City of Corpus Christi

Water Master Plan, Land Use Assumptions, and Capital Improvements Plan

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PAPE-DAWSON ENGINEERS

Transportation | Water Resources | Land Development | Surveying | Environmental

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

Corpus Christi Water (CCW) is responsible for the maintenance, operation, management, and expansion of water treatment and distribution for the City of Corpus Christi, Texas (City) and surrounding areas and it the water provider for a large surrounding region. Water distribution within the City and surrounding region must meet local, state, and federal regulatory requirements and the reasonable expectations of the public for a healthy, safe, and thriving community. This Water System Master Plan is an overarching planning document intended to guide policy on maintenance, improvement, and expansion of water services through a foreseeable planning horizon (ten years), and for the long term beyond the initial horizon. This plan sets forth identified areas where repair, replacement or upgrades of existing infrastructure are recommended to maintain service at acceptable levels and where upgraded and new infrastructure may be required to support ongoing growth and development. Proposed capital improvement, repair, and upgrade projects are recommended and general cost data is provided.

The water system was evaluated by Lockwood, Andrews & Newnam, Inc. (LAN) as a sub-consultant to Pape Dawson Engineers. Information provide herein is based on LAN's review, analysis, and recommendations.

1.1. General Overview

On February 9, 2021, the City Council of the City of Corpus Christi, by Resolution 032350, approved Pape-Dawson Engineers to develop Master Planning and Impact Fee Studies for water, wastewater, stormwater and transportation.

This Water System Master Plan has been developed in accordance with Texas Local Government Code Title 12, Planning and Development, Subtitle C, Planning and Development Provisions Applying to More Than One Type of Local Government, Chapter 395 – Financing Capital Improvements Required by New Development in Municipalities, Counties, and Certain other Local Governments (Chapter 395). In addition, existing local codes and regulations including the City's Infrastructure Design Manual (IDM), Unified Development Code (UDC); minimum standards set forth by the Texas Commission on Environmental Quality (TCEQ), and other relevant state and federal codes and regulations were considered in providing development, upgrade, and maintenance recommendations. Existing system conditions, The City's Comprehensive Plan, Area Development Plans, current and past Master Plans, Master Plan amendments,

existing studies, billing information, usage and flow data, and land use information have been collected, reviewed, and assessed to develop planning and development guidance through a ten-year planning period and an ultimate buildout condition. This Master Plan meets the requirements of Chapter 395 for use in evaluating impacts related to development and identified projects and related costs are apportioned for maintenance and improvement of existing service separately from projects and costs related to new development. Where projects address both current needs and development costs are apportioned accordingly.

1.2. Outline of Scope

Development of this comprehensive master plan for the City Corpus Christi Water System was accomplished through a series of tasks as outlined below:

1.2.1. *Land Use Assumptions Update*

Updated Land Use Assumptions (LUAs) are necessary to accurately assess current and future water system demand and infrastructure needs. Comprehensive master plans, Area Development Plans, platting and building permit history, along with adopted current and future Land Uses from the City were reviewed to provide updated LUAs. Land use assumptions are based on past and present development patterns, current and projected land use, current and projected zoning, projected population growth and patterns, and input from city Staff and the community.

1.2.2. *Collect and Review of Existing Data*

Data and documents reviewed in conjunction with the development of this Master Plan include, but are not limited to:

- City of Corpus Christi water network GIS files.
- Existing Water Master Plan
- Information on Elevated Storage Tanks.
- Water flow records (Monitoring, Water Treatment Plant (WTP) volumes.
- Water system plans (as-built drawings, record drawings, construction plans), including plans for currently proposed projects.
- Water Certificate of Convenience and Necessity (CNN) boundaries.
- City bid tabulations for water projects for the last 5 years.

- Existing design standards and operation procedures.
- Hydraulic modeling provided by the City's Consultant CP&Y.

1.2.3. *Flow and Usage Development*

The City recently completed a review of its elevated storage tanks. According to CP&Y (the City's elevated storage review consultant), the average daily flow within the model increases from 62 MGD (year 2011) to 82.5 MGD in Year 2025. Using the land uses determined in II, Consultant will compare water data within the City's existing 2011-2025 model for consistency with the land use plan. Consultant shall also review the preliminary raw water mater plan information being completed by others for consistency in projections through the planning period In addition, Consultant will develop flows for the planning period (beyond year 2025) for incorporation back into the water model, further described in Section Prioritization of this task. The objective of this task is to conform the 10-year flow assumptions for use across all water system components (raw water, treatment, and distribution). a reasonable assessment of the inflow and infiltration component.

1.2.4. *Water Supply Strategies and Evaluation*

Raw water supply strategies being developed by others were reviewed to identify key information required for incorporation into the impact fee analysis. Implementations of any recommendations from previous evaluations, remaining recommendations for the previous evaluations and ability for the existing water system to supply current, 5-year and 10-year planned flows and recommended improvements will be evaluated in terms of growth versus retrofit and maintenance-related improvements. As this plan is focused near-term (0-3 years), mid-term (3-7 years) and long-term (7-10 years) flows, excluded from this scope are evaluations long-term (>10 year) alternative water supply strategies.

1.2.5. *Existing System Review*

CP&Y has completed an existing system review as part of their elevated storage report. This report included recommendations for a renewed Pipe Reinvestment Program. This program would replace pipes at the end of their useful life or adversely affected by the new elevated storage tanks. It is Consultant's understanding that the existing distribution system has been adequately evaluated for piping needs as part of CP&Y's efforts.

There are current projects identified in the City's Capital Improvement Plan that will need to be evaluated to determine the portion associated with maintenance-related versus growth-related costs. These include:

- Citywide Water Distribution System Indefinite Delivery/Indefinite Quantity Program
- San Patricio Municipal Water District Transmission Main Connection
- Yorktown Boulevard Water Line Extension
- Water Line Replacement Program
- Elevated Water Storage Tanks- Citywide

1.2.6. *Future Flows and Project Prioritization*

The existing model developed as part of CP&Y's efforts included a planning period through 2025. Modifications necessary to conform the distribution system projected flows past year 2025 for were developed as part of this planning effort to provide ten-year and ultimate buildout projections. CP&Y completed the post-2025 modelling efforts under direction from the City. Regular communication and meetings with CP&Y were completed to coordinate the model imputes and results.

1.2.7. *Water Treatment Plant Asset Evaluation*

Conditions and capacity of the Stevens Water Treatment Plant were completed and included:

- Review of previous evaluations prepared within the last five years. Using information provided by the city and determine which, if any, of the recommendations from the previous evaluations have been implemented and which recommendations are remaining. Using this existing information, evaluate if existing facilities have the capacity to meet projected 5-year and 10-year flow demands. Provide a list of recommended improvements to meet flow demands. The focus of this evaluation will be only on high-level unit processes. \
- Visiting the WTP site to observe major unit processes and meeting with WTP staff to review data collected and discuss history of plant operations, confirm/clarify observations, and obtain information on current operations and identified needs.
- Evaluate current projects identified in the City's and the Texas Water Development Board (TWDB) Region N capital improvement plans to determine the portion associated with maintenance-related versus growth-related costs These include and are limited to:

- ONSWTP High Service Building No. 3.
- ONSWTP Raw Water Influent and Chemical Facilities Improvements.
- ONSWTP On-Site Hypochlorite Generation.
- ONSWTP Solids Handling and Disposal Facilities.
- ONSWTP Site Infrastructure Improvements.
- ONSWTP Sedimentation Basin Improvements.
- ONSWTP Clearwell No. 3.
- ONSWTP Filtration System Hydraulic Improvements

1.2.8. *Water Pump Station and Storage Tank Evaluation*

Condition and capacity of existing pump station and storage tank facilities was completed and included:

- Review of previous evaluations prepared within the last five years using information provided by the city. Recommendations from the previous evaluations that have been implemented and those remaining were reviewed to evaluate current capacity and ability to meet projected 10-year flow demands.
- A list of recommended improvements to meet flow demands were developed.
- Meetings were conducted Operations and Maintenance staff to review data collected and discuss history of pump station operations and maintenance concerns.

1.2.9. *Capital Improvement and Master Plan development.*

The current Capital Improvement Plan was reviewed with the information developed under the previous tasks. Projects that were included in this review are:

- Future Transmission Mains (12-inch and up).
- Existing and Future Elevated Storage Tanks.
- Existing and Future Ground Storage Tanks.
- Existing and Future Pump Stations.
- Existing and Future Water Treatment Plant Facilities. Citywide Lift Station Repair.

These projects and associated projected costs were reviewed to assess the overall impact to the water system and to provide an apportionment of maintenance and service improvement related costs separately from development related costs.

New projects were identified and developed to meet projected water maintenance and service needs for the 10-year horizon and ultimate buildout conditions. Probable costs for identified projects were developed using historic costs data from recent projects in the city, information provided by local construction contractors, and accepted costs estimating methods.

This Master Plan was then developed by compiling the information, data, analysis, and results from the various tasks as described.

1.3. Capital Improvement Advisory Council

In accordance with Chapter 395, the City established a Capital Improvement Advisory Council (CIAC) that was tasked with overseeing and guiding the development of the Master Plan and the associated Capital Improvement Program. Composition of the CIAC is fifteen members appointed by the City council of which at least six members represent the real estate, development, or building industry. AS noted by the City's description of the CIAC:

"The committee shall serve in an advisory capacity; advise and assist the City Council in adopting land use assumptions; review the capital improvements plan, land use assumptions and impact fees, and file written comments in accordance with Chapter 395 of the Texas Local Government Code; monitor and evaluate the implementation of the capital improvements plan; file semiannual reports with respect to the progress of the capital improvements plan and report to City Council any perceived inequities in implementing the plan or imposing the impact fee; and advise the City Council of the need to update or revise the land use assumptions, capital improvements plan, and impact fee."

Members of CIAC were regularly briefed on the development of the Master Plan, provided information as it was developed, and provided input and recommendations.

2. WATER DISTRIBUTION SYSTEM

A general description of the water treatment, storage and distribution assets is provided as a baseline for planning and proposed development. As maintenance, modification, upgrades, and new development are ongoing activities, conditions as described in this section are general in nature and will change with time.

2.1. Water Assets

CCW provided water to the City Corpus Christi and a surrounding seven-county region covering 140 square miles. Serving over 500,000 residents the Corpus Christi Water System comprises four surface water sources, the ON Stevens Water Treatment Plant, 9 water storage tanks, and over 1,700 miles of distribution pipe.

2.1.1. ***Water Sources***

Raw water is currently obtained from four surface resources and is then routed to the ON Stevens plant for treatment to potable standards, or distributed, untreated, to bulk use customers.

2.1.1.1. Choke Canyon Reservoir

Choke Canyon Reservoir is located on the Frio River approximately 62 miles northwest of Corpus Christi. Covering 25,670 acres the reservoir has a storage capacity of 695,271 acre-feet and water discharges into the Nueces River basin and flows downstream to the ON Stevens Treatment plant.

2.1.1.2. Lake Corpus Christi

Lake Corpus Christi is located on the Nueces River approximately 25 miles northwest of Corpus Christi. Covering 19,336 acres this reservoir provides storage of 242,241 acre-feet of water. Water from Lake Corpus Christi flows into the Nueces River and downstream to the ON Stevens Wastewater treatment Plant.

2.1.1.3. Lake Texana

Lake Texana is located on the Navidad River approximately 92 miles northeast of Corpus Christi. Lake Texana and covers 8,611 acres and has a storage capacity of 158,975 acre-feet and approximately 45 percent of the current raw water supply the City comes from this reservoir. Water is pumped to the ON Stevens WTP through the 101 mile long, 64-inch diameter Mary Rhodes pipeline.

2.1.1.4. Colorado River

Water rights on the Colorado River were purchased and an additional 42 miles of pipeline constructed (Mary Rhodes Pipeline Phase II) to provide an additional water source. Currently approximately five percent of the water demand is provided from the Colorado River.

2.1.2. ***Water treatment plant.***

Potable water for the region is treated at the ON Stevens WTP. Raw water is drawn from the Nueces river and the Mary Rhodes pipeline for treatment to potable standards and distribution throughout the region.

2.1.3. ***Storage Tanks***

There is was a separate study completed by CP&Y (now STV) that was not available for independent review but included as projects identified by CCW.

2.1.4. ***Distribution System***

The existing system was analyzed for improvements needed to address present-day system issues. For this analysis, the study used the peak hour demand scenario of the City's existing hydraulic model to represent the worst-case scenario. Analysis of the existing system results indicated that except for locations in the vicinity of ESTs or upstream of pump stations, the minimum pressure at all other locations was above 35 psi, satisfying Texas Commission on Environmental Quality (TCEQ) requirements.

3. LAND USE ASSUMPTIONS

Demand on public infrastructure is a function of the population, where that population lives and works, and how the land within the service area of the public system is used. Evaluation of the future demands on the Water System related to development requires a reasonable assessment of the increase in population, where and how new development occurs, and changes in land use and population density. Taken together these parameters are referred to as Land Use Assumptions (LUAs).

Projections for growth in employees and households are regularly conducted by the Corpus Christi Metropolitan Planning Organization (MPO). Current projections were used as an initial point in the development of Land Use Assumptions and evaluating future demands on the water system.

3.1. Area Development Plans

To improve City-wide planning, zoning, and land use assumptions the City Planning Department has divided the city into nine planning areas (Bayside, Corpus Christi Airport, Downtown, Flour Bluff, London, Northwest, Padre/Mustang Island, Southside, and Westside) and has developed planning documents for each area. These Area Development Plans (ADPs) are based on current and projected land usage and on projected needs based on the character, land use, population, and anticipated development of the individual areas. Projections for each area can be combined to provide overall City-wide Land Use Assumptions.

In addition to the ADPs currently in place, a tenth planning area located between the Northwest ADP, the City of Robstown, Texas, and west of Interstate 69 has been identified and used in the master plan development. This tenth planning area is referred to as the Calallen Planning Development Area. Exhibit 9 shows the PDAs used in developing the land use assumptions.

Both the London and Calallen planning areas extend into the City's ETJ outside of the City Limits. Development in these areas is occurring and is expected to continue to occur with related annexation of the land and extension of City services. Master planning for extension of water services in these areas is provided like planning within the city limits. Additional development of land in the ETJ is expected to follow the growth patterns of the adjacent ADP and is assumed to follow the established land use patterns. Significant portions of the ETJ are located north of Corpus Christi Bay and Nueces Bay (See Exhibit 10).

There are no City owned services in these areas and development is not expected to be significant within the planning horizons of this Master Plan. Planning efforts have not been included for areas of the ETJ where costs to extend water services are high and significant development is not expected to occur for an extended period.

3.2. Projected Growth Rate

Growth projections are developed and updated by the Metropolitan Planning Organization. Data from the MPO projections was initially used to calculate a predicted annual growth rate based on increase in households and the projected increase in employees from 2021 to 2031. Project growth rates were calculated using the following equation.

$$Percent\ Annual\ Growth\ = \left[\left\{\left(\frac{2031\ households/employees}{2021\ households/emplyees}\right)^{\frac{1}{number\ of\ years}}\right\} - 1\right] 100$$

As an example, in the Downtown ADP, the number of current households is 3,794. In 2031, it is projected that the number of households in this ADP may be 4,919. This is a difference of 1,124 and correlates to a 2.6 percent growth per year in households. Similar methodology was used for projected increases in employees.

Projected annual growth based on households and employees are shown in Table 3-1 and Table 3-2.

Table 3-1 Projected Annual Growth by households

ADP	2021 Households	2031 Households	2031 Less 2021	Annual Growth in households
Bayside	31,508	32,478	970	0.3%
Calallen	1,310	2,201	891	5.3%
CC Airport	1,582	2,228	646	3.5%
Downtown	3,794	4,919	1,125	2.6%
Flour Bluff	8,006	8,573	567	0.7%
London	1,100	1,720	620	4.6%
Northwest	12,152	15,194	3,042	2.3%
Padre/Mustang Island	5,987	7,295	1,308	2.0%
Southside	41,601	47,130	5,529	1.3%
Westside	18,533	19,978	1,445	0.8%
Total	125,573	141,716	16,143	1.2%

Table 3-2 Projected Annual Growth by Employees

ADP	2021 Employees	2031 Employees	2031 Less 2021	Annual Growth in Employees
Bayside	25,887	26,342	455	0.2%
Calallen	3,502	4,093	591	1.6%
CC Airport	8,927	10,755	1,828	1.9%
Downtown	17,328	17,450	122	0.1%
Flour Bluff	11,725	12,077	352	0.3%
London	423	732	309	5.6%
Northwest	11,536	13,307	1,771	1.4%
Padre/Mustang Island	2,666	3,431	765	2.6%
Southside	26,898	30,226	3,328	1.2%
Westside	31,253	33,767	2,514	0.8%
Total	140,145	152,180	12,035	0.8%

According to the US Census Bureau, the City of Corpus Christi had an annual growth rate of 0.4 percent from 2010 to 2020. The data from the MPO projections shows a more robust growth rate is anticipated over the next ten-year period.

City records of lots added in each ADP from January 1, 2020, to January 25, 2022, were then used to generate an annual growth rate for the last two years. The MPO baseline number for 2021 households was used in conjunction with the lots added data from the city using the same formula to generate an annual growth rate based on the lot added information. The growth rate from lots added is compared to the MPO Households growth rate in Table 3-3.

Table 3-3 MPO Annual Growth Rate vs. Annual Growth Rate by Lot Additioins

ADP	MPO Annual Residential Units Added	MPO Annual Growth Rate	Average Annual Lot Addition	Annual Lot Addition Growth Rate
Bayside	97	0.3%	60	0.2%
Calallen	80	5.3%	24	1.8%
CC Airport	65	4.1%	0	0.0%
Downtown	112	3.0%	5	0.5%
Flour Bluff	57	0.7%	112	1.4%
London	288	4.6%	225	4.5%
Northwest	304	2.5%	71	0.6%
Padre/Mustang Island	131	2.2%	36	0.6%
Southside	553	1.3%	421	1.0%
Westside	145	0.8%	70	0.4%
Total	**1,832**	**1.3%**	**1024**	**0.8%**

In addition, the City provided growth rate information from previous time periods for six of the ADPs, which was included in the overall evaluation of growth rates. Historic growth rate and the associated period are provided in Table 3-4.

Table 3-4 Historic Growth Rate by ADP

ADP	Time Period	Growth Trend
Bayside	2010-2021	0.15%
Calallen	No Data	
CC Airport	No Data	
Downtown	No Data	
Flour Bluff	2010-2019	0.67%
London	2000-2018	7.2%
Northwest	No Data	
Padre/Mustang Island	2000-2019	2.48%
Southside	2000-2018	2.04%
Westside	2000-2019	0.36%

This information was considered along with the other data discussed to develop a baseline and a reasonable prediction of projected growth. Growth trends were discussed with City Staff and the CIAC, who provided input from the builder, developer, engineering, business, and general citizen communities. Growth rates were adjusted based on the input from the CIC and based on the reviews and the discussions noted, a growth rate for each ADP was selected with the following rational:

- Bayside is judged to have minimal growth and there is no current indication this growth rate may increase in the ten-year planning periods. A growth rate of 0.2 percent is used.
- Conditions and growth in Calallen are like those in the Northwest ADP and the same growth rate of 1.5 percent is used.
- Based on discussions with the CIAC, residential development in the CC Airport ADP may not occur at an appreciable rate during the planning horizon of this Master Plan and no growth (0.0 percent) is used.
- The Downtown rates have a broad range; however, there is an ongoing effort to encourage “redevelopment” in the downtown areas, necessitating consideration of a higher growth rate. A rate of 2.0 percent is used.
- In the Flour Bluff area, the MPO and City growth rate are similar, but there is an increase in growth occurring recently based on the lot added information. This observation is consistent with recent development activity in the area. A rate of 1.0 percent is used for this area.

- For the London area there is currently strong interest in development, the past observed growth rate as identified by the City is 7.2 percent. After discussions and review with the CIAC, an annual growth rate of 10.6 percent has been applied in this area.
- The Northwest area has a significant range in the available data. An average growth rate between the MPO household data and the lot addition data of 1.5 percent is used.
- In the Padre/Mustang Island ADP, the MPO growth rate and the City's growth trend are consistent. The growth rate in lot count may be minimal due to the type of growth (i.e., planned use developments). A growth rate of 2.4 percent is used.
- The Southside area has experienced a higher rate identified by City data than either the MPO or the added lot count data. Interest in development in this area is strong and a conservative 2.0 percent growth rate has been selected.
- The Westside lot count rate and growth trend identified by the City are consistent. A growth rate of 0.4 percent was selected for the Westside.

The growth rates developed and considered and the selected growth rates for use as the basis of this Master Plan are shown in Table 3-5.

Table 3-5 Growth Rates Reviewed and Selected

ADP	Annual Growth in Employees	Annual Growth in households	Annual Lot Addition Growth Rate	Historic Growth Rate	Selected Growth Rate
Bayside	0.2%	0.3%	0.2%	0.15%	0.2%
Calallen	1.6%	5.3%	1.8%		1.5%
CC Airport	1.9%	3.5%	0.0%		0.0%
Downtown	0.1%	2.6%	0.5%		2.0%
Flour Bluff	0.3%	0.7%	1.4%	0.67%	1.0%
London	5.6%	4.6%	4.6%	7.2%	10.6%
Northwest	1.4%	2.3%	0.6%		1.5%
Padre/Mustang Island	2.6%	2.0%	0.6%	2.48%	2.4%
Southside	1.2%	1.3%	1.0%	2.04%	2.0%
Westside	0.8%	0.8%	0.4%	0.36%	0.4%
Total	0.9%	1.3%	1.8%		1.5%

For commercial development, the growth rates taken from the MPO data are used. Table 3-6 provides the 2021 and 2031 data for residential and commercial growth used for evaluating future water demands and proposed Projects to meet current and future needs.

Table 3-6 Projected 10-Year Commercial and Residental Growth by ADP

ADP	2021 Households	2031 Households	2021 Employees	2031 Employees
Bayside	31,508	32,144	25,887	26,342
Calallen	13,310	1,520	3,502	4,093
CC Airport	1,585	1,582	8,927	10,755
Downtown	3,794	4,625	17,328	17,450
Flour Bluff	8,006	8,844	11,725	12,077
London	1,100	3,000	423	732
Northwest	12,152	14,103	11,536	13,307
Padre / Mustang Island	5,987	7,589	2,666	3,431
Southside	41,601	50,711	26,898	30,226
Westside	18,533	19,288	31,253	33,767
Total	**129,485**	**147,886**	**142,214**	**155,164**

3.3. Land Use

With the annual growth rate for the ADPs selected, the next step is to identify where the anticipated growth may occur to facilitate planning for future water system expansion. Vacant land that could develop withing the planning horizon of the master plan is assessed by comparing the anticipated growth with current land use density and use. For example, residential growth can be assessed in ADPs by determining the overall density and then using the number of projected new households to calculate how much undeveloped land may be impacted by the predicted development. As an example, for residential development, there are 8,006 residences in the Flower Bluff ADP in 2021, the current density across residential land use types is three units per gross acre. The predicted growth by 2031 in households is 567, which equates to 189 acres of currently undeveloped or agricultural land being developed into some type of residential use. Similar evaluations have been conducted in each ADP.

Current land use maps and information from ADPs were used to identify currently vacant and agricultural areas within the ADPs and future land use mapping based on current land use zoning and previous master planning efforts have been developed by the City to facilitate practical and efficient

development. The existing and future land use maps were overlayed to identify currently vacant and agricultural land that could be developed, and what the anticipated land use for the area would be.

Maps have been prepared for the ADPs identifying currently undeveloped land. The base color of the vacant lands correlate to the zoned land use (see map legends) and the outline color for parcels indicates whether the current land use is vacant (orange outline) or agricultural (green outline). Due to their size, this information is maintained in a shapefile provided to the City.

New lot information provided by the City was then reviewed to assess where potential growth would occur and to identify overall growth patterns. For a new development outside of the City limits to have water services, the land must be annexed, and the water collection system extended, so growth outside of the City is assumed to occur adjacent to existing development within the City Limit or to follow patterns like current development and then to move outward into the ETJ. Other development factors, such as properties within the Air Installation Compatible Use Zones (AICUZ) around military air installation and Accident Potential Zones (APZ) around the Corpus Christin international Airport. Such zoning and use restrictions were assumed to delay development and limit the land use density in the associated areas. For developing ten-year projections, development in within areas with land use restrictions was assumed to remain stagnate and no contributions were included for the ten-year flows.

It should also be noted that areas within defined 100-year flood zones is anticipated to develop eventually. Based on conversations with the CIAC, development in these areas would be larger lots and water system needs will be minimal.

4. WATER FLOWS

4.1. Master Plan methodology

Land use assumptions are used to develop a general prediction of where growth will occur, both in residential and commercial / industrial areas, how fast that growth will occur, and the impact predicted growth patterns will have on the water collection and treatment system. General guidelines have been developed and presented for use in planning and guiding future expansion of the water system. These guidelines are not intended to be prescriptive as to exact location and specific route of future improvements while providing guidance on flows that can be anticipated and how to manage increased flows due to development.

To complete the master plan, three source documents were used:

- FY 2022-2023 City of Corpus Christi Amended CIP
- Texas Water Development Board Coastal Bend (Region N) Regional Water Planning Group 2021 Regional Water Plan
- 10-Year Water System Master Plan Recommendations

The City had completed a hydraulic model of their distribution system as part of another project. That model was used to identify future needs within the City.

4.2. Existing Water Flows

Water demands within the existing City model were not changed.

4.3. Future Flows

Future flows were developed and evaluated for a ten-year planning horizon and an ultimate build-out condition. These flows are provided in Table 4-1.

Table 4-1. Water Demands

Year	Projected Maximum Treated Water Demand * (MGD)
2021	107
2031	122
2036+	137

* Does not include future large volume users or new industries.

5. WATER SYSTEM EVALUATION

The Water System Evaluation was completed by LAN. Their evaluation is included as Appendix A. Key summary factors for this report are:

- The City hydraulic model for existing conditions did not identify any capacity issues. Therefore, there are no near term distribution system projects required.
- Short-range (2022-2023) and long range (2026-2027) projects already planned by the City were included in the model.
- There are two 10-year projects recommended to relieve pressure issues.

6. COST FACTORS

Proposed projects have been developed to address the identified capacity constraints that currently exist and that are anticipated based on potential development. To provide a reasonable estimate of cost for the proposed projects cost factors have been developed that can be applied to proposed work to develop a budgetary level estimate of project costs. Estimates of cost are high level and are based on generally accepted construction practices, overall capacity needs, materials, sizes, and depth of various system components and are not based on a specific design. The cost factors for water system improvements are included in Appendix A.

7. CAPITAL IMPROVEMENTS

The capital improvements have been divided into near term, 10-year and ultimate projects. “Near term” are projects that should be completed or and in the process of being completed prior to 2025. 10-Year are projects that aren’t immediately needed but should be completed for growth in the next ten years. Ultimate projects are projects defined for the ultimate buildout of the City. Appendix A includes individual costing sheets for each recommended project.

Although the amount of development that will occur in the next ten years can be predicted, it is difficult to determine with reasonable accuracy where that growth will occur. Generally, costs were developed for the current project needs and for the ultimate flow conditions project needs. Ten-year costs were then developed by taking a percentage of the ultimate project costs based on predicted growth rates. Based on the breakdown generated using this approach a list of probable ten-year projects has been developed.

The City currently has significant capital investment planned to preserve and expand accessibility to raw water. Table 7-1 provides information on projects that have been identified and are currently in progress or are being developed for Near Term Projects.

Table 7-1 Near Term Improvements

Project No.	Project	Year	Estimated Cost
1	Choke Canyon Dam Infrastructure Improvements	2022	$1,219,533
2	Wesley Seale Dam (Lake Corpus Christi) Instrumentation Rehabilitation	2022	$5,060,000
3	Wesley Seale Dam Dewatering System and Spillway Gate Rehabilitation	2022	$13,440,000
4	Mary Rhodes Pipeline Phase I Condition Assessment	2024	$3,381,000
5	Mary Rhodes Pipeline Phase I System Improvements	2022	$19,300,000
6	Mary Rhodes Pipeline Phase II System Improvements (Bank Erosion)	2022	$14,895,000
8	Nueces River Raw Water Pump Station Transmission Main	2022	$9,350,000
9	Baffle Wall Improvements	2024	$832,000
10	Electrical Distribution Improvements	2023	$1,250,000
11	Electrical Substation	2023	$8,085,000
12	Flocculation Upgrades and Baffling In Basins 1 and 2	2023	$14,500,000
13	Security Upgrade	2023	$2,750,000
14	Sedimentation Basin Improvements	2023	$18,515,730
15	Site Infrastructure Improvements	2023	$4,567,500
16	Chlorine System Improvements	2023, 2031	$54,357,811

Project No.	Project	Year	Estimated Cost
17	Recycle Pond Improvements	2023, 2025	$4,750,000

10-year improvements are provided in Table 7-2.

Table 7-2 10-Year Improvements

Project Number		Project Name	Cost	Growth %
WATER SOURCES[1]				
	LR 2	Reclaimed Water Infrastructure Study	$10,000,000	50%
E15117		Seawater Desalination	$220,736,326	50%
	LR 3	Seawater Desalination (City's Second Desalination Facility)	$275,000,000	50%
WATER TREATMENT[2]				
18131		ONSWTP Clearwell No. 3	$17,369,000	24%
19032		ONSWTP Filtration System Hydraulic Improvements	$20,000,000	24%
E17047		ONSWTP Raw Water Influent and Chemical Facilities Improvements	$69,300,000	24%
	LR 8	ONSWTP Clearwell No. 4	$20,000,000	24%
23059	LR 10	ONSWTP Solids Handling & Disposal Facility	$43,700,000	24%
26003	LR 11	ONSWTP Third Treatment Train	$96,000,000	24%
23025	LR 12	ONSWTP Weir Improvements Basins 3 & 4	$8,847,000	24%
WATER DISTRIBUTION				
22144		Flour Bluff 18'' Line Extension[3]	$8,085,000	100%
21039		Nueces Bay Blvd - Poth Lane Water Line Replacement[4]	$17,750,000	27%
	LR 17	Rand Morgan 16" Water Main Extension[3]	$5,775,000	100%
23033	LR 22	Water Line Extension to Padre Island[5]	$44,310,000	50%
	LR 24	Water System Integration Piping for New Water Plant[5]	$25,000,000	50%

[1] Water Source IFCIP projects include a 50% factor for resilience or redundancy of the existing water supply and a 50% growth factor.
[2] Water Treatment IFCIP projects have a 24% growth factor representing the capacity increase from 161.5 MGD to 200 MGD.
[3] Flour Bluff Water Line and Rand Morgan Water Main Extensions are 100% growth, extending service to new developments.
[4] The Nueces Bay Boulevard / Poth Water line is a 27% upsize over existing capacity for service to new development, and the growth percentage is 27%.

[5] The Padre Island Extension and New Water Plant Piping represent a 50% growth percentage and a 50% resilience factor for existing water service.

Beyond the recommended improvements for Year 2031, no additional system deficiencies are identified requiring water system improvements for the ultimate planning year.

CITY OF CORPUS CHRISTI
Water Master Plan, Land Use Assumptions, and Capital Improvements Plan

Appendix A. Water Master Plan Technical Report

Texas Registered Engineering Firm No. 2614

Water Master Plan Technical Report

City of Corpus Christi | Pape-Dawson Master Planning and Impact Fee Study

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding, or construction.

Engineers: Lisa K. Lattu, Behnaz Khakbaz
PE License Numbers: 90205, 143075
Firm: Lockwood, Andrews & Newnam, Inc.
Firm Number: F-2614
Date: 12 September 2023

9/12/2023

Table of Contents

1 Purpose

The City of Corpus Christi (City) contracted Pape-Dawson Engineers, Inc. (Pape-Dawson) for a Master Planning and Impact Fee Study. Pape-Dawson contracted with Lockwood, Andrews, and Newnam Inc. (LAN) for Water and Wastewater Master Plan Support. This technical memorandum summarizes the Water Master Plan Support including system modeling and Water Impact Fee Capital Improvement Plan (IFCIP) development for the water system for the 2031 and ultimate planning years.

1.1 Scope Assumptions

- Development of capital improvements associated with new water source(s) is not included in this technical memorandum.
- Review of water treatment plant and other facilities is based solely on condition and capacity.
- Treatability, bench scale or modeling of water quality performance and water chemistry effects on the distribution system water quality or impacts were excluded.
- Costs were developed utilizing the City of Corpus Christi *Fiscal Year 2023-2024 Proposed Capital Budget* (FY 2023 CIP) and the *Texas Water Development Board Coastal Bend Regional Water Planning Area Region N* 2021 *Regional Water Plan* (2021 Region N Water Plan).

2 Flow Usage / Development

2.1 Land Use and Growth Projections Existing Land Use

Pape-Dawson provided a technical memorandum dated November 2, 2022, titled City of Corpus Christi Master Plans – Land Use and Population Projections which provides a detailed analysis of future land use in determining growth. **Table 2-1:** is the final growth rate by area development plan (ADP).

Table 2-1. Assumed 10-Year Growth by ADP

ADP	2021 Households	2031 Households
CC Airport	1,582	1,582
Downtown	3,794	4,625
Flour Bluff	8,006	8,844
Bayside	31,508	32,144
Northwest	12,152	14,103
Southside	41,601	50,711
Westside	18,533	19,288
London	1,100	2,205
Calallen	1,310	1,520
Main System Subtotal	**119,586**	**135,022**
Padre/Mustang Island	5,987	7,589
TOTAL City of Corpus Christi	**125,573**	**142,611**

2.2 Raw Water Master Plan

For this technical memorandum, the City instructed LAN to use the 2021 Region N Water Plan as the preliminary raw water master plan. The information from that plan is reviewed in the next section, Water Supply Strategies and Evaluations.

2.3 Future Treated Water Flows

The City completed a review of its elevated storage tanks within the past two years. As part of that effort, CP&Y, Inc. (CP&Y)[1] reported the average daily flow increases from 62 million gallons per day (MGD) in Year 2011 to 82.5 MGD in year 2025 based on the City's water model.

Due to the influence of water flows on wastewater loads, Pape-Dawson received the City's current and historical water data to prepare uniform 10-year and ultimate water demands for use with the water and wastewater plans. LAN received these demands as a shapefile with the demands allocated to parcels with planned growth.

3 Water Supply Strategies and Evaluations

3.1 Water Supply Master Plan

Upon the City's direction, LAN reviewed the 2021 Region N Water Plan to prepare the preliminary raw water master plan. While the 2026 Region N Water Plan is in preparation by the Regional Water Planning Group, there were no demand or water management strategy updates available for use during the Water Master Plan Development.

3.1.1 Water Supply Strategies

The 2021 Region N Water Plan includes potential water supply or water management strategies over a 50-year horizon. The IFCIP considers only those improvements through the Year 2031, so the water management strategies from the 2021 Region N Water Plan beyond 2031 are excluded.

The City is included as a potential sponsor for the six projects listed below.

- O.N. Stevens Water Treatment Plant Improvements: The City is completing an O.N. Stevens Water Treatment Plant (ONSWTP) master plan with a current list of improvements. LAN reviewed the improvements listed in the 2021 Region N Water Plan, but the City's master plan updates provided the projects utilized in this technical memorandum.
- Municipal Conservation: Municipal Conservation is considered as a water demand strategy but is not included as water supply in the IFCIP.
- Aquifer Storage and Recovery: The Aquifer Storage and Recovery (ASR) project is included in Appendix A for reference, but not included in the IFCIP. The Regional Planning Group and the City are evaluating this project as part of the 2027 update to the Region N Water Plan.
- Inner Harbor and La Quinta Desalination: The City has two desalination projects under consideration for future water supply. These projects update and replace the 2021 Region N Water Plan desalination projects.

[1] CP&Y, Inc. is now doing business as STV Group, Inc.(STV)

- Evangeline / Laguna Treated Groundwater Project: The Evangeline / Laguna Treated Groundwater project is included in Appendix A for reference. The project is included in the 2021 Region N Water Plan as a joint project between the City and the San Patricio Municipal Water District, though it has not been fully vetted or adopted by the City and is under review as part of the 2027 update to the Region N Water Plan.

4 Existing System Review

4.1 Model Setup and Assumptions

The City's existing InfoWater Pro hydraulic model (October 2022) was used as the basis for this analysis and provided by CP&Y[2]. Corpus Christi Water (CCW) requested a model update to include projects already in planning, design, or construction and additional water system improvement projects identified to serve future known developments. Proposed water system improvements were reviewed or developed to meet existing and projected demands with a minimum system pressure of 35 psi.

4.2 Existing System Demands

The existing hydraulic model included three steady-state scenarios representing existing Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD) conditions. **Table 4-1** lists the existing system demands.

Table 4-1: Existing System Demands

Demand Condition	GPM	MGD	Peaking Factor*
ADD	59,046	85	1
MDD	74,398	107	1.26
PHD	83,325	120	1.41

**Peaking Factor= Demand/ADD*

4.3 Existing System Currently Planned Projects

The existing water system model update by STV included projects completed within the last five (5) years. Additional project information was provided by the City for analysis of projects currently planned or in early design stages.

The City has a Pipe Reinvestment Program to replace pipes at the end of their useful life or adversely affected by the new elevated storage tanks. There were no recent reports or project information for the Pipe Reinvestment Program available for review; those projects are included as budgetary estimates from the Fiscal Year 2023-2024 Proposed Capital Budget.

[2] CP&Y, Inc. is now doing business as STV Group, Inc.(STV)

4.3.1 Specifically Referenced Projects

The following were identified in the scope as currently planned projects subject for review and possible inclusion in the water model. The status of the review is addressed for each project.

- Citywide Water Distribution System Indefinite Delivery/Indefinite Quantity Program: This was a separate study not available for independent review but included as projects identified by CCW.
- San Patricio Municipal Water District Transmission Main Connection: This project is in service.
- Yorktown Boulevard Water Line Extension: This project is in service.
- Water Line Replacement Program: This was a separate study not available for independent review but included as projects identified by CCW.
- Elevated Water Storage Tanks – Citywide: This was a separate study not available for independent review but included as projects identified by CCW.

4.3.2 Existing System Water Treatment Capacity

ONSWTP staff confirmed the plant's current capability to treat 161.5 MGD and projects identified in the ongoing plant master plan expands the treatment capacity to 200 MGD.

4.4 Existing System Evaluation

The existing system was analyzed for improvements needed to address present-day system issues. For this analysis, LAN used the PHD scenario in the existing hydraulic model to represent the worst-case scenario. LAN conducted a steady-state PHD analysis to identify possible capacity issues within the existing system. Analysis of the existing system results indicated that except for locations in the vicinity of ESTs or upstream of pump stations, the minimum pressure at all other locations was above 35 psi, satisfying Texas Commission on Environmental Quality (TCEQ) requirements.

4.4.1 Model Limitations and Recommendations

The limitations encountered by LAN during this project were:

- Lack of demand diurnal patterns in the received model, as all scenarios were steady-state.
- The existing system hydraulic model was not calibrated.

Due to a lack of demand diurnal patterns, LAN did not evaluate the system storage variation for operational efficiency. A criterion for maximum pipe velocity was not available and should be evaluated with the City's model when available. Fire flow analysis was not addressed since it was not within the IFCIP scope of work.

To address these limitations, LAN recommends re-evaluating future projects once the existing system model is calibrated, and the elevated storage tank study is complete.

4.5 Existing System Recommended Improvements

Since the existing system evaluation did not identify any hydraulic capacity issues, no near-term capital improvement projects are recommended for the City's existing system.

5 Future System Review

5.1 Future System Demands

For uniformity between the water and wastewater plans, Pape-Dawson distributed the demands to future parcels with planned growth for the 2031 and Ultimate planning years. That information was shared with LAN as a GIS shapefile which was imported into the City's model maintained by STV.

An estimate of unaccounted-for water (UFW) of 6% was assumed to estimate leakage within the City's water system. InfoWater Pro's Allocation Manager was used to allocate future demands to model nodes following the closest pipe/closest junction rule. The Year 2031 and Ultimate System Average Day Demands (ADD), Maximum Day Demands (MDD), and Peak Hour Demands (PHD) are included in **Table 5-1** below.

Table 5-1: Existing and Future System Demands

Demand Condition	Existing Demand		Peaking Factor[1]	Demand Growth		2031 Demand		UFW[2]		Ultimate Demand	
	GPM	MGD		GPM	MGD	GPM	MGD	GPM	MGD	GPM	MGD
ADD	59,046	85	1	4,518	6.5	63,564	92	3,814	5.5	67,378	97
MDD	74,398	107	1.26	5,692	8.2	80,090	115	4,805	6.9	84,896	122
PHD	83,325	120	1.41	6,370	9.2	89,695	129	5,382	7.7	95,077	137

[1]Peaking Factor= Demand/ADD
[2]UFW assumed as 6%

5.2 Modeled O.N. Stevens Water Treatment Plant Production

As part of the modeling effort, the water supply needed from the O.N. Stevens Water Treatment Plant (ONSWTP) was evaluated. Based on information from CCW staff, ONSWTP currently treats up to 110 MGD. This confirms the existing demand in the 2022 model of 107 MGD.

An additional 19 MGD regular pump capacity will be needed for a new maximum day demand of 129 MGD for projected 2031 system demands. An additional 27 MGD regular pumping capacity is needed meet the ultimate maximum day demand of 137 MGD. The increased production amounts are possible with the existing ONSWTP capacity of 161.5 MGD.

5.3 Future System Evaluations

PHD scenarios were developed as the worst-case scenario to identify future IFCIPs. Projects that are currently in various stages of design and construction were provided by the City and implemented into the model. **Table 5-2** lists the City's short-range (2022 to 2025) and long-range (2026 to 2027) projects that were incorporated into the future system models for the 2031 and ultimate planning years.

Table 5-2: Fiscal Year 2022-2023 Projects Incorporated in Future Hydraulic Models

Timeline	CIP#	Name	Description
Short-Range FY 2022-2025	22144	Flour Bluff 18” Line Extension	Existing 18" main extended approximately 14,500 LF and connected to a larger transmission main that runs along Flour Bluff Drive
	21038	Leopard St & Up River Rd Water Line Replacement	Removal of 32,000 LF of 30” CIP pipe and replacement with new 24” FPVC pipe
	21039	Nueces Bay Blvd & Poth Lane - Water line	Replacement of ~9,000 LF of existing 16” CIP water line along W Broadway St and Nueces Bay Blvd, and 5,000 LF of existing 16” CIP water line along Poth Lane with 18” PVC pipe
	20100	Packery Channel Water Line	Building a new water transmission line along State Hwy 361 to provide redundant and reliable water supply to NCWID #4
	19038	Port Avenue Water Line Replacement	Replacement of ~7,540 LF of existing 16” CIP pipe along Port Ave from Horne Rd to Guadalupe St with 16” PVC pipe
	18156	Ship Channel Water Line Relocation	Replacing the existing two 16” water lines that cross the Ship Channel at Avery Point with a 24” steel pipe
	23033	Water Line Extension to Padre Island	Connecting a 42” water line on Whitley across Laguna Madre to Coral Vines EST with a 24” pipe
	E16290	Elevated Water Storage Tanks-Citywide	FY 22: Modifications to Holly and Rand Morgan ESTs. Installation of pressure relief valves (PRVs) FY 24: Completion of new EST in Flour Bluff on Division Road. FY 25: Completion of new EST on Nueces Bay Boulevard. Demolish old EST at Flour Bluff on Division Road, and old EST on Morgan
Long-Range FY 2025-2026	LR-13	Rand Morgan 16" Water Main Extension	Adding an interconnection of 16” transmission main along Rand Morgan Rd from Agnes St to McNorton Rd.

Based on the received hydraulic model, the location and capacity of the two new ESTs were assumed as listed in **Table 5-3**.

Table 5-3: New ESTs Properties

Name	Capacity (MG)	Location
New Flour Bluff EST	3.0	Division Rd, west of Flour Bluff Dr.
New Nueces Bay Blvd EST	1.25	Near the intersection of Nueces Bay Blvd and Hulbirt St.

5.4 TCEQ Capacity Analysis

An evaluation of the City's system was performed to determine if the system met the Texas Commission on Environmental Quality's (TCEQ's) minimum pumpage and storage requirements as outlined in Chapter §290.45 of the Texas Administrative Code. A summary of the applicable TCEQ minimum requirements is included below. TCEQ's requirements are based on the raw number of connections, which have been approximated as the number of households in each of the city's pressure planes.

5.4.1 TCEQ Minimum Requirements:

- Elevated Storage Capacity: Elevated storage capacity of 100 gallons per connection.
- Elevated Storage Credit: If an elevated storage capacity of 200 gallons per connection is provided, reduced service pumping requirements can be applied as discussed below.
- Pressure Tank Capacity: For future systems, if elevated storage is not provided, a pressure tank capacity of 20 gallons per connection is required.
- Total Storage Capacity (elevated and ground storage): Total storage capacity of 200 gallons per connection, inclusive of the 100-gallon minimum requirement listed above.
- Service Pump Capacity: A minimum of two (2) pumps with a combined capacity of 2.0 GPM per connection or 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. For systems that meet the elevated storage credit requirement listed above, a minimum of two (2) pumps with a combined capacity of 0.6 GPM per connection are required for each pump station or pressure plane.

The City's existing system is divided into two (2) pressure planes – Main and Padre Island. The 2031 system meets all TCEQ capacity requirements except for the elevated storage capacity in the Main Pressure Plane. Results are summarized in **Tables 5-4 and 5-5**.

Table 5-4: 2031 TCEQ Capacity Analysis for Main Pressure Plane

	Main Pressure Plane Evaluation				
	TCEQ Requirements			System Check	
Elevated Storage Capacity [gal]	100	gal/conn	13,502,200	10,000,000	DOESN'T MEET TCEQ REQUIREMENTS[1]
Elevated Storage Credit [gal]	200	gal/conn	27,004,400	10,000,000	DOESN'T QUALIFY FOR PUMPING CREDIT
Total Storage Capacity [gal]	200	gal/conn	27,004,400	37,500,000	MEETS TCEQ REQUIREMENTS
Service Pump Capacity [gpm]	2	gpm/conn	101,088	159,924	MEETS TCEQ REQUIREMENTS

[1] Options for bringing additional elevated storage on-line or pursuing an Alternative Capacity Requirement (ACR) are part of the separate elevated storage project and report.

Table 5-5: 2031 TCEQ Capacity Analysis for Padre Island Pressure Plane

	Padre Island Pressure Plane Evaluation				
	TCEQ Requirements			System Check	
Elevated Storage Capacity [gal]	100	gal/conn	758,900	1,500,000	MEETS TCEQ REQUIREMENTS
Elevated Storage Credit [gal]	200	gal/conn	1,517,800	1,500,000	DOESN'T QUALIFY FOR PUMPING CREDIT
Total Storage Capacity [gal]	200	gal/conn	1,517,800	2,650,000	MEETS TCEQ REQUIREMENTS
Service Pump Capacity [GPM]	2	gpm/conn	5,565	8,000	MEETS TCEQ REQUIREMENTS

5.5 Future System Draft Recommended Improvements

Draft projects for Year 2031 are listed in **Table 5-6**. No additional projects were required to meet system demands or pressures for the Ultimate scenario in the Main System.

Table 5-6: LAN's Recommended Projects for Year 2031

Description	Note
Replace ~8,600 LF of 16" ACP pipe with 16" PVC pipe along State Hwy 361	Prevents low pressures along State Hwy 361 near Frontside Dr
Upsize ~1,670 LF of 2" to 6" pipe south of Saratoga Blvd and west of Chapman Ranch Rd	Improve minimum pressure along this pipeline

5.5.1 Model Limitations and Recommendations

The limitations encountered by LAN for future model scenarios are detailed in Section 4.4.

To address these limitations, LAN recommends re-evaluating future projects once the existing system model is calibrated, and the elevated storage tank study is complete.

5.5.2 London and Calallen Recommended Year 2031 Improvements

Additional 2031 demands were developed by Pape-Dawson for the high-growth London and Calallen ADPs. LAN incorporated those demands into the Year 2031 model scenario and recommended additional projects to create a framework for development.

5.5.3 Capital Improvement Advisory Committee

After review by the Capital Improvement Advisory Committee (CIAC) on June 22, 2023, projects ineligible for impact fees were eliminated from the recommendations. Projects outside the City's Certificate of Convenience and Necessity (CCN) boundary and water lines smaller than 12-inches were removed, leaving only the CCW planned CIP.

6 Water Treatment Plant Asset Evaluation

This technical memorandum does not include or address water quality performance, or water chemistry, or impacts and/or effects to the distribution or transmission system.

Per Pape-Dawson's scope with the City, the O.N. Stevens Surface Water Treatment Plant (ONSWTP) conditions/capacity assessment included the following objectives:

- Review of previous evaluations prepared within the last five years. Using information provided by the City, to determine which recommendations from the previous evaluations have been implemented and which remain. Using this existing information, evaluate if existing facilities have the capacity to meet projected 5-year and 10-year flow demands and provide a list of recommended improvements to meet flow demands, focusing only on high-level unit processes.
- Visit water treatment plant site and observe major unit processes. Meet with water treatment plant staff to confirm/clarify observations and discuss history of plant operations and maintenance concerns.
- Evaluate the current projects identified in the City's Capital Improvement Plan to determine the portion associated with maintenance-related versus growth-related costs.

LAN's scope for the ONSWTP Asset Evaluation is in line with the Pape-Dawson scope with the City in that:

- Review of the water treatment plant is based solely on condition and capacity.
- This assessment does not include any water quality evaluations in accordance with the United States Environmental Protection Act (US EPA) or (TCEQ) Safe Drinking Water Act compliance.
- Any treatability, bench scale or modeling of water quality performance or any water chemistry effects on the distribution system water quality or impacts is excluded from this evaluation.

6.1 Previous Evaluations

LAN received no previous reports or evaluations for ONSWTP.

Beyond the information provided in the City's Capital Improvement Plans, a site plan map of the ONSWTP master plan and brief phone or email communications, LAN was only able to address facility conditions and operational concerns raised by staff during the site visit.

6.2 Evaluation of Current Processes and Projects

LAN performed a site visit October 11, 2021. The site visit involved a guided tour of the facility focused only on high-level unit processes and did not include an in-depth inspection of specific equipment to evaluate treatment performance or condition.

LAN had a follow-up staff tele/video meeting with ONSWTP Staff April 20, 2023. The follow-up staff meeting involved a review and discussion of ongoing and future projects.

After reviewing observations, plant maintenance history and any operational concerns LAN confirmed that the ongoing ONSWTP master plan had incorporated staff concerns with the facility or operations. Capacity Discussions with Staff confirmed that the existing facility could treat 161.5 MGD and that ONSWTP master plan would increase that capacity to 200 MGD. While individual projects may increase individual process capacities, the facility total capacity will not increase beyond 161.5 MGD until all process improvements are in place.

6.2.1 Specifically Referenced Projects

The following were identified in the scope as currently planned projects subject for review in the water master plan. The status or project details are addressed for each project below.

- ONSWTP High Service Building No. 3: Project is complete.
- ONSWTP Raw Water Influent and Chemical Facilities Improvements: Project E17047 will address existing hydraulic constraints and upgrade chemical feed systems. The scope involves eliminating hydraulic constrictions in the front-end piping, modernizing chemical storage and chemical feed systems to optimize dosage, reliability, monitoring, and control of water treatment chemicals. This is a continuation of projects 180415 and 180156 . The project was scheduled to advertise in 2023 with construction to begin in late 2026 or early 2027.
- ONSWTP On-Site Hypochlorite Generation: Projects 21104 and LR 7 consist of replacing the existing, aging chlorine gas system with a safer, more reliable on-site hypochlorite generation system. This will eliminate the health and life risk of exposure to chlorine gas for ONSWTP staff and the surrounding community. Modifications to the existing chlorine dioxide system are also included in this project's scope. Design should be complete and out for bids in the fall. The chlorine system will treat 200 MGD.
- ONSWTP Solids Handling and Disposal Facilities: Projects 23059 and LR10 address the design and construction of a new solids handling facility at ONSWTP. ONSWTP uses conventional water treatment processes (coagulation, flocculation, sedimentation, filtration) for removal of turbidity and naturally occurring organic matter. The combination of these processes generates a solids waste stream that is stored using three (3) on-site and four (4) off-site lagoons. Once filled, the on-site lagoons require the City to hire a 3rd party contractor to remove accumulated solids, dewater and haul to the landfill. Further, the initial solids storage permit allowed for permit renewals of off-site lagoon storage only until 2026. It is essential that a new solids handling facility be built at ONSWTP as a long-term solution to manage solids.
- ONSWTP Site Infrastructure Improvements: Project E13051 incorporates ongoing operational improvements and/or emergency repair. Improvements include but are not limited to: filter-to-drain sluice gate replacement, filter-to-drain butterfly valves replacement, filter-to-waste butterfly valves replacement, facilitates structural repairs, cable tray foundation repairs and storm water drainage repairs and improvements. There is no projected operational impact with this project, but a reassessment will be done upon completion of the project design to determine ongoing or maintenance costs.
- ONSWTP Sedimentation Basin Improvements: Project 18130 addresses the existing Trac-Vac solids collector system at ONSWTP Plant 1 primary sedimentation basin. The existing system is obsolete and has exceeded its useful design life. The current system requires substantial corrective maintenance and has failed often, resulting in inefficient/ineffective solids removal from the basins which impacts the ability to reliably treat water. The scope of this project includes conducting a preliminary design to determine alternatives and best option for replacing the existing system, developing detailed design and construction documents, and providing construction phase services. A one-time removal and disposal of accumulated sludge and existing vegetation in the ONSWTP presedimentation basin is also included. The rebid for the presedimentation dredging is ongoing.

- ONSWTP Clearwell No. 3: Project 18131 will be built to meet the requirements of treatment capacity and operations. Clearwell 1, originally constructed in 1954, has exceeded its design lifespan and sustained severe deterioration. With a capacity of 4 MG, Clearwell 1 can no longer meet TCEQ requirements of providing a minimum clearwell storage capacity. The other existing clearwell, Clearwell No. 2 has a capacity of 10 MG and remains in good condition and is functioning as intended. There is no projected operational impact with this project, but a reassessment will be done upon completion of the project design to determine ongoing or maintenance costs. This project has been awarded and is expected to be completed in 2025.
- ONSWTP Filtration System Hydraulic Improvements: Project 19032 will upgrade the filtration system components and equipment that has reached its end of service life. The project will also address post-filtration hydraulic bottlenecks which will assist ONSWTP in meeting future capacity requirements of 200 MGD, an increase over the current capacity of 161.5 MGD. Planned improvements will include but are not limited to upgrades to filtration system piping, the replacement of filter gates, valves, and actuators, and filtration system effluent piping and channel hydraulic improvements. There is no projected operational impact with this project, but a reassessment will be done upon completion of the project design to determine ongoing or maintenance costs. This project is currently under design.

7 Water Pump Station and Storage Tanks Evaluation

No previous evaluations were received or reviewed including the ongoing elevated storage report which was not complete at the time of the Master Plan.

Operations staff indicated that other than the ongoing elevated storage update no deficiencies were noted or observed in regular or critical operations.

8 Water Impact Fee Capital Improvement Plan

8.1 Recommended Near-Term Improvements

There is a separate ongoing elevated storage report and associated ACR that may have Near Term Improvements identified for TCEQ compliance. No other near-term or existing system deficiencies are identified in this technical memorandum.

8.2 Recommended 2031 Improvements

The Recommended 2031 Improvements with a growth component, eligible for impact fee analysis are included in **Table 8-1**.

The complete Proposed Capital Improvement Plan Project Sheets, Proposed Capital Improvement Plan Exhibits, and 2021 Regional Plan Project Information Sheets are included as **Appendix A**.

Table 8-1: Recommended Growth Projects through Year 2031

Project Number		Project Name	Planning Cost	Growth %
		WATER SOURCES[1]		
	LR 2	Reclaimed Water Infrastructure Study	$10,000,000	50%
E15117		Seawater Desalination	$220,736,326	50%
	LR 3	Seawater Desalination (City's Second Desalination Facility)	$275,000,000	50%
		WATER TREATMENT[2]		
18131		ONSWTP Clearwell No. 3	$17,369,000	24%
19032		ONSWTP Filtration System Hydraulic Improvements	$20,000,000	24%
E17047		ONSWTP Raw Water Influent and Chemical Facilities Improvements	$69,300,000	24%
	LR 8	ONSWTP Clearwell No. 4	$20,000,000	24%
23059	LR 10	ONSWTP Solids Handling & Disposal Facility	$43,700,000	24%
26003	LR 11	ONSWTP Third Treatment Train	$96,000,000	24%
23025	LR 12	ONSWTP Weir Improvements Basins 3 & 4	$8,847,000	24%
		WATER DISTRIBUTION		
22144		Flour Bluff 18'' Line Extension[3]	$8,085,000	100%
21039		Nueces Bay Blvd - Poth Lane Water Line Replacement[4]	$17,750,000	27%
	LR 17	Rand Morgan 16" Water Main Extension[3]	$5,775,000	100%
23033	LR 22	Water Line Extension to Padre Island[5]	$44,310,000	50%
	LR 24	Water System Integration Piping for New Water Plant[5]	$25,000,000	50%

[1] Water Source IFCIP projects include a 50% factor for resilience or redundancy of the existing water supply and a 50% growth factor.

[2] Water Treatment IFCIP projects have a 24% growth factor representing the capacity increase from 161.5 MGD to 200 MGD.

[3] Flour Bluff Water Line and Rand Morgan Water Main Extensions are 100% growth, extending service to new developments.

[4] The Nueces Bay Boulevard / Poth Water line is a 27% upsize over existing capacity for service to new development, and the growth percentage is 27%.

[5] The Padre Island Extension and New Water Plant Piping represent a 50% growth percentage and a 50% resilience factor for existing water service.

8.3 Recommended Ultimate Improvements

Beyond the recommended improvements for Year 2031, no additional system deficiencies are identified requiring water system improvements for the ultimate planning year.

Appendix A

A-1 **Proposed Capital Improvement Plan Project Sheets**

A-2 **Proposed Capital Improvement Plan Exhibits**

A-3 **2021 Regional Plan Project Information**

A-1 Proposed Capital Improvement Plan Project Sheets

City of Corpus Christi FY 2024 Proposed CIP

Project Number		Project Name	10-Year Planning Cost	Percent Growth
		WATER SOURCES		
E13050	**LR 1**	Choke Canyon Dam Infrastructure Improvements	$5,500,000	0%
	LR 2	Reclaimed Water Infrastructure Study	$10,000,000	50%
E15117		Seawater Desalination	$220,736,326	50%
	LR 3	Seawater Desalination (City's Second Desalination Facility)	$275,000,000	50%
20258		Wesley Seale Dam Instrumentation Rehabilitation	$3,675,000	0%
22023	**LR 4**	Wesley Seale Dam Dewatering System and Spillway Gate Rehabilitation	$42,900,000	0%
	LR 5	Wesley Seale Dam Infrastructure Improvements	$20,000,000	0%
		WATER SOURCES PROJECT TOTAL:	**$577,811,326**	---
		WATER SUPPLY LINES		
23027		Mary Rhodes I Condition Assessment	$1,231,000	0%
E13037		Mary Rhodes I System Improvements	$12,750,000	0%
19025		Mary Rhodes II System Improvements (Bank Erosion)	$14,271,000	0%
E16417		Nueces River Raw Water Pump Station Transmission Main	$330,000	0%
	LR 6	Mary Rhodes I Pump Station Upgrades	$27,300,000	0%
		WATER SUPPLY LINES PROJECT TOTAL:	**$55,882,000**	---
		WATER TREATMENT		
21104	**LR 7**	ONSWTP Chlorine System Improvements	$82,700,000	0%
18131		ONSWTP Clearwell No. 3	$17,369,000	24%
21030		ONSWTP Electrical Generation & Distribution Improvements	$15,975,000	0%
23024		ONSWTP Electrical Reliability Upgrades	$8,085,000	0%
19032		ONSWTP Filtration System Hydraulic Improvements	$20,000,000	24%
22407		ONSWTP Flocculation Upgrades and Baffling in Basins 1, 2	$17,000,000	0%
22406		ONSWTP Fluoride System Improvements	$2,420,000	0%
22405		ONSWTP Navigation Pump Station Improvements	$10,500,000	0%
E17047		ONSWTP Raw Water Influent and Chemical Facilities Improvements	$69,300,000	24%
22406		ONSWTP Recycle Pond Improvements	$4,200,000	0%
	LR 8	ONSWTP Clearwell No. 4	$20,000,000	24%
22408	**LR 9**	ONSWTP Security Upgrade	$8,150,000	0%
18130		ONSWTP Sedimentation Basin Improvements	$14,145,000	0%
E13051		ONSWTP Site Infrastructure Improvements	$4,050,000	0%
23059	**LR 10**	ONSWTP Solids Handling & Disposal Facility	$43,700,000	24%
26003	**LR 11**	ONSWTP Third Treatment Train	$96,000,000	24%
23025	**LR 12**	ONSWTP Weir Improvements Basins 3 & 4	$8,847,000	24%
		WATER TREATMENT PROJECT TOTAL:	**$442,441,000**	---
		WATER DISTRIBUTION LINES		
23061		16" Water Main Extension - Hwy 286 to Alameda	$6,960,000	0%
18154 / 23064	**LR 13**	Citywide Large-Size Water Line Cathodic Protection System	$9,163,000	0%
19037 / 23065 / 23107	**LR 14**	Citywide Water Line Repair/Replacement (Large Diameter)	$115,955,655	0%
19010 / 23073 / 23108	**LR 15**	Citywide Water Line Repair/Replacement (Small Diameter)	$100,600,000	0%
E16290 / 20267	**LR 16**	Elevated Water Storage Tanks - Citywide	$53,870,000	0%
24020		E. Navigation Blvd Water Line Replacement	$12,100,000	0%
22144		Flour Bluff 18" Line Extension	$8,085,000	100%
21038		Leopard Street & Up River Road Water Line Replacement	$17,840,000	0%
21039		Nueces Bay Blvd - Poth Lane Water Line Replacement	$17,750,000	27%
23021		Sand Dollar Connection Line 16" (Coral Vine)	$13,260,000	0%
20101		SH286 Water Line Replacement	$11,569,000	0%
24027		SH358 Water Line Relocation	$1,375,000	0%
18156		Ship Channel Water Line Relocation	$5,959,787	0%
21041		South Side Water Transmission Main Cathodic Protection Improvements	$3,300,000	0%
	LR 17	Rand Morgan 16" Water Main Extension	$5,775,000	100%
	LR 18	Relocation of Water Transmission Line at Corpus Christi Airport	$20,000,000	0%
	LR 19	South Side Transmission Main Line Constraint	$7,000,000	0%
23060	**LR 20**	South Side Transmission Grid Completion	$51,980,000	0%
24021		Up River Rd Water Line Replacement	$8,840,000	0%
	LR 21	Water Line Crossing Replacement - SPID, Hwy 286, US-37	$12,000,000	0%
23033	**LR 22**	Water Line Extension to Padre Island	$44,310,000	50%
23068		Water Street Line Improvements	$6,385,500	0%
	LR 23	Water Line Replacement- N. Chaparral & Mesquite Street	$15,000,000	0%
	LR 24	Water System Integration Piping for New Water Plant	$25,000,000	50%
	LR 25	Weber Rd. Water Line Replacement	$17,000,000	0%
	LR 26	West Broadway Street Water Line Replacement	$12,000,000	0%
		WATER DISTRIBUTION LINES PROJECT TOTAL:	**$603,077,942**	---
		WATER FACILITIES AND OTHER		
23026		Corpus Christi Water Parking Lot Improvements	**$250,000**	0%
23080		Corpus Christi Water Warehouse	**$12,000,000**	0%
24001		Open Storage Yard (CC Water)	**$3,925,000**	0%
23029		Sunrise Beach Facility Improvements	**$1,760,000**	0%
23051		Warehouse Facility from Ground Storage Tank	**$3,093,000**	0%
24110		Wash Rack Water Utilities	**$1,396,000**	0%
21116		Westley Seale Boat and Ramp Pier - (Sunrise Beach)	**$1,100,000**	0%
	LR 27	Water Meter Capital Replacement Program	**$30,000,000**	0%
	LR 28	Water Utility Support - Streets projects	**$106,236,279**	0%
		WATER FACILITIES AND OTHER PROJECT TOTAL:	**$159,760,279**	---
WATER PROJECT TOTAL:			**$1,838,972,547**	---

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**E13050**
Project Name	**Choke Canyon Dam Infrastructure Improvements**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	Outside City Limits
Status	Active

Description

Choke Canyon Dam is located in South Texas on the Frio River, four miles west of Three Rivers, Texas, and approximately 90 miles northwest of Corpus Christi. The reservoir supplies water for municipal and industrial needs and provides recreational and environmental benefits. This project provides for various repairs and improvements identified by City and Bureau of Reclamation including, but not limited to crane repairs, soil erosion control, electrical system repairs, spillway operator motor brake repair, emergency spillway and low flow outlet controls, instrumentation repairs life safety improvements and other miscellaneous improvements required to maintain the 40-year-old structure and to comply with federal statutes.

Justification

This project will ensure the normal operation and increase service life of structure.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	-
Design	-
Eng Admin Reimbursements	-
Long-Range Costs	5,500,000
Total	5,500,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Grant - American Rescue Act	-
Revenue Bonds	-
TBD	5,500,000
Total	5,500,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. This project is anticipated to save maintenance and operations costs by avoiding repeated spot repairs and emergency repairs.

Capital Improvement Plan

2024 *thru* 2033

City of Corpus Christi, Texas

Project #	**LR 2**
Project Name	**Reclaimed Water Infrastucture Study**

SEQ **LR 2**

Type	Study	**Department**	Water Department
Useful Life	15 years	**Contact**	Director of Water Utilities
Category	Water Supply	**Priority**	Critical- Asset Condition/longevity
		Council District	All
		Status	Long-Range

Description

The objective of this project is to develop a reclaimed water infrastructure plan. The plan will include the outline of the distribution network needed within the City for both commercial and institutional customers.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	10,000,000
Total	10,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	10,000,000
Total	10,000,000

Budget Impact/Other

Capital Improvement Plan

City of Corpus Christi, Texas

2024 *thru* **2033**

Project #	**E15117**
Project Name	**Seawater Desalination**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Needed- Deficient Services
Council District	1
Status	Active

Description

The City's Inner Harbor seawater desalination project consists of the technical feasibility, plant site selection, conceptual life-cycle delivery cost, regulatory and permitting criteria, procurement methodology, and design and construction of a 20 million gallon a day (MGD) and expandable to 30 MGD municipal seawater desalination facility in Nueces County.
On April 2020, the City Council approved the submission of an application for a low interest loan from the State for the design and construction for the Inner Harbor seawater desalination facility. Funding was approved in July 2020 and in August 2020 City Council approved the draw of funds for design, RFQ, RFP, land, permits, environmental, legal, power, contingency, and extension of owner's representative agreement for the Inner Harbor facility. In October 2022, the City was granted the Water Rights permit for the Inner Harbor facility by the Texas Commission on Environmental Quality (TCEQ). Land Acquisition, TPDES permit, and U.S. Army Corps permitting are underway.

Justification

Following the 2011-2013 drought of record, the City of Corpus Christi decided to pursue seawater desalination as a new drought-proof water supply for the region. The City is the regional water supplier for commercial, residential, and industrial water needs, serving directly or indirectly approximately 500,000 people across the Coastal Bend. In 2018 the City Council approved a "trigger point" which states that when the region's water supply demands exceed 75% of the firm yield, (the amount of water the City can guarantee during the worst drought of record) the City will need to add a new water supply. Following City Council approval in 2020, the City submitted permit applications for the seawater desalination project.

Expenditures	FY 2023-2024 to FY 2032-2033
Planning	2,521,326
Land Acquisition	5,525,000
Construction/Rehab	188,570,000
Design	21,000,000
Eng Admin Reimbursements	3,120,000
Long-Range Costs	-
Total	220,736,326

Funding Sources	FY 2023-2024 to FY 2032-2033
State Water Implementation Fund Texas Loan- 2020	9,686,326
State Water Implementation Fund Texas Loan- Future	211,050,000
TBD	-
Total	220,736,326

Budget Impact/Other

Maintenance and operational costs will increase, but corresponding revenues will increase with additional water consumption. The City is also seeking additional grant funding from State and Federal agencies to supplement this project.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 3**
Project Name	**Seawater Desalination (City's Second Desalination Facility)**

SEQ **LR 3**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Supply	**Priority**	Needed- Deficient Services
		Council District	All
		Status	Long-Range

Description

This project is to design and construct the City’s second desalination facility.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	275,000,000
Total	275,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	275,000,000
Total	275,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**20258**
Project Name	**Wesley Seale Dam Instrumentation Rehabilitation**
Type	Improvement/Additions
Useful Life	25 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	Outside City Limits
Status	Active

Description

This project provides for improvements to original instrumentation system including integration with O. N. Stevens WTP process controls in response to previous inspection and priority investment recommendations into the system. This project will protect integrity of Wesley Seale Dam system (1957), to provide for proper inspection and updated regulatory reports per TCEQ and preserve a steady flow of dam stability data over time to better inform future maintenance and repair decisions.

Justification

This project will improve reliability, comply with state requirements for high hazard dam owners, and reduce costs. This project is required by TCEQ.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	3,000,000
Inspection	250,000
Design	-
Eng Admin Reimbursements	425,000
Long-Range Costs	10,000,000
Total	13,675,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	3,675,000
TBD	10,000,000
Total	13,675,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. This project is required by TCEQ.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**22023**
Project Name	**Wesley Seale Dam Dewatering/Spillway Gate Rehab**
Type	Reconditioning- Asset Longevity
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	Outside City Limits
Status	Active

Description

This project provides a new dewatering system at Wesley Seale Dam, it will protect the integrity of Wesley Seale Dam system (1957), to provide for proper inspection and maintenance of crest gates and seals pursuant to regulatory reports per TCEQ. Project will also provide for necessary improvements to the gates including seal replacement, miscellaneous structural repairs, full gate reconstruction and application of a protective coating system for new gates. The gate reconstruction will be completed in 6 phases.

Justification

Wesley Seale Dam has 60 crest gates located in two separate spillways: south spillway includes 27 gates and north spillway includes 33 gates. The crest gates are critical infrastructure holding the top 6 feet of water supply in Lake Corpus Christi. Over the years, leakage from side seals has increased and become significant at several gates. Water flow from excessive leakage damages concrete and encourages algae and other vegetative growth. This leads to corrosion issues on gates, metal appurtenances and reinforcing steel.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	14,400,000
Design	-
Eng Admin Reimbursements	1,000,000
Long-Range Costs	-
Total	15,400,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	15,400,000
TBD	-
Total	15,400,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 5**	**SEQ**	**LR 5**
Project Name	**Wesley Seale Dam Infrastructure Improvements**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Supply	**Priority**	Critical- Asset Condition/longevity
		Council District	Outside City Limits
		Status	Long-Range

Description

This project will consist of infrastructure improvements to the Wesley Seale Dam.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	20,000,000
Total	20,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	20,000,000
Total	20,000,000

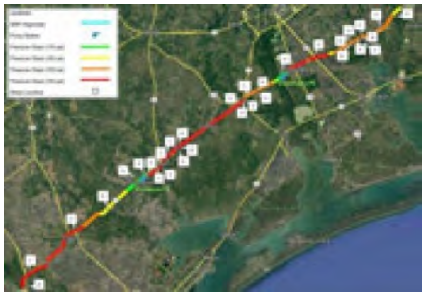
Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23027**
Project Name	**Mary Rhodes Pipeline Phase 1 Assessment**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	Outside City Limits
Status	Active



Description

The City of Corpus Christi owns and operates the Mary Rhodes Phase I (MRPI) pipeline for the delivery of raw water to the O.N. Stevens Water Treatment Plant from both Lake Texana and the Colorado River. MRPI consists of 101 miles of pipeline to Lake Texana in Edna, TX. The City has a contract with Lavaca-Navidad River Authority to purchase water from Lake Texana.
This project consists of an assessment review to determine the condition and capacity of the pipeline. Once assessment is completed rehabilitation and improvements will be carried out in order of priorities determined by the assessment.

Justification

This project will provided detail and analysis regarding the pipeline efficiency, reliability, and capacity. Required repairs and upgrades will also be identified and designed.

Expenditures	FY 2023-2024 to FY 2032-2033
Inspection	-
Design	1,100,000
Eng Admin Reimbursements	131,000
Long-Range Costs	-
Total	1,231,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	-
Raw Water Fund	1,231,000
TBD	-
Total	1,231,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**E13037**
Project Name	**Mary Rhodes Pipeline System Improvements**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	Outside City Limits
Status	Active

Description

The City of Corpus Christi owns and operates the Mary Rhodes Phase I (MRPI) pipeline for the delivery of raw water to the O.N. Stevens Water Treatment Plant from both Lake Texana and the Colorado River. MRPI consists of 101 miles of pipeline to Lake Texana in Edna, TX . The City has a contract with Lavaca-Navidad River Authority to purchase water from Lake Texana. Improvements to Mary Rhodes Pipeline Pump Stations are required to ensure continuous water supply from the Phase 1 Pipeline. This project addresses replacement and upgrade of various outdated system components, including, but not limited to electrical, instrumentation, mechanical, structural, incoming power supply upgrades, and HVAC at Woodsboro and Bloomington Pump Stations. A new pumping assembly will be added to the Bloomington pump station. Two new Variable Frequency Drives (VFD) will be installed at Bloomington and one at the Woodsboro pump station.

Justification

This project improves the operational efficiency and reliability of Mary Rhodes Pipeline pump stations.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	12,000,000
Inspection	250,000
Design	-
Eng Admin Reimbursements	500,000
Long-Range Costs	-
Total	12,750,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	-
Raw Water Fund	12,750,000
TBD	-
Total	12,750,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**19025**
Project Name	**Mary Rhodes Pipeline II System Improvements (Bank Erosion)**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	Outside City Limits
Status	Active

Description

The City of Corpus Christi owns and operates the Mary Rhodes Phase II pipeline (MRPII) for the delivery of raw water to the O.N. Stevens Water Treatment Plant from the Colorado River. MRPII consists of 42 miles of pipeline to the Colorado River in Bay City, TX where the City has a run of the river water rights. This project includes various required improvements to Mary Rhodes Phase 2 pumping system. Improvements include, but are not limited to river bank stabilization due to natural erosion and other improvements as identified. The City applied and was selected for a cost share agreement with the U.S. Army Corps of Engineers under Section 14 of the Flood Control Act of 1946 (Public Law 79-526) for a cost share agreement for the riverbank stabilization. The federal cost share portion will be up to $10 million for design and construction.

Justification

This project improves the operational efficiency and reliability of Mary Rhodes Pipeline pump stations.

Expenditures	FY 2023-2024 to FY 2032-2033
Planning	-
Construction/Rehab	12,250,000
Design	1,226,000
Eng Admin Reimbursements	795,000
Long-Range Costs	-
Total	14,271,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Grant - U.S. Army Corps of Engineers	8,569,900
Revenue Bonds	5,701,100
Raw Water Fund	-
TBD	-
Total	14,271,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**E16417**
Project Name	**Nueces River Raw Water Pump Station Transmission Main**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

The O.N. Stevens Water Treatment Plant (ONSWTP) is being upgraded to meet additional demands and treatment capacity requirements. The Nueces River Pump Station supplies water from the Nueces river to the ONSWTP through two – 54" pipelines. The project will install a third 54" transmission main from the Nueces River Pump Station to ONSWTP. The project is critical for the ONSWTP to achieve a treatment capacity of 160 MGD.

Justification

The project improves the transmission capability of the Nueces River Pump Station to provide water to the O.N. Stevens Water Treatment Plant.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	-
Contingency	300,000
Eng Admin Reimbursements	30,000
Long-Range Costs	-
Total	330,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	330,000
TBD	-
Total	330,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 6**	**SEQ**	**LR 6**
Project Name	**Mary Rhodes I Pump Station Upgrades**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Supply	**Priority**	Critical- Asset Condition/longevity
		Council District	Outside City Limits
		Status	Long-Range

Description

This project will address the findings from the Mary Rhodes Pipeline assessment 23027, and can include but is not limited to: replacement of necessary portions of the pipeline with a higher pressure rated pipe (between Edna and Bloomington), adding clean-out stations, cleaning pipeline, installing pumps in all remaining slots for final phase pump buildout, and upsizing the 2 MG tank to a 6 MG tank at both Woodsboro and Bloomington Pump Stations. Each pump station currently houses 4 pumps and a 2 million gallon on-site storage tank. In addition, pipeline is currently rated to run pump schedule 4 for a max of 79 MGD for brief periods of time. These upgrades will allow for the pipeline system to run at design capacity.

Justification

Expenditures	**FY 2023-2024 to FY 2032-2033**
Long-Range Cost	27,300,000
Total	27,300,000

Funding Sources	**FY 2023-2024 to FY 2032-2033**
TBD	27,300,000
Total	27,300,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**21104**
Project Name	**ONSWTP Chlorine System Improvements**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Treatment	**Priority**	Critical- Health & Safety
		Council District	1
		Status	Active

Description

This project will replace existing, aging chlorine gas system with safer and more reliable on-site hypochlorite generation system. This will eliminate the health and life risk of exposure to chlorine gas to ONSWTP staff and surrounding communities. Will also include modifications to the existing chlorine dioxide system.

Justification

Proposed improvements will completely eliminate ONSWTP's dependence on hazardous liquid chlorine for water disinfection thereby reducing health and life risk of ONSWTP staff and surrounding communities.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	65,000,000
Contingency	-
Eng Admin Reimbursements	2,200,000
Long-Range Costs	15,500,000
Total	82,700,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	67,200,000
TBD	15,500,000
Total	82,700,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**18131**
Project Name	**ONSWTP Clearwell No. 3**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

Clearwell 1 at ONSWTP has a 4 MG capacity and was originally constructed in 1954. It has exceeded its design lifespan with severe deterioration. In addition, with increased treatment capacity of ONSWTP, Clearwell 1 cannot meet TCEQ requirements of providing a minimum clear well storage capacity. This project will build a new Clearwell 3 at ONSWTP to meet the requirements of treatment capacity and operations. The 10 MG Clearwell 2 at ONSWTP remains in good condition and is able to function as intended.

Justification

This project ensures compliance with TCEQ requirements.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	15,954,000
Design	-
Contingency	500,000
Eng Admin Reimbursements	915,000
Long-Range Costs	-
Total	17,369,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	17,369,000
TBD	-
Total	17,369,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**21030**
Project Name	**ONSWTP Electrical Generation & Distribution Improvements**
Type	Reconditioning- Asset Longevity
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1
Status	Active

Description

This project consists of technical assistance with troubleshooting electrical and instrumentation issues, configuration, modeling, condition assessments, and electrical system documentation management. Improvements include design and implementation of improved power generation, power feed improvements for the pumping complex, replacement of protection equipment that has reached its service life, and integration of power protection equipment into a real-time monitoring and diagnostic network.

Justification

This project will prevent plant shutdowns due to aged electrical equipment. Managed electrical system performance with early detection of potential causes of failure will be achieved. Power consumption monitoring for optimization will reduce operational cost.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	15,000,000
Inspection	75,000
Design	900,000
Long-Range Costs	-
Total	15,975,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	15,975,000
TBD	-
Total	15,975,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23024**
Project Name	**ONSWTP Electrical Reliability Upgrades**
Type	Reconditioning- Asset Longevity
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

This project will increase electrical reliability and resiliency of the ON Stevens Water Treatment Plant (ONSWTP) based on recommendations from Jacobs Engineering and AEP Texas. Project outcomes include reduced power outages and addition of redundant power capabilities to maintain water treatment and water distribution requirements.

Justification

Electrical reliability and resiliency is needed at ONSWTP because Power Control Room I (PCR I) is a single point of failure for the plant wide electrical system. The plant has also experienced numerous unplanned AEP outages in the recent past causing pressure drops in the distribution system.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	7,000,000
Design	700,000
Eng Admin Reimbursements	385,000
Long-Range Costs	-
Total	8,085,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	8,085,000
TBD	-
Total	8,085,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. Operational budget impact should be improved through more efficient equipment.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**19032**
Project Name	**ONSWTP Filtration System Hydraulic Improvements**
Type	Improvement/Additions
Useful Life	25 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1
Status	Active

Description

This project will upgrade filtration system components and equipment that has reached its end of service life. Additionally, the project will addres post-filtration hydraulic issues. The project is required to obtain a reliable treatment capacity of 160 MGD from the ON Stevens Water Treatment Plant. Improvements include but will not be limited to: upgrades to filtration piping; replacement of filter gates, valve , and actuators; and filtration system effiuent piping and channel hydraulic improvements.

Justification

Proposed improvements will fix the hydraulics on the back end of the plant to facilitate the production of 160 MGD.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	18,750,000
Inspection	250,000
Design	-
Eng Admin Reimbursements	1,000,000
Long-Range Costs	-
Total	20,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	20,000,000
TBD	-
Total	20,000,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**22407**
Project Name	**ONSWTP Flocculation Upgrades & Baffling**
Type	Reconditioning- Asset Longevity
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1
Status	Active

Description

The purpose of this project is to upgrade the existing walking beam flocculators in basins 1 and 2 at O.N.Stevens Water Treatment Plant. The existing equipment is obsolete, causes operational issues and are high-maintenance. This has necessitated need of replacing these aging equipment with more reliable, low-maintenance equipment like paddle wheel flocculator. Preliminary design will be carried out to evaluate the best suited alternative followed by detailed design and construction. This equipment will provide adequate mixing and prevent floc carryover into other areas of the treatment process and ensure the water treatment plant can continue to meet state and federal drinking water standards. This project will also add baffle walls to Plant 1 Secondary Basins 1 and 2. These baffle walls are intended to provide adequate chemical mixing and even out flow distribution.

Justification

This project improves water treatment efficiency by upgrading Basin 1 and 2 walking beam flocculators. Baffle walls to be added to Plant 1 and Secondary Basins 1 and 2 which are required for adequate chemical mixing and even flow distribution.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	16,000,000
Design	-
Eng Admin Reimbursements	1,000,000
Long-Range Costs	-
Total	17,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	17,000,000
TBD	-
Total	17,000,000

Budget Impact/Other

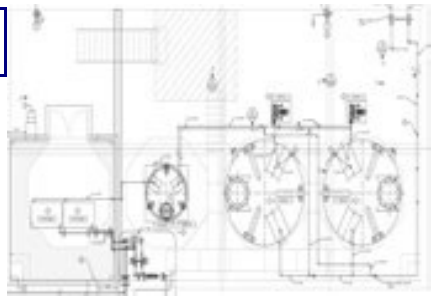
An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24026**
Project Name	**ONSWTP Fluoride System Improvements**



Type	Improvement/Additions	**Department**	Water Department
Useful Life	25 years	**Contact**	Director of Water Utilities
Category	Water Treatment	**Priority**	Critical- Asset Condition/longevity
		Council District	1
		Status	Active

Description

This project will upgrade the existing Fluoride injection system. Operational issues of the current system will be addressed and upgrades will be implemented to ensure a consistent and effective Fluoride feed. Hydrofluorosilicic acid is added in the treatment of potable water through a controlled liquid feed system at the ONSWTP. As Fluoride is a very corrosive chemical, the design will focus on the safe operation and maintenance of the system.

Justification

The current system requires upgrades including but not limited to bulk storage, piping replacement, building exhaust, corrosion points, scales, injection points, and pumps.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	1,900,000
Inspection	100,000
Design	300,000
Eng Admin Reimbursements	120,000
Long-Range Costs	-
Total	2,420,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	2,420,000
TBD	-
Total	2,420,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**22405**
Project Name	**ONSWTP Navigation Pump Station Improvements**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

The City of Corpus Christi owns the Navigation Pump Station (PS), located at 302 North Navigation Blvd, Corpus Christi, Texas, which consists of 2 - 10 MG tanks. Under the current distribution system set up, the pump station does not contribute to maintenance of system pressure and was taken out of service in 2018 . This project includes changes to Navigation Pump Station and surrounding distribution piping to help the City improve water delivery and water quality in the distribution system. A feasibility study followed by design will be carried out for these improvements. The major anticipated improvements for this project include upgrades to existing three pumps, one new pump and four new VFDs, and potential transmission main upgrades.

Justification

This project improves the operational efficiency and reliability of the Navigation pump station.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	10,000,000
Design	-
Eng Admin Reimbursements	500,000
Long-Range Costs	-
Total	10,500,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	10,500,000
TBD	-
Total	10,500,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**E17047**
Project Name	**ONSWTP Raw Water Influent and Chemical Facilities Improvements**

Type Improvement/Additions
Useful Life 40 years
Category Water Treatment
Department Water Department
Contact Director of Water Utilities
Priority Critical- Health & Safety
Council District 1
Status Active

Description

This project will address existing hydraulic constraints and upgrade the chemical feed systems for optimized dosing, monitoring, and control of water treatment chemicals at ON Stevens Water Treatment Plant. These improvements are necessary to meet TCEQ requirements and support an increase in water treatment capacity. The project is required to achieve a treatment capacity of 135 MGD with a future treatment capacity of 160 MGD.

Justification

This project will allow the Plant to meet upcoming demand as projected by the Texas Water Development Board, increase treatment capacity and improve treatment efficiency.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	65,000,000
Design	-
Contingency	1,300,000
Eng Admin Reimbursements	3,000,000
Long-Range Costs	-
Total	69,300,000

Funding Sources	FY 2023-2024 to FY 2032-2033
PAYGO	-
Revenue Bonds	10,500,000
TBD	-
Total	10,500,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. The cost to treat water should be reduced due to increased plant efficiencies.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**22406**
Project Name	**ONSWTP Recycle Pond Improvements**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

The O.N.Stevens Water Treatment Plant utilizes Lagoon -7 also known as wash-water recycle pond for decanting solids from backwash water sent by the filters. The decanted water is pumped back to the head of the plant with the help of existing wash-water return pump station located adjacent to the berms. The berm around the ponds is currently experiencing leakage and deterioration that has occurred as a result of this leakage along with weather, runoff, and destructive pests. Leakage has also been observed at the wash-water return pump station. This has necessitated condition assessment to identify extent of damage followed by repairs to prevent failure and reduce leakage. After performing a detailed condition assessment and developing recommendations, necessary repairs shall be carried out to establish the integrity of the earthen berm and associated facilities to ensure compliance with state and federal regulations, and protect the safety of people, property, and the environment as well as aid in optimizing recycled water return.

Justification

Proposed improvements will repair earthen berms, stop leakage at the pond and at pump station in order to maintain compliance with state and federal regulations, as well as reduce water loss and ensure safe working conditions at the plant.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	2,930,000
Inspection	470,000
Design	350,000
Eng Admin Reimbursements	450,000
Long-Range Costs	-
Total	4,200,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	4,200,000
TBD	-
Total	4,200,000

Budget Impact/Other

There is no projected operational impact with this project at this time. A reassessment will be done upon completion of project to determine on-going or maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 8**	**SEQ**	**LR 8**
Project Name	**ONSWTP Clearwell No. 4**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Treatment	**Priority**	Critical- Health & Safety
		Council District	1
		Status	Long-Range

Description

Clearwell #4 will be additional underground storage to replace the Clearwell No. 2 constructed in 1981. Project will continue into Year 11 and 12.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	20,000,000
Total	20,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	20,000,000
Total	20,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**22408**
Project Name	**ONSWTP Security Upgrade**
Type	Improvement/Additions
Useful Life	15 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Needed- Deficient Services
Council District	1
Status	Active

Description

O.N. Stevens WTP is the only water treatment plant in the city of Corpus Christi and is considered critical infrastructure for residents, schools, hospitals and surrounding industry. Currently the plant is surrounded by chain link fence and minimal security camera presence. This project would upgrade 10 more structurally sound fencing and install additional security cameras around the plant perimeter. This project will be designed and constructed in multiple phases.

Justification

Project will provide needed security enhancements to protect the O.N. Stevens WTP which is the only water treatment plant in the city of Corpus Christi and is considered critical infrastructure for residents, schools, hospitals and surrounding industry.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	2,000,000
Design	400,000
Capital Equipment	110,000
Eng Admin Reimbursements	240,000
Long-Range Costs	5,400,000
Total	8,150,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	2,750,000
TBD	5,400,000
Total	8,150,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**18130**
Project Name	**ONSWTP Sedimentation Basin Improvements**

Type Improvement/Additions
Useful Life 40 years
Category Water Treatment
Department Water Department
Contact Director of Water Utilities
Priority Critical- Health & Safety
Council District 1
Status Active

Description

This project will dredge, dewater, haul, and dispose 28,000-44,000 dry tons (DT) of water treatment plant residuals from the pre-sedimentation basin located at ON Stevens Water Treatment Plant (ONSWTP). Project scope also includes remove existing vegetation and cattails from the basin.

Justification

The pre-sedimentation basin is greater than 40% full and must be dredged to increase storage capacity and assist in construction of E17047 ONSWTP Raw Water Influent and Chemical Feed Improvements project.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	13,000,000
Testing	585,000
Design	-
Eng Admin Reimbursements	560,000
Long-Range Costs	-
Total	14,145,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	14,145,000
TBD	-
Total	14,145,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**E13051**
Project Name	**ONSWTP Site Infrastructure Improvements**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

This project will serve as a mechanism to execute major facility and site improvements, end-of-life equipment replacement, and unanticipated capital upgrades for ONSWTP. Improvements will include, but not limited to, pump station valving; filter-to-drain butterfly valves replacement; filter-to-waste butterfly valves replacement; facilitates structural repairs; cable tray foundation repairs, FBI building relocation, and storm water drainage repair and improvements.

Justification

Project will reduce risk of unexpected equipment or facilities failure. Responsible, proactive replacement and upgrade instead of reactive emergency repair can reduce cost of operation and better predictable system performance.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	3,500,000
Testing	-
Design	250,000
Eng Admin Reimbursements	300,000
Long-Range Costs	-
Total	4,050,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	4,050,000
TBD	-
Total	4,050,000

Budget Impact/Other

There is no projected operational impact with this project at this time. A reassessment will be done upon completion of project to determine on-going or maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23059**
Project Name	**ONSWTP Solids Handling & Disposal Facility**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Treatment
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

The purpose of this project is to design and construct a new solids handling facility at O.N. Stevens WTP. ONSWTP uses conventional water treatment processes (coagulation, flocculation, sedimentation, filtration) for removal of turbidity and naturally occurring organic matter. The combination of these processes generates a solids waste stream that is stored using three (3) on-site and four (4) off-site lagoons. Once filled, the on-site lagoons require the City to hire a 3rd party contractor to remove accumulated solids, dewater and haul to the landfill. Further, the initial solids storage permit allowed for permit renewals of off-site lagoon storage only until 2026. It is essential that a new solids handling facility be built at ONSWTP as a long term solution to manage solids.

Justification

ONSWTP has limited capacity in on-site lagoons and off-site lagoons for solids storage.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	24,000,000
Design	3,000,000
Contingency	500,000
Eng Admin Reimbursements	1,200,000
Long-Range Costs	15,000,000
Total	43,700,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	28,700,000
TBD	15,000,000
Total	43,700,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. The cost to treat the water should be reduced due to plant efficiencies.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**26003**
Project Name	**ONSWTP Third Treatment Train**

Type Improvement/Additions
Useful Life 40 years
Category Water Treatment
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District 1
Status Active

Description

The ON Stevens Water Treatment Plant was originally constructed in 1954. The master plan for this facility includes the addition of a third treatment train. This expansion is required to obtain a treatment capacity of 160 MGD with a peak capacity of 200 MGD. The additional train will also allow for the ability to complete maintenance and upgrades on the other treatment trains.

Justification

This expansion is required to obtain a treatment capacity of 160 MGD with a peak capacity of 200 MGD.

Expenditures	FY 2023-2024 to FY 2032-2033
Design	5,500,000
Eng Admin Reimbursements	500,000
Long-Range Costs	90,000,000
Total	96,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	6,000,000
TBD	90,000,000
Total	96,000,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23025**
Project Name	**ONSWTP Weir Improvements - Basins 3 & 4**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

Basins 3 and 4 located in O. N. Stevens Water Treatment Plant Train 2 are a finger weir style that protrudes from the end of the basins into the secondaries. The general layout of the finger weirs causes an uneven distribution of water flowing over the weirs. Upgrading the weirs to straight weirs along the end of the basin will optimize settling time by allowing the water more time to travel before flowing over the weirs and allow for even distribution of water flow.

Justification

Upgrading Basins 3 and 4 finger weirs to straight weirs, or an engineer approved style, at the end of the secondaries to improve flows and optimize use of the space for settling.

Expenditures	FY 2023-2024 to FY 2032-2033
Design	700,000
Eng Admin Reimbursements	77,000
Long-Range Costs	8,070,000
Total	8,847,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	777,000
TBD	8,070,000
Total	8,847,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. The cost to treat the water should be reduced due to plant efficiencies.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23061**
Project Name	**16" Water Main Extension HWY 286- Alameda**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Health & Safety
		Council District	1
		Status	Active

Description

This project will consist of installing approximately 3,100lf of new 16" PVC main beginning at Crosstown Expressway, running along Caldwell and connecting to a 16" main at Alameda and Laredo. It will make use of the new 16" crossing at Crosstown and provide redudancy to the downtown area.

Justification

This project will assist in the need for reliable services and will offer redundancy to downtown.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	6,000,000
Design	325,000
Eng Admin Reimbursements	635,000
Long-Range Costs	-
Total	6,960,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	6,960,000
TBD	-
Total	6,960,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs. Operational budget impact should be improved through more efficient equipment.

Capital Improvement Plan

2024 *thru* 2033

City of Corpus Christi, Texas

Project #	**18154 / 23064**
Project Name	**City-Wide Large-Size Water Line Cathodic Protection**

Type Rehabilitation
Useful Life 25 years
Category Water Distribution
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District City-Wide
Status Active

Description

A majority of the City's large diameter transmission lines have been in service many years and are made of non-plastic corrosive materials such as Cast Iron Pipe (CIP), Ductile Iron Pipe(DIP), Concrete Steel Cylinder Pressure (CSCP) and steel. In some cases, these lines were installed with cathodic protection systems to help minimize corrosion and in some cases, they were not. This project will ensure reliable delivery of drinking water for years to come by assessing the physical condition, both external and internal, of transmission mains and associated cathodic protection systems and determining the remaining useful life of each asset. In addition, the project will also repair the most critical lines that have significant maintenance/repair history or where failure may be reasonably expected in the near future.

Justification

This project will improve the service life and water quality of City's large water lines.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	6,000,000
Design	300,000
Eng Admin Reimbursements	363,000
Long-Range Costs	2,500,000
Total	9,163,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	6,663,000
TBD	2,500,000
Total	9,163,000

Budget Impact/Other

This project itself does not increase revenue or decrease expenses, but it prevents cost of maintenance from rising.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**19037 / 23065 / 23107**
Project Name	**City-Wide Water Line Repair/Replace-Large Diameter**

Type Reconditioning- Asset Longevity
Useful Life 40 years
Category Water Distribution
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District City-Wide
Status Active

Description

This project provides a strategic lifecycle program for replacement and extension of the City's water distribution system (1,800 miles). The program is flexible and provides a systematic approach to extend service life of the system while enhancing monitoring capability and water quality. The program also provides a mechanism to quickly address emergency and priority projects as they arise reducing service outages, and operational

Justification

Extension of service life of water mains is critical to ensuring integrity of the system.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	30,000,000
Design	600,000
Eng Admin Reimbursements	1,355,655
Long-Range Costs	84,000,000
Total	115,955,655

Funding Sources	FY 2023-2024 to FY 2032-2033
Grant - American Rescue Act	-
Revenue Bonds	31,955,655
TBD	84,000,000
Total	115,955,655

Budget Impact/Other

This project itself does not increase revenue or decrease expenses, but it prevents cost of maintenance from rising.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**19010 / 23073 / 23108**
Project Name	**City-Wide Water Line Repair/Replace-Small Diameter**

Type Improvement/Additions
Useful Life 40 years
Category Water Distribution
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District City-Wide
Status Active

Description

This project provides the replacement of small diameter water lines within the City's water distribution system. The strategic life cycle management and replacement of these assets is predicated on an a likelihood-of-failure (LOF) risk analysis that utilizes historical failure data, condition assessments and asset specifications. The program is flexible and provides a systematic approach to replacing aging water lines while enhancing water quality. Additional benefits will include increased distribution reliability with reduced service outages and reduced operational costs.

Justification

The extension of service life for water mains is critical to ensuring integrity of the system.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	30,000,000
Eng Admin Reimbursements	600,000
Long-Range Costs	70,000,000
Total	100,600,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	30,600,000
TBD	70,000,000
Total	100,600,000

Budget Impact/Other

This project itself does not increase revenue or decrease expenses, but it prevents cost of maintenance from rising.

Capital Improvement Plan

2024 *thru* 2033

City of Corpus Christi, Texas

Project #	**E16290 / 20267**
Project Name	**Elevated Water Storage Tanks- City-Wide**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	City-Wide
Status	Active

Description

The existing Elevated Storage Tanks (EST) have inadequate volume and elevation to meet minimum storage and pressure requirements as defined by Texas Commission on Environmental Quality (TCEQ). The plan to meet these requirements is outlined below:
FY 23: Begin construction of new EST in Flour Bluff on Division Road.
FY24: Complete Construction of the Flour Bluff EST. Begin design and construction of new Calallen EST, corresponding Calallen pump station located at ON Stevens WTP, and necessary water line improvements. Demolish Morgan EST.
FY 25: Complete Construction of new Cal alien EST, pump station, and water line improvements. Demolish old EST at Flour Bluff on Division Road.
FY 26: Begin design of new EST at a yet to be determined site pending review and hydraulic modeling.
FY 27: Begin construction of new EST at a yet to be determined site.
FY 28: Complete construction of new EST at a yet to be determined site.
FY 29: Demolish existing Alameda and Gollihar ESTs.

Justification

This project will allow the city to meet its commitment to TCEQ. Higher tanks will additionally provide higher pressure and better pressure stabilization in the distribution system as required.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	15,000,000
Capital Equipment	700,000
Design	1,470,000
Eng Admin Reimbursements	1,200,000
Long-Range Costs	35,500,000
Total	53,870,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	18,370,000
TBD	35,500,000
Total	53,870,000

Budget Impact/Other

A reassessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24020**
Project Name	**E. Navigation Blvd Water Line Replacement**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

This project will consist of replacement of existing 12" Cast Iron Pipe (CIP) water line along E. Navigation Blvd. from approximately 340 feet west of Burleson St. to approximately 30 feet east of Texaco Street due to condition and age resulting in leaks and failures. The alignment of this existing water line will be reviewed to ensure that a new route meets hydraulic expectations and also provides the appropriate back feed options to ensure that service is reliable.

Justification

The existing water line is currently aging and in poor condition resulting in leaks and failures.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	11,000,000
Design	500,000
Eng Admin Reimbursements	600,000
Long-Range Costs	-
Total	12,100,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	12,100,000
TBD	-
Total	12,100,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**22144**
Project Name	**Flour Bluff 18" Line Extension**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	4
Status	Active

Description

The proposed construction would have the existing 18" main extended approximately 12,000 linear feet and connected to a larger transmission main that runs along Flour Bluff Drive. This would provide the redundancy and flows needed to operate the 18" line at its full capacity. Cost estimates and alignment are preliminary and may change during the design phase of the project.

Justification

This project will connect the 18" water transmission main to a source capable of providing flows that maximizes the delivery of water to Coral Vines EST. Continued growth on Padre Island requires all systems operate to the fullest extent of their design capacity. In addition, due to the Islands isolation from the main land, it is necessary to provide adequate redundancy capable of providing continued service in the event of any parallel system failure.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	7,600,000
Design	-
Eng Admin Reimbursements	485,000
Long-Range Costs	-
Total	8,085,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Grant - American Rescue Act	6,510,000
Revenue Bonds	1,575,000
TBD	-
Total	8,085,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**21038**
Project Name	**Leopard St & Up River Rd Water Line Replacement**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1
Status	Active

Description

Project consist of removal of 32000 LF cast iron pipe and replace with new PVC Pipe. This project will serve both residential and commercial services on the north side of IH 37 from Sessions Road to Sharpsburg Road. The diameter of the new line will be reviewed to ensure that it is appropriate for the current hydraulic conditions.

Justification

The new line will serve the community without outages and other issues. High priority distribution water line.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	17,000,000
Design	-
Eng Admin Reimbursements	840,000
Long-Range Costs	-
Total	17,840,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Grant - American Rescue Act	9,490,000
Revenue Bonds	8,350,000
TBD	-
Total	17,840,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**21039**
Project Name	**Nueces Bay Blvd & Poth Lane - Water Line**

Type Improvement/Additions
Useful Life 40 years
Category Water Distribution
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District 1
Status Active

Description

This is a new project to replace the approximately 9,000 LF of existing 16-in CIP water line along West Broadway Street and Nueces Bay Blvd. from the intersection of Nueces Bay Blvd and I-37 Frontage Rd. to the intersection of West Broadway Street and Port Ave; and 5,000 LF of existing 16-in CIP water line along Poth Lane from the intersection of Buddy Lawrence and Upriver Road. The existing 16-in CIP water line was built in 1971-1978, 1954 respectively.

Justification

The replacement of the existing water line will increase the reliability of service to this area as the current infrastructure is aging.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	17,000,000
Design	-
Eng Admin Reimbursements	750,000
Long-Range Costs	-
Total	17,750,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	17,750,000
TBD	-
Total	17,750,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* 2033

City of Corpus Christi, Texas

Project #	**23021**
Project Name	**Sand Dollar Connection Line 16"(Coral Vine)**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	4
Status	Active

Description

This project is designed to extend an existing 16" water line from White Cap to the Coral Vine elevated storage tank and implement water interconnections as needed. This infrastructure will allow the Sand Dollar pump station to more easily control operation of the elevated storage tank on Padre Island and provide adequate supply for the anticipated growth.

Justification

The Sand Dollar Pump Station has caused distribution difficulties in the past due to its pumping capacity. Strengthening of the distribution system is crucial to ensure normal operations and a reliable water supply to Padre Island.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	12,000,000
Design	600,000
Eng Admin Reimbursements	660,000
Long-Range Costs	-
Total	13,260,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	13,260,000
TBD	-
Total	13,260,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**20101**
Project Name	**SH286 Water Line Replacement**

Type Improvement/Additions
Useful Life 40 years
Category Water Distribution
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District Outside City Limits
Status Active

Description

This project is required to relocate the existing water line between FM43 (Weber Rd) and FM2444 (Staples St.) to meet the construction needs of TxDOT's SH286 extension. The new line will adhere to the adopted Master Plan for this area. Due to lack of spacing within TxDOT's right-of way this project will require land acquisition.

Justification

This project is required to relocate the existing water line between FM43 (Weber Rd) and FM2444 (Staples St.) to meet the construction needs of TxDOT's SH286 extension. If this project is not completed the TxDOT's SH286 extension project will be delayed.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	11,000,000
Design	-
Eng Admin Reimbursements	569,000
Long-Range Costs	-
Total	11,569,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	11,569,000
TBD	-
Total	11,569,000

Budget Impact/Other

This project itself does not increase revenue or decrease expenses, but it prevents cost of maintenance from rising.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24027**
Project Name	**SH358 Water Line Relocation**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	3/4
Status	Active

Description

The project will relocate waterlines that would be in conflict with the Texas Department of Transportation Ramp Reversal Program between Staples Street and Nile Drive. Eight inch ACP and PVC water line will be relocated along with associated fire hydrants and water meters. The work will be completed prior to ramp reversal work.

Justification

The Texas Department of Transportation has issued a Notice of Required Accommodation to relocate the water lines in conflict with the SH 358 Phase II Ramp Reversal Project.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	1,250,000
Eng Admin Reimbursements	125,000
Long-Range Costs	-
Total	1,375,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	1,375,000
TBD	-
Total	1,375,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**18156**
Project Name	**Ship Channel Water Line Relocation**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1
Status	Active

Description

This project is to relocate the existing two 16-in water line crossing the Ship Channel at the Avery Point. The U.S Army Engineering District, Galveston (USAED) will soon commence the deepening and widening of the Corpus Christi Ship Channel. This project is to relocate the existing two 16-in water line crossing the Ship Channel at the Avery Point as required by the USAED to facilitate the construction of Ship Channel deepening. The demolition of the existing two 16-in water lines was planned by the Utilities in-house engineering. City has requested a Consultant Engineer to evaluate the relocation options. This is a 50/50 cost sharing project between the City and the Port of Corpus Christi.

Justification

The Ship Channel deepening project will be delayed.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	5,659,787
Design	-
Eng Admin Reimbursements	300,000
Long-Range Costs	84,000,000
Total	89,959,787

Funding Sources	FY 2023-2024 to FY 2032-2033
Port of Corpus Christi	2,979,893
Revenue Bonds	2,979,894
TBD	86,979,893
Total	89,959,787

Budget Impact/Other

This project itself does not increase revenue or decrease expenses, but it prevents cost of maintenance from rising.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**21041**
Project Name	**South Side Water Transmission Main Cathodic Protection**

Type Improvement/Additions
Useful Life 40 years
Category Water Distribution
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District City-Wide
Status Active

Description

This project provides for design and construction of Water Distribution Transmission Infrastructure cathodic protection to protect and extend useful service life of the South Side Water Transmission from ON Stevens to Padre Island. This project is part of the citywide water transmission main cathodic protection improvements. Cost estimates and alignment are preliminary and may change during the design phase of the project. Additional work will be performed on the South Side distribution water network to increase efficiency and improve the overall network in this area; which is seeing large growth in housing.

Justification

Cathodic protection design of water transmission infrastructure will extend useful service life of infrastructure asset.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	2,750,000
Inspection	50,000
Design	250,000
Contingency	25,000
Eng Admin Reimbursements	225,000
Long-Range Costs	-
Total	3,300,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	3,300,000
TBD	-
Total	3,300,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 17**	**SEQ**	**LR 17**
Project Name	**Rand Morgan 16" Water Main Extension**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	1
		Status	Long-Range

Description

This project will create an interconnection of a 16" transmission main along Rand Morgan Rd from Agnes st to McNorton Rd. The interconnection will be beneficial as growth and development increases in this area.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	5,775,000
Total	5,775,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	5,775,000
Total	5,775,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 18**
Project Name	**Relocation of Water Transmission Line at Corpus Christi Airport**

SEQ **LR 18**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	3
		Status	Long-Range

Description

The alignment of the existing 48” transmission line is underneath airport infrastructure.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	20,000,000
Total	20,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	20,000,000
Total	20,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 19**	**SEQ**	**LR 19**
Project Name	**South Side Transmission Main Line Constraint**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	3
		Status	Long-Range

Description

Re-design of the fault mitigation design on the southside transmission main to eliminate the diameter restriction.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	7,000,000
Total	7,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	7,000,000
Total	7,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23060**
Project Name	**South Side Water Transmission Grid Completion**

Type Improvement/Additions
Useful Life 40 years
Category Water Supply
Department Water Department
Contact Director of Water Utilities
Priority Critical- Asset Condition/longevity
Council District 3
Status Active

Description

This project is intended to prioritize and complete interconnections between multiple water transmission mains improving the systems redundancy, improve chlorine residuals, and move water more effectively around the City. This project will also allow staff the ability to abandon the 30" transmission main under South Padre Island Drive due to its age and the continued expansion of the roadway. This project may progress into the long range, and will be reviewed for phasing once planning and design has been completed. This project continues on the long range.

Justification

This project will also allow Utilities staff the ability to abandon the 30" transmission main under South Padre Island Drive due to its age and the continued expansion of the roadway. The new line will improve the functionality of these high priority distribution lines and increase service reliability.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	16,500,000
Design	1,800,000
Eng Admin Reimbursements	680,000
Long-Range Costs	33,000,000
Total	51,980,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	18,980,000
TBD	33,000,000
Total	51,980,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24021**
Project Name	**Up River Rd Water Line Replacement**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Health & Safety
Council District	1
Status	Active

Description

This project will consist of removal and replacement of the existing 20" Cast Iron Pipe (CIP) water transmission line. The new line will be reduced in diameter as the current line is oversized. The work will also include a crossing under I-37. All work would be conducted in the same project as Up River Wastewater Force Main project 23038.

Justification

The existing water line installed in 1930 is in poor condition resulting in leaks and failures.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	8,000,000
Design	400,000
Eng Admin Reimbursements	440,000
Long-Range Costs	-
Total	8,840,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	8,840,000
TBD	-
Total	8,840,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	-
Project Name	**Water Line Crossing Replacement - SPID, Hwy 286, US-37**
SEQ	**LR 21**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	1
		Status	Long-Range

Description

Current waterline crossings of this major roadways require replacement due to age and condition.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	12,000,000
Total	12,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	12,000,000
Total	12,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23033**
Project Name	**Water Line Extension to Padre Island**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	4
Status	Active

Description

The City currently does not have a true redundant water supply source to Padre Island. The line is required to provide a reliable supply for our customers and is critical as development and growth increases. A previous engineering report was conducted in November 2011 to investigate options for provide a redundant supply to Padre Island. The first phase of this project will consist of design only. Construction will take place as a planned long term CIP project.

Justification

The current water lines provides sufficient capacity but do not provide a true redundant supply. Redundancy is essential to this supply line, if a failure occurs with the current line then the supply to the Island would be insufficient and severely diminished.

Expenditures	FY 2023-2024 to FY 2032-2033
Design	3,905,000
Eng Admin Reimbursements	405,000
Long-Range Costs	40,000,000
Total	44,310,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	4,310,000
TBD	40,000,000
Total	44,310,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23068**
Project Name	**Water Street Water Line Improvements**
Type	Improvement/Additions
Useful Life	35 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1
Status	Active

Description

This project will replace over 4,000 linear feet of a circa 1954, 10" cast iron pipe that runs under Water Street from IH 37 to Kinney Ave. The replacement of this water line would lead to fewer water main failures resulting in improved services, less disruption of daily activities and enhanced revitalization of the downtown area. This project would be done in conjunction with the wastewater line to provide all new Utility infrastructure along Water Street.

Justification

This water main serves much of the downtown district and due to its advanced age is prone to failure. These water main failures can be disruptive to everyday downtown activities, traffic flows and business needs.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	5,500,000
Design	550,000
Eng Admin Reimbursements	335,500
Long-Range Costs	-
Total	6,385,500

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	6,385,500
TBD	-
Total	6,385,500

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 23**
Project Name	**Water Line Replacement- N. Chaparral & Mesquite Street**

SEQ **LR 23**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	1
		Status	Long-Range

Description

Project will consist of the replacement of the water line between Chaparral and Mesquite.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	15,000,000
Total	15,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	15,000,000
Total	15,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 24**
Project Name	**Water System Integration Piping for New Water Plant**

SEQ **LR 24**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	All
		Status	Long-Range

Description

New water lines required to integrate a new water plant in the system.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	25,000,000
Total	25,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	25,000,000
Total	25,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 25**	**SEQ**	**LR 25**
Project Name	**Weber Rd. Water Line Replacement**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	3
		Status	Long-Range

Description

Replace existing 16” CIP Water Line from Staples to under SPID.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	17,000,000
Total	17,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	17,000,000
Total	17,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 26**	**SEQ**	**LR 26**
Project Name	**West Broadway Street Water Line Replacement**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	1
		Status	Long-Range

Description

Replacement of existing 16" CIP Water Line.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	12,000,000
Total	12,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	12,000,000
Total	12,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23026**
Project Name	**CC Water Parking Lot Improvements**
Type	Improvement/Additions
Useful Life	25 years
Category	Site Improvement
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	1/3
Status	Active

Description

This project consists of the rehabilitation and improvements of two large water facility parking lots. First phase will be improvements to the O.N. Stevens WTP parking area near the filter building. Second phase improvements will be to the utilities building parking lot located on Holly Rd.

Justification

Improve the parking situation and add needed capacity.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	210,000
Design	20,000
Eng Admin Reimbursements	20,000
Long-Range Costs	-
Total	250,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	250,000
TBD	-
Total	250,000

Budget Impact/Other

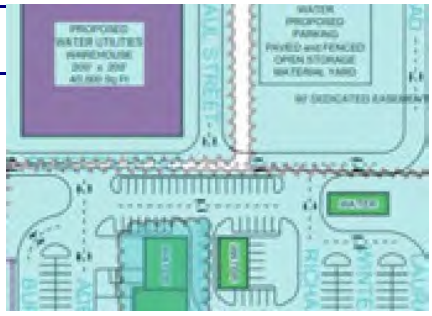
An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* 2033

City of Corpus Christi, Texas

Project #	**23080**
Project Name	**CC Water Warehouse**
Type	Improvement/Additions
Useful Life	25 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	3
Status	Active



Description

The purpose of this project is to improve Water Utilities handling, inventory and security of various materials used in daily operations. Utilities is seeking to construct a 30,000 SF warehouse facility that is outfitted with warehouse space, offices, equipment check-out counter, equipment cages, and maintenance area. Materials such as pipe, fittings, meters, and electronics are currently stored in small portable buildings located at the Utilities yard or in open air conditions subjecting inventory to harsh environmental conditions and making proper inventory management difficult. The construction of a new warehouse would allow for the proper stocking levels of all inventory needed to maintain the water distribution system, minimize the exposure of materials to environmental factors, and increase the controls on management of these materials.
Additional funds will be used for improvements to the current CCW building, electrical, HVAC and back-up generator.

Justification

The proposed expansion will improve the operational capacity of the Utilities Department.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	11,200,000
Design	-
Eng Admin Reimbursements	800,000
Long-Range Costs	-
Total	12,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	12,000,000
TBD	-
Total	12,000,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24001**
Project Name	**Open Storage Yard (CC Water)**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	25 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	3
		Status	Active

Description

The project will consist of renovation and improvement of the land and space located on Civitan Drive, to enable and open storage yard, where there will be storage of products, goods or equipment for the water department.

Justification

This project will allow and assist the water department to stage needed equipment and supplies to be proactively preparing and strategizing of scheduled future projects.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	3,400,000
Contingency	80,000
Eng Admin Reimbursements	445,000
Long-Range Costs	-
Total	3,925,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	3,925,000
TBD	-
Total	3,925,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24001**
Project Name	**Open Storage Yard (CC Water)**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	25 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	Outside City Limits
		Status	Active

Description

With this project, the existing restroom/shower facilities will be demolished and replaced with new restroom/shower facilities. The existing basketball court will also be renovated to like-new condition with new appurtenances, as well as the addition of a new pavilion to accommodate a designated outdoor activity facility. The new and improved facilities would provide a better experience to sunrise beach visitors and also provide additional actives to diversify the visiting population.

Justification

These facilities will be updated to meet Texas Accessibility Standards and to provide a higher quality experience to the visitors.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	1,500,000
Design	100,000
Eng Admin Reimbursements	160,000
Long-Range Costs	-
Total	1,760,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	1,760,000
TBD	-
Total	1,760,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**23051**
Project Name	**Warehouse Facility from Ground Storage Tank**

Type	Improvement/Additions	**Department**	Water Department
Useful Life	25 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	3
		Status	Active

Description

The project will consist of the modification of the existing Holly Ground Storage Tank so that it can be utilized for an additional warehouse for the Utility Department. Construction will consist of design modifications and improvements. The construction will consist of modifying the existing ground storage tank located at 2901 Holly Road. This tank is not in service and not planned to be utilized as part of the water distribution system going forward. An engineering feasibility study was conducted by Chuck Anastos and Associates, LLC. The study was submitted March 31, 2022.

Justification

The Utilities Department requires additional warehouse space for materials associated with water line and wastewater line repairs. The primary stored items will consist of piping, valves, and fittings.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	2,400,000
Design	192,000
Contingency	240,000
Eng Admin Reimbursements	261,000
Long-Range Costs	-
Total	3,093,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	3,093,000
TBD	-
Total	3,093,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**24110**
Project Name	**Wash Rack Water Utilities**
Type	Improvement/Additions
Useful Life	25 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Critical- Asset Condition/longevity
Council District	3
Status	Active

Description

The project will consist of the construction of a wash-rack for standard size vehicles and large equipment assigned to Water Utilities. Construct a (2) bay wash-rack for standard size vehicles and large equipment assigned to Water Utilities complete with a reinforced concrete driveway, security fence, and vacuum stations.

Justification

The Water department must maintain fleet vehicles which includes periodic washing to prevent premature corrosion and deterioration. The department currently pays outside privately owned car washes, this alternative will be cost effective and offer convenience to the department.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	1,165,000
Design	121,000
Eng Admin Reimbursements	110,000
Long-Range Costs	-
Total	1,396,000

Funding Sources	FY 2023-2024 to FY 2032-2033
Revenue Bonds	3,093,000
TBD	-
Total	3,093,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**21116**
Project Name	**Wesley Seale Boat Ramp and Pier (Sunrise Beach)**
Type	Improvement/Additions
Useful Life	25 years
Category	Water Distribution
Department	Water Department
Contact	Director of Water Utilities
Priority	Important- Community Investment
Council District	Outside City Limits
Status	Active

Description

Sunrise Beach Park is located approximately four miles southwest of Mathis, at the north end of Wesley E. Seale Dam, and includes approximately one mile of shoreline on Lake Corpus Christi. The park is approximately 27 acres in size and accommodates RV and tent camping as well as day use activities such as boating, fishing, and swimming. For decades Sunrise Beach Park was operated by private individuals under contract with the City of Corpus Christi's formerly named Water Department, now Corpus Christi Water. Corpus Christi Water assumed operation of the Park on January 1, 2009, with the intent of upgrading facilities, operations and revenues. The Boat Launch and Dock Buildout project includes the planning and design for the construction of a new boat ramp and pier at Sunrise Beach. The addition of a boat ramp will allow for a safer boating experience as well as promote the park and increase revenues.

Justification

This amenity will increase public and visitors to this recreational park.

Expenditures	FY 2023-2024 to FY 2032-2033
Construction/Rehab	1,000,000
Design	-
Eng Admin Reimbursements	100,000
Long-Range Costs	-
Total	1,100,000

Funding Sources	FY 2023-2024 to FY 2032-2033
PAYGO	-
Revenue Bonds	1,100,000
TBD	-
Total	1,100,000

Budget Impact/Other

An assessment will be done upon completion of project to determine maintenance costs.

Capital Improvement Plan

2024 *thru* **2033**

City of Corpus Christi, Texas

Project #	**LR 27**	**SEQ**	**LR 27**
Project Name	**Water Meter Capital Replacement Program**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	City-Wide
		Status	Long-Range

Description

This project will consist of replacement of water meters that have reached the end of their life cycle.

Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Long-Range Cost	30,000,000
Total	30,000,000

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	30,000,000
Total	30,000,000

Budget Impact/Other

Capital Improvement Plan

2024 *thru* 2033

City of Corpus Christi, Texas

Project #	**LR 28**	**SEQ**	**LR 28**
Project Name	**Water Utility Support - Streets projects**		

Type	Improvement/Additions	**Department**	Water Department
Useful Life	40 years	**Contact**	Director of Water Utilities
Category	Water Distribution	**Priority**	Critical- Asset Condition/longevity
		Council District	City-Wide
		Status	Active

Description

This project will consist of water utility support for street reconstruction as planned and needed for the future term.

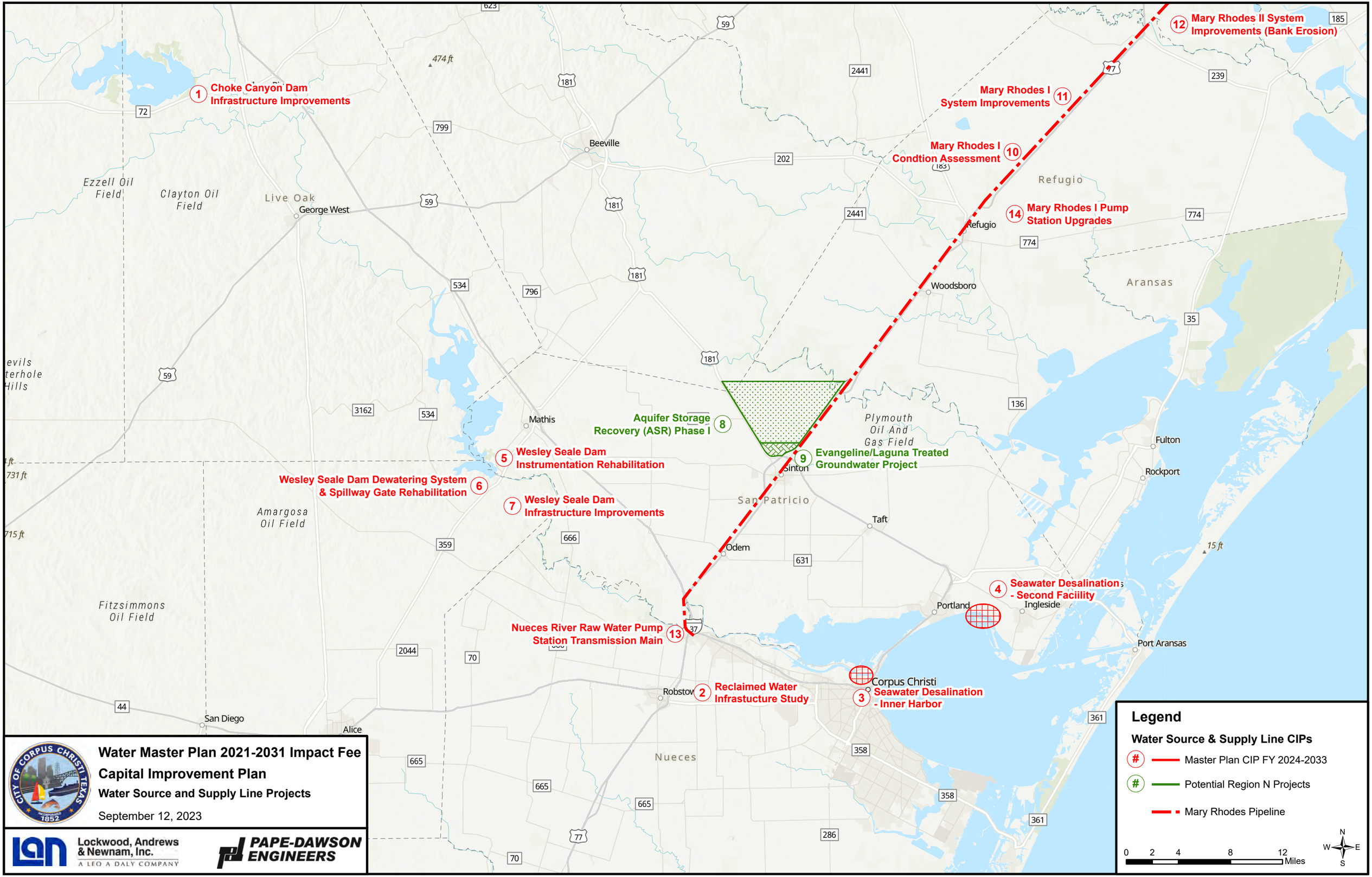
Justification

Expenditures	FY 2023-2024 to FY 2032-2033
Short-Range Cost	29,236,279
Long-Range Costs	77,000,000
Total	106,236,279

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	106,236,279
Total	106,236,279

Budget Impact/Other

A-2 Proposed Capital Improvement Plan Exhibits


1 Choke Canyon Dam Infrastructure Improvements
2 Reclaimed Water Infrastucture Study
3 Seawater Desalination - Inner Harbor
4 Seawater Desalination - Second Faciility
5 Wesley Seale Dam Instrumentation Rehabilitation
6 Wesley Seale Dam Dewatering System & Spillway Gate Rehabilitation
7 Wesley Seale Dam Infrastructure Improvements
8 Aquifer Storage Recovery (ASR) Phase I
9 Evangeline/Laguna Treated Groundwater Project
10 Mary Rhodes I Condtion Assessment
11 Mary Rhodes I System Improvements
12 Mary Rhodes II System Improvements (Bank Erosion)
13 Nueces River Raw Water Pump Station Transmission Main
14 Mary Rhodes I Pump Station Upgrades
Beeville
George West
Live Oak
Refugio
Woodsboro
Mathis
Sinton
Taft
Odem
Portland
Ingleside
Corpus Christi
Port Aransas
Fulton
Rockport
San Diego
Alice
Robstown
Ezzell Oil Field
Clayton Oil Field
Amargosa Oil Field
Fitzsimmons Oil Field
Plymouth Oil And Gas Field
Aransas
Nueces
San Patricio
474 ft
731 ft
715 ft
15 ft
Water Master Plan 2021-2031 Impact Fee
Capital Improvement Plan
Water Source and Supply Line Projects
September 12, 2023
Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
PAPE-DAWSON ENGINEERS
Legend
Water Source & Supply Line CIPs
Master Plan CIP FY 2024-2033
Potential Region N Projects
Mary Rhodes Pipeline
0 2 4 8 12 Miles
N W E S

Water Master Plan 2021-2031 Impact Fee

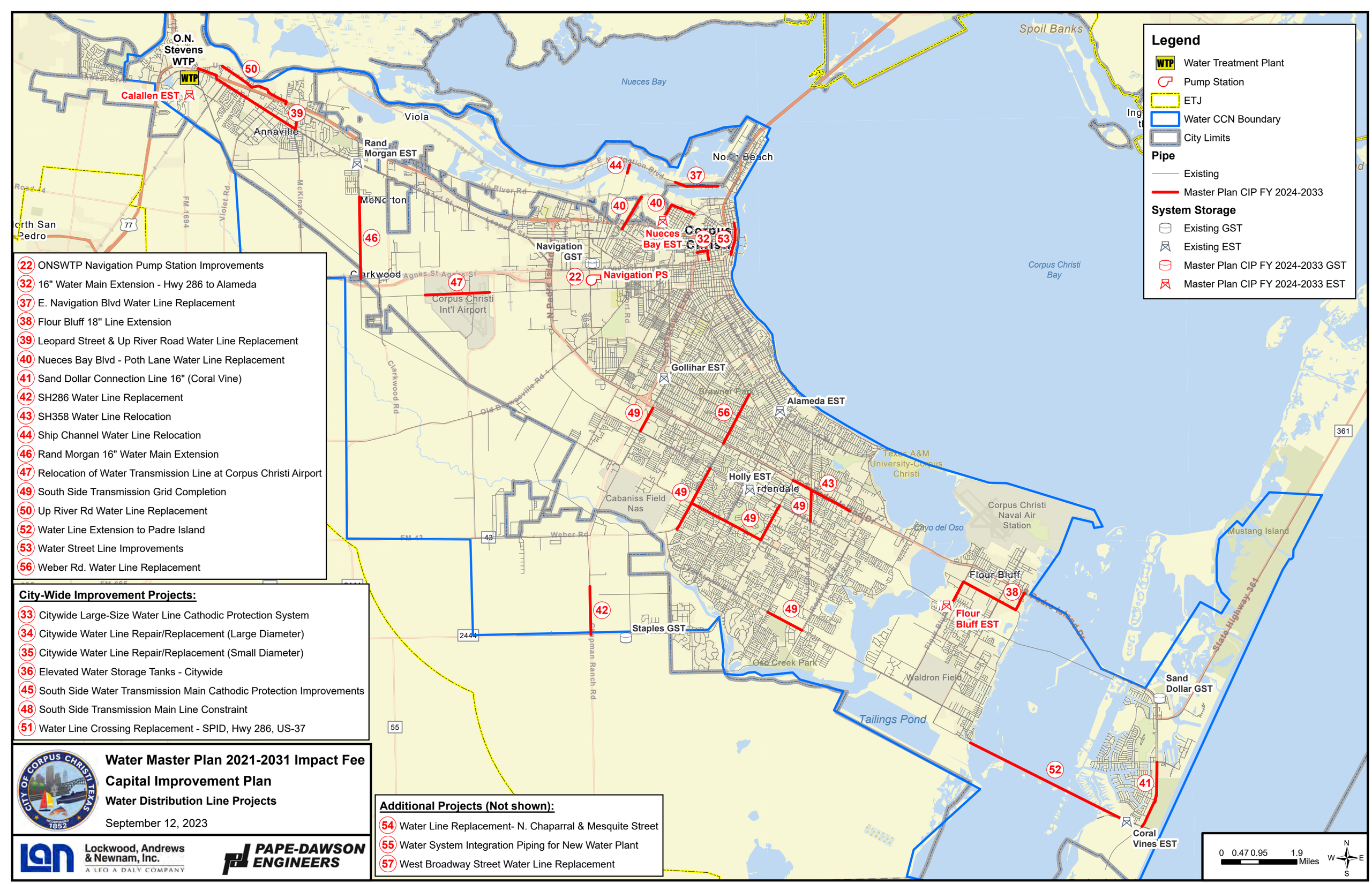
Capital Improvement Plan

Water Treatment: O.N. Stevens

September 12, 2023

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

PAPE-DAWSON ENGINEERS



Legend

- Water Treatment Plant
- Pump Station
- ETJ
- Water CCN Boundary
- City Limits

Pipe

- Existing
- Master Plan CIP FY 2024-2033

System Storage

- Existing GST
- Existing EST
- Master Plan CIP FY 2024-2033 GST
- Master Plan CIP FY 2024-2033 EST

- 22 ONSWTP Navigation Pump Station Improvements
- 32 16" Water Main Extension - Hwy 286 to Alameda
- 37 E. Navigation Blvd Water Line Replacement
- 38 Flour Bluff 18" Line Extension
- 39 Leopard Street & Up River Road Water Line Replacement
- 40 Nueces Bay Blvd - Poth Lane Water Line Replacement
- 41 Sand Dollar Connection Line 16" (Coral Vine)
- 42 SH286 Water Line Replacement
- 43 SH358 Water Line Relocation
- 44 Ship Channel Water Line Relocation
- 46 Rand Morgan 16" Water Main Extension
- 47 Relocation of Water Transmission Line at Corpus Christi Airport
- 49 South Side Transmission Grid Completion
- 50 Up River Rd Water Line Replacement
- 52 Water Line Extension to Padre Island
- 53 Water Street Line Improvements
- 56 Weber Rd. Water Line Replacement

City-Wide Improvement Projects:

- 33 Citywide Large-Size Water Line Cathodic Protection System
- 34 Citywide Water Line Repair/Replacement (Large Diameter)
- 35 Citywide Water Line Repair/Replacement (Small Diameter)
- 36 Elevated Water Storage Tanks - Citywide
- 45 South Side Water Transmission Main Cathodic Protection Improvements
- 48 South Side Transmission Main Line Constraint
- 51 Water Line Crossing Replacement - SPID, Hwy 286, US-37

Additional Projects (Not shown):

- 54 Water Line Replacement- N. Chaparral & Mesquite Street
- 55 Water System Integration Piping for New Water Plant
- 57 West Broadway Street Water Line Replacement

Water Master Plan 2021-2031 Impact Fee
Capital Improvement Plan
Water Distribution Line Projects

September 12, 2023

Lockwood, Andrews & Newnam, Inc. A LEO A DALY COMPANY

PAPE-DAWSON ENGINEERS

A-3 2021 Regional Plan Project Information

2021 Region N Water Plan

NOT RECOMMENDED AT THIS TIME

Project #	**5D.7.1**
Project Name	**City of Corpus Christi - ASR Phase I**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply

Description

The Corpus Christi Aquifer Storage and Recovery (ASR) Project upcycles treated effluent from the Greenwood Wastewater Treatment Plant (WWTP) for beneficial non-potable water supply for industries during droughts and/or high seasonal demands. This project includes two phases (Phase I and II) based on current WWTP treatment capacity and phased according to industrial growth needs up to 18 MGD.
Phase I includes the construction of 10 wells at the Corpus Christi International Airport site and transmission pipelines needed for recharge, recovery, and conveyance. Phase I also includes treatment improvements (5 MGD) so that Greenwood WWTP effluent reaches the necessary water quality for aquifer recharge. Costs are included for secondary treatment improvements (Modified Ludzack-Ettinger (MLE) process) and additional tertiary processes (Ozone and Biologically Active Filters (BAF) with Microfiltration polishing).

Justification

Potential Project for Future Water Supply

Expenditures	FY 2023-2024 to FY 2032-2033
Direct Construction Cost	77,763,772
Studies, Soft Costs, Design, and Contingency	31,165,981
Mobilization (10%)	7,776,377
Bond (5%)	3,888,189
OH&P (10%)	7,776,377
Total	128,370,696

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	128,370,696
Total	128,370,696

Budget Impact/Other

Treatment processes for Greenwood WWTP will be selected based on pilot system results and costs will be adjusted accordingly.
Cost Estimate from: 2021 RWP - Table 5D.7.1 (page 403)
Estimated Costs with Ozone + BAF + Microfiltration (High)
Sept 2018 costs adjusted for inflation; $1 in Sept 2018 = $1.2143 in 2023

5D.7 D.7 Aquifer Storage and Recovery (N-7)

5D.7.1 Description of Strategy

Aquifer Storage and Recovery (ASR) is a process whereby treated water is placed into an aquifer for storage to be recovered during a later time when needed. Treated water is normally recharged into the aquifer through well(s). During the recharge and recovery cycles, well screens placed in productive zones for storage allow water to flow through porous areas of the aquifer. The stored water is then recovered and used when water supplies are constrained, such as during drought, periods of high seasonal demands, or water service interruptions. Monitoring wells are used to help maintain a buffer zone within the aquifer between stored and native groundwater and manage storage for supply system operations. ASR can be readily adapted to current infrastructure, delay costly system improvements, and provide supply system redundancy for reliability.

The City of Corpus Christi, in conjunction with the Corpus Christi Aquifer Storage and Recovery Conservation District (District), completed a Corpus Christi ASR Feasibility Project in August 2019. The project was partially funded by a grant from the TWDB to study innovative water solutions to promote long term, cost-effective, reliable water supplies for future growth. The work included (1) developing a field testing approach (2) conducting an exploratory test drilling and sampling program (3) performing a geochemical analysis for source and groundwater compatibility (4) developing a groundwater model and simulating potential ASR operations for long-term drought and supply augmentation during peaking and (5) evaluating ASR operating policies for project implementation. The final report is available on the TWDB website[1]. During the study, both O.N. Stevens WTP and Greenwood WWTP effluent were evaluated as potential supplies. Based on City staff directives, it was determined that Greenwood WWTP effluent was the preferred recharge source due to less competing needs for its use, native groundwater quality considerations, and more frequent availability for recharge than O.N. Stevens WTP water. A conceptual ASR schematic is shown in Figure 5D.7.1.

The Corpus Christi ASR project upcycles treated effluent from the Greenwood Wastewater Treatment Plant (WWTP) for beneficial non-potable water supply for industries during droughts and/or high seasonal demands. Greenwood WWTP effluent is treated and conditioned prior to recharge for storage in the brackish Gulf Coast Aquifer System. After multiple cycles, water quality improves and stored water takes on the characteristics of the recharge water separated by a buffer zone from native groundwater. Based on exploratory testing results, the most favorable ASR storage zones are located between 350 and 800 feet below ground surface. The recovered water quality is anticipated to have total dissolved solids (TDS) and chloride levels around 2,000 mg/L and 750 mg/L, respectively. Based on water quality needs, reverse osmosis treatment can be added to reduce TDS and chloride levels.

[1] https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/1600011956_Corpus_Christi_ASR.pdf?d=1581391239865

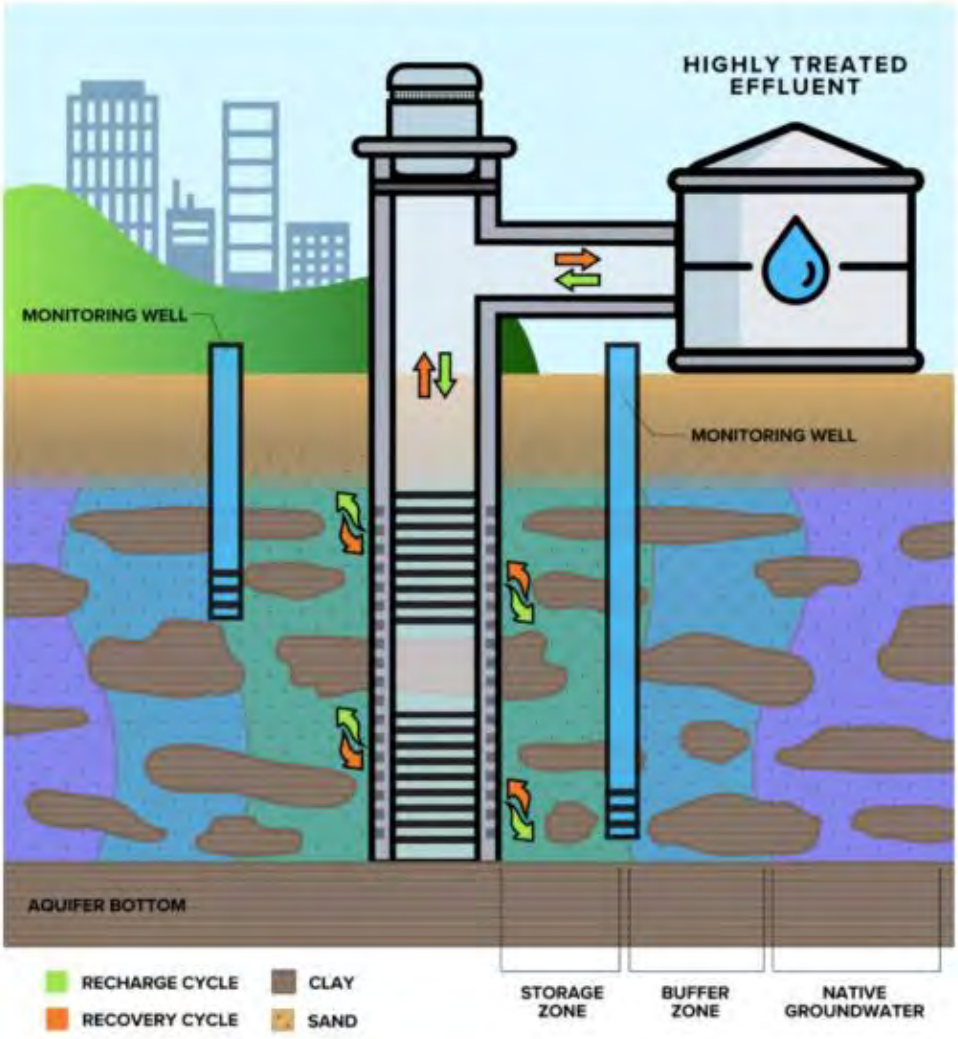


Figure 5D.7.1.
Conceptual ASR Process

For ASR projects, it is important to evaluate source water compatibility with native groundwater and aquifer minerology to avoid adverse mechanical and chemical processes with project implementation. The geochemical analysis did not identify any fatal flaws, however pilot testing of tertiary treatment of WWTP effluent is needed prior to aquifer recharge and monitoring during pilot testing will be critical in proving up geochemical desk-top analyses prior to full scale project implementation and remove suspended materials to avoid clogging the fine sand in aquifer formation for storage. Prior to implementation, a piloting program is needed to verify field tests and confirm water treatment processes necessary to obtain a TCEQ permit for ASR production, which requires that the source water for recharge to be treated to a sufficient quality so as to not impact or impair the aquifer formation or groundwater. The Greenwood WWTP effluent will need to be improved with additional treatment upgrades to reduce the following constituents in the existing effluent that could affect operations:

- Total Suspended Solids (TSS)

- Nitrate (NO_3)
- Total Organic Carbon (TOC)
- Manganese (Mn)
- Bacteria

A field-scale groundwater model was constructed using site-specific data collected during the exploratory testing program. The model was then used to simulate most likely ASR operational scenarios[2] based on source water availability and future water demands in the vicinity of the project site to determine yield. During scenario development, it was determined that industrial water users in the vicinity of the ASR wellfield would be the most likely customers for recovered water. This determination is based on projected future growth and non-potable needs that could be met with ASR supplies with minimal to no treatment anticipated after recovery.

5D.7.2 Available Yield

The Corpus Christi Aquifer Storage and Recovery Project is a phased project, with the initial size based on current Greenwood WWTP capacity and capable of expansion to address industrial growth by providing up to 18 MGD of new water supply.

Phase I is focused on 10 wells at the Corpus Christi International Airport site and Phase II adds 5 wells to the east of Phase I. A schematic showing transmission pipelines, Phase I and II wells and associated well field pipeline, and delivery location is shown in Figure 5D.7.2. Phase I and II operated conjunctively would be capable of providing about 10 MGD from ASR well operation, and up to 18 MGD with Greenwood WWTP expansion[3].

The Phase I and II findings from the Corpus Christi Aquifer Storage and Recovery Feasibility Project are as follows:

Phase I

- Phase I limits recharge to 5 MGD, which is based on current available Greenwood WWTP capacity after considering existing contracts to provide treated effluent to golf courses and would be capable of providing up to 8 MGD through recovery at ASR wells.
- If tertiary treated Greenwood WWTP effluent by-passes ASR and is delivered concurrent with ASR recovery, then the combined water supply would be 13 MGD for Phase I.

Phase II

- Based on City Staff input, Greenwood WWTP will likely be expanded to 10 MGD by 2030 to 2035. With tertiary treatment expansion to 10 MGD, it is assumed that up to 8 MGD would be available for ASR project and/or delivery to industrial customers.

[2] Based on conversations with City Staff and stakeholders
[3] Based on City staff feedback, Greenwood WWTP expansion to 12 MGD by Year 2025-2030 would result in about 8 MGD treated effluent available for potential ASR use.

- Phase I and II operated conjunctively would provide about 10 MGD from ASR well operation, and up to 18 MGD total by-passed water from Greenwood WWTP expansion[4].

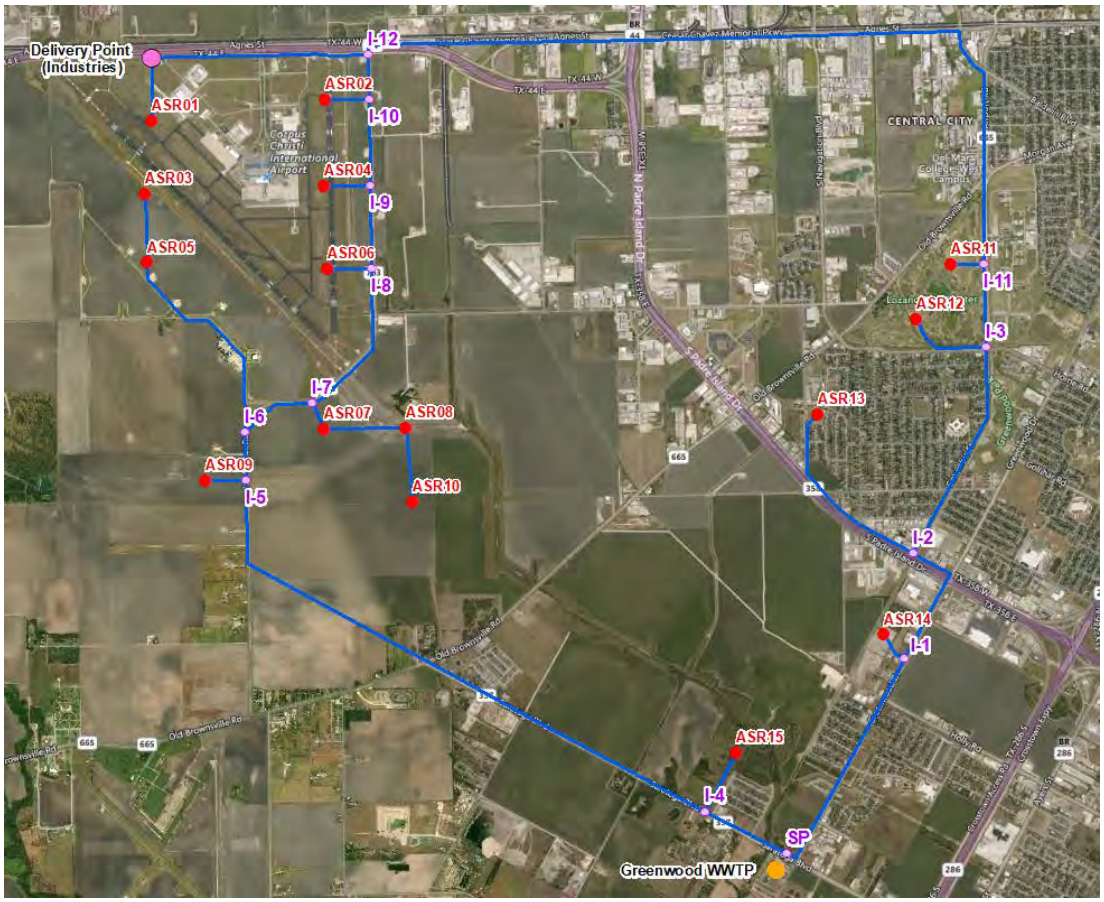


Figure 5D.7.2.
Project Layout of the Corpus Christi ASR Feasibility Project (Phase I and II)

5D.7.3 Environmental Issues

The 2001 Agreed Order includes provisions for 151,000 ac-ft/yr of freshwater inflows to the Nueces Bay and Estuary System, made up with a combination of 54,000 ac-ft return flow credit and remaining 97,000 ac-ft from pass-throughs and controlled releases from the CCR/LCC system according to inflow and stored water levels. The actual wastewater discharges in 2017 and 2018 amounted to 84,663 and 92,327 ac-ft, respectively. It is unlikely that use of Greenwood WWTP effluent as a source water for ASR will have a meaningful impact on achieving freshwater inflow requirements associated with the 2001 Agreed Order.

[4] Based on City staff feedback, Greenwood WWTP expansion to 12 MGD by Year 2025-2030 would result in about 8 MGD treated effluent available for potential ASR use.

The most significant environmental issue associated with this project is repurposing Greenwood WWTP effluent that would otherwise be discharged to Oso Creek. Oso Creek receives treated domestic wastewater from a number of facilities, one industrial facility, three municipal storm sewer systems, four concrete production facilities, and three pesticide plants authorized to discharge. As presented in Table 5D.5.1 (Chapter 5D.5- Reuse), Greenwood WWTP discharged 13,694 ac-ft/yr in 2018. Based on a three year average from January 2015- December 2017, the discharge from Greenwood WWTP was about 5.5 MGD. This represents about 1.7% of the recent discharge to Oso Creek from 2015-2017[5]. Oso Creek (Segment 2485A), is listed[6] to have bacteria impairment and water quality concerns of Chlorophyll-a, nitrates, and total P, as shown in Chapter 1- Planning Area Description Table 1.2. Within the Oso Creek watershed, the most probable sources of bacteria is regulated stormwater, industrial sources, and nonpoint sources.[7] The Texas A&M University at Corpus Christi Center for Coastal Studies and local stakeholders have formed a group to study Oso Creek and in response, the TCEQ adopted a total maximum daily load[8] (TMDL) for Oso Creek on July 31, 2019 to monitor and reduce bacterial loads in Oso Creek. The EPA approved the TMDL on October 25, 2019, and is now part of the state's Water Quality Management Plan. The Texas State Soil and Water Conservation Board is working to decrease bacterial loads from agriculture by assisting landowners in developing and implementing water quality management plans. Additional studies are needed to evaluate the environmental impact of reducing Greenwood WWTP discharge to use as a supply for ASR.

5D.7.4 Engineering and Costing

The ASR project includes two phases (Phase I and II) based on current WWTP treatment capacity and phased according to industrial growth needs. If tertiary treated Greenwood WWTP effluent by-passes ASR and is delivered concurrent with ASR recovery, then the combined water supply would be 13 MGD for Phase I. Phase I and II operated conjunctively would be capable of providing about 10 MGD from ASR well operation, and up to 18 MGD with Greenwood WWTP expansion[9].

The current secondary treatment process at the Greenwood WWTP consists of a conventional, activated sludge treatment system. The system effectively reduces the biochemical oxygen demand (BOD) and nitrifies the influent ammonia. However, augmentations to the secondary treatment system are required to reduce the effluent nitrate (NO3). This process will reduce NO3 to less than 10 mg/L, the maximum contaminant level (MCL). A Modified Ludzack-Ettinger (MLE) process is proposed to complete this treatment. To fully treat the wastewater effluent after the MLE process to sufficient quality to be able to inject it into the aquifer, additional unit processes will likely be required. The main parameters to be reduced or removed in the tertiary system are Manganese (Mn), Total Suspended Solids (TSS), Total Organic Carbon (TOC), and

[5] Table 5. TCEQ, One Total Maximum Daily Load for Indicator Bacteria in Oso Creek, Adopted July 2019.
[6] Nueces River Authority 2019 Basin Highlights Report: San Antonio-Nueces Coastal Basin, Nueces River Basin, Nueces-Rio Grande Coastal Basin. https://www.nueces-ra.org/CP/CRP/pdfs/2019_BHR.pdf
[7] TCEQ, One Total Maximum Daily Load for Indicator Bacteria in Oso Creek, Adopted July 2019.
[8] https://www.tceq.texas.gov/assets/public/waterquality/tmdl/67osocreekbacteria/67-osocreekbacteria.pdf
[9] Based on City staff feedback, Greenwood WWTP expansion to 12 MGD by Year 2025-2030 would result in about 8 MGD treated effluent available for potential ASR use.

bacteria. Three treatment trains are recommended to be compared during the pilot system which will inform and direct the Phase I and II project construction and later expansion of the treatment plant. The proposed pilot plant arrangement is shown in Figure 5D.7.3.

In the absence of pilot system results, the cost analysis considers secondary treatment improvements and the additional tertiary system considers the following processes:

- Tertiary Membrane Filtration, (TMF or Microfiltration)
- Ozone and Biologically Active Filter (BAF)
- Ozone and BAF with Microfiltration polishing

Microfiltration (TMF)

The standard method for removing suspended particles is typically through a membrane filter. Microfiltration, or Tertiary Membrane Filtration (TMF), through hollow fiber membranes is an efficient system to effectively remove particles larger than 1 µm, which includes most bacteria. The system will use a submerged membrane configuration and be maintained with an air scouring system with periodic cleaning using acid based cleaners. The physical filtration mechanism should efficiently remove TSS and bacteria once the MLE system removes NO_3. Microfiltration treatment will likely not sufficiently remove TOC or dissolved Mn.

Ozone and BAF

Biologically active filters (BAF) operate in a similar way as a traditional slow sand filter. However, a biologically active layer is allowed to develop at the surface of the filter to further treat organic constituents. Ozone is used as an oxidizer before the filter to breakdown recalcitrant TOC that was not available to be processed in the secondary treatment. The biological layer for the BAF will then consume the now biodegradable TOC. An additional benefit of the configuration is that any remaining Mn is expected to be oxidized and removed. Potential inefficiencies of the treatment systems is that the bacteria from the biologically active area may be carried into the effluent and TSS will likely not be sufficiently reduced.

Ozone and BAF with Microfiltration polishing

The combination of the two treatment systems should effectively treat the effluent to a level that will not significantly impact the aquifer environment. All constituents of concern should be removed to meet water quality requirements for ASR injection as detailed previously. This option effectively eliminates individual limitations for the TMF and Ozone/BAF systems.

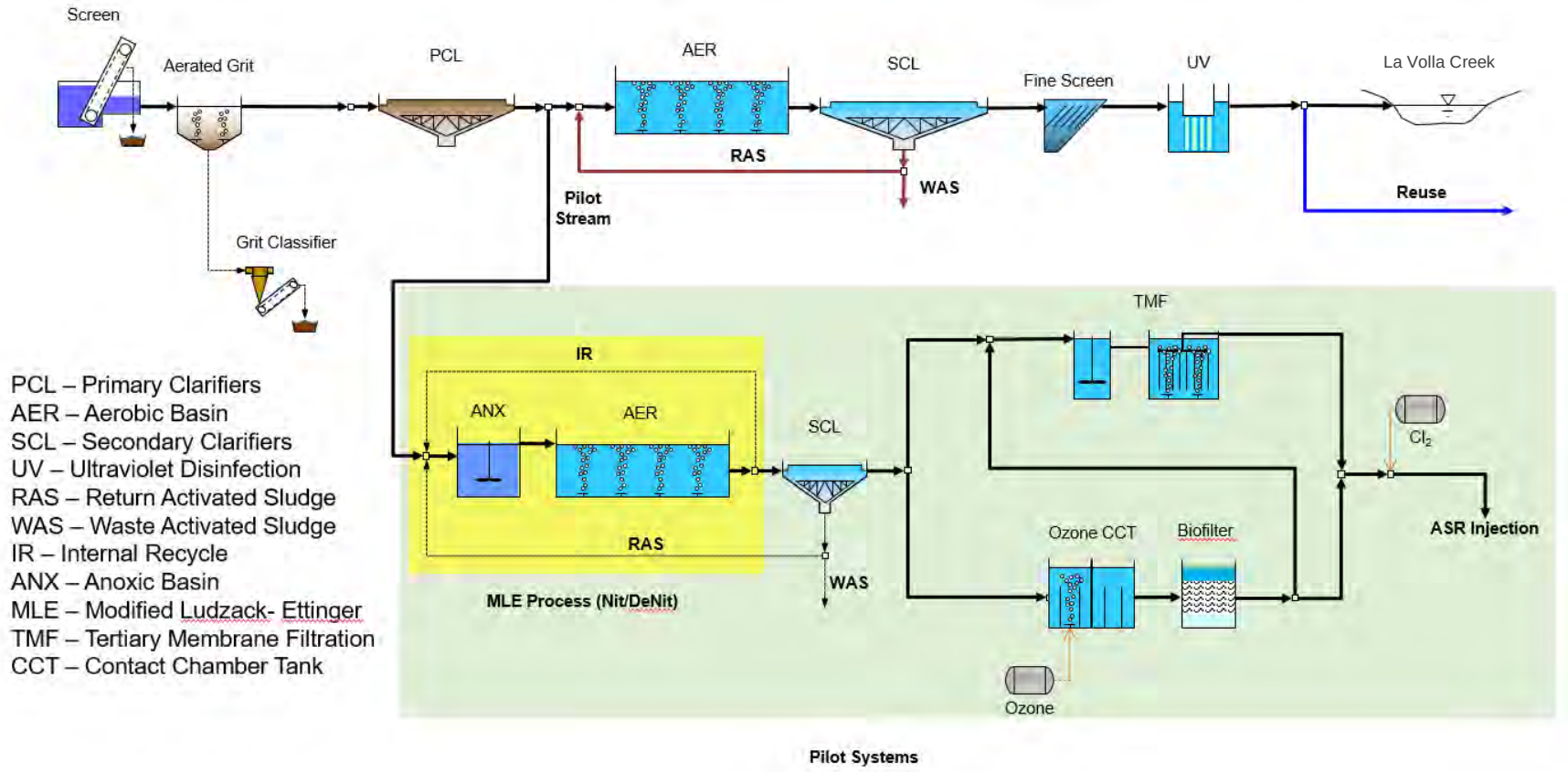


Figure 5D.7.3.
Proposed Pilot System Configuration Process Flow Diagram

5D.7.4.1 Phase I Cost Estimate

The Phase I planning-level cost estimate includes:

- 10 wells constructed and equipped to:
  - Recharge up to 415 gpm each (total 5.976 MGD, or about 20% extra to account for well downtime and/or maintenance)
  - Recover up to 685 gpm each (total 9.8 MGD, or about 23% to account for well downtime and/or maintenance)
- 5 MGD pump station at Greenwood WWTP (for recharge)
- 10.9 MGD booster pump station near Phase I wellfield (for recovery)
- 24-inch transmission pipeline from tertiary treatment facilities at Greenwood WWTP to Phase I well field and 8-inch to 30-inch well field piping
- 30-inch diameter pipe to deliver total Phase I supply produced by 10 wells to a delivery point located to the north west of the Corpus Christi International Airport on Agnes Road, south of the intersection of Bronco Road and Interstate Hwy 44
- 2 MG terminal storage tank
- SCADA estimated at 3% of construction costs
- Easement acquisition of 96 acres at cost of $10,000 per acre
- Survey and geotech costs estimated at $55,000 per mile
- Tertiary treatment (5 MGD)
  - MLE treatment
  - Additional tertiary treatment (low to high)
    - Alternative 2: Ozone + BAF (low)
    - Alternative 3: Ozone + BAF + Microfiltration (high)
- Yields up to 13 MGD during recovery
  - 8 MGD through ASR wellfield operation plus
  - 5 MGD through bypass from tertiary treatment facilities at Greenwood WWTP.

A cost estimate for Phase I wells and transmission pipelines needed for recharge, recovery, and conveyance is shown in Table 5D.7.1. The costs shown represent a range of treatment processes that will be identified during piloting for subsequent refinement of Phase I costs, accordingly.

The total project cost is expected to range from $68,632,000 to $90,199,000 depending on treatment process. The annual cost ranges from $6,979,000 to $8,836,000. The unit cost of water is estimated to be $479 to $606 per ac-ft during recovery, which is the firm yield expected during drought conditions. After adding recharge operations to replenish storage for later recovery, the energy costs increase to $1,633,000. The unit cost increases to $537 to $664 per ac-ft.

Table 5D.7.1.
Cost Estimate Summary,
City of Corpus Christi - ASR Phase I (Low to High Range Based on Treatment)

Item	Estimated Costs with Ozone + BAF (Low)	Estimated Costs with Ozone + BAF + Microfiltration (High)
Capital Cost		
Greenwood WWTP Pump Station (5 MGD Phase 1)	$3,914,000	$3,914,000
Booster Pump Station(s) & Storage Tank(s) (10.9 MGD Phase 1)	$3,402,000	$3,402,000
Wellfield Piping (13.4 mi (P1), 8 IN - 30 IN dia.)	$13,855,000	$13,855,000
ASR Wells (10 wells, 685 gpm, 700 ft depth)	$11,653,000	$11,653,000
Terminal Storage Tank (2 MG)	$1,516,000	$1,516,000
Tertiary Treatment and MLE Upgrade, 5 MGD	$12,018,000	$27,112,000
SCADA	$1,171,000	$1,624,000
Total Cost of Facilities	**$47,529,000**	**$63,076,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$16,547,000	$21,989,000
Environmental & Archaeology Studies and Mitigation	$548,000	$548,000
Land Acquisition (96 acres (P1))	$964,000	$964,000
Surveying and Geotechnical (22 miles (P1))	$1,207,000	$1,207,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,837,000	$2,415,000
Total Cost of Project	**$68,632,000**	**$90,199,000**
Annual Cost		
Debt Service (3.5 percent, 20 years)	$4,829,000	$6,347,000
Operation and Maintenance		
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$297,000	$301,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$147,000	$147,000
Tertiary Treatment (Ozone + BAF)	$913,000	$1,248,000
Pumping Energy Costs (@ 0.08 $/kW-hr)	$793,000	$793,000
Total Annual Cost	**$6,979,000**	**$8,836,000**
Available Project Yield (acft/yr)	14,573	14,573
Capacity Cost ($/gpd)	$5.28	$6.94
Annual Cost of Water ($ per acft), during recovery	$479	$606
Annual Cost of Water After Debt Service ($ per acft), during recovery	$148	$171
Annual Cost of Water ($ per 1,000 gallons), during recovery	$1.47	$1.86
Annual Cost of Water After Debt Service ($ per 1,000 gallons),	$0.45	$0.52

5D.7.4.2 Phase II Cost Estimate

The Phase II planning-level cost estimate includes:

- 15 wells constructed and equipped to:
  - Recharge up to 415 gpm each for Phase I wells and 500 gpm for Phase II wells (total 9.6 MGD, or about 30% for well downtime and/or maintenance)
  - Recover up to 685 gpm each for Phase I wells and 750 gpm for Phase II wells (total 15.3 MGD to account for well downtime and/or maintenance)
- 10 MGD pump station at Greenwood WWTP (for recharge)
- 17 MGD booster pump station(s) total
- Phase I pipelines + 12-inch transmission pipeline from tertiary treatment facilities at Greenwood WWTP to Phase II well field and well field piping
- 30-inch diameter pipe to deliver total Phase II supply to a delivery point located to the north west of the Corpus Christi International Airport on Agnes Road, south of the intersection of Bronco Road and Interstate Hwy 44
- Two- 2 MG terminal storage tanks (4 MG total)
- SCADA estimated at 3% of construction costs
- Land acquisition of 155 acres at cost of $10,000 per acre
- Survey and geotech costs estimated at $55,000 per mile
- Tertiary treatment (10 MGD, total)
  - MLE treatment
  - Additional tertiary treatment (low to high)
    - Alternative 2: Ozone + BAF (low)
    - Alternative 3: Ozone + BAF + Microfiltration (high)
- Yields up to 18 MGD during recovery
  - 10 MGD through ASR wellfield operation plus
  - 8 MGD through bypass from tertiary treatment facilities at Greenwood WWTP after expansion.

A cost estimate for Phase II wells and transmission pipelines needed for recharge, recovery, and conveyance of water to the delivery point for industrial customer use is shown in Table 5D.7.2. Similar to Phase I, the costs shown represent a range of treatment processes that will be identified during piloting for subsequent refinement of Phase I costs, accordingly.

The total project cost is expected to range from $123,253,000 to $174,668,000 depending on treatment process. The annual cost ranges from $12,189,000 to $16,383,000. The unit cost of water is estimated to be $604 to $812 per ac-ft during recovery, which is the firm yield expected during drought conditions. After adding recharge operations to replenish storage for later recovery, the energy costs increase to $1,824,000. The unit cost increases to $646 to $854 per ac-ft.

Table 5D.7.2.
Cost Estimate Summary,
City of Corpus Christi - ASR Phase II (Low to High Range Based on Treatment)

Item	Estimated Costs with Ozone + BAF (Low)	Estimated Costs with Ozone + BAF + Microfiltration (High)
Capital Cost		
Greenwood WWTP Pump Station (10 MGD Phase II)	$5,689,000	$5,689,000
Booster Pump Station(s) & Storage Tank (16.9 MGD, 500 HP Phase II)	$4,778,000	$4,778,000
Wellfield Piping (24.5 mi (P1+2), 8 IN - 30 IN dia.)	$23,517,000	$23,517,000
ASR Wells (15 wells, 685-750 gpm, 700-800 ft depth)	$18,190,000	$18,190,000
Terminal Storage Tank (4 MG)	$3,033,000	$3,033,000
Tertiary Treatment and MLE Upgrade, 10 MGD	$28,654,000	$64,641,000
SCADA	$2,202,000	$3,281,000
Total Cost of Facilities	**$86,063,000**	**$123,129,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$29,806,000	$42,779,000
Environmental & Archaeology Studies and Mitigation	$791,000	$791,000
Land Acquisition (155 acres (P1+P2))	$1,553,000	$1,553,000
Surveying and Geotechnical (32 miles (P1+P2))	$1,741,000	$1,741,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$3,299,000	$4,675,000
Total Cost of Project	**$123,253,000**	**$174,668,000**
Annual Cost		
Debt Service (3.5 percent, 20 years)	$8,672,000	$12,290,000
Operation and Maintenance		
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$485,000	$496,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$222,000	$222,000
Tertiary Treatment	$1,825,000	$2,390,000
Pumping Energy Costs (@ 0.08 $/kW-hr)	$985,000	$985,000
Total Annual Cost	**$12,189,000**	**$16,383,000**
Available Project Yield (acft/yr)	20,178	20,178
Capacity Cost ($/gpd)	$6.84	$9.70
Annual Cost of Water ($ per acft), during recovery	$604	$812
Annual Cost of Water After Debt Service ($ per acft), during recovery	$174	$203
Annual Cost of Water ($ per 1,000 gallons), during recovery	$1.85	$2.49
Annual Cost of Water After Debt Service ($ per 1,000 gal), recovery	$0.53	$0.62

5D.7.5 Implementation Issues

The state rules governing most facets of ASR project implementation in Texas are administered by the Texas Commission on Environmental Quality (TCEQ) and are contained in Title 30 of the Texas Administrative Code (30 TAC), Chapter 331, Underground Injection Control (UIC). The TCEQ has primacy from the US EPA to regulate most injection wells through the Texas UIC Program. Since the proposed ASR project does not currently contemplate recovery of water directly to a public water system, rules related to public supply wells and groundwater sources and development, as contained in 30 TAC §290.41 (c), do not apply. Of particular relevance to the proposed ASR project are the requirements in 30 TAC§331.186 (a), which outlines the criteria to be consider by TCEQ in authorizing ASR operations. The effluent from the Greenwood WWTP does not currently meet drinking water standards for chloride, TDS, manganese, and nitrate concentration, or pathogen removal. While it is anticipated that nitrate and manganese will likely be below the drinking water maximum contaminant limit after tertiary treatment, the other parameters will not be significantly altered prior to recharge. As such, the City will need to demonstrate to the TCEQ that proposed ASR well operations will not: 1) render the groundwater produced from the receiving formation harmful or detrimental to people, animals, vegetation, or property, or 2) require an unreasonably higher level of treatment of the groundwater produced from the receiving geologic formation than is necessary for the native groundwater in order to render the groundwater suitable for beneficial use.

For most previous ASR applications, TCEQ has required treatment to drinking water standards prior to recharge but newer rules passed in 2015 and described in Section 5 of Exhibit G may give some flexibility since both the quality of the effluent relative to drinking water is considered along with the potential to degrade the native groundwater. This project would improve the native groundwater for constituents more relevant to Safe Drinking Water Act as a result of the tertiary treatment prior to injection that address the constituents above MCL. Although the storage aquifer is considered brackish it would still be classified as an underground source of drinking water (USDW) per Title 40, Code of Federal Regulations (40 CFR) Section 144.3. It is likely that additional treatment at the WWTP may be required by TCEQ to meet MCLs, and could be necessary to maintain ASR operations and water compatibility. Treatment may include modifications to the WWTP's treatment process to promote de-nitrification, reduce turbidity, and improve the disinfection system to further inactivate bacteria.

There are several existing wells identified within the ASR study area that will likely be impacted by ASR implementation. Additional efforts to survey unregistered wells in the vicinity of the proposed ASR well field area would be helpful to identify wells to monitor and/or mitigate in advance of commencing ASR operations. Supply protection is within the jurisdictional authority of the District as detailed in the District's 2019 Groundwater Management Plan[10].

[10] http://www.twdb.texas.gov/groundwater/docs/GCD/ccasrcd/CCASRCDMgmtPlan2019.pdf?d=1581392749650

5D.7.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5D.7.3.

Table 5D.7.3.
Evaluation Summary of City of Corpus Christi ASR Project

Impact Category	Comment(s)
a. Water Supply	
1 Quantity	1. Firm Yield: 14,573 ac-ft/yr (Phase I) and 20,178 ac-ft/yr (Phase II)
2. Reliability 3. Cost of Treated Water	2. Reliable, based on system operations 3. Non-Potable cost: $479- $606 per ac-ft (Phase I) and $604- $812 per ac-ft (Phase II)
b. Environmental factors	
1. Instream flows	1. Low impact. Reduced flow in Oso Creek.
2. Bay and Estuary Inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a. Dissolved solids are estimated to be around 2,000 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. b. Salinity are addressed for non-potable use. If water use needed is potable, additional treatment will be required. c. Bacteria is addressed with treatment process. d. Chlorides are estimated to be around 750 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. e-h. None or low impact i. Nitrate, TSS, TOC, and Mn addressed with treatment processes.
c. Impacts to agricultural resources and State water resources	• Reduce discharge to Oso Creek.
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• Reduce discharge to Oso Creek.
i. Efficient use of existing water supplies and regional opportunities	• Reuses water supply and compatible with regional development.
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

2021 Region N Water Plan

NOT RECOMMENDED AT THIS TIME

Project #	**5D.8.2**
Project Name	**Evangeline/Laguna Treated Groundwater Project**
Type	Improvement/Additions
Useful Life	40 years
Category	Water Supply

Description

The Evangeline/Laguna LP Groundwater Project includes groundwater production of up to 25.4 MGD (28,486 acft/yr) from 23,000+ acres located in San Patricio County for conveyance and delivery to the City of Corpus Christi and/or future industries in San Patricio County.
This project will be phased based on current modeled available groundwater (MAG) limitations, with full well field build-out after 2050. The first phase is a well field with 13 wells, but at full project production, the wellfield consists of 18 wells including contingency.
Three raw water delivery options are being considered for the project. Costs are included for the most expensive option (Delivery Option 1).

Justification

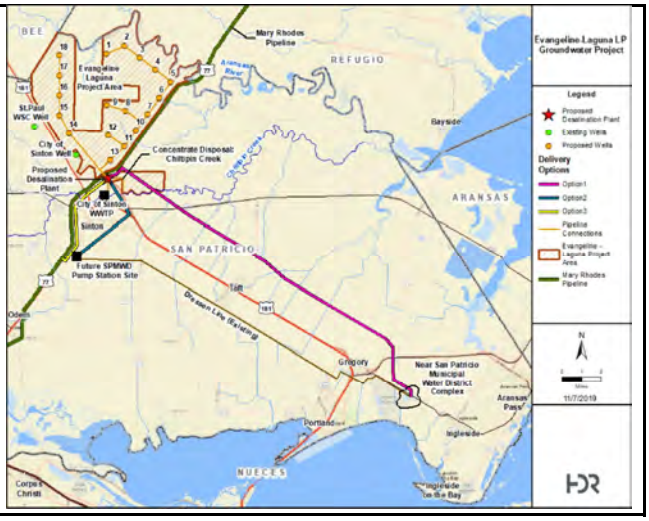
Potential Project for Future Water Supply

Expenditures	FY 2023-2024 to FY 2032-2033
Direct Construction Cost	77,763,772
Studies, Soft Costs, Design, and Contingency	42,510,214
Mobilization (10%)	7,776,377
Bond (5%)	3,888,189
OH&P (10%)	7,776,377
Total	139,714,929

Funding Sources	FY 2023-2024 to FY 2032-2033
TBD	139,714,929
Total	139,714,929

Budget Impact/Other

Project cost is subject to change depending on the selected raw water delivery option.
Cost Estimate from: 2021 RWP - Table 5D.8.29 (page 456)
Estimated Costs for Facilities
(Delivery Option 1)
Sept 2018 costs adjusted for inflation;
$1 in Sept 2018 = $1.2143 in 2023



5D.8.2 Evangeline/Laguna LP Raw Groundwater Project

5D.8.2.1 Description of Strategy

The Evangeline/Laguna LP Groundwater Project includes groundwater production of up to 25.4 MGD (28,486 acft/yr) from 23,000+ acres located in San Patricio County for conveyance and delivery to the City of Corpus Christi and/or future industries in San Patricio County. Figure 5D.8.1 shows the approximate location of the project site. Since the 2016 Plan, project developers have moved this project towards implementation by securing permits from the San Patricio County Groundwater Conservation District (SPCGCD), drilling and collecting data from a test well, and performing a corrosion analysis, but no blending analysis has been conducted yet. The test well water quality results were all within TCEQ drinking water standards. TDS and chloride levels measured at the test well were 792 mg/L and 269 mg/L, respectively. The SPCGCD production permit granted to Evangeline/Laguna LP is for up to 25.4 MGD (28,486 acft/yr), the current modeled available groundwater (MAG) for regional planning purposes limits groundwater production in San Patricio County to 24,873 acft/yr in Year 2020. However, in Year 2050, the full groundwater production equal to the 25.4 MGD permit issued by the SPCGCD is available under regional planning guidelines.

This project has been evaluated in two ways for the 2021 Region N Plan: (a) as a raw, groundwater supply with minimal treatment and (b) with groundwater desalination to reduce TDS and chlorides to around 200 mg/L for high water quality use (Chapter 5D.9). **The strategy presented here is for the raw, groundwater supply with minimal treatment options based on the water quality results provided by Evangeline/Laguna LP that shows water quality results within TCEQ drinking water standards**.

This project will be phased based on MAG limitations, with full well field build-out after 2050 as described above. The first phase is a well field with 13 wells (production constrained by MAG), but at full project production, the wellfield consists of 18 wells including contingency. The wells will be around 1,000 ft and have an estimated pumping rate of 1,200 gpm. The current raw groundwater quality is around 800 mg/L TDS, and wells would be screened and operated in such a manner to target groundwater with lower levels of TDS and chlorides. Based on test well data water quality meets drinking water standards and could be delivered to a customer untreated or with minimal chlorine treatment.

Three delivery options were evaluated as part of this water management strategy and the costs are provided in the Engineering and Costing Section.

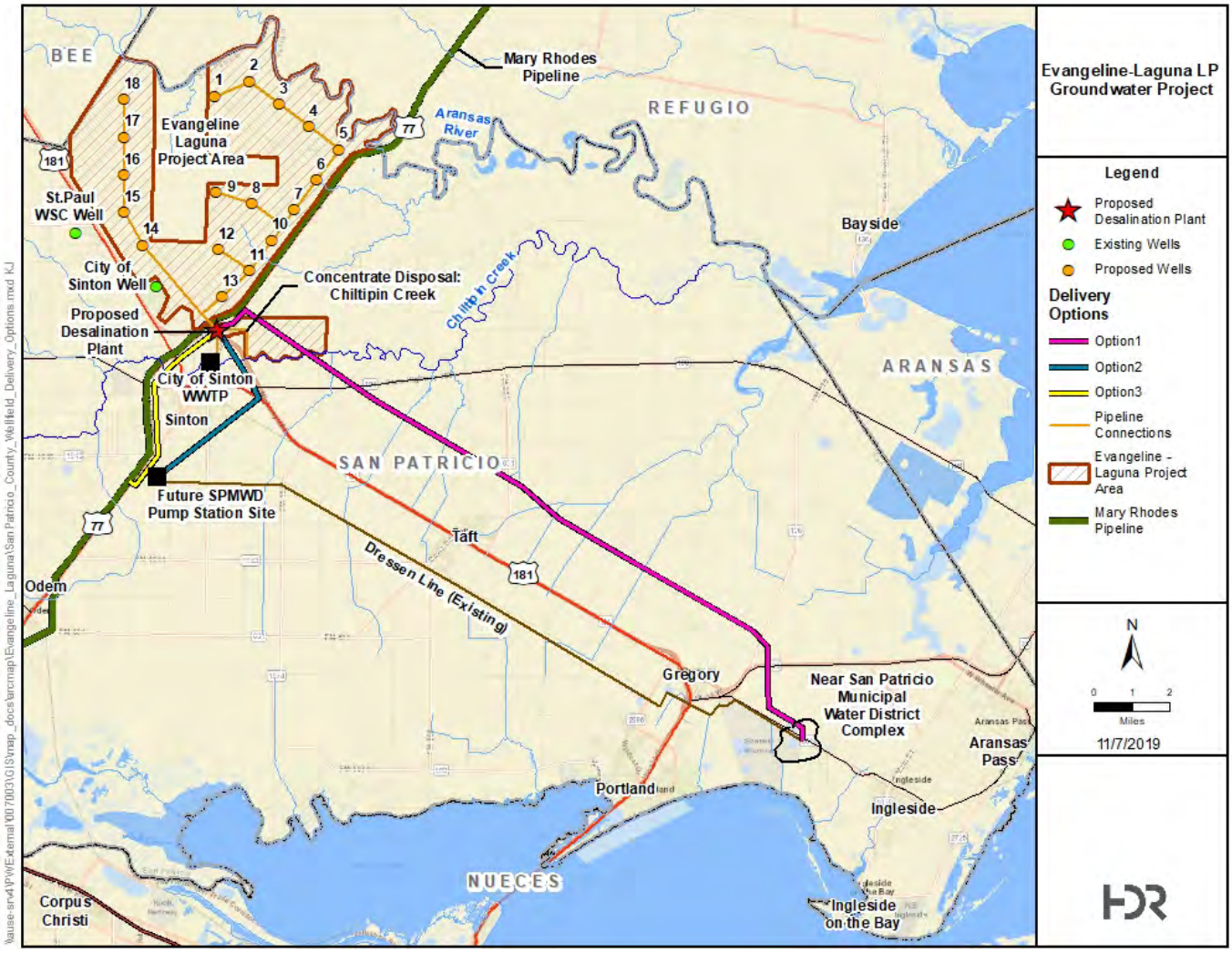


Figure 5D.8.1.
Location of Conceptual Layout of Evangeline/Laguna LP Groundwater Project

5D.8.2.2 Available Yield

In the Coastal Bend region, the Gulf Coast Aquifer System is the primary source of substantial groundwater supplies. The most productive water-bearing zone is the Goliad Sand, which is also known as the Evangeline Aquifer. The outcrop of the Goliad Sand is about 50 to 75 miles inland. The formation dips toward the coast at about 20 feet per mile. Near the coast, the shallower Chicot Aquifer provides some groundwater supplies. West of the outcrop of the Goliad Sands, the deeper Jasper Aquifer can supply a moderate amount of groundwater in some areas.

The SPCGCD production permit granted to Evangeline/Laguna LP is for up to 25.4 MGD (28,486 acft/yr), the current modeled available groundwater (MAG) for regional planning purposes limits groundwater production in San Patricio County to 24,873 acft/yr in Year 2020. However, in Year 2050, the full groundwater production equal to the 25.4 MGD permit issued by the SPCGCD is available under regional planning guidelines.

5D.8.2.3 Environmental Issues

The primary environmental issues related to the development of raw groundwater from the Evangeline Aquifer in San Patricio County are the development of the well fields and associated pipelines, and integration into the pipeline system for conveyance and delivery.

The project is located in the Gulf Coastal Plains of Texas Physiographic Province, specifically in the subprovince of the Coastal Prairies. This area is locally characterized as a nearly flat prairie composed of deltaic sands and muds which terminates at the Gulf of Mexico and includes topography changes of less than one foot per mile. Elevation levels in the Coastal Prairies range from 0 to 300 feet above mean sea level.

Environmental Considerations Associated with Evangeline-Laguna LP Groundwater Project

The Evangeline-Laguna LP Groundwater project includes a well field of 18 water wells located in San Patricio County near its border with Bee County. For this strategy, water would be minimally treated and delivered to the City of Corpus Christi and/or to San Patricio Municipal Water District for future industries in San Patricio County.

Three delivery pipeline options are proposed. The proposed transmission pipelines cross areas which are primarily used for pasture and crops. Vegetation types found along the pipeline route also include areas of Mesquite-Live Oak-Bluewood Parks. Planning of the pipeline route should include avoidance of impacts to wetland areas where possible. Although the construction of portions of the treated water pipeline may include the clearing and removal of woody vegetation, destruction of potential habitat can generally be avoided by diverting the corridor through previously disturbed areas.

The well field area is primarily located within an area used for crops; however, it also contains smaller portions of Mesquite-Live Oak-Bluewood Parks vegetation areas. Mesquite-Live Oak-Bluewood Parks areas commonly contain plants such as huisache, grajeno, lotebush, pricklypear, agarita, purple threeawn, and Mexican persimmon. Distribution of this vegetation type is found primarily within the South Texas Plains. Site selection for the wells should include the avoidance of impacts to wetland areas.

Appropriate pipeline route selection, construction methods and right-of-way selection should avoid or minimize anticipated impacts to potential wetland areas or other waters of the U.S. along the three treated water pipeline options.

Area Vegetation and Wildlife Habitat

The groundwater project area is located within the Gulf Prairies and Marshes Vegetational Area. Gulf Prairies have slow surface drainage and elevations that range from sea level to 250 feet. These areas include nearly level and virtually undissected plains. Originally the Gulf Prairies were composed of tallgrass prairie and post oak savannah. However tree species such as honey mesquite, and acacia, along with other trees and shrubs have increased in this area forming dense thickets in many places. Typical oak species found in this area include live oak

(*Quercus virginiana*) and post oak (*Q. stellata*), in addition to huisache (*Acacia smallii*), black-brush (*A. rigidula*), and a dwarf shrub; bushy sea-ox-eye (*Borrichia frutescens*). Principal climax grasses of the Gulf Prairies include gulf cordgrass (*Spartina spartinae*), indiangrass (*Sorghastrum nutans*), and big bluestem (*Andropogon gerardii* var. *gerardii*). Prickleypear (*Opunita* sp.) are common within this area along with forbs including asters (*Aster* sp.), poppy mallows (*Callirhoe* sp.), bluebonnets (*Lupinus* sp.), and evening primroses (*Oenothera* sp.). Gulf Marshes range from sea level to a few feet in elevation, and include low, wet marshy coast areas commonly covered with saline water. These salty areas support numerous species of sedges (*Carex* and *Cyperus* sp.), bulrushes (*Scirpus* sp.), rushes (*Juncus* sp.), and grasses. Aquatic forbs found in these areas generally include pepperweeds (*Lepidium* sp.), smartweeds (*Polygonum* sp.), cattails (*Typha domingensis*) and spiderworts (*Tradescantia* sp.) among others. Game and waterfowl find these low marshy areas to be excellent natural wildlife habitat.

Threatened and Endangered Species (ES)

The Federal Endangered Species Act of 1973, as amended, prohibits the "take" of any threatened or endangered species. The term "take" under the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." The term "harm" was further defined to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." Designation of critical habitat areas has been established for the public knowledge where the publishing of such information would not cause harm to the species. Additional federal protection is extended to migratory birds, and bald and golden eagles under the Migratory Bird Treaty Act (MBTA) as amended, and the Bald and Golden Eagle Protection Act. Protection is also afforded to Texas state-listed species. The Texas Parks and Wildlife Department (TPWD) enforces the state regulations.

The MBTA protects most bird species, including, but not limited to, cranes, ducks, geese, shore-birds, hawks, and songbirds. Migratory bird pathways, stopover habitats, wintering areas, and breeding areas may occur within and adjacent to the pipeline area, and may be associated with wetlands, ponds, shorelines, riparian corridors, fallow fields and grasslands, and woodland and forested areas. Pipeline construction activities could disturb migratory bird habitats and/or species' activities.

Reasonable and prudent measures should be taken to avoid and minimize the potential effects of the proposed project's activities on threatened and endangered species, as well as bald eagles. Species' locations, activities, and habitat requirements should be considered based on U.S. Fish and Wildlife Service and TPWD recommendations.

In San Patricio County there may occur 40 state-listed endangered or threatened species and 19 federally-listed endangered or threatened wildlife species, according to the county lists of rare species published by the TPWD. A list of these species, their preferred habitat and potential occurrence in the four county areas is provided in Table 5D.8.28.

Table 5D.8.28. Federal- and State-Listed Threatened, Endangered, and Species of Concern Listed for San Patricio County

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Black-spotted newt	*Notophthalmus meridionalis*	May be found in resacas and bodies of water with firm bottoms and little or no vegetation.	Resident	--	T
Sheep frog	*Hypopachus variolosus*	Predominantly grassland and savanna.	Resident	--	T
South Texas siren (large form)	*Siren sp. 1*	Mainly found in bodies of quiet water, permanent or temporary, with or without submerged vegetation.	Resident	--	T
Strecker's chorus frog	*Pseudacris streckeri*	Wooded floodplains and flats, prairies, cultivated fields and marshes.	Resident	--	--
Bald eagle	*Haliaeetus leucocephalus*	Found primarily near rivers and large lakes, nests in tall trees or on cliffs near water.	Resident	--	T
Black rail	*Laterallus jamaicensis*	Salt, brackish, and freshwater marshes, pond borders, wet meadows and grassy swamps.	Nesting	PT	--
Botteri's sparrow	*Peucaea botterii*	Habitat description is not available at this time.	Resident	--	T
Eskimo Curlew	*Numenius borealis*	Nonbreeding in grasslands, pastures and plowed fields	Historic	LE	E
Franklin's gull	*Leucophaeus pipixcan*	Habitat description is not available at this time.	Migrant	__	__
Mountain plover	*Charadrius montanus*	Breeding, nesting on shortgrass prairie	Resident	__	__
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	Open country, especially savanna and open woodland, and sometimes in very barren areas; grassy plains and valleys with scattered mesquite, yucca, and cactus	Migrant	LE	E
Piping plover	*Charadrius melodus*	Beaches and flats of coastal Texas	Migrant	LT	T
Red knot	*Calidris canutus rufa*	Primarily sea coast on tidal flats and beaches, herbaceous wetland, and tidal flat/shore.	Resident	LT	--
Swallow-tailed kite	*Elanoides forficatus*	Lowland forested regions, especially swampy areas, ranging into open woodland.	Resident	__	T
Texas Botteri's Sparrow	*Aimophila botterii texana*	Grassland and short-grass plains with scattered bushes or shrubs, sagebrush, mesquite, or yucca; nests on ground of low clump of grasses	Resident	__	T
Tropical kingbird	*Tyrannus melancholicus*	Habitat description is not available at this time	Resident	--	--
Tropical parula	*Setophaga pitiayumi*	Semi-tropical evergreen woodland along rivers and resacas	Resident	--	T
Western burrowing owl	*Athene cunicularia hypugaea*	Open grasslands, especially prairie	Resident	__	__

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
White-faced ibis	*Plegadis chihi*	Prefers freshwater marshes	Resident	__	T
White-tailed hawk	*Buteo albicaudatus*	Coastal prairies, savannahs and marshes in Gulf Coastal Plain	Nesting/Migrant	__	T
Whooping crane	*Grus Americana*	Winters in coastal marshes	Migrant	LE	E
Wood stork	*Mycteria Americana*	Forages in prairie ponds, ditches and shallow standing water; formerly nested in Texas	Migrant	__	T
Opossum pipefish	*Microphis brachyurus*	Brooding adults found in fresh or low salinity waters and young move or are carried into more saline waters after birth.	Aquatic Resident	--	T
Snook	*Centropomus undecimalis*	Habitat description is not available at this time	Aquatic Resident	--	--
Southern flounder	*Paralichthys lethostigma*	Habitat description is not available at this time	Aquatic Resident	--	--
American bumblebee	*Bombus pensylvanicus*	Habitat description is not available at this time	Resident	--	--
Manfreda giant-skipper	*Stallingsia maculosus*	Most skippers are small and stout-bodied; name derives from fast, erratic flight	Resident	__	__
No accepted common name	*Disonycha stenosticha*	Habitat description is not available at this time	Resident	__	__
No accepted common name	*Dacoderus steineri*	Habitat description is not available at this time	Resident	__	__
No accepted common name	*Cryptocephalus downiei*	Habitat description is not available at this time	Resident	__	__
No accepted common name	*Ormiscus albofasciatus*	Habitat description is not available at this time	Resident	__	__
No accepted common name	*Ceophengus pallidus*	Habitat description is not available at this time	Resident	__	__
American badger	*Taxidea taxus*	Habitat description is not available at this time	Resident	__	__
Big free-tailed bat	*Nyctinomops macrotis*	Roosts in crevices and cracks in high canyon walls, but will use buildings as well.	Resident	--	--
Cave myotis bat	*Myotis velifer*	Colonial and cave dwelling, also roosts in rock crevices, old buildings, carports, and under bridges	Resident	--	--
Eastern red bat	*Lasiurus borealis*	Found in a variety of habitats in Texas. Usually associated with wooded areas.	Resident	--	--
Eastern spotted skunk	*Spilogale putorius*	Catholic, open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands	Resident	--	--
Hoary bat	*Lasiurus cinereus*	Known from montane and riparian woodland in Trans-Pecos, forest and woods in east central Texas.	Resident	--	--
Humpback whale	*Megaptera novaeangliae*	Open ocean and coastal waters, sometimes including inshore areas such as bays.	Ocean Resident	LE	E

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Long-tailed weasel	*Mustela frenata*	Brushlands, fence rows, upland woods and bottomland hardwoods, forest edges, and rocky desert scrub	Resident	--	--
Maritime pocket gopher	*Geomys personatus maritimus*	Fossorial in deep sandy soils.	Resident	--	--
Mexican free-tailed bat	*Tadarida brasiliensis*	Found in all habitats, forest to desert.	Resident	--	--
Mountain lion	*Puma concolor*	Rugged mountains and riparian zones	Resident	--	--
Ocelot	*Leopardus pardalis*	Dense chaparral thickets; mesquite-thorn shrub and live oak stands	Resident	LE	E
Plains spotted skunk	*Spilogale putorius interrupta*	Open fields, and prairies	Resident	__	__
Southern yellow bat	*Lasiurus ega*	Associated with trees, such as palm trees	Resident	__	T
Swamp rabbit	*Sylvilagus aquaticus*	Habitat description is not available at this time.	Resident	--	--
Tricolored bat	*Perimyotis subflavus*	Forest, woodland, and riparian areas are important. Caves are very important	Resident	--	--
Western hog-nosed skunk	*Conepatus leuconotus*	Woodlands, grasslands, and deserts to 7,200 feet.	Resident	--	--
White-nosed coati	*Nasua narica*	Woodlands, riparian corridors and canyons	Transient	__	T
Golden Orb	*Quadrula aurea*	Sand/ gravel areas in river basins	Resident	C	T
No accepted common name	*Praticolella candida*	Habitat description is not available at this time	Resident	--	--
American alligator	*Alligator mississippiensis*	Coastal marshes, inland natural rivers and marshes, manmade impoundments	Resident	--	--
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	Gulf and bay system, warm shallow waters especially in rocky marine environments	Aquatic Resident	LE	E
Common garter snake	*Thamnophis sirtalis*	Irrigation canals and riparian-corridor farmlands in west. Marshy, flooded pastureland, grassy or brushy borders of permanent bodies of water, coastal salt marshes.	Resident	--	--
Eastern box turtle	*Terrapene carolina*	Forests, fields, forest-brush and forest-field ecotones.	Resident	--	--
Green sea turtle	*Chelonia mydas*	Gulf and bay systems; shallow water seagrass beds	Aquatic Resident	LT	T
Keeled earless lizard	*Holbrookia propinqua*	Coastal dunes, barrier islands, and other sandy areas; eats insects and likely other small invertebrates	Resident	__	__
Loggerhead sea turtle	*Caretta caretta*	Gulf and bay systems for juveniles, adults prefer open waters	Aquatic Resident	LT	T

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Massasauga	*Sistrurus tergeminus*	Quite common in gently rolling prairie occasionally broken by creek valley or rocky hillside.	Resident	--	--
Northern scarlet snake	*Cemophora coccinea coperi*	Along Gulf Coast, known from mixed hardwood scrub on sandy soils.	Resident	--	T
Slender glass lizard	*Ophisaurus attenuatus*	Open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds.	Resident	--	--
Southern spot-tailed earless lizard	*Holbrookia lacerata subcaudalis*	Habitat description is not available at this time.	Resident	--	--
Spot-tailed earless lizard	*Holbrookia lacerate*	Open prairie-brushland	Resident	__	__
Texas diamondback terrapin	*Malaclemys terrapin littoralis*	Coastal marshes and tidal flats	Resident	__	__
Texas horned lizard	*Phrynosoma cornutum*	Varied; sparsely vegetated uplands, grass, cactus, brush	Resident	__	T
Texas Indigo snake	*Drymarchon melanurus erebennus*	Thornbrush-chapparal woodland of south Texas, in particular dense riparian corridors. Can do well in suburban and irrigated croplands.	Resident	--	T
Texas scarlet snake	*Cemophora coccinea lineri*	Mixed hardwood scrub on sandy soils	Resident	__	T
Texas tortoise	*Gopherus berlandieri*	Open bush with grass understory; open grass and bare ground avoided	Resident	__	T
Timber/Canebrake rattlesnake	*Crotalus horridus*	Floodplains, riparian zones with dense ground cover	Resident	__	T
Western box turtle	*Terrapene ornate*	Prairie grassland, pasture, fields, sandhills, and open woodland.	Resident	--	--
Arrowleaf milkvine	*Matelea sagittifolia*	Most consistently encountered in thronscrub in south Texas.	Resident	--	--
Billie's bitterweed	*Tetraneuris turneri*	Grasslands on shallow sandy soils and caliche outcrops.	Resident	--	--
Coastal gay-feather	*Liatris bracteata*	Endemic to black clay soils of prairie	Resident	__	__
Crestless onion	*Allium canadense var. ecristatum*	Occurs on poorly drained sites on sandy substrates within coastal prairies of the Coastal Bend area (Carr 2015)	Resident	--	--
Croft's bluet	*Houstonia croftiae*	Occurs in sparsely vegetated areas in grasslands or among shrubs (Carr 2015)	Resident	--	--
Drummond's rushpea	*Caesalpinia drummondii*	Open areas on sandy clay.	Resident	--	--
Elmendorf's onion	*Allium elmendorfii*	Endemic to grassland openings in woodlands	Resident	__	__
Greenman's bluet	*Houstonia parviflora*	Habitat description is not available at this time.	Resident	--	--

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Indianola beakrush	*Rhynchospora indianolensis*	Locally abundant in cattle pastures in some areas (at least during wet years).	Resident	--	--
Jone's rainlilly	*Cooperia jonesii*	Habitat description is not available at this time.	Resident	--	--
Large selenia	*Selenia grandis*	Occurs in seasonally wet clayey soils in open areas.	Resident	--	--
Lila de los Llanos	*Echeandia chandleri*	Shrubs or in grassy openings in subtropical thorn shrublands along Gulf Coast	Resident	__	__
Low spurge	*Euphorbia peplidion*	Occurs in a variety of vernally-moist situations in a number of natural regions.	Resident	--	--
Net-leaf bundleflower	*Desmanthus reticulatus*	Mostly on clay prairies of the coastal plain of central and south Texas.	Resident	--	--
Plains gumweed	*Grindelia oolepis*	Coastal prairies on heavy clay soils	Resident	__	__
Refugio rainlily	*Zephyranthes refugiensis*	Occurs on deep heavy black clay soils or sandy loams in swales or drainages on herbacrous grasslands or shrublands on level to rolling landscapes underlain by the Lissie Formation.	Resident	--	--
Sand Brazos mint	*Brazoria arenaria*	Sandy areas in South Texas.	Resident	--	--
Seaside beebalm	*Monarda maritima*	Occurs in grasslands and pastures on sandy soil near the coast.	Resident	--	--
South Texas false cudweed	*Pseudognaphalium austrotexanum*	Habitat description is not available at this time.	Resident	--	--
South Texas spikesedge	*Eleocharis austrotexana*	Occurring in miscellaneous wetlands at scattered locations on the coastal plain.	Resident	--	--
South Texas yellow clammyweed	*Polanisia erosa ssp. Breviglandulosa*	Habitat description is not available at this time.	Resident	--	--
Texsa peachbush	*Prunus texana*	Occurs at scattered sites in various well drained sandy situations.	Resident	--	--
Texas stonecrop	*Lenophyllum texanum*	Found in shrublands on clay dunes (lomas) at the mouth of the Rio Grande and on calcareous rock outcrops at scattered inland sites.	Resident	--	--
Texas wilkommia	*Wilkommia texana var. texana*	Mostly in sparsely vegetated patches within taller prairies on alkaline or saline soils on the Coastal Plain (Carr 2015)	Resident	--	--
Texas windmill-grass	*Chloris texensis*	Texas endemic; sandy to sandy loam soils in bare areas in coastal prairie grassland remnants	Resident	__	__
Tharp's dropseed	*Sporobolus tharpii*	Occurs on barrier islands, shores of lagoons and bays protected by the barrier islands, and on shores of a few near-coastal ponds.	Resident	--	--

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Three-flower broomweed	*Thurovia triflora*	Endemic, remnant grasslands and tidal flats	Resident	—	—
Tree dodder	*Cuscuta exaltata*	Parasitic on various *Quercus*, *Juglans*, *Rhus*, *Vitis*, *Ulmus*, and *Diospyros* species as well as *Acacia berlandieri* and other woody plants.	Resident	--	--
Velvet spurge	*Euphorbia innocua*	Open or brushy areas on coastal sands and the south Texas Sand Sheet.	Resident	--	--
Welder machaeranthera	*Psilactia heterocarpa*	Grasslands, varying from midgrass coastal prairies, and open mesquite-huisache woodlands.	Resident	--	--
Wright's trichocoronis	*Trichocoronis wrightii var. wrightii*	Most records from Texas are historical.	Historic Resident	--	--

Source: TPWD, Annotated County List of Rare Species, San Patricio County, July 17, 2019.

PT Proposed Threatened
LT Federally listed threatened
E State Endangered
LE Federally listed endangered
-- Not Listed (Species of Concern)
T State Threatened

Inclusion in Table 5D.8.28 does not imply that a species will occur within the project area, but only acknowledges the potential for occurrence in the project area county. A more intensive field reconnaissance is necessary to confirm and identify specific species habitat that may be present in the project area.

The proposed project occurs primarily in areas which have been previously developed and used for farming and pasture for a long period of time. Disturbance within these areas due to construction of the pipeline routes and well field is anticipated to have minimal effect on the existing environment. Although suitable habitat for some listed species may exist within the project areas, no impact is anticipated due to the abundance of similar habitat near the project area and the ability of most species to relocate to those areas if necessary. The presence or absence of potential habitat within an area does not confirm the presence or absence of a listed species. No species specific surveys were conducted in the project area for this report.

Wetland Areas

Potential wetland impacts could occur along the pipeline and well field areas located near rivers, streams, or marshy areas. The wells, collection system within the well field, and transmission systems should be sited in such a way as to avoid or minimize impacts to these sensitive resources. Potential impacts can be minimized by right-of-way selection and appropriate construction methods, including erosion controls and revegetation procedures. Compensation for net losses of wetland would be required where impacts are unavoidable and a permit from the U.S. Army Corps of Engineers would be required for impacts to waters of the U.S.

Cultural Resources

Impacts to National Register-listed properties or districts, state historic sites, cemeteries or other cultural resources that are mapped by the Texas Historical Commission should be easily avoided through planning associated with the development of the well fields and pipeline routes.

A cultural resource survey of the well field and pipeline routes for each of the proposed project areas will need to be performed consistent with requirements of the Texas Antiquities Code.

Summary of Overall Possible Environmental Impacts

Because of the relatively small areas involved, construction and maintenance of surface facilities are not expected to result in substantial environmental impacts. Where environmental resources (e.g., endangered species habitat and cultural resource sites) could be impacted by infrastructure, minor adjustments in facility siting and pipeline alignment would generally be sufficient to avoid or minimize adverse effects.

The pumping of groundwater from the Evangeline Aquifer could cause a slight reduction on baseflow in downstream reaches. However, no measurable impact on wildlife along the streams is anticipated from this project. Minor land surface subsidence could potentially occur as a result of lowering of groundwater levels. As a result, drainage patterns and other habitats might change to a small extent.

5D.8.2.4 Engineering and Costing

Based on data collected and provided by Evangeline/Laguna LP, the key features identified and evaluated for planning and costing purposes for 2021 Region N Plan water management strategy are as follows:

- Wells: The well field consists of 13 wells (production constrained by MAG). At full project production, the wellfield consists of 18 wells including contingency. Well depth = 1,000 ft Pumping rate = 1,200 gallons per minute (gpm) each. Wells are phased based on MAG limitations, with full well field build-out after Year 2050 as described above.
- Raw groundwater quality of 800 mg/L TDS is expected, and wells would be screened and operated in such a manner to target groundwater with lower levels of TDS and chlorides.
- A purchase cost of raw water of $480.60 per ac-ft.
- Facilities are sized to deliver full project amount: 28,486 acft/yr (25 MGD). Yield is limited based on MAG.
- Raw water delivery options:
    - Option 1 - Evangeline/Laguna LP Raw Groundwater Strategy- Region N Plan With MAG Limits (Delivery Option 1, Figure 5D.8.1)
    - Option 2 - Evangeline/Laguna LP Raw Groundwater Strategy - Region N Plan With MAG Limits (Delivery Option 2, Figure 5D.8.1)
    - Option 3 - Evangeline/Laguna LP Raw Groundwater Strategy - Region N Plan With MAG Limits (Delivery Option 3, Figure 5D.8.1)

Overall, the project cost ranges from $74,596,000 to $115,585,000 depending on delivery option. Annual costs range from $18,492,000 to $22,210,000. At a yield of 24,873 ac-ft/yr, the unit cost of water ranges from $743 to $893 per ac-ft. Cost tables are presented in Table 5D.8.29 through Table 5D.8.32. A cost estimate summarizing updated unit cost with full utilization of Delivery Option 1 after 2050 when sufficient MAG is available is shown in Table 5D.8.30.

Table 5D.8.29.
Cost Estimate Summary Water Supply Project Option,
September 2018 Prices,
Evangeline/Laguna LP Raw Groundwater Strategy- Region N Plan with MAG Limits
(Delivery Option 1)

Item	Estimated Costs for Facilities
Primary Pump Station	$14,127,000
Transmission Pipeline (36 in dia., 20.5 miles)	$28,911,000
Well Fields (18 Wells, *only 12 Operating*, Pumps, and Piping)	$35,051,000
Storage Tanks (Other Than at Booster Pump Stations)	$1,956,000
Water Treatment Plant (0 MGD)	$0
Total Cost of Facilities	**$80,045,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$26,570,000
Environmental & Archaeology Studies and Mitigation	$1,002,000
Land Acquisition and Surveying (~80 acres)	$532,000
Interest During Construction (3% for 2.5 years with a 0.5% ROI)	$7,436,000
Total Cost of Project	**$115,585,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$8,133,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$659,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$353,000
Pumping Energy Costs (13890348 kW-hr @ 0.08 $/kW-hr)	$1,111,000
Purchase of Water (24873 acft/yr @ 480.6 $/acft)	$11,954,000
Total Annual Cost	**$22,210,000**
Available Project Yield (acft/yr)	24,873
Annual Cost of Water ($ per acft)	$893
Annual Cost of Water After Debt Service ($ per acft)	$566
Annual Cost of Water ($ per 1,000 gallons)	$2.74
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$1.74

Note: One or more cost element has been calculated externally

Table 5D.8.30.
Cost Estimate Summary Water Supply Project Option,
September 2018 Prices,
Evangeline/Laguna LP Raw Groundwater Strategy-
Up to Permitted Amount after 2050 when MAG is Available (Delivery Option 1)

Item	Estimated Costs for Facilities
Primary Pump Station	$14,127,000
Transmission Pipeline (36 in dia., 20.5 miles)	$28,911,000
Well Fields (18 Wells, Pumps, and Piping)	$35,051,000
Storage Tanks (Other Than at Booster Pump Stations)	$1,956,000
Water Treatment Plant (0 MGD)	$0
Total Cost of Facilities	**$80,045,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$26,570,000
Environmental & Archaeology Studies and Mitigation	$1,002,000
Land Acquisition and Surveying (~80 acres)	$532,000
Interest During Construction (3% for 2.5 years with a 0.5% ROI)	$7,436,000
Total Cost of Project	**$115,585,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$8,133,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$659,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$353,000
Water Treatment Plant	$0
Pumping Energy Costs (20142359 kW-hr @ 0.08 $/kW-hr)	$1,611,000
Purchase of Water (28485 acft/yr @ 480.6 $/acft)	$13,690,000
Total Annual Cost	**$24,446,000**
Available Project Yield (acft/yr)	28,486
Annual Cost of Water ($ per acft)	$858
Annual Cost of Water After Debt Service ($ per acft)	$573
Annual Cost of Water ($ per 1,000 gallons)	$2.63
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$1.76

Note: One or more cost element has been calculated externally

Table 5D.8.31.
Cost Estimate Summary Water Supply Project Option,
September 2018 Prices,
Evangeline/Laguna LP Raw Groundwater Strategy - Region N Plan With MAG Limits (Option 2)

Item	Estimated Costs for Facilities
Primary Pump Station	$5,769,000
Transmission Pipeline (36 in dia., 5 miles)	$8,542,000
Well Fields (18 Wells *only 12 Operating*, Pumps, and Piping)	$35,051,000
Storage Tanks (Other Than at Booster Pump Stations)	$1,956,000
Water Treatment Plant (0 MGD)	$0
Total Cost of Facilities	**$51,318,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$17,534,000
Environmental & Archaeology Studies and Mitigation	$622,000
Land Acquisition and Surveying (19 acres)	$323,000
Interest During Construction (3% for 2.5 years with a 0.5% ROI)	$4,799,000
Total Cost of Project	**$74,596,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$5,249,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$455,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$144,000
Pumping Energy Costs (8621955 kW-hr @ 0.08 $/kW-hr)	$690,000
Purchase of Water (24873 acft/yr @ 480.6 $/acft)	$11,954,000
Total Annual Cost	**$18,492,000**
Available Project Yield (acft/yr)	24,873
Annual Cost of Water ($ per acft)	$743
Annual Cost of Water After Debt Service ($ per acft)	$532
Annual Cost of Water ($ per 1,000 gallons)	$2.28
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$1.63

Note: One or more cost element has been calculated externally

Table 5D.8.32.
Cost Estimate Summary Water Supply Project Option,
September 2018 Prices,
Evangeline/Laguna LP Raw Groundwater Strategy - Region N Plan With MAG Limits (Option 3)

Item	Estimated Costs for Facilities
Primary Pump Station	$7,672,000
Transmission Pipeline (36 in dia., 5.6 miles)	$9,053,000
Well Fields (18 Wells *only 12 Operating*, Pumps, and Piping)	$35,051,000
Storage Tanks (Other Than at Booster Pump Stations)	$1,956,000
Water Treatment Plant (0 MGD)	$0
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$18,353,000
Environmental & Archaeology Studies and Mitigation	$629,000
Land Acquisition and Surveying (20 acres)	$327,000
Interest During Construction (3% for 2.5 years with a 0.5% ROI)	$5,022,000
Annual Cost	
Debt Service (3.5 percent, 20 years)	$5,493,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$461,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$192,000
Pumping Energy Costs (10149031 kW-hr @ 0.08 $/kW-hr)	$812,000
MRP Energy and Power Capacity Compensation	$207,000
Purchase of Water (24873 acft/yr @ 480.6 $/acft)	$11,954,000
Available Project Yield (acft/yr)	24,873
Annual Cost of Water ($ per acft)	$769
Annual Cost of Water After Debt Service ($ per acft)	$548
Annual Cost of Water ($ per 1,000 gallons)	$2.36
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$1.68

Note: One or more cost element has been calculated externally

5D.8.2.5 Implementation Issues

The groundwater supply analyses considered for this water management strategy were based on MAGs adopted by local GCD and GMAs according to TWDB guidance for regional water planning. For future planning efforts, new MAGs provided by GCDs and GMAs located in the Coastal Bend Region need to be considered when determining available groundwater supplies.

Implementation of the Raw Groundwater Supply Project includes the following issues:

- Verification of the Gulf Coast Aquifer water quality for concentrations of the dissolved constituents such as TDS, chloride, sulfate, iron, manganese, radium, uranium, and arsenic;
- Purchase of water or lease of property for well field, and coordination with landowners;
- Impact of water levels in the aquifer, potential intrusion of saline groundwater, land surface subsidence, and streamflow;
- USACE Section 10 and 404 dredge and fill permits for pipelines;
- General Land Office Sand and Gravel Removal permit for pipeline and crossings of streams and roads;
- General Land Office Easement for use of State-owned lands, if any;
- Cultural resources investigations in accordance with the Texas Historical Commission and the Texas Antiquities Code;
- Texas Parks and Wildlife Department Sand, Gravel, and Marl permit; and
- Mitigation requirements would vary depending on impacts, but could include vegetation restoration, wetland creation or enhancement, or additional land acquisition.

5D.8.2.6 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5D.8.33.

Table 5D.8.33.
Evaluation Summary of the Evangeline/Laguna LP Raw Groundwater Project Option

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Yield limited to 24,873 acft/yr through 2050 based on MAG.
2. Reliability	2. High reliability.
3. Cost of treated water	3. Generally moderate cost; between $743 to $893 per ac-ft for three different delivery options.
b. Environmental factors:	
1. Instream flows	1. Moderate impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife habitat	3. None or low impact
4. Wetlands	4. None or low impact
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a-b,d. Total dissolved solids, chloride, and salinity of water is expected to be within TCEQ drinking water standards. c. None or low impact. e-i. Sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to Agricultural Resources or State water resources	• Negligible impacts to agricultural resources. • None or low negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• None or low impacts. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions •
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible impact to wildlife habitat along pipeline route and right-of-way.

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5D.10.5 City of Corpus Christi Seawater Desalination- Inner Harbor and La Quinta Channel Projects

5D.10.5.1 Description of Strategy

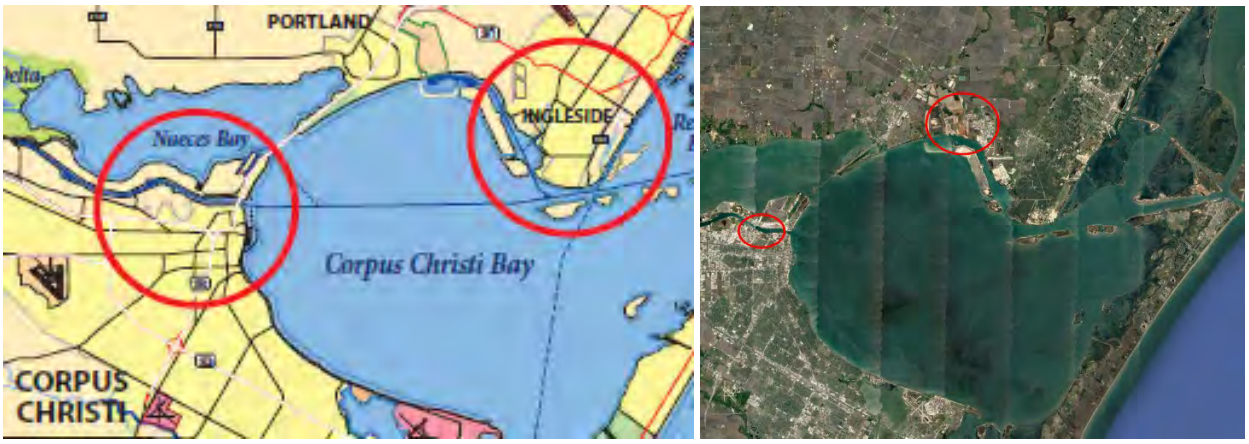
Desalting seawater from the Gulf of Mexico is a potential source of freshwater supplies for municipal and industrial uses. In August 2004, the City of Corpus Christi (City) conducted a feasibility study[11] funded by the TWDB of a large-scale seawater desalination facility in the Region N area. For the 2006 and 2011 Coastal Bend Regional Water Plans, a large-scale 25 to 100 mgd seawater desalination facility co-sited with the Barney M. Davis Power Station in Corpus Christi near Laguna Madre, Oso Bay, and Corpus Christi Bay was considered. Favorable factors for the Barney Davis power station location include: use of cooling plant effluent for diluting concentrate, ability to use the existing seawater intake infrastructure at the power plant, and close proximity to the water distribution system. The desalination concentrate was considered to be piped out to the open Gulf of Mexico to be discharged in waters over 30 feet deep. The 2011 Coastal Bend Plan estimated the cost of a 25 mgd seawater desalination facility at Barney M. Davis Power Station with 5-mile pipeline delivery to proposed distribution center on the south side of town at $1,696 per ac-ft (or $5.21 per 1,000 gallons) based on September 2008 dollars. Blending with brackish groundwater, previously evaluated in the 2006 Plan, was eliminated from further consideration based on the lack of availability of groundwater at suitable quality (summarized in Chapter 11). The seawater desalination facility co-sited with Barney M. Davis Power Station was included as an alternate strategy in the 2011 Coastal Bend Regional Water Plan at the 25 mgd size, which was subsequently updated through amendment in August 2014 to be listed as a recommended strategy in the 2011 Coastal Bend Plan to meet needs beginning in 2020.

The City, as a wholesale water provider, continues to evaluate seawater desalination options, including variable desalination programs and combinations with brackish groundwater resources to address future industrial development and anticipated population growth associated with new industry and Eagle Ford Shale production. In April 2014, the Corpus Christi City Council voted to accept a federal, U.S. Bureau of Reclamation grant and transfer funds from the City's Raw Water Supply Development Fund for a City of Corpus Christi Desalination Program Pilot Study. In July 2014, Corpus Christi City Council considered and subsequently adopted a resolution to the 84th Texas Legislature to appropriate funding for FY 16-17 biennium and partnering with local sponsors to implement desalination projects.

The City conducted a $3 million demonstration program with support from the U.S. Bureau of Reclamation to design, construct, and operate a demonstration desalination plant for industrial and drinking water purposes. The objectives of the program are to evaluate the feasibility of seawater desalination and develop cost estimates, to test emerging technologies, and to identify and assess site options and requirements for a full-scale facility.[12] With the results of the study,

[11] City of Corpus Christi, Draft Report "Large Scale Demonstration Desalination Feasibility Study," August 2004.
[12] City of Corpus Christi website, "Corpus Christi Desalination Demonstration Project", June 2014. http://www.cctexas.com/Assets/Departments/Water/Files/DesalFactSheet.pdf

the City will consider moving forward with a full-scale desalination project. During preliminary studies, the Barney M. Davis Power Station option was removed from further consideration due to a lack of interest by the power station to participate, as well as the location not being favorable with respect to anticipated industrial and municipal growth areas.[13] As of November 2019, two potential sites are being considered by the City of Corpus Christi to provide additional supplies of 10 mgd for Nueces County industries and municipal customers and 20 mgd for San Patricio County: Inner Harbor and La Quinta Channel. These locations are shown in Figure 5D.10.3, with the aerial photograph showing the most current location.



Source: Corpus Christi Desalination Demonstration Project Fact Sheet, June 2014 (http://www.cctexas.com/Assets/Departments/Water/Files/DesalFactSheet.pdf) and City of Corpus Christi, email October 2019

Figure 5D.10.3.
Proposed Location for Seawater Desalination Program

The Inner Harbor Desalination site in Nueces County could scale up from 10 to 30 MGD and La Quinta Channel Desalination site in San Patricio County could scale up from 20 to 40 MGD. The plants will likely expand to ultimate capacity in 30 years or more (2070+), but flexibility will be left for significant demand growth in the region. The treatment efficiency of the desalination plant is estimated to be 45- 50 percent. The finished water quality is targeted to be approximately 500 mg/L. The Inner Harbor Plant will treat all of its product water to potable standards and send it through the City of Corpus Christi distribution system. The La Quinta Channel Plant will treat the product water to potable water standards and deliver it to SPMWD. The SPMWD will deliver this water to industrial customers, but they may adjust water quality to meet the needs of different customers.

[13] City of Corpus Christi staff, February 2015.

5D.10.5.2 Available Yield- Inner Harbor

Seawater from the Gulf of Mexico is assumed to be available in an unlimited quantity within the context of a supply for the Coastal Bend Region. Also, it is assumed that the cost of Gulf water is zero prior to extraction from the source. The City of Corpus Christi and port industries are currently considering finished desalination supplies of 10 mgd (11,201 ac-ft/yr) to 30 MGD (33,604 ac-ft/yr) at the Inner Harbor facility.

5D.10.5.3 Engineering and Costing- Inner Harbor

Based on information provided by City staff and its consultant, the following costs were identified for the Inner Harbor seawater desalination project as shown in Table 5D.10.3 and Table 5D.10.4:

- Total estimated construction costs for a 10 mgd Inner Harbor facility $237 million.
- Total estimated construction costs for a 30 mgd Inner Harbor facility $563 million.
- Lifecycle water production costs, at the fence, are estimate to be $9.87 per 1,000 gallons with debt service for a plant located at the 10 MGD Inner Harbor facility.
- Lifecycle water production costs, at the fence, are estimate to be $7.84 per 1,000 gallons with debt service for a plant located at the 30 MGD Inner Harbor facility.

Details regarding intake, desalination process, concentrate disposal outfall, and site-specific environmental impacts for transmission and delivery is unavailable at this time. A 3,500 ft raw water pipeline, 2,300 ft concentrate discharge pipeline, and 500 ft product water delivery line are included in the cost estimate, based on information provided by Freese and Nichols.

Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. Using the Unified Costing Model tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance is expected to result in an annual cost around $36,042,000 to $85,875,000 for the 10 MGD and 30 MGD plants. This results in a unit cost of water of $3,218 to $2,555 per ac-ft after debt service for Inner Harbor sites with plant size ranging from 10-30 MGD. Private industry partnerships and funding structures may be considered to help reduce costs and minimize treatment plant operation and maintenance risks assumed by City operators, which may account for costing differences as compared to information shown in Table 5D.10.3 and Table 5D.10.4. The information was developed based on capital costs, project costs, and annual water productions costs provided by Freese and Nichols, updated using the UCM and is relevant for desalination distribution near the facility. Delivery costs to specific industries or municipal distribution system are not included.

Table 5D.10.3.
Cost Estimate Summary,
City of Corpus Christi- Inner Harbor 10 mgd Desalination Project (Sept 2018 Prices)

Item	Estimated Costs for Facilities
Transmission Pipeline (raw water piping)	$25,000,000
Storage Tanks (and Delivery)	$11,000,000
Water Treatment Plant (10 MGD)	$126,855,000
Total Cost of Facilities	**$162,855,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$55,749,000
Land Acquisition and Surveying (12 acres)	$50,000
Interest During Construction (3% for 3 years with a 0.5% ROI)	$18,039,000
Total Cost of Project	**$236,693,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$16,654,000
Water Treatment Plant	$19,028,000
Total Annual Cost	**$36,042,000**
Available Project Yield (acft/yr)	11,201
Annual Cost of Water ($ per acft)	$3,218
Annual Cost of Water After Debt Service ($ per acft)	$1,731
Annual Cost of Water ($ per 1,000 gallons)	$9.87
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$5.31

Note: Costs based on information provided by the City of Corpus Christi. The water treatment plant annual costs from the TWDB uniform costing model includes energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

Table 5D.10.4.
Cost Estimate Summary,
City of Corpus Christi- Inner Harbor 30 mgd Desalination Project (Sept 2018 Prices)

Item	Estimated Costs for Facilities
Transmission Pipeline (raw water piping; brine concentrate disposal x 3)	$51,000,000
Storage Tanks (and Delivery) x 3	$33,000,000
Water Treatment Plant (30 MGD)	$302,911,000
Total Cost of Facilities	**$386,911,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$132,869,000
Land Acquisition and Surveying (26 acres)	$108,000
Interest During Construction (3% for 3 years with a 0.5% ROI)	$42,891,000
Total Cost of Project	**$562,779,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$39,598,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$840,000
Water Treatment Plant	$45,437,000
Total Annual Cost	**$85,875,000**
Available Project Yield (acft/yr)	33,604
Annual Cost of Water ($ per acft)	$2,555
Annual Cost of Water After Debt Service ($ per acft)	$1,377
Annual Cost of Water ($ per 1,000 gallons)	$7.84
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$4.23

Note: Costs based on information provided by the City of Corpus Christi. The water treatment plant annual costs from the TWDB uniform costing model includes energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

5D.10.5.4 Available Yield- La Quinta

Seawater from the Gulf of Mexico is assumed to be available in an unlimited quantity within the context of a supply for the Coastal Bend Region. Also, it is assumed that the cost of Gulf water is zero prior to extraction from the source. The City of Corpus Christi and port industries are currently considering finished desalination supplies of 20 mgd (22,403 ac-ft/yr) to 40 mgd (44,806 ac-ft/yr).

5D.10.5.5 Engineering and Costing- La Quinta

Based on information provided by City staff and its consultant, the following costs were identified for the La Quinta Channel seawater desalination project as shown in Table 5D.10.5 and Table 5D.10.6:

- Total estimated construction costs for a 20 mgd La Quinta facility $420 million.
- Total estimated construction costs for a 40 mgd La Quinta facility $768 million.
- Lifecycle water production costs, at the fence, are estimate to be $8.59 per 1,000 gallons with debt service at the 20 MGD La Quinta facility.
- Lifecycle water production costs, at the fence, are estimate to be $7.81 per 1,000 gallons with debt service for a plant located at the 40 MGD La Quinta facility.

Details regarding intake, desalination process, concentrate disposal outfall, and site-specific environmental impacts for transmission and delivery is unavailable at this time. A 11,800 ft raw water pipeline, 14,500 ft concentrate discharge pipeline, and 2,000 ft product water delivery line are included in the cost estimate, based on information provided by Freese and Nichols.

Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. Using the Unified Costing Model tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance is expected to result in an annual cost around $62,720,000 to $114,102,000. This results in a unit cost of water of $2,800 to $2,547 per ac-ft after debt service for La Quinta sites with plant size ranging from 20-40 MGD. Private industry partnerships and funding structures may be considered to help reduce costs and minimize treatment plant operation and maintenance risks assumed by City operators, which may account for costing differences as compared to information shown in Table 5D.10.5 and Table 5D.10.6. The information presented in the tables was developed based on capital costs, project costs, and annual water productions costs provided by Freese and Nichols, updated using the UCM and is relevant for desalination distribution near the facility. Delivery costs to specific industries or municipal distribution system are not included.

Table 5D.10.5.
Cost Estimate Summary,
City of Corpus Christi- La Quinta 20 mgd Desalination Project (Sept 2018 Prices)

Item	Estimated Costs for Facilities
Transmission Pipeline	$78,000,000
Storage Tanks (Other Than at Booster Pump Stations)	$13,000,000
Water Treatment Plant (20 MGD)	$214,883,000
Total Cost of Facilities	**$305,883,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$103,159,000
Land Acquisition and Surveying (19 acres)	$79,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$11,251,000
Total Cost of Project	**$420,372,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$29,578,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$910,000
Water Treatment Plant	$32,232,000
Total Annual Cost	**$62,720,000**
Available Project Yield (acft/yr)	22,402
Annual Cost of Water ($ per acft),	$2,800
Annual Cost of Water After Debt Service ($ per acft),	$1,479
Annual Cost of Water ($ per 1,000 gallons),	$8.59
Annual Cost of Water After Debt Service ($ per 1,000 gallons),	$4.54

Note: Costs based on information provided by the City of Corpus Christi. The water treatment plant annual costs from the TWDB uniform costing model includes energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

Table 5D.10.6.
Cost Estimate Summary,
City of Corpus Christi- La Quinta 40 mgd Desalination Project (Sept 2018 Prices)

Item	Estimated Costs for Facilities
Transmission Pipeline (raw water piping/intake; brine concentrate disposal x 2)	$113,000,000
Storage Tanks (and Delivery) x 2	$26,000,000
Water Treatment Plant (40 MGD)	$390,940,000
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$179,829,000
Land Acquisition and Surveying (33 acres)	$138,000
Interest During Construction (3% for 3 years with a 0.5% ROI)	$58,568,000
Annual Cost	
Debt Service (3.5 percent, 20 years)	$54,071,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,390,000
Water Treatment Plant	$58,641,000
Available Project Yield (acft/yr)	44,804
Annual Cost of Water ($ per acft)	$2,547
Annual Cost of Water After Debt Service ($ per acft)	$1,340
Annual Cost of Water ($ per 1,000 gallons)	$7.81
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$4.11

Note: Costs based on information provided by the City of Corpus Christi. The water treatment plant annual costs from the TWDB uniform costing model includes energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

5D.10.5.6 Environmental Issues

The two project areas being considered by the City of Corpus Christi for the proposed desalination plant are the Inner Harbor and La Quinta sites. The La Quinta option is located on Corpus Christi Bay, east of the inlet to Nueces Bay; the Inner Ship Channel option is located along the Main Turning Basin, near the outlet to Corpus Christi Bay. The specific siting information is still to be determined, but each proposed desalination plant site would be approximately 10 acres in size. Key factors considered in the selection of these two locations are the availability of power, proximity to the water transmission system, the character of the source water, location of a suitable concentrate discharge location, among other environmental considerations.[14]

Specific siting information for the discharge of desalination concentrate will be determined during project design. Since the desalination concentrate will be saltier than the receiving waters, the

[14] City of Corpus Christi Desalination Project Frequently Asked Questions (https://www.cctexas.com/sites/default/files/water-desal-faq-022819.pdf)

City of Corpus Christi has stated that a diffusing system would be desirable to remix the concentrate with the source water. Additional chemicals, which may be used during the filtering/treating process, may be present in the concentrate. The outfall for brine concentrate will need to consider impacts to the estuary and bay system. Prior to construction, site specific environmental studies will need to be conducted to evaluate all potential impacts to the environment, and identify best management practices to eliminate or reduce adverse impacts. [15] The City plans to submit water rights and discharge permit applications to TCEQ in 2020.

Inner Harbor Desalination Site

The Texas Parks and Wildlife Department maintains the Texas Natural Diversity Database (TXNDD) which documents the occurrence of endangered, threatened and rare species, natural communities, and animal aggregations. The TXNDD data was reviewed for recorded occurrences of listed or rare species or natural communities, near the proposed project. The plains spotted skunk (*Spilogale putorius interrupta*), a rare species has been documented at the project site. The West Indian manatee (*Trichechus manatus*), a federally-listed threatened species, and a marine mammal with protections under the Marine Mammal Protection Act has been documented within two miles of the proposed project site. Three rare species, the Texas diamondback terrapin (*Malaclemys terrapin littoralis*), Texas stonecrop (*Lenophyllum texanum*), and Texas windmill grass (*Chloris texensis*) have also been documented within two miles of the proposed project. The TXNDD data identified a colonial wading bird colony (rookery) on the northeast side of the causeway (US 181) across Nueces Bay.

National Wetland Inventory (NWI) maps were reviewed and the proposed Inner Harbor Desalination site may be in close proximity to estuarine and marine deepwater habitat, freshwater ponds, and freshwater emergent wetlands. A jurisdictional determination of waters should be completed for the proposed project site, during project planning. Coordination with the U.S. Army Corps of Engineers would be required for impacts to waters of the U.S.

The proposed desalination plant would be located on the Inner Harbor. The Corpus Christi Inner Harbor (TCEQ Segment 2484) is listed as impaired on TCEQ's 2020 Draft 303(d) List[16] for copper in the water. Within approximately 5 miles, several Corpus Christi Bay Recreational Beaches (TCEQ Segments 2481CB_03, _04 and _06) are listed as impaired for bacteria in water. Additionally, the inlet to Nueces Bay (Oyster Water) (TCEQ Segment 2482OW) is likely within 5 miles of the proposed desalination plant and is listed as impaired for copper in water.

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (Pl96-515), and the Archeological and Historic Preservation Act (PL93-291). Based on the review of publicly available Geographic Information System (GIS) records obtained from the Texas Historical Commission, there are no State Historic Sites, National

[15] City of Corpus Christi Desalination Project Frequently Asked Questions (https://www.cctexas.com/sites/default/files/water-desal-faq-022819.pdf)
[16] TCEQ, 2020. Draft 2020 Texas Integrated Repot – Texas 303(d) List (Category 5). Accessed online https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/20txir/2020_303d.pdf January 13, 2020.

Register Properties or Districts, cemeteries or Historical Markers within the project area. Two cemeteries, New Bayview and Old Bayview, as well as five sites listed on the National Register of Historic Places, the Nueces County Courthouse, Simon Gugenheim House, Charlotte Sidbury House, S. Julius Lichtenstein House, and the U.S.S. Lexington were located within approximately one mile from the project area. A review of archaeological resources in the proposed project area should be conducted during the project planning phase. Because the owner or controller of the proposed project, the City of Corpus Christi, is a political subdivision of the State of Texas they will be required to coordinate with the Texas Historical Commission prior to project construction.

La Quinta Desalination Site

The TXNDD data was reviewed for documented occurrences of listed or rare species or natural communities near the project area. The federally-listed endangered jaguarundi (*Felis yagouaroundi cacomitli*), as well as several rare species or SGCN, the keeled earless lizard (*Holbrookia propinqua*), coastal gay-feather (*Liatris bracteata*), threeflower broomweed (*Thurovia triflora*), Indianola beakrush (*Rynchospora indianolensis*), and Wright's trichocoronis (*Trichocoronis wrightii var wrightii*) have been documented within two miles of the proposed La Quinta site. Additionally, a rookery was documented on the spoil banks in Corpus Christi Bay, located southeast of the project area.

National Wetland Inventory (NWI) maps were reviewed and the proposed La Quinta Desalination site may be in close proximity to estuarine and marine deepwater habitat, estuarine and marine wetlands, freshwater ponds, and lakes. A jurisdictional determination of waters should be completed for the proposed project site, during project planning. Coordination with the U.S. Army Corps of Engineers would be required for impacts to waters of the U.S.

The proposed desalination plant would be located on the Corpus Christi Bay (TCEQ Segment 2481OW).[17] This Segment is not listed as impaired on the 2020 Draft 303(d) List. No impaired water quality segments are likely located within 5 miles of the proposed project site.

Based on the review of publicly available GIS records obtained from the Texas Historical Commission, there are no State Historic Sites, National Register Properties or Districts, cemeteries or Historical Markers within the project area, or within one mile of the proposed project area. A review of archaeological resources in the proposed project area should be conducted during the project planning phase. Because the owner or controller of the proposed project, the City of Corpus Christi, is a political subdivision of the State of Texas (i.e., river authority, municipality, county, etc.), they will be required to coordinate with the Texas Historical Commission prior to project construction.

5D.10.5.7 Implementation Issues

The installation and operation of a seawater desalination water treatment plant may have to address the following issues.

[17] TCEQ, 2020. Surface Water Quality Viewer. Accessed online tceq.maps.arcgis.com January 13, 2020.

- Disposal of concentrated brine from desalination water treatment plant;
- Permitting and constructing concentrate pipeline through seagrass beds and barrier island, including conforming with applicable laws and regulations including:
    - USACE permitting (including Section 404 Clean Waters Act and Section 10 Rivers & Harbors Act)
    - Endangered Species Act compliance and TPWD coordination, if required
    - Compliance with the Antiquities Code of Texas, the National Historic Preservation Act, and the Archeological and Historic Preservation.
    - TCEQ Water Right, TPDES, stormwater, and associated construction permits
    - Associated TCEQ registrations
    - Local land use and construction permits
    - GLO permitting requirements
- Impact on the bays from removing water for consumptive use and altering existing power plant water rights permits;
- Confirming that blending desalted seawater with other water sources in the municipal demand distribution system can be successfully accomplished;
- High power requirements for desalination process dependent on large, reliable power source;
- Skilled operators of desalination water treatment plants;
- Permitting of a pipeline across rivers, highways, and private rural and urban property; and
- Possibility of using design, build, operate contract for a desalination water treatment plant.

5D.10.5.8 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5D.10.7.

Table 5D.10.7.
Evaluation Summary of the City of Corpus Christi's Inner Harbor and La Quinta Seawater Desalination Projects

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Project size: Inner Harbor: 11,201 ac-ft/yr) to 33,604 ac-ft/yr and La Quinta: 22,402 ac-ft/yr) to 44,804 ac-ft/yr
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Cost for Inner Harbor: $2,555 to $3,218 and La Quinta $2,547 to $2,800 perac-ft.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some environmental impact to estuary.
3. Wildlife habitat	3. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5. Threatened and endangered species	5. None identified. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrate disposal issues will need to be evaluated. 7c-i. Bacteria, chlorides, nitrate, alkalinity, ammonia, and copper were all identified as constituents of concern for the Nueces Bay in the TCEQ and NRA Basin Highlights Report. Additional studies regarding impacts on or as a result of project are needed.
c. Impacts to agricultural resources and State water resources	• None or low impacts on other water resources • Negligible impacts to agricultural resources
d. Threats to agriculture and natural resources in region	• Some. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Seawater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None
k. Impacts to water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor (in future). Possible impact to wildlife habitat along pipeline route and right-of-way.