Caney Creek Watershed: A Community Project to Protect Recreational Uses

Two Total Maximum Daily Loads for Indicator Bacteria in the Caney Creek Watershed[1]

Adopted August 11, 2021.

Approved by EPA February 2, 2022.

One TMDL for Indicator Bacteria in Caney Creek Tidal Added by Addendum I, January 2024

Via the January 2024 Update to the Texas Water Quality Management Plan (SFR-121/2024-02).

Approved by EPA April 17, 2024.

[1] https://www.tceq.texas.gov/downloads/water-quality/tmdl/caney-creek-linnville-bayou-recreational-115/115-caneycreek-bacteria-adopted-2021august.pdf

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Appendix II. Addendum One to Two TMDLs for Indicator Bacteria in the Caney Creek Watershed

Adding one TMDL for 1304_02

One TMDL for Indicator Bacteria in Caney Creek Tidal

Introduction

TCEQ adopted *Two TMDLs for Indicator Bacteria in the Caney Creek Watershed* (TCEQ, 2021) on Aug. 11, 2021. The United States Environmental Protection Agency (EPA) approved the TMDLs on Feb. 2, 2022. This document is the first addendum to the original TMDL report.

This first addendum includes information specific to one additional assessment unit (AU) for Caney Creek Tidal (AU 1304_02). This AU is located within the watershed of the approved original TMDLs for Caney Creek Tidal and Linnville Bayou. The concentration of indicator bacteria in this additional AU exceeds the criterion used to evaluate support of the primary contact recreation 1 use.

This addendum details the development of the added TMDL allocation for this additional AU, which was not specifically addressed in the original TMDL report. For background or other explanatory information, please refer to the *Technical Support Document for One TMDL for Indicator Bacteria in Caney Creek Tidal*[2] (Johnston, 2022). Refer to the original, approved TMDL document for details about the overall project watershed as well as methods and assumptions used in developing the original TMDLs.

Problem Definition

TCEQ first identified the bacteria impairment for Caney Creek Tidal in the *2020 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (Texas Integrated Report; TCEQ, 2020). The impairment was identified again in the subsequent 2022 Texas Integrated Report (TCEQ, 2022a), the latest EPA-approved edition. The water body includes two AUs, 1304_01 and 1304_02. The impaired AU is 1304_02. The downstream AU (1304_01) was addressed in the original TMDL report. Figure II-1 shows the watershed added in this addendum in relation to the entire

[2] www.tceq.texas.gov/downloads/water-quality/tmdl/caney-creek-linnville-bayou-recreational-115/as-486-115b-caney_creek_addendum-tsd.pdf

watershed of the original TMDLs, which is located within the Brazos-Colorado Coastal Basin.

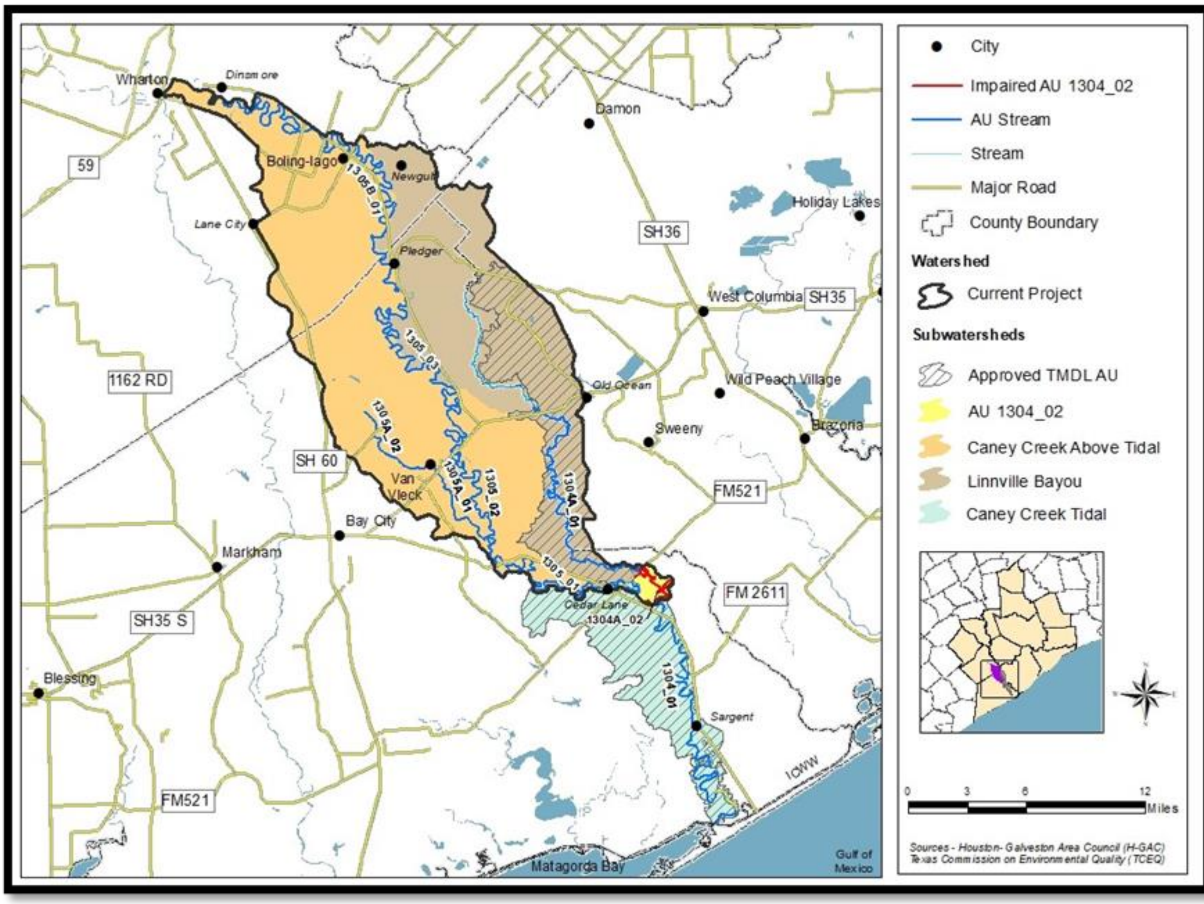

Figure II-1. Map showing the previously approved TMDL watersheds and the Caney Creek Tidal 1304_02 watershed added by this addendum

The Texas Surface Water Quality Standards (TCEQ, 2022b) identify uses for surface waters and numeric and narrative criteria to evaluate attainment of those uses. The basis for the water quality target for the TMDL developed in this addendum is the numeric criterion for indicator bacteria from the 2022 Texas Surface Water Quality Standards. Enterococci are used in the state of Texas as the fecal indicator bacteria for assessing primary contact recreation 1 use in saltwater.

Table II-1 summarizes the ambient water quality data for the TCEQ surface water quality monitoring (SWQM) station on the water body, as reported in the 2022 Texas Integrated Report (TCEQ, 2022a). The data from the assessment indicate nonsupport of the primary contact recreation 1 use for the AU, because the geometric mean concentration for Enterococci exceeds the saltwater geometric mean criterion of 35 colony forming units per 100 milliliters (cfu/100 mL) of water. Figure II-2 shows the location of the TCEQ SWQM station that was used in evaluating water quality in the 2022 Texas Integrated Report for the water body added by this addendum.

Table II-1. 2022 Texas Integrated Report summary

AU	Station	Parameter	Number of Samples	Date Range	Enterococci Geometric Mean (cfu/100 mL)
1304_02	12151	Enterococci	26	12/01/2013 – 11/30/2020	45.86

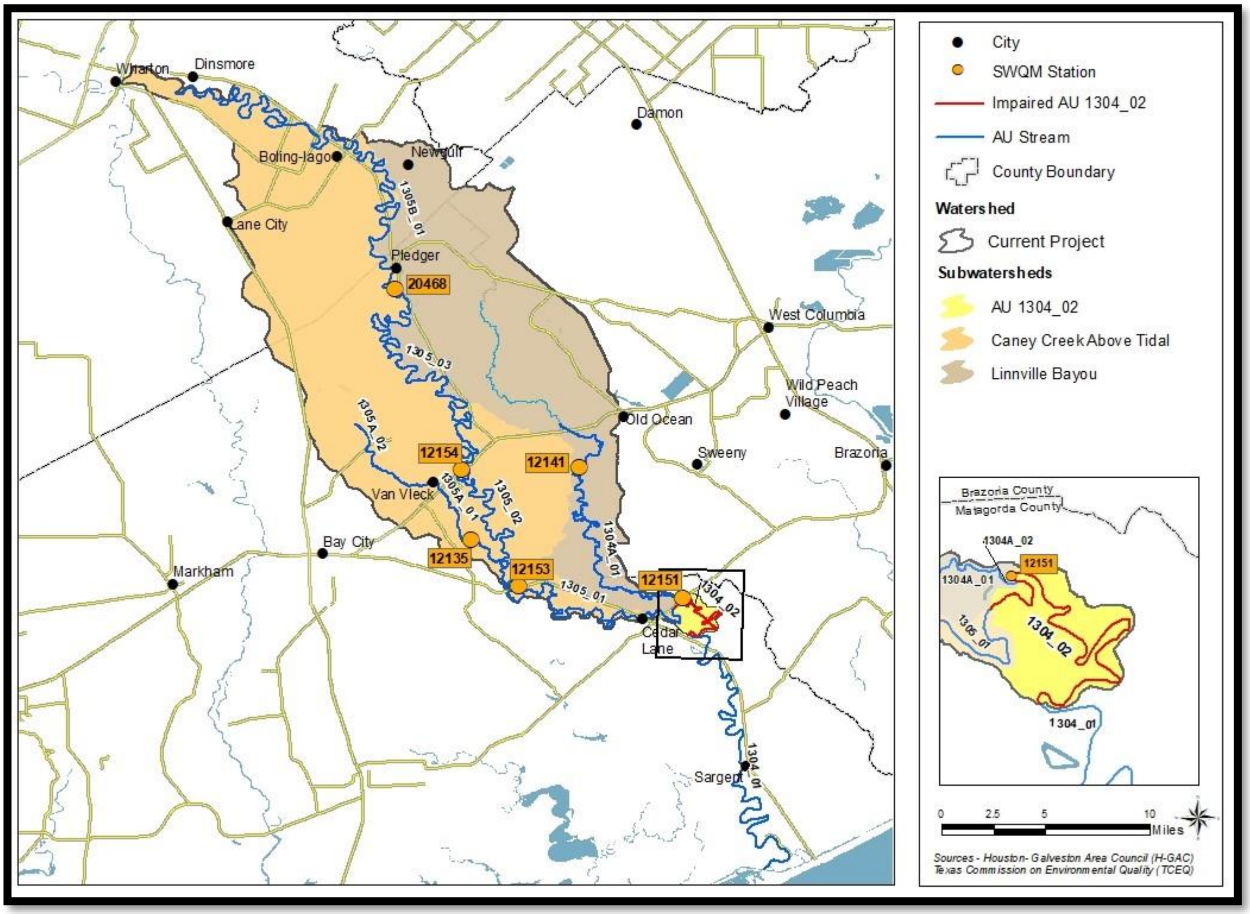

Figure II-2. TMDL watershed showing the TCEQ SWQM station

Watershed Overview

Caney Creek is approximately 130 miles long, beginning in the City of Wharton and ending at the Intracoastal Waterway south of the town of Sargent, with a watershed covering 303 square miles. The AU 1304_02 subwatershed is a small 2.57 square mile watershed within Caney Creek Tidal in Matagorda County. The AU begins near the village of Cedar Lane and Farm-to-Market (FM) 521 and flows approximately 7.51 miles southeastward to the confluence with Dead Slough, where AU 1304_02 ends and AU 1304_01 begins.

Collectively, the TMDL watershed for this report includes the entire AU 1304_02 catchment area, including the AU subwatershed described above (Figure II-2). The catchment area above AU 1304_02 includes the classified segment Caney Creek Above Tidal (1305) and the unclassified water bodies Linnville Bayou (1304A), Hardeman Slough (1305A), and Caney Creek above Waterhole Creek (1305B). Hardeman Slough and Caney Creek above Waterhole Creek will be considered part of the Caney Creek Above Tidal subwatershed for the remainder of this report. The TMDL watershed (i.e., the catchment area) is approximately 261.61 square miles.

The 2022 Texas Integrated Report (TCEQ, 2022a) provides the following water body and AU description:

- 1304 (Caney Creek Tidal) – From the confluence with the Intracoastal Waterway in Matagorda County to a point 1.9 kilometers (1.2 miles) upstream of the confluence of Linnville Bayou in Matagorda County.
    - AU 1304_02 – From the confluence with Dead Slough to the upstream end of segment.

Climate

Weather data were obtained for the 17-year period from January 2004 through December 2020 from the the National Oceanic and Atmospheric Administration (NOAA) for the City of Freeport (NOAA, 2022). Data from this 17-year period indicate that the average monthly high temperature typically reaches a maximum of 92.4 °F in August, and the average monthly low temperature reaches a minimum of 46.3 °F in January (Figure II-3). Annual rainfall averages 47.8 inches. The wettest month is September (6.5 inches) while February (2.3 inches) is the driest month, with rainfall occurring throughout the year.

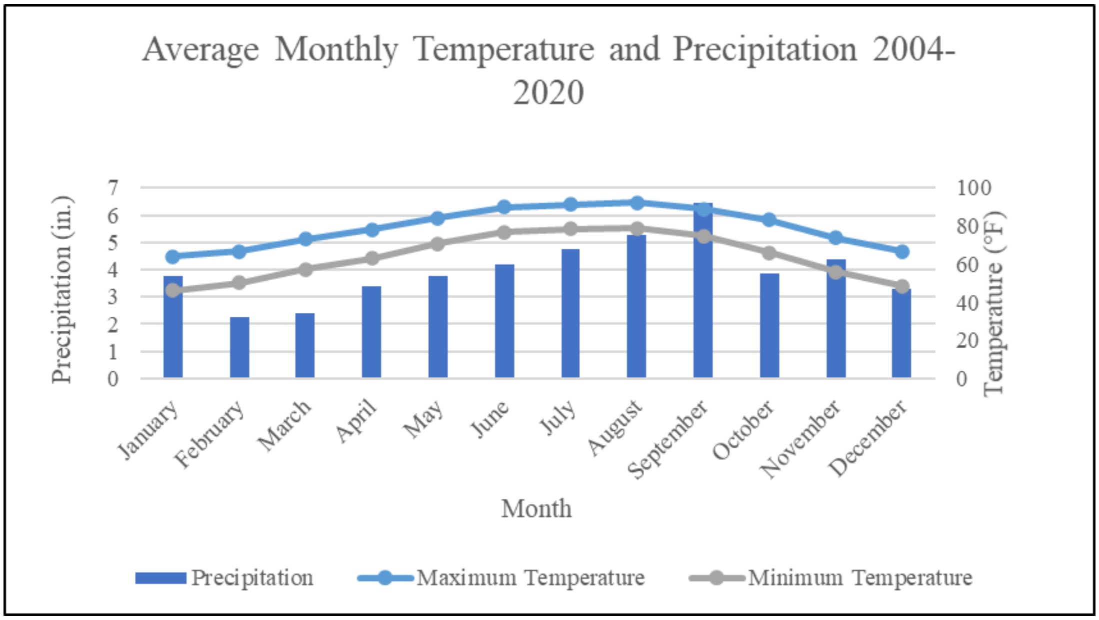

Figure II-3. Average monthly temperature and precipitation (2004-2020) at the City of Freeport

Population and Population Projections

The TMDL watershed is located within portions of Brazoria, Matagorda, and Wharton counties. Based on the Houston-Galveston Area Council's (H-GAC) Regional Forecast analysis of the United States Census Bureau (USCB) 2020 Decadal Census (H-GAC, 2022a), the TMDL watershed had an estimated population of 9,274 in 2020.

A population projection through 2070 was developed using data from the Texas Water Development Board's (TWDB) 2021 County Population Projections (TWDB, 2019) to be consistent with the original TMDLs. Table II-2 provides a summary of the population projection for the TMDL watershed.

Table II-2. 2020 population and 2070 population projection for the TMDL watershed

Area	2020 Estimated Population	2070 Projected Population	Projected Population Increase	Percent Change
TMDL Watershed	9,274	11,294	2,020	21.78%

The following steps detail the method used by the H-GAC regional forecast team to estimate the 2020 and projected 2070 populations in the TMDL watershed.

1. Obtained 2020 USCB data at the block level.
2. Used census block data to develop population estimates for a hexagonal grid of three-square miles each (H3M).

3. Estimated 2020 watershed populations using the H3M data for the portion of the H3M located within the watershed assuming equal distribution.
4. Obtained county population change rates for Brazoria, Matagorda, and Wharton counties for the year 2070 from the TWDB (TWDB, 2019).
5. Developed population projections by applying the 2070 population change rate to the 2020 population based on the proportion each county makes up within the TMDL watershed.
6. The 2070 total project population was calculated by adding the county proportional area populations together.
7. Calculated the percent population change between the 2020 population and the projected 2070 population.

Land Cover

The land cover data for the TMDL watershed were obtained from an H-GAC analysis of LANDSAT imagery (H-GAC, 2018). The land cover for the TMDL watershed is shown in Figure II-4. A summary of the land cover data is provided in Table II-3 and indicates that Pasture/Grassland (39.04%) is the dominant land cover in the TMDL watershed.

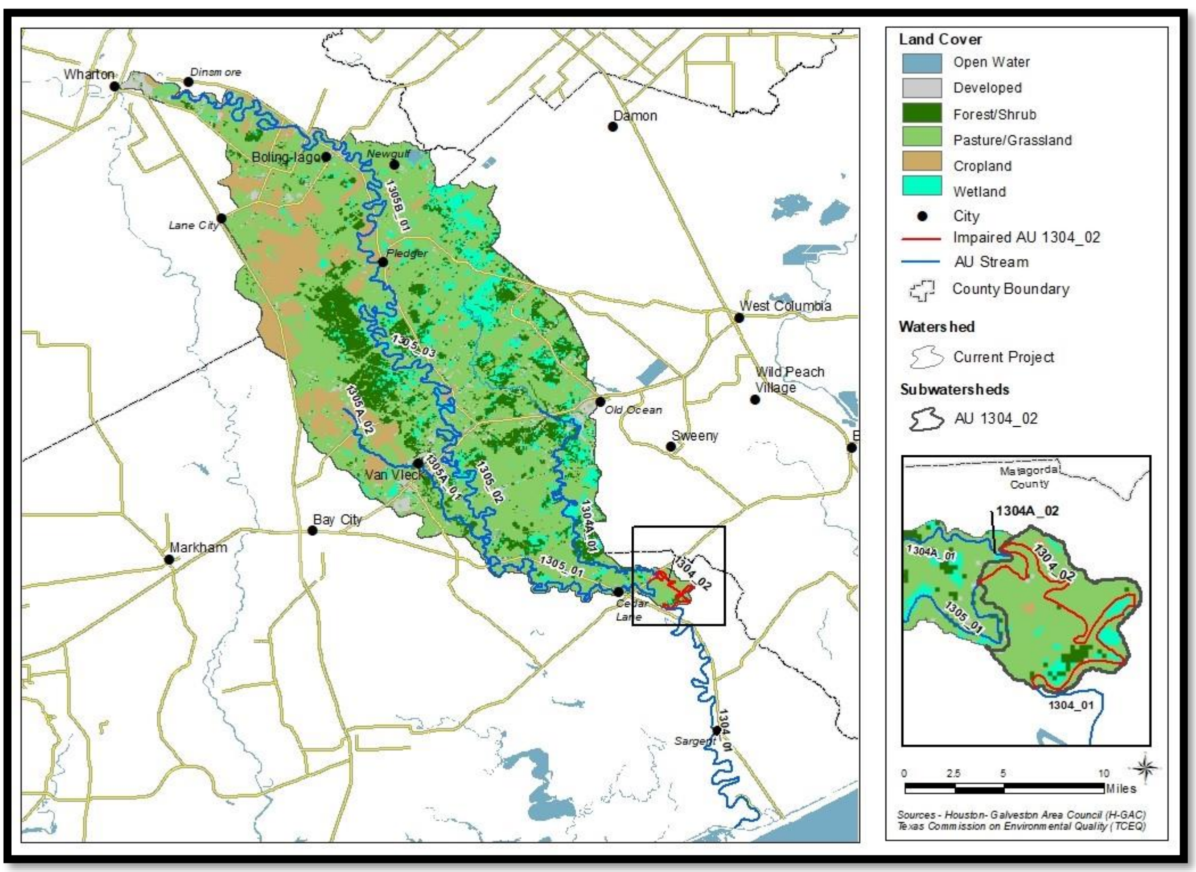

Figure II-4. 2018 land cover

Table II-3. Land cover summary

2018 Land Cover Class Type	Area (Acres)	% of Total
Open Water	561.53	0.33%
Developed - High Intensity	596.58	0.35%
Developed - Medium Intensity	384.15	0.23%
Developed - Low Intensity	4,765.00	2.82%
Developed - Open Space	4,667.19	2.76%
Barren Land	580.92	0.34%
Forest/Shrubs	31,976.14	18.91%
Pasture/Grassland	66,004.24	39.04%
Cropland	31,049.40	18.36%
Wetlands	28,491.42	16.85%
Total	**169,076.57**	**100%**

Endpoint Identification

The endpoint for the TMDL is to maintain the concentration of Enterococci below the geometric mean criterion of 35 cfu/100 mL, which is protective of the primary contact recreation 1 use in saltwater.

Source Analysis

Pollutants may come from several sources, both regulated and unregulated. Pollutants in regulated discharges, referred to as “point sources,” come from a single definable point, such as a pipe, and are regulated by permit under the Texas Pollutant Discharge Elimination System (TPDES) program. Wastewater treatment facilities (WWTFs) and stormwater discharges from industries, construction activities, and the separate storm sewer systems of cities are considered point sources of pollution.

Unregulated sources are typically nonpoint source in origin, meaning the pollutants originate from multiple locations and rainfall runoff washes them into surface waters. Nonpoint sources are not regulated by permit.

Except for WWTFs, which receive individual wasteload allocations (WLAs; see the Wasteload Allocation section), the regulated and unregulated sources in this section are presented to give a general account of the different sources of bacteria expected in the watershed. These are not meant to be used for allocating bacteria loads or interpreted as precise inventories and loadings.

Regulated Sources

Regulated sources are controlled by permit under the TPDES program. The regulated sources in the TMDL watershed include WWTF outfalls and stormwater discharges from industries and regulated construction activities.

Domestic and Industrial WWTFs

As of May 1, 2022, there were five WWTF permittees in the TMDL watershed that maintain wastewater discharge permits for nine distinct wastewater outfalls (Table II-4 and Figure II-5). All permittees discharge upstream of the impaired AU to either 1304A or 1305. The two industrial permittees (WQ0000721000 and WQ0005147000) do not have bacteria limits in their permits, and their outfalls will be excluded from further analysis. In addition, one permittee (WQ0003891000) is physically located in the northern part of the TMDL watershed but discharges outside of it to Segment 1302 and is not included in Table II-4.

Table II-4. TPDES-permitted WWTFs discharging in the TMDL watershed

AU	TPDES Number	NPDES[a] Number	Permittee	Outfall Number	Bacteria Limits (cfu/ 100 mL)	Primary Discharge Type	Daily Average Flow – Permitted Discharge (MGD[b])
1304A_01	WQ0000721000	TX00007536	Phillips 66 Co.	2	None	Industrial	Continuous/Flow Variable
1304A_01	WQ0000721000	TX00007536	Phillips 66 Co.	6	None	Industrial	Continuous/Flow Variable
1304A_01	WQ0000721000	TX00007536	Phillips 66 Co.	10	None	Industrial	Continuous/Flow Variable
1304A_01	WQ0000721000	TX00007536	Phillips 66 Co.	13	None	Industrial	0.216
1304A_01	WQ0005147000	TX00135917	Chevron Phillips Chemical Co. LP	1	None	Industrial	Continuous/Flow Variable
1304A_01	WQ0005147000	TX00135917	Chevron Phillips Chemical Co. LP	3	None	Industrial	Continuous/Flow Variable
1305A_01	WQ0010663001	TX00024155	Matagorda County WCID 6	1	126 *Escherichia coli* (*E. coli*)	Domestic	0.193
1305A_01	WQ0011768001	TX00070297	Massey Jimmie Wayne	1	126 (*E. coli*)	Domestic	0.01
1305B_01	WQ0010843001	TX00033910	Boling MWD	1	126 (*E. coli*)	Domestic	0.133

[a]NPDES: National Pollutant Discharge Elimination System

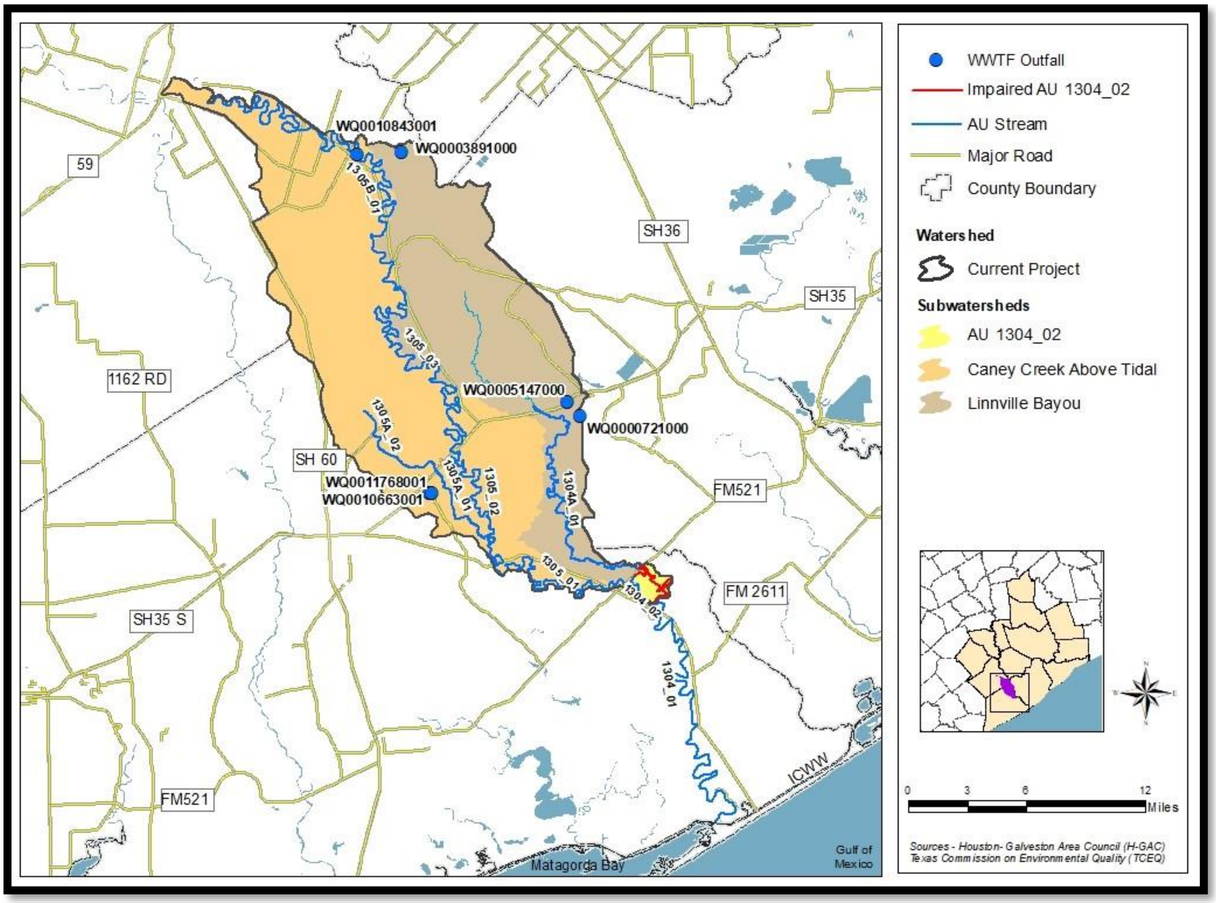

Figure II-5. WWTFs in the TMDL watershed

TCEQ/TPDES Water Quality General Permits

Certain types of activities are required to be covered by one of several TCEQ/TPDES wastewater general permits:

TXG110000 – concrete production facilities
TXG130000 – aquaculture production
TXG340000 – petroleum bulk stations and terminals
TXG640000 – conventional water treatment plants
TXG670000 – hydrostatic test water discharges
TXG830000 – water contaminated by petroleum fuel or petroleum substances
TXG870000 – pesticides (application only)
TXG920000 – concentrated animal feeding operations
WQG100000 – wastewater evaporation
WQG200000 – livestock manure compost operations (irrigation only)

A review of active general permit coverage (TCEQ, 2022c) in the TMDL watershed as of May 1, 2022, found one concrete production facility covered by the general permit. One concentrated animal feeding operation (CAFO) was found in the Caney Creek Above Tidal subwatershed, however, CAFOs are required to contain wastes onsite and would not be considered a source of discharge to the water body.

Sanitary Sewer Overflows

A summary of sanitary sewer overflow (SSO) incidents that occurred during a six-year period from 2016 through 2021 in the TMDL watershed was obtained from TCEQ Central Office in Austin. The summary data indicated no SSO incidents had been reported within the TMDL watershed.

TPDES-Regulated Stormwater

When evaluating stormwater for a TMDL allocation, a distinction must be made between stormwater originating from an area under a TPDES-regulated discharge permit and stormwater originating from areas not under a TPDES-regulated discharge permit. Stormwater discharges fall into two categories:

1. Stormwater subject to regulation, which is any stormwater originating from TPDES-regulated municipal separate storm sewer system (MS4) entities, stormwater discharges associated with regulated industrial facilities, and construction activities.
2. Stormwater runoff not subject to regulation.

Discharges of stormwater from a Phase II MS4 area, regulated industrial facility, construction area, or other facility involved in certain activities must be covered under the following TCEQ/TPDES general permits:

- TXR040000 – Phase II MS4 General Permit for MS4s located in urbanized areas
- TXR050000 – Multi-sector General Permit (MSGP) for industrial facilities
- TXR150000 – Construction General Permit (CGP) for construction activities disturbing more than one acre or are part of a common plan of development disturbing more than one acre

A review of active stormwater general permit authorizations (TCEQ, 2022c) in the TMDL watershed as of May 1, 2022, found four active MSGP authorizations and seven CGP authorizations within the watershed. No active MS4 permits were discovered for the TMDL watershed based on this review.

Illicit Discharges

Pollutant loads can enter water bodies from MS4 outfalls that carry authorized sources as well as illicit discharges under both dry- and wet-weather conditions. The term “illicit discharge” is defined in TPDES General Permit TXR040000 for Phase II MS4s as “Any discharge to a municipal separate storm sewer system that is not entirely composed of stormwater, except discharges pursuant to this general permit or a separate authorization and discharges resulting from emergency firefighting activities." Illicit discharges can be categorized as either direct or indirect contributions. The TMDL watershed does not include any area covered by active Phase II MS4 permits.

Unregulated Sources

Unregulated sources of bacteria are nonpoint and can originate from wildlife and feral hogs, various agricultural activities, agricultural animals, land application fields, urban runoff not covered by a permit, failing on-site sewage facilities (OSSFs), and domestic pets.

Unregulated Agricultural Activities and Domesticated Animals

A number of agricultural activities that do not require permits can be potential sources of fecal bacteria loading. Livestock are present throughout the more rural portions of the project watershed.

Table II-5 provides estimated numbers of selected livestock in the watershed based on the 2017 Census of Agriculture conducted by United States Department of Agriculture (USDA, 2019). The county-level estimated livestock populations were reviewed by Texas State Soil and Water Conservation Board staff and were refined to better reflect actual numbers within the TMDL watershed. The county livestock numbers were distributed equally across livestock and farm operations in pasture and grassland land cover types within the county. To determine the number of livestock within each subwatershed, the number of livestock to acre was calculated for each county and then that stocking rate was applied to the watershed based on the proportion of the county found within the watershed. These livestock numbers, however, were not used to develop an allocation of allowable bacteria loading to livestock.

Table II-5. Estimated livestock populations

Watershed	Cattle and Calves	Hogs and Pigs	Goats and Sheep	Horses
TMDL Watershed	15,611	221	425	419

Fecal bacteria from dogs and cats is transported to water bodies by runoff in both urban and rural areas and can be a potential source of bacteria loading. Table II-6 summarizes the estimated number of dogs and cats within the TMDL watershed. Pet population estimates were calculated as the estimated number of dogs (0.614) and cats (0.457) per household (AVMA, 2018). The number of households in the TMDL watershed was estimated using USCB 2020 census data. The actual contribution and significance of bacteria loads from pets reaching Caney Creek Tidal is unknown.

Table II-6. Estimated households and pet population

Watershed	Estimated Households	Estimated Dog Population	Estimated Cat Population
TMDL Watershed	3,424	2,103	1,565

Wildlife and Unmanaged Animals

Fecal bacteria are common inhabitants of the intestines of all warm-blooded animals, including wildlife such as mammals and birds. In developing bacteria TMDLs, it is important to identify by watershed the potential for bacteria contributions from wildlife. Wildlife are naturally attracted to riparian corridors of water bodies. With direct access to the stream channel, the direct deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Fecal bacteria from wildlife are also deposited onto land surfaces, where they may be washed into nearby water bodies by rainfall runoff.

For feral hogs, a study by Timmons et al. (2012) estimated a range of feral hog densities within suitable habitat in Texas from 8.9 to 16.4 hogs per square mile. Feral hog population estimates may be weighted more heavily in riparian areas where animals are protected from the stresses associated with development and have more direct access to water resources. Considering these factors, feral hog populations were estimated to be 8.9 per square mile in Developed - Low Intensity, Barren Lands, and Cropland (“Low Quality”); 16.4 per square mile in Developed - Open Space, Pasture/Grassland, Forest/Shrubs and Wetlands (“High Quality”); and no hogs in other developed areas or open water. Using these assumptions, the total feral hog population of the TMDL watershed is estimated to be 3,867.

For deer, the Texas Parks and Wildlife Department (TPWD) has published data showing deer population-density estimates by Deer Management Unit (DMU) and Ecoregion in the state (TPWD, 2020). The TMDL watershed is located within DMU 10. For 2008 through 2019, the estimated deer population density for DMU 10 was one deer per 25.57 acres and applies to all habitat types within the DMU. Applying this value to the entire area of the TMDL watershed returns an estimated 6,691 deer within the TMDL watershed. The Enterococci contribution from feral hogs and wildlife in the TMDL watershed could not be determined based on existing information.

On-site Sewage Facilities

The estimated number of OSSFs in the TMDL watershed was determined using known OSSF locations, 911 addresses, and WWTF service boundaries. These data indicate that there are 599 documented OSSFs located within the TMDL watershed (H-GAC, 2022b; Figure II-6) plus an additional 1,642 unregistered OSSFs (H-GAC, 2022c) for a total of 2,241. Several pathways of the liquid waste in OSSFs afford opportunities for bacteria to enter ground and surface waters, if the systems are not properly operating. Properly designed and operated, however, OSSFs would be expected to contribute virtually no fecal bacteria to surface waters (Weiskel et al., 1996).

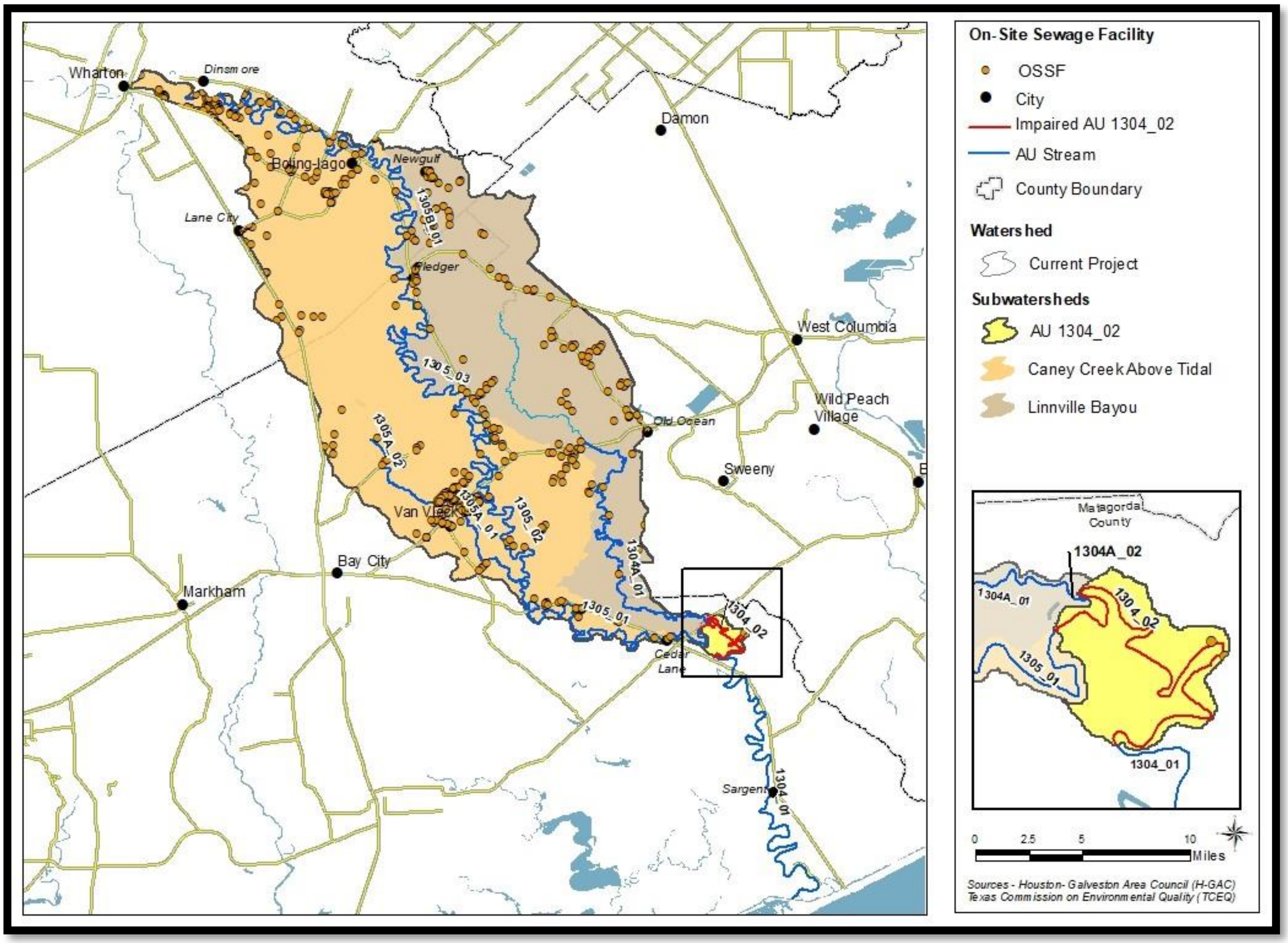

Figure II-6. Documented OSSFs located within the TMDL watershed

Linkage Analysis

The load duration curve (LDC) method was used to examine the relationship between instream water quality and the source of indicator bacteria loads. Inherent to the use of LDCs as the mechanism of linkage analysis is the assumption of a one-to-one relationship between instream loadings and loadings originating from point sources as regulated and from the landscape as unregulated sources. Further, this one-to-one relationship was also inherently assumed when using the LDC to define the TMDL pollutant load allocation. The LDC method allows for estimation of TMDL loads by utilizing the cumulative frequency distribution of streamflow and measured pollutant concentration data (Cleland, 2003). In addition to estimating stream loads, this method allows for the determination of the hydrologic conditions under which impairments are typically occurring, can give indications of the broad origins of the bacteria (i.e., point or nonpoint source), and provides a means to allocate allowable loadings. As AU 1304_02 is considered a tidal waterbody, constructing a modified LDC was considered (ODEQ, 2006). Modified LDCs are based on the assumption that combining freshwater with seawater increases the loading capacity in the tidal water body. After a review of salinity for SWQM Station 12151, the values were found to be too low for tidal inflows to influence LDC development. A standard (rather than modified) LDC was developed. The technical support document for this addendum (Johnston, 2022) provides details about the linkage analysis along with the LDC method and its application.

The load regression curve modeled from observed Enterococci data at SWQM Station 12151 exceeds the curve representing the geometric mean maximum in all flow conditions (Figure II-7). The allowable load at the single sample criterion (130 cfu/100 mL) is included on the LDC for comparison with individual Enterococci samples, although it is not used for assessment or allocation purposes.

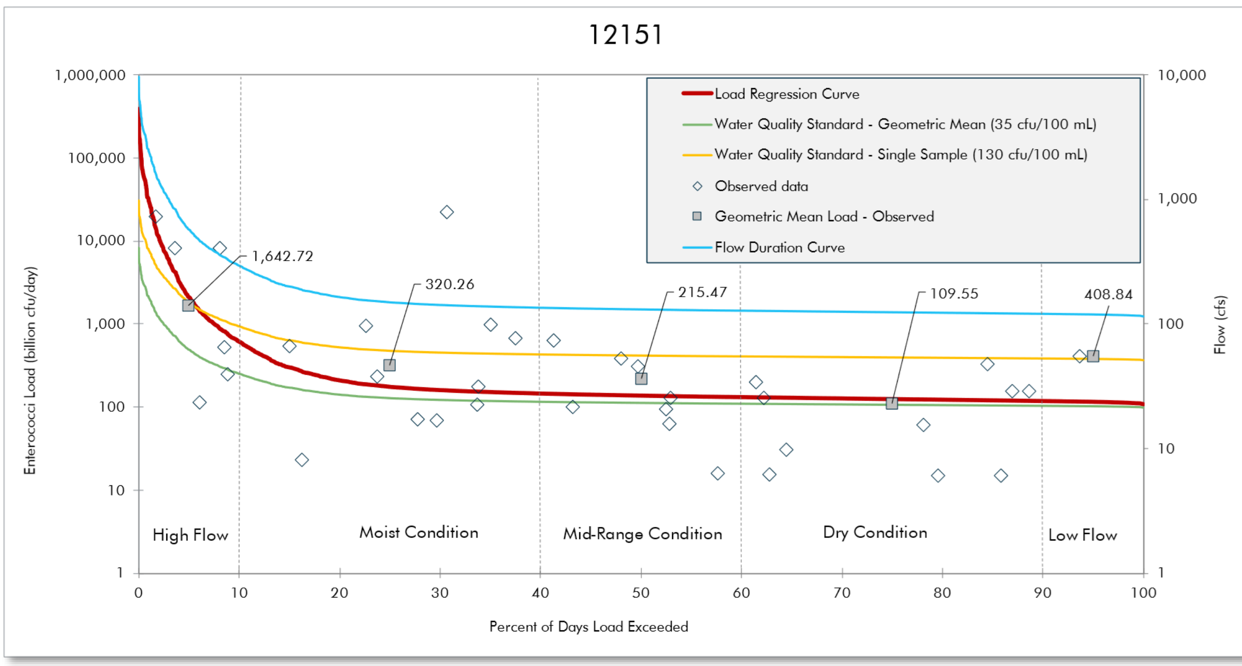

Figure II-7. LDC at SWQM Station 12151

Margin of Safety

The margin of safety (MOS) is designed to account for any uncertainty that may arise in specifying water quality control strategies for the complex environmental processes that affect water quality. Quantification of this uncertainty, to the extent possible, is the basis for assigning an MOS. The TMDL in this report incorporates an explicit MOS of 5% of the total TMDL allocation.

Pollutant Load Allocation

The TMDL represents the maximum amount of a pollutant that the stream can receive in a single day without exceeding water quality standards. The pollutant load allocations for the selected scenarios were calculated using the following equation:

TMDL = WLA + LA + FG + MOS

Where:

WLA = wasteload allocations, the amount of pollutant allowed by regulated dischargers

LA = load allocations, the amount of pollutant allowed by unregulated sources

FG = loadings associated with future growth from potential regulated facilities

MOS = margin of safety load

For the remainder of this report some calculations have been rounded and may not lead to the exact final amounts listed in the text, tables, or figures.

AU-Level TMDL Calculation

To be consistent with previously completed TMDLs in the original watershed, the TMDL for Caney Creek Tidal AU 1304_02 was derived using the median flow within the "High Flow" regime (or 5% load duration exceedance) of the LDC developed for TCEQ SWQM Station 12151. This station represents the location within Caney Creek Tidal AU 1304_02 where an adequate number of Enterococci samples was collected.

Margin of Safety Calculation

The TMDL in this report incorporates an explicit MOS of 5%.

Wasteload Allocation

The WLA is the sum of loads from regulated sources, which are WWTFs and regulated stormwater.

Wastewater Treatment Facilities

TPDES-permitted WWTFs are allocated a daily wasteload (WLA_{WWTF}) calculated as their full permitted discharge flow rate multiplied by the instream geometric mean criterion (35 cfu/100 mL for Enterococci). Table II-7 presents the WLAs for the WWTFs.

Table II-7. WLAs for TPDES-permitted facilities

AU	TPDES Number	Permittee	Bacteria Limit (cfu/100 mL *E. coli*)[1]	Full Permitted Flow (MGD)	WLA_{WWTF} (billion cfu/day Enterococci)
1305A_01	WQ0010663001	Matagorda County WCID 6	126	0.193	0.256
1305A_01	WQ0011768001	Massey Jimmie Wayne	126	0.01	0.013
1305B_01	WQ0010843001	Boling MWD	126	0.133	0.176
			Total	**0.336**	**0.445**

[1] All of the domestic permittees discharge to freshwater segments and have *E. coli* limits in their permits. For developing the TMDL allocations, 35 cfu/100 mL Enterococci was used to to calculate the WLA_{WWTF} values.

Regulated Stormwater

Stormwater discharges from MS4, industrial, and construction areas are also considered regulated point sources. Therefore, the WLA calculations must also include an allocation for regulated stormwater discharges (WLA_{SW}). The percentage of the land area included in the project watershed that is under the jurisdiction of stormwater permits is used to estimate the amount of the overall runoff load that should be allocated as the permitted stormwater contribution in the WLA_{SW} component.

Acreages associated with a concrete production facility (4.86 acres), MSGP authorizations (2,079.23 acres), and the annual average area disturbed by CGP authorizations from 2017-2021 (678.12 acres) were calculated using geographic information system shapefiles as well as aerial imagery by measuring the estimated disturbed area at each facility location (or the "area disturbed" listed for CGP authorizations). The percentage of land under the jurisdiction of stormwater permits (a total of 2,762.21 acres) in the TMDL watershed is 1.634%.

As of May 1, 2022 there are no active MS4 permits in the TMDL watershed.

Load Allocation

The load allocation (LA) component of the TMDL corresponds to direct nonpoint runoff and is the difference between the total load from stormwater runoff and the portion allocated to WLA_{SW}.

Allowance for Future Growth

The FG component of the TMDL equation addresses the requirement of TMDLs to account for future loadings that might occur as a result of population growth, changes in community infrastructure, and development. Specifically, this TMDL component takes into account the probability that new flows from WWTF discharges may occur in the future. The assimilative capacity of water bodies increases as the amount of flow increases. The allowance for FG in this TMDL report will result in protection of existing uses and conform to Texas' antidegradation policy.

The FG component of the TMDL watershed was based on population projections and current permitted wastewater dischargers for the entire TMDL watershed. Recent population and projected population growth between 2020 and 2070 for the TMDL watershed are provided in Table II-2. The projected population percentage increase within the watershed was multiplied by the corresponding WLA_{WWTF} to calculate future WLA_{WWTF}. In consideration of a possible growth in population within the Linnville Bayou watershed where there are currently no existing domestic WWTFs, a hypothetical future WWTF was included in the FG calculation. This potential WWTF was given a 0.05 MGD permitted flow.

FG of existing or new point sources is not limited by this TMDL as long as the sources do not cause bacteria to exceed the limits. The assimilative capacity of water bodies increases as the amount of flow increases. Consequently, increases in flow allow for increased loadings. The LDC and tables in this TMDL report will guide determination of the assimilative capacity of the water body under changing conditions, including FG.

Summary of TMDL Calculations

Table II-8 summarizes the TMDL calculations for the TMDL watershed. The TMDL was calculated based on the median flow in the 0-10 percentile range (5% exceedance, "High Flow" regime) from the LDC developed for the TCEQ SWQM Station 12151. Allocations are based on the current geometric mean criterion for Enterococci of 35 cfu/100 mL for each component of the TMDL.

Table II-8. TMDL allocation summary for AU 1304_02

All loads expressed as billion cfu/day Enterococci

Water Body	AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA	FG
Caney Creek Tidal	1304_02	353.891	17.695	0.445	5.483	330.122	0.146

The final TMDL allocations (Table II-9) needed to comply with federal requirements include the FG component within the WLA_{WWTF} (40 CFR Section 103.7).

Table II-9. Final TMDL allocations for AU 1304_02

All loads expressed as billion cfu/day Enterococci

Water Body	AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA
Caney Creek Tidal	1304_02	353.891	17.695	0.591	5.483	330.122

Seasonal Variation

Federal regulations require that TMDLs account for seasonal variation in watershed conditions and pollutant loading [40 CFR Section 130.7(c)(1)]. Analysis of the seasonal differences in indicator bacteria concentrations were assessed by comparing Enterococci concentrations obtained from 16 years (2004 through 2020) of routine monitoring data collected in the warmer months (May through September) against those collected during the cooler months (November through March). The months of April and October were considered transitional between warm and cool seasons and were excluded from the seasonal analysis. Differences in Enterococci concentrations obtained in warmer versus cooler months were then evaluated by performing a Wilcoxon Rank Sum test (also known as the "Mann-Whitney" test). This analysis of Enterococci data indicated that there was no significant difference between the warm and cool seasons. Seasonal variation was also addressed by using all available flow and Enterococci records (covering all seasons) from the period of record used in LDC development for this project.

Public Participation

TCEQ maintains an inclusive public participation process. From the inception of TMDL development, the project team sought to ensure that stakeholders were informed and involved. Communication and comments from the stakeholders in the watershed strengthen TMDL projects and their implementation.

The technical support document for this TMDL addendum (Johnston, 2022) was published on the TCEQ website on Nov. 30, 2023. Project staff presented information about this addendum at a watershed stakeholder meeting held in Sargent on June 9, 2022 and a meeting held online on Aug. 24, 2022. The public had an opportunity to comment on this addendum during the public comment period (Feb. 9 through March 12, 2024) for the WQMP update in which this addendum is included. Notice of the public comment period for this addendum was emailed to stakeholders and posted on the TCEQ's TMDL Program News webpage.[3] Notice of the comment period, along with the document, was also posted on the WQMP Updates webpage.[4] TCEQ accepted public comments on the original TMDL report from Feb. 12 through March 16, 2021. Twelve comments were submitted, and none of them referred directly to the AU in this TMDL addendum.

[3] www.tceq.texas.gov/waterquality/tmdl/tmdlnews.html
[4] www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html

Implementation and Reasonable Assurance

The water body covered by this addendum is within the existing bacteria TMDL watershed for the Caney Creek watershed. That TMDL watershed, including Caney Creek Tidal, is within area covered by the implementation plan (I-Plan) developed by Caney Creek stakeholders and H-GAC, which was approved by the commission on June 14, 2023. The I-Plan outlines an adaptive management approach in which measures are assessed annually by the stakeholders for efficiency and effectiveness. The iterative process of evaluation and adjustment ensures continuing progress toward achieving water quality goals and expresses stakeholder commitment to the process. Please refer to the original TMDL document for additional information regarding implementation and reasonable assurance.

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