



NUECES COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT #4 WATER AND WASTEWATER FACILITIES MASTER PLAN



Adopted: June 17, 2009
Job No. 6189
Revised/Updated: July 2025

Urban | **DCCM**

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**Nueces County Water Control
And Improvement District #4**
WATER AND WASTEWATER FACILITIES MASTER PLAN

Prepared for the N.C.W.C. & I.D. #4

Adopted: June 17, 2009

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TABLE OF CONTENTS

iii	LIST OF TABLES.....
iii	LIST OF FIGURES.....
iv	LIST OF ABBREVIATIONS.....
v	LIST OF DEFINITIONS.....
I.1-2	CHAPTER I – INTRODUCTION.....
	Acknowledgements
	Previous Master Plans
	Scope and Purpose
II.1-7	CHAPTER II - SERVICE AREA CHARACTERISTICS.....
	Principal Environmental Characteristics
	Population
	Land Use and Densities
III.1-5	CHAPTER III - EXISTING WATER SYSTEM.....
	Storage and Pumping
	Water Distribution
IV.1-12	CHAPTER IV - WATER SYSTEM ANALYSIS.....
	Water Supply, Storage, and Pumping Facilities
	Water Pressures
	Distribution Lines, Fire Hydrants, and Valves
	Water Unaccounted for
	Water Quality
	Operational Procedures
	Water Costs and Water System Rates
V.1-5	CHAPTER V - DEVELOPMENT OF WATER SYSTEM MODEL.....
	Development of Model
	Water System Model Calibration
	Updates to the 2017 Model
	Water Demand Scenarios
VI.1-8	CHAPTER VI - SUMMARY OF WATER ANALYSIS AND RECOMMENDATIONS.....
	Contractual Agreement with City of Corpus Christi and SPWMD
	High Service Pump Capacity
	Elevated Storage
	Ground Storage
	Distribution System Improvements
	Fire Flow Improvements
	Proposed Water System Projects

VII.1-6	CHAPTER VII - EXISTING WASTEWATER SYSTEM.....	Collection System North Wastewater Treatment Plant South Wastewater Treatment Plant
VIII.1-3	CHAPTER VIII - WASTEWATER FLOW ANALYSIS AND LOAD FACTORS.....	
IX.1-7	CHAPTER IX - WASTEWATER SYSTEM ANALYSIS.....	Wastewater Treatment Plant Analysis Collection System Analysis Projected 15 Year Performance and Improvement Plan

APPENDIX A: NCWC&ID #4 MASTER PLAN OPINION OF PROBABLE CONSTRUCTION COSTS
APPENDIX B: TCEQ GUIDANCE FOR DETERMINING CONNECTIONS AND POPULATIONS
APPENDIX C: MASTER PLAN BASEMAPS

LIST OF TABLES

Table	Title	Page
II-1	Connection Count Data 2019 – 2024.....	II-4
II-2	Population Projections for NCWC&ID#4 Service Area.....	II-4
II-3	Land Usage Characteristics.....	II-7
II-4	Density Assumptions Used Throughout the Master Plan for Year 2040.....	II-7
III-1	Summary of Existing and Future Water Storage.....	III-3
IV-1	Water Demands 2019 – 2024 Using Metered Data.....	IV-1
IV-2	Water Demands 2019 – 2024 Using Metered Data Summer Peak Flows.....	IV-2
IV-3	Projected Water Demands 2025 – 2040 Using Summer Peak Flows.....	IV-3
IV-4	Projected Peak Demand.....	IV-4
IV-5	NCWC&ID#4 Current Water System Capacities.....	IV-5
IV-6	TCEQ Water System Minimum Requirements based on Demand.....	IV-5
IV-7	Source of Water Supply Current Demand.....	IV-8
IV-8	Source of Water Supply Peak Demand.....	IV-8
IV-9	Annual Drinking Water Quality (2023).....	IV-11
IV-10	NCWC&ID#4 Residential Water Rates.....	IV-12
V-1	2025 and 2040 Summer Peak Flow Demand Criteria.....	V-3
V-2	2025 and 2040 Peak Demand Criteria.....	V-3
VII-1	Existing Lift Stations.....	VII-2
VIII-1	Wastewater Treatment Plant Operating Data 2019 – 2024.....	VIII-1
VIII-2	Monthly Precipitation Data 2019 – 2024.....	VIII-2
VIII-3	Approximate Wastewater Flows Per Acre of Land.....	VIII-3
IX-1	2019 – 2024 Summer Peak Average Daily Flow.....	IX-2
IX-2	North and South WWTP Tributary Lift Stations.....	IX-5

LIST OF FIGURES

Figure	Title
II-1	Primary Service Area
II-2	Secondary Service Area
II-3	Basic Environmental Zones
II-4	Primary Service Area – Year 2025 Land Usage Plan
II-5	Primary Service Area – Year 2040 Land Usage Plan
III-1	Location Map for Pump Stations and Storage Tanks
VI-1	Fire Flow Improvements – Marina 6” Waterline to 8” Waterline
VI-2	Fire Flow Improvements – Private Road A Waterline
VI-3	Fire Flow Improvements – Palimino Drive Waterline
VII-1	Existing Lift Station Schematic
VII-2	Future Lift Station Schematic

LIST OF ABBREVIATIONS

Key abbreviations used in this report are as follows:

AAD	- Average annual daily demand
ACP	- Asbestos cement pipe
Conn.	- Connection
CDC	- Centers for Disease Control and Prevention
District	- Nueces County Water Control and Improvement District #4
gal	- Gallon
gpd/c	- Gallons per capita per day
gpd	- Gallons per day
gpm	- Gallons per minute
EPA	- Environmental Protection Agency
FEMA	- Federal Emergency Management Agency
ft	- Feet
hp	- Horsepower
HS	- High Service (Pump)
ISO	- Insurance Services Office
MD	- Maximum daily demand
MG	- Million Gallons
MGD	- Million Gallons per Day
MSL	- Mean Sea Level
NCWC&ID#4	- Nueces County Water Control and Improvement District #4
PH	- Peak hourly
PVC	- Polyvinyl chloride pipe
Pop.	- Population
PS	- Pump Station
psi	- Pounds per square inch
rpm	- Revolutions per minute
SPMWD	- San Patricio Municipal Water District
SBI	- State Board of Insurance
TCEQ	- Texas Commission on Environmental Quality
TDH	- Total Dynamic Head (feet)
TNRCC	- Texas Natural Resources Conservation Commission
TWDB	- Texas Water Development Board
USGS	- United States Geological Survey
WWTP	- Wastewater Treatment Plant
WTP	- Water Treatment Plant

LIST OF DEFINITIONS

Key definitions used in this report are as follows:

- Distribution mains – Mains connected to supply mains that provide fire protection and domestic service.
- Transmission mains – Mains of large diameter are used to transport water from treatment facilities or re-pump stations to distribution areas.
- Connection – A single-family residential unit or each commercial or industrial establishment to which drinking water is supplied from the system. As an example, the number of service connections in an apartment complex would be equal to the number of individual apartment units. When enough data is not available to accurately determine the number of connections to be served or being served, the population served divided by three will be used as the number of connections for calculating system capacity requirements. Conversely, if only the number of connections is known, the connection total multiplied by three will be the number used for population served. *
- Distribution system – A system of pipes that conveys potable water from a treatment plant to the consumers. The term includes pump stations, ground and elevated storage tanks, potable water mains, and potable water service lines and all associated valves, fittings, and meters, but excludes potable water customer service lines. *
- Maximum daily demand – The maximum water used on a single day from the metered flow data provided by the District.
- Peak hourly demand – In the absence of verified historical data, peak hourly demand means 1.25 times the maximum daily demand if a public water supply meets the commission's minimum requirements for elevated storage capacity. *

*As defined by the Texas Administrative Code, Title 30 – Environmental Quality, Part 1 – Texas Commission on Environmental Quality, Chapter 290 – Public Drinking Water, Subchapter D: Rules and Regulations for Public Water Systems, §290.38, Effective January 9, 2025.

CHAPTER I - INTRODUCTION

Urban | DCCM would like to express our sincere appreciation for the assistance provided during the preparation of this Master Plan update by the staff of the Nueces County Water Control and Improvement District #4 (NCWC&ID #4, the "District").

Previous Master Plans

The original Water and Wastewater Master Plan was prepared for the District by Urban Engineering in 1995. Due to the many improvements made to the water and wastewater systems, the Master Plan and its Basemaps have been regularly updated to reflect the new land developments within the service area and the improvements made to the distribution and collection systems. The 2017 update depicted the improvements, facilities, and land developments within the serviceable area since the 2009 Master Plan. This Master Plan update includes reassessed land use information, water & wastewater flow data and updated existing facilities.

Since the preparation of the 2017 Master Plan update, the District has changed the operation of the water distribution system. The following operational changes have been implemented:

- 1) The Ferry Landing Pump Station (PS) is used to supply and pressurize the system.
- 2) The existing 500,000 gallon elevated water storage facility at SH 361/Mariners Drive was decommissioned. A new, 1.0 MG elevated storage tank on SH 361 (across from the Gulf Waters R.V. Park) has been constructed and put into service in 2019.
- 3) The District replaced a 2,300-ft segment of 12-inch waterline on SH 361 with 20-inch PVC in 2019.
- 4) The District replaced a 3,300-ft segment of 20-inch steel waterline with a new 20-inch steel waterline under the CC Ship Channel in 2021.
- 5) A new Mustang Island PS with three high-service pumps was constructed and put into service in 2025.
- 6) The 50,000 gallon ground storage tank has been demolished at the Mustang Island PS. Construction of a new, 1.5 MG ground storage tank commenced in December 2024. Estimated completion and commissioning is September 2025.
- 7) The current water system operates as follows: when water levels drop to 108' in the elevated storage tanks, all pump stations turn on to fill the tanks. When adequate levels are restored, the pump stations turn off in the following order: Mustang Island, then Ferry, then Beasley.

Scope and Purpose

The primary purpose of the Water and Wastewater Master Plan report is to evaluate the adequacy of the existing water distribution & wastewater collection systems and to determine the improvements needed to meet the projected demands through the year 2040. The plan includes base mapping, population characteristics & land use inventory, hydraulic analysis & modeling of the distribution system, water system capital improvements program, wastewater system analysis, and a wastewater capital improvements program.

The water and wastewater system studies were based on the total number of connections to the water system, a calculated population based on the number of connections, and estimates of 2025/2040 land development. The water study begins in Chapter III and includes an analysis of the distribution, transmission, storage capacity, and pumping systems. The wastewater study begins in Chapter VII and includes an analysis of the existing collection system, treatment facilities, and pumping systems.

CHAPTER II - SERVICE AREA CHARACTERISTICS

The District currently provides water and wastewater service for residents and businesses within the City of Port Aransas and the surrounding areas. The primary service boundary for both the water and wastewater is bound by the Corpus Christi Ship Channel on the north, the Gulf of Mexico on the east, Mustang Island State Park on the south, and Corpus Christi Bay on the west. It is relatively narrow (about 1 mile wide by 10 to 11 miles long), and is divided by a major highway (SH 361), with approximately 2,700 acres to the east and 4,000 acres to the west. With the exception of the City of Port Aransas which occupies the very north end of Mustang Island, the remainder of the service area is moderately developed. The primary service area boundary is shown on Figure II-1. As illustrated on Figure II-2, the District maintains a secondary service boundary along Harbor Island, which is bound by Redfish Bay on the north, the Corpus Christi Ship Channel on the east, the Corpus Christi Bay on the south, and the City of Aransas Pass on the west. The boundary runs parallel with SH 361 from the City of Aransas Pass to the City of Port Aransas, and consists of approximately 1,400 acres that is sparsely developed.

A. PRINCIPAL ENVIRONMENTAL CHARACTERISTICS

The area is generally identified by four basic environmental units. These units are the gulf beach, dune complex, barrier flats, and tidal flats, see Figure II-3.

1. GULF BEACH

The beach is about 200 to 300 feet wide, and composed primarily of fine to very fine sand. It is subject to erosion and accretion at a rate between -4.9 to 1.6 ft/year, according to the U.T. Bureau of Economic Geology. The beach serves as an energy dissipater complex during non-storm conditions.

2. DUNE COMPLEX

The dune complex varies in height from 15 to 25 feet, and averages 800 feet in width. It serves as protection to the barrier island during storm surges.

3. BARRIER FLAT

The barrier flat is generally the level plain between the dune complex and the tidal flat on the Corpus Christi Bay side of Mustang Island. Elevations range from sea-level to approximately ten feet. This area collects rain water and transmits it to ground water, and experiences

flooding at low elevations, with heavy flooding during hurricanes. This is the environmental unit of the island that is comparatively more suitable for development. Roads, home sites, utilities and other facilities can be placed within the barrier flats with limited adverse impact; however, storm drainage and the management of surface water provide the biggest challenge. The wastewater utilities for this area are managed at higher than normal costs due to the subsurface water conditions and ground composition.

4. TIDAL FLATS

The tidal flats of the island consist of the low lying areas with either water cover or areas impacted by continuous to intermittent wind and tidal influences. The tidal flats vary in elevation from nearly 3 feet below to 3 feet above sea-level, and consist of grass flats, salt marshes, sand beaches and wind tidal flats. The relatively low elevation of this area makes it generally undesirable for development, while its main purpose is to serve as a barrier dissipating energy to the island from the bay.

The primary service area, with the exception of the Port Aransas City Limits, is divided approximately as follows:

- Beach - approximately 200 acres
- Dune Complexes - approximately 1,100 acres
- Barrier Flats - approximately 3,700 acres
- Tidal Flats - approximately 2,000 acres

The secondary service area is divided approximately as follows:

- Barrier Flats - approximately 700 acres
- Tidal Flats - approximately 700 acres

The District was originally formed to provide water service to the City of Port Aransas. In the early years, some of the landowners petitioned to the Courts for exclusion. They contended that as rural areas they would not expect to receive water and sewer service from the District and thus should not be included within its service area. Some of these petitioned requests were granted, one of which was for the Wilson family trusts, who owned a large portion of Mustang Island. Consequently, as the Wilson properties have been subdivided and sold for development, they have

had to negotiate with the District for re-inclusion into its service area. Presently, only a small number of tracts remain excluded from the District, such as the San Ramon tract.

B. POPULATION

The demand placed on the water and wastewater systems is attributed to roughly three general types of population. The first type consists of residents that permanently reside within the District's service area including the City of Port Aransas. The second category includes customers that have second homes but live elsewhere the majority of the time, and have an active account and meter with the District but may not always create the same type of demand that a permanent resident would. The third type of population consists of tourists and vacationers that visit on weekends and holidays. Due to climate and location, the City of Port Aransas and the surrounding areas are an excellent recreational destination which attracts many visitors during the summer and winter months.

For the 2009 and 2017 Master Plan updates, the 2006 and 2011 Regional Water Plan population projections published by the Texas Water Development Board (TWDB) were utilized for planning purposes. The 2006 and 2011 Regional Water Plans itemized the populations for both the City of Port Aransas and the remainder of the District's service boundary separately. The populations for the City and the District's service boundary were added together to obtain the total population. The population ranged from 8,000 persons in 2000 to 42,900 persons in 2060. When preparing the 2025 Master Plan update, we reviewed the State Water Planning information for the 2016 and 2021 Regional Water Plans. In these Plans, the TWDB did not include the population for the City of Port Aransas and the District separately. The population data in these plans ranged from 3,800 in 2020 to around 5,800 in 2060. Since the data varied greatly from the previous Regional Water Plans, we decided to use a different approach to assess the population in this Master Plan update.

In lieu of this population data, the total number of metered connections reported to the TWDB for the annual Water Use Survey was utilized to project the future population. A growth factor of 2.35% was calculated using the connection count data from 2019 to 2024. The resulting population was then calculated by multiplying the number of connections by 3.0 in accordance with the Texas Commission on Environmental Quality (TCEQ) guidance document titled

(1) Based on 2.35% growth factor.
(2) 3.0 x Total Connections based on TCEQ guidance.

TABLE II-2: Population Projections for NCWC&ID #4 Service Area

(1) From Water Use Survey data provided by NCWC&ID #4 and published by the TWDB.
(2) 3.0 x Total Connections based on TCEQ guidance.

TABLE II-1: Connection Count Data 2019 – 2024

Urban

assumed to be attributed to a reduction in water usage as a result of water conservation methods that had been instituted throughout the service area.

Total annual flow (metered data), connection data from the District from 2019 to 2024 and 3 persons per connection resulted in calculated average daily water consumption rates of 53 gpd per capita (12-month average) and 70 gpd per capita (summer peak for the months June to August). See Chapter IV for additional information.

Total annual flow (wastewater treatment plant effluent data) connection data from the District from 2019 to 2024 and 3 persons per connection resulted in calculated average wastewater flow of 31 gpd per capita (12-month average) and 42 gpd per capita (summer peak for the months June to August). See Chapter VIII for additional information.

C. LAND USE AND DENSITIES

A number of studies have been made regarding the potential development of Padre and Mustang Island. This list includes the following:

- Comprehensive Plan for Mustang Island/Port Aransas, Texas, 1980 by Harland & Bartholomew.
- Mustang Island Area Development Plan, 1988 by City of Corpus Christi Planning Department.
- Area Development Plan for Mustang Island/ Port Aransas/ Harbor Island, 2007 by Urban Engineering & NCWC&ID #4 personnel.
- Padre/Mustang Island Area Development Plan, 2021 by Freese and Nichols.
- Port Aransas Comprehensive Plan, 2023 by Freese and Nichols.

The plans recommend low density residential development west of SH 361, with a higher density east of SH 361. Under the plans, no development is recommended in the tidal flats portion of the island and the beach. No density development is recommended in the dune complex portion, and nearly all development and density is recommended within the barrier flats.

Within the District's primary service boundary, the Area Development Plan was sub-divided in to three planning zones; Old Town, Gulf Area, and Bay Area. Old Town, which currently consists of approximately 70% of the District's customers, is bound by the Corpus Christi Ship Channel on the north, Gulf of Mexico on the east, Access Road 1A/ Piper Blvd. on the south and Corpus Christi Bay on the west. The Gulf area is defined by Access Road 1A on the north, the Gulf of Mexico on the east, Mustang Island State Park on the south, and SH 361 on the west. The Bay area is bound by Piper Blvd. on the north, SH 361 on the east, Mustang Island State Park on the south, and Corpus Christi Bay on the west.

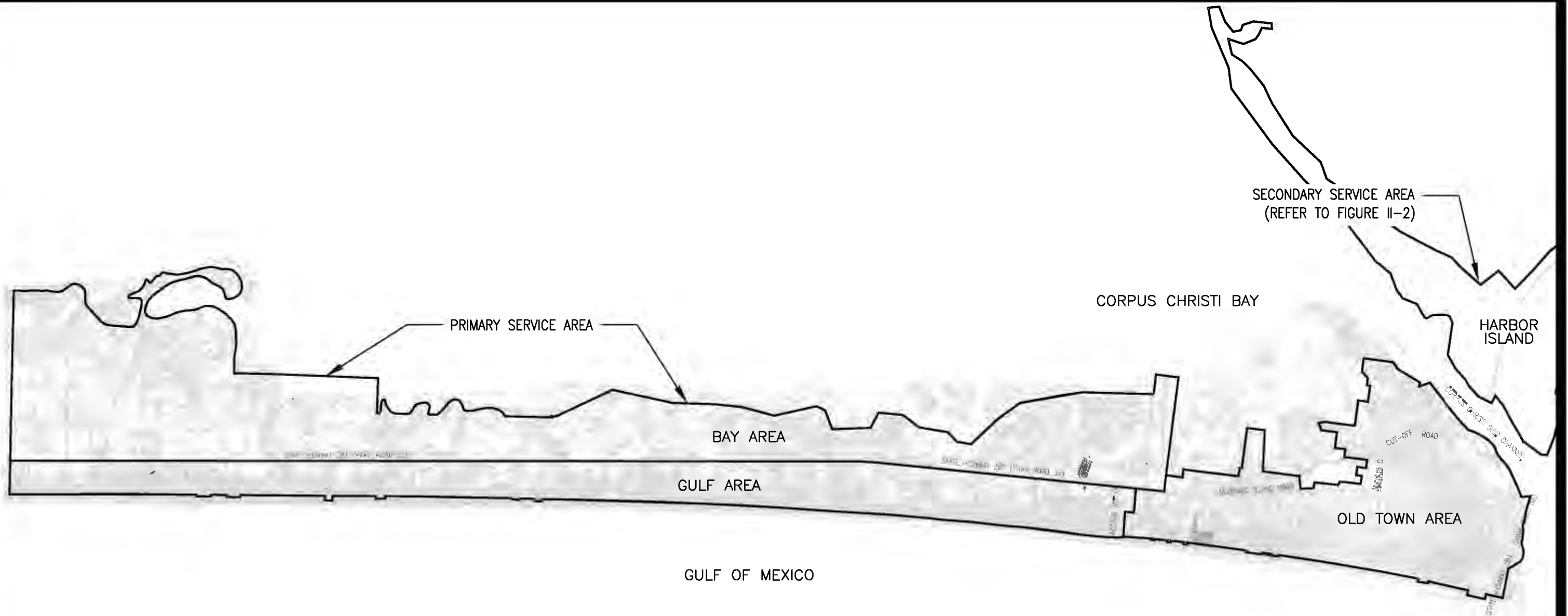
Furthermore, each zone was separated into five land usage categories: open acreage, one acre single family residential/commercial, single family residential/commercial, low rise condominiums/hotels, and high rise condominiums/hotels. Each land usage type was assigned a unit per acre value based on actual density on the developed properties at the present time. Refer to Table II-3 for a list of these values and Figure II-4 and II-5 for an illustration of Year 2025 and 2040 land usage plan. For instance, a single family residential block at the intersection of Avenue B and Trojan Street indicates 19 home sites on 4.2 acres, which equates to approximately 4.5 units per acre. We have assumed these values per land usage type in order to generate projections for ultimate water consumption and wastewater flow demands. In year 2025, the average densities (units/acre) for the three zones, according to the updated land usage plan was calculated to be 3.9 for Old Town, 2.2 for Gulf area, and 0.3 for Bay area. Refer to Table II - 4, for a list of the average densities per zone for year 2040.

Units per Acre	
	Zero Density (Open Acreage)
0	
1	Extra-low Density (One acre Single Family Residential/ Commercial)
4.5	Low Density (Single Family Residential/ Commercial)
14.5	Medium Density (Low Rise Condominiums)
30	High Density (High Rise Condominiums)

household (dwelling unit) is assumed.

AREA	Avg. Density (Dwelling units/acre)	Persons per Dwelling Unit	Density (persons/acre)
Zone 1: Old Town	4.5	3.0	13.5
Zone 2: Gulf Area	4.6	3.0	13.8
Zone 3: Bay Area	1.2	3.0	3.6

$$\text{persons/acre} = (\text{dwelling units/acre}) \times (\text{persons/dwelling unit})$$



NOTE:

PRIMARY SERVICE AREA DIVIDED INTO THREE ZONES:
OLD TOWN AREA, BAY AREA, & GULF AREA.

**FIGURE II-1:
PRIMARY SERVICE AREA
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4**

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TBPELS FIRM NUMBERS: ENGINEERING 145 | SURVEYING 10032400
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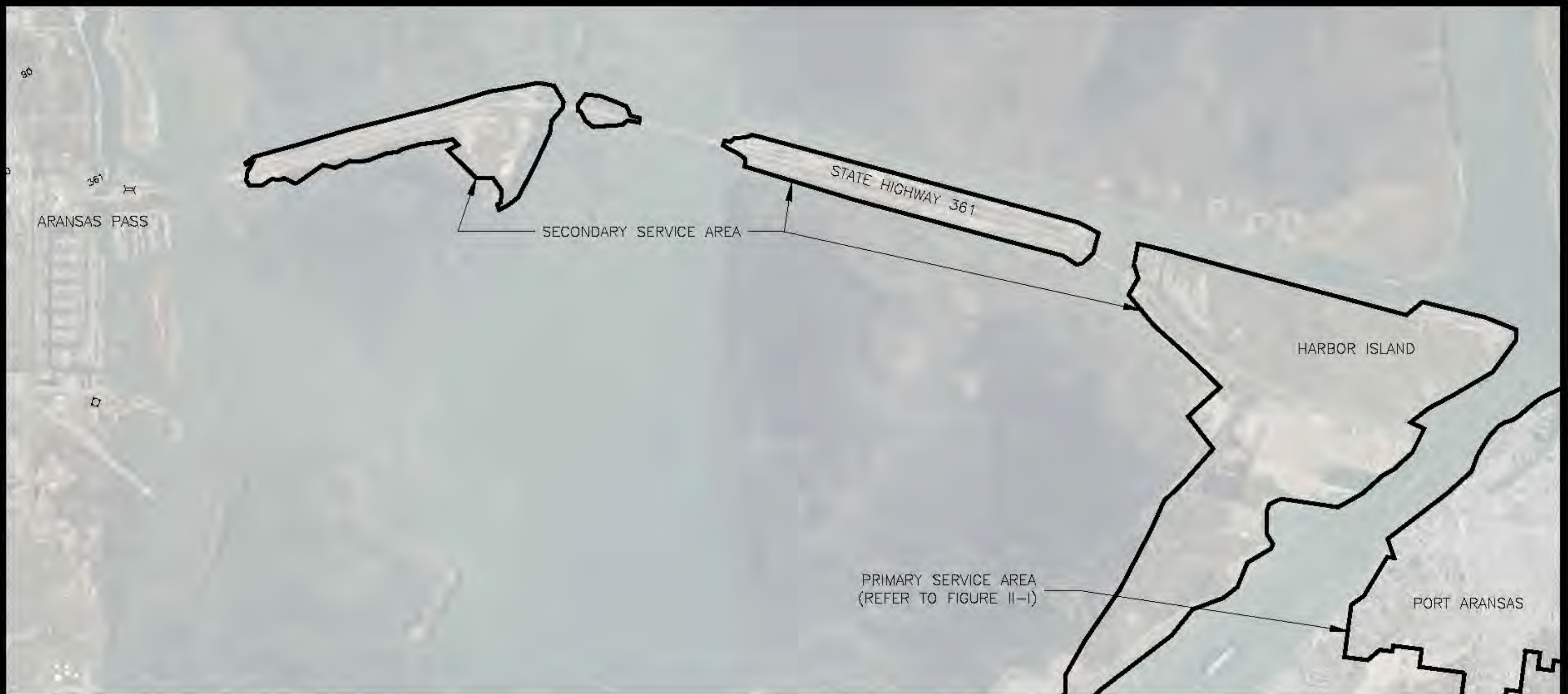
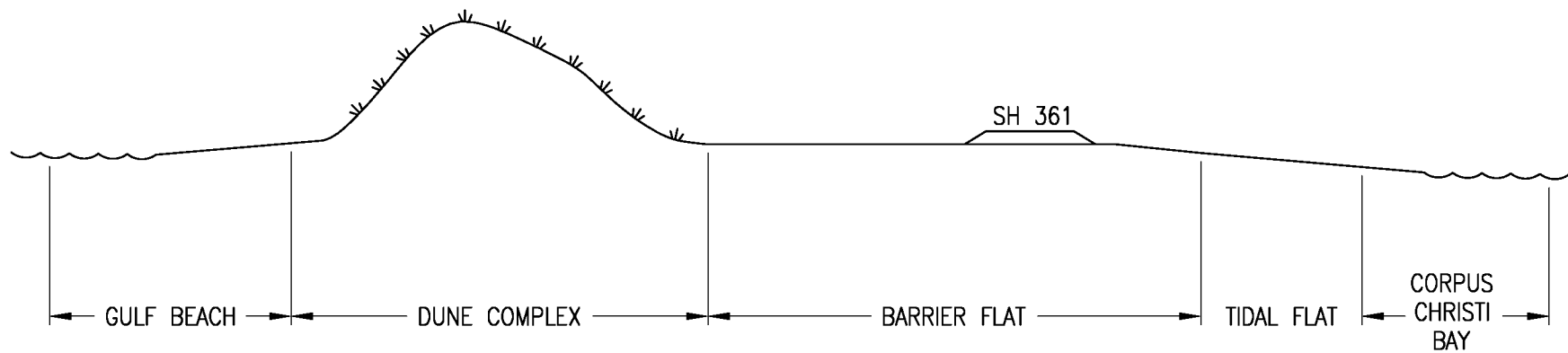


FIGURE II-2:
SECONDARY SERVICE AREA
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4

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ENVIRONMENTAL ZONES

**FIGURE II-3:
BASIC ENVIRONMENTAL ZONES
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4**

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LEGEND

- ZERO DENSITY (OPEN ACREAGE)
- EXTRA-LOW DENSITY (ONE ACRE SINGLE FAMILY RESIDENTIAL/COMMERCIAL)
- LOW DENSITY (SINGLE FAMILY RESIDENTIAL/COMMERCIAL)
- MEDIUM DENSITY (LOW RISE CONDOMINIUMS/HOTELS)
- HIGH DENSITY (HIGH RISE CONDOMINIUMS/HOTELS)

FIGURE II-4:
PRIMARY/SECONDARY SERVICE AREA - YEAR 2025 LAND USAGE PLAN
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4

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FIGURE II-5:
PRIMARY/SECONDARY SERVICE AREA - YEAR 2040 LAND USAGE PLAN
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4

CHAPTER III – EXISTING WATER SYSTEM

The District provides water service to developed lands from the north boundary of Mustang Island State Park to the Corpus Christi Ship Channel, including Harbor Island. By agreement with the City of Corpus Christi, responsibility for providing water from the north boundary of Mustang Island State Park to the South rests with the City of Corpus Christi.

Presently, there are two water systems that provide water to the District. From the north, treated water is purchased from the San Patricio Municipal Water District (SPMWD) which is re-pumped at the Beasley Street PS in the City of Aransas Pass and transmitted through an 8-inch and a 12-inch/24-inch line on Harbor Island to the Corpus Christi Ship Channel. At the crossing, a 20-inch line carries the water under the ship channel to the Ferry Landing PS in the City of Port Aransas. In 2019 the District replaced a 2,300-ft segment of 12-inch waterline on SH 361 with 20-inch PVC. In 2021 the District replaced a 3,300-ft segment of 20-inch steel waterline with a new 20-inch steel waterline under the Corpus Christi Ship Channel.

The water supply from the North is accomplished by an agreement with the SPMWD. The SPMWD purchases treated and untreated water from the City of Corpus Christi, which in turn obtains its supply from the Lake Corpus Christi/Choke Canyon Reservoir System along with an intake from the Mary Rhodes Pipeline. SPMWD's contractual agreement with the District presently states that the maximum daily supply is 1.2 MG.

From the South, the District obtains water from the City of Corpus Christi by a 24-inch line from the Flour Bluff area which is re-pumped at the Sandardollar PS and transmitted through a 20-inch line and a 16-inch line to the District's Mustang Island PS at the north end of Mustang Island State Park. The City of Corpus Christi's contractual agreement with the District presently states that the maximum daily supply is 7.23 MG (2025-2029). This contract contains the following provision:

"Should there be a shortage in the basic supply of water which requires the restriction or curtailing of any consumer of water within the city limits of Corpus Christi that coincide with such restriction or limitation within Corpus Christi, the

District will limit and restrict all of its customers, both direct and indirect through resale to the same extent.”

This contract provision indicated above regarding water supply restrictions applies to the supply from the SPMWD as well. In addition to the transmission mains for water supply indicated above, the District has the following facilities:

A. STORAGE AND PUMPING

The elevated and ground storage tanks perform different functions; however they both aim to decrease the impact of the demand fluctuations. The distribution system provides water to the elevated storage tanks that serves three purposes:

- Equalization of peak demands to maintain a fairly constant pumping rate.
- Provide pressure maintenance and system surge protection.
- Reserve capacity for fire protection and emergency conditions.

Ground storage tanks are located at the pump stations and generally serve two functions:

- Equalizing the different rates of supply and pumping into the system.
- Reserve for emergency conditions.

The District’s existing water distribution system is served by two elevated storage tanks, five ground storage tanks, and three full-time pump stations. The total existing available storage capacity is provided in the following table:

TABLE III-1: Summary of Existing and Future Water Storage

LOCATION	CAPACITY (gallons)
Port Aransas Elevated Tank (Eskridge Rd & Glover Rd)	500,000
Mid-Island Elevated Tank (Across from Gulf Waters R.V. Park)	1,000,000
Mustang Island PS (South end of the Primary Service Boundary)	1,500,000 & 1,500,000*
Ferry Landing PS (Port Street)	1,000,000 & 200,000
Beasley Street PS (Beasley Ave, Aransas Pass)	200,000 & 50,000
EXISTING TOTAL	4,450,000
FUTURE TOTAL	5,950,000*

* Currently under construction

The storage tank and pump station locations and capacities are described in the following:

1. ELEVATED STORAGE

The District has the following two elevated storage tanks:

- Mid-Island Elevated Tank: 1,000,000 gallons.
Composite Tank
Located on SH 361 across from Gulf Waters R.V. Park
Overflow Elev.: El. 134
Base Elev.: El. 10
Min. Elev.: El. 104
Operating Elev.: 106 – 113
- Port Aransas Elevated Tank: 500,000 gallons.
Composite Tank
Located at intersection of Eskridge & Glover Rd.
Overflow Elev.: El. 134
Base Elev.: El. 8
Min. Elev.: El. 105
Operating Elev.: 109 – 118

The combined elevated storage capacity for the District is 1,500,000 gallons.

The Ferry Landing PS and associated storage tanks located at Port Street and Cotter Avenue in Port Aransas, store water received from Beasley PS in Aransas Pass. The pump station is equipped with three pumps used to pump water to the Port Aransas Elevated Tank and provide service to the distribution system. Two are equipped with a 50 Hp motor with a capacity of 800 gpm each maintaining an average operating pressure of 50 psi, and one is one 125 Hp pump in operation.

The Beasley Street PS and associated storage tanks located on Beasley Street in Aransas Pass, approximately seven miles west of Port Aransas, store water received from the SPMWD and pumps it to the distribution system in Port Aransas through an 8-inch, 24-inch, 12-inch, and 20-inch transmission lines. The pump station is equipped with two 125 HP pumps and variable frequency drive (VFD) units that run independently of one another. Each pump is 125 Hp and has a firm capacity of 1,000 gpm. According to District personnel, the normal operating pressure is 80 psi and the average pumping capacity is 1.44 MGD (1,000 gpm) with

3. WATER PUMP STATIONS

Currently, only 1,500,000 gallons are available at the Mustang Island PS, 250,000 gallons at the Beasley Street PS and 1,200,000 gallons at the Ferry Landing PS for a combined storage capacity of 1,500,000 gallons of elevated storage and 2,950,000 gallons of ground storage. Upon completion of the new ground storage tank at the Mustang Island PS, there will be 4,450,000 gallons of ground storage.

- Beasley Ground Storage Tanks - 200,000 gallons and 50,000 gallons. These are located at the Beasley Street PS in the City of Aransas Pass.
- Mustang Island Ground Storage Tanks - 1,500,000 gallon. This tank is located at the Mustang Island PS at the south end of the District's primary service boundary. The 50,000 gallon ground storage tank has been decommissioned/demolished.
- Ferry Landing Ground Storage Tanks - 1,000,000 gallons and 200,000 gallons. These are located at the Port Street PS within the City of Port Aransas near the ferry landing.

The District has the following five ground storage tanks:

2. GROUND STORAGE

equipped with a 20 Hp motor with a capacity of 400 gpm. The maximum pumping capacity at the Ferry Landing PS is approximately 2.88 MGD according to District personnel.

The Mustang Island PS and associated storage tanks, located approximately 11 miles south of the City of Port Aransas on Mustang Island, stores water received from the City of Corpus Christi. The water is then pumped to Port Aransas through a 12-inch, 14-inch, 16-inch, and 18-inch transmission lines. The pump station was upgraded in 2025 with three new high services pumps. Each pump has a VFD equipped 100 Hp motor with a capacity of 2,238 gpm capable of maintaining an average operating pressure of 70 psi. The station has a firm capacity of 4,476 gpm (6.45 MGD) provided through two pumps in operation.

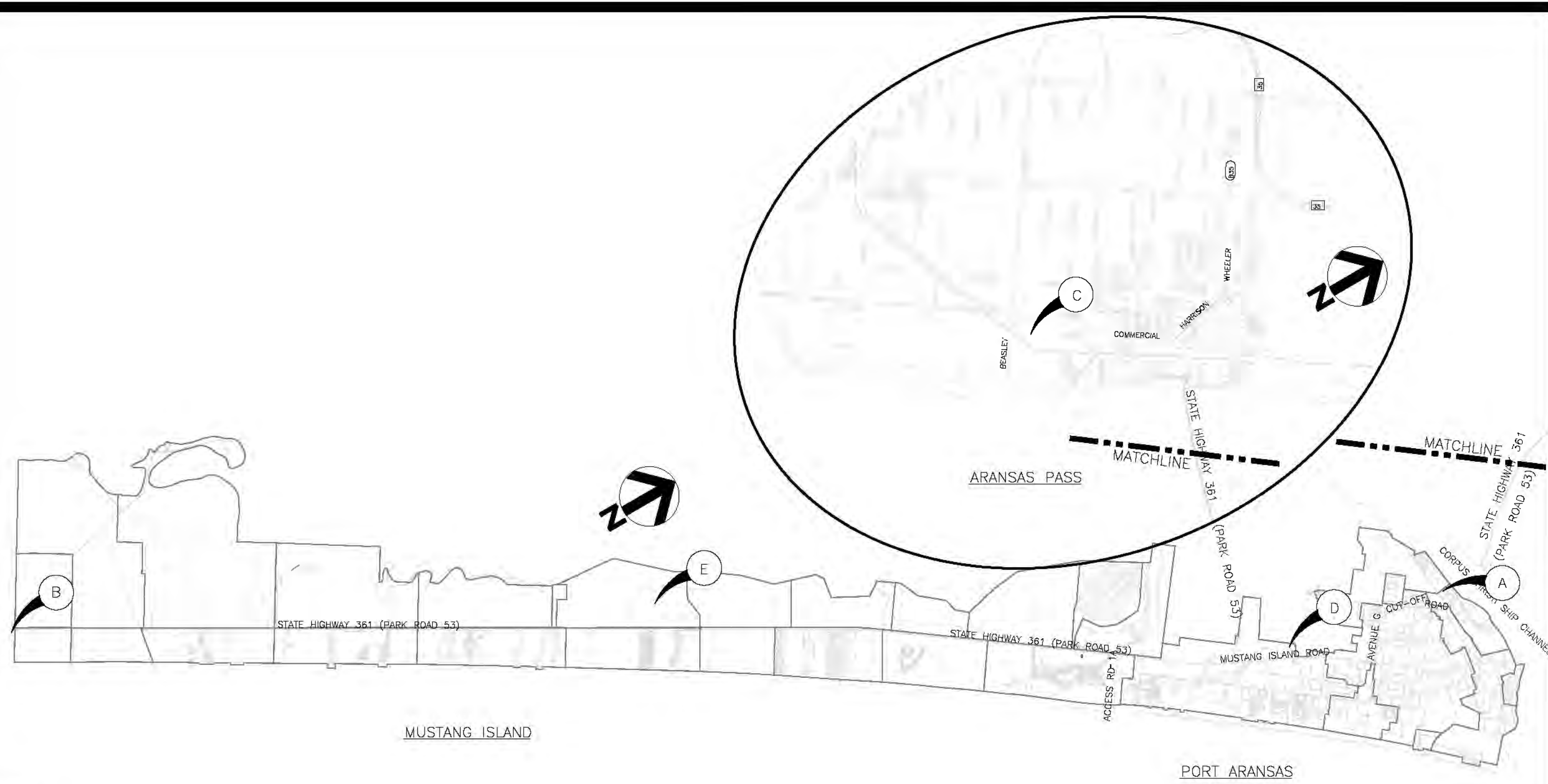
The District no longer operates or maintains any water wells. The locations of the pump stations and storage tanks are illustrated on Figure III-1.

B. WATER DISTRIBUTION

The District owns and operates the water distribution system which supplies water to the customers of Port Aransas, Mustang Island, and Harbor Island. In order to maintain and operate the distribution system, the District has a total of twenty-one employees. Ten certified operators; two of which have “B” certification, six of which have “C” certification licenses and two that have “D” certification licenses. In the year 2025, the distribution system served approximately 36,177 customers during the peak season with a system of pipelines ranging in diameter from 2 inches to 20 inches. The existing distribution system is shown on the Master Plan Basemaps attached to this report (Appendix C).

The distribution system is designed and should be sustained to provide a minimum operating pressure of 35 psi during normal conditions and a minimum of 20 psi during extreme operating conditions, such as during a fire flow demand. According to TCEQ, the minimum normal pressure allowed is 35 psi. Pressures above 80 psi should be limited and no greater than 120 psi due to potential harmful affect on the system and higher operating costs. Maximum allowable velocities in the piping should be limited to 8 feet per second. Refer to Table’s IV-5 and IV-6 for a comparison of the existing system and the TCEQ requirements.

S:\projects\pump\clients\nueces county\ncd\engineering\pumps - 2025\ncd\pump\update\design phase\DWG\Figure III-1.dwg modified by ccardo on Jun 11, 2025 - 9:48am



LEGEND:

- A. FERRY LANDING PUMP STATION & GROUND STORAGE TANKS: 1,000,000 GAL. & 200,000 GAL.
- B. MUSTANG ISLAND PUMP STATION & GROUND STORAGE TANKS: (2) 1,500,000 GAL.
- C. BEASLEY PUMP STATION & GROUND STORAGE TANKS: 200,000 GAL. & 50,000 GAL.
- D. PORT ARANSAS ELEVATED TANK - 500,000 GAL.
- E. MID-ISLAND ELEVATED TANK - 1,000,000 GAL.

FIGURE III-1:
LOCATION MAP FOR PUMP STATIONS
AND STORAGE TANKS
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4

CHAPTER IV – WATER SYSTEM ANALYSIS

Port Aransas is a small recreational and tourist community located on the coast adjacent to the Gulf of Mexico. Due to the vacation and recreational appeal, the community receives a high influx of population which impacts the water supply in the same manner as it does the wastewater. The census only shows the permanent residents, which does not represent actual connections and varies substantially, due to weekend visitors and vacationers.

A. WATER SUPPLY, STORAGE AND PUMPING FACILITIES

The factors which actually affect water supply and storage are as follows:

- The resident population.
- The influx of weekend tourists and other visitors who occupy the hotels, motels and condominiums.
- The influx of additional people on major holidays such as the Fourth of July and three-day weekends.

1. Water Demand Analysis

Using water usage data supplied by the District, the average annual daily demand (AAD), average annual max daily demand (MD), and average annual peak hourly demand (PH) was determined for 2019 to 2024. See Table IV-1 for a summary of the demands:

TABLE IV-1: Water Demands 2019-2024 Using Metered Data

Water Demands (MGD)						
DATE	2019	2020	2021	2022	2023	2024
AAD (MGD)	1.55	1.88	1.60	1.88	1.85	1.69
MD (MGD)	2.34	2.61	2.66	2.74	2.97	2.71
PH (MGD)	2.93	3.26	3.33	3.43	3.71	3.39

Throughout this report, an average and a peak demand is mentioned to describe both water and wastewater needs. A peaking factor of 1.5 was calculated in 2017 using the District's supervisory control and data acquisition (the peaking factor is the ratio of maximum daily

demand over average day demand). Water usage data for 2019 to 2024 was assessed to determine if there was any change in the previous peaking factor of 1.5. The range of peaking factors observed during 2019 to 2024 is shown below.

<u>Year</u>	<u>Peaking Factor</u>	<u>Average</u>
2019	1.33 – 1.84	1.51
2020	1.17 – 1.80	1.41
2021	1.32 – 2.87	1.71
2022	1.20 – 1.94	1.49
2023	1.27 – 3.34	1.66
2024	1.28 – 2.08	1.60

The average of the peak factors noted above was found to be 1.574. This value was used to determine the maximum daily flow in this report. The summer peak flows were obtained using the average daily flow from the peak summer months (June to August). The maximum daily flow was obtained by multiplying the average daily flow by the average peaking factor of 1.574. The peak hourly flow was obtained by multiplying the maximum daily flow by 1.25.

TABLE IV-2: Water Demands 2019-2024 Using Metered Data Summer Peak Flows

Water Demands (MGD)						
DATE	2019	2020	2021	2022	2023	2024
ADF (MGD)	2.13	2.38	2.19	2.55	2.49	2.08
MDF (MGD)	3.34	3.74	3.44	4.01	3.92	3.27
PH (MGD)	4.18	4.68	4.30	5.01	4.91	4.08

Using the summer peak flow information from 2019 to 2024 along with the population data developed using the number of connections to the system (see Table II-1) the per capita water usage ranges from 59 to 75 gpd per capita (gpd/c). The average of this range of values indicates a water usage of 70 gpd/c. This is significantly less than the 170 gpd/c determined in the 2009 Master Plan and the 162 gpd/c found in the 2017 Master Plan update.

We believe that the main reason for the dramatic drop in per capita usage is due to the drought conditions that have existed in the area for the last 5 years. The drought conditions have required the City of Corpus Christi to place restrictions on water supplied to the District. Limiting irrigation of residential and commercial properties is one of the main contributors to the reduction in water demand.

The 2021 Regional Water Plan water demand projections published by the TWDB suggests a 0.57% growth per year (year 2020 to year 2040) however using actual flow data provided by the District from 2019 to 2024, a water demand growth rate of 1.89% was observed. Table IV-3 shows projected water demands to year 2040 and was developed using the District's actual water usage growth rate of 1.89% per year.

The maximum daily flow was obtained by multiplying the average daily flow by the average peak factor of 1.574. The peak hourly flow was obtained by multiplying the maximum daily flow by 1.25. The following table represents the projected demand on the distribution system based on the current water usage as influenced by drought conditions.

TABLE IV-3: Projected Water Demands 2025-2040 Using Summer Peak Flows

Water Demands (MGD)				
DATE	2025	2030	2035	2040
ADF (MGD)	2.11	2.32	2.55	2.80
MDF (MGD)	3.33	3.66	4.01	4.41
PH (MGD)	4.16	4.57	5.02	5.51

To further analyze the water system components, we developed a peak demand flow for the existing (2025) and future conditions (2040). The projected number of total connections and 0.22 gpm/connection was used to determine the peak average daily flow that the system would experience. The factor of 0.22 gpm/connection was confirmed using the average annual daily demand from the peak month between 2019 and 2024. This value ranged from

0.16 to 0.18. To be conservative, we used 0.22 gpm/connection, the same value that was used in the previous Master Plan update.

Table IV-4: Projected Peak Demand

	Minimum Criteria	Year 2025 (12,059 Conn.)	Year 2030 (13,544 Conn.)	Year 2035 (15,212 Conn.)	Year 2040 (17,085 Conn.)
ADF ⁽¹⁾	0.22 gpm/conn.	3.820 MGD (2,653 gpm)	4.291 MGD (2,980 gpm)	4.820 MGD (3,347 gpm)	5.413 MGD (3,759 gpm)
MDF ⁽²⁾	1.574 x ADF	6.013 MGD (4,176 gpm)	6.754 MGD (4,690 gpm)	7.586 MGD (5,268 gpm)	8.519 MGD (5,916 gpm)
PH ⁽³⁾	1.25 x MDF	7.516 MGD (5,220 gpm)	8.443 MGD (5,863 gpm)	9.481 MGD (6,584 gpm)	10.649 MGD (7,395 gpm)

⁽¹⁾ Average Annual Daily Flow (ADF) in peak month

⁽²⁾ Maximum Daily Flow (MDF) – data was obtained from District personnel in order to determine historical peak daily demand.

⁽³⁾ Maximum Hourly demand (PH) – According to TCEQ, Page 4, "in the absence of verified historical data, peak hourly demand equals 1.25 times the maximum daily demand (prorated to an hourly if a public water supply meets the commission's minimum requirements for elevated storage capacity and 1.85 times the max daily demand (prorated to an hourly rate) if the system uses pressure tanks or fails to meet the commission's minimum elevated storage capacity requirement.

2. Evaluation of Existing Elevated and Ground Storage Facilities

Table IV-5 illustrates the current water system capacity based on Year 2025 demand (note: the "Total Capacity (2025/2026)" column displays capacities that will be available when the improvements at the Mustang Island PS are complete). Table IV-6 depicts the minimum design standards set forth by the TCEQ in regard to the existing and projected demands for the District through the Year 2040.

TABLE IV-5 NCWC&ID #4 Current Water System Capacities

Facility	Total Capacity (2025)	Total Capacity (2025/2026)
	Conn. = 12,059 Pop. = 36,177	Conn. = 12,059 Pop. = 36,177
Total Storage	4,450,000 gal	5,950,000 gal
Elevated Storage	1,500,000 gal (1)	1,500,000 gal (1)
Ground Storage	2,950,000 gal (2)	4,450,000 gal (3)
High-Service Pumps	9.04 MGD (6,276 gpm) (4)	9.04 MGD (6,276 gpm) (4)
Distribution Lines	6" - 20"	6" - 20"
Pressure: Residual Operating / Fire Flow	47 -52 psi / 20 psi	47 – 52 psi / 20 psi
Certified Water System Operators	10	10

NOTES:

- (1) Mid-Island=1,000,000 gal & Port Aransas=500,000 gal
- (2) Mustang Island PS=1,500,000 gal, Ferry PS=1,000,000 gal & 200,000 gal, Beasley PS=200,000 gal & 50,000 gal
- (3) Mustang Island PS=(2) 1,500,000 gal, Ferry PS=1,000,000 gal & 200,000 gal, Beasley PS=200,000 gal & 50,000 gal
- (4) With one of three pumps off @ Mustang Island PS Capacity = 4,476 gpm, one pump off at Beasley PS Capacity = 1,000 gpm and one pump off at Ferry PS Capacity = 800 gpm. The total capacity is 6,276 gpm (9,037,440 gpd)

TABLE IV-6: TCEQ Water System Minimum Requirements based on Demand

Facility	TCEQ Minimum Requirements Needed	Year 2025 System Needed	Year 2040 System Needed
		Conn. = 12,059 Pop. = 36,177	Conn. = 17,085 Pop = 51,256
Total Storage	200 gal/conn.	(200 gal/conn * 12,059 conn) = 2,411,775gal	(200 gal/conn * 17,085 conn) = 3,417,075 gal
Elevated Storage	100 gal/conn.	1,205,888 gal	1,708,538 gal
Ground Storage	100 gal/conn.	1,205,888 gal	1,708,538 gal
High-Service Pumps	Peak hourly demand	7.516 MGD (5,220 gpm)	10.649 MGD (7,395 gpm)
Distribution Lines	1.5 gpm/conn.	6" - 20"	6" - 20"
Pressure	Residual	35 psi	35 psi
	Operating Fire Flow	20 psi	20 psi

In analyzing the existing capacity in Table IV-5 and comparing the TCEQ's minimum requirements based on demand in Table IV-6, it appears that the elevated storage capacity will become deficient in 2034.

In addition to meeting the TCEQ elevated storage criteria, sufficient storage should be provided to meet three hours of fire flow demand in excess of 3,500 gpm with no pumping according to Insurance Services Office, Inc. (ISO). The current system has an elevated storage capacity of 1.5 MG. The system is adequate and meets the maximum fire flow demand with no pumping (3,500 gpm multiply by 60 minutes/ hour multiply by 3 hours equals 630,000 gallons).

Ground storage must contain sufficient capacity to supply the difference between average and maximum demands. In addition to meeting the TCEQ storage criteria, sufficient ground storage should provide a minimum of 50% of the Maximum Day Demand (MD). For 2025, the District's ground storage capacity provided 74% of the maximum day demand (4.45 MG ground storage capacity divided by 6.013 MGD peak maximum day demand); therefore, the system meets and exceeds the minimum capacity needed.

3. Evaluation of Existing Pumping Facilities

The minimum high-service pump capacity for the period between 2025 through 2040 on was calculated according to TCEQ minimum standard requirements, Section 290.45 (b)(1)(D)(iii). "Two or more pumps that have a total capacity of 2.0 gpm per connection or that have a total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service, whichever is less, at each pump station or pressure plane. For systems which provide an elevated storage capacity of 200 gallons per connection, two service pumps with a minimum combined capacity of 0.6 gpm per connection are required at each pump station or pressure plane. If only wells and elevated storage are provided, service pumps are not required."

The current available high-service pump capacity is 9.04 MGD (6,276 gpm), and the required capacity in 2025 according to TCEQ is 7.516 MGD (5,220 gpm) based on the calculated peak hourly demand. This indicates that the pump system is currently able to meet the peak hourly demand. Using the projected flows as noted in Table IV-4, the required capacity will be 9.264 MGD (6,433 gpm) in 2034. This means that the District will need to start assessing the pumping system by that time.

4. Evaluation of Existing Transmission System

The District experiences a variation of water demand as a result of the influx of weekend tourists/visitors who occupy the hotels, motels and condominiums as well as the influx of additional people on major holidays; therefore the amount of water supply needed by the District fluctuates.

Two providers, one on the north side (the SPMWD) and one on the south side of the District's service boundary (the City of Corpus Christi) supply water to the distribution system. From the north the District maintains a transmission line that also serves as a distribution line for customers along Harbor Island; therefore the District maintains a secondary Service Boundary along Harbor Island; which is discussed in Chapter II. The boundary runs parallel with SH 361 from the City of Aransas Pass to the City of Port Aransas. This system consists of 12-inch to 24-inch steel and PVC waterlines which convey water from the Districts Beasley Street PS in Aransas Pass, to the District's ground storage tank at the Ferry Landing PS. The northern transmission system was assessed in 2012 to determine the cost of increasing the capacity of the delivery system. The results of this study are found in the report titled *Harbor Island Water Improvements Route Study*, prepared by Urban Engineering, dated April 20, 2012. Due to the cost of upgrading the transmission system a phased approach was considered the best option. In 2013 the District constructed Phase 1, which upsized the existing 12-inch transmission main in the City of Aransas Pass to a 24-inch main. The Beasley Street PS was also upgraded at that time. As noted in Chapter III, the District also replaced a segment of the 12-inch transmission main and the 20-inch segment that traverses the Corpus Christi Ship Channel. This southerly transmission system is owned and operated by the City of Corpus Christi. The system consists of 16-inch to 20-inch steel and PVC waterlines which convey water from the City's Sand Dollar PS to the Districts ground storage tank at the Mustang Island PS. The southern transmission system was also assessed in 2012 to determine the cost of increasing the capacity of the delivery system. The results of this study are found in the report *Harbor Island Water Improvements Route Study*.

Due to the water usage restrictions being implemented by the City of Corpus Christi the amount of supply has been reduced in recent years. It is unknown if the current restrictions

and usage trends will continue, but we wanted to assess the capacity of the transmission systems for this Master Plan update.

Using the 2019 to 2024 water usage data, we found that the average annual total supply from the SPMWD was 211,175,000 gallons and the average annual total supply from the City of Corpus Christi was 423,854,000 gallons. This indicates that on average, the District obtains approximately 34% of its water from SPMWD and 66% from the City of Corpus Christi. Using this information, we projected the current water usage and peak demand flows for each water supply source and tabulated the information in the following tables.

TABLE IV-7: Source of Water Supply Current Demand

Year	Average Daily Demand (MG)		Maximum Daily Demand (MG)	
	Beasley PS	Mustang Island PS	Beasley PS	Mustang Island PS
2025	0.72	1.40	1.13	2.20
2030	0.79	1.53	1.24	2.41
2035	0.87	1.68	1.36	2.65
2040	0.95	1.85	1.50	2.91

TABLE IV-8: Source of Water Supply Peak Demand

Year	Average Daily Demand (MG)		Maximum Daily Demand (MG)	
	Beasley PS	Mustang Island PS	Beasley PS	Mustang Island PS
2025	1.30	2.52	2.04	3.97
2030	1.46	2.83	2.30	4.46
2035	1.64	3.18	2.58	5.01
2040	1.84	3.57	2.90	5.62

According to the water system model, the transmission main from Beasley Street PS to the Ferry Landing PS can provide up to 1.69 MGD with the operating pressure at Beasley being 80 psi and maintain the minimum pressure of 20 psi. This flow meets the average daily and maximum daily

demand under current water usage trend to 2040. Under the peak demand scenario, the average daily demand is met until 2035 but maximum daily demand cannot be met.

According to the water system model, the transmission main from the Sand Dollar PS to the Mustang Island PS can provide up to 3.31 MGD with the operating pressure at Sand Dollar being 68 psi and maintain the minimum pressure of 20 psi. This flow meets the average daily and maximum daily demand under current water usage trend to 2040. Under the peak demand scenario, the average daily demand is met until 2035 but maximum daily demand cannot be met.

The transmission systems both meet the projected flow under the current water usage trend. If the water usage trends upwards over the next few years, the District will need to request an increase in the supply provided by the SPMWD or the supply provided by the City of Corpus Christi. If a northern supply is the best solution, then the District should revisit the recommendations provided in the *Harbor Island Water Supply Study*. If a southern supply directly from the City of Corpus Christi is more feasible or economical, then a new transmission main will need to be installed by the City of Corpus Christi or a joint City of Corpus Christi/District effort.

B. WATER PRESSURES

District officials indicated that the normal operating pressure is 47 – 52 psi, with a minimum residual pressure of 35 psi. These figures are consistent with the required pressures indicated in Table IV - 6. In order to evaluate the pressure system throughout the distribution system, the 2017 hydraulic model was updated with the latest pipe network, as well as the 2025 and 2040 estimated land use. The water system model development is discussed in detail in Chapter V.

C. DISTRIBUTION LINES, FIRE HYDRANTS, AND VALVES

The distribution system was evaluated using projected summer peaks flows, see Table IV-3, and using the projected peak demands as shown in Table IV-4. In both cases, the pressures in the system were found to be between 35 psi and 75 psi. The distribution system was also evaluated under fire flow conditions. The results of the pressure distribution analysis and fire flow analysis are discussed in detail in Chapter VI. The following are a list of general recommendations:

- Installation of any future water mains should be with 6” or larger lines. This will allow for the ability of the system to cope with the peak demands placed on it by the population fluctuations.
- A program should be implemented to replace old existing lines in business areas and should be replaced with minimum 6” lines. This program should be initiated after determination is made of the condition of pipe and its ability to provide the required service and demand.
- An effort should be made by the District to provide a distribution line loop system in a number of areas to ensure that in the event of a line break, continuous fire protection is provided at all times.

D. WATER UNACCOUNTED FOR

The difference between the water purchased and the amount sold in a defined time period is generally referred to as unaccounted water for the system. Some of the main causes for these losses are listed below:

- Leakage of lines
- Fire fighting or flushing lines
- Facility or inaccurate meters

District’s records trace the actual loss of water per month including unknown losses and known losses, such as flushing lines. The actual loss percentage averages between three to seven percent per month according to District personnel.

E. WATER QUALITY

According to the Annual Drinking Water Quality Report (2023 reporting year) which is depicted in Table IV-9, the District distributes and maintains high quality water well within the limits set by the EPA/ Centers for Disease Control and Prevention (CDC).

TABLE IV-9: Annual Drinking Water Quality (2023)

CONSTITUENT	NCWC&ID #4 AVERAGE LEVEL (ppm, unless otherwise noted)	EPA/ CDC'S MAXIMUM LEVEL/ LIMIT (ppm, unless otherwise noted)
Aluminum (ppb)	NA	200
Atrazine (ppb)	NA	3
Barium	NA	2
Bromodichloromethane	NA	Unregulated
Bromoform	NA	Unregulated
Chloramines	2.6	4
Chloride	NA	300
Chloroform	NA	Unregulated
Copper	0.294	1.3
Cyanide (ppb)	NA	200
Dibromochloromethane	NA	Unregulated
Fluoride	NA	4
Gross beta emitters (pCi/L)	NA	50
Hardness	NA	Unregulated
Lead (ppb)	3.44	15
Manganese (ppb)	NA	50
Nitrate	1	10
pH (units)	NA	> 7.0
Sulfate	NA	300
Total Dissolved Solids	NA	1000
Total Haloacetic Acids (ppb)	28	60
Total Trihalomethanes (ppb)	57	80
Turbidity (NTU)	NA	Treatment Technique
Zinc	NA	5

NTU (Nephelometric Turbidity Units)

F. OPERATIONAL PROCEDURES

1. Repairing of Water Mains and Services during times of moderate weather conditions: Due to the sandy soil conditions with the District's Jurisdiction, very few problems occur with line breakage. District officials indicate that during extreme conditions, they may repair a maximum of two breaks per month. This is a good indication that the system is in good condition and well maintained.

2. Checking and/or Replacing Water Meters: Each month meter readings are examined to determine abnormal readings. Any meter in question is replaced. This is also an excellent approach to maintenance of meters.
3. Flushing Water Lines: Water lines with dead ends (no loops) are flushed each month, or every two weeks depending on the conditions. The Fire Department flushes the fire hydrants as needed. This is also a further indication that the District has adopted quality maintenance procedures for the overall performance of its water lines.

G. WATER COSTS AND WATER SYSTEM RATES

Table IV - 10 illustrates the cost to residential customers purchasing 10,000 gallons of water within the District. The table also shows the water rates on which that amount was based.

TABLE IV-10: NCWC&ID #4 Residential Water Rates

Average Cost Per Month ¹	Residential Water Rate
\$70.84	\$24.20 ² min. \$5.83 /1000 gal over min.

1 Based on residence with a ¾" meter using 10,000 gallons.

2 Minimum rate includes first 2,000 gallons.

CHAPTER V - DEVELOPMENT OF WATER SYSTEM MODEL

This chapter describes the development and application of the water system model for the District's existing and future water system analysis. WaterGEMS by Bentley Systems, Inc. was the modeling software utilized to evaluate the water system. It was used in conjunction with AutoCAD 2025 and ArcGIS Pro 2.9.5 to depict the distribution network portion and assign density demands within the boundary. The database contains information pertaining to the diameter, pipe material, and length of all waterlines equal to or greater than 4-inch in diameter within the distribution system. The water demands used in the model are listed in Tables V-1 and V-2.

A. DEVELOPMENT OF MODEL

The District's water system model was originally developed in 2009 and was updated in 2017. For this Master Plan update, the model has been revised based upon the updated pipe network and land use base maps for 2025 and 2040, as described in Chapter II. The assumptions and criteria that were used in the development and verification of the District model are described by the following:

- Model nodes indicate waterline intersections, dead ends, and significant points of demand, pump stations/ground storage and elevated storage tanks.
- All known waterlines that are 4 inch or greater in diameter are included in the model. The pipe network was taken from the latest version of the Water District's GIS mapping
- Pump station piping configurations are obtained from record drawings and District personnel knowledge; pump performance data was obtained from manufacturer's pump curves and staff input.
- The pressure that is being investigated per node is the pressure at the ground elevation; therefore the ground elevation is the elevation assigned to the node in the model.
- The District is relatively flat and therefore assigning an elevation would have insignificant affects to the analysis of the model; therefore all nodes are assigned an elevation of zero with the exception of the pumps and tanks. The elevation assigned was the difference between the ground elevation and the elevation of the pump or tank.
- The flow data for the 2025 model was obtained from the District's supervisory control and data acquisition.

- Demands were assigned to nodes using Load Builder; a tool of WaterGEMS that leverages the spatial abilities of GIS software to distribute demands according to demand density information. The type of allocation tactic that was applied using Load Builder was 'Projection by Land Use.' There are two steps to this process. First, a service polygon per node was assigned. Second, the demand is allocated based upon the density per land use type of each service polygon that assigned the peak day demand. A global multiplier was applied to create the max hour demand for the system.
- Hazen-Williams C-factors (the pipe roughness coefficient) were assigned based on the pipe material.
- Minor losses occurring at valves, tees, bends, reducers, and other appurtenances within the piping system result in turbulence within the bulk flow as it moves through fittings. This type of loss is negligible compared to the head loss due to friction; therefore an overall minor loss was not applied to the model.

The hydraulic model is based on the latest version of the actual distribution system layout created in AutoCAD with added inputs for line sizes and the pipe roughness coefficient (Hazen Williams 'C' Factor). Node inputs consist of the water demand, a fire flow requirement and the node elevation.

B. WATER SYSTEM MODEL CALIBRATION

The model used in this Master Plan update was first established in 2009. At that time field data and knowledge obtained from District personnel was used to verify the model operation comparing predicted trends to observed performance. The updated model was calibrated to the average daily, maximum daily and peak hourly summer peak flows and peak demand flows using a global factor.

C. UPDATES TO THE 2017 MODEL

The following updates were made to the 2017 model so that we could carry out the water distribution system analysis:

- The latest version of the Water District's GIS and record drawings were reviewed to update the distribution system. The updated pipe network was added to the model.
- The Ferry Landing PS was included in the analysis.
- The 2025 and 2040 land usages were estimated for the Water Districts service area using a color-coded system, representing extra-low density, low density, medium density and

high density. The land use densities are discussed in Chapter II.C and shown on Figure II-4 and II-5. This information was inputted into the model in the form of four shape files.

- The 2025 calibrated model was modified by a factor to produce results under the 2025 and 2040 average daily (AD), maximum daily (MD), and peak hourly (PH) system demands.
- The water demands in GPM/acre were developed for the summer peak flow demand and the peak demand conditions. The demands are summarized in the following tables:

Table V-1: 2025 and 2040 Summer Peak Flow Demand Criteria

Land Use	Conn./Acre	Persons/Conn.	GPD/Person	GPD/Acre	GPM/Acre
Extra Low	1	3	70	210	0.146
Low	4.5	3	70	945	0.656
Medium	14.5	3	70	3,045	2.115
High	30	3	70	6,300	4.375

Table V-2: 2025 and 2040 Peak Demand Criteria

Land Use	Conn./Acre	Persons/Conn.	GPD/Person	GPD/Acre	GPM/Acre
Extra Low	1	3	105	315	0.219
Low	4.5	3	105	1,417.5	0.984
Medium	14.5	3	105	4,567.5	3.172
High	30	3	105	9,450	6.563

D. WATER DEMAND SCENARIOS

A steady-state simulation was performed for the existing 2025 and future water systems 2040. This analysis determines the operating behavior under steady-state conditions (flow rates and hydraulic grades remaining constant over time). This type of analysis was used to determine pressure and flow rates during existing and peak demand scenarios. Multiple scenarios were produced to analyze the water system reaction to different demands and physical conditions, including fire flow situations.

1. Water Distribution System Analysis

The model was run using the average daily, maximum daily and peak hour demand for existing conditions, 2025 and the future conditions, 2040. The following conditions were used in our assessment of the system:

Existing Conditions 2025

- Water level in the existing Port Aransas and new Mid-Island elevated storage tank was set at the high-point of the operating range, 113-ft and at the low point 109-ft/106-ft.
- The water level in the ground storage tank was set at the mid-point, 23-ft.
- The Beasley Street PS was pumping 1,000 gpm, the pumps for the new Mustang Island PS were set to deliver 2,238 gpm and the Ferry Landing pumps were set to deliver 800 gpm. The combined flow was the capacity of the existing pumps.

Future Conditions 2040

- Water level in the existing Port Aransas and new elevated storage tanks was set at the high-point of the operating range, 113-ft and at the low point of the operating range 109-ft/106-ft.
- The water level in the ground storage tank was set at the mid-point, 23-ft.
- The Beasley Street PS was pumping 1,000 gpm and the pumps for the new Mustang Island PS were set to deliver 2,238 gpm and the Ferry Landing pumps were set to deliver 800 gpm. The combined flow was capacity for the existing pumps.

2. Water Distribution System - Fire Flow Analysis

The water distribution system was also assessed under existing and future maximum daily demands with fire flows at each node to determine the amount of flow available at each node for fire suppression. The City of Corpus Christi requires 750 gpm in residential areas, 1,500 gpm in commercial areas and 3,000 gpm in industrial areas. The TCEQ requires that the fire flow be the minimum flow achieved when the system pressure is 20 psi or greater. The following conditions were set in the model:

Existing Conditions 2025

- Water level in the existing Port Aransas and new elevated storage tanks was set at the high-point of the operating range, 113-ft and at the low point of the operating range 109-ft/106-ft.
- The water level in the ground storage tank was set at the mid-point, 23-ft.
- The Beasley Street PS was pumping 1,000 gpm and the pumps for the new Mustang Island PS were set to deliver 2,238 gpm and the Ferry Landing pumps were set to deliver 800 gpm. The combined flow was capacity for the existing pumps.

Future Conditions 2040

- Water level in the existing Port Aransas and new elevated storage tanks was set at the high-point of the operating range, 113-ft and at the low point of the operating range 109-ft/106-ft.
- The water level in the ground storage tank was set at the mid-point, 23-ft.
- The Beasley Street PS was pumping 1,000 gpm and the pumps for the new Mustang Island PS were set to deliver 2,238 gpm and the Ferry Landing pumps were set to deliver 800 gpm. The combined flow was capacity for the existing pumps.

CHAPTER VI - SUMMARY OF WATER ANALYSIS AND RECOMMENDATIONS

In order for the District to provide safe and adequate amounts of water to the general public, they must adhere to guidelines set out by the TCEQ. Outlined below are comparisons of existing conditions that are required by TCEQ.

Another set of guidelines that have been used on past master plans to identify any deficiencies within the water system during fire flow demands set out by the former State Board of Insurance (SBI). Insurance companies adjust their premiums based on the water system capabilities to suppress certain size fires. Based on population, the State Board of Insurance had guidelines outlining the amount of elevated storage, ground storage, high service pump capacity ratings, distribution line sizes, and the number of certified water system operators. Between the periods of 1997-1998, a transition was made from the State Board of Insurance requirements to grading criteria defined by the newly formed Insurance Services Office (ISO), a subsidiary of Verisk Analytics.

The ISO does not have specific requirements that have to be met; however, they do analyze each building within the city and determine a flow, in gpm, that will be needed to suppress a fire at that building. They then analyze the water system around that particular building to determine if the fire flow demands can be met.

The rating system that ISO uses is called the Public Protection Classification (PPC). The PPC is a point type system that adds and deducts points based on the condition of the District's overall water system. Nationwide, every water district or city receives a rating between one and ten, with one being the best; the District currently has a rating of four. Insurance companies then use the ratings produced by ISO to determine insurance premiums for the buildings within the District's service boundary.

A. CONTRACTUAL AGREEMENT WITH CITY OF CORPUS CHRISTI & SPMWD

The City of Corpus Christi and SPMWD have contractual agreements with the District to provide a maximum amount of water to the District per day. SPMWD is contracted to provide 1.2 MGD and the City is contracted to provide 7.23 MGD (2025-2029). Total contractual supply is 8.43 MGD. Based on the 2019 to 2024 peak summer data, the City and SPMWD are only providing a maximum daily amount of 3.62 (2,515 gpm), which is 43% of the contracted amount. As indicated in Table IV-3 and IV-4, the maximum daily demand in Year 2025 is 3.33 MGD under current water usage and 6.01 MGD under peak conditions. Under current water use conditions the contracted supply will meet the maximum daily flow requirement. Under current water usage conditions the water supply will meet demand until 2030. Under the projected peak flow conditions, the demand exceeds the firm capacity of water currently supplied by both water providers. Due to water restrictions adopted by the City of Corpus Christi, it is unlikely that they will consider increasing the supply to the District at this time. It is recommended that the District re-evaluate the water demands in 2030 and if the trend is higher than the current projections that they begin negotiations with both the City of Corpus Christi and SPMWD in order to provide additional water supply capacity to the District at that time.

B. HIGH SERVICE PUMP CAPACITY

As indicated in Table IV-5 and IV-6, the current high service pump capacity under projected peak water usage is 5,220 gpm in 2025 and 7,395 gpm in 2040. The TCEQ minimum standard calculated capacity based on peak hourly demand is 6,276 gpm. By 2034, the projected peak water usage will be 6,433 gpm which exceeds the TCEQ minimum. The District's pumping facilities are adequate at the present time but by 2034 the District will need to begin planning for an upgrade to the high service pumping system to meet the minimum requirements. It is recommended that the following actions be taken by the District.

The District could consider an upgrade to the Ferry Landing PS to increase the flow to supplement the new Mustang Island PS and Beasley Street PS. The new pumps will require a firm capacity of 1,950 gpm to bring the total system's firm capacity (including Mustang Island and Beasley PS) to 7,400 gpm. This upgrade will service to District until 2040 at which point the District will need to begin planning for another upgrade to the system.

The above assessment is based on the projected peak water demand conditions (see Table IV-4). As previously noted, if the current water usage trend continues the District will meet the peak hourly requirement until 2040 (see Table IV-3).

C. ELEVATED STORAGE

The TCEQ minimum required elevated storage for 2025 is 12,059 connections x 100 gallons per connection = 1,205,888 gallons. The District currently has a total elevated storage capacity of 1,500,000 gallons, which meets the TCEQ minimum requirement as shown above. According to the calculated projected service connections, the elevated storage will become deficient sometime after the year 2034 (14,863 connections x 100 gallons per connection = 1,486,269 gallons). This analysis is based on the projected growth of the connections to the distribution system. As we get closer to 2034, the growth should be assessed again. If the current trend continues, it is recommended that the following actions be taken by the District.

- Assess the system to determine the best location to construct a minimum 500,000 gallon elevated storage tank. This will increase the elevated storage to a total capacity of 2.0 MGD; which is projected to meet TCEQ's requirement of 100 gallons per connection of elevated storage beyond the year 2040.

D. GROUND STORAGE

The TCEQ minimum required ground storage for 2025 is 12,059 connections x 100 gallons per connection = 1,205,888 gallons. The District currently has a total ground storage of 2,950,000 gallons which exceeds TCEQ's minimum requirement. In 2040 the projected connections is 17,085 or 1,708,538 gallons; therefore the District will meet TCEQ's ground storage requirement beyond 2040. As noted in Chapter IV, the District is currently constructing a new 1,500,000 gallon ground storage tank at the Mustang Island PS. This new tank will increase the existing capacity to 4,450,000 gallons.

The ground storage is also required to meet 50% of the maximum daily demand. In 2025, projected peak maximum daily flow is 6.01 MGD (6,013,077 gallons). The required ground storage capacity in 2025 is 6,013,077 gallons x 0.5 = 3,006,539 gallons and the total available is 2,950,000 gallons. The total available ground storage capacity will not meet this requirement until

the new 1,500,000 gallon ground storage tank at the Mustang Island PS is in service at which point the total capacity will be 4,450,000 gallons. Based on the 50% of maximum daily demand requirement, the new total capacity of 4,450,000 gallons will last until 2040.

E. DISTRIBUTION SYSTEM IMPROVEMENTS

The distribution system assessment is based on the results of the WaterGEMS modeling. The model development is discussed in Chapter V. We assessed the distribution system under current (2025) conditions and future conditions (2040) using the current water usage trend and a peak water usage trend, as discussed in Chapter IV.

1. Assessment of Existing 2025 Conditions Current Water Usage Trend

Under the existing conditions the average daily flow of 2.11 MGD (1,469 gpm) is met with single pump on at Beasley, Mustang and Ferry with 3,108 gpm flowing to the elevated storage. The maximum daily flow of 3.33 MGD (2,312 gpm) is met with 2,317 gpm flowing to the elevated storage. The peak hourly demand of 4.16 MGD (2,890 gpm), is met with 1,771 gpm flowing to the elevated storage.

The existing condition (2025) system pressure under average day, maximum day and peak hour ranged from greater than 35 psi to 75 psi. As can be seen, the system pressures under the existing conditions meet the TCEQ minimum pressure requirements of 35 psi.

2. Assessment of Future 2040 Conditions Current Water Usage Trend

Under the future conditions the average daily flow of 2.80 MGD (1,945 gpm) is met with single pump on at Beasley, Mustang and Ferry with 2,672 gpm flowing to the elevated storage. The maximum daily flow of 4.41 MGD (3,062 gpm) is met with 1,626 gpm flowing to the elevated storage. The peak hourly demand of 5.51 MGD (3,827 gpm), is met with 903 gpm flowing to the elevated storage.

The future condition (2040) system pressure under average day, maximum day and peak hour ranged from greater than 35 psi to 75 psi. As can be seen, the system pressures under the existing conditions meet the TCEQ minimum pressure requirements of 35 psi.

3. Assessment of Existing 2025 Conditions Peak Water Usage

Under the existing peak conditions the average daily flow of 3.82 MGD (2,653 gpm) is met with single pump on at Beasley and Ferry and 2 pumps on at Mustang Island with 2,868 gpm flowing to the elevated storage. The maximum daily flow of 6.01 MGD (4,176 gpm) is met with 1,462 gpm flowing to the elevated storage. The peak hourly demand of 7.52 MGD (5,220 gpm), is met with 491 gpm flowing to the elevated storage.

The existing peak condition (2025) system pressure under average day, maximum day and peak hour ranged from greater than 35 psi to 75 psi. As can be seen, the system pressures under the existing conditions meet the TCEQ minimum pressure requirements of 35 psi.

4. Assessment of Future 2040 Conditions Peak Water Usage

The 2040 conditions were initially assessed with the existing 16-inch transmission main from the Mustang Island PS to the old elevated storage tank. Under these conditions the average daily flow of 5.41 MGD (3,759 gpm) is met with 1,939 gpm flowing to storage. As the demand on the system increases, the pumped flow had to be met with increased flow from the elevated storage. The maximum daily flow of 8.52 MGD (5,916 gpm) cannot be met and must be supplemented with 18 gpm from the elevated storage tanks. The peak hour flow of 10.65 MGD (7,395 gpm) also cannot be met and must be supplemented with 1,368 gpm from the elevated storage. As the demand on the system increases, the pumping rate at the new Mustang Island PS increases to meet the demand. The increased pump rate increases the pressure at the pump station and limits the amount that the pumps will deliver. To increase the flow from the Mustang Island PS, a 24-inch transmission main from the pumping station to the old elevated storage tower was assessed.

With the proposed 24-inch transmission main in place, the average daily flow of 5.41 MGD (3,759 gpm) is met with 3,214 gpm flowing to the elevated storage tanks. The maximum daily flow of 8.52 MGD (5,916 gpm) is also met with 1,229 gpm flowing to the elevated storage. The peak hourly flow of 10.65 MGD (7,395 gpm) cannot be met when the water

level in the tower is at the upper level of the operating range. The peak hourly flow must be supplemented with 132 gpm from the elevated storage.

The above assessment is based on the projected peak water demand conditions (see Table IV-4). As previously noted, if the current water usage trend continues the District will meet the peak hourly requirement until 2040 (see Table IV-3). The pumping system should be reassessed in 2030 if the current water usage trend increases.

The future peak condition (2040) system pressure under average day, maximum day and peak hour ranged from greater than 35 psi to 75 psi. As can be seen the system pressures under the existing conditions meet the TCEQ minimum pressure requirements of 35 psi.

F. FIRE FLOW IMPROVEMENTS

The hydraulic model was run in the fire flow analysis mode under the current water usage condition and under the peak demand condition. In both cases, there are 21 areas within the service boundary that do not meet fire flow requirements of 20 psi at 750 gpm. These areas are located at the end of dead-end lines at various locations in the City of Port Aransas and on Mustang Island. The following locations were identified as being deficient:

- The existing 6-inch ACP at the marina park provides 627 gpm. If it is upsized to an 8-inch PVC it will meet the 750 gpm fire flow demand. See Figure VI-1.
- The existing 6-inch ACP on Private Road A only provides 627 gpm. If it is upsized to an 8-inch it will meet the 750 gpm fire flow demand. See Figure VI-2.
- The existing 4-inch ACP on Private Road E only provides 470 gpm. If a 6-inch looping main is installed by HDD and the Private Road A improvements are completed it will meet the 750 gpm fire flow demand. See Figure VI-2.

- The existing 4-inch ACP on Private Road D will only provide 539 gpm. If a 6-inch looping main is installed by HDD and the Private Road A improvements are completed it will meet the 750 gpm fire flow demand. See Figure VI-2.
- The existing 4-inch ACP on Private Road C only provides 598 gpm. If a 6-inch looping main is installed by HDD and the Private Road A improvements are completed it will meet the 750 gpm fire flow demand. See Figure VI-2.
- The existing 2-inch PVC on Del Mar Lane only provides 76 gpm. It does not require upsizing at this time as it can be serviced by the fire hydrant on Avenue G.
- The existing 4-inch ACP on North Palimino Drive only provides 623 gpm. If a 6-inch looping main is installed it will meet the 750 gpm fire flow demand. See Figure VI-3.

G. PROPOSED WATER SYSTEM PROJECTS

The recommended improvements and probable costs for budgeting purposes are listed below. The detailed cost estimates are included in Appendix A. All costs are based on 2025 prices and include allowances of 20 percent for construction contingencies and 15 percent for engineering design. The effect of inflation should be considered when planning budget costs for these recommended improvements.

High Service Pump Capacity Improvements

New pumps at the Ferry Landing pumping station with a firm capacity of 2.88 MGD (2,000 gpm) at a cost of \$708,849, see also detailed cost estimate in Appendix A. Note this cost assumes that the existing electrical system and pump building can accommodate the new pumps.

Elevated Storage Improvements

Construct a new 0.5 MG elevated storage facility at a cost of \$7,564,470 see also detailed cost estimate in Appendix A.

Distribution System Improvements

Transmission

Construct 24-inch transmission main from the Mustang Island PS to the old elevated storage facility on SH 361/Mariners Drive at a cost of \$12,024,573 see also detailed cost estimate in Appendix A.

Looping Mains

Several locations in the distribution have been identified where a watermain can be added to enhance the flow capabilities, at a cost of \$165,531 to construct the looping main at Location 1 (see Sheet 7, Appendix C), \$248,952 to construct the looping main at Location 2 (see Sheet 22, Appendix C), and \$91,644 to construct the looping main at Location 3 (see Sheet 25, Appendix C), see also detailed cost estimate in Appendix A.

Fire Flow Improvements

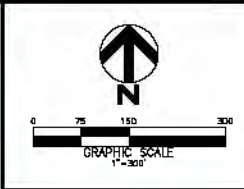
The following fire flow improvements are required to increase the available fire flow capacity. A detailed cost estimate for each location is provided in Appendix A:

Upsizing the existing 6-inch ACP at the marina park to an 8-inch PVC at a cost of \$833,681 will meet the 750 gpm fire flow demand. See Figure VI-1.

Upsizing the existing 6-inch ACP to and 8-inch PVC along Private Road A and installing new 6-inch PVC on Private Roads B, C, D and E to create a looped system at a cost of \$1,327,434 will meet the 750 gpm fire flow demand. See Figure VI-2.

Installing a new 6-inch PVC to create a looped system on North Palimino Drive at a cost of \$131,744 will meet the 750 gpm fire flow demand. See Figure VI-3.

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LEGEND

- W EXIST. WATERLINE
- W PROP. WATERLINE
- WWM EXIST. WASTEWATER LINE
- WWM EXIST. WASTEWATER FORCEMAIN
- FM EXIST. FIRE HYDRANT
- FM EXIST. WASTEWATER MANHOLE
- FM EXIST. WASTEWATER LIFTSTATION

FIGURE VI-1
FIRE FLOW IMPROVEMENTS
MARINA 6" WATERLINE TO 8" WATERLINE
NUECES COUNTY WATER CONTROL AND
IMPROVEMENT DISTRICT #4

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LEGEND

- W EXIST. WATERLINE
- W PROP. WATERLINE
- WW EXIST. WASTEWATER LINE
- WW EXIST. WASTEWATER FORCEMAIN
- FH EXIST. FIRE HYDRANT
- S EXIST. WASTEWATER MANHOLE
- EXIST. WASTEWATER LIFTSTATION

FIGURE VI-2
FIRE FLOW IMPROVEMENTS
PRIVATE ROAD A WATERLINE
NUECES COUNTY WATER CONTROL AND
IMPROVEMENT DISTRICT #4

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CHAPTER VII – EXISTING WASTEWATER SYSTEM

A. COLLECTION SYSTEM

The wastewater collection system can be identified as separate components, one serving the City of Port Aransas and the other serving the remainder of Mustang Island, including the Terramar tracts. The two components are interconnected and the flow is presently transported by a series of lift stations to the District's North Wastewater Treatment Plant (WWTP).

The overall collection system consists of lift stations with force mains (an essential element of design in flat terrain areas such as the District's service area) and gravity lines varying in diameter from 4" to 24". Line materials generally consist of PVC pipe and some older clay pipe. Two additional lift stations, Merisol (completed in 2021) and Spoonbill (completed in 2024), have been constructed since the 2017 Master Plan update, bringing the total number of lift stations to 23. It should be noted that Merisol has yet to be put into service since there have not been any houses constructed in that subdivision. See Figure VII-1 for a schematic showing the existing interconnections and wastewater flow path throughout the system. The following table denotes each lift station and describes the existing pumps and their available pumping capacity.

TABLE VII-11: Existing Lift Stations

#	LOCATION	Quantity	HP -Type	PUMP CAPACITY*
1	La Concha #1	2	10 hp - Flygt	501
2	La Concha #2	2	12 hp - Flygt	1026
3	Mayan Princess (Previously Admiral's Row)	2	3 hp - Flygt	384
4	Lost Colony	2	10 hp - Flygt	466
5	Port Royal	2	15 hp - Flygt	560
6	Gulf Waters	2	5 hp - Flygt	405
7	LS #7	N/A	---	---
8	El Cortez (Previously Beachwalk)	3	20 hp - Flygt	809
9	Pioneer RV	2	15 hp - Ebara	513
10	Newport	2	20 hp - Flygt	1068
11	Island Moorings	2	15 hp - Flygt	560
12	Airport	2	10 hp - Flygt	727
13	Cemetery	2	20 hp - Flygt	943
14	Avenue G @ Alister	3	20 hp - Flygt	---
15	Avenue G @ 11 th St.	2	3 hp - Flygt	384
16	Channel Vista	2	5 hp - Flygt	400
17	Dunes	2	3 hp - Flygt	384
18	Private Marina	2	3 hp - Flygt	384
19	Municipal Harbor	2	3 hp - Flygt	313
20	Cotter	2	20 hp - Flygt	809
21	WWTP	2	10 hp - Flygt	466
22	Merisol	2	7.5 hp - Flygt	362
23	Spoonbill Bay	2	10 hp - Flygt	264

* Unchanged from 2017 Master Plan update

In order to maintain and operate the wastewater collection and treatment system, the District has a total of twenty-one employees. 13 certified operators; one of which is a level "B" WWTP operator, seven of which are level "C" WWTP operators, and five that have level "D" wastewater certifications.

B. NORTH WASTEWATER TREATMENT PLANT

The "North Wastewater Treatment Facility" (North WWTP) is located approximately 1/4 mile west of the intersection of Sixth Street and Avenue I, at the end of Ross Avenue in the City of Port Aransas, Texas. It is operated under TCEQ's TPDES Permit No. WQ0010846001 (issued June 18, 2020, expires June 18, 2025) and discharges into a freshwater pond, then to the marsh area west of the plant, then into the East Flats portion of Corpus Christi Bay in water segment No. 2481 of the Bays and Estuaries. A permit renewal application was submitted to TCEQ on December 16, 2024 and it is going through the review and approval process. As of the end of May 2025, a draft permit had not been received from TCEQ, but changes to the existing permit parameters are not anticipated.

Treated wastewater effluent from the North WWTP has been used since 2007 to irrigate the Palmilla Beach Golf Course (previously the Newport Golf Course) under reuse authorization R10846-001. Treated effluent is pumped from the plant via a 12" force main to a 100' diameter concrete storage tank (2.46 ac-ft) located at 103 Palmilla Beach Drive, Port Aransas, TX. The irrigation area is approximately 191 acres. District flow data from 2020 to 2024 indicated treated effluent flow to the golf course ranged from 59,000 gpd to 454,000 gpd.

The annual average design hydraulic capacity of the North WWTP is 1.88 MGD with a two-hour peak of 5.64 MGD (3,917 gpm). The plant consists of two separate treatment units: Unit 1 has capacity for 60% of the design flow and Unit 2 the remaining 40%. Flow is presently split 50:50 between the units until flow rate approaches the design capacity of the plant. Unit 1 is an oxidation ditch type aeration basin with horizontal rotors providing the air and Unit 2 is a circular tank with diffused air provided by blowers. Both units use complete mix activated sludge for the treatment process. All flow is pumped into the Influent Structure from offsite lift stations and from the plant lift station. The raw wastewater flows through the Influent Structure where debris is screened out and grit is removed, then flows to Splitter Box No. 1 where it is mixed with the return activated sludge (R.A.S.) from the Clarifiers and the mixed flow is then split between Unit 1 Aeration Basin and Unit 2 Aeration Basin. Mixed liquor leaves the aeration basins and flows through the Clarifiers No. 1 and No. 2, solids settle out and are pumped as R.A.S. to Splitter Box No. 1 and the clear water effluent flows over the Clarifier weirs and flows to the Chlorine Contact Chamber where it is

The first unit of the North WWTP was originally constructed in 1961, plant capacity expanded in 1984 to 1.33 MGD, and expanded again in 2003 to its present average capacity of 1.88 MGD. Recent improvements completed in early 2025 include a new generator/blower building housing, new centrifugal blowers, new backup diesel power generator and climate controlled electrical control room, new above ground air piping, dechlorination building refurbishment, digester

Average Daily Flow	1.88 MGD
Two Hour Peak Flow	5.64 MGD
Carbonaceous Biochemical Oxygen Demand (CBOD ₅)	10 mg/l
Total Suspended Solids (TSS)	15 mg/l
Ammonia Nitrogen (NH ₃)	2 mg/l
E. Coli, CFU or MPN per 100 ml	126
Dissolved Oxygen (DO)	5 mg/l

hauler and taken to the Cofe Valenzuela Landfill in Corpus Christi, Texas.

chlorinated and then de-chlorinated before being discharged as treated effluent. Settled solids in the Clarifiers are also pumped as waste activated sludge (W.A.S.) to the Aerobic Digestion for sludge stabilization. Waste solids flow through the Aerobic Digester and is circulated through the gravity Thickener for thickening. Settled thickened solids are airlift pumped back into the Aerobic Digester for continued stabilization and supernatant flows over weirs and is returned to the Plant Lift Station. Periodically the stabilized solids are drained to the sludge drying beds for solids dewatering. Filtrate from the drying beds return to the Plant Lift Station and dried solids periodically removed by Plant staff to large roll-off containers that are picked up by a licensed

from residential land owners is provided on the north side and the City of Port Aransas is leasing property from the District on the south side for its solid waste transfer station. It appears that any further expansion at the North WWTP must occur within the existing fenced property.

C. SOUTH WASTEWATER TREATMENT PLANT

A second treatment plant for the District has been considered for many years. The District has had the property and a TCEQ discharge permit for a plant to be located south of the City of Port Aransas for over forty years, just waiting on the right time to construct it. The District's property is a 10.9 acre tract of land on the west side of SH 361, approximately 1.66 miles south-southwest of the intersection of Bent Grass Drive and SH 361. Previous reports have referred to this future plant as the "Mid-Island Plant." Moving forward, this plant will be referred to as the "South WWTP." The South WWTP is permitted as TCEQ's TPDES Permit No. WQ0010846002 (issued December 9, 2019, expired December 9, 2024). Effluent is permitted to be discharged to mud flats via diffuser pipe, then to a tidal canal, then to Shamrock Cove, then into Corpus Christi Bay in water segment No. 2481 of the Bays and Estuaries. A permit renewal application was submitted to TCEQ on June 4, 2024 and it is going through the review and approval process. As of the end of May 2025, a draft permit has not been received from TCEQ, but changes to the existing permit parameters are not anticipated.

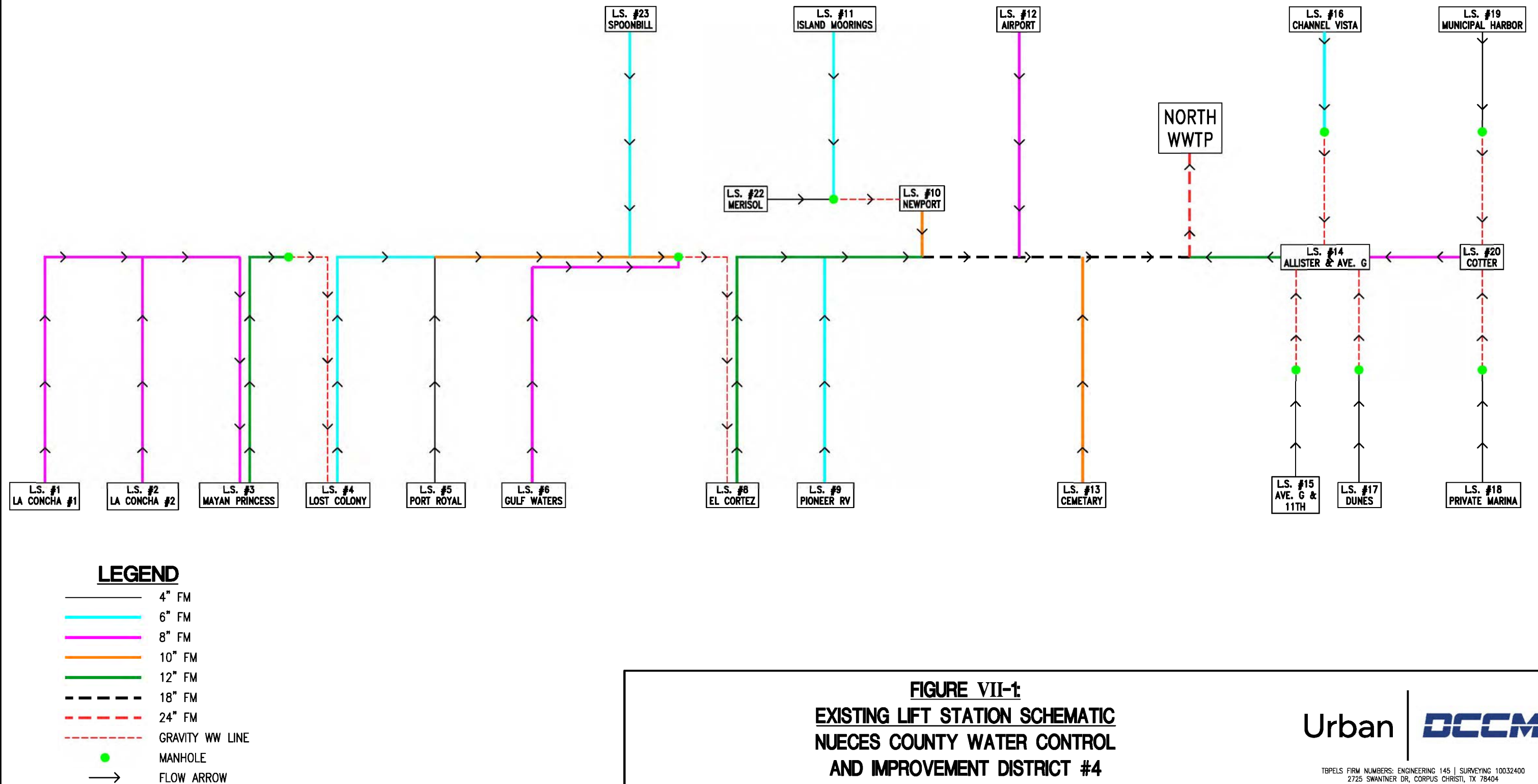
Over the last few years, the North WWTP has received wastewater flows that pressed District staff to move forward with adding capacity to their treatment system and the decision was made to do it at the proposed South WWTP location. The design of the South WWTP was completed in 2024, construction is starting the summer of 2025 and it is expected to be put into service by July 2027.

The new plant is designed as a conventional activated sludge treatment process compliant with the existing permit parameters listed below:

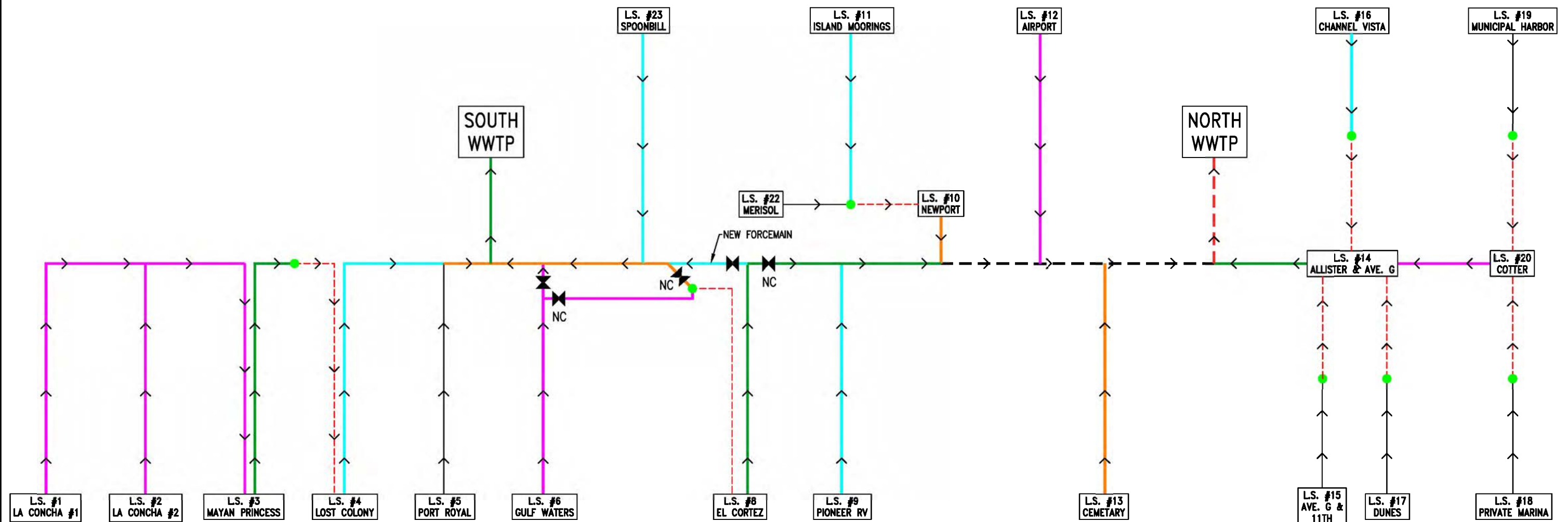
Average Daily Flow	0.6 MGD
Two Hour Peak Flow	1.8 MGD
Carbonaceous Biochemical Oxygen Demand (CBOD ₅)	20 mg/l
Total Suspended Solids (TSS)	20 mg/l
Enterococci, CFU or MPN per 100 ml	35
Dissolved Oxygen (DO)	6 mg/l

There are eight existing lift stations on Mustang Island that are presently pumping to the North WWTTP and will have their flow redirected to the new South WWTTP. Force main improvements and valving will allow the existing lift stations to still pump to the North WWTTP should they need to. Design of these offsite utilities to support the new South WWTTP will be finalized in the second quarter of 2025 and bidding/construction commencing in the third quarter. See Figure VII-2 for a schematic showing the future interconnections and wastewater flow path throughout the system following completion of the South WWTTP.

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LEGEND

- 4" FM
- 6" FM
- 8" FM
- 10" FM
- 12" FM
- - - 18" FM
- - - 24" FM
- - - GRAVITY WW LINE
- MANHOLE
- FLOW ARROW
- ✕ NC VALVE (NORMALLY CLOSED)

FIGURE VII-2:
FUTURE LIFT STATION SCHEMATIC
NUECES COUNTY WATER CONTROL
AND IMPROVEMENT DISTRICT #4

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CHAPTER VIII – WASTEWATER FLOW ANALYSIS AND LOAD FACTORS

In order to evaluate the adequacy and size of the wastewater collection and treatment system, it is necessary to determine the peak wet weather flow (PWWF), wastewater systems have to be able to handle the peak flow. PWWF is normally a function of average per capita daily flow plus a peaking factor to cover infiltration (ground water) and inflow (rainfall). The operating data of wastewater flows from 2019 to 2024 is included below. Population used to determine the average flow per capita per day (gpd/c) is based on the population shown in Table II-1 in Chapter II.

TABLE VIII-1: Wastewater Treatment Plant Operating Data 2019-2024

Monthly Wastewater Flow (gal)						
DATE	2019	2020	2021	2022	2023	2024
JAN	23,795,000	22,537,000	28,675,000	24,490,000	22,351,000	27,342,000
FEB	21,845,000	20,692,000	24,164,000	24,724,000	19,964,000	25,424,000
MAR	26,326,000	25,730,000	34,131,000	29,636,000	26,753,000	34,193,000
APR	25,406,000	17,100,000	30,930,000	27,900,000	26,760,000	26,520,000
MAY	33,347,000	34,410,000	48,980,000	34,565,000	29,574,000	33,201,000
JUN	43,592,000	39,510,000	48,540,000	40,440,000	39,480,000	43,380,000
JUL	41,653,000	39,432,000	69,502,000	42,005,000	49,290,000	50,158,000
AUG	31,917,000	36,301,000	37,789,000	32,240,000	34,193,000	36,301,000
SEPT	25,188,000	32,280,000	29,760,000	33,420,000	27,960,000	35,760,000
OCT	23,948,000	27,745,000	35,681,000	24,521,000	28,241,000	27,993,000
NOV	21,848,000	25,770,000	24,270,000	24,360,000	24,810,000	23,610,000
DEC	21,421,000	24,862,000	23,095,000	23,126,000	23,808,000	22,475,000
Annual Total (gal)	340,286,000	346,369,000	435,517,000	361,427,000	353,184,000	386,357,000
ADF (gpd)	932,290	948,956	1,193,197	990,211	967,627	1,058,512
ADF per Capita (gpd/c)	30	30	38	29	28	30

* ADF = Average Daily Flow

In most communities, wastewater flow is composed of residential, commercial and industrial flow; however, in Port Aransas there is no industry, so the greatest impact is from the residential community.

In previous Master Plan versions, the average flow per person was determined to be 65 gpd/c which was derived from the raw operating data for the peak summer months (June to August). A minimum peaking factor of 3.0 is typical and was used to arrive at the wet weather peak flow, which equated to 195 gpd/c. All this information was used to evaluate line sizes and applied to the projected population and land usage to arrive at the various milestones for the collection system improvements.

Based on the 2019 to 2024 total number of connections and (3) persons per connection, the average flow per person was determined to be 42 gpd/c for the peak summer months (June to August). The deviation in flow from previously calculated 65 gpd/c is likely due to the drought conditions over the past few years. The lack of rainfall correlates to lower rates of inflow and infiltration into the wastewater collection system, which in turn results in reduced flows to the WWTP. See Table VIII-2 below for monthly precipitation data from the “PORT ARANSAS 11 SSW” monitoring station located at 8185 TX-361, Corpus Christi, TX 78418 (Fire Station 16 located on Mustang Island next to the District’s Mustang Island PS). When comparing the data shown in Table VIII-1 and VIII-2, the correlation is clear; 2021 had 53 inches of rainfall and a calculated ADF per capita of 38 gpd/c. All other years had approximately 26-35 inches of rainfall and calculated ADFs per capita ranging from 28-30 gpd/c, a marked difference from the 2021 calculated value.

TABLE VIII-2: Monthly Precipitation Data 2019-2024

Monthly Precipitation (inches)						
DATE	2019	2020	2021	2022	2023	2024
JAN	2.33	1.43	4.87	1.85	0.52	2.95
FEB	1.07	0.30	0.50	1.11	0.31	1.60
MAR	1.56	0.43	0.56	0.15	0.52	1.05
APR	2.59	0.82	0.88	0.38	5.14	0.28
MAY	4.68	6.86	12.83	2.69	1.28	2.63
JUN	5.27	7.65	3.57	0.04	1.13	3.83
JUL	0.02	4.68	14.46	0.06	4.57	9.46
AUG	0.38	0.05	1.22	6.66	3.50	0.84
SEPT	3.03	1.17	3.62	5.02	0.24	9.76
OCT	1.18	0.38	8.32	0.85	4.01	1.12
NOV	2.43	1.88	1.37	6.33	4.80	0.44
DEC	4.06	1.07	0.39	1.18	1.13	1.04
Annual Total (in)	28.60	26.72	52.59	26.32	27.15	35.00

The Texas Administrative Code (TAC) Title 30, Part 1, Chapter 217 provides a range of 75 to 100 gpd/c for typical residential wastewater design, unless historical information is available. The District's per capita rate is difficult to pin down due to several factors including the wide fluctuation in population over the year, the mix of residential, tourists, and transient accommodations, and the recent drought. For the purpose of this Master Plan update, the more conservative and typical value of 100 gpd/c (300 gpd/c peak) was utilized for current and projected flow estimations.

As discussed in Chapter IV, the projected population has a direct correlation to the projected density established within the service boundary and can be used interchangeably. The following table depicts the projected population density used to calculate the current and future flows during the peak 2-hour, diurnal periods.

TABLE VIII-3: Approximate Wastewater Flows Per Acre of Land

AREA	Avg. Density 2025 (Dwelling Units/acre)	Avg. Density 2040 (Dwelling Units /acre)	Peak Wastewater Flow (gal/cap/day)	Wastewater Flow 2025 - 2040 ¹ (gal/acre/day)
Gulf	2.2	4.6	300	1,980 – 4,140
Bay	0.3	1.2	300	270 – 1080
Old Town	3.9	4.5	300	3,510 – 4,050

1. Based on 3.0 persons per Dwelling Unit

The associated Master Plan Basemaps (Appendix C) of Mustang Island indicate the calculated 2025 wastewater flows and projected 2040 wastewater flows.

CHAPTER IX – WASTEWATER SYSTEM ANALYSIS

A. WASTEWATER TREATMENT PLANT ANALYSIS

The 1995 Master Plan proposed a 0.5 MGD expansion of the existing North WWTP and the probable construction of a new South WWTP (previously referred to as the Mid-Island WWTP) to cope with existing and future flows beyond 2016. The report intended to have the North Plant handle existing flows in the City of Port Aransas and the South Plant to handle flows from the existing and proposed development along Mustang Island. A Facility Plan, prepared in 1981, prompted the District to complete the design and obtain the discharge permit for a 1.2 MGD South WWTP.

The 0.5 MGD expansion of the North Plant from a capacity of 1.38 MGD to a capacity of 1.88 MGD was completed in 2003. The 0.5 MGD expansion was critical to handle the development of the island and extended the need for another expansion until 22 years later. Now, another expansion of capacity is planned with the construction of the South Plant.

According to the data from the 2009 Master Plan, during the peak summer months of 2008, June, July, and August, the wastewater flow reached 66.3% of the North WWTP capacity. The report also indicated that, if the population and projected density continue to grow as predicted, the plant would reach its 90% capacity of 1.69 MGD during the year 2015.

For the 2017 Master Plan update, the projections from the 2009 Master Plan were compared to more recent data to determine if the timing for construction of additional treatment capacity was required as noted above. Based on the updated flow data, it was determined that the existing North Plant capacity reached 69.8% (1.313 MGD) in 2014. Flow was projected using the TWDB population estimates and it was determined the plant would reach 90% (1.692 MGD) capacity by 2017 and 100% (1.88 MGD) capacity by 2020.

For this Master Plan update, data from 2019 through 2024 was analyzed. The data indicated the North WWTP treated a daily average of 1.370 MGD of wastewater during its peak summer months

which equate to 72.9% of the existing plant design average daily flow capacity. See the table below for the peak summer months average daily flow per year. The North WWTP has not reached capacity as predicted in the previous Master Plan update, likely due to the lack of rainfall as discussed in Chapter VIII.

TABLE IX-1: 2019 – 2024 Summer Peak Average Daily Flow

YEAR	Average Daily Flow (MGD)	Capacity of WWTP (%)
2019	1.275	67.8%
2020	1.253	66.7%
2021	1.697	90.2%
2022	1.248	66.4%
2023	1.336	71.1%
2024	1.412	75.1%
Average	1.370	72.9%

The TCEQ requires that engineering and financial planning for expansion and/or upgrading of the domestic wastewater treatment and/or collection facilities be underway when the existing system is processing at least 75% of its capacity for a period of three (3) consecutive months. Construction of an increase in capacity is required to be underway when the existing system is processing at least 90% of its capacity for a period of three (3) consecutive months. The 75% threshold was met in 2021 at which time design for the new South WWTP commenced.

Although the three (3) month 90% threshold has not been reached, there are times when daily flows to the North Plant exceed the 1.88 MGD plant capacity. During the wetter year 2021, there were four days that exceeded 2.0 MGD, one day was recorded at 3.81 MGD and there were three days in July that hit 4.65 MGD, 4.82 MGD and 4.63 MGD. To keep up with these peak days, design of the South WWTP was completed and construction is planned to begin in July 2025 and be complete by July 2027.

B. COLLECTION SYSTEM ANALYSIS

1. Service Area Development

The 2009 Master Plan calculated the collection system's serviceable area by extending the flow line of all gravity lines (illustrated in green on the Master Plan Basemaps found in Appendix C) to an elevation of 0.0' at the minimum slope required by the TCEQ, regardless of location. Manholes were not shown in all areas, but spacing of them shall not exceed the TCEQ's maximum spacing of 500'. The plan assumed that the future developers would be able to acquire a permit to grade their developable land up to an elevation of 5.0'; however, final calculations shall be performed to verify if these specific developments could effectively be served by the existing system. These "potential" wastewater lines have been reassessed and revised as required based on recent development within the NCWC&ID #4's service boundary for this Master Plan update.

"Potential" wastewater lines (i.e. extensions of collection lines) are shown on the plan Basemaps for guidance only in order to illustrate the practical reach of the collection system directly connected to each lift station. Where the extensions of these lines would require crossing adjacent property, provisions shall be made by the owner (developer) with the downstream tract for extension upstream, within the service area. In some areas, many of the existing lift stations cannot serve the furthest points of their individual basins and require additional means to serve these areas. Minor lift stations were chosen as the most practical method to serve the larger boundaries and are depicted on the plans to complement the nearest lift station and allow it to serve the extents of the proposed basin.

Some areas within the city limits are not presently tied to the system. However, extensions are indicated within streets and easements to provide service to them. These extensions are also shown as a guide only. The timing, or the responsibility for such extensions, will depend on the District's policies and development demands in the future.

The plan recognizes the uniqueness of these areas and that some areas are more impacted by tidal fluctuations than others and that it is possible for these areas to be developed in the future. Should this occur, our assumptions on density of development, particularly west of S.H. 361 are liberal to the extent that some additional flows could be contributed to the proposed ultimate

system without adversely impacting the system's capacity. A service plan for approval by the District must be submitted as part of the development plan. Notes to this effect have been added to the plan for clarification.

2. Gravity Network

As discussed in Chapter II, the collection system serves two separate areas, the City of Port Aransas (i.e. Old Town) and the remainder of Mustang Island (i.e. Bay Area and Gulf Area). The City of Port Aransas is essentially built out, and the existing gravity system serving this area is operating as designed. As such, increased flows are typically not expected in this portion of the collection system and it is functioning as intended. The remainder of Mustang Island is located south of the City of Port Aransas, where the new growth is currently experienced and anticipated in the future. In this area, the gravity system is designed using the most current wastewater parameters. The new sanitary sewers are designed to convey the flows based on current conditions and function as intended. Due to the flat nature of Mustang Island, the gravity sewers drain to lift stations that are located along the SH 361 corridor. These lift stations then pump the wastewater via force mains from the south end of the District's service area to the wastewater treatment plants, see Section 3 below.

Existing older clay gravity lines that have not been rehabilitated or replaced should be repaired or improved with CIPP (Cured-in-Place Pipe). This process is relatively less expensive than replacing the clay pipe with new material and extends the life span of the existing structures. Although it has not been a problem in recent years, rehabilitation of clay lines will also reduce the amount of I/I entering the collection system.

3. Lift Station Pressure System

The existing lift stations and force main network, currently discharge to the North WWTP (See Figure VII-1). Upon commissioning of the South WWTP and associated offsite utilities, flow will be split between the two plants. Flow from El Cortez LS (#8) and southward will be diverted to the South WWTP (see Figure VII-2) and lift stations to the north will continue to pump to the North WWTP. Valves will be installed on the new and existing force main network on Mustang Island, as part of the offsite utility improvements, which will allow all flow to still be pumped to the North

WWTP, should the need arise. The following table summarizes how the lift station network will be divided between the plants under normal operating conditions:

Table IX-2: North and South WWTP Tributary Lift Stations

South WWTP		North WWTP	
LS #	LOCATION	LS #	LOCATION
1	La Concha #1	9	Pioneer RV
2	La Concha #2	10	Newport
3	Mayan Princess	11	Island Moorings
4	Lost Colony	12	Airport
5	Port Royal	13	Cemetery
6	Gulf Waters	14	Avenue G @ Alister
8	El Cortez	15	Avenue G @ 11 th St.
23	Spoonbill Bay	16	Channel Vista
		17	Dunes
		18	Private Marina
		19	Municipal Harbor
		20	Cotter
		22	Merisol

The construction and commissioning of the new South WWTP will greatly impact the flow patterns of wastewater through the District's collection system. Flow to the North Plant and all tributary lift stations will be reduced. With this reduction of flow, the existing lift station pumps will be sufficient under the new flow pattern. The El Cortez LS (#8) in particular will see a drastic reduction, as it will no longer receive flow from the lift stations upstream. Reference Figures VII-1 and VII-2 for existing and future flow schematics.

As part of the design of the Spoonbill Bay LS (#23), a force main system model was developed to help with pump selection. The design required that the pumps convey flow to the North WWTP under existing conditions and the South WWTP upon completion of construction. The other lift stations that are within the service area for the new South WWTP include the Lost Colony LS (#4), Port Royal LS (#5), Gulf Waters LS (#6), and El Cortez LS (#8). It should be noted that the Lost Colony LS (#4) receives flow from La Concha LS (#1), La Concha LS (#2), and Mayan Princess LS (#3). The model was used for determining flow requirements for the Spoonbill Bay LS to pump up

to the headworks of the new South WWTP with combinations of the other four lift stations pumping into the network.

Currently, the Lost Colony LS (#4), Port Royal LS (#5), and Spoonbill Bay LS (#23) all pump into a force main that discharges into a manhole that then gravity flows into the El Cortez LS (#8). The Gulf Waters LS (#6) pumps through a separate 8" force main pipe to the same manhole that the other stations discharge to. The El Cortez LS (#8) then pumps the flow northward via a 12" force main to the North WWTP. See Figure VII-1 for a schematic of the existing pressure system.

Upon commissioning of the South WWTP, the Lost Colony LS (#4), Port Royal LS (#5), Gulf Waters LS (#6), Spoonbill Bay LS (#23), and El Cortez LS (#8) will pump through an interconnected pressure system up to the plant influent structure. See Figure VII-2 for a schematic of the future pressure system.

Using the developed force main system model, multiple scenarios were assessed with different combinations of lift stations running within the South WWTP's pressure system. From the original design plans, the design flow of the Gulf Waters LS (#6) is stated to be 274 gpm. When pumping with no other lift stations running, the Gulf Waters LS (#6) will pump more than original design flow. This is due to the reduced length of force main pipe in the future scenario to convey wastewater to the new South WWTP. The Gulf Waters LS (#6) pumping capacity is reduced the greatest when the adjacent El Cortez LS (#8) is on.

C. PROJECTED 15 YEAR PERFORMANCE AND IMPROVEMENT PLAN

With the construction of the South WWTP, it is anticipated that the District's wastewater treatment capacity will be sufficient through year 2040.

As discussed in Part B, Sections 2 and 3 of this chapter, a majority of the lift stations in the City of Port Aransas are generally located in areas that have been fully developed (i.e. Old Town) and therefore future flows should not vary drastically from existing conditions. For the lift stations located in areas down Mustang Island with developable land (i.e. Bay Area and Gulf Area),

analysis should be conducted if/when there is major development proposed. Level control adjustments and reconfiguration may be required in response to the altered flow pattern once the South WWTP is operational. The SCADA system should also be evaluated if any modifications are made.

As discussed in Part B, Sections 3 of this chapter, the wastewater model results show that the Gulf Waters LS (#6) output capacity is greatly reduced when the adjacent El Cortez LS (#8) is on. It is recommended that pumps with higher flow and head capabilities be installed at the Gulf Waters LS (#6) in order to operate better when tied into the new force main system pumping to the South WWTP. For specific flow and head requirements, an in-depth analysis will be required to determine which new pump should be used. For budgetary purposes, rough order of magnitude costs for pump upgrades have been estimated at \$59,064 based on recently constructed projects. Note this cost assumes upgrades to the existing control panel are not required. See Appendix A for a full breakdown of costs.

APPENDIX A

NCWC&ID #4 MASTER PLAN OPINION OF PROBABLE CONSTRUCTION COSTS

- #1 Water Pump Upgrade at Ferry Landing PS
- #2 New 0.5 MG Elevated Storage Tank
- #3 24-inch Transmission Main SH 361 from Mustang Island PS to Old EST
- #4 Waterline Loop Improvement #1
- #5 Waterline Loop Improvement #2
- #6 Waterline Loop Improvement #3
- #7 Fire Flow Improvements – Marina 6" Waterline to 8" Waterline
- #8 Fire Flow Improvements – Private Road A Waterline
- #9 Fire Flow Improvements – Palimino Drive Waterline
- #10 Gulf Waters Lift Station Upgrade

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Centrifugal Water Pumps	2	EA	\$40,000	\$80,000
2	Discharge Header	1	LS	\$187,500	\$187,500
3	Suction Header	1	LS	\$187,500	\$187,500
4	SCADA	2	EA	\$34,300	\$68,600
5	Demo Existing Pumps	1	LS	\$15,000	\$15,000
	Subtotal				\$538,600
	Bonds (2%)				\$10,770
	Move-in Move-out (5%)				\$26,930
	Subtotal				\$576,300
	Contingencies (20%)				\$115,260
	Total Construction				\$691,560

\$17,289

\$708,849

OPINION OF PROBABLE CONSTRUCTION COST

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

#2 - New 0.5 MG Elevated Storage Tank

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	0.5 Million Gallon Composite	1	LS	\$4,012,500	\$4,012,500
2	Yard Piping	1	LS	\$112,500	\$112,500
3	Waterline Connection	1	EA	\$30,000	\$30,000
4	Electrical & SCADA	1	LS	\$562,500	\$562,500
5	Fire Hydrant Assembly	1	EA	\$11,000	\$11,000
6	Concrete Paving	3000	SY	\$150	\$450,000
7	Caliche Access Road	2780	SY	\$50	\$139,000
8	Chainlink Security Fence	700	LF	\$80	\$56,000
9	SWPPP	1	LS	\$8,000	\$8,000
10	Allowance for Unanticipated Imp.	1	AL	\$100,000	\$100,000
	Subtotal				\$5,481,500
	Bonds (incl. in Item 1)				
	Move-in Move-out (incl. in Item 1)				
	Subtotal				\$5,481,500
	Contingencies (20%)				\$1,096,300
	Total Construction				\$6,577,800

Engineering (15%)

\$986,670

TOTAL

\$7,564,470

OPINION OF PROBABLE CONSTRUCTION COST

NCWCID #4 2025 MASTERPLAN UPDATE
PORT ARANSAS, TEXAS

#3 - 24-inch Transmission Main SH 361 from Mustang Island PS to Old EST

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	2	EA	\$13,340	\$26,680
2	Install 24" Dia. C-905 DR-18 PVC by Conventional Trenching	21600	LF	\$320	\$6,912,000
3	Fittings (Horizontal)	8	EA	\$4,000	\$32,000
4	24" Butterfly Valve	2	EA	\$17,800	\$35,600
5	2" ARV and Manhole	2	EA	\$17,750	\$35,500
6	Dewatering	21600	LF	\$13	\$277,990
7	Install 24" Dia. C-905 DR-18 PVC w/ 32" STL Casing by Boring	100	LF	\$1,337	\$133,700
8	Seeding and Sodding	48000	SY	\$8	\$384,000
9	Traffic Control	1	LS	\$30,000	\$30,000
10	Trench Safety	21600	LF	\$2	\$43,200
11	SWPPP	1	LS	\$10,000	\$10,000
12	Caliche Repair	270	SY	\$25	\$6,750
13	Silt Fence	43200	LF	\$5	\$216,000
	Subtotal				\$8,143,420
	Bonds (2%)				\$162,870
	Move-in Move-out (5%)				\$407,170
	Subtotal				\$8,713,460
	Contingencies (20%)				\$1,742,690
	TOTAL				\$10,456,150

Engineering (15%)
TOTAL

\$1,568,423
\$12,024,573

OPINION OF PROBABLE CONSTRUCTION COST
 NCWCID #4 2025 MASTERPLAN UPDATE
 PORT ARANSAS, TEXAS

#4 - Waterline Loop Improvement #1

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	2	EA	\$5,000	\$10,000
2	Install 8" Dia. C-900 DR-18 PVC	560	LF	\$100	\$56,000
3	8" Gate Valve	2	EA	\$4,000	\$8,000
4	8" Fittings	5	EA	\$1,300	\$6,500
5	Fire Hydrant	2	EA	\$11,000	\$22,000
6	Trench Safety	560	LS	\$10	\$5,600
7	Asphalt Pavement Repair	10	SY	\$200	\$2,000
8	Seeding	250	SY	\$8	\$2,000
	Subtotal				\$112,100
	Bonds (2%)				\$2,240
	Move-in Move-out (5%)				\$5,610
	Subtotal				\$119,950
	Contingencies (20%)				\$23,990
	Total Construction				\$143,940

Engineering (15%)	\$21,591
TOTAL	\$165,531

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	2	EA	\$5,000	\$10,000
2	Install 6" Dia. C-900 DR-18 PVC	760	LF	\$90	\$68,400
3	6" Gate Valve	1	EA	\$3,600	\$3,600
4	Fire Hydrant	1	EA	\$11,000	\$11,000
5	Trench Safety	760	LS	\$10	\$7,600
6	Asphalt Pavement Repair	340	SY	\$200	\$68,000
	Subtotal				\$168,600
	Bonds (2%)				\$3,370
	Move-in Move-out (5%)				\$8,430
	Subtotal				\$180,400
	Contingencies (20%)				\$36,080
	Total Construction				\$216,480

\$32,472
\$248,952

OPINION OF PROBABLE CONSTRUCTION COST
 NCWCID #4 2025 MASTERPLAN UPDATE
 PORT ARANSAS, TEXAS

#6 - Waterline Loop Improvement #3

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	2	EA	\$5,000	\$10,000
2	Install 8" Dia. C-900 DR-18 PVC	370	LF	\$100	\$37,000
3	8" Gate Valve	2	EA	\$4,000	\$8,000
4	8" Fittings	1	EA	\$1,300	\$1,300
5	Trench Safety	370	LS	\$10	\$3,700
6	Clearing and Grubbing	150	SY	\$5	\$750
7	Seeding	165	SY	\$8	\$1,320
	Subtotal				\$62,070
	Bonds (2%)				\$1,240
	Move-in Move-out (5%)				\$3,100
	Subtotal				\$66,410
	Contingencies (20%)				\$13,280
	Total Construction				\$79,690
	Engineering (15%)				\$11,954
	TOTAL				\$91,644

OPINION OF PROBABLE CONSTRUCTION COST

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

#7 - Fire Flow Improvements - Marina 6" Waterline to 8" Waterline

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	2	EA	\$5,000	\$10,000
2	Install 8" Dia. C-900 DR-18 PVC	2000	LF	\$100	\$200,000
3	8" Gate Valve	4	EA	\$4,000	\$16,000
4	8" Fittings	10	EA	\$1,300	\$13,000
5	Fire Hydrant	1	EA	\$11,000	\$11,000
6	Reconnect Services	2	EA	\$2,500	\$5,000
7	Trench Safety	2000	LS	\$10	\$20,000
8	Pavement Repair	468	SY	\$200	\$93,600
9	Seeding	4500	SY	\$8	\$36,000
10	Remove and Dispose Existing 6" ACP Waterline	2000	LF	\$80	\$160,000
	Subtotal				\$564,600
	Bonds (2%)				\$11,290
	Move-in Move-out (5%)				\$28,230
	Subtotal				\$604,120
	Contingencies (20%)				\$120,820
	Total Construction				\$724,940

Engineering (15%)

\$108,741

TOTAL

\$833,681

OPINION OF PROBABLE CONSTRUCTION COST

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

#8 - Fire Flow Improvements - Private Road A Waterline

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	6	EA	\$5,000	\$30,000
2	Install 8" Dia. C-900 DR-18 PVC	1600	LF	\$100	\$160,000
3	Install 6" Dia. C-900 DR 18 FPVC by HDD	1850	LF	\$220	\$407,000
4	8" Gate Valve	6	EA	\$4,000	\$24,000
5	8" Fittings	10	EA	\$1,300	\$13,000
6	Fire Hydrant	3	EA	\$11,000	\$33,000
7	Reconnect Services	13	EA	\$2,500	\$32,500
8	Trench Safety	1600	LS	\$10	\$16,000
9	Pavement Repair	135	SY	\$200	\$27,000
10	Seeding	3560	SY	\$8	\$28,480
11	Remove and Dispose Existing 6" ACP Waterline	1600	LF	\$80	\$128,000
	Subtotal				\$898,980
	Bonds (2%)				\$17,980
	Move-in Move-out (5%)				\$44,950
	Subtotal				\$961,910
	Contingencies (20%)				\$192,380
	Total Construction				\$1,154,290

Engineering (15%)

\$173,144

TOTAL

\$1,327,434

OPINION OF PROBABLE CONSTRUCTION COST

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

#9 - Fire Flow Improvements - Palimino Drive Waterline

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Tie-In	1	EA	\$3,750	\$3,750
2	Install 6" Dia. C-900 DR-18 PVC	250	LF	\$75	\$18,750
3	6" Gate Valve	4	EA	\$3,000	\$12,000
4	6" Fittings	10	EA	\$975	\$9,750
5	Fire Hydrant	2	EA	\$11,000	\$22,000
6	Reconnect Services	2	EA	\$2,500	\$5,000
7	Trench Safety	250	LS	\$10	\$2,500
8	Pavement Repair	55	SY	\$200	\$11,000
9	Seeding	560	SY	\$8	\$4,480
	Subtotal				\$89,230
	Bonds (2%)				\$1,780
	Move-in Move-out (5%)				\$4,460
	Subtotal				\$95,470
	Contingencies (20%)				\$19,090
	Total Construction				\$114,560

Engineering (15%)

\$17,184

TOTAL

\$131,744

NCWCID #4 2025 MASTERPLAN UPDATE

PORT ARANSAS, TEXAS

ITEM	DESCRIPTION	Quantity	Unit	Unit Cost	Total
1	Pump Upgrades	2	EA	\$18,000	\$36,000
2	Electrical & SCADA Modifications	1	LS	\$4,000	\$4,000
	Subtotal				\$40,000
	Bonds (2%)				\$800
	Move-in Move-out (5%)				\$2,000
	Subtotal				\$42,800
	Contingencies (20%)				\$8,560
	Total Construction				\$51,360

\$7,704
\$59,064

APPENDIX B

TCEQ GUIDELINE FOR DETERMINING
CONNECTIONS AND POPULATIONS



TCEQ GUIDANCE

Water Supply Division and Office of Compliance and
Enforcement Regional Areas
Staff Guidance Document • January 2019

Determining Connections and Populations Served for Public Water Systems

This guidance is intended to clarify practical application of “connections” and “population served” (i.e. people served) as they pertain to public water systems (PWSs) to ensure uniform determination. This guidance aggregates rule information regarding connections and populations to provide a single resource for the TCEQ and the regulated public. This guidance also includes a list of relevant resources and describes documentation that will help to ensure consistent data for the accurate application of regulatory requirements.

Public Water System Fees

The Public Health Service fee – see [Water Supply Division RG-077](#) – is collected by the Texas Commission on Environmental Quality (TCEQ) to fund the services it provides to public water systems. The fees charged to each system are calculated as detailed in 30 Texas Administrative Code (TAC) §290.51(a)(3)-(6). These calculations are dependent on the number of total connections and, in some cases, the population served. This guidance should assist in the uniform determination of number of connections and population served to facilitate fee calculation.

Other TCEQ Rules Impacted by Connection and Population Served Data

In addition to 30 TAC § 290.51(a)(3)-(6), the drinking water rules which rely on accurate quantification of connection and population served data include, but are not limited to:

- The definition of Public Water System(s) [30 TAC § 290.38(58), (71), (84)];
- The definition of Combined Distribution System [30 TAC § 290.103(2)(B)(i)-(ii)];
- Requirements under General Provisions [30 TAC § 290.39(e)(1)(B), (f)(1), (j)(1)(D)];

- Treatment Design Capacity requirements [30 TAC § 290.42(d)(11)(B)(iv)-(vi)];
- Treatment Analytical requirements [30 TAC § 290.42(d)(15)];
- Water Distribution minimum waterline requirements [30 TAC § 290.44(c), (d)];
- Minimum Water System Capacity requirements [30 TAC § 290.45(b)-(g)];
- Minimum Acceptable Operating Practices – licensed personnel [30 TAC § 290.46(e)], operating records and reports [30 TAC § 290.46(f)], safety standards [30 TAC § 290.46(x)];
- Various Minimum Monitoring requirements – Revised Total Coliform Rule [30 TAC § 290.109(d)(2)(A)(iii)], Disinfectant Residual [30 TAC § 290.110(c)(1)(B)(i),], Disinfectant By-Products [30 TAC §§ 290.113(a)(2), 290.113(c)(3), 290.115(a)(2), 290.115(c)(1)-(2), 290.115(c)(5)(B)-(C)], Lead and Copper Rule [30 TAC §§ 290.117(c)(1)(A), 290.117(e)(1)], Long-Term 2 Enhanced Surface Water Treatment Rule [30 TAC §§ 290.111(b)(3)(A)(i), 290.111(b)(4)(A), 290.111(c)(3)(A)(iii), 290.111(c)(3)(B)(i)];
- Groundwater Corrective Actions and Treatment Techniques- Microbial inactivation and removal [30 TAC § 290.116(c)(1)(A)];
- Public Education requirements -Lead and Copper Rule [30 TAC § 290.117(k)(4)(A)(ii)];
- Consumer Confidence Report – delivery requirements [30 TAC § 290.274(f), (i)]; and
- Fees for Service to Drinking Water Systems- Public Health Service Fee [30 TAC § 290.51 – see discussion above].

Connections and Population Served

Population served, and number of connections are fundamental characteristics of a PWS. This guidance provides clarification concerning connection terminology as well as resources for population and connection determinations.

The TCEQ obtains current numbers of connections with the potential to be served or being served by PWSs and updated population served numbers through:

- Routine TCEQ regional office comprehensive compliance investigations;
- PWS officials reporting directly to TCEQ's central office Water Supply Division (WSD) staff pursuant to 30 TAC § 290.39(j) regarding changes to existing systems or supplies;
- Regular correspondence with the WSD inventory group; and
- Fee billing process.

The data is recorded in the Safe Drinking Water Information System (a.k.a. “SDWIS”) and is used to determine the regulatory requirements and fees of the system based on the number of connections and population served.

Determination of Connections:

Under 30 TAC § 290.38(16), “connection” means “A single-family residential unit or each commercial or industrial establishment to which drinking water is supplied” from the PWS. The TCEQ interprets an “active connection” as a connection that is completed or existing and able to supply drinking water from the PWS to a single-family residential unit or each commercial or industrial establishment, regardless of whether the single-family residential unit, commercial, or industrial establishment is occupied or unoccupied.

Active Connections and Total Connections: The terms “active connections” and “total connections” are synonymous because an active connection includes all connections that have the capacity to receive water from the PWS even if there is no customer receiving the water service at the time of the connection count. The connection is not considered “inactive” unless the ability to provide water is either physically removed or permanently closed. Therefore, the number of active connections is considered equal to the number of total connections, and vice versa.

- Connections that must be counted include those that use the water for potable purposes such as drinking, cooking, brushing teeth, bathing, washing hands, washing dishes, food preparation, and beverage preparation, etc. *See* definition of “drinking water” [30 TAC § 290.38(23)] and “human consumption” [30 TAC § 290.38(36)].
- Connections that should *not* be counted include those that use the water for non-potable purposes *only*, such as irrigation [30 TAC § 290.38(16)(A)]. However, PWSs must comply with 30 TAC § 290.41(b) Water Quantity requirements.
- **Community systems:** Connections are not limited to metered service. All residential, commercial, and industrial service meeting the definition of a connection must be counted, regardless of whether that connection is metered. In community systems, connection counts have a relationship to, but may not be equal to, the number of meters and bill payers. If a meter serves a single family residential unit or commercial or industrial establishment, meter count will equal connection count because community PWSs must provide a meter at each residential, commercial, or industrial service connection under 30 TAC § 290.44(d)(4). However, if a meter serves a residential complex (i.e. apartments, condos, assisted living, etc.) the number of service connections in an apartment complex would be equal to the number of individual living units [30 TAC § 290.38(16)].

- **Non-community systems:** In non-community systems the connection count is equal to the number of specific, designated spaces where potable water is available. For example, connections include each hotel room, RV hookup, cabin, or villa, in addition to each kitchen, bathroom, event hall, dining room, etc., which has potable water service from a PWS.

Documentation of Connection Count

The number of connections should include any connection that is being served drinking water by the PWS or has the potential to be served drinking water by the PWS, regardless of whether the connection is a residence that is occupied or unoccupied or if the water service provided by the connection is being paid for or not. As stated above, connection counts have a relationship to, but may not be equal to, the number of meters and bill payers. If a meter serves a residential complex (i.e. apartments, condos, etc.) where multiple single family residential units are present, the total number of individual units is equal to the connection count.

When a PWS contains metered single-family homes and/or industrial or commercial establishments, the connection count *for these homes and establishments* can be documented by meter counts from billing or lot counts from the county appraisal district.

If a PWS contains residential complexes served through a single meter, the residential unit count (i.e. the total number of apartment, condo, etc. units) should be obtained from the complexes, local real estate board, local permitting office, etc. The summation of single-family residential homes, sites providing commercial and industrial services, and complex unit counts should provide the total connection count for a PWS with mixed customer types.

Determination of Population served:

Within the definition of PWS [30 TAC § 290.38(71)] and without excluding other meanings of the terms “individual” or “served,” an individual is deemed to be served by a water system if he consumes water from, lives in, uses as his place of employment, is a customer of, or works in a place to which drinking water is supplied from the system [see 30 TAC § 290.38(23) and (36)]. Available data resources to accurately determine connections and population served are discussed in this guidance.

At the time of each investigation a factual analysis of population served should be completed to obtain the data to support the population served by the system as it pertains to the definition of a public water system, i.e. persons served over a one-year period. This factual analysis should include obtaining sufficient records to document the population served within the past year, *see* Documentation of Population served section below.

In accordance with the definition of “connection” [30 TAC § 290.38(16)], *when enough data is not available* to accurately determine the number of connections to be served or being served, the population served divided by three will be used as the number of connections for calculating system capacity requirements. Conversely, if only the number of connections is known, the connection total multiplied by three will be the number used for population served. *This conversion should only be used when not enough reasonably reliable data is available.*

Documentation of Population Served

The population served for residential areas can be documented by the Census data for the area (i.e. city limits, census block, zip code census, etc.) if the available data can be accurately applied to the PWS service area. Be aware that Census data for a City only accounts for those residing within the City limits and is only performed every ten years. If the PWS service area extends beyond the City limits this may not be an accurate population count. Defer to smaller Census units and approved interim Census estimates, if necessary, to determine an accurate count. Ensure the population counts include special populations, i.e. prisons, retirement facilities, and that such populations are not double counted. For smaller residential communities such as mobile home parks or apartment complexes rental agreements, physical counts of household members, or census estimates of typical household size for the area can be used to support population served.

- **Census data:** Most recent estimates available at the United States Census Bureau’s website or QuickFacts may be used *in absence of more accurate data*. While the Bureau conducts a full population count once every 10 years, these information sources also include population estimates that are within 2 years. The most recent estimates should be used.

For non-transient, non-community populations, such as child care centers, office buildings, industrial areas or similar, the population served could be documented by employment counts of the businesses/industries, counts of vehicles in the parking lot during regular business hours (account for multiple shifts, if needed), enrollment numbers for the services offered, etc. Some facilities are permitted to serve a specific number, i.e. occupancy certificate for an event hall or restaurant, enrollment certification for a childcare or nursing facility. These permits can be used to document population numbers.

For transient populations, such as convenience stores, parks, restaurants, etc. business records can be used to document the population served. Possible records to request or review include sales receipts, guest logs, traffic counters, admission records, etc. Trends identified over a one-year period of time can be used to determine the population served by the PWS.

Additional Connection Count and Population Records:

- **Wholesale agreements:** All wholesale agreements should be provided in both wholesale and purchaser investigations. Water wholesalers must comply with 30 TAC § 290.45(e)(1) and purchasers must comply with 30 TAC § 290.45(f).

Note: The number of connections/population served by the contract should be included in the connection count for capacity calculations. Any purchase agreements that agree to a volume that amounts to less than the amount needed to supply the number of connections being served, may result in a capacity violation for the buyer and/or the seller. The records discussed in the sections above may be requested or used to determine accurate connection counts and populations served.

- **Water haulers:** Since Water haulers are their own PWS they should be counted as a wholesale connection.
- **Facility Population Data for Prisons:** The Texas Department of Criminal Justice (TDCJ) maintains detailed population records for each facility. If a TDCJ facility is served by the PWS in question, you may reach out to the facility and request an up to date “count” or call the central office water representative at 936-437-7048 or 936-437-7247 to get facility populations. A complete listing of TDCJ facilities with their statistics and contact information is located on the web at https://www.tdcj.state.tx.us/unit_directory/index.html.
- **Housing Authority or Local Real Estate Board:** The local housing authority or real estate board may maintain detailed living unit and unit population data and statistics.

Resources

This guidance is not a substitute for the rules. It is the PWS’s responsibility to ensure that it complies with applicable regulations. Requirements for community and noncommunity PWSs can be located online at:

- The federal Safe Drinking Water Act
<http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm>
- The Texas Health and Safety Code, Chapter 341, Subchapter C
<http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.341.htm>
- The Texas Administrative Code (TAC), Title 30, Chapter 290, Subchapters D and F
[http://texreg.sos.state.tx.us/public/readtac\\$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=290](http://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=290)
- TCEQ Guidance Document for Water Haulers

<https://www.tceq.texas.gov/assets/public/permitting/watersupply/pdw/Water%20Hauler%20Guidance.pdf>

Examples:

Example 1 - Apartment Complex

A PWS is an apartment complex with its own source which has 100 apartment units and only 75 are occupied with a total of 250 people.

- All 100 units have the potential to be occupied at any time, so the apartment complex has 100 connections. The connection count will remain at 100 until such time additional units are built and connected or existing units are physically removed from the system. If the 75 occupied units have a total of 250 people living in them, the population served is 250. This information can be obtained from lease or rental agreements or census data (for example, the census reported average household size for the area multiplied by the number of occupied units).

Helpful Hint: The total/active connections in an apartment complex is equal to the total number of individual apartment units.

Example 2 - On-going Construction

A 50-lot subdivision is under construction and all 50 lots have a meter box set (and a meter may even be installed), but the PWS connections have only been completed on eight houses and construction is continuing on the remaining 42 lots.

- Once construction is complete on a house or people are living on the lot, it then becomes a single family residential unit to which drinking water is supplied from the system, i.e. then it becomes a connection.
- Once 15 connections have been completed or the population served is at least 25 individuals, through a lesser number of connections, the subdivision is considered an active PWS.
- To determine population served a direct survey of residents or census data (i.e. average household size for the area multiplied by connections) can be used to determine population.

Example 3 - Completed Construction

Connections shall be determined by all completed single-family residential units and/or commercial or industrial establishments once they are connected to a PWS and have the potential to be served drinking water by the PWS.

A 50-lot subdivision has been completed and 50 houses exist, but only 8 houses are occupied.

- 50 houses exist; therefore the system has 50 connections.
- Once construction is complete on a house and it becomes a single family residential unit to which drinking water is or could be supplied from the system, even if the single-family residence unit is unoccupied, all 50 houses have the potential to be served drinking water by the PWS.
- The connection count will remain at 50 until such time additional units are built and connected or existing units are physically removed from the system.
- The population served by the system are those living in the eight occupied houses. To determine population served a direct survey of residents or census data (i.e. average household size for the area multiplied by connections) can be used to determine population.

Example 4 – Mobile Home Parks (MHPs)

A MHP has 30 lots available for rent or purchase and water service is provided to all 30 lots and a laundry facility. Only 8 lots have mobile homes located on them and the other 22 lots are vacant.

- A total of 31 service connections, 30 lots and laundry facility, have the potential to be served water by the PWS since, unlike a house, a mobile home can be located on any of the 30 lots at any time. MHPs typically fit the community water system definition based on the limited mobility and residential nature of the living units.
- The population served of the MHP can be determined from a direct survey of residents, lease or rental agreements and occupancy record review over the previous year. If specific numbers of people served cannot be determined, census data (i.e. average household size for the area multiplied by occupied connections) can be used to determine population.

Example 5 – Campground

A campground has 45 lots - 20 recreational vehicle spots and 25 campsites - available for rent, men's and women's restrooms. Water service is provided to all 45 locations and restrooms. During an investigation only 13 lots -11 recreational vehicle and 2 campsites - are currently occupied and the other 32 lots are vacant.

- A total of 45 connections have the potential to be served drinking water by the PWS since, unlike a house, a recreational vehicle or tent campsite can be located on any of the 45 lots at any time. Additionally, the two restrooms serve the public. Therefore, the campground has a total of 47 connections.
- The population served by the campground can be determined from RV rental agreements and site occupancy record reviews over the previous year. The campground may also have traffic counter records or other data to assist in this determination.

Helpful Hint: Separate men's and women's restrooms count as two specific, designated spaces with connections.

Example 6– Recreational Vehicle Parks (RVPs)

A RVP has 30 lots available for rent and water service is provided to all 30 lots. Only 8 lots have RVs located on them and the other 22 lots are vacant.

- A total of 30 connections have the potential to be served drinking water by the PWS since an RV, unlike a house, can be located on any of the 30 lots at any time.
- The population served by the RVP can be determined from RV rental agreements and occupancy record review over the previous year. The RVP may also have traffic counter records or other data to assist in this determination.

Example 7 – A Multi-Purpose Resort and Events Hall

A multi-purpose resort and events hall has two kitchens with a sink each, three bathrooms with a sink each, three hotel rooms with sinks and bathrooms, ten villas/cabins with sinks and bathrooms, a theater with a drinking fountain, a museum with drinking a fountain, and a bar with an ice machine. During an investigation each of these connections is identified and counted.

- A total of 21 service connections exist that have the potential to serve water in specific, designated spaces where drinking water has the potential to be served.
- Duration of habitation is not a factor in connection counting because the TCEQ does not make a distinction between total connections and active connections.
- Population served by this system can be determined by review of operational records for the year. This can include hotel/cabin/villa rental records, event hall rental records, theater, museum, and bar usage records. The occupancy allowances of the rooms for rent, rental hall, and theater, museum, and bar can also be used to support probable population numbers.

Example 8- Mixed Development Types

A community PWS serves a mid-sized suburb with 17 subdivisions with a total of 4,250 single family homes, they also serve two industrial parks with 25 industrial connections, four strip centers with 27 commercial connections, and 3 apartment complexes with a total of 350 apartment units. The service area of the PWS is contained within two zip codes and no other drinking water provider serves the area. The census data for those zip codes indicates a population of 12,652 people.

- The PWS serves a total of 4,652 connections. In addition to available meter data for metered connections other records to consider include: property records to assist in determining the single-family home connections, service agreements to

determine the industrial and commercial connections, and local housing authority or real estate board information to determine the apartment units.

- The population served is 12,652 people.

Example 9- Industrial Complex

A chemical plant has 4 buildings where approximately 75 persons work every day. The main building includes a breakroom and each building has a community restroom. There are 25 employee truck drivers that come and go and stop for coffee and restrooms and to take breaks between deliveries.

There are 3 eye wash stations located throughout the complex and 4 rooms located in Building 2 for temporary overnight stays. These rooms share one additional restroom.

- A total of 9 connections have the potential to serve water (3 eyewashes, 4 community bathrooms, the breakroom, and the overnight bathroom). The four overnight rooms would not be separate connections because they share a common restroom.
- Total population served for this site would be 100; this is the sum of the 75 plant personnel and 25 truck drivers.

Example 10- Strip Center

A strip center containing 8 businesses is served water from one well. Each business has a meter in order to calculate the amount of water consumed by each.

Two of those businesses house offices and have a total of 8 of the same people that come in every day and a bathroom and breakroom in each unit. The other 6 businesses are small fast food establishments that serve a total population of 100 persons a day with approximately 2 employees for each of the 6 businesses. Each restaurant unit has a restroom and a kitchen.

- The PWS has a total of 16 connections. Each of the eight units contains a restroom and either a kitchen or breakroom.
- Total population served would be 120 people. (Office employees = 8, Restaurant employees = 12, and Restaurant Customers= 100).

Example 11- PWSs serving Marinas

A PWS serves a marina with 25 boat slips without hose bibs at each slip, a bait shop with a restroom, and a small café with a kitchen and restroom all being served by one well. The marina has 6 employees and approximately 25 people per day come to the marina to fish, eat or take their boats out.

- A total of 3 connections (bait shop restroom, café kitchen, café restroom) because the boat slips do not have the potential to provide water.

- Total population served would be 31. (Employees= 6, customers=25).

A PWS serves a marina with 25 boat slips with hose bibs at each slip, a bait shop with restroom, a small café (kitchen and restroom), and a shower facility. All facilities are served by one well. The marina has 6 employees and approximately 25 people per day come to the marina to fish, eat or take their boats out. Only 20 boat slips are being used at the time of investigation. All boat slips have a potable water hose bib.

- A total of 29 connections. Count all 25 boat slips because they have the potential to serve drinking water at any time.
- Total population served would be 31. (Employees= 6, customers=25).

Helpful hint: Connection counts in non-community systems include hose bibs since these can provide water for human consumption.

Example 12- Oil Field Housing (a.k.a. “Man camps”)

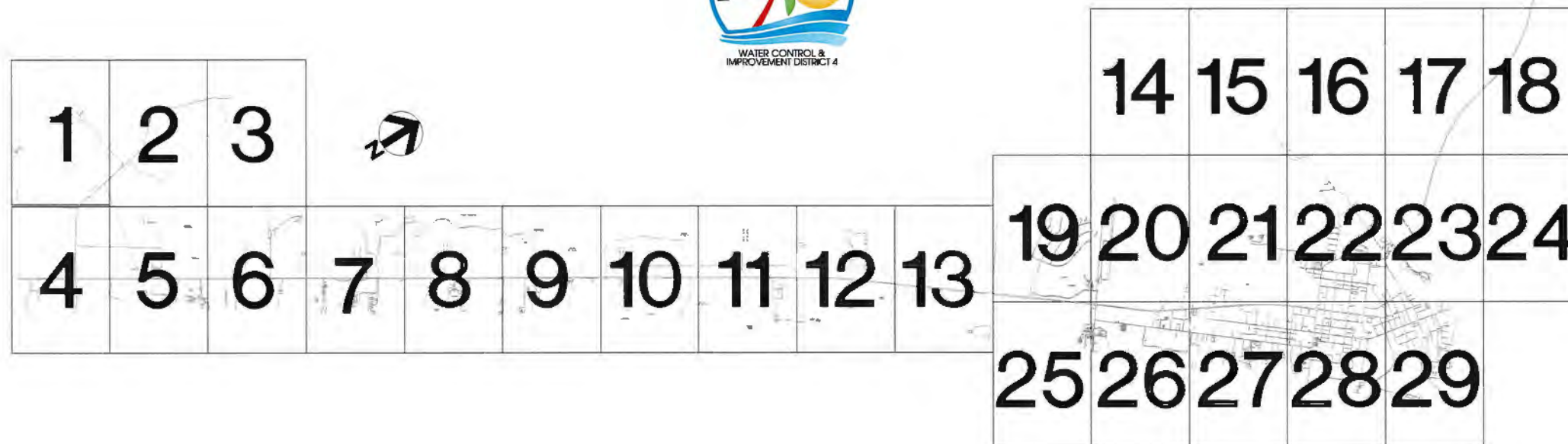
A PWS serves a housing facility for oil field workers where each of 12 modular mobile units are occupied by 8 workers, with a bathroom in each unit, for a total of 96 workers. One additional unit is set up for cooking and a place for the employees to eat. The workers work in 2-week rotations for as long as they are needed, then a new set of 96 men come on board.

- This PWS has a total of 13 connections. 12 for each modular unit’s bathroom and 1 for the modular kitchen/dining hall.
- A total population of 96 served.

APPENDIX C

MASTER PLAN BASEMAPS

JOB NO. 06189
JULY 2025
MUSTANG ISLAND
PORT ARANSAS, TEXAS



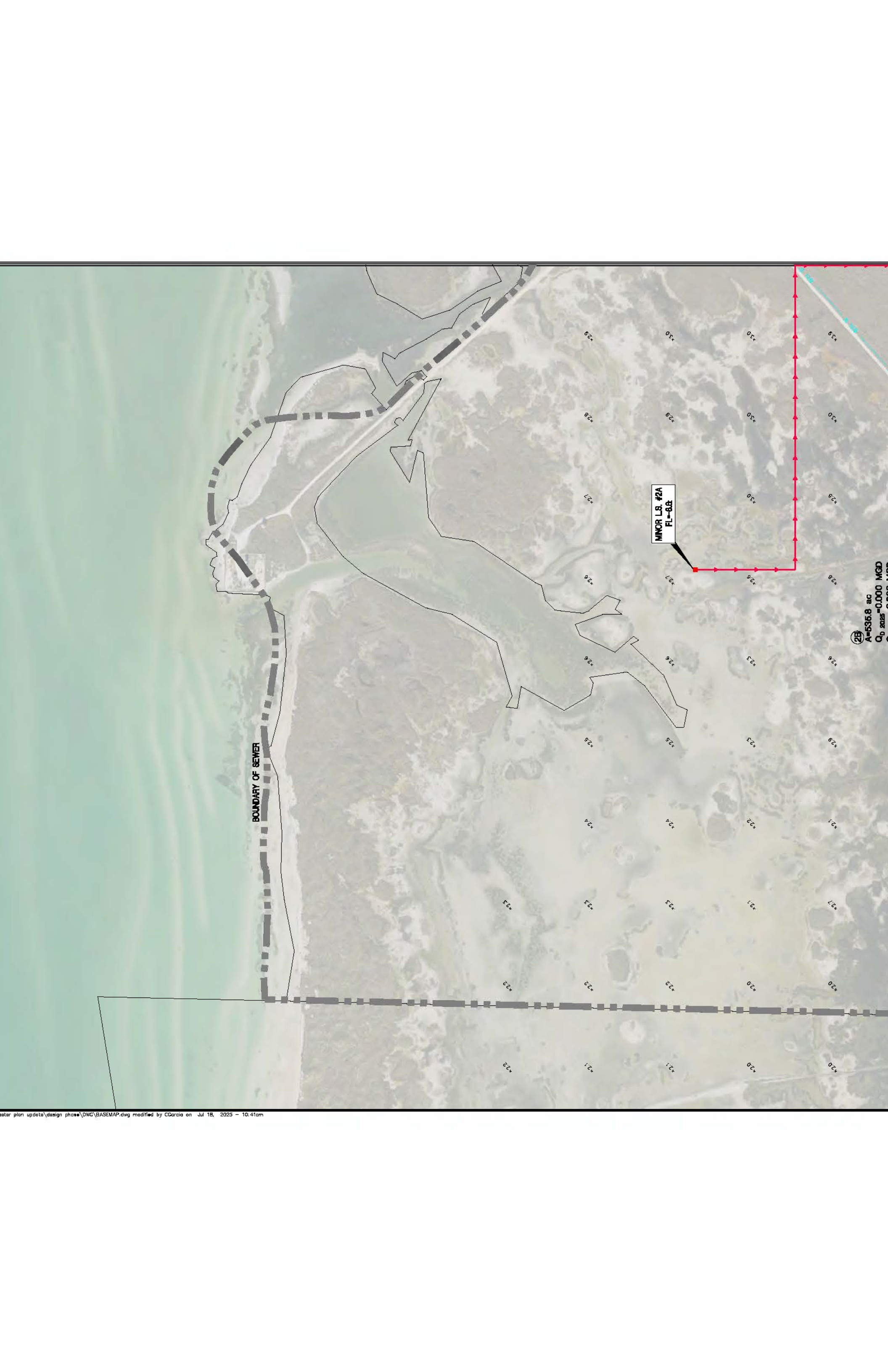
THE CALIBRATED NON-VEGETATED VERTICAL ACCURACY (NVA) PROVIDED BY THE VENDOR AT THE 95% CONFIDENCE INTERVAL IS 0.3FT. THE CALIBRATED VEGETATED VERTICAL ACCURACY (VVA) PROVIDED BY THE VENDOR AT THE 95% CONFIDENCE INTERVAL IS 0.9FT.

ENGINEER:

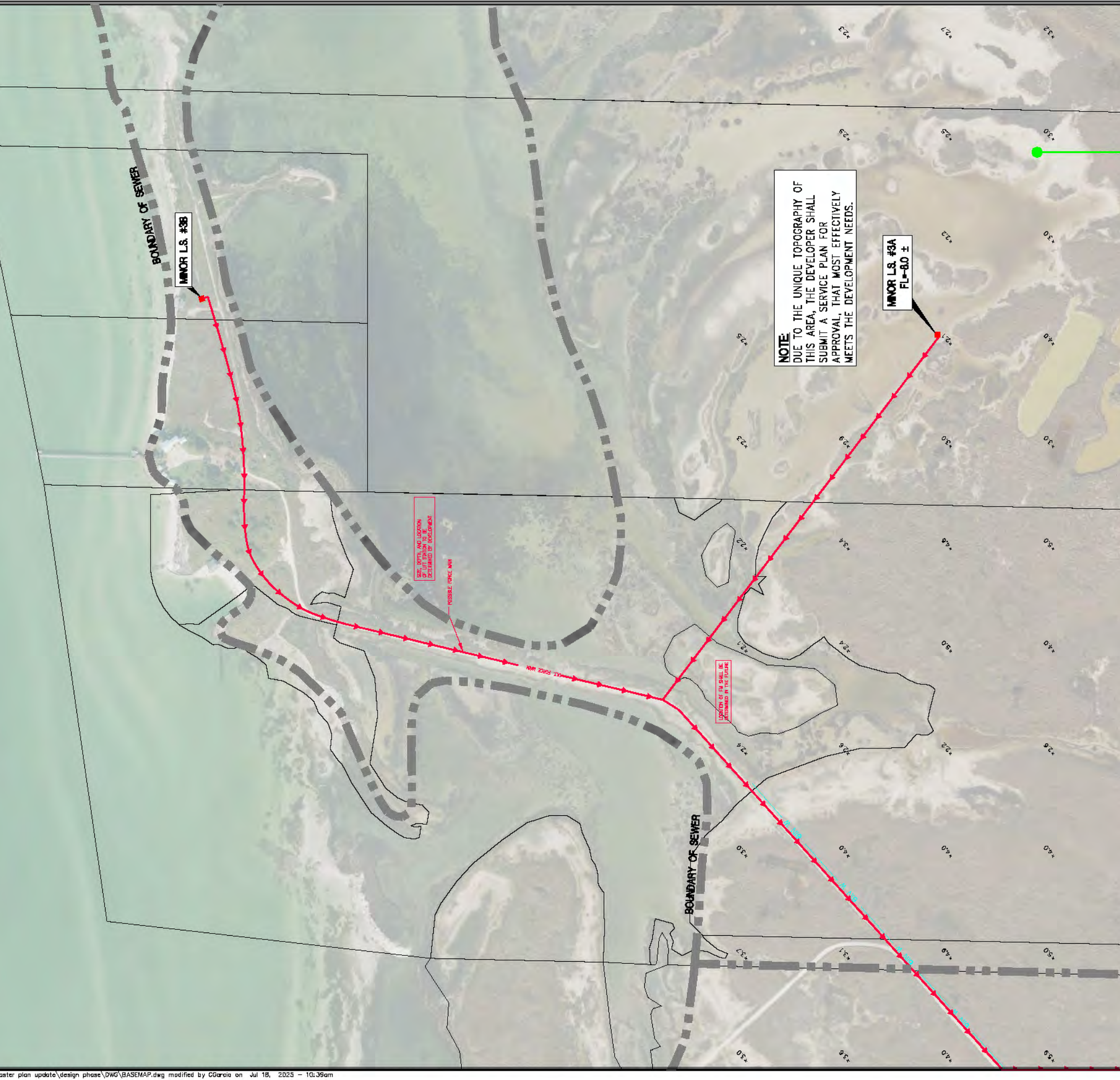
Douglas M. Mullan
J. DOUGLAS MCMULLAN, P.E.

Urban **DCCM**

TSPELS FIRM NUMBERS ENGINEERING 143 | SURVEYING 0032400
2325 SWANTNER DR. CORPUS CHRISTI, TX 78404
PHONE 361.354.3101 WWW.TSPELS.COM



(2B) A=636.8 ac
Q_b 2025=0.000 MGD



NOTE
DUE TO THE UNIQUE TOPOGRAPHY OF
THIS AREA, THE DEVELOPER SHALL
SUBMIT A SERVICE PLAN FOR
APPROVAL, THAT MOST EFFECTIVELY
MEETS THE DEVELOPMENT NEEDS.

MINOR L.S. #3A
FL=80 ±

MINOR L.S. #3B

SEE 2024 FIELD LOCATION
OF UTILITY TO BE
DETERMINED BY DEVELOPER

POSSIBLE FORCE MAIN

LOCATION OF UTILITY TO
BE DETERMINED IN THE FUTURE

BOUNDARY OF SEWER

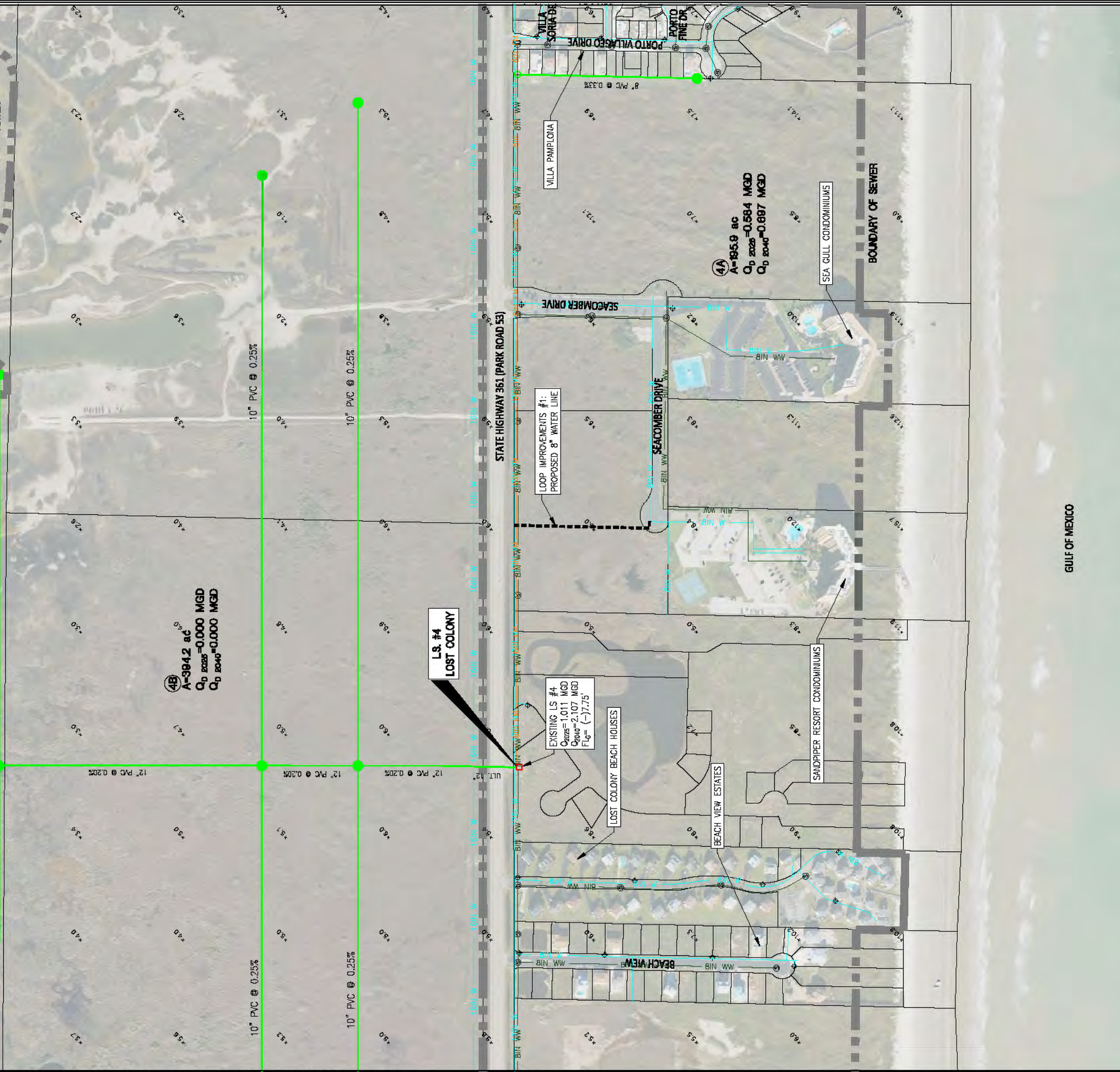


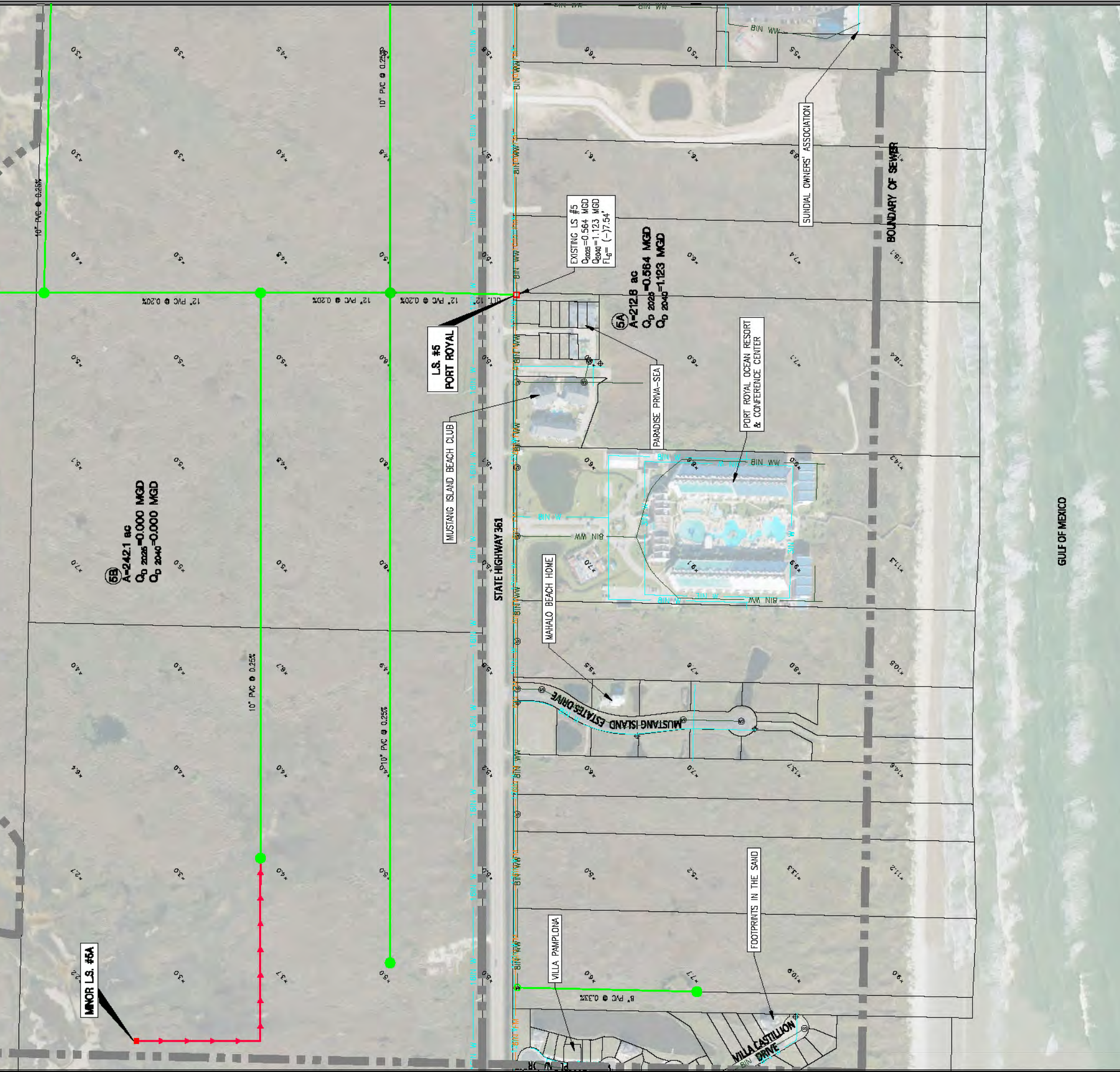
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MEETS THE DEVELOPMENT NEEDS.

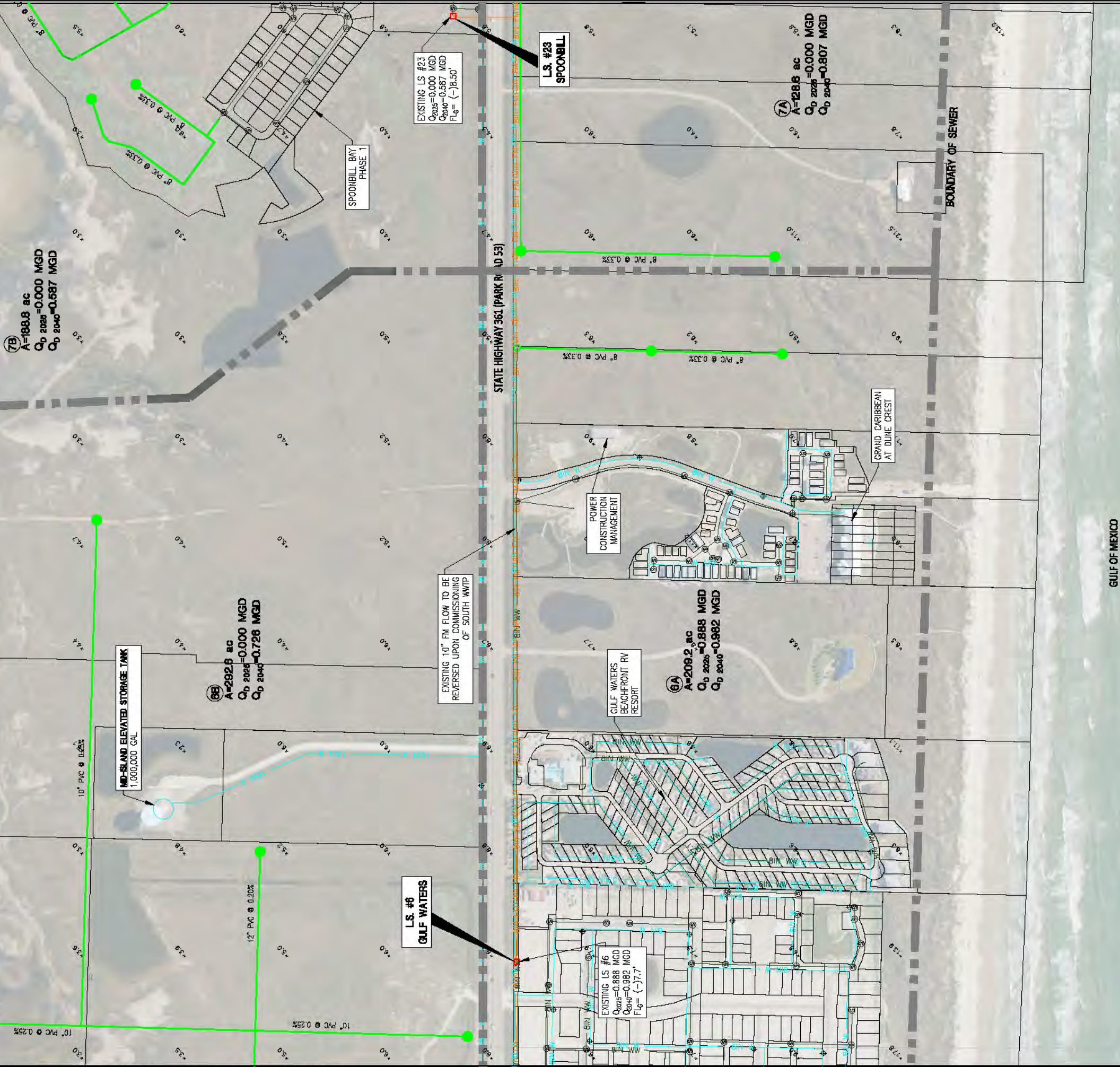
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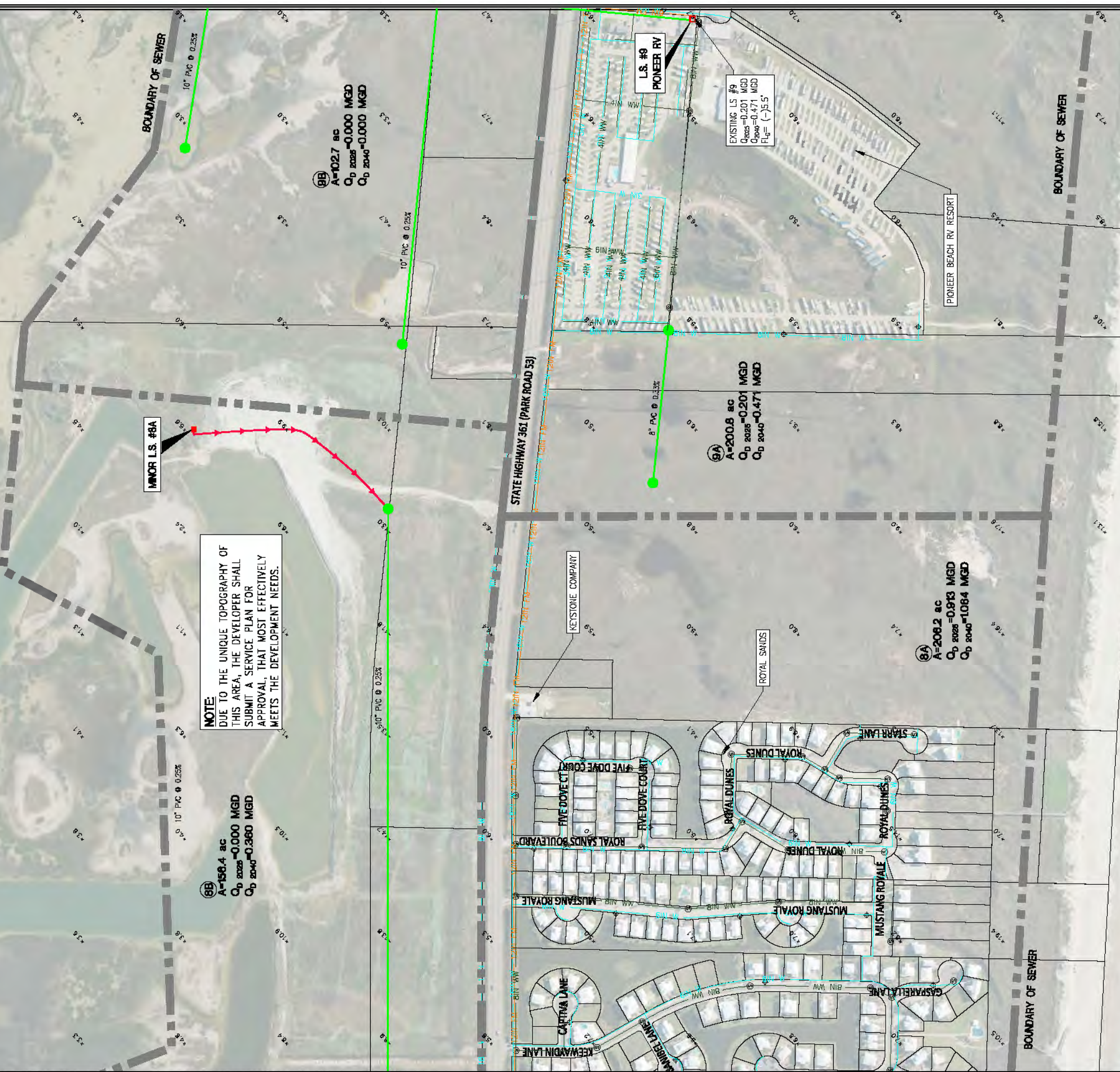


















CORPUS CHRISTI SHIP CHANNEL

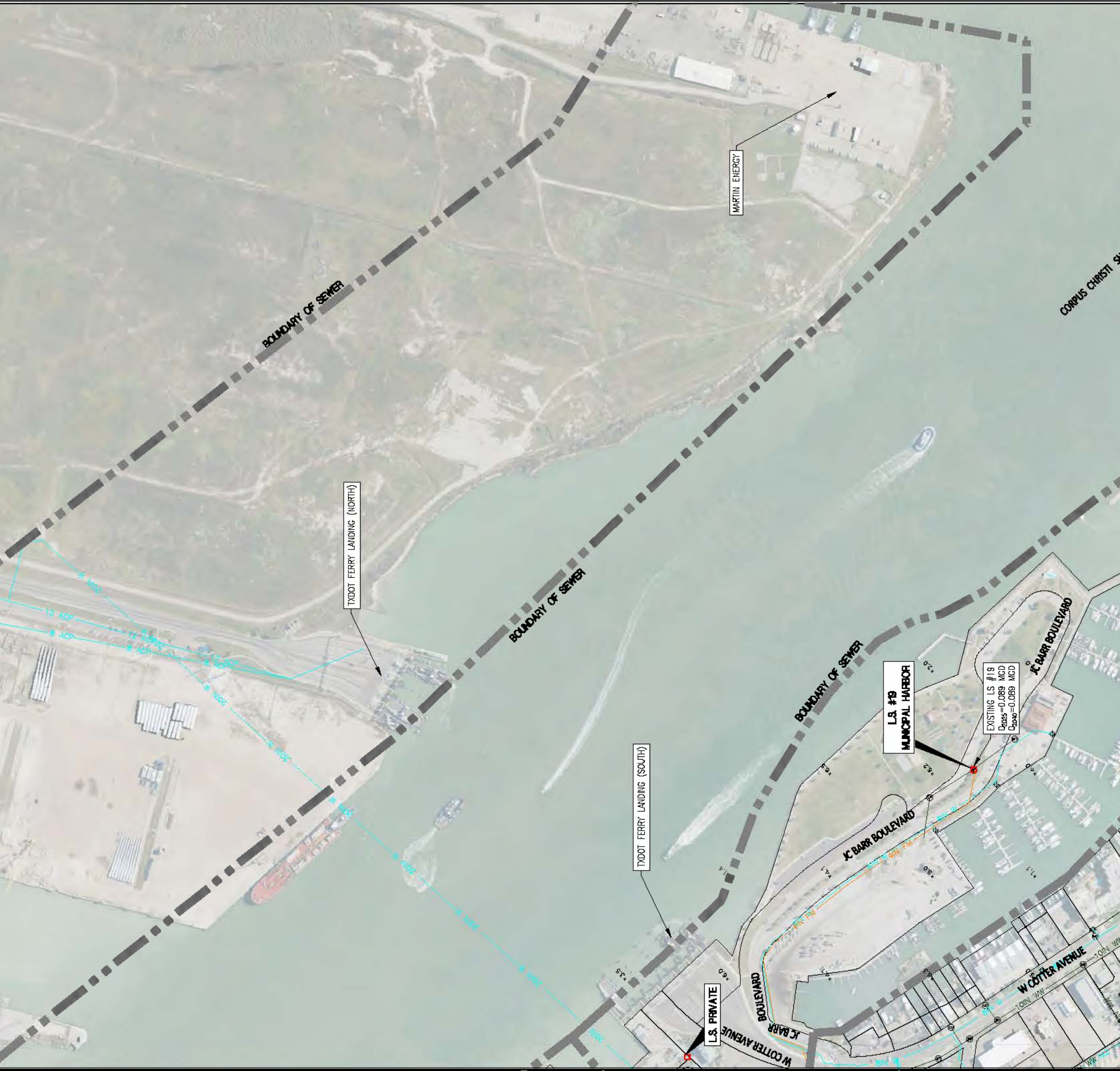


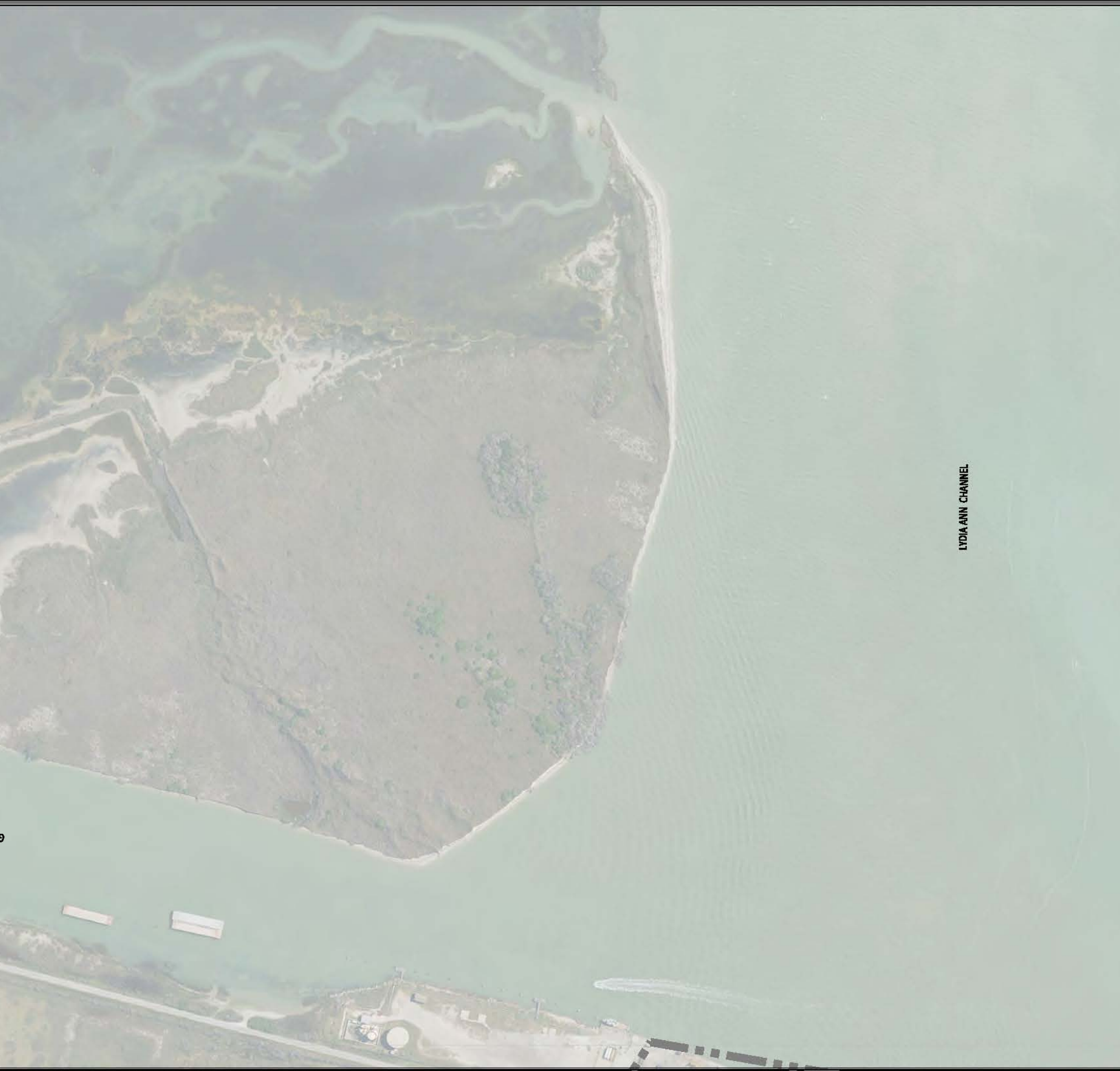
APAKISAS TERMINAL COMPANY HARBOR ISLAND

BOUNDARY OF SEWER

CORPUS CHRISTI SHIP CHANNEL







LYDIA ANN CHANNEL

