MCL) and secondary contaminant levels (SCL);
3. ☐ Submit an engineering report on the final corrosion control treatment to be used and under what conditions. Include any chemical dosage used at the time the finished water quality parameters for item No. 1 were taken. Include the specific chemical(s) used, its SDS Sheet and NSF 60 certification.
4. ☐ Systems that treat surface water must meet the requirements of §290.46(e)(6) in regard to licensed operators. Please provide listing of operators and copies of the current licenses for the operators that will operate the plant. [§290.46(e)(6)]
5. ☐ Public water systems shall ensure that their operators are trained regarding the use of all chemicals used in the water treatment plant. Submit the applicable training records of operators pertinent to this requirement. Please include copies of training materials. [§290.46(e)(2)(B)]
6. ☐ Public water systems shall not allow new or repaired production, treatment, storage, pressure maintenance, or distribution facilities to be placed into service without the prior guidance and approval of a licensed water works operator. Please submit a certification by a licensed operator that the plant is ready to be placed into service. [§290.46(e)(2)(A)]
7. ☐ Upon completion of the water works project, the engineer or owner shall notify the executive director in writing as to its completion and attest to the fact that the completed work is substantially in accordance with the plans and change orders on file with the commission. Provide a certificate of completion certifying that all facilities were constructed according to approved plans and specifications; [§290.39(h)(3)]
8. ☐ Provide verification that a concentration-time (CT) study was conducted and approved by the TCEQ for the final configuration of the plant;

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1. ☐ Provide a physical and chemical analysis of the finished water. The analyses for the water after any post-treatment (including blending) must be submitted to an accredited laboratory for chemical analyses. (See below)

PRIMARY	MCL
Nitrate	10 (as N)
Nitrite	1 (as N)
Arsenic	10
Fluoride	4.0

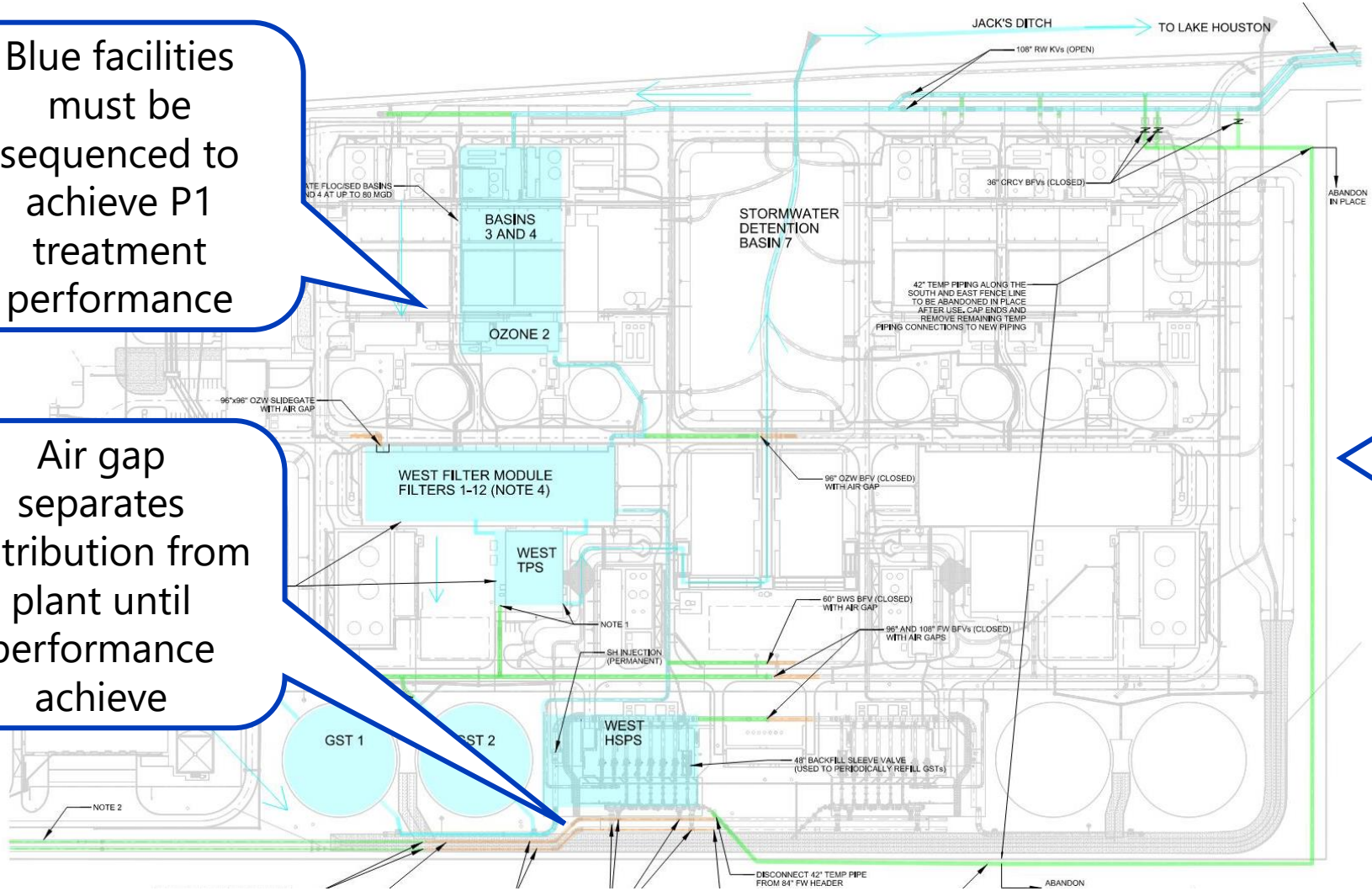
Water Quality Parameters	
Parameter	Units
Alkalinity as $CaCO_3$	mg/l
Calcium as $CaCO_3$	mg/l
Sodium	mg/l

SECONDARY	SCL
Aluminum	0.2
Copper	1.0
Iron	0.3
Manganese	0.05
Zinc	5.0
Total Dissolved Solids	1,000
Fluoride	2.0
Lead	N/A
Sulfate	300
Chloride	300
pH	> 7.0

Treated water discharged to Jack's Ditch until TCEQ issues permission to pump to system

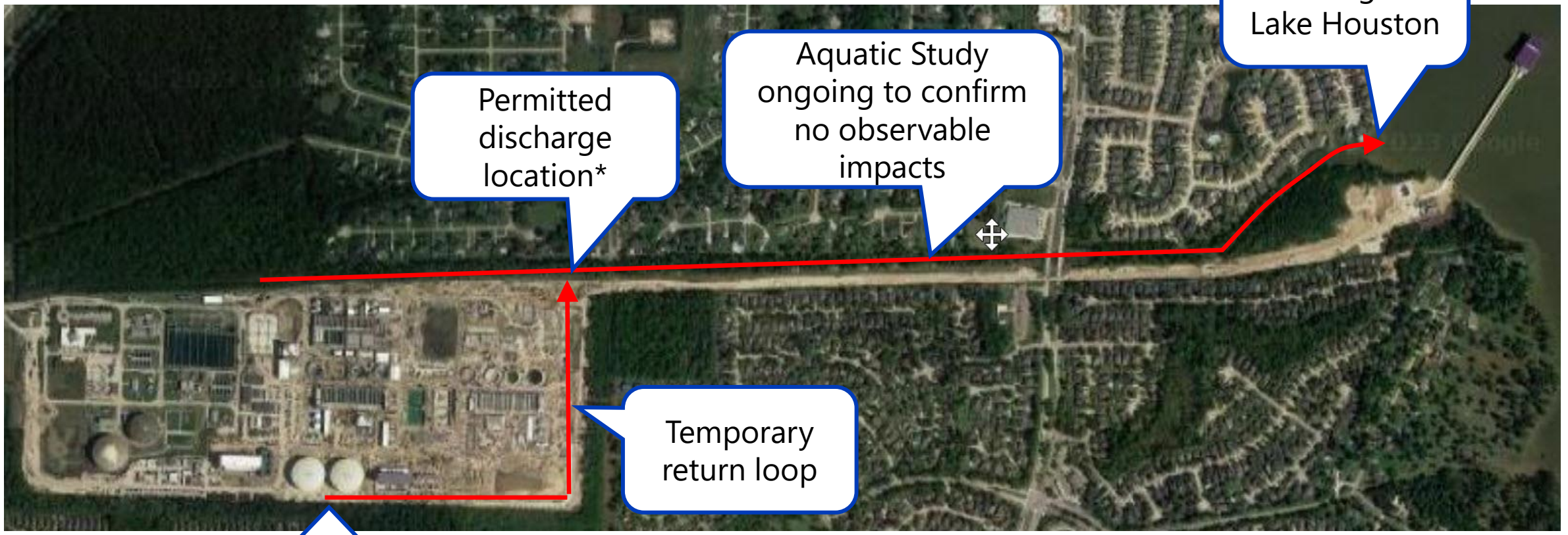
Blue facilities must be sequenced to achieve P1 treatment performance

Air gap separates distribution from plant until performance achieve



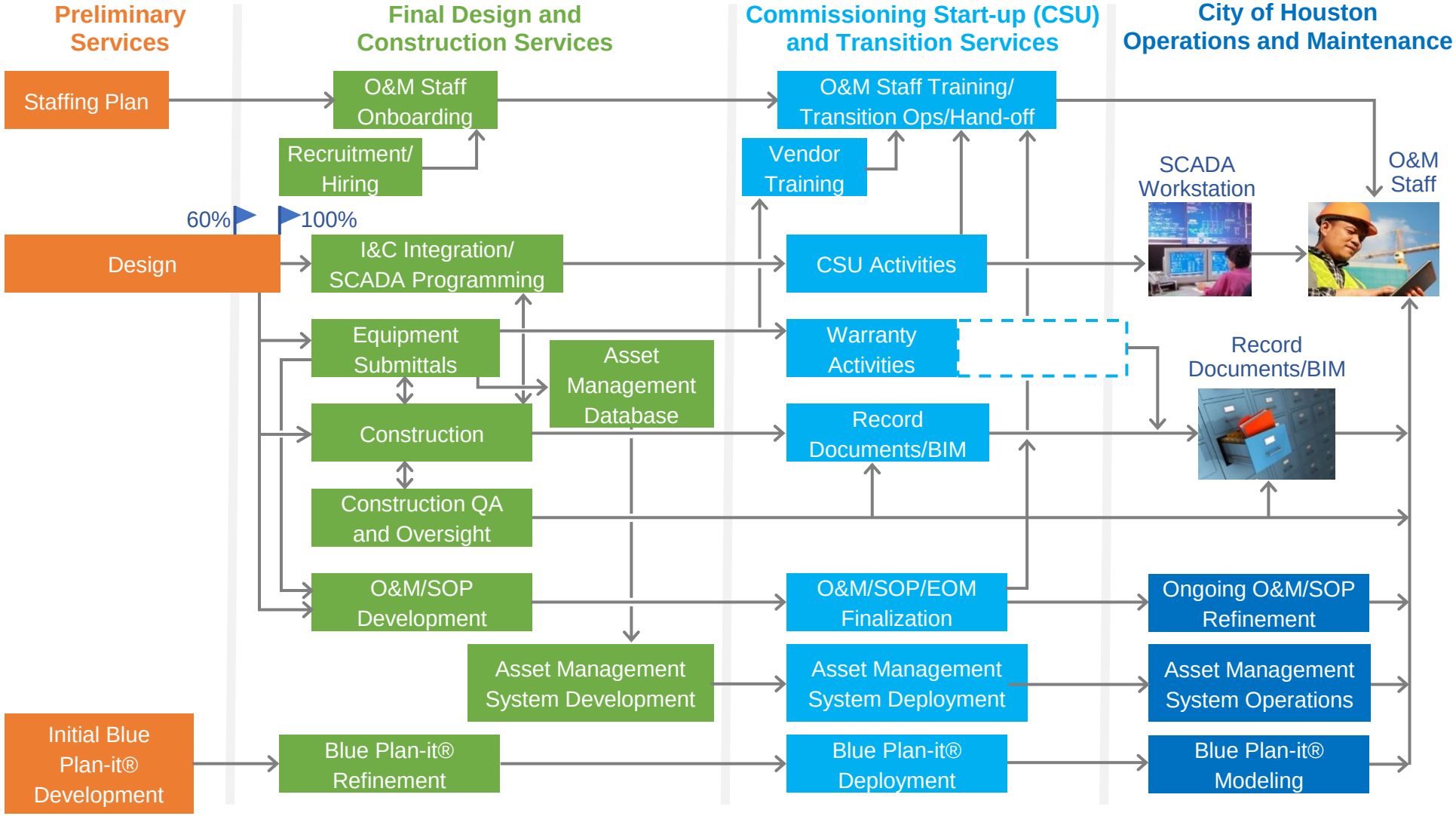
Temporary loop used to recycle water during initial start-up

Discharge permit obtained to discharge treated water to Jack's Ditch/Lake Houston



*Water quality monitoring required

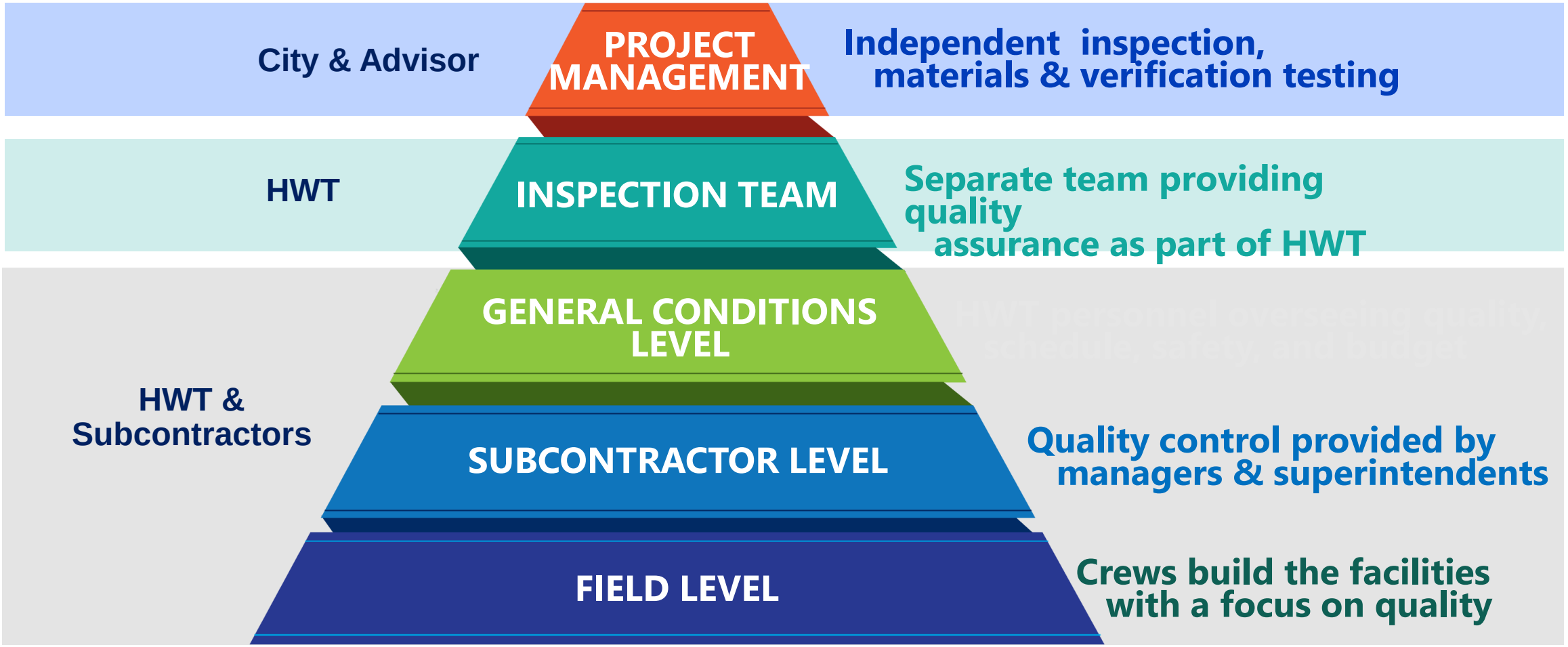
Staff involvement is extensive in all phases of delivery



Preparing staff takes time and effort, plan accordingly

- Construction area is walked frequently with newly hired staff
- Water Schools
- Transition services support
- Over the shoulder involvement during commissioning & start-up
- Designated liaison providing staff advocacy

A bottoms-up approach to quality was applied



03

Closing Thoughts

Closing thoughts

1	Mega projects present unique challenges – plan slowly then act fast
2	Progressive design-build is complicated – dedicate an experienced team to deliver the project
3	Raw water quality + finished quality goals drive process selection – perform the necessary due diligence
4	Preparing staff to take over new facilities takes planning, time, and persistance

THANK YOU!