CITY OF LEAGUE CITY

2023 WATER MASTER PLAN UPDATE

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City of League City

2023 Water Master Plan Update

FINAL Report

January 10th, 2024

Prepared for:

City of League City

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List of Abbreviations

ADD	Average Daily Demand
AMI	Advanced Metering Infrastructure
AWWA	American Water Works Association
BPS	Booster Pump Station
CIP	Capital Improvements Plan
CMU	Concrete Masonry Units
COH	City of Houston
DEM	Digital Elevation Model
EDU	Equivalent Dwelling Unit
EPS	Extended Period Simulation
EST	Elevated Storage Tank
ETJ	Extraterritorial Jurisdiction
FNI	Freese and Nichols
FT	feet
GCWA	Gulf Coast Water Authority
GIS	Geographic Information System
gpad	gallons per acre per day
gpcd	gallons per person per day
gpm	gallons per minute
GST	Ground Storage Tank
HDPE	high density polyethylene
HGSD	Harris-Galveston Subsidence District
LAS	liquid ammonium sulphate
LF	Linear Feet
LUA	Land Use Assumptions
MDD	Max Day Demand
MG	million gallons
MGD	million gallons per day
MUD	Municipal Utility District
PHD	Peak Hour Demand
PHF	Peak Hour Factor
psi	pounds per square inch
PUD	Planned Unit Development
PVC	polyvinyl chloride
RMSE	Root Mean Square Deviation
SCADA	Supervisory Control and Data Acquisition
SETL	Southeast Transmission Line
SEWPP	Southeast Water Purification Plant
SH3	State Highway 3 (Booster Pump Station)
SSH	Southshore Harbour (Booster Pump Station)
TCEQ	Texas Commission on Environmental Quality
TMWTP	Thomas Mackey Water Treatment Plant

Executive Summary

The City of League City (City) is facing significant water supply and infrastructure challenges to meet future water demands. The City population is expected to continue to grow at an approximate rate of 2.5% over the next 10 years and more than double by the anticipated 2040 buildout year. The City also faces operational challenges associated with aging infrastructure, operation of numerous small water wells and booster stations, and the few pipelines within the system that still operate as both transmission and distribution lines. The existing water system has been significantly upgraded over the past 10 years, but new infrastructure and upgrades are necessary to meet future demands.

Contracted through Freese and Nichols, Inc. (FNI), Ardurra developed a system-wide plan to guide the City through the future water supply, infrastructure and operational challenges and ensure a reliable and high performing water system.

ES.1 Project Objectives

The specific project objectives are to provide the City with a comprehensive water master plan, addressing the following project needs:

- Develop a plan to provide adequate water supplies with defined projects to support future growth for inclusion in the Capital Recovery Fee (CRF) update report. The population of League City is expected to more than double between now and the future City buildout.
- Ensure that the water system meets TCEQ requirements and other design criteria. Specific criteria include enclosed/protected equipment, standby pump capacity, adequate storage throughout the system, and adequate fire flow capacity.

ES.2 Project Approach

To simulate the City's water system, a water model was created using Bentley's WaterGEMS Connect Edition and incorporated GIS data provided by League City as the model base. Demand alternatives were created using over three years monthly meter billing data and metered water production data to simulate average annual and maximum day conditions. Ardurra held meetings with City staff to ensure that the proper operational controls and water facility layouts were used in the model.

To validate the model, the existing scenario results were compared to meter and pressure data from various sites throughout the City to verify that the model was accurately representing the system. The model results for existing system conditions validated anecdotal evidence from the City's operations team.

ES.3 System Characterization and Performance

With the improvements made since 2018, the existing water system performs well. There are no remaining low-pressure areas in the system. Modeling analysis revealed that pressures exceeding 50 psi are maintained throughout the system during all times of day. **Figure ES-1** shows the existing water pressures throughout the system during the instantaneous peak time of the maximum day.

There are ten booster pump stations in League City, varying in age from 10 to 54 years old. Many of the facilities are small, and the existing wells require improvement or relocation due to deterioration. There are four elevated storage tanks (EST), with only the Brittany Bay and the new Eastside EST providing regular pressure functionality. Alabama EST was built in 1962 and is currently too short to provide additional pressure assistance. The tank was taken out of regular service in 2011 and is now used only to provide water supply for firefighting capabilities. South Shore EST was built in 2006 but system dynamics limit use during periods of moderate to high demand. A 2018/2019 waterline project that was recommended in the 2013 water master plan improved South Shore EST's operability.

The 2018 Master Plan aimed to resolve the remaining functional issues in the water distribution system. Modeling performed for the 2018 master plan identified the need for a transmission line to supply South Shore Harbour BPS, a new low service booster station at SH3 and transmission line from SH3 directly to the South Shore Harbour BPS. This proposed line is currently in construction and will resolve the lack of a redundant supply line. Until this water line comes online, most of the City's water enters through SH3 BPS and travels down a single 42-inch/39-inch line to Calder BPS and various large taps, leaving the water system without a redundant supply line. If something were to happen to this water line or to SH3 BPS, then the City would lose access to nearly 90% of its surface water supply. Other water line projects completed between 2018 and 2022 finalized the conversion from the existing hybrid distribution/transmission system to dedicated transmission and distribution lines.

The combined effect of these improvements has set up the League City water distribution system well to be able to focus on future capital improvements to meet the needs of its growing population.

ES.4 System Operation

Prior to recent major water infrastructure projects, the existing water system operation required careful attention during the summer months. With major projects completed within the last ten years at State Highway 3, South Shore Harbor, Calder Rd and Northside Booster Pump Stations, the water system operations have stabilized, and special summer operational procedures have been reduced to localized pockets only during peak demand conditions.

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE ES-1
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
MINIMUM PRESSURES UNDER MAX DAY PEAK HOUR DEMAND

LEGEND

- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES

- Less than 35 psi
- 35 - 50 psi
- 50 - 60 psi
- 60 - 65 psi
- Greater than 65 psi

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ES.5 Future Water Challenges

Based on the modeling results, additional source water in addition to the presently secured 28.044 MGD (this includes the 5 MGD City of Houston connection at Beamer Road and 1.0 MGD from City of South Houston) will be required to meet the maximum day demand for League City between 2030 and 2032, provided that adequate pumping capacity upgrades and additional storage recommended by year 2028 has been added to the system to meet increased peak demands. Ultimately, an additional 20.4 MGD of water is required to meet the projected demands at buildout without using groundwater. Although the City has emergency well capacity, the City is restricted to only 10% of the total annual water supply from groundwater sources without facing heavy monetary penalties from the Harris-Galveston Subsidence District (HGSD).

To meet future water supply requirements, it is recommended for League City to fund a 20.0 MGD expansion to Southeast Water Purification Plant (SEWPP) and temporarily supplement the water supply with water from the wells throughout the city until the SEWPP is designed, constructed, and commissioned in 2031. Thomas Mackey Water Treatment Plant (TMWTP) was re-rated in 2022 and provided an additional 3 MGD of surface water capacity to League City, however, it is not anticipated to be further expanded or re-rated, therefore the SEWPP is the only source of additional surface water supply.

The City engaged in an agreement to reserve 20 MGD of capacity at the SEWPP. Due to the nature of the contract with the COH, the rate at which League City reserves this water will continue to increase over time until the SEWPP 20 MGD expansion is complete. Although the reservation fee carries a cost to the city, continuing to secure the final 20 MGD of capacity available at SEWPP is critical to minimize the larger cost of acquiring additional water supply to meet future demands. The 20 MGD of capacity at the SEWPP is the lowest cost water source available to the city. As discussed in Section 7, future expansions beyond the 20 MGD reserved by League City will have a significantly higher infrastructure cost.

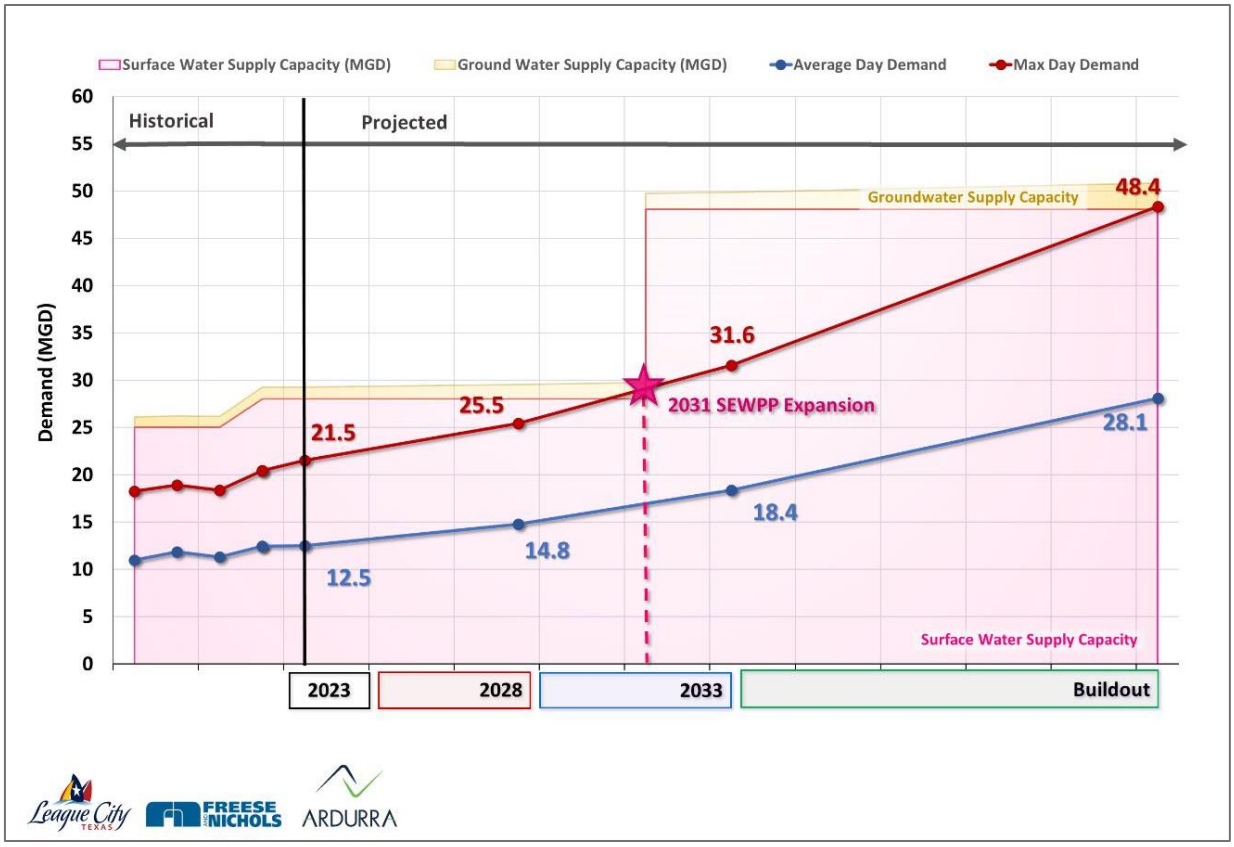

Figure ES-2 Comparison of Secured Water Sources and Future Demand – 2031 SEWPP Expansion

The City of Houston is in the process of planning the replacement of the existing 42-inch treated water supply line that extends down SH3 from the SEWPP to the City's SH3-BPS. The replacement costs will be shared with all the co-participants. This City of Houston project is for the design and construction of 47,500LF of 60-inch water line along SH3 (Old Galveston Rd) to replace the current 42-inch line from the Southeast Water Purification Plant (SEWPP) on SH3. The city's share of the estimated cost of this project reflects the anticipated increase in conveyance associated with the additional 20 MGD in capacity from the planned SEWPP Expansion. This project is further discussed in Section ES.6.1.

For the buildout scenario, all the remaining future water required is assumed to be coming from the SEWPP at the SH3 BPS. The SH3 BPS would serve as the single point of delivery from the SEWPP for this additional source water.

ES.6 Recommended Plan

ES.6.1 Existing CIP Projects

Projects that are ongoing or recently completed at the time of this study are shown in **Table ES-1.** The completion of these projects is valuable to the water system's ability to maintain service to existing customers and provide service to future customers. The recently completed and ongoing projects are included in future scenarios.

Table ES-1 Recently Completed and Ongoing Projects

CIP PROJECT NUMBER	PROJECT NAME
A	3.0 MGD Treated Surface Water Capacity from the Thomas Mackey Water Treatment Plant
B	FM 518 Water Line Replacement Project (Palomino to I-45)
C	16" Trunk Waterline SSH BPS to FM 2094
D	36" Waterline from SH3 BPS to Southshore Harbor BPS
E	New Waterlines to West Side – Segments 0 & 1
F	Southeast Service Area Trunks
G	North Service Area 12" Waterline - Grissom
H	Replacement of State Highway 3 Line (SETL)
I	24" Waterline along Ervin and the Future GP to Maple Leaf Drive

Through the performance assessment of each CIP within the various scenarios of the model three CIP projects were determined to have no benefit to the water system or required modification based on the new planning data and the determination that Waterlines under 16" in diameter will be constructed by the developer in new areas of development. The eliminated CIP project and the associated total savings is outlined in **Table ES-2** in 2023 dollars.

Table ES-2 Current CIP Projects Recommended for Elimination

ELIMINATED CIP PROJECT	COST SAVINGS
New Waterlines to Westside – Segments 7 & 8	$4,200,000
12" Waterline to Connect Grand Parkway	$3,080,000
16" Waterline to New West Side GST	$490,000
Total Savings	**$7,770,000**

ES.6.2 Development of CIP Projects

Once all the immediate improvement projects (listed in the next section) were identified, 2028 water demand and buildout demand were compiled and, were categorized based on prioritization and planning level cost estimates were developed. The project descriptions for all CIP projects can be found in **Appendix A**. The project lists and costs have been updated based on providing well capacity (10% maximum total annual demand) through the year 2028 and providing new surface water to satisfy the additional demand in the 2033 scenario and at buildout. **Figure ES-3** shows the existing and ongoing CIP projects and the proposed CIP projects with the color representing the proposed project prioritization. The proposed project locations shown are conceptual. It will be necessary to identify and evaluate specific routing locations during preliminary engineering design for each of the proposed projects.

ES.6.3 Immediate Requirements

Immediate Projects are the most urgent to begin so that they can be completed before they are needed to serve future growth. Delaying these projects could result in strains on the water distribution system to meet pressure criteria, water quality, or max day demand under future scenarios. These projects and their associated costs can be seen in **Table ES-3**.

Table ES-3 Facility Project Costs for Immediate Future

PROJECT NUMBER	IMMEDIATE PROJECT NAME	COST
1.	SH3 BPS Chemical Feed Building & Storage	$5,230,000
2.	Calder South (Well, Generator, & BPS)	$12,850,000
3.	New Waterlines to West Side	$4,540,000
4.	Raw Water Reservation from COH[1]	$12,635,789
5.	20 MGD SEWPP Expansion	$156,000,000
	Total	**$179,914,381**

Note:
1. Total Anticipated Cost until SEWPP Expansion Completed

ES.6.4 2028 Requirements

Projects needed for 2028 have a significant impact on the system's redundancy, add emergency capacity, serve future development demands, and ensure and increase the level of service to League City residents. These 2028 projects and their associated cost can be seen in **Table ES-4**.

Table ES-4 Facility Project Costs for 2028 Scenario

PROJECT NUMBER	PROJECT NAME	COST
6.	8" Water Line from Cross Colony to Mary Ln.	$212,450
7.	Muldoon Parkway Waterline Extension Phase 1	$6,010,000
8.	24" Waterline on Bay Area Blvd (Segment 2)	$2,580,000
9.	Maple Leaf Waterline Extension Phase 1	$1,680,000
10.	Calder Rd BPS Pump Expansion Phase 1	$5,270,000
11.	2028 Water Master Plan Update	$350,000
Total Cost		**$16,102,450**

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST
SH 3 BPS Chemical Feed Building and Storage
New (2) - 5,525 gpm Pumps

From City of Houston's Southeast Water Purification Plant (SEWPP)

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST
(4) - Replacement 2,900 gpm Pumps

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs
(2) - New 1,700 gpm Booster Pumps

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

2.0 MG Brittany Bay EST

Parkway West Water Plant
Well #1 = 1,150 gpm
(2) - 750 gpm Pumps
(2) - 1,500 gpm Pumps
(1) - 1.0 MG GST

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(1) - 1.0 MG GST
(1) - 0.5 MG GST
Expansion Phase 1 -
(2) 5,000 gpm Pumps
(2) - Replacement 5,000 gpm Pumps

New West Side Water Plant
Well #1 = 1,150 gpm
(2) - 800 gpm Pumps
(2) - 1,550 gpm Pumps
(1) - 2.0 MG GST

New Calder South Water Plant
GCWA Surface Water Interconnect
Well #1 = 1,500 gpm
(2) 1,250 gpm Pumps
(2) 2,000 gpm Pumps
(1) 1.0 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

SEWPP
20 MGD Expansion

- **A** New Water GCWA 3.0 MGD from Thomas Mackey Water Treatment Plant
- **4** COH Raw Water Reservation Fee
- **11** 2028 Water Master Plan Update

The timing of projects shown is subject to change based on development patterns. The utility alignments shown in this figure are for illustration purposes only and do not set the alignments. The alignment of each utility will be determined at the time of the engineering design.

0 3,000 6,000 SCALE IN FEET

FIGURE ES-3
CITY OF LEAGUE CITY
WATER SYSTEM CAPITAL IMPROVEMENTS PLAN
LEGEND

Ongoing/Recently Completed Improvements
- Pump Station
- Water Line

Immediate Improvements
- Water Purification Plant
- Well
- Pump Station
- Water Line

2028 Proposed Improvements
- Pump Station
- Water Line

2033 Proposed Improvements
- Well
- Ground StorageTank
- Pump Station
- Water Purification Plant

Buildout Proposed Improvements
- Well
- Ground StorageTank
- Pump Station
- Water Purification Plant
- Water Line

Existing System
- Emergency Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant

- Water Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Developer Line
- Railroad
- CRF Service Area
- City Limits
- ETJ
- Other City Limit

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ES.6.5 2033 Requirements

Projects needed for 2033 have a significant impact on the system's redundancy, add emergency capacity, serve future development demands, and ensure and ensure the level of service to League City residents is maintained. These 2033 projects and their associated cost can be seen in **Table ES-3**.

Table ES-5 Facility Project Costs for 2033 Scenario

PROJECT NUMBER	PROJECT NAME	COST
12.	New West Side GST, Well, and BPS	$12,360,000
13.	SH 3 BPS Pump Expansion	$6,080,000
14.	FM 517 Waterline Extension from Landing Blvd to Maple Leaf Drive	$9,270,000
15.	24" Bay Area Blvd Waterline Extension	$4,430,000
16.	Muldoon Pkwy Waterline Extension Phase 2 (to West Blvd)	$2,880,000
17.	Maple Leaf Waterline Extension to FM 517	$2,330,000
Total Cost		**$37,350,000**

ES.6.6 Buildout Requirements

All projects for the buildout scenario can be seen in **Table ES-4**.

Table ES-6 Facility Project Costs for Buildout Scenario

PROJECT NUMBER	PROJECT NAME	COST
18.	Calder Rd BPS Pump Expansion Phase 2	$3,710,000
19.	Northside BPS Pump Addition	$5,450,000
20.	SSH BPS Pump Expansion	$6,360,000
21.	Parkway West Well, GST BPS	$11,920,000
22.	Water Trunk Line from Walker WP to Louisiana	$10,560,000
23.	16" Waterline from FM 646 to Hobbs Rd (Segment 4)	$2,780,000
24.	FM 517 Waterline Extension Phase 2	$5,870,000
25.	24" Waterline along Future Unnamed Rd. from FM 517 to Muldoon Parkway	$3,700,000
26.	Muldoon Parkway Waterline Extension Phase 3	$3,840,000
Total Cost		**$54,190,000**

Section 1
Introduction

1.1 Project Background

The purpose of this report is to provide a comprehensive update to the 2018 Water Master Plan. It should be noted that a capital recovery fee (CRF) was also prepared in 2023 and submitted to the City as a separate document. The CRF report includes the 10-year land use assumptions, CRF eligible capital improvement plan (CIP), and calculation of the maximum allowable CRF as per Chapter 395 of the Texas Local Government Code. League City embarked on its first comprehensive Master Plan effort in 2011 as a result of low water pressure in summer 2009 during the drought in areas served by the State Highway 3 Booster Pump Station (SH3 BPS) which necessitated the activation of city-wide water conservation plans. The purpose of the first comprehensive master plan was to assess the water system infrastructure, analyze current performance through a sophisticated dynamic hydraulic model, project future flows, develop a comprehensive plan to address identified deficiencies, and develop a long-term strategy for additional water sources. The first comprehensive modeling and planning effort was completed in 2011 and subsequently updated in 2013. As a result of the findings and recommendations in the 2011/2013 reports, the City embarked on an aggressive infrastructure program that included significant upgrades to the SH3 BPS, the Calder Road BPS and the South Shore Harbour BPS as well as construction of the Northside BPS and various waterline addition and improvement projects. The implementation of the 2011/2013 Water Master Plan recommendations resulted in a significant increase in the level of service to League City residents by significantly reducing pressure drops during peak demand times as well as providing significant improvements in the water system resiliency.

In 2018 the City performed an additional update to the Master Plan and with a focus on planning for the future rapid growth and development on the city's west side. The 2018 plan utilized available land use and population projections to develop water supply and infrastructure requirements for future areas of development to maintain the level of service in the city of League City as it grows and expands.

The 2023 Water Master Plan update builds off the previous work performed in 2018. Since the 2018 update to the master plan, the city has received more information about future areas of development. This report utilizes the updated land use information to refine the water demand projections and the near term and buildout infrastructure needs for the City of League City.

1.2 Objective

The objective of this study is to identify areas that require improvements to the City's water transmission and distribution system as well as identify required additional water supply to meet the following needs:

- Develop a plan to provide adequate water supplies for the significant growth anticipated. The population of League City is expected to more than double between now and the future City buildout.
- Ensure that the water system meets TCEQ requirements and other design criteria. Specific criteria include enclosed/protected equipment, standby pump capacity, adequate storage throughout the system and adequate fire flow capacity.
- Update the hydraulic model to reflect improvements the City has made to improve the water distribution system.

1.3 Scope of Work

This study consists of the following tasks outlined below:

- Review of Historic Documents
- Demand Allocations and Projections
- Hydraulic Model Update
- Water System Analysis
- Project Development
- Source Water Development

1.3.1 Review Historic Documents

Existing information and previous studies were reviewed to understand City needs. Water usage, system wide operational data, and existing future planning data provided by City staff were analyzed to understand how the existing water system performs and the projected future system requirements.

1.3.2 Demand Allocations and Projections

Demand development is one of the key aspects of hydraulic model development. Existing demand was allocated based on water billing data and existing water production and pumping data. One of the new datasets available to help ascertain better water usage demand is detailed meter data made available from the City's recently deployed AMI smart meter system. In the previous water master plan, the AMI smart meter system was new, however now that the system has been fully implemented, the volume of data available can be used to better establish water consumption trends in League City. The data recorded by the AMI smart meters provided over 70 million data points containing actual demands. The increased accuracy in water demand information ensures current and projected infrastructure is sized appropriately. The additional granularity provided by the AMI data improved the calibration of the model and saved time during model analysis. Future demand allocations were based on City predicted development. An ultimate buildout scenario based on density and land use was developed after working closely with the City's planning staff.

1.3.3 Model Improvement

The model improvement task included a comprehensive review of the existing model configuration and system operation. Where appropriate, the model was modified to reflect changes that have taken place in the system or in the system operations since the previous master plan. Proposed changes in the system were presented for review with City staff. Updated data sources were incorporated into the revised system.

The updated model is capable of evaluating changes in projected water demands, pressure criteria, and fire flows, and the impacts of improvements to the distribution system. Operational improvements were made to the model based on new data on operation and on improved model demand distribution, diurnal pattern assignments, physical layout, friction or C-factors, and major facility operations. More detailed improvements include:

- Verifying the pipe configuration in the model through direct comparison to the GIS and updating to reflect the current state of the distribution system, as detailed in the GIS
- Building all facilities into the model and accurately representing their existing system operation
- Appropriately distributing water demands based on water usage data and geo-coded water meters
- Establishing an appropriate peaking factor using available operational data
- Establishing a water loss factor to be applied system wide
- Establishing a diurnal demand pattern to accurately represent the variation in water demand throughout the day
- Verifying the facility operations through water operation data and meetings for City staff review
- Establishing existing and future scenarios within the model for identifying existing and future water system needs

1.3.4 Model Verification

After review of the model configuration was completed and modifications to model inputs performed and confirmed by the City, the hydraulic model was verified. The verification process is a result of data collected from the distribution system that reflects actual operation, comparison with hydrant fire flow test data, and pressure logger data collected. The data was used to compare model predictions to field conditions and to adjust model parameters if necessary to better reflect the existing water system operations and performance.

1.3.5 Model Analysis

Model analysis includes a complete review of current conditions using the verified distribution system model. These simulations will evaluate the water system using defined evaluation criteria under both current and future flow conditions, and subsequently identify potential improvements. Using the verified model, operation scenarios were created that utilize the existing system layout. Through the model analysis phase, immediate and future water system issues were identified, and projects developed to provide solutions to these issues.

1.3.6 Project Development

The previous task generated a list of potential projects. All the available documents, reports, data, and model results have been reviewed and recommendations were developed under this task. This task developed the recommended plan for system improvements, and how they will be incorporated into the City's CIP.

1.3.7 Data Sources

The data sources provided by the City of League City provide adequate information to populate and provide context for the model. The following information was provided by League City:

- Hourly city water consumption and sources for June – August for 2020, 2021, and 2022
- Monthly individual meter billing data for 37,039 meters from December 2018 to July 2022 (No personal information was provided to Ardurra)
- Identified physical and operational information for all water facilities
- Water supply logs and data for the fiscal years 2016 to 2022
- GIS files of the water mains, fittings, hydrants, and valves within the City's transmission/distribution system
- Fire Hydrant testing data for 2021 and part of 2022. Hydrant flow test data included hydrant ID, hydrant flow rate, and hydrant residual pressure but did not include flow or pressure information from any other points in the system at the time of the test.
- The 2018 Water Master Plan, including the water model used to develop the master plan.
- Proposed Capital Improvement Program for Fiscal Years 2022 – 2027
- Capital Recovery Fees, from 2018 to 2022
- Current Zoning Map
- Public Utility District Maps, Plats, and design drawings, for future development areas
- Housing Statistics
- Construction drawings for the various booster pump stations throughout the City

1.3.8 Report Structure

The report sections and contents are briefly described below:

- Section 1 - Introduction. The project background, objectives and scope are explained, and the structure of the report presented.
- Section 2 – Water Infrastructure. This section describes the existing water infrastructure including water supply capacities, booster pump stations, ground and elevated storage tanks, and waterlines.
- Section 3 – Water Demand Development. This section defines the water demand criteria with respect to land use and demand allocations.
- Section 4 – Water Demand Projections. This section utilizes the planned growth from the Land Use Assumptions Report to establish new future flows.
- Section 5 – Hydraulic Model Update and Evaluation Criteria. The model update process is explained in this section, with detailed information on model construction, demand development, assumptions, verification, as well as the planning and evaluation criteria used.
- Section 6 – System Analyses and Results. This section discusses the existing system's model performance results including water demands, existing pressures and modeling evaluation.
- Section 7 – Capacity Evaluation and Source Water Development. This section discusses the results of the supply evaluation, ground and elevated storage, pumping capacities, and waterline improvements for the various planning scenarios.
- Section 8 – Water Capital Improvements Plan. This section explains how the identified CIP projects are defined and shows the recommended projects for the Existing, 5-Year, 10-year, and Buildout planning scenarios. This section describes the project prioritization system and gives the planning level cost estimate for each recommended project.

Section 2

Water Infrastructure

2.1 System Overview

League City is geographically located in the Harris-Galveston Subsidence District's Regulatory Area 1 and is required to limit its use of ground water to 10% of the annual usage due to subsidence. Ground water usage greater than 10% of the total annual volume can be utilized but will result in disincentive fees of $10.78 per thousand gallons from the HGSD. As such, League City receives most of its treated water from surface water treatment facilities. One facility is the City of Houston's Southeast Water Purification Plant (SEWPP) and the other is the Thomas Mackey Surface Water Treatment Plant (TMWTP) in Texas City that is owned and operated by the Gulf Coast Water Authority (GCWA).

League City provides treated potable water to local customers of League City only. The service area consists of residential, commercial, and industrial developments as well as open spaces such as community parks, golf courses and cemeteries. Commercial use areas are concentrated along I-45, State Highway 3, FM 518, FM 646, and FM 2094. League City does not have any wholesale customers.

2.2 General System Operation

The general operating philosophy of the City's water supply and distribution system is straightforward. The City purchases wholesale treated surface water from the City of Houston's SEWPP through GCWA and directly from the GCWA via the TMWTP in amounts adequate to meet the City's maximum day demands. Supplemental, redundant, and backup water is supplied from the City's groundwater wells which are geographically distributed and connected to the City's distribution system. **Figure 2-1** shows an overview of the existing system with the locations of the water facilities. A more detailed description of each facility may be found in Section 2.3.

Simulating a system with these types of complex operations requires detailed modeling to accurately calculate proper pump design points, adequate transmission and distribution line sizes, ground storage tank capacity, and additional booster pump capacity. To accurately identify any possible deficiencies and recommend future permanent water system improvements, a major update to the water model and master plan, including future planned service areas was necessary.

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 2-1
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
LEGEND

- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

League City TEXAS
ARDURRA
FREESE NICHOLS

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2.3 Water Supply and Source Water

2.3.1 Surface Water

Contractually, the City of League City purchases treated wholesale surface water from GCWA. Physically, the water comes from two different sources; the City of Houston's Southeast Water Purification Plant (SEWPP) and the Thomas Mackey Water Treatment Plant (TMWTP) that is owned and operated by the GCWA in Texas City. The largest allotment of water, 16.5 MGD, is from the City of Houston's SEWPP at a surface water connection point to the north of the City at the State Highway 3 booster station. An additional 5.0 MGD became available through the Beamer Road waterline when the expansion to the SEWPP was completed in 2012. League City has also entered into a short-term lease for an additional 1.0 MGD from the City of South Houston. The total available supply from the SEWPP is 22.5 MGD including the 1.0 MGD lease from the City of South Houston.

GCWA also provides up to 2.544 MGD from the TMWTP to League City from the south conveyed through a 39-inch transmission line directly to the Calder Road booster station. Recently, an additional 3.0 MGD became available bringing the total supply from TMWTP to 5.544 MGD. A summary of the surface water receiving locations, sources, and amounts is shown in **Table 2-1**.

Table 2-1 Treated Surface Water Source

RECEIVING FACILITY NAME	SOURCE	CAPACITY (MGD)
State Highway 3 BPS[1]	SEWPP	17.5
Northside BPS	SEWPP	5.0
Calder BPS	GCWA	5.544
Total		**28.044**

Note:
1. Includes 1.0 MGD under short term contract from the City of South Houston

2.3.2 Ground Water

There are groundwater wells scattered throughout the system to augment peak demand and provide redundant supply. The Harris-Galveston Subsidence District (HGSD) regulates the amount of groundwater that can be withdrawn each year. Presently, League City is in a geographical zone that limits ground water usage to a maximum of 10% of the total annual volume. Ground water usage greater than 10% of the total annual volume can be utilized but will result in hefty monetary fines from the HGSD ($10.78 per thousand gallons). The existing groundwater well capacities are shown in **Table 2-2**.

Table 2-2 Existing Well Pump Capacities

WELL FACILITY NAME	WELL PUMP CAPACITY (MGD)
Calder BPS	2,000
Countryside Well Station	1,150
Dickinson BPS	407
Northside BPS	1,500
South Shore BPS	1,255
Third St Well Station	550
Walker St Well Station	700
Eastside Elevated Storage Tank	807

2.4 Booster Pump Stations

As League City has grown over the last 35 years, so has their water distribution system. Several of the booster stations were taken over from municipal utility districts (MUDs) when they were annexed by the City. The agglomeration of several former MUD facilities coupled with groundwater reduction requirements created a challenging supply and operational management situation. Accordingly, the strategy deployed from the 2011/2013 Water Master Plan has served the City well by separating the transmission and distribution system.

As described in the plan, the wholesale treated surface water is received at the SH3 BPS, Northside BPS, and Calder BPS. The South Shore Harbour (SSH) BPS also receives surface water, but it must travel through the currently combined transmission/distribution system prior to discharging into the SSH BPS ground storage tanks. With the completion of 36-inch transmission line from SH3 BPS to SSH BPS, the SSH BPS and eastern service area will experience more reliable and consistent water service. The remainder of the pump stations serve as access points to introduce ground water from the wells as necessary. Additionally, these smaller groundwater facilities could store surface water during times of the day with lower demands and repump during times of higher demand, much like an elevated storage tank would operate, just with better controls.

There are 10 booster pump stations within the City. Booster pumps are located downstream of the ground storage tanks to pressurize the water to distribution system pressure. **Table 2-3** summarizes the booster pump information at each facility.

Table 2-3 Booster Pump Summary

NO.	STATION NAME	NUMBER OF PUMPS	FIRM PUMPING CAPACITY
1.	Calder Road	4	8,700 gpm
2.	Northside	4	3,200 gpm
3.	State Highway 3	4	16,605 gpm
4.	South Shore	4	6,300 gpm
5.	Bay Ridge	2	350 gpm
6.	Countryside	4	1,000 gpm
7.	Dickinson	3	700 gpm
8.	Meadow Bend	3	1,200 gpm
9.	Third Street	2	500 gpm
10.	Walker Street	2	500 gpm
Total		**32**	

2.4.1 Major Booster Pump Stations

2.4.1.1 Calder Road Booster Station

The Calder Road BPS was originally constructed in 1979 and receives treated water from both the SH3 BPS from the north and the Thomas Mackey Water Treatment Plant from the south. It was recently reconstructed in 2016 to add significant ground storage capacity as well as booster pump capacity. The Calder Road BPS has four 2,900 gpm pumps. There are empty slots for a future 5th and 6th pump. The facility has a total ground storage capacity of 8.0 MGD comprised of two 3 MG prestressed concrete tanks and two older 1 MGD steel tanks. The Calder Rd BPS serves the majority of the west side of town and is the only major water booster station serving those residents.

2.4.1.2 Northside Booster Station

The Northside BPS (NS BPS) was recently constructed to receive treated surface water from the Beamer Road connection to the SEWPP. Treated surface water enters one of two 3.0 MG prestressed concrete ground storage tanks for a total of 6.0 MG of storage, before being pumped to distribution via two 750 gpm pumps and two 1,700 gpm pump (one duty, one spare).

2.4.1.3 State Highway 3 Booster Station

The State Highway 3 BPS (SH3 BPS) is the major transmission receiving point for the City's water system. It was originally constructed in 1970 by the GCWA to provide treated water to the City of Galveston with a 1.0 MG ground storage tank. The SH3-BPS was purchased from the GCWA and after a rehabilitation project was completed in 2003. In 2015, the facility completed a major reconstruction project that added two 3.0 MGD prestressed concrete ground storage tanks as well as reconstruction of the booster pump station.

The BPS reconstruction was designed to transmit treated surface water from the SEWPP to Calder Road BPS through the existing 42-inch and 39-inch transmission lines as well as directly to the SSH BPS through a 36-inch transmission line that is under construction at the time of this report. Additionally, the newly constructed intake piping and metering station to the GSTs was designed and constructed for ultimate future flows.

Pumping capacity and arrangement consists of two pumps each with a capacity of 5,535 gpm to feed the Calder Rd BPS and two pumps each with a capacity of 5,535 gpm to feed the SSH BPS when the 36-inch line is constructed.

The SH3 BPS is currently equipped with four 5,535 gpm pumps and two 3.0 MG and one 1.0 MG ground storage tanks, for a total of 7.0 MG of storage. Given that most of the City's water presently comes from the SEWPP, the SH3 BPS is a key facility in the water distribution system, directly providing water to most of the residences and businesses in the eastern half of the city.

2.4.1.4 South Shore Harbour Booster Station

The South Shore Harbour BPS (SSH BPS) is in the northeast section of the City of League City and is responsible for supplying the entire east side with water. It was originally built in 1982, was reconstructed in 2016, and is the largest of the eastside booster stations. South Shore Harbour BPS has four 2,100 gpm pumps, and two 1.0 MG and one 3.0 MG ground storage tanks, for a total of 5.0 MG of storage. Presently, this facility receives treated surface water supply from the SH3 BPS through a hybrid transmission/distribution system. Once the 36-inch transmission waterline from SH 3 is constructed directly to the SSH BPS, the SSH BPS will provide direct distribution pressure to the entire eastside of the City. Additionally, there is a 1,225-gpm groundwater well located on the facility site to provide supplemental water during periods of peak demand.

2.4.2 Minor Booster Pump Stations

2.4.2.1 Bay Ridge Booster Station

The Bay Ridge BPS takes water from the distribution system southeast of South Shore Harbour BPS and repumps it to the Bay Ridge, Mar Bella, and Whispering Lakes communities. It was constructed in 1980 and is one of the smallest stations in the League City distribution system, with two 350 gpm pumps and one 0.42 MG ground storage tank. Bay Ridge BPS also has a 10,000-gallon hydropneumatic tank in operation to reduce pump start/stops. For the purposes of future planning, this station was not considered in the modeling process.

2.4.2.2 Countryside Booster Station and Water Well

The Countryside BPS is on the northwest side of the City and was originally built in 1985. Since the last water master plan, the facility, including the well, was rehabilitated to address the age of the facility. It provides ground water during times of peak demand. The total well pump capacity is 1,150 gpm. There are four total booster pumps: two 250 gpm and two 500 gpm pumps that pump from the 0.35 MG ground storage tank.

2.4.2.3 Dickinson Booster Station

Dickinson BPS is in the southeast side of League City and connects to Galveston County Water Control and Improvement District No. 1. The station was constructed in 1985 and this connection is for emergency purposes only. The station has three booster pumps: two 350 gpm and one 850 gpm. The station also has a 0.40 MG ground storage tank. There is no regular usage of water from this source.

2.4.2.4 Meadow Bend Booster Station

The Meadow Bend BPS has its take point along the Louisiana Avenue water line, just before flow from SH3 BPS reaches South Shore Harbour BPS. The Meadow Bend BPS is a small booster pump station, built in 1978 that feeds the east central areas of the City. The station has three 600 gpm pumps in addition to one 0.5 MG ground storage tank. The tank was added in the mid-1990s. The station was previously the booster station for a MUD development before it was annexed by the City. For the purposes of future planning, this station was not considered in the modeling process.

2.4.2.5 Third Street Booster Station & Water Well

The Third Street BPS is in the north central part of League City and was built in 1963. The station has an operational 550 gpm well. There is a 0.5 MG ground storage tank to collect the water from the well and two 500 gpm booster pumps. The well was rehabilitated in 2012 and currently operates normally, however improvements at larger BPSs have reduced the need for the Third Street BPS and well to operate. Consequently, for the purposes of future planning, this station was not considered in the modeling process.

2.4.2.6 Walker Booster Station & Water Well

Walker BPS is in the center of League City and is the first take point along the main transmission line from SH3 BPS. It was built in 1970. Walker BPS has little room for expansion, which was taken into consideration for future growth. The station has two 500 gpm pumps and one 0.5 MG ground storage tank. The tank was added in the mid-1990s. Walker BPS also has a 700 gpm well pump that feeds into the ground storage tank. The well is currently operated daily, however improvements to the Calder Rd BPS have reduced the need for this facility.

2.5 Storage

The City's storage reservoirs consist of ground storage tanks (GST) and elevated storage tanks (EST). Each provides a similar, but very different function. Additionally, they each have minimum storage requirement to meet TCEQ guidelines unless exceptions are granted.

2.5.1 Ground Storage

Ground storage capacity provides a place to store water from the source provider during off-peak demand periods. During periods of high demand, water can be delivered at a higher rate than it can be received for short, defined periods of time. This allows capital and O&M costs to be reduced as the City can provide lower source water supplies as compared to the instantaneous peak demand. Generally, it is prudent to locate ground storage tanks as close to the demand as possible. Much of the ground storage capacity in League City is located at the Northside BPS, Calder Road BPS and SSH BPS. SH3 BPS also has a relatively high volume of ground storage.

Table 2-4 shows the current modeled ground storage in the League City water system at each facility. The combined storage capacity of multiple GSTs at each booster pump station has been represented in the form of a single tank. There are 16 ground storage reservoirs within the City's water distribution system at 10 different sites.

Table 2-4 Ground Storage Facility Summary

FACILITY NAME	MODELED DIAMETER (FT)	VOLUME (MG)
Calder BPS	233	8.0
Northside BPS	184	6.0
State Highway 3 BPS	200	7.0
South Shore BPS	168	5.0
Bay Ridge BPS	60	0.42
Countryside Well Station	45	0.35
Dickinson BPS	39	0.40
Meadow Bend BPS	66	0.5
Third St Well Station	58	0.5
Walker Well Station	58	0.5
Total Ground Storage	**28.67**	

2.5.2 Elevated Storage

Elevated Storage Tanks (ESTs) are operated using surplus distribution line pressure during off-peak demand periods. The City maintains a pressure higher than the overflow elevation of the ESTs, resulting in normally closed inlet and outlet valves. During peak demand or low pressures, operators open the valves to maintain pressure variation and reduce strain on booster pumps. This maximizes the amount of available elevated emergency water but requires additional operator oversight. To prevent water quality issues, tanks are cycled and flushed regularly. The operational strategy of the ESTs was modeled based on interviews with operations staff and is similar to the current operational practice. As an alternative to excess EST capacity, the City uses well sites, smaller Ground Storage Tanks (GSTs), and booster pump stations to provide additional flow/pressure during peak demands. This approach provides greater flexibility in system operation.

2.5.2.1 Alabama Elevated Storage Tank

Alabama EST was built in 1962 and has a capacity of 0.40 MG. However, its low height is problematic to be used as an elevated storage tanks. For a while, it was operated as a ground storage tank and is equipped with a 250-gpm booster pump. However, it is currently not in operation and was not considered in future scenarios.

2.5.2.2 Brittany Bay Elevated Storage Tank

Brittany Bay EST, also known as Countryside EST, was built in 1989 and is a 2.0 MG composite construction tank. Per discussion with the operators, this tank does not operate during normal conditions. The elevated tank is pulled into service only during high demand periods and then refilled overnight.

2.5.2.3 East Side Elevated Storage Tank

East Side EST was built in 2017 and is a 2.0 MG composite construction tank. Per discussion with operators, the East Side EST is regular operation, being pulled into service 70-80% of the time. It is presently set to fill in the middle of the night.

2.5.2.4 South Shore Elevated Storage Tank

South Shore EST was built in 2004 and is a 2.0 MG composite construction tank. The tank is in the southeast section of town between the Meadow Bend BPS and Bay Ridge BPS. Similar to the Brittany Bay EST, the South Shore EST is not regularly pulled into service unless the distribution system demands require it.

A summary of the elevated storage tank facilities and capacities are shown below in **Table 2-5**.

Table 2-5 Elevated Facility Summary

FACILITY NAME	VOLUME (MG)	MODELED DIAMETER (FT)	BOTTOM ELEVATION (FT)	OVERFLOW ELEVATION (FT)	HEIGHT (FT)
Alabama Elevated	0.4	54	118	148	136
Brittany Bay Elevated	2.0	96	126	166	106
Eastside Elevated	2.0	98	100	166	128
South Shore Elevated	2.0	91	121	166	148
Total Active Elevated Storage Capacity	**6.0**				

2.6 Transmission Lines

There is only one true transmission line in the League City water system. The 39-inch line from the Thomas Mackey Water Treatment Plant on the south side of town is untapped all the way to the Calder BPS. The remaining major lines are combination transmission distribution lines. The 42-inch/39-inch line extending south from SH3 BPS has a tap for the Walker BPS. It also feeds the 24-inch line that heads east along League City Parkway and then north along Louisiana Avenue. Each segment also has limited taps into neighborhoods. Once the 36-inch transmission line from SH3 BPS to SSH BPS is completed, there will be four (4) transmission lines as follows:

- The 42/39-inch from SH 3 to Calder Rd BPS; and
- The 39-inch from GCWA connection to Calder BPS from the south; and
- The 36-inch from SH3 BPS to SSH BPS; and
- 24" Waterline from Bay Area Blvd Meter Station to North Service Area BPS.

2.7 Distribution Lines

The distribution lines in the water system range in size from 1- to 42-inches. All pipelines were included in the hydraulic model developed for this study. A summation of the total length of each pipe diameter based on the GIS data provided by the City is given in **Table 2-6** and a pie chart of the pipe material distribution is included in **Figure 2-2.** Note: Pipe materials representing less than 1% of total piping are not included in the figure. This includes Polypropylene, HDPE, and Copper piping which are present in very limited quantities in the system.

Table 2-6 Total Pipe Lengths in Existing Water System

NOMINAL PIPE DIAMETER (IN)	LENGTH (FT)
1	1,647
2	22,743
3	5,682
4	126,282
6	386,141
8	1,574,964
10	71,231
12	409,765
14	83
16	57,559
18	14,262
24	149,734
30	1,740
36	512
39	23,083
42	16,170
48	58
All Diameters	2,861,656

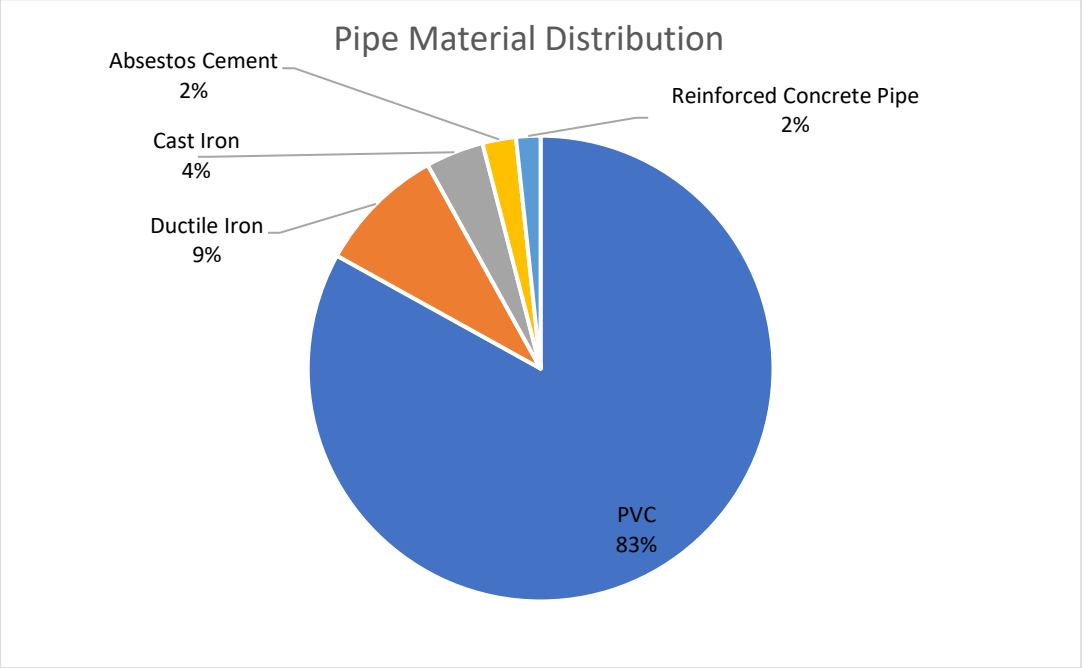

Figure 2-2 Pipe Material Distribution

Section 3

Water Demand Development

3.1 Study Area

The City of League City, Texas is located just south of the Houston Metropolitan area in northern Galveston County. The City is located approximately 29 miles southeast of downtown Houston and 27 miles northwest of Galveston, with Interstate 45 cutting through the center of the City. A map of the City, with the water service area and its vicinity is shown in **Figure 3-1**. It should be noted that population and land use projections utilized for growth projections within the City's service area were developed by Freese & Nichols, Inc. (FNI) in collaboration with the City as part of the 2023 Master Plan Update. The land use assumptions are documented in 2023 Wastewater Master Plan Update.

The study area consists of predominantly flat, gentle terrain that slopes to the east. The elevations vary from 4 feet above sea level along Clear Lake to the north to 34 feet above sea level in the undeveloped southwest corner of the City.

The City provides water service to retail customers only. The service area consists of residential, commercial, and industrial developments as well as open space such as community parks, golf courses and cemeteries. Existing commercial use areas are concentrated along I-45, State Highway 3, FM 518, FM 646, and FM 2094. League City does not have any wholesale customers. Large proposed mixed use commercial and residential developments are currently in the advanced planning stages in the undeveloped west and southwest corner of the City. Future pockets of commercial development are planned along the Grand Parkway, FM 517, and other major arterial streets.

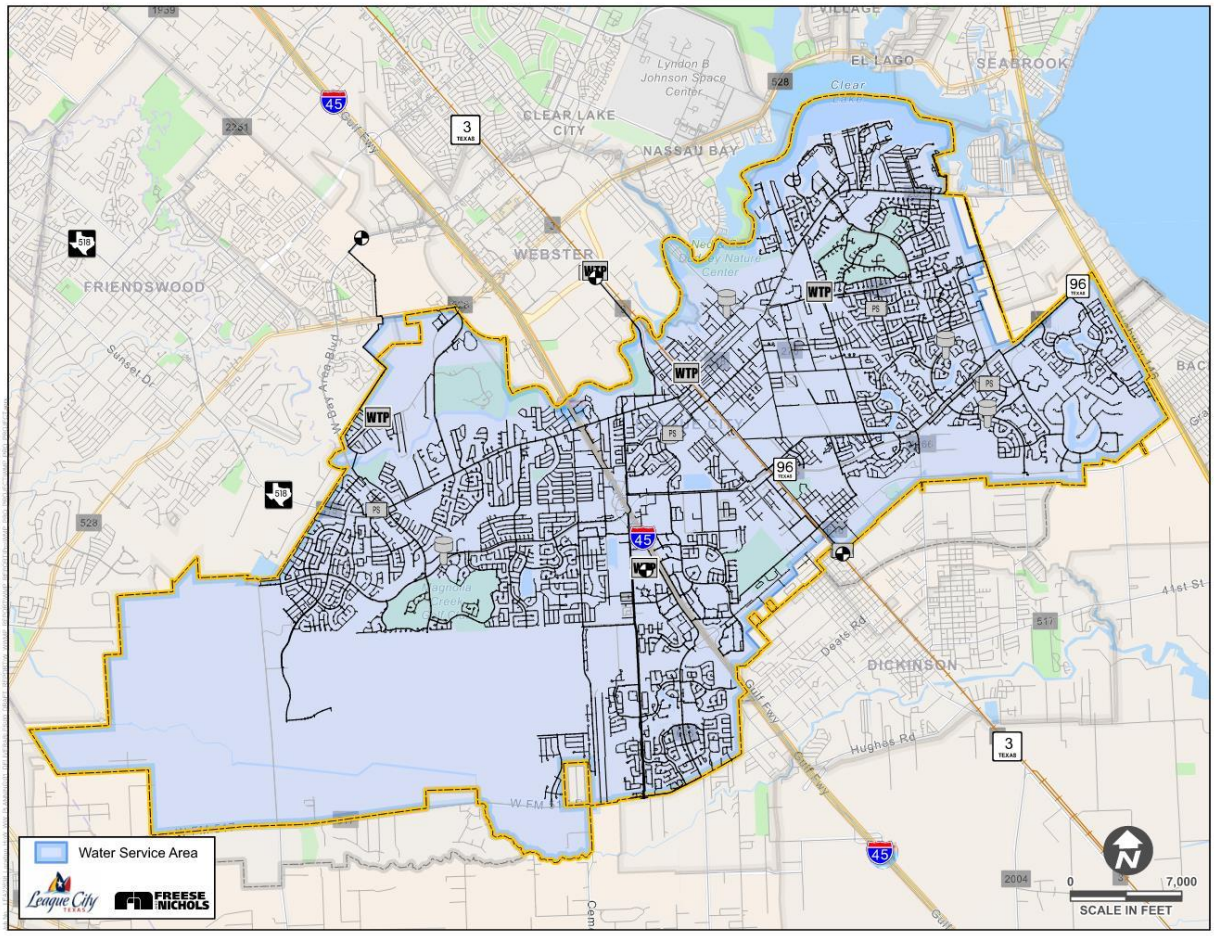

Figure 3-1 City of League City Location Map

3.2 Population and Land Use

Population and land use within the City's service area were determined by FNI as part of the Land Use Assumptions (LUA) documented in the Wastewater Master Plan report. Details on how the population projections were created can be found in that document. The projected population and commercial acreage projections are shown in the tables reproduced below. **Table 3-1** shows the population projections between 2023 and buildout. The future Land Use Assumptions are shown in **Figure 3-2**.

Table 3-1 City-Wide Population Projections

YEAR	COMMERCIAL ACREAGE	POPULATION
2023	2,807	116,834
2033	3,916	149,478
Buildout	5,886	201,729

FIGURE 3-2
CITY OF LEAGUE CITY
2023 WATER AND WASTEWATER MASTER PLAN UPDATE
ANTICIPATED DEVELOPMENTS

Existing Demands

Existing Demands were developed using three years of monthly AMI meter readings provided by the city. The average daily demand was calculated for each water meter from the monthly readings. Using the location data for the meters, the average day demands were geospatially distributed and used as the basis for the average day demand in the existing model scenarios.

Table 3-2 shows the distribution of meter types within League City and the percentage of total usage by service type. Note that approximately 70% of the water demand in League City comes from residential meters. Commercial, multifamily housing, and landscaping irrigation account for much of the remaining water demand. The meter types are grouped into service type groups to develop the water usage rates for the water demands discussed in Section 4.

Table 3-2 Meter Distribution by Type

METER TYPE	SERVICE TYPE DESCRIPTION	SERVICE TYPE GROUP	NUMBER OF METERS	PERCENTAGE OF TOTAL WATER USAGE
C	City Parks and Facilities	Commercial	136	0.8%
S	School	Commercial	43	2.2%
CM/CR	Commercial	Commercial	1,178	11.0%
L	Landscaping	Commercial	535	7.4%
M	Multifamily	Residential	196	8.9%
TH	Townhome	Residential	68	0.1%
R	Single Family Residential	Residential	34,685	69.7%
		Grand Total	36,841	100%

Average Day and Maximum Day Demand

Annual Average Day Demand (ADD) and Maximum Day Demand (MDD) were determined using historical daily water production data from October 2016 to September 2022. **Table 3-3** below shows the Average Day Demand Flows and the Max Day Demand flows from 2016 through 2022. For 2019 through 2022 when water meter data was available, the breakdown of water consumption between residential uses, commercial uses, and landscaping was developed.

In the past 5 years water demand has been consistent despite the growth in population. The annual average daily usage for the year 2021 for the entire city was approximately 11.3 MGD. Due to dry conditions during 2022, water demands were higher. In 2022, the max day demand in League City was 20.4 MGD. The month with the maximum City usage was July 2022, with a water demand of approximately 15.4 MGD on average. For modeling future max day demand, the Max Day Factor was set to 1.72, the highest ratio for the Max Day Demand to the Average Day Demand in the past five years.

When multifamily housing is included in residential water demands, residential water makes up approximately 79% of the total water consumption. The average residential meter used 77 gallons per person per day (gpcd) in 2021. Commercial water usage primarily from retail stores and restaurants makes up the second highest category of demand in League City. In 2021, commercial demand made up 14% of the water usage in league city, with an average of 602 gallons per acre per day (gpad). Commercial and HOA Landscape Irrigation account for the remaining 7% of total water demand.

Table 3-3 League City Historical Water Usage Data

YEAR	AVERAGE DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)	POPULATION	MDD: ADD PEAKING FACTOR	% RESIDENTIAL	GPCD	% COMMERCIAL	COMMERCIAL ACRES	GPAD
2016	10.9	16.3	102,634	1.49					
2017	11.2	17.4	102,634	1.56					
2018	11.3	19.5	104,857	**1.72**					
2019	11.0	18.3	106,803	1.66	77%	79.5	23%	2,455	1,012
2020	11.9	18.9	114,392	1.59	80%	82.5	20%	2,572	925
2021	11.3	18.4	115,747	1.63	79%	77.2	21%	2,690	876
2022	12.5	20.4	116,834	1.64	79%	84.1	21%	2,807	940

Water Loss

By comparing monthly billing data to the monthly water supply volumes, we calculated the typical water loss factor. **Table 3-4** shows the unmetered water loss percentage for the available data period in which both meter data and water production data were available. The water loss factor is used to scale the billed water to the total water demand in the master plan. In previous years water loss reached as high as 30% at times due to system leaks. To avoid skewing the master plan demand projections, the water loss factor was set at 15%. Although this is lower than the values shown in **Table 3-4**, this number is closer to the historical water loss data reported to TCEQ and is more reflective of industry standards for water systems of this size and age.

Table 3-4 Water Loss Analysis for 2018 through 2022

YEAR	TOTAL SUPPLY (MGD)	TOTAL BILLED WATER (MGD)	UNMETERED WATER LOSS (MGD)	UNMETERED WATER LOSS (%)
2018 (Dec)	9.39	7.21	2.18	23%
2019	10.97	9.12	1.86	17%
2020	11.86	9.96	1.90	16%
2021	11.29	9.15	2.14	19%
2022	12.43	8.52	3.92	31%

Peak Hour Factor

In addition to the monthly billing data, the City provided hourly meter readings for June through August of 2020, 2021 and 2022. This dataset allowed us to analyze the peak summer demands to quantify the peak hour factor. Due to size of this dataset, non-summer months were excluded from the dataset. Using the historical data, the peak hour for 2021, 2022, and 2023 was determined. The peak hour demand (PHD) during this period was 22,300 gallons per minute (32.1 MGD) and occurred at 6AM on August 1st, 2022. The peak hour factor (PHF) is defined as the ratio of the PHD for the entire system to the annual average daily demand (i.e., PHD/ADD). **Table 3-5** contains the historical peak hour data.

Table 3-5 Historical Peak Hourly Demand

YEAR	PEAK HOUR DEMAND (GPM)	PEAK HOUR DEMAND (MGD)	AVERAGE DAY DEMAND (MGD)	PEAK HOUR FACTOR
2020	20,389	29.4	11.9	2.47
2021	18,498	26.6	11.3	2.35
2022	22,300	32.1	12.5	2.57

In the 2018 Water Master Plan, the peak hour factor was found to be 3.68. The peak hour factor used in 2018 is higher than the peak hour in the 2020 to 2022 period. However, due to limited data available to analyze the peak hour factor, the more conservative factor for 3.68 was used in the 2023 model to ensure adequate future pumping capacity. The average day demand in 2022 only includes data from January to July, so the number for the average day demand is artificially high, as it does not include the fall and winter months where demands are lower. This would mean that the peak hour factor in 2022 could be higher than 2.57. In future years, when the hourly data across more years is available, it is recommended that the peak hour factor be revisited to determine if a lower peak hour factor is appropriate.

Table 3-6 summarizes the demand factors used to model max day demand and peak hour demand in the 2023 master plan.

Table 3-6 Demand Factors

DEMAND FACTOR	VALUE
Max Day Factor	1.72
Water Loss Factor	1.15
Peak Hour Factor	3.68

Diurnal Curve

Diurnal curves were developed for the system using standard diurnal curves provided by WaterGEMS for residential, commercial, and landscaping demand types. The hourly water demand pattern is a diurnal curve in which the peak water demand for each hour of the day can be expressed as a ratio to the average daily water demand. The built-in diurnal curves from WaterGEMS were used to create the City's diurnal curve. **Figure 3-3 thru 3-5** shows the diurnal curve at 1hour intervals.

The diurnal curve for the residential meters, which has the heaviest influence on the overall city diurnal curve, shows a typical sinusoidal shape, peaking during the morning and evening. The curves were imported to the model and applied to the demand by meter type.

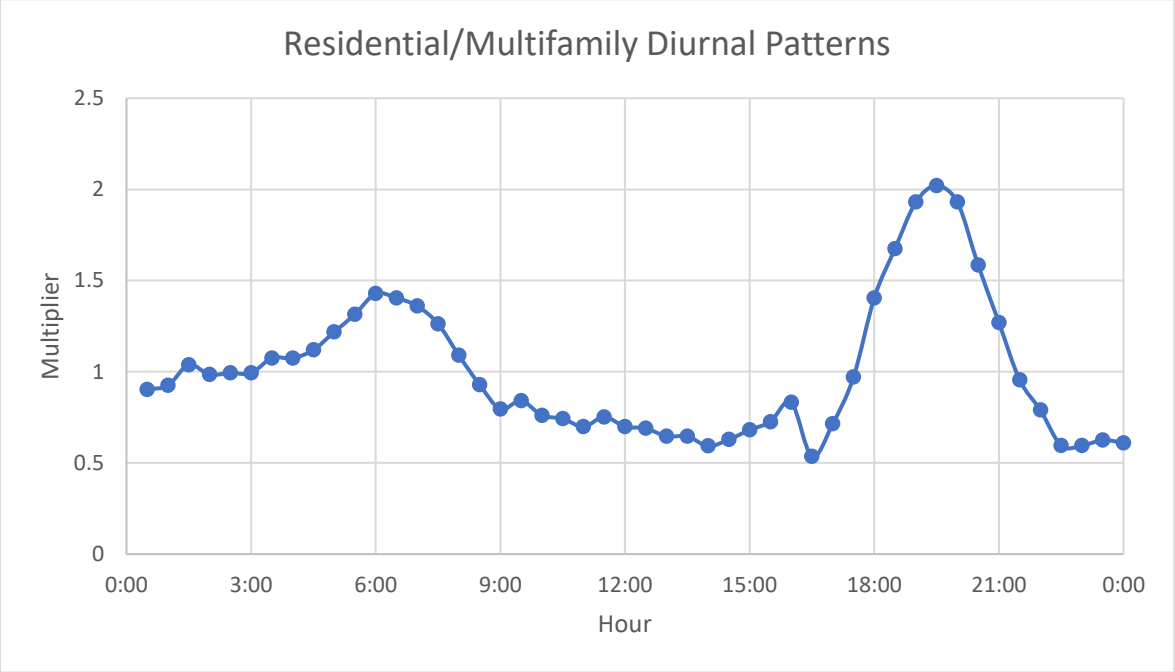

Figure 3-3 Residential Diurnal Pattern

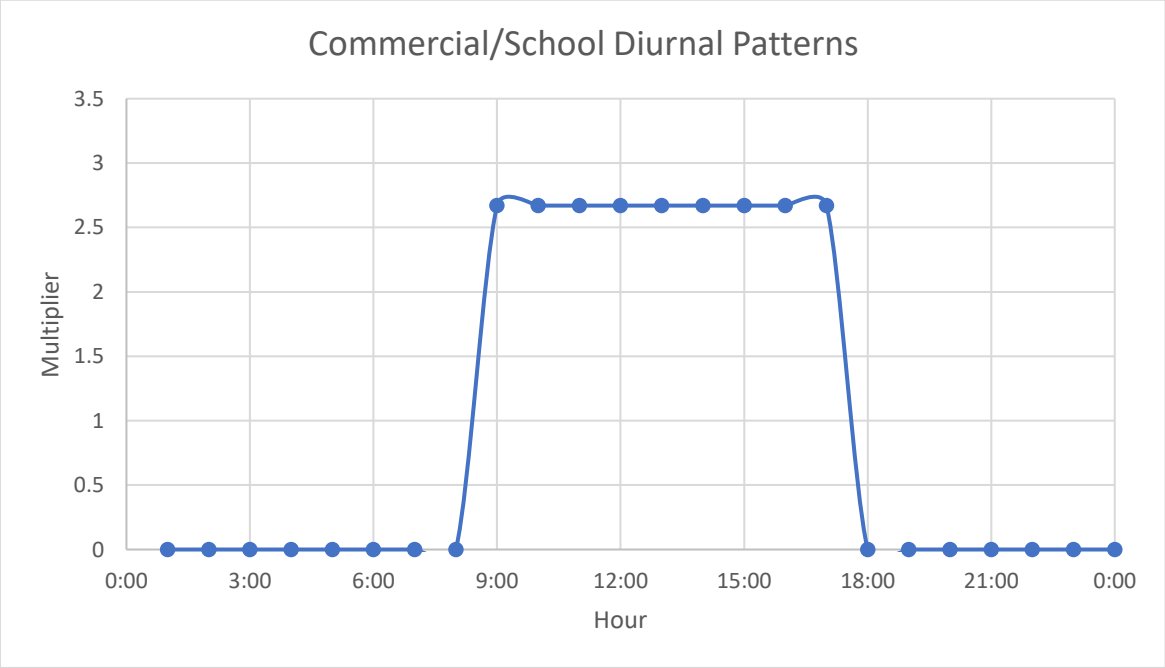

Figure 3-4 Commercial Diurnal Pattern

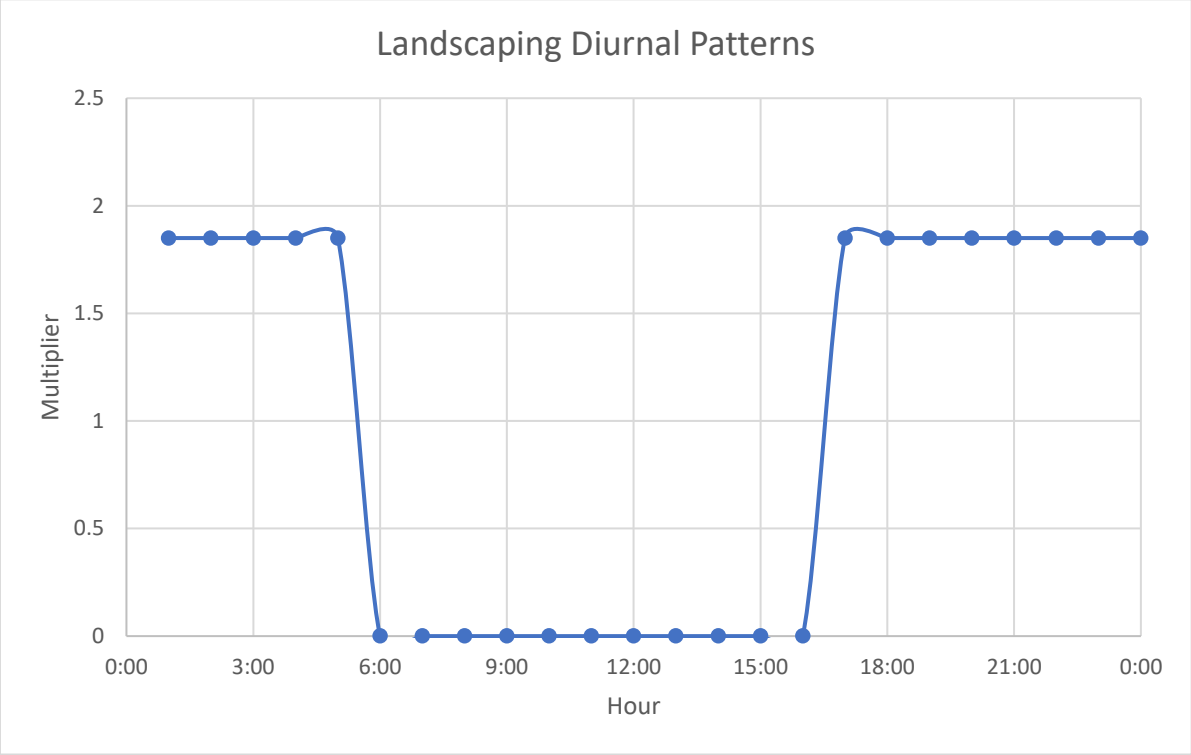

Figure 3-5 Landscaping Diurnal Pattern

Section 4

Water Demand Projections

4.1 Projected Future Water Demands

Based on the FNI LUA report, the population of League City has grown 2.9% annually from 2011 to 2022. The 40-year growth rate of 5.2% is based on census data dating back to 1970. The 2023 Wastewater Master Plan Report documents the population growth rates used to determine the projected population.

4.1.1 Projected Water Usage Rates

The water demand projections are based on data including the expected residential population increase, and commercial acreage increase through buildout. As described in Section 3, existing use factors were determined using the water meter billing data. The average water usage per capita specific to League City was also calculated from the water meter billing data and the historical population data. **Table 3-3** shows the average residential water usage per capita. The water demand projections were calculated using a residential water usage rate of 112 gallons per capita per day. This was selected to represent the usage from future developments that the City anticipates serving.

Spatial analysis was performed to determine the existing acres in the League City service area that were associated with commercial meters. The average daily water usage for the commercial service types from the meter data and divided by the acreage of the parcel to calculate the existing commercial water usage rates. These rates are shown in **Table 3-3**. The commercial usage type includes projected future commercial developments and HOA landscaping demands. The future commercial water usage rate was set at 2,000 gallons per acre per day. Using this water usage rate allows League City to avoid modeling scenarios for service extensions for commercial parcels using less than 2,000 gpad, effectively allowing all commercial areas to have the capacity of at least 2,000 gpad.

The residential and commercial usage rates are shown in **Table 4-1**. For the future scenarios, this demand was added in addition to the existing meter demands to create the total demand for 2028, 2033 and Buildout.

Table 4-1 Residential and Commercial Water Usage Factors

USAGE TYPE	AVERAGE WATER USE RATE
Residential	112 gpcd
Commercial	2,000 gpad

4.1.2 Commercial Acreage Projections

Future commercial acreage projections were determined by FNI in collaboration with the City in the future land use analysis documented in the 2023 Wastewater Master Plan. FNI provided the estimated commercial acres for each parcel in future areas of development for the 2028, 2033 and buildout scenarios. The demand of 2,000 gpd/acre was applied to the future commercial acres. These demands were input spatially by parcel into the modeling scenarios.

4.1.3 Future Residential Area Projections

The City provided concept plans, Planned Unit Development (PUD) maps, and development design drawings for several proposed developments in League City. This information was utilized by FNI in their Land Use Analysis to develop population projections for parcels associated with future development areas. Water demands were developed for each parcel using the 112 gpcd water usage factor. Development information was also used in the model to inform the locations of water mains and their size, if available.

Figure 4-1 shows the city-wide water demand projections using the water use factors in **Table 4-1**.

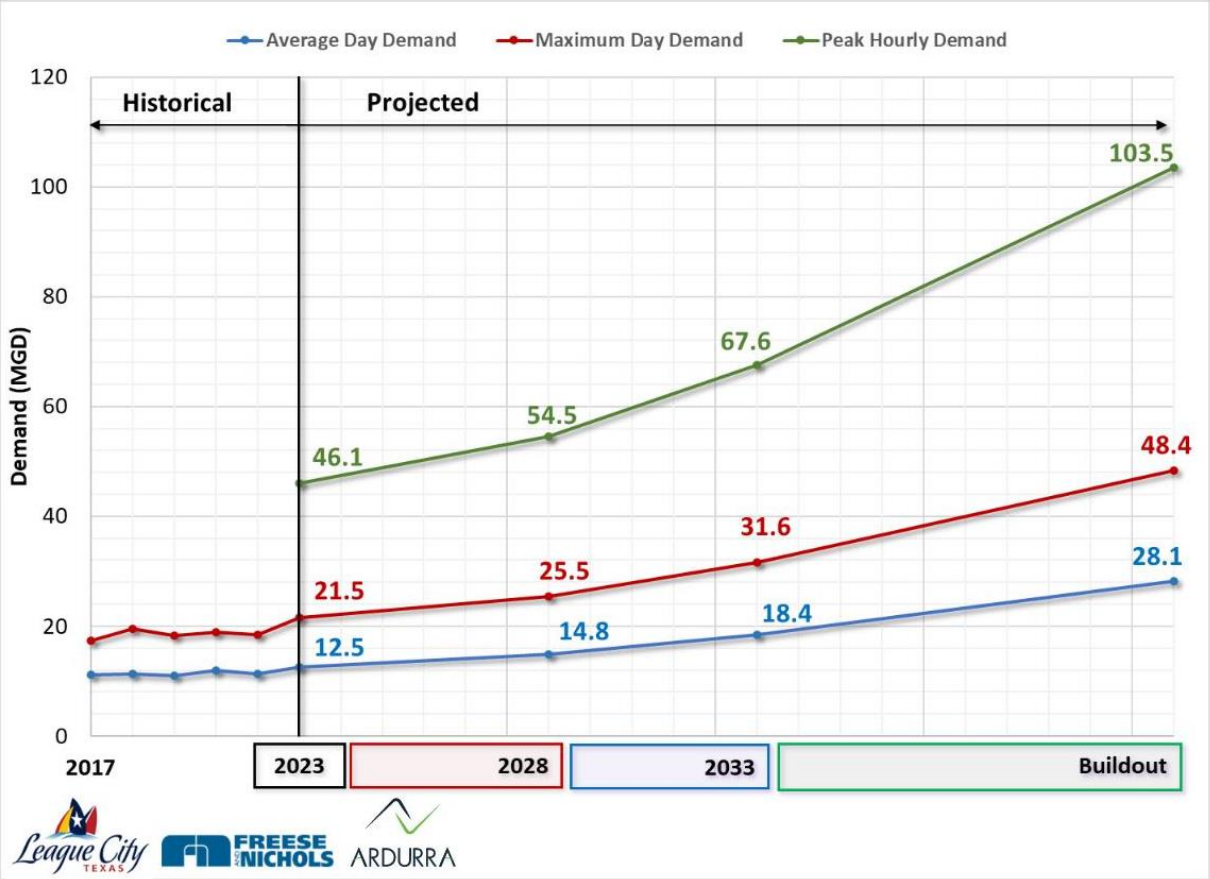

Figure 4-1 Water Demand Projections

Section 5

Hydraulic Model Update and Evaluation Criteria

The modeling methodology follows a logical progression of events including data acquisition, model construction, demand allocation, model verification and system evaluation. The first four activities are described in this section while the system evaluation is presented in Section 6.

5.1 Overview

The City's water distribution system was modeled using the WaterGEMS Connect Edition software by Bentley Systems. The software can simulate the hydraulic conditions of the League City water system under various scenarios. The following subsections explain how the model was assembled and evaluated.

5.2 Data Collection

The previous model was last updated by Ardurra in the 2018 Water Master Plan update. This model was used as a starting point to build the new updated model. Additional available data was gathered for the water distribution system's physical facilities, including piping size and location, storage tank locations, elevations, and volumes, well locations and capacities, booster pump station locations, operating capacities and controls, and water supply connection locations and permitted flow.

Data was also gathered on historical and projected populations, water production, and future land use maps of the City to be used for the development of water production projections and water demand allocations. The City also provided the current CIP project details to be included within the model update.

The City's billing department provided individual water meter usage for December 2018 through July 2022. The water meter billing data was evaluated to determine the existing water usage, which was imported into the model as the average/base demand condition as described in Section 3. The water meters were geocoded based on their physical location allowing its attributes from each meter to be assigned to an accurate location within the model. An existing average day demand scenario was created using the data.

5.3 Model Construction

The primary source of information on the water network was the GIS data provided by the City. WaterGEMS is compatible with ArcGIS software and allows direct import of GIS data into the model. Pipelines that were not in the previous version of the model were imported, including ones that were constructed since the previous master plan. Pipeline attributes include diameter, material, and installation year. The pipeline length is automatically calculated from the geographically determined length.

Junctions are point features that are located throughout the model at pipe intersections, ends, or size or material changes. Junction attributes included elevation and demand data. Demands were applied to the closest pipe to the water meter location and then distributed proportionally to that pipe's end

junctions based on the location of the service tap along the pipe. Therefore, in the model, each water service comprises a customer meter, lateral, and service tap to the nearest pipe.

Ground storage tanks (GST) are modeled as cylindrical tanks. Where there are multiple GST's, such as at booster pump station sites, one representative tank is utilized with the height and total capacity of the tanks that are represented. This assumption is acceptable for hydraulic modeling; however, individual tanks would need to be modeled for a detailed water age analysis.

Each supply point is modeled as a fixed-head reservoir feeding into the system. Every water source used a flow control valve to limit outflow based on the capacity at each connection. The flow control valve at the groundwater wells was set to the capacity of the well pump. The flow control valve for each surface water connection was set to the daily permissible flow. The flow control valve is then programmed to open or close based on conditions within the model such as the elevation in ground storage tanks reaching a minimum threshold and closing once the tank is full. This same philosophy was used for controlling take points based on the time of day per City contract with water suppliers.

Isolation valves throughout the water distribution system were modeled and valve positions determined based on information from the City's water operation staff.

On September 20, 2022, Ardurra met with City operation staff to review each water facility and overall operational philosophy to ensure the water model accurately reflected real world conditions. Changes to the system included opening/closing valves within the system, adjusting altitude valve controls, and modeling EST operation protocols.

5.4 Modeling Assumptions

Assumptions are necessary when modeling if information is not available or the model needs to be simplified to process data in a timely manner. The following information provides details for how the system was simulated in the model.

5.4.1 Pipe Material and Roughness Factor

The existing pipe materials were unchanged from the previous model. The new pipes were imported from the City GIS. Hazen-Williams C value for roughness was calibrated for pipe materials and ages using city provided hydrant testing data. Calibration will be discussed in section 5.7. All future pipes were created as PVC with a Hazen-Williams C value of 130, which is the maximum allowable C-factor recommended by TCEQ and AWWA standards.

5.4.2 Booster Pump Stations

The booster pump station locations were provided within the water system GIS data. The actual station layout, pumping capacities and storage tank details were provided in schematic layouts. Station isolation valves' open or closed status were based on direction from the City water operations group and the provided station layouts for the existing scenario.

The pump curves for the existing pumps were obtained from manufacturers based on City provided pump capacity and model number information. For future scenarios, individual pumps with adequate additional pumping capabilities were added to a station. Future scenarios were simplified by simulating only one future pump running that could carry the station's future load, reducing the run

time of the model. However, the CIPs were developed with multiple pumps as needed to best suit the situation.

Pump station setups were relatively unchanged compared to the previous model's setup. Existing controls for the pump stations were time or system pressure based. After the new demands were met, additional controls were added to prevent the pumps from trying to run when their supply tanks reached their minimum levels.

5.4.3 Elevations

The water system model used ground elevations from the 2018 model for existing infrastructure. Elevations for proposed sites were based on the City's 2-foot contours developed from the Houston-Galveston Area Council 10-meter Digital Elevation Model (DEM) and applied to new model nodes and facilities throughout the water system. Because the overall topography of the City is fairly flat and pressurized water distribution systems are not as reliant on precise elevation data as wastewater modeling is, field surveying was not performed for this study.

5.5 Model Operations

System controls were based on the controls philosophy discussed during the operator interview meeting held on 9/20/22. Constant speed pumps in the system are controlled based on pressure in downstream nodes, calling the booster pump to run when pressures are low and shut off once they have returned to a minimum value. VFD controlled pumps, such as those at State Highway 3 BPS, Northside BPS, and South Shore Harbour BPS use a pressure set point that ramps the pump speeds up or down to maintain the set pressure. Each of the booster pump stations include a low-level lockout which shuts the pumps off if the level in the GST becomes too low to safely pump from.

5.6 Model Verification

To verify that a model is serving its purpose by reasonably representing its real-world counterpart, it is important to have accurate data on existing system configuration and operation. For the GIS data, it is important to verify that there are no inaccuracies created during the import process. All crossing connections, isolation valves positions, and booster station layouts were verified with the League City water operations staff, particularly crossing connections in key locations such as in or around booster stations or along major transmission or distribution lines.

General operations information is also extremely important to model verification. The WaterGEMS software allows for reasonably complicated control situations. Therefore, the City of League City's water operations staff were interviewed regarding common practices, valve positions, and special circumstances. As described above, these controls are modeled using real time control settings and allow a more accurate representation of existing system operation.

5.7 Model Calibration

The final step in model creation is model calibration which involves the collection of field data to compare against modeled performance to evaluate the predictive performance of the model and adjust performance to match the real world more closely. Model calibration was performed in two stages: steady state and extended period simulation (EPS).

The steady state calibration was performed using a collection of fire hydrant flow test data from 2021 and part of 2022 that the city regularly collects as part of the flushing and maintenance program. Hydrant flow test data included hydrant ID, hydrant flow rate, and hydrant residual pressure but did not include flow or pressure information from any other points in the system at the time of the test. As a result, the GST tank levels, pump settings, and system demands could not be directly modeled for every test. Instead, an average day steady state analysis was run to compare a predicted pressure given a set hydrant flow rate against reality. In aggregate, the multitude of flow tests cancel out the individual system variation present during each test and allows the model to be calibrated on the average behavior. WaterGEMs includes a suite of calibration tools that use genetic algorithms to determine optimal pipe roughness, identify potential valve closures, and adjust unit demands that result in a minimization of error between predicted model values and reality. The steady state calibration was performed using a random sample of 50 hydrant flow tests. Computer memory limits prevented performing this analysis on more flow tests at one time. The resulting analysis provided C factor adjustments based on the age of the pipe that would result in a closer model fit given the training data. **Table 5-**1 shows the resulting C factor adjustments from this calibration.

Table 5-1: Pipe Roughness Adjustments

Pipe Roughness Group	H-W C Multiplier	# of pipes
Older than 1980	0.9	2,200
1980s	1	2,351
1990s	0.9	2,608
2000s	0.9	6,386
2010s	1.1	3,566
2020s	0.9	654

Once the steady state calibration was performed, an additional 50 hydrant flow test results were selected to test model performance. Normally this is not feasible given the time and effort required to collect this number of field data points. However, because the City includes collecting hydrant flow test results in the normal maintenance and testing program, we were able to divide the data into separate training and testing datasets which allows for an unbiased review of the calibration effectiveness since the model was not directly trained on the test data and therefore has not been overfit to it. **Figure 5-1** shows the performance of the model on the test data which shows a strong correspondence between observed and predicted hydraulic grades. The resulting root mean square deviation (RMSE) which represents the average error in the model is 3.85 ft which meets the AWWA M-32 recommended criteria of +/- 10 ft. This represents a high degree of agreement between predicted and observed results and means the connectivity, pipe roughness, and average operations accurately reflect reality. However, it does not confirm that pump, EST, flow control valves, and GSTs programmed setpoints have been programmed properly since these can only be analyzed in extend period simulations.

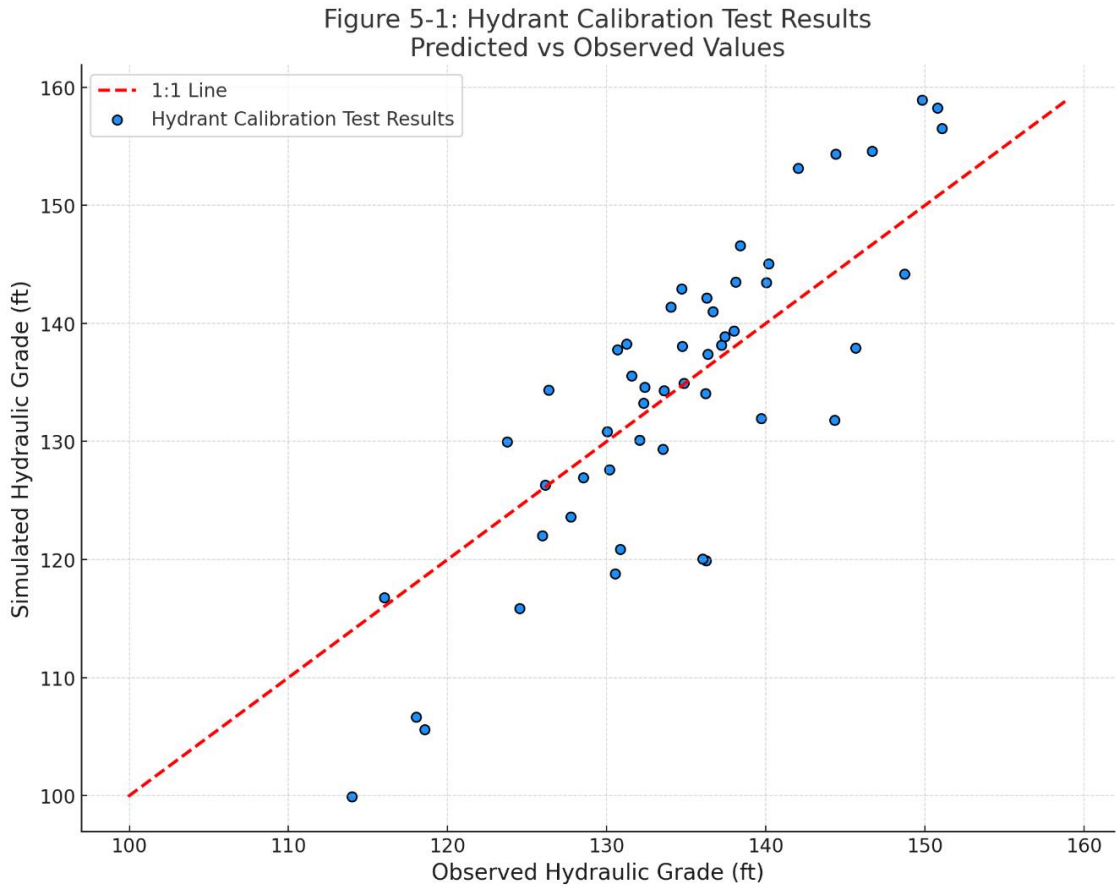

Figure 5-1: Hydrant Calibration Test Results. Predicted vs Observed Values

In addition to the steady state calibration, an EPS calibration was performed to further confirm the validity of the model. Six pressure loggers were installed at strategically chosen locations throughout the distribution system and set to record the resulting pressure every 30 seconds for two weeks. The SCADA data including pump status, pump speeds, GST elevations, pressures, and flow rates were also exported from the City's system. Combining the two time-stamped datasets allowed for the water model to simulate minute by minute behavior of the water system in the same conditions observed by the pressure loggers. This calibration allowed for the operational setpoints to be fine-tuned and confirmed. **Figure 5-2** shows the predicted vs observed pressure for each of the pressure loggers on 10/23/22 which was the day with the highest record flow rate and no missing data. As can be seen there is a strong correspondence between the two, and we can therefore confirm that the model is properly calibrated both physically and operationally.

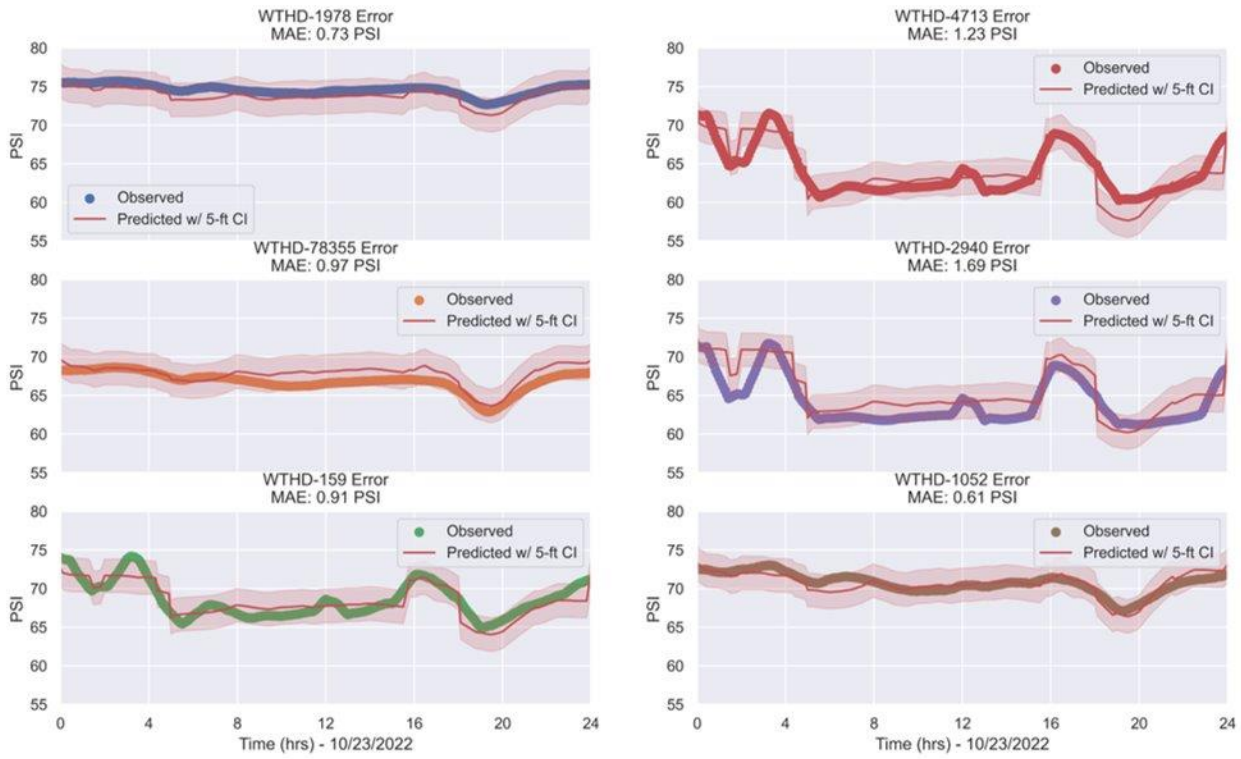

Figure 5-2: Predicted vs Observed Pressure Loggers for 10/23/22

5.8 Planning and Evaluation Criteria

Various planning criteria are used in the evaluation of both the existing and future system hydraulic models. The planning criteria is developed based on water systems like League City, local codes, engineering judgment, commonly accepted industry standards, and input from City staff. The "industry standards" are typically ranges of acceptable values for the criteria in question and therefore, they were utilized more as a check to confirm that the values being developed are reasonable. A list of planning criteria developed through meetings with City staff and used in the evaluation of the City's water distribution system is shown in **Table 5-2**. Emergency storage has been lowered from 100% of ADD to 80% of ADD based on the City's diversified water supply which requires less in-system water storage. The proposed change was presented and agreed upon at a progress meeting held on December 6th, 2022. This change reduces the amount of additional storage that must be built in the future, it also reduces average water age without hampering operations.

Table 5-2 Summary of Planning Criteria

DESCRIPTION	PLANNING CRITERIA
Peaking Factors:	
- Maximum Day Demand	1.72 x Average Day Demand
- Peak Hour Demand	3.68 x Average Day Demand
Minimum System Pressure	35 psi, with a goal of 50 psi on trunk distribution pipelines
Maximum System Pressure	80 psi, with a goal of 65 psi
Maximum Velocity in Pipe	8 feet per second
Storage Capacities:	
- Operational Storage	25% of Max Day Demand
- Fire Flow Storage	4 hours at 4,000 gpm (1 MG)
- Emergency Storage	80% of Average Day Demand

There are three primary evaluation criteria: 1) acceptable pressure, 2) maximum acceptable pipeline velocities, and 3) adequacy of storage volumes. TCEQ has a minimum requirement of 100 gallons of ground storage and 100 gallons of elevated storage for each service connection. However, the City of League City has an active Alternative Capacity Request reducing this requirement to 73 gallons per connection. This 27% reduction applies to all TCEQ capacity requirements in chapter 290.45(b)(2). Based on the City's current total population of 117,293 and an estimated 2.63 people/connection based on City statistics, the minimum required ground storage and elevated storage is 3.25 MG each for a total of 6.5 MG. However, the city currently exceeds this significantly with a combined GST/EST storage of 35 million gallons.

For planning purposes, it is recommended to provide additional storage beyond TCEQ required minimum storage. It is recommended that the City plan operational storage to provide 25% of maximum day demand, fire flow storage to provide sufficient water for four hours at 4,000 gpm (1 MG), and emergency storage to provide 80% of the average day demand. Storage volume and location planning should be reviewed in the future for conformance with connection requirements and the City's source water connection risks.

5.9 Modeling Scenarios

5.9.1 Existing Scenario

Multiple scenarios were modelled to simulate the existing and future conditions in the League City water system. Average and Maximum Day scenarios for Existing, 5-year, 10-year, and Buildout demands were evaluated.

The existing scenarios include the current water demand determined by the existing water meter data as well as the existing system configuration. The existing system configuration was also used as the base scenario to perform calibrations on.

5.9.2 5-year Scenario

The 2028 scenario uses the existing scenario as a base with the addition of the beneficial CIP projects. The development of the 2028 demand alternative is described in detail in Section 4.5.1. The new demands for commercial property and residential population by 2028 were added to the existing demands to create the 2028 demand alternative.

To reduce maintenance requirements throughout the water system and because of the age of most of the smaller water facilities, the smaller water facilities were not considered operational in future planning scenarios. The CIP projects associated with these facilities were similarly eliminated from the future planning scenarios. The following facilities were eliminated and are recommended for decommissioning:

- Bay Ridge BPS
- Meadow Bend BPS
- Third Street Well Station
- Walker Well Station

The decommissioning of these facilities is dependent on the completion of the 36" Waterline SH3 to SSH Booster Station and 16" Waterline SSH BPS to FM 2094 project and the 2028 Calder Rd BPS Pump Upgrade project. The descriptions of these projects can be found in Sections 8.1.1 and 8.1.2, respectively.

5.9.3 10-year Scenario

The 10-year scenario also uses the existing infrastructure and the CIP projects as well as the 10-year demands described in the previous section to model operations in 2033. For each scenario, the water system was analyzed to determine large transmission and distribution lines requirements as well as storage and pumping upgrades at booster stations to meet water demands and operational requirements. Specific projects are identified in Section 8.

5.9.4 Buildout Scenario

The buildout scenario also uses the existing infrastructure and the CIP projects as well as the ultimate demands described in the previous section. For each scenario, the water system was analyzed to determine large transmission and distribution lines requirements as well as storage and pumping upgrades at booster stations to meet water demands and operational requirements. Specific projects are identified in Section 8.

Section 6
System Analyses and Results

The purpose of this section is to describe the evaluation of the City's existing and future water distribution system and discuss the performance of the system using the calibrated hydraulic model. The model incorporated the planning criteria and demand projections previously described. Key components of the water system—water sources, node pressures, pipeline velocities, storage tank volumes, and booster pump capacities—were investigated and evaluated under existing and projected future conditions, including full buildout.

Recommendations to address identified deficiencies and ensure the system can meet additional future demands are provided at the end of this section. The results of this evaluation will guide capital planning and infrastructure investments to maintain a robust and resilient water system for generations to come.

6.1 Water Demands

The City of League City's water system was evaluated for adequate supply, system pressure, storage, and pumping capacity to meet existing and projected future demands, including buildout conditions. The demand scenarios analyzed are summarized in **Table 6-1.**

Table 6-1 Water Demands

YEAR	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)
Existing (1/1/2023)	12.5	21.5
2028	14.8	25.5
2033	18.2	31.4
Buildout	28.1	48.4

Average daily demand was calculated from daily facility data for 2016 to 2022 provided by the City. Maximum daily demand was determined by using the Max Day Factor of 1.72 as described in Section 3. These metrics formed the baseline for the modeling scenarios.

6.2 Existing System Pressure

Several figures were created to understand the existing performance of the water system. In each figure, the booster station's pumping values were taken from the model during the peak demand time in the diurnal curve. **Figure 6-1** shows the water pressure of the existing League City water system at average daily demand. The pressures throughout the City are quite adequate, ranging from 50 to 75 psi, with the highest pressures located in the northeast area served by South Shore Harbour BPS.

6.3 Modeling Evaluation

Once the model was properly verified and results closely mirrored existing system operation and performance data, the results were analyzed for system performance, deficiencies in the defined evaluation criteria identified, and solutions developed. The modeling results are described in the following sections.

6.3.1 Results from Existing Scenarios

Figure 6-2 and Figure 6-3 show the water pressure of the existing League City water system under Max Day and Peak Hour conditions, respectively. The model results for existing system conditions validated anecdotal evidence from the City's operations team. With the improvements made since 2018, no significant low-pressure areas remain—the model showed that pressures exceeding 50 psi are maintained throughout the system during all times of day.

The strong correspondence between the model and actual operating conditions confirmed that the hydraulic model was well calibrated and able to accurately represent the real-world system. This verification provided confidence in the model's ability to evaluate future "what-if" scenarios for planning purposes.

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 6-1
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM MINIMUM PRESSURES UNDER AVERAGE DAY DEMAND

LEGEND

- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES

- Less than 35 psi
- 35 - 50 psi
- 50 - 60 psi
- 60 - 65 psi
- Greater than 65 psi

League City TEXAS
ARDURRA
FREESE AND NICHOLS

Created By Freese and Nichols, Inc.
Job No.: GF117041
Location: H:\W_WW_PLANNING\D1_DELIVERABLES\00_DRAFT_REPORT\W_WWMP_REPORT\WMP_REPORT\[Figure_6-1]-Existing_System_Min_Pressure_AD_Demand.mxd
Updated: Monday, June 5, 2023 2:56:10 PM

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
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0.4 MG Alabama EST
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South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 6-2
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
MINIMUM PRESSURES UNDER MAX DAY DEMAND

LEGEND

- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES

- Less than 35 psi
- 35 - 50 psi
- 50 - 60 psi
- 60 - 65 psi
- Greater than 65 psi

League City TEXAS
ARDURRA
FREESE NICHOLS

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Location: H:\W_WW_PLANNING\01_DELIVERABLES\00_DRAFT_REPORT\W_WWMP_REPORT\WMP_REPORT\Figure_6-2\1-Existing_System_Min_Pressure_Max_Demand.mxd
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Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 6-3
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
MINIMUM PRESSURES UNDER MAX DAY PEAK HOUR DEMAND

LEGEND

- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES

- Less than 35 psi
- 35 - 50 psi
- 50 - 60 psi
- 60 - 65 psi
- Greater than 65 psi

League City TEXAS
ARDURRA
FREESE NICHOLS

Created By Freese and Nichols, Inc.
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Location: H:\W_WW_PLANNING\01_DELIVERABLES\00_DRAFT_REPORT\W_WWMP_REPORT\WMP_REPORT\Figure_6-3-Existing_System_Min_Pressure_Max_Peak_Hour_Demand.mxd
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6.3.2 Results from 2028 Scenario

The 2028 scenario evaluated how well projects proposed in 2018 would meet the system's current and future needs based on updated demand projections and planning criteria. While most projects remained effective, some required modifications to optimize system benefits.

For example, model simulations identified a need for additional pressure support to maintain minimum 50 psi trunkline pressure in the far west region during peak demands, especially under buildout conditions. By strategically installing new pump stations and increasing pipeline diameters to reduce head loss, the model showed this problem was addressed with minimal changes to the ultimate CIP.

6.3.3 Results from 2033 Scenario

With the immediate CIP projects incorporated into the existing infrastructure for the 2033 scenario, few problems with pressure were seen due to the increase in demand projections. The scenarios were subjected to one week of maximum demand days.

With the addition of the projects identified in Section 8, the evaluation criteria listed in Section 5.1 were met. All system pressures at all times exceeded 35 psi and were lower than 85 psi, while meeting TCEQ requirements of at least 20 psi during fire flow. The velocities for all pipelines were less than 8 feet per second.

6.3.4 Results from Buildout Scenario

For the Buildout scenario evaluation, the total needed water source was estimated to be 48.4 million gallons per day (MGD), a significant increase from the current demand. To meet this increased demand, major upgrades to the existing booster pump stations will be required.

After modeling the necessary increases in flow and pumping capacity at the various booster stations, the water system is anticipated to perform well. The system performance will depend primarily on expanding the State Highway 3 Booster Pump Station and Calder Booster Pump Station. Three new water wells and booster pump stations will be needed to meet worst-case peak day demands, though they will typically not be required for normal operations.

In the model, all system pressures met the minimum 35 psi requirement and always stayed below the maximum 85 psi limit during the simulation, while also meeting TCEQ requirements of at least 20 psi during fire flow. All pipeline velocities remained below 8 feet per second.

Section 7

Capacity Evaluation and Source Water Development

7.1 Source Evaluation

The City, through GCWA, is a part owner of 21.5 MGD of capacity in the SEWPP and another 5.544 MGD from the GCWA Thomas Mackey Water Treatment Plant (TMWTP). Included in the 5.544 MGD from GCWA is an additional 3.0 MGD from the TMWTP that became available after the re-rate of the TMWTP capacity in 2022. League City also has a short- term lease for 1 MGD from the City of South Houston giving a combined total surface water supply of 28.044 MGD. To meet the projected 48.4 MGD demand at buildout, additional water capacity is needed. League City has 12 MGD of groundwater available but is only able to use groundwater to meet up to 10% of its total annual water supply because it is in Zone 1 of the Harris-Galveston Subsidence District (HGSD). Therefore, surface water will be required to meet future water supply needs.

The City of League City has entered into an agreement with the City of Houston to reserve 20 MGD of future treated water capacity at the SEWPP. The city chose to pursue this reservation contract and pay a fee for the capacity reservation since the next 20 MGD module at SEWPP will be significantly less expensive than future expansions. The SEWPP Treatment Module 2 was constructed at 80 MGD capacity and set up for a future expansion of 20 MGD of additional capacity. Expanding SEWPP after the 20 MGD purchased by League City will be more expensive because they will require a holistic expansion of treatment capacity, raw water infrastructure (raw water pump station or pipeline facilities), and treated water delivery infrastructure.

League City's capacity reservation contract with the City of Houston is structured to charge a percentage of the raw water rate until League City completes the construction of the treatment plant expansion. The reservation rate increases when the project to replace and upgrade the Southeast Transmission Line (SETL) is completed. Due to this cost structure, League City is incentivized to complete the 20 MGD SEWPP expansion.

7.2 Supply Evaluation

Under typical conditions, the total capacity of water supplies should be equal to or greater than the maximum day demand (MDD). Demands above MDD are typically supplied from ground storage and replenished during off peak times.

The evaluated total surface water contributions from each source are shown in **Figure 7-1**. Funding, acquiring, and constructing new facilities to achieve the 20 MGD SEWPP expansion will take a minimum of 7 or more years so the additional 20 MGD from SEWPP is anticipated to become available in mid-2031. As described above, TMWTP was re-rated in 2022 and provided an additional 3 MGD of surface water capacity to League City, however, it is not anticipated to be further expanded or re-rated, therefore Southeast Water Purification Plant is the only source of additional surface water supply.

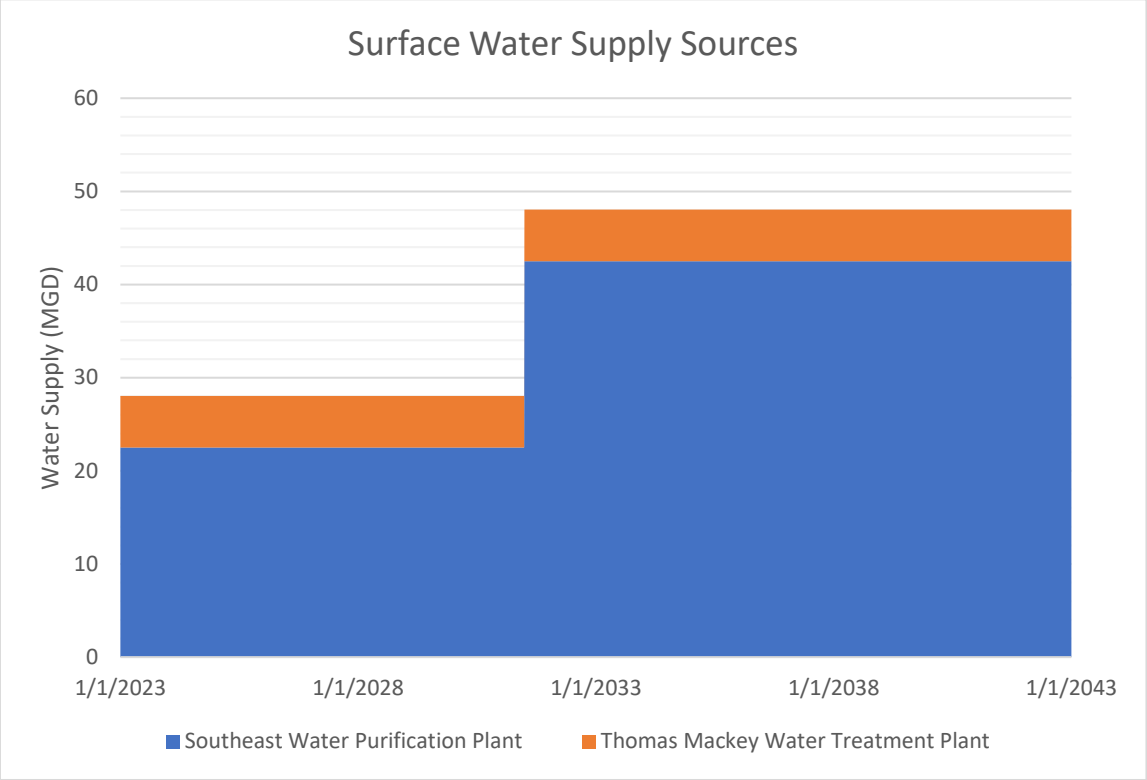

Figure 7-1 Evaluated Source Water Alternatives

Per the City's detailed logs, the City was supplied with 4.2 billion gallons of water in the year 2021. Historical water supplies and their origins for calendar years 2019-2021 are shown in **Table 7-1** below.

Table 7-1 Historical Water Supply

CALENDAR YEAR	LEAGUE CITY WELLS (MGD)	CITY OF HOUSTON (MGD)	GULF COAST WATER AUTHORITY (MGD)
2021	0.14	10.34	1.0
2020	0.82	10.06	1.8
2019	0.94	9.24	1.7

Most of the City's water supply is provided by the City of Houston's SEWPP and the TMWTP, via the Gulf Coast Water Authority through various take points in the city. The SEWPP provides 16.5 MGD through the State Highway 3 Booster Pump Station (BPS), and 5 MGD via the Beamer Road interconnect which supplies the Northside PBS. The TMWTP provides 5.544 MGD to the Calder Rd BPS via a 39-in transmission line along State Highway 3.

The City currently has an existing total well capacity of approximately 12 MGD. Fully utilizing the existing well capacity would result in significant disincentive fees in excess of 5 times the cost of current wholesale water rates. Further usage of groundwater wells is limited to 10% of the total annual volume by the Harris-Galveston Subsidence District, Zone 1. As the City's water infrastructure has been improved, the need for utilizing groundwater wells close to demand sources has been greatly reduced except in times of peak demand. **Figure 7-2** illustrates the city's available water sources compared to their projected Max Day Demand.

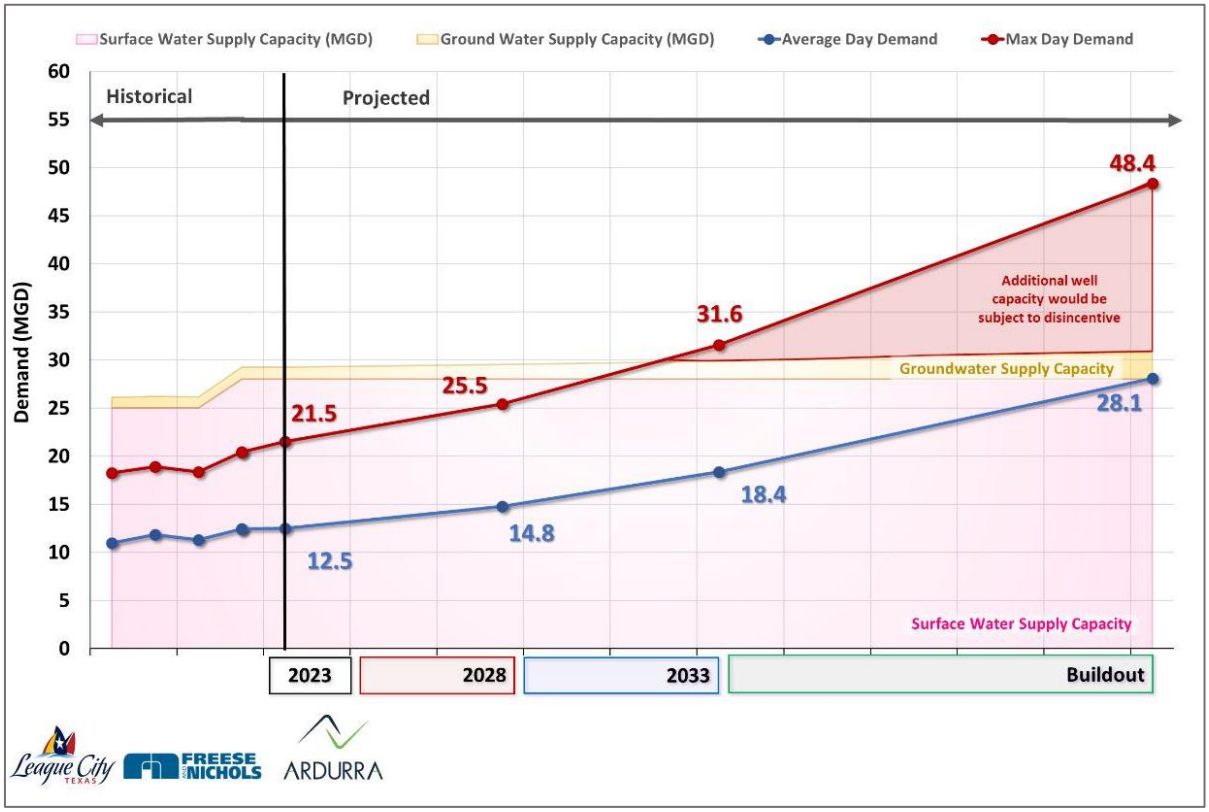

Figure 7-2 Comparison of Secured Water Sources and Future Demand

Additional surface water supply is needed between 2028 and 2033. Existing groundwater supply will be able to bridge any gaps in water supply during high demand periods until the 20 MGD SEWPP expansion comes online. If SEWPP expansion is delayed, existing (and future) ground water wells could be managed to restrict usage to the peak months of the year, which are typically June through September (4 months). This would spread the 10% annual usage across just those four (4) months when needed. This would allow the City to use an estimated 9.7 MGD of groundwater when needed to stretch its water capacity between 2028 and 2033 without receiving penalties for exceeding the ground water usage regulations.

Figure 7-3 shows the existing surface water supply from each source, future water demand based on anticipated growth, and current well capacity. **Figure 7-3** indicates the addition of 20 MGD of surface water capacity at the SEWPP in 2031, when the groundwater well capacity no longer meets the demand. This timeframe for implementation is achievable if League City begins pursuing coordination

efforts to start designing the facility within the next Fiscal Year. Until the SEWPP expansion is implemented, demand fueled by growth could be met using groundwater sources. The groundwater usage shown in **Figure 7-3** represents using the 10% of groundwater spread across the entire year.

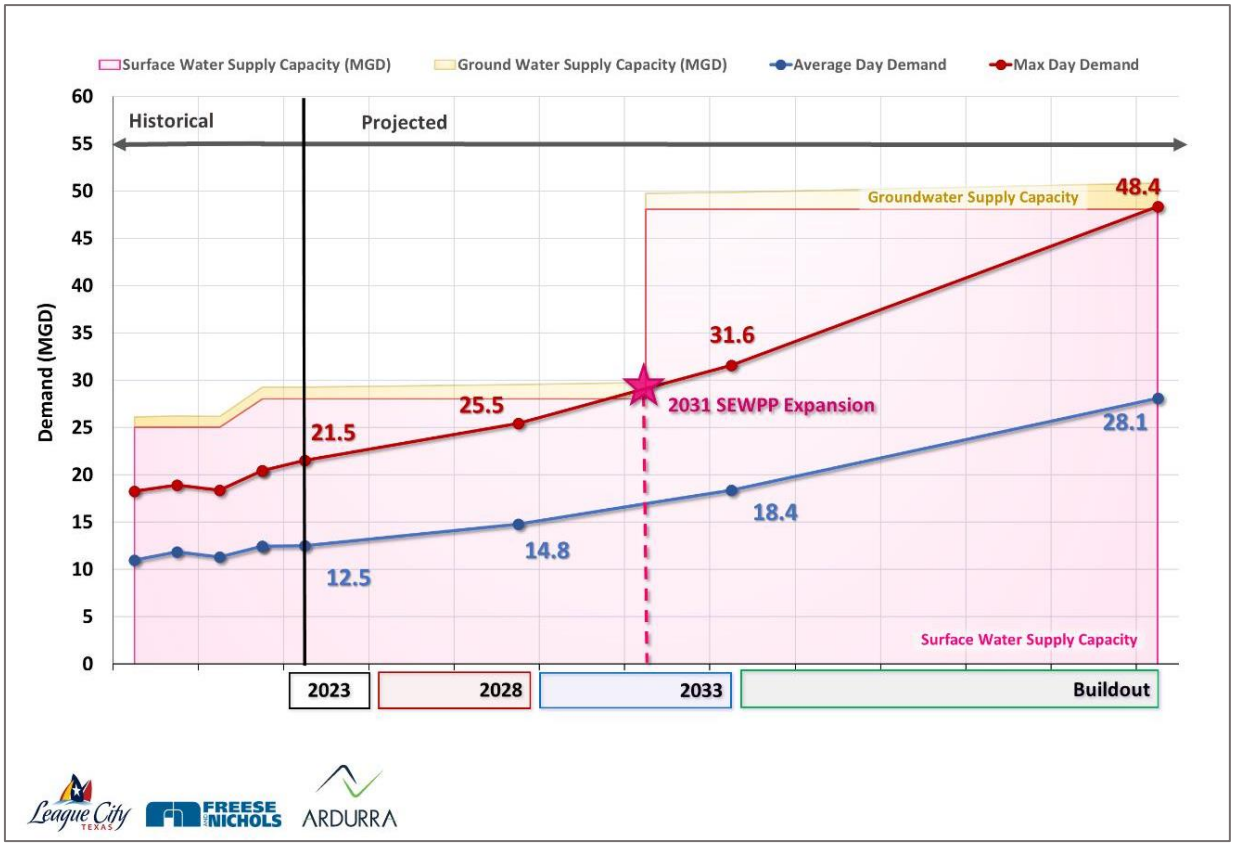

Figure 7-3 Comparison of Secured Water Sources and Future Demand – 2031 SEWPP Expansion

7.3 Storage Capacity Evaluation

A summary of the available, required, and recommended storage volumes for each scenario are presented in **Table 7-2** and **Figure 7-4**. Storage projects were able to be removed from the 2023 Master Plan relative to the 2018 Water Master plan because of the improvements to the resiliency of the water distribution system network made in the last five years. See section 5.8 for a discussion on the adopted planning criteria. The City currently has 6.4 MG of elevated storage. Following the decommissioning of the 0.4 MG Alabama Elevated Storage, the City will have 6.0 MG of elevated storage remaining. The anticipated TCEQ requirements for Elevated Storage at Buildout are 5.6 MG, so no additional elevated storage is required.

Table 7-2 Storage Capacity Evaluation

YEAR	ADD (MGD)	MDD (MGD)	EXISTING STORAGE (MG)[1]	TCEQ TOTAL REQUIRED STORAGE (MG)	TCEQ ADDITIONAL STORAGE REQUIRED (MG)	TOTAL RECOMMENDED (MG)	ADDITIONAL RECOMMENDED STORAGE (MG)
Existing	12.5	21.5	33.75	6.5	0	33.75	0.00
2028	14.8	25.5	33.75	7.1	0	34.5	0.75
2033	18.2	31.4	33.75	8.2	0	36.5	2.0
Buildout	28.1	48.4	33.75	11.2	0	37.5	1.0

Note:
1 Does not include storage at minor facilities recommended for decommissioning.

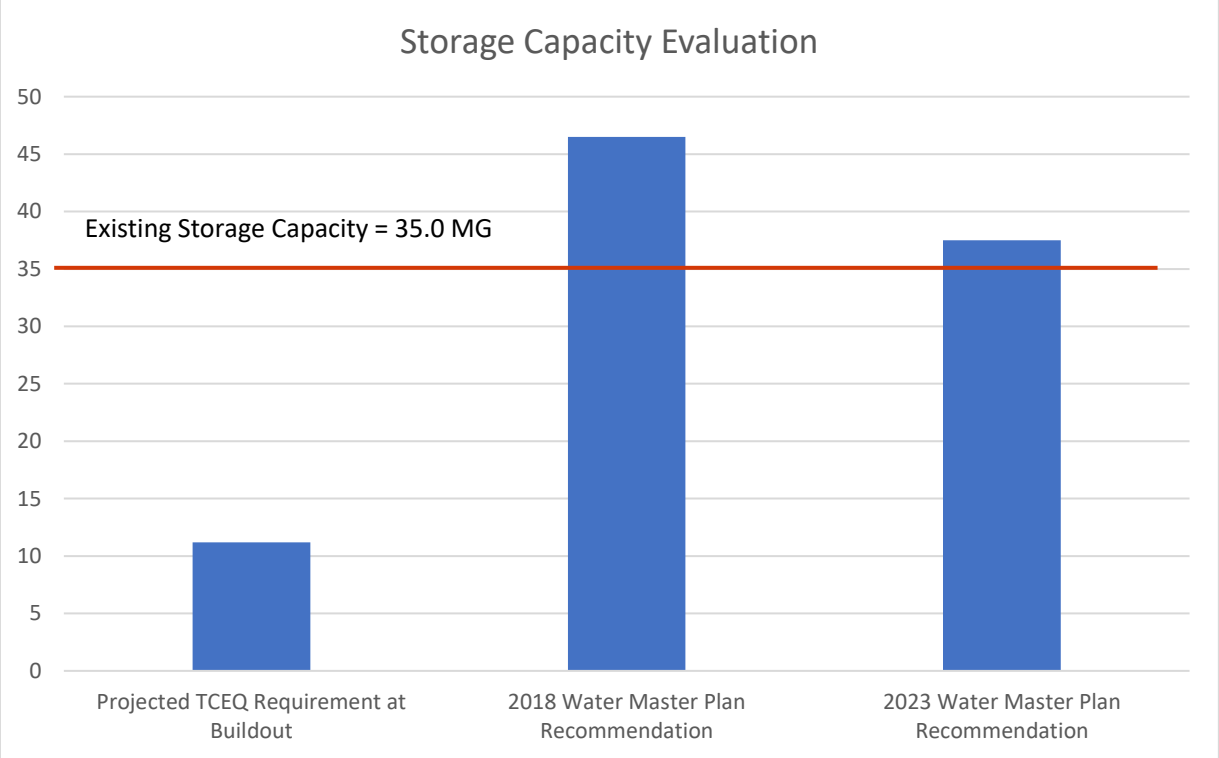

Figure 7-4 Storage Capacity Evaluation

7.4 2028 Scenario

The recommended pipeline, storage, and booster pump station capacity upgrade projects for the 2028 scenario are outlined below in **Table 7-3** to **Table 7-5** respectively. **Figure 7-5** illustrates the result of the 2028 model with these projects. All facility projects are sized to meet peak hour demands with the required standby capacity per TCEQ.

Table 7-3 Recommended Pipeline Projects for 2028 Scenario

PROJECT TITLE	APPROXIMATE LENGTH (FT)	DIAMETER (IN)	PURPOSE
New Waterlines to West Side (Segment 6)	7,600	24	New Development
8" Water Line from Cross Colony to Mary Ln	700	8	Improved Conveyance, System Redundancy
Muldoon Parkway Waterline Extension Phase 1	13,400	16	New Development
24" Waterline on Bay Area Blvd (Segment 2)	4,300	24	New Development
Maple Leaf Waterline Extension Phase 1	2,800	24	New Development

Table 7-4 Recommended Storage Projects for 2028 Scenario

PROJECT TITLE	EXISTING STORAGE CAPACITY (MG)	PROPOSED STORAGE CAPACITY (MG)	ADDITIONAL TANK VOLUME (MG)
Calder South (West Side Well, Generator, and BPS)	0	1.00	1.00

Table 7-5 Recommended Booster Station Projects for 2028 Scenario

PROJECT TITLE	EXISTING FIRM PUMPING CAPACITY (GPM)	PROPOSED FIRM PUMPING CAPACITY (GPM)	PROPOSED TOTAL PUMPING CAPACITY (GPM)
Calder South (West Side Well, Generator, and BPS)	N/A	4,500	6,000
Calder Rd BPS Pump Expansion Phase 1	8,700	10,800	15,800

Detailed descriptions of each recommended CIP project along with cost estimates and reference figures can be found in **Appendix A**.

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST
SH 3 BPS Chemical Feed Building and Storage

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST
Expansion Phase 1 - (2) 5,000 gpm Pumps

New Calder South Water Plant
GCWA Surface Water Interconnect
Well #1 = 1,500 gpm
(2) - 1,250 gpm Pumps
(2) - 2,000 gpm Pumps
(1) - 1.0 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 7-5
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
2028 MINIMUM PRESSURES UNDER MAX DAY DEMAND

LEGEND

Proposed Improvements
- Pump Station
- Water Treatment Plant
- Water Line

Existing Water System
- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES
- Less than 35 psi
- 35 - 50 psi
- 50 - 60 psi
- 60 - 65 psi
- Greater than 65 psi

FREESE NICHOLS ARDURRA League City TEXAS

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7.5 2033 Scenario

The recommended pipeline, storage, and booster pump station capacity upgrade projects for the 2033 scenario are outlined below in **Table 7-6** to **Table 7-8** respectively. **Figure 7-6** illustrates the result of the 2033 model with these projects. All facility projects consider the required standby pumping.

The 2033 Scenario assumes that the SEWPP 20 MGD Expansion is completed, providing League City with an additional 20 MGD of water supply to meet Max Day conditions. As calculated in the supply evaluation, an additional 20.0 MGD is necessary to meet buildout demand. A total of 5.544 MGD would be supplied from the Mackey Plant, 5 MGD from the Beamer Rd SEWPP connection, and 38 MGD from SEWPP at the SH3 BPS, a portion of which would be pumped through a 36" transmission line to the South Shore Harbour BPS and the balance to the Calder Road BPS.

Table 7-6 Recommended Pipeline Projects for 2033 Scenario

PROJECT TITLE	APPROXIMATE LENGTH (FT)	DIAMETER (IN)	PURPOSE
FM 517 Waterline Extension from Landing Blvd to Maple Leaf Drive	15,500	24	New Development
24" Bay Area Blvd Waterline Extension	7,400	24	New Development
Muldoon Pkwy Waterline Extension Phase 2 (to West Blvd)	4,800	24	New Development
Maple Leaf Waterline Extension to FM 517	3,900	24	New Development

Table 7-7 Recommended Storage Projects for 2033 Scenario

PROJECT TITLE	EXISTING STORAGE CAPACITY (MG)	PROPOSED STORAGE CAPACITY (MG)	ADDITIONAL TANK VOLUME (MG)
New West Side GST, Well, and BPS	N/A	2.00	2.00

Table 7-8 Recommended Booster Station Projects for 2033 Scenario

PROJECT TITLE	EXISTING FIRM PUMPING CAPACITY (GPM)	PROPOSED FIRM PUMPING CAPACITY (GPM)	PROPOSED TOTAL PUMPING CAPACITY (GPM)
New West Side GST, Well, and BPS	N/A	3,150	4,700
SH3 BPS Expansion	16,605	27,675	33,210

Detailed descriptions of each recommended CIP project along with cost estimates and reference figures can be found in **Appendix A**.

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST
SH 3 BPS Chemical Feed Building and Storage
New (2) - 5,525 gpm Pumps

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST
Expansion Phase 1 - (2) 5,000 gpm Pumps

New West Side Water Plant
Well #1 = 1,500 gpm
(2) - 800 gpm Pumps
(2) - 1,550 gpm Pumps
(1) - 2.0 MG GST

New Calder South Water Plant
GCWA Surface Water Interconnect
Well #1 = 1,500 gpm
(2) - 1,250 gpm Pumps
(2) - 2,000 gpm Pumps
(1) - 1.0 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 7-6
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
2033 MINIMUM PRESSURES UNDER MAX DAY DEMAND

LEGEND

Proposed Improvents
- Pump Station
- Water Treatment Plant
- Water Line

Existing Water System
- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES
- Less than 35 psi
- 35 - 50 psi
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7.6 Buildout Scenario

The recommended pipeline, storage, and booster pump station capacity upgrade projects for the buildout scenario with all additional source water supplied from the SEWPP are outlined below in **Table 7-9** to **Table 7-11** respectively. **Figure 7-7** illustrates the result of the Buildout model with these projects.

Table 7-9 Recommended Pipeline Projects for Buildout Scenario

PROJECT TITLE	APPROXIMATE LENGTH (FT)	DIAMETER (IN)	PURPOSE
Water Trunk Line from Walker WP to Louisiana	15,000	24	Improved Conveyance, System Reliability
	1,500	8	
	6,100	8	
16" Waterline from FM 646 to Hobbs Rd (Segment 4)	6,200	16	Improved Conveyance
FM 517 Waterline Extension Phase 2	9,800	24	New Development
24" Waterline along Future Unnamed Road from FM 517 to Muldoon Pkwy	6,200	24	New Development
Muldoon Pkwy Waterline Extension Phase 3 (to West Blvd)	3,800	24	New Development
	3,500	16	

Table 7-10 Recommended Storage Projects for Buildout Scenario

PROJECT TITLE	2028 STORAGE CAPACITY (MG)	PROPOSED STORAGE CAPACITY (MG)	ADDITIONAL TANK VOLUME (MG)
Parkway West Well, GST, BPS	N/A	1.0	1.0

Table 7-11 Recommended Booster Station Projects for Buildout Scenario

PROJECT TITLE	2028 FIRM PUMPING CAPACITY (GPM)	PROPOSED FIRM PUMPING CAPACITY (GPM)	PROPOSED TOTAL PUMPING CAPACITY (GPM)
Calder Rd BPS Pump Expansion Phase 2	10,800	15,000	20,000
Northside BPS Pump Addition	3,200	6,600	8,300
SSH BPS Pump Upgrades and	6,300	8,700	11,600
Parkway West Well, GST, BPS	N/A	3,000	4,500

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST
SH 3 BPS Chemical Feed Building and Storage
New (2) - 5,525 gpm Pumps

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST
(4) - Replacement 2,900 gpm Pumps

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs
(2) - New 1,700 gpm Booster Pumps

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

2.0 MG Brittany Bay EST

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Parkway West Water Plant
Well #1 = 1,150 gpm
(2) - 750 gpm Pumps
(2) - 1,500 gpm Pumps
(1) - 1.0 MG GST

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(4) - 2,900 gpm Pumps
(1) - 1.0 MG GST
(1) - 0.5 MG GST
Expansion Phase 1 - (2) 5,000 gpm Pumps
(2) - Replacement 5,000 gpm Pumps

New West Side Water Plant
Well #1 = 1,500 gpm
(2) - 800 gpm Pumps
(2) - 1,550 gpm Pumps
(1) - 2.0 MG GST

New Calder South Water Plant
GCWA Surface Water Interconnect
Well #1 = 1,500 gpm
(2) - 1,250 gpm Pumps
(2) - 2,000 gpm Pumps
(1) - 1.0 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

0 2,500 5,000
SCALE IN FEET

FIGURE 7-7
CITY OF LEAGUE CITY
2023 WATER MASTER PLAN UPDATE
BUILDOUT MINIMUM PRESSURES UNDER MAX DAY DEMAND

LEGEND

Proposed Improvents
- Pump Station
- Water Treatment Plant
- Water Line

Existing Water System
- Emergency Interconnect
- Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Transmission Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Railroad
- City Limits
- ETJ
- Other City Limit

MODELED PRESSURES
- Less than 35 psi
- 35 - 50 psi
- 50 - 60 psi
- 60 - 65 psi
- Greater than 65 psi

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Section 8

Water Capital Improvements Plan

8.1 Development of Costs

Planning level estimates of probable project costs for the identified capital improvement plan projects were categorized two different ways: pipelines and water facility upgrades. The pipeline costs were developed based on available cost information and include recent price increases due to inflation. The inclusive cost per linear foot includes costs associated with easements, installation, valves, fittings, and appurtenances. The pipeline unit costs can be seen in **Table 8-1**.

Table 8-1 Unit Costs for Pipeline Construction

DIAMETER	INCLUSIVE COST PER FOOT
8"	$140
16”	$300
24"	$400

The facility costs were estimated based on available cost information for each type of facility. For both facilities and pipelines, the costs include the following:

- Contingency – 30 percent of the total construction raw cost. This item covers unanticipated work that will be needed by the Contractor to complete the project.
- Engineering and Professional Services for Waterline Project– 15 percent of the total construction cost. This covers the preliminary engineering and final design work required for the project.
- Engineering and Professional Services for Facility Project– 20 percent of the total construction cost. This covers the preliminary engineering and final design work required for the project.

The intended use of this type of estimate is for planning purposes and for comparing alternatives. Costs are given in 2023 dollars for all projects and do not include financing costs or inflation to the beginning of the project. Cost escalation should be incorporated into future detailed cost estimates. The final cost of any project will depend on the project complexity, actual labor and material costs, competitive market condition, actual site conditions, final scope of work, implementation schedule, continuity of personnel, and engineering. All proposed capital improvement projects require a preliminary engineering report to determine the final scope of work and confirm any site constraints or easement concerns.

8.2 Development of Project Priority

To assist the City with project planning, the recommended CIP projects were separated into categories based on priority. The recommended prioritization for each project will be presented in the following subsections. The four priority levels indicate the urgency of a project to ensure that the water system continues to meet the expected level of service. Priority 1 projects are recommended to be started immediately, Priority 2 projects are necessary to meet 2028 needs, Priority 3 projects are necessary to meet 2033 needs, and Priority 4 projects are needed for anticipated Buildout conditions. All CIP projects are shown in **Figure 8-1** as well as projects that have been completed since the 2018 Water Master Plan Update. Projects that are ongoing or recently completed at the time of this study are shown in **Table 8-2.**

Table 8-2 Recently Completed and Ongoing Projects

CIP PROJECT NUMBER	PROJECT NAME
A	3.0 MGD Treated Surface Water Capacity from the Thomas Mackey Water Treatment Plant
B	FM 518 Water Line Replacement Project (Palomino to I-45)
C	16" Trunk Waterline SSH BPS to FM 2094
D	36" Waterline from SH3 BPS to Southshore Harbor BPS
E	New Waterlines to West Side – Segments 0 & 1
F	Southeast Service Area Trunks
G	North Service Area 12" Waterline - Grissom
H	Replacement of State Highway 3 Line (SETL)
I	24" Waterline along Ervin and the Future GP to Maple Leaf Drive

Beamer Road Interconnect
City of Houston Surface Water Interconnect

From City of Houston's Southeast Water Purification Plant (SEWPP)

Highway 3 Water Plant
City of Houston Surface Water Interconnect
(4) - 5,535 gpm Pumps
(2) - 3.0 MG GSTs
(1) - 1.0 MG GST
SH 3 BPS Chemical Feed Building and Storage
New (2) - 5,525 gpm Pumps

From City of Houston's Southeast Water Purification Plant (SEWPP)

0.4 MG Alabama EST
(1) - 250 gpm Pump (Inactive)

South Shore Water Plant
Well #1 = 1,255 gpm
(4) - 2,100 gpm Pumps
(2) - 1.0 MG GSTs
(1) - 3.0 MG GST
(4) - Replacement 2,900 gpm Pumps

Meadowbend Pump Station
(3) - 600 gpm Pumps
(1) - 0.5 MG GST

Third Street Water Plant
Well #1 = 550 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

2.0 MG South Shore EST

Northside Water Plant
Beamer Road Interconnect
Well #1 = 1,500 gpm
(2) - 750 gpm Pumps
(2) - 1,700 gpm Pumps
(2) - 3.0 MG GSTs
(2) - New 1,700 gpm Booster Pumps

Walker Street Water Plant
Well #1 = 700 gpm
(2) - 500 gpm Pumps
(1) - 0.5 MG GST

Bayridge Pump Station
(2) - 350 gpm Pumps
(1) - 0.42 MG GST

2.0 MG East Side EST
Well #1 = 807 gpm

Countryside Water Plant
Well #1 = 1,150 gpm
(2) - 250 gpm Pumps
(2) - 500 gpm Pumps
(1) - 0.35 MG GST

Galveston County Water Control and Improvement District No. 1 Emergency Interconnect

Dickinson Water Plant
Well #1 = 407 gpm
(2) - 350 gpm Pumps
(1) - 850 gpm Pump
(1) - 0.40 MG GST

Parkway West Water Plant
Well #1 = 1,150 gpm
(2) - 750 gpm Pumps
(2) - 1,500 gpm Pumps
(1) - 1.0 MG GST

2.0 MG Brittany Bay EST

Calder Road Water Plant
GCWA Surface Water Interconnect
Well #1 = 2,000 gpm
(1) - 1.0 MG GST
(1) - 0.5 MG GST
Expansion Phase 1 -
(2) 5,000 gpm Pumps
(2) - Replacement 5,000 gpm Pumps

New West Side Water Plant
Well #1 = 1,150 gpm
(2) - 800 gpm Pumps
(2) - 1,550 gpm Pumps
(1) - 2.0 MG GST

New Calder South Water Plant
GCWA Surface Water Interconnect
Well #1 = 1,500 gpm
(2) 1,250 gpm Pumps
(2) 2,000 gpm Pumps
(1) 1.0 MG GST

From GCWA's Thomas Mackey Water Treatment Plant

SEWPP
20 MGD Expansion

A — New Water GCWA 3.0 MGD from Thomas Mackey Water Treatment Plant
4 — COH Raw Water Reservation Fee
11 — 2028 Water Master Plan Update

The timing of projects shown is subject to change based on development patterns. The utility alignments shown in this figure are for illustration purposes only and do not set the alignments. The alignment of each utility will be determined at the time of the engineering design.

0 3,000 6,000 SCALE IN FEET

FIGURE 8-1
CITY OF LEAGUE CITY
WATER SYSTEM CAPITAL IMPROVEMENTS PLAN
LEGEND

Ongoing/Recently Completed Improvements
- Pump Station
- Water Line

Immediate Improvements
- Water Purification Plant
- Well
- Pump Station
- Water Line

2028 Proposed Improvements
- Pump Station
- Water Line

2033 Proposed Improvements
- Well
- Ground StorageTank
- Pump Station
- Water Purification Plant

Buildout Proposed Improvements
- Well
- Ground StorageTank
- Pump Station
- Water Purification Plant
- Water Line

Existing System
- Emergency Interconnect
- Well
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Treatment Plant
- Water Line
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Developer Line
- Railroad
- CRF Service Area
- City Limits
- ETJ
- Other City Limit

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8.2.1 Immediate Projects

Priority 1 projects are the most urgent to begin so that they can be completed before they are needed to serve future growth and improve the resiliency of the existing system. Delaying these projects could result in strains on the water distribution system to meet pressure criteria, water quality, or max day demand under future scenarios.

There are approximately 5.6 miles of small diameter (1,2,3") water mains throughout the City. These small diameter water lines are not included in the capacity CIP for upsizing. However, it is recommended that as these water lines require maintenance or repairs, they should be replaced with larger pipe sizes, in accordance with City of League City Design Guidelines. These water line replacements should be identified on a case-by-case basis.

The individual OPCCs, project descriptions, and project drivers for all CIP projects can be found in **Appendix A**.

Table 8-3 shows the Priority 1 water facility projects recommended to begin in the immediate future.

Table 8-3 Priority 1 Facility Projects for Immediate Future

CIP PROJECT NUMBER	IMMEDIATE PROJECT NAME	COST
1.	SH3 BPS Chemical Feed Building & Storage	$5,230,000
2.	Calder South (Well, Generator, & BPS)	$13,100,000
3.	New Waterlines to West Side	$4,540,000
4.	Raw Water Reservation from COH[1]	$12,640,000
5.	20 MGD SEWPP Expansion	$156,000,000
	Total	**$191,510,000**

Note:
1. Total Anticipated Cost until 20 MGD SEWPP Expansion Completed.
2. All costs are in 2023 dollars.

Project 1: SH3 BPS Chemical Feed Building & Storage

Project Description: The State Highway 3 Booster Pump Station Chemical Feed Building and Storage Project increases the city's capacity to boost disinfection residual for treated surface water coming into the city from SEWPP. This project will consist of the construction of a permanent CMU chemical building and storage area with associated mechanical and electrical appurtenances. The project includes all required chemical feed equipment, analyzers, and bulk storage for dosing chlorine gas and liquid ammonium sulphate (LAS).

Project Drivers: Water Production Operations have experienced low chloramine residuals during times of peak summer demands creating the need to boost disinfection residuals beyond the capabilities of the existing equipment. This project will provide SH3 BPS with additional capacity to boost disinfection residuals, maintaining the desired level of residual to protect water quality and maintain compliance as water demands increase in the city.

Project 2: Calder South (Well, Generator & BPS)

Project Description: This project will consist of a new groundwater well and 4,500 gpm firm capacity booster pump station located on Calder Road. This facility also includes a connection to the waterline transmission line from the TMWTP, providing an additional source of surface water to serve the city's west side. The scope includes construction of a new pump building with miscellaneous piping, pumps, electrical equipment, and controls as well as a new chemical feed system, a 1.0 MG ground storage tank, SCADA system, generator, and a Water Meter Base Station for GCWA.

Project Drivers: This facility will ensure there is enough capacity to meet the projected west side demands and maintain adequate system pressures. It will also provide an additional connection to the surface water supply from TMWTP, improving reliability.

Project 3: New Waterlines to West Side

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 7,600 linear feet of 24-inch water transmission line running along FM 517 from Calder Rd to Landing Blvd.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 4: Raw Water Reservation from COH

Project Description: The raw water reservation from the City of Houston is an ongoing project that allows the City to reserve treated water capacity at the SEWPP from the City of Houston. Under this contract, League City pays a percentage of the raw water rate to the City of Houston until the SEWPP expansion is completed. The percentage of the raw water rate that League City is required to pay increases when the Southeast Transmission Line (SETL) rehabilitation and capacity increase project is completed. The cost shown is the anticipated total cost of the project, but this cost will be paid to the COH as annual payments per the contract.

Project Drivers: Due to the nature of the contract with the COH, the rate at which the City reserves this water will continue to increase over time until the SEWPP 20 MGD expansion is complete. Although the reservation fee carries a cost to the city, continuing to secure the final 20 MGD of capacity available at SEWPP is critical to minimize the larger cost of acquiring additional water supply to meet future demands. The 20 MGD of capacity at the SEWPP is the lowest cost water source available to the city. As discussed in Section 7, future expansions beyond the 20 MGD reserved by League City will have a higher infrastructure cost.

Project 5: 20 MGD SEWPP Expansion

Project Description: This project will consist of a 20 MGD expansion to SEWPP that will provide the water supply required to meet future demands. This project will require coordination with the City of Houston. It is anticipated that the design and construction of this project will take 7 years to complete, so it is imperative that League City begins taking steps to initiate the design phase of the project.

Project Drivers: Beginning this project imminently is necessary to not only ensure additional capacity is available to when future demands are realized, but also to ensure the City does not pay rates in excess of what is necessary for the Raw Water Reservation from the City of Houston.

8.2.2 2028 Projects

Priority 2 projects consist of both waterline and booster pump station improvements recommended to be completed by 2028. These projects have a significant impact in meeting future demands and on maintaining the system's redundancies as the water demand increases with development. The proposed booster pump station improvements are also critical to meet the objective of decommissioning the minor water facilities. These priorities should be reassessed and updated on a regular basis depending on the timing and the rate of development in the presently undeveloped areas in the southwest part of the City.

The individual OPCCs, project descriptions, and project drivers for all CIP projects can be found in **Appendix A**.

Table 8-4 shows the Priority 2 water facility projects recommended for 2028.

Table 8-4 Priority 2 Facility Projects for 2028 Scenario

CIP PROJECT NUMBER	PROJECT NAME	COST
6.	8" Water Line from Cross Colony to Mary Ln.	$212,450
7.	Muldoon Parkway Waterline Extension Phase 1	$6,010,000
8.	24" Waterline on Bay Area Blvd (Segment 2)	$2,580,000
9.	Maple Leaf Waterline Extension Phase 1	$1,680,000
10.	Calder Rd BPS Pump Expansion Phase 1	$5,270,000
11.	2028 Water Master Plan Update	$350,000
	Total Cost	**$16,102,450**

Note:
1. All costs are in 2023 dollars.

Project 6: 8" Water Line from Cross Colony to Mary Ln.

Project Description: This project will consist of the design, construction, and land acquisition of 700 linear feet of 8-inch water line from Cross Colony Dr to the north reaches of Tallow Forest and Mary Lane. This project requires agreement with WCID #1.

Project Drivers: This project addresses projected pressure issues in the 2028 modeling scenario. The line will create a looped system, ultimately improving pressure and fire protection for the developing areas.

Project 7: Muldoon Parkway Waterline Extension Phase 1

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 13,400 linear feet of 16-inch waterline along the future Muldoon Parkway to provide service to future developments on the west side.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 8: 24" Waterline on Bay Area Blvd (Segment 2)

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 4,300 linear feet of 24-inch water transmission line that will run along the future Bay Area Blvd extension to the future Grand Parkway.

Project Drivers: This line is necessary for the City to be able to provide water supply for future capacity demands and to provide a looped system with the City's existing west side infrastructure to maintain adequate system capacity, pressure, and fire protection to the existing west side development.

Project 9: Maple Leaf Waterline Extension Phase 1

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 2,800 linear feet of 24-inch water transmission line on future Maple Leaf Drive south to Unnamed Major Arterial Road.

Project Drivers: This line is necessary for the City to be able to provide water supply for future capacity demands and to provide a looped system with the City's existing west side infrastructure to maintain adequate system capacity, pressure, and fire protection to the existing west side development.

Project 10: Calder Rd BPS Pump Expansion Phase 1

Project Description: This project will consist of upgrading the booster pumps to higher design pressure and higher flow to serve new west side developments and the replacement of the standby generator. The two pumps will be upgraded to 5,000 gpm, increasing the facility firm capacity to 10,800 gpm.

Project Drivers: The pump and generator replacements will ensure there is enough pump capacity to meet projected demand requirements and provide a reliable source of emergency power.

Project 11: 2028 Water Master Plan Update

Project Description: The last Master Plan and CRF updates were completed from 2022-2023 with fees adopted in 2023; each are required to be updated every five years. The new study will be conducted in FY2027. The Water Master Plan will use updated land use information, water consumption data and operational data to update the League City Water Model, Water Demand Projections, and Capital Improvements Plan.

Project Drivers: This project will allow the city to update its Capital Recovery Fees to account for changes in project cost due to changing water demand projections and project costs. Updating the Water Master Plan every five years allows the city to update its water demand projections and water modeling scenarios with updated data and land development information. These updates ensure that the City is investing in the necessary capital projects to maintain its level of service as the population grows.

8.2.3 2033 Projects

Priority 3 projects also consist of both waterline and booster pump station improvements. With the current population growth and water demand projections, these projects will need to be completed by 2033 to ensure the water system can meet future demands and maintain the system's redundancy. These priorities should be reassessed and updated on a regular basis depending on the timing of adding extra-territorial jurisdiction (ETJ) areas and the rate and locations of development in the presently undeveloped areas in the southwest part of the City.

The individual OPCCs, project descriptions, and project drivers for all CIP projects can be found in **Appendix A.**

Table 8-5 shows the Priority 3 water facility projects recommended for 2033.

Table 8-5 Priority 3 Facility Projects for 2033 scenario

CIP PROJECT NUMBER	PROJECT NAME	COST
12.	New West Side GST, Well, and BPS	$12,360,000
13.	SH 3 BPS Pump Expansion	$6,080,000
14.	FM 517 Waterline Extension from Landing Blvd to Maple Leaf Drive	$9,270,000
15.	24" Bay Area Blvd Waterline Extension	$4,430,000
16.	Muldoon Pkwy Waterline Extension Phase 2 (to West Blvd)	$2,880,000
17.	Maple Leaf Waterline Extension to FM 517	$2,330,000
	Total Cost	**$37,350,000**

Note:
1. All costs are in 2023 dollars.

Project 12: New West Side GST, Well, and BPS

Project Description: This project constructs a new water facility located on the west side of the City, west of the future Maple Leaf Drive, near the proposed Stedman West and Georgetown Developments. The facility consists of a groundwater well, booster pump station, and 2 MG of storage. Proposed pump station to connect to a 12" line, at a minimum.

Project Drivers: This facility will ensure there is enough pumping capacity to meet the projected west side demands and maintain adequate system pressures.

Project 13: SH 3 BPS Pump Expansion

Project Description: This project includes the addition of 2 booster pumps of 5,535 gpm each at the State Highway 3 Booster Pump Station.

Project Drivers: The expansion at the State Highway 3 Booster Pump Station will ensure there is enough pumping capacity to meet projected demands from future development.

Project 14: FM 517 Waterline Extension from Landing Blvd to Maple Leaf Drive

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 15,500 linear feet of 24-inch water transmission line along FM 517 from Landing Blvd to Maple Leaf Drive.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 15: 24" Bay Area Blvd Waterline Extension

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 7,400 linear feet of 24-inch water transmission line along Bay Area Blvd from the future Grand Parkway to FM 517.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 16: Muldoon Pkwy Waterline Extension Phase 2 (to West Blvd)

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 4,800 linear feet of 24-inch water transmission line along Muldoon Parkway from Maple Leaf Blvd to future West Blvd.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 17: Maple Leaf Waterline Extension to FM517

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 3,900 linear feet of 24" Waterline along Maple Leaf Drive to FM 517.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

8.2.4 Buildout Projects

Priority 4 projects are the most urgent to complete between 2033 and buildout. The individual OPCCs, project descriptions, and project drivers for all CIP projects can be found in **Appendix A**. These priorities should be reassessed and updated on a regular basis depending on the timing of adding extra-territorial jurisdiction (ETJ) areas and the rate and locations of development in the presently undeveloped areas in the southwest part of the City.

Table 8-6 shows the Priority 4 water facility projects recommended for the buildout scenario to meet the anticipated growth in water demand beyond 2033.

Table 8-6 Priority 4 Facility Projects for Buildout Scenario

CIP PROJECT NUMBER	PROJECT NAME	COST
18.	Calder Rd BPS Pump Expansion Phase 2	$3,710,000
19.	Northside BPS Pump Addition	$5,450,000
20.	SSH BPS Pump Expansion	$6,360,000
21.	Parkway West Well, GST BPS	$11,920,000
22.	Water Trunk Line from Walker WP to Louisiana	$10,560,000
23.	16" Waterline from FM 646 to Hobbs Rd (Segment 4)	$2,780,000
24.	FM 517 Waterline Extension Phase 2	$5,870,000
25.	24" Waterline along Future Unnamed Rd. from FM 517 to Muldoon Parkway	$3,700,000
26.	Muldoon Parkway Waterline Extension Phase 3	$3,840,000
	Total Cost	**$54,190,000**

Note:
1. All costs are in 2023 dollars.

Project 18: Calder Rd BPS Pump Expansion Phase 2

Project Description: This project will consist of upgrading two booster pumps at the Calder Road Booster Pump Station to higher design pressure and higher flow to serve new west side developments. The two pumps will be upgraded to 5,000 gpm, bringing the facility firm capacity to 15,000 gpm.

Project Drivers: The pump replacements at Calder Road Booster Pump Station will ensure there is enough pump capacity to meet projected demand requirements.

Project 19: Northside BPS Pump Addition

Project Description: This project includes expanding the Northside Booster Pump Station to include two additional 1,700 gpm booster pumps, increasing the facility firm capacity to 6,600 gpm.

Project Drivers: The pump additions at Northside Booster Pump Station will ensure there is enough pump capacity to meet projected demand requirements.

Project 20: SSH BPS Pump Expansion

Project Description: This project includes the upgrade of four booster pumps at the Southshore Harbor (SSH) Booster Pump Station to 2,900 gpm pumps, increasing the facility firm capacity to 8,700 gpm.

Project Drivers: The pump replacements at the Southshore Harbor (SSH) Booster Pump Station will ensure there is enough pump capacity to meet projected demand requirements.

Project 21: Parkway West Well, GST BPS

Project Description: The Parkway West facility will consist of a groundwater well, booster pump station, and a 1 MG ground storage tank located on 2-acres off League City Parkway. The project includes construction of a pre-engineered control and mechanical building, yard piping, SCADA system, standby generator, booster pumps, and associated electrical and mechanical work.

Project Drivers: This facility will ensure there is enough capacity to meet the projected west side demands and maintain adequate system pressures.

Project 22: Water Trunk Line from Walker WP to Louisiana

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 7,600 linear feet of 8-inch line, and approximately 15,000 linear feet of 24" line. The project will add a pressure sustaining valve at the Walker Plant.

Project Drivers: This new waterline will provide additional capacity and pressure to the central and east sides of the city, supplementing the water system and maintaining adequate system pressure and fire protection.

Project 23: 16” Waterline from FM 646 to Hobbs Rd (Segment 4)

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 6,200 linear feet of 24-inch water transmission line running along the future Grand Parkway from the future Hobbs Rd extension to FM 646.

Project Drivers: This line is necessary for the City to be able to provide water supply for future capacity demands and to provide a looped system with the City's existing infrastructure to maintain adequate system capacity, pressure, and fire protection as demands increase in the future.

Project 24: FM 517 Waterline Extension Phase 2

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 9,800 linear feet of 24" Waterline along FM 517 to serve future westside developments.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 25: 24" Waterline along Future Unnamed Rd. from FM 517 to Muldoon Parkway

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 6,200 linear feet of 24" Waterline along future unnamed road from FM 517 to future Muldoon Parkway.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Project 26: Muldoon Parkway Waterline Extension Phase 3 (to West Blvd)

Project Description: This project will consist of obtaining water line easements, design, and construction of approximately 3,800 linear feet of 24" waterline and 3,500 linear feet of 16" waterline along Muldoon Parkway to extend service to future westside developments.

Project Drivers: This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

8.2.5 Eliminated CIP Projects

Through the performance assessment of each CIP within the various scenarios of the model, three CIP projects were removed in the 2023 Water Master Plan that were in the 2018 Water Master Plan. The eliminated CIP projects and their associated total savings of $7.77 million are outlined in **Table 8-7**.

Some projects were eliminated due to having pipe diameters of smaller than 16". Projects smaller than 16" are anticipated to be developer projects and not a part of the City Capital Improvements Plan. The CIP Plan does include some Waterlines under 16" when the waterlines are required in an existing developed area as opposed to a future development.

Table 8-7 Eliminated 2018 CIP Projects

ELIMINATED CIP PROJECT	COST SAVINGS
New Waterlines to Westside – Segments 7 & 8	$4,200,000
12" Waterline to Connect Grand Parkway	$3,080,000
16" Waterline to New West Side GST	$490,000
Total Savings	**$7,770,000**

Note:
1. All costs are in 2023 dollars.

New Waterlines to Westside – Segments 7 & 8

This project consisted of obtaining water line easements, design, and construction of approximately 5,100 linear feet of 8-inch and 10,500 linear feet of 12-inch water transmission line. Segment 7 consists of an 8-inch water line running along the future Grand Parkway from the future Maple Leaf Drive extension to the far west side of the City. Segment 7 was eliminated from the CIP since it was under 16" in size. Segment 8 consisted of a 16-inch waterline running along the proposed Ervin St. from the future Maple Lead Drive Extension to the future Bay Area Blvd extension. The new alignment of Ongoing Project I provides capacity to the users that would have been served by Segment 8, allowing the size of segment 8 to be reduced and removed from the CIP Projects.

12" Waterline to Connect Grand Parkway

This project consisted of obtaining water line easements, design, and construction of approximately 10,300 linear feet of 12-inch water transmission line. This 12-inch water line was proposed to run along the "Future Unnamed Road 4" from League City Parkway to the future Grand Parkway. This project was eliminated from the CIP since it was under 16" in size.

16" Waterline to New West Side GST

This project included design and construction of 1,300 LF of 16-inch water line from the future 16-inch water line east from Bay Area Boulevard to the proposed 2 MG ground storage tank site at the West Side Water Facility project. This project was removed due to the facility being moved further West and sited along a future 12" waterline to be constructed by a developer.

8.2.6 Modified CIP Projects

Through the performance assessment of each project within the various scenarios of the model, some of the 2018 CIP projects were modified in the 2023 CIP to reflect changes in the planning data and source water availability.

One of the primary modifications to the previous 2018 CIP was the removal of Ground Storage Tank capacity from projects. Storage projects were able to be removed from the 2023 Master Plan relative to the 2018 Water Master plan because of the improvements to the resiliency of the water distribution system network. The modified CIP projects and the associated total savings of $9,050,950 is outlined in **Table 8-8**.

Table 8-8 Modified CIP Projects

PREVIOUS CIP # AND CIP NAME	PREVIOUS CIP COST	NEW CIP NAME	NEW CIP COST
WT 5 – New Waterlines to West Side	$6,340,000	Project E – New Waterlines to West Side – Segments 0 & 1	$3,794,501
		Project 7 – Muldoon Parkway Waterline Extension Phase 1	$6,010,000
WT 6 – New Waterlines to West Side – Segments 2,3, and 5	$8,750,000	Project 8 - 24" Waterline on Bay Area Blvd (Segment 2)	$2,580,000
		Project I – 24" Waterline along Ervin and the Future GP to Maple Leaf Drive	$4,431,817
WT-10 Calder Rd BPS Pump Expansion Phase 1	$13,140,000	Project 10 – Calder Rd BPS Pump Expansion Phase 1	$5,270,000
WT 12 – New West Side GST, Well, and BPS	$10,800,000	Project 12 - New West Side GST, Well, and BPS	$12,360,000
WT 14 – Northwest Side Well, GST, and BPS	$10,820,000	Project 21 - Parkway West Well, GST, BPS	$11,920,000
WT 19 – North Service Area 12" Waterline -Grissom	$1,500,000	Project G – North Service Area 12" Waterline - Grissom	$742,732
WT 22 – SSH BPS Pump Upgrades	$11,170,000	Project 20 – SSH BPS Pump Upgrades	$6,360,000
Total	**$62,520,000**		**$53,469,050**

Note:
1. All costs are in 2023 dollars.

WT-5 New Waterlines to West Side

Previous CIP Project WT 5 has been realigned due to the "New West Side GST, Well, and BPS" facility being relocated which will be discussed in **Section 8.1.6.3**. In addition to the realignment, this project has also been split between existing Project E and Future Project 7. The modifications are reflected in the new Project 7 "Muldoon Parkway Waterline Extension Phase 1" in **Section 8.2.2.**

WT-6 New Waterlines to West Side – Segment 2, 3, and 5

Previous CIP Project WT-6 has also been realigned as Segment 5 has been removed from the scope and Segment 3 has been modified to connect onto Ervin Drive and is currently under construction under Project I. Segment 3 has remained as originally designed. The updated project description for Segment 3 is under Project 8 which can be found in **Section 8.2.2.**

WT-10 Calder Rd BPS Pump Expansion Phase 1

Previous CIP Project WT-10 included 6 million gallons of ground storage which has been removed from the scope of the project. Existing storage is adequate to meet operational and emergency storage capacity requirements due to improvements in the resiliency of the water distribution system. These modifications are reflected in the new Project 10 "Calder Rd BPS Pump Expansion Phase 1 which can be found in **Section 8.2.2.**

WT-12 New West Side GST, Well, and BPS

Previous CIP Project WT-12 has been relocated further Northwest from its original location. Each of the 4 booster pumps were also given an additional 50 gpm. A generator was added to the scope of work to improve system reliability. All these modifications can be found in **Section 8.2.3.**

WT-14 Northwest Side Well, GST, and BPS

Previous CIP Project WT-14 was relocated further East from its original location. The meter base station was removed from the scope and a generator was added to help improve system reliability. The modified project has been renamed to "Parkway West Well, GST, and BPS" and can be found in **Section 8.2.4.**

WT-19 North Service Area 12" Waterline-Grissom

Previous CIP Project WT-19 has been modified to not include the most Southern segment as two waterlines have already been built and have sufficient capacity to meet future demand. The updated project is under existing Project G.

WT-22 SSH BPS Pump Upgrades

Previous CIP Project WT-22 included 3 million gallons of ground storage which has been removed from the scope of the project. Existing storage is adequate to meet operational and emergency storage capacity requirements due to improvements in the resiliency of the water distribution system. These modifications are reflected in the new Project 20 "SSH BPS Pump Upgrades" which can be found in **Section 8.2.4.**

Appendix A

CIP PROJECT DESCRIPTIONS & OPCCs

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City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 1 **Phase:** 5-year

Project Name:	**SH3 BPS Chemical Feed Building & Storage**

Project Description:

The State Highway 3 Booster Pump Station Chemical Feed Building and Storage Project increases the city's capacity to boost disinfection residual for treated surface water coming into the city from SEWPP. This project will consist of the construction of a permanent CMU chemical building and storage area with associated mechanical and electrical appurtenances. The project includes all required chemical feed equipment, analyzers, and bulk storage for dosing chlorine gas and liquid ammonium sulphate (LAS).

Project Drivers:

Water Production Operations have experienced low chloramine residuals during times of peak summer demands creating the need to boost disinfection residuals beyond the capabilities of the existing equipment. This project will provide SH3 BPS with additional capacity to boost disinfection residuals, maintaining the desired level of residual to protect water quality and maintain compliance as water demands increase in the city.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	CMU Chemical Storage and Feed Building	1	EA	$ 500,000	$ 500,000
2	Chlorine Gas Bulk Storage and Feed Equipment	1	EA	$ 750,000	$ 750,000
3	LAS Bulk Storage and Feed Equipment	1	EA	$ 350,000	$ 350,000
4	Process Mechanical Allowance	1	LS	$ 750,000	$ 750,000
5	Electrical/ Miscellaneous Allowance	1	LS	$ 1,000,000	$ 1,000,000
6					
7					
8					
				SUBTOTAL:	**$ 3,350,000**
		CONTINGENCY		30%	$ 1,010,000
				SUBTOTAL:	**$ 4,360,000**
		ENG/SURVEY		20%	$ 870,000
				SUBTOTAL:	**$ 5,230,000**
				Estimated Project Total:	**$ 5,230,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 2 **Phase:** 5-year

Project Name:	**Calder South (Well, Generator & BPS)**

Project Description:

This project will consist of a new groundwater well and 4,500 gpm firm capacity booster pump station located on Calder Road. This facility also includes a connection to the waterline transmission line from the TMWTP, providing an additional source of surface water to serve the city's west side. The scope includes construction of a new pump building with miscellaneous piping, pumps, electrical equipment, and controls as well a new chemical feed system, a 1.0 MG ground storage tank, SCADA system, generator and a Water Meter Base Station for GCWA.

Project Drivers:

This facility will ensure there is enough capacity to meet the projected west side demands and maintain adequate system pressures. It will also provide an additional connection to the surface water supply from TMWTP, improving reliability.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1,250 GPM Booster Pumps	2	EA	$ 300,000	$ 600,000
2	2,000 GPM Booster Pumps	2	EA	$ 300,000	$ 600,000
3	1.00 MG Ground Storage Tank	1	EA	$ 1,400,000	$ 1,400,000
4	1,500 GPM Well Pump	1	LS	$ 2,000,000	$ 2,000,000
5	Process Mechanical Allowance	1	LS	$ 900,000	$ 900,000
6	Electrical/ Miscellaneous Allowance	1	EA	$ 1,600,000	$ 1,600,000
7	Meter Base Station	1	EA	$ 300,000	$ 300,000
8	Generator	1	EA	$ 1,000,000	$ 1,000,000
				SUBTOTAL:	**$ 8,400,000**
		CONTINGENCY		30%	$ 2,520,000
				SUBTOTAL:	**$ 10,920,000**
		ENG/SURVEY		20%	$ 2,180,000
				SUBTOTAL:	**$ 13,100,000**
				Estimated Project Total:	**$ 13,100,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 3 **Phase:** 5-year

Project Name:	**New Waterlines to West Side**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 7,600 linear feet of 24-inch water transmission line running along FM 517 from Calder Rd to Landing Blvd.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	7,600	LF	$ 400	$ 3,040,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 3,040,000**
		CONTINGENCY		30%	$ 910,000
				SUBTOTAL:	**$ 3,950,000**
		ENG/SURVEY		15%	$ 590,000
				SUBTOTAL:	**$ 4,540,000**
				Estimated Project Total:	**$ 4,540,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 4 **Phase:** 5-year

Project Name:	**Raw Water Reservation from COH**

Project Description:

The raw water reservation from the City of Houston is an ongoing project that allows the City to reserve treated water capacity at the SEWPP from the City of Houston. Under this contract, League City pays a percentage of the raw water rate to the City of Houston until the SEWPP expansion is completed. The percentage of the raw water rate that League City is required to pay increases when the Southeast Transmission Line (SETL) rehabilitation and capacity increase project is completed. The cost shown is the anticipated total cost of the project but this cost will be paid to the COH as annual payments per the contract

Project Drivers:

Although the reservation fee carries a cost to the city, continuing to secure the final 20 MGD of capacity available at SEWPP is critical to minimize the larger cost of acquiring additional water supply to meet future demands. The 20 MGD of capacity at the SEWPP is the lowest cost water source available to the city. Due to the nature of the contract with the COH, the rate at which the City reserves this water will continue to increase over time until the SEWPP 20 MGD expansion is complete. Cost shown below is the total anticipated cost of the reservation until SEWPP is complete.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Reservation of Raw Water From COH	1	EA	$ 12,640,000	$ 12,640,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 12,640,000**
		CONTINGENCY		N/A	$ -
				SUBTOTAL:	**$ 12,640,000**
		ENG/SURVEY		N/A	$ -
				SUBTOTAL:	**$ 12,640,000**
				Estimated Project Total:	**$ 12,640,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* | **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 5 | **Phase:** 5-Year

Project Name:	**20 MGD SEWPP Expansion**

Project Description:

This project will consist of a 20 MGD expansion to SEWPP that will provide the water supply required to meet the future demands. This project will require coordination with the City of Houston. It is anticipated that the design and construction of this project will take 7 years to complete, so it is imperative that League City begins taking steps to initiate the design phase of the project.

Project Drivers:

Beginning this project imminently is necessary to not only ensure additional capacity is available to when future demands are realized, but also to ensure the City does not pay rates in excess of what is necessary for the Raw Water Reservation from the City of Houston.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	20 MGD SEWPP Expansion	20	MGD	$ 5,000,000	$ 100,000,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 100,000,000**
		CONTINGENCY		30%	$ 30,000,000
				SUBTOTAL:	**$ 130,000,000**
		ENG/SURVEY		20%	$ 26,000,000
				SUBTOTAL:	**$ 156,000,000**
				Estimated Project Total:	**$ 156,000,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 6 **Phase:** 5-year

Project Name:	**8" Water Line from Cross Colony to Mary Ln**

Project Description:

This project will consist of the design, construction, and land acquisition of 700 linear feet of 8-inch water line from Cross Colony Dr to the north reaches of Tallow Forest and Mary Lane. This project requires agreement with WCID #1.

Project Drivers:

This project addresses projected pressure issues in the 2028 modeling scenario. The line will create looped system, ultimately improving pressure and fire protection for the developing areas.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Waterline	700	LF	$ 140	$ 100,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 100,000**
		CONTINGENCY		30%	$ 30,000
				SUBTOTAL:	**$ 130,000**
		ENG/SURVEY		Cost Estimate	$ 82,450
				SUBTOTAL:	**$ 212,450**
				Estimated Project Total:	**$ 212,450**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 7 **Phase:** 5-year

Project Name:	**Muldoon Parkway Waterline Extension Phase 1**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 13,400 linear feet of waterline along future Muldoon Parkway to provide service to future developments on the west side.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure, and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	16" Waterline	13,400	LF	$ 300	$ 4,020,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 4,020,000**
			CONTINGENCY	30%	$ 1,210,000
				SUBTOTAL:	**$ 5,230,000**
			ENG/SURVEY	15%	$ 780,000
				SUBTOTAL:	**$ 6,010,000**
				Estimated Project Total:	**$ 6,010,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 8 **Phase:** 5-year

Project Name:	**24" Waterline on Bay Area Blvd (Segment 2)**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 4,300 linear feet of 24-inch water transmission line that will run along the future Bay Area Blvd extension to the future Grand Parkway.

Project Drivers:

This line is necessary for the City to be able to provide water supply for future capacity demands and to provide a looped system with the City's existing west side infrastructure to maintain adequate system capacity, pressure, and fire protection to the existing west side development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	4,300	LF	$ 400	$ 1,720,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 1,720,000**
		CONTINGENCY		30%	$ 520,000
				SUBTOTAL:	**$ 2,240,000**
		ENG/SURVEY		15%	$ 340,000
				SUBTOTAL:	**$ 2,580,000**
				Estimated Project Total:	**$ 2,580,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 9 **Phase:** 5-year

Project Name:	**Maple Leaf Waterline Extension Phase 1**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 2,800 linear feet of 24-inch water transmission line on future Maple Leaf drive south to Unnamed Major Arterial Road.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	2,800	LF	$ 400	$ 1,120,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 1,120,000**
		CONTINGENCY		30%	$ 340,000
				SUBTOTAL:	**$ 1,460,000**
		ENG/SURVEY		15%	$ 220,000
				SUBTOTAL:	**$ 1,680,000**
				Estimated Project Total:	**$ 1,680,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 10 **Phase:** 5-year

Project Name:	**Calder Rd BPS Pump Expansion Phase 1**

Project Description:

This project will consist of upgrading the booster pumps to higher design pressure and higher flow to serve new west side developments and the replacement of the standby generator. The two pumps will be upgraded to 5,000 gpm, increasing the facility firm capacity to 10,800 gpm

Project Drivers:

The pump and generator replacements will ensure there is enough pump capacity to meet projected demand requirements and provide a reliable source of emergency power.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	5,000 GPM Booster Pump	2	EA	$ 350,000	$ 700,000
2	Process Mechanical Allowance	1	LS	$ 840,000	$ 840,000
3	Electrical/ Miscellaneous Allowance	1	LS	$ 840,000	$ 840,000
4	Generator	1	LS	$ 1,000,000	$ 1,000,000
5					
6					
7					
8					
				SUBTOTAL:	**$ 3,380,000**
		CONTINGENCY		30%	$ 1,010,000
				SUBTOTAL:	**$ 4,390,000**
		ENG/SURVEY		20%	$ 880,000
				SUBTOTAL:	**$ 5,270,000**
				Estimated Project Total:	**$ 5,270,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 11 **Phase:** 5-year

Project Name:	**2028 Water Master Plan Update**

Project Description:

The last Master Plan and CRF updates were completed from 2022-2023 with fees adopted in 2023; each are required to be updated every five years. The new study will be conducted in FY2027. The Water Master Plan will use updated land use information, water consumption data and operational data to update the League City Water Model, Water Demand Projections, and Capital Improvement Plan.

Project Drivers:

This project will allow the city to update its Capital Recovery Fees. Updating the Water Master Plan every five years allows the city to update its water demand projections and water modeling scenarios using updated data and development information. These updates ensure that the City is investing in the necessary capital projects to maintain its level of service as population grows.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	2028 Water Master Plan	1	LS	$ 350,000	$ 350,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 350,000**
				CONTINGENCY	$ -
				SUBTOTAL:	**$ 350,000**
				ENG/SURVEY	$ -
				SUBTOTAL:	**$ 350,000**
				Estimated Project Total:	**$ 350,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 12 **Phase:** 10-Year

Project Name:	**New West Side GST, Well, and BPS**

Project Description:

This project constructs a new water facility located on the west side of the City, west of the future Maple Leaf Drive, near the proposed Stedman West and Georgetown Developments. The facility consists of a groundwater well, booster pump station, and 2 MG of storage. Proposed pump station to connect to a 12" line, at a minimum.

Project Drivers:

This facility will ensure there is enough pumping capacity to meet the projected west side demands and maintain adequate system pressures.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	2 MG Ground Storage Tank	1	EA	$ 1,680,000	$ 1,680,000
2	1,500 GPM Well Pump	1	EA	$ 2,000,000	$ 2,000,000
3	800 GPM Booster Pump	2	EA	$ 150,000	$ 300,000
4	1,550 GPM Booster Pump	2	EA	$ 300,000	$ 600,000
5	Process Mechanical Allowance	1	LS	$ 840,000	$ 840,000
6	Electrical Allowance	1	LS	$ 1,500,000	$ 1,500,000
7	Generator	1	EA	$ 1,000,000	$ 1,000,000
8					
				SUBTOTAL:	**$ 7,920,000**
		CONTINGENCY		30%	$ 2,380,000
				SUBTOTAL:	**$ 10,300,000**
		ENG/SURVEY		20%	$ 2,060,000
				SUBTOTAL:	**$ 12,360,000**
				Estimated Project Total:	**$ 12,360,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 13 **Phase:** 10-Year

Project Name:	**SH 3 BPS Pump Expansion**

Project Description:

This project includes the addition of 2 booster pumps of 5,535 gpm each at the SH3 Booster Pump Station.

Project Drivers:

The expansion at the SH3 booster pump station will ensure there is enough pumping capacity to meet projected demands from future development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	5,535 GPM Booster Pump Station	2	EA	$ 350,000	$ 700,000
2	Process Mechanical Allowance	1	LS	$ 700,000	$ 700,000
3	Electrical/ Miscellaneous Allowance	1	LS	$ 1,000,000	$ 1,000,000
4	Generator	1	EA	$ 1,500,000	$ 1,500,000
5					
6					
7					
8					
				SUBTOTAL:	**$ 3,900,000**
		CONTINGENCY		30%	$ 1,170,000
				SUBTOTAL:	**$ 5,070,000**
		ENG/SURVEY		20%	$ 1,010,000
				SUBTOTAL:	**$ 6,080,000**
				Estimated Project Total:	**$ 6,080,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 14 **Phase:** 10-Year

Project Name:	**FM 517 Waterline Extension from Landing Blvd to Maple Leaf Drive**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 15,500 linear feet of 24-inch water transmission line along FM 517 from Landing Blvd to Maple Leaf Drive.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	15,500	LF	$ 400	$ 6,200,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 6,200,000**
				CONTINGENCY 30%	$ 1,860,000
				SUBTOTAL:	**$ 8,060,000**
				ENG/SURVEY 15%	$ 1,210,000
				SUBTOTAL:	**$ 9,270,000**
				Estimated Project Total:	**$ 9,270,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 15 **Phase:** 10-Year

Project Name:	**24" Bay Area Blvd Waterline Extension**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 7,400 linear feet of 24-inch water transmission line along Bay Area Blvd from the future Grand Parkway to FM 517.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	7,400	LF	$ 400	$ 2,960,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 2,960,000**
		CONTINGENCY		30%	$ 890,000
				SUBTOTAL:	**$ 3,850,000**
		ENG/SURVEY		15%	$ 580,000
				SUBTOTAL:	**$ 4,430,000**
				Estimated Project Total:	**$ 4,430,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 16 **Phase:** 10-Year

Project Name:	**Muldoon Pkwy Waterline Extension Phase 2 (to West Blvd)**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 4,800 linear feet of 24-inch water transmission line along Muldoon Parkway from Maple Leaf Blvd to future West Blvd.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	4,800	LF	$ 400	$ 1,920,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 1,920,000**
			CONTINGENCY	30%	$ 580,000
				SUBTOTAL:	**$ 2,500,000**
			ENG/SURVEY	15%	$ 380,000
				SUBTOTAL:	**$ 2,880,000**
				Estimated Project Total:	**$ 2,880,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 17 **Phase:** 10-Year

Project Name:	**Maple Leaf Waterline Extension to FM 517**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 3,900 linear feet of 24" Waterline along Maple Leaf Drive to FM 517.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	3,900	LF	$ 400	$ 1,560,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 1,560,000**
		CONTINGENCY		30%	$ 470,000
				SUBTOTAL:	**$ 2,030,000**
		ENG/SURVEY		15%	$ 300,000
				SUBTOTAL:	**$ 2,330,000**
				Estimated Project Total:	**$ 2,330,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 18 **Phase:** Buildout

Project Name:	**Calder Rd BPS Pump Expansion Phase 2**

Project Description:

This project will consist of upgrading two booster pumps to higher design pressure and higher flow to serve new west side developments. The two pumps will be upgraded to 5,000 gpm, bringing the facility firm capacity to 15,000 gpm

Project Drivers:

The pump replacements at Calder BPS will ensure there is enough pump capacity to meet future demand requirements.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	5,000 gpm Booster Pump	2	EA	$ 350,000	$ 700,000
2	Process Mechanical Allowance	1	LS	$ 840,000	$ 840,000
3	Electrical/ Miscellaneous Allowance	1	LS	$ 840,000	$ 840,000
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 2,380,000**
		CONTINGENCY		30%	$ 710,000
				SUBTOTAL:	**$ 3,090,000**
		ENG/SURVEY		20%	$ 620,000
				SUBTOTAL:	**$ 3,710,000**
				Estimated Project Total:	**$ 3,710,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 19 **Phase:** Buildout

Project Name:	**Northside BPS Pump Expansion**

Project Description:

This project includes expanding the Northside BPS to include two additional 1,700 gpm booster pumps, increasing the facility firm capacity to 6,600 gpm.

Project Drivers:

The pump additions at Northside BPS will ensure there is enough pump capacity to meet projected demand requirements

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1,700 gpm Booster Pump	2	EA	$ 325,000	$ 650,000
2	Process Mechanical Allowance	1	LS	$ 840,000	$ 840,000
3	Electrical/ Miscellaneous Allowance	1	LS	$ 1,000,000	$ 1,000,000
4	Generator	1	EA	$ 1,000,000	$ 1,000,000
5					
6					
7					
8					
				SUBTOTAL:	**$ 3,490,000**
		CONTINGENCY		30%	$ 1,050,000
				SUBTOTAL:	**$ 4,540,000**
		ENG/SURVEY		20%	$ 910,000
				SUBTOTAL:	**$ 5,450,000**
				Estimated Project Total:	**$ 5,450,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 20 **Phase:** Buildout

Project Name:	**SSH BPS Pump Upgrades**

Project Description:

This project includes the upgrade of four booster pumps at the Southshore Harbor (SSH) BPS to 2,900 gpm pumps, increasing the facility firm capacity to 8,700 gpm.

Project Drivers:

The pump replacements at the Southshore Harbor (SSH) BPS will ensure there is enough pump capacity to meet projected demand requirements

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	2,900 gpm Booster Pump	4	EA	$ 350,000	$ 1,400,000
2	Process Mechanical Allowance	1	LS	$ 840,000	$ 840,000
3	Electrical/ Miscellaneous Allowance	1	LS	$ 840,000	$ 840,000
4	Generator	1	EA	$ 1,000,000	$ 1,000,000
5					
6					
7					
8					
				SUBTOTAL:	**$ 4,080,000**
		CONTINGENCY		30%	$ 1,220,000
				SUBTOTAL:	**$ 5,300,000**
		ENG/SURVEY		20%	$ 1,060,000
				SUBTOTAL:	**$ 6,360,000**
				Estimated Project Total:	**$ 6,360,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 21 **Phase:** Buildout

Project Name:	**Parkway West Well, GST, BPS**

Project Description:

The Parkway West facility will consist of a groundwater well, booster pump station, and a 1 MG ground storage tank located on 2-acres off of League City Parkway. The project includes construction of a pre-engineered control and mechanical building, yard piping, SCADA system, standby generator, booster pumps, and associated electrical and mechanical work.

Project Drivers:

This facility will ensure there is enough capacity to meet the projected west side demands and maintain adequate system pressures.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1500 GPM Well Pump	1	EA	$ 2,000,000	$ 2,000,000
2	750 GPM Booster Pump	2	EA	$ 150,000	$ 300,000
3	1500 GPM Booster Pump	2	EA	$ 300,000	$ 600,000
4	1 MG Ground Storage Tank	1	EA	$ 1,400,000	$ 1,400,000
5	Process Mechanical Allowance	1	LS	$ 840,000	$ 840,000
6	Electrical/ Miscellaneous Allowance	1	LS	$ 1,500,000	$ 1,500,000
7	Generator	1	EA	$ 1,000,000	$ 1,000,000
				SUBTOTAL:	**$ 7,640,000**
		CONTINGENCY		30%	$ 2,290,000
				SUBTOTAL:	**$ 9,930,000**
		ENG/SURVEY		20%	$ 1,990,000
				SUBTOTAL:	**$ 11,920,000**
				Estimated Project Total:	**$ 11,920,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 22 **Phase:** Buildout

Project Name:	**Water Trunk Line from Walker WP to Louisiana**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 7,600 linear feet of 8-inch line, and approximately 15,000 linear feet of 24" line. The project will add a pressure sustaining valve at the Walker Plant.

Project Drivers:

This new waterline will provide additional capacity and pressure to the central and east sides of the city, supplementing the water system and maintaining adequate system pressure and fire protection.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Waterline	1,500	LF	$ 140	$ 210,000
2	8" Waterline	6,100	LF	$ 140	$ 850,000
3	24" Waterline	15,000	LF	$ 400	$ 6,000,000
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 7,060,000**
		CONTINGENCY		30%	$ 2,120,000
				SUBTOTAL:	**$ 9,180,000**
		ENG/SURVEY		15%	$ 1,380,000
				SUBTOTAL:	**$ 10,560,000**
				Estimated Project Total:	**$ 10,560,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 23 **Phase:** Buildout

Project Name:	**16” Waterline from FM 646 to Hobbs Rd (Segment 4)**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 6,200 linear feet of 24-inch water transmission line running along the future Grand Parkway from the future Hobbs Rd extension to FM 646.

Project Drivers:

This line is necessary for the City to be able to provide water supply for future capacity demands and to provide a looped system with the City's existing infrastructure to maintain adequate system capacity, pressure, and fire protection as demands increase in the future.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	16" Waterline	6,200	LF	$ 300	$ 1,860,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 1,860,000**
		CONTINGENCY		30%	$ 560,000
				SUBTOTAL:	**$ 2,420,000**
		ENG/SURVEY		15%	$ 360,000
				SUBTOTAL:	**$ 2,780,000**
				Estimated Project Total:	**$ 2,780,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 24 **Phase:** Buildout

Project Name:	**FM 517 Waterline Extension Phase 2**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 9,800 linear feet of 24" Waterline along FM 517 to serve future westside developments.

Project Drivers:

This line is necessary to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	9,800	LF	$ 400	$ 3,920,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 3,920,000**
		CONTINGENCY		30%	$ 1,180,000
				SUBTOTAL:	**$ 5,100,000**
		ENG/SURVEY		15%	$ 770,000
				SUBTOTAL:	**$ 5,870,000**
				Estimated Project Total:	**$ 5,870,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

Planning Level Cost in 2023 Dollars

CIP Project Number: 25 **Phase:** Buildout

Project Name:	**24" Waterline along Future Unnamed Road from FM 517 to Muldoon Pkwy**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 6,200 linear feet of 24" Waterline along future unnamed road from FM 517 to future Muldoon Parkway.

Project Drivers:

This line is necessary in order to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	6,200	LF	$ 400	$ 2,480,000
2					
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 2,480,000**
		CONTINGENCY		30%	$ 740,000
				SUBTOTAL:	**$ 3,220,000**
		ENG/SURVEY		15%	$ 480,000
				SUBTOTAL:	**$ 3,700,000**
				Estimated Project Total:	**$ 3,700,000**

City of League City

Water CIP - Opinion of Probable Construction Cost* **Date 05/30/2023**

**Planning Level Cost in 2023 Dollars*

CIP Project Number: 26 **Phase:** Buildout

Project Name:	**Muldoon Pkwy Waterline Extension Phase 3 (to West Blvd)**

Project Description:

This project will consist of obtaining water line easements, design, and construction of approximately 3,800 linear feet of 24" waterline and 3,500 linear feet of 16" waterline along Muldoon Parkway to serve future westside developments.

Project Drivers:

This line is necessary in order to meet future development needs on the west side of the City and to provide a looped system to the City's existing west side infrastructure, thereby providing back-up capacity, pressure and fire protection to the west side of the City.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Waterline	3,800	LF	$ 400	$ 1,520,000
2	16" Waterline	3,500	LF	$ 300	$ 1,050,000
3					
4					
5					
6					
7					
8					
				SUBTOTAL:	**$ 2,570,000**
		CONTINGENCY		30%	$ 770,000
				SUBTOTAL:	**$ 3,340,000**
		ENG/SURVEY		15%	$ 500,000
				SUBTOTAL:	**$ 3,840,000**
				Estimated Project Total:	**$ 3,840,000**