January 2024 Update to the Texas Water Quality Management Plan

Prepared by
Water Quality Division, Office of Water

Draft TCEQ SFR-121/2024-02
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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY • PO BOX 13087 • AUSTIN, TX 78711-3087

Prepared by the
Office of Water
Water Quality Division

Draft WQMP updates for public comment are available on the TCEQ webpage:
www.tceq.texas.gov/permitting/wqmp/WQmanagement_comment.html

Developed in accordance with Sections 205(j), 208,
and 303 of the Clean Water Act
and applicable regulations thereto.

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Introduction

The Texas Water Quality Management Plan (WQMP) is the product of a wastewater treatment facility (WWTF) planning process developed and updated in accordance with provisions of Sections 205(j), 208, and 303 of the federal Clean Water Act (CWA), as amended. The WQMP is an important part of the State's program for accomplishing its clean water goals.[1]

The Texas Department of Water Resources, a predecessor agency of the Texas Commission on Environmental Quality (TCEQ), prepared the initial WQMP for waste treatment management during the late 1970s. The CWA mandates that the WQMP be updated as needed to fill information gaps and revise earlier certified and approved plans. Any updates to the plan need involve only the elements of the plan that require modification. The original plan and its subsequent updates are collectively referred to as the "State of Texas Water Quality Management Plan."

The WQMP is tied to the State's water quality assessments that identify priority water quality problems. WQMPs are used to direct planning for implementation measures that control and/or prevent water quality problems. Several elements may be contained in the WQMP, such as effluent limitations of wastewater facilities, total maximum daily loads (TMDLs), nonpoint source management controls, identification of designated management agencies, and groundwater and source-water protection planning. Some of these elements may be contained in separate documents, which are prepared independently of the current WQMP update process but may be referenced as needed to address planning for water quality control measures.

This document, as with previous updates[2], will become part of the WQMP after completion of the public comment period, certification by TCEQ, and approval by the United States Environmental Protection Agency (EPA).

The materials presented in this document revise only the information specifically addressed in the following sections. Previously certified and approved WQMPs remain in effect.

[1] See the formal definition of a water quality management plan in Title 40 Code of Federal Regulations (CFR) 130.2(k).

[2] Fiscal Years 1974, 1975, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984/85, 1986/88, 1989, 1990, 1991, 1992, 1993/94, 1995, 1996, 1997/98, 02/1999, 05/1999, 07/1999, 10/1999, 01/2000, 04/2000, 07/2000, 10/2000, 01/2001, 04/2001, 07/2001, 10/2001, 01/2002, 04/2002, 07/2002, 10/2002, 01/2003, 04/2003, 07/2003, 10/2003, 01/2004, 04/2004, 07/2004, 10/2004, 01/2005, 04/2005, 07/2005, 10/2005, 01/2006, 04/2006, 07/2006, 10/2006, 01/2007, 04/2007, 07/2007, 10/2007, 01/2008, 04/2008, 07/2008, 10/2008, 01/2009, 04/2009, 07/2009, 10/2009, 01/2010, 04/2010, 07/2010,10/2010, 01/2011, 04/2011, 07/2011, 10/2011, BPUB 2011, 01/2012, 04/2012, 07/2012,10/2012, 01/2013, 04/2013, 07/2013,10/2013, 01/2014, 04/2014, 07/2014, 10/2014, 01/2015, 04/2015, 07/2015, 10/2015, 01/2016, 04/2016, 07/2016, 10/2016, 01/2017, 04/2017, 07/2017, 10/2017, 01/2018, 04/2018, 07/2018, 10/2018, 01/2019, Terra Verde 2019, 04/2019, 07/2019, 10/2019, 01/2020, 04/2020, 07/2020 10/2020, 01/2021, 04/2021, 07/2021, 10/2021, 01/2022, 04/2022, 07/2022, 10/2022, 01/2023, 04/2023, 7/2023 and 10/2023.

The draft January 2024 WQMP update addresses the following topics for water quality planning purposes:

1. Projected Effluent Limit Updates
2. TMDL Updates

The public comment period for the draft October WQMP update will be from February 9, 2024 through March 12, 2024.

The "Projected Effluent Limit Update" section provides information compiled from November 1, 2023 through January 31, 2024, and is based on the Texas Surface Water Quality Standards (TSWQS). Projected effluent limits may be used for water quality planning purposes in Texas Pollutant Discharge Elimination System (TPDES) permit actions.

The "Total Maximum Daily Load Update" section provides information on proposed wasteload allocations (WLAs) for new dischargers and revisions to existing TMDLs and was developed by the TCEQ TMDL Program in the Water Quality Planning Division.

Projected Effluent Limit Updates

Table 1 reflects proposed effluent limits for new dischargers and preliminary revisions to original proposed effluent limits for preexisting dischargers. Abbreviations used in the table heading include:

- BOD_5–5-Day Biochemical Oxygen Demand
- $CBOD_5$–5-Day Carbonaceous Biochemical Oxygen Demand
- DO–Dissolved Oxygen
- lbs/day–Pounds per Day
- MGD–Million Gallons per Day
- mg/L–Milligrams per Liter
- NH_3-N–Ammonia-Nitrogen

Effluent flows indicated in Table 1 reflect future needs and do not reflect current permits for these facilities. These revisions may be useful for water quality management planning purposes. The effluent flows and constituent limits indicated in the table have been preliminarily determined to be appropriate to satisfy the stream standards for dissolved oxygen in their respective receiving waters. These flow volumes and effluent sets may be modified at the time of permit action. These limits are based on the TSWQS effective at the time of the production of this update. The TSWQS are subject to revision on a triennial basis.

Table 1. Projected Effluent Limit Updates

State Permit Number	Segment Number	EPA ID Number	Permittee Name and County	Flow (MGD)	$CBOD_5$ (mg/L)	$CBOD_5$ (lbs/day)	NH_3-N (mg/L)	NH_3-N (lbs/day)	BOD_5 (mg/L)	BOD_5 (lbs/day)	DO (mg/L)	Months/ Comments
10408-010	2307	TX0101605	El Paso Water Utilities Public Service Board El Paso	51.4	20	8573.52	5	2143.38			4	April-October
				51.4					20	8573.52	4	November-March
10489-008	1248	TX0145254	City of Georgetown Williamson	21	5	875.70	1	175.14			6	
11521-001	1012	TX0056693	City of Montgomery Montgomery	0.6	5	25.02	1	5.00			6	
13138-001	1428	TX0103781	Texas Water Utilities LP Travis	2.5	10	208.50	2	41.70			5	
13452-001	1604	TX0103781	Sheridan Water Supply Corporation Colorado	0.152	20	25.35	12	15.21			2	
13546-002	1227	TX0135411	City of Rio Vista Johnson	0.3	10	25.02	3	7.51			4	
14740-001	1014	TX0129071	Harris County Municipal Utility District No. 500 Harris	0.99	10	82.57	2	16.51			6	

State Permit Number	Segment Number	EPA ID Number	Permittee Name and County	Flow (MGD)	$CBOD_5$ (mg/L)	$CBOD_5$ (lbs/day)	NH_3-N (mg/L)	NH_3-N (lbs/day)	BOD_5 (mg/L)	BOD_5 (lbs/day)	DO (mg/L)	Months/ Comments
16321-001	1243	TX0144487	Jarrell Estates TX WW LLC Williamson	0.9	5	37.53	2	15.01			4	
16362-001	1248	TX0144681	Williamson County Municipal Utility District No. 48 and Cathy Albrecht Moore Williamson	1.75	10	145.95	3	43.79			4	
16370-001	0830	TX0144789	Kelly Ranch Estates LLC Parker	2.25	5	93.83	1.3	24.39			6	
16399-001	1002	TX0145025	Texas Water Utilities, L.P. Liberty	0.975	10	81.32	3	24.39			4	
16410-001	1010	TX0145084	Texas Water Utilities, L.P. Montgomery	0.17	10	14.18	3	4.25			4	
16411-001	0838	TX0145092	BL 374 LLC Tarrant	0.49	10	40.87	3	12.26			4	
16413-001	1202	TX0145122	Mayer Road WWTP LLC Waller	0.35	10	29.19	2	5.84			4	
16414-001	1229	TX0145131	Bluff Dale ISD Erath	0.01					20	1.668	4	
16415-001	0802	TX0145149	Treaty Oaks Developers LLC Liberty	0.42	10	35.03	3	10.51			4	

State Permit Number	Segment Number	EPA ID Number	Permittee Name and County	Flow (MGD)	$CBOD_5$ (mg/L)	$CBOD_5$ (lbs/day)	NH_3-N (mg/L)	NH_3-N (lbs/day)	BOD_5 (mg/L)	BOD_5 (lbs/day)	DO (mg/L)	Months/ Comments
16417-001	1001	TX0145173	Woodmere Development Co., Ltd. Harris	2.5	5	104.25	1.9	39.62			6	
16419-001	1009	TX0145190	The Mike A. Myers Foundation Harris	0.08	10	6.67	3	2.00			4	
16422-001	1808	TX0145220	South Central Water Company Caldwell	0.975	7	56.92	2	16.26			6	
16434-001	0507	TX0145271	Caddo Mills Laguna Land Azure LLC Hunt	0.95	10	79.23	3	23.77			4	
16436-001	0802	TX0145297	The Oasis of Texas, LP Polk	0.05	10	4.17	3	1.25			4	

Total Maximum Daily Load Revisions

The TMDL Program works to improve water quality in impaired or threatened water bodies in Texas. The program is authorized by and created to fulfill the requirements of Section 303(d) of the federal CWA.

The goal of a TMDL is to restore the full use of a water body that has limited quality in relation to one or more of its uses. The TMDL defines an environmental target, and based on that target, TCEQ and stakeholders develop an implementation plan with WLAs for point source dischargers to mitigate human-caused sources of pollution within the watershed and restore full use of the water body.

TMDLs are developed based on intensive data collection and scientific analysis. After adoption by TCEQ, TMDLs are submitted to EPA for review and approval.

The attached appendixes may reflect proposed WLAs for new dischargers and/or additions or revisions to TMDLs. Updates and addendums will be provided in the same units of measure used in the original TMDL document and will include the segment and assessment unit (AU) numbers of the affected segments. Also, note that for bacteria TMDLs, loads will typically be expressed as colony-forming units per day (cfu/day). On occasion, other expressions may be used due to different laboratory methods, such as counts or most probable number per day. For the purposes of the TMDL program, these terms are considered to be synonymous.

Appendix I. Updates to Eighteen Total Maximum Daily Loads for Bacteria in Buffalo and Whiteoak Bayous and Tributaries

Segments 1013, 1013A, 1013C, 1014, 1014A, 1014B, 1014E, 1014H, 1014K, 1014L, 1014M, 1014N, 1014O, 1017, 1017A, 1017B, 1017D, and 1017E

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Buffalo and Whiteoak Bayous and Tributaries.

The report, *Eighteen Total Maximum Daily Loads for Bacteria in Buffalo and Whiteoak Bayous and Tributaries for Segment Numbers 1013, 1013A, 1013C, 1014, 1014A, 1014B, 1014E, 1014H, 1014K, 1014L, 1014M, 1014N, 1014O, 1017, 1017A, 1017B, 1017D, and 1017E,* was adopted by TCEQ on April 8, 2009 and approved by EPA on June 11, 2009. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated 36 times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. Additionally, TCEQ submitted addenda to the original TMDL in the April 2013, April 2015, and January 2021 WQMP updates. These addenda added three new AUs to the original TMDL project.

The purpose of this update is to make the following change to the TMDL (presented in Table I-1):

- Increase the discharge for an existing permit.

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for future growth (FG) in one AU. This was originally presented in Table 53 in the original TMDL document. The affected AU in this update is included here as Table I-2.

For AU 1014E_01, the existing FG allocations were insufficient to cover the increased flow to the AU for this update. To account for this, the total amount exceeded beyond the original FG allocation was added to the total TMDL allocation. This resulted in a change to the overall TMDL allocation for the one AU, which has been updated in Tables I-2 and I-3.

Table I-1 - Change to individual WLAs for the TMDL watershed

Updates Table 45, p. 99-103 in the original TMDL document.

The WLA is expressed in billion most probable number (MPN)/day *Escherichia coli (E. coli*).

State Permit Number	Outfall	EPA Permit Number	AU	Permittee Name	Flow (MGD)	WLA	TMDL Comments
14740-001	001	TX0129071	1014E_01	HARRIS COUNTY MUD 500	0.99	2.361	Increased discharge

Table I-2 - TMDL summary calculations for one AU in the TMDL watershed

Updates Table 53, p. 116-117 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	TMDL	WLA WWTF	WLA SW	LA	MOS	Upstream Load	FG
1014E_01	302.21	74.43	205	22.78	0	0	0.00

Table I-3 - TMDL final calculations

Updates Table 54, p. 118-119 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	TMDL	WLA WWTF	WLA SW	LA TOTAL	MOS
1014E_01	302.21	74.43	205	22.78	0

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 August 11, 2021. EPA approved the TMDLs on February 2, 2022. This document is the first addendum to the original TMDL report.

This first addendum includes information specific to one additional 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*[c] (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 watershed of the original TMDLs, which is located within the Brazos-Colorado Coastal Basin.

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

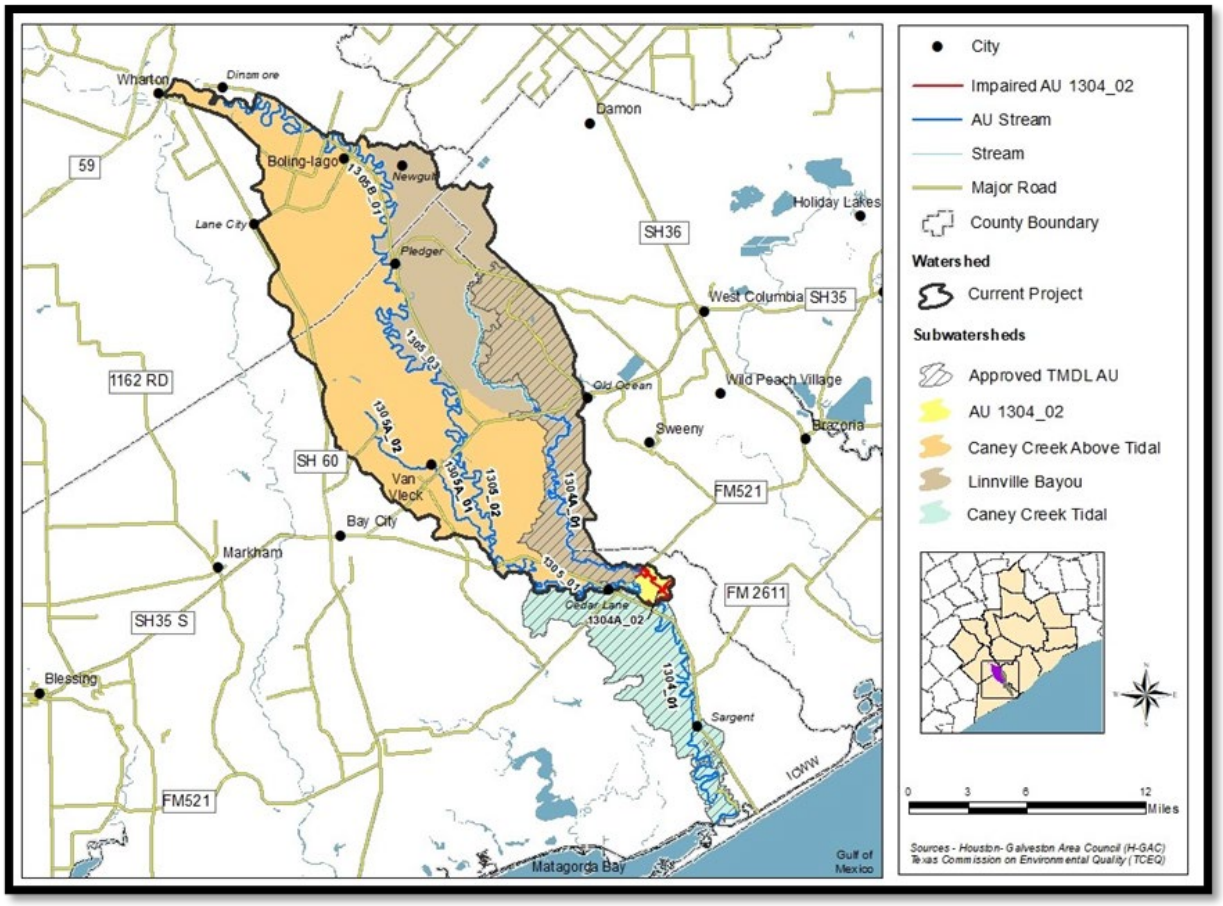

Figure II-1. Map showing the previously approved TMDL watersheds and the Caney Creek Tidal 1304_02 watershed added by this addendum

The TSWQS (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 TSWQS. 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

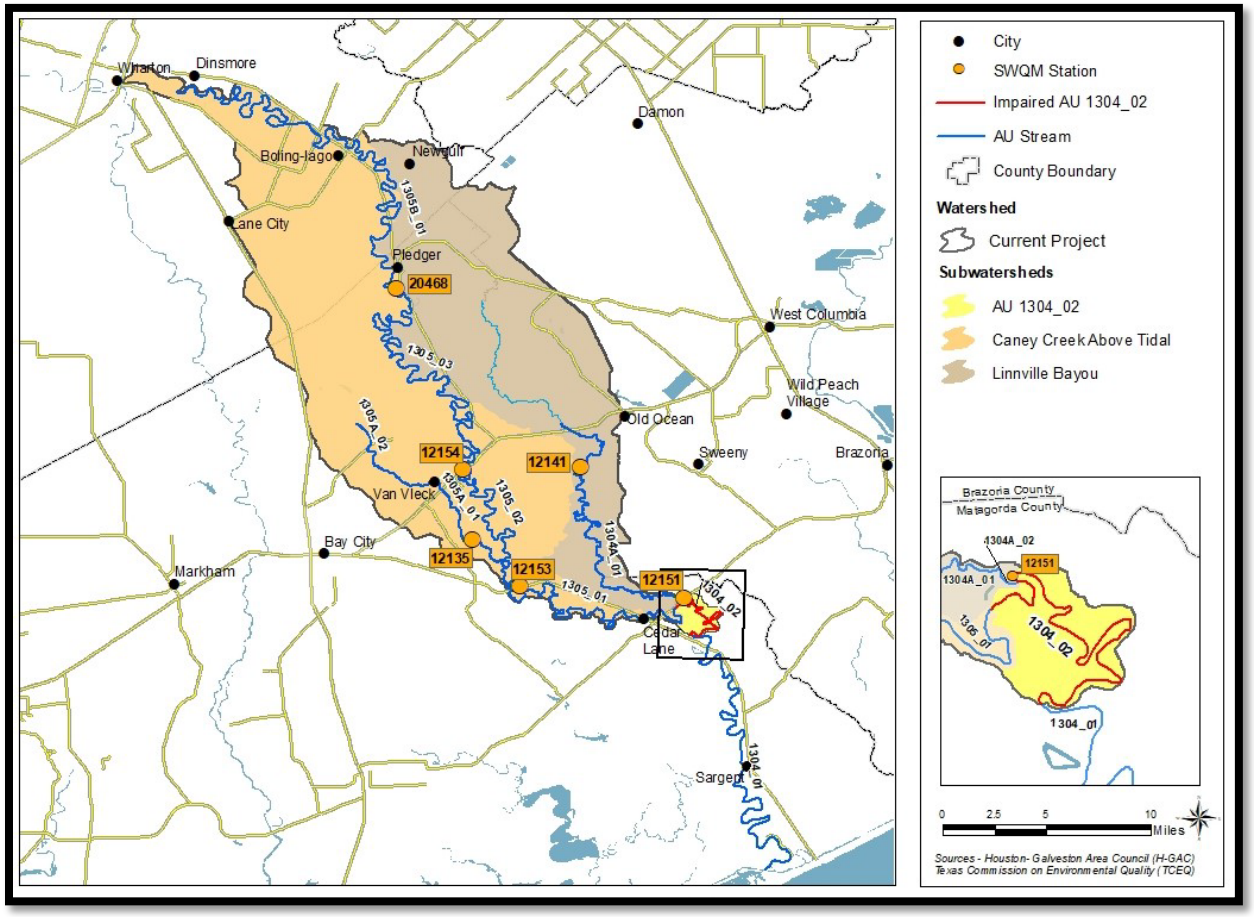

Figure II-2. TMDL watershed showing the TCEQ SWQM station

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 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 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.

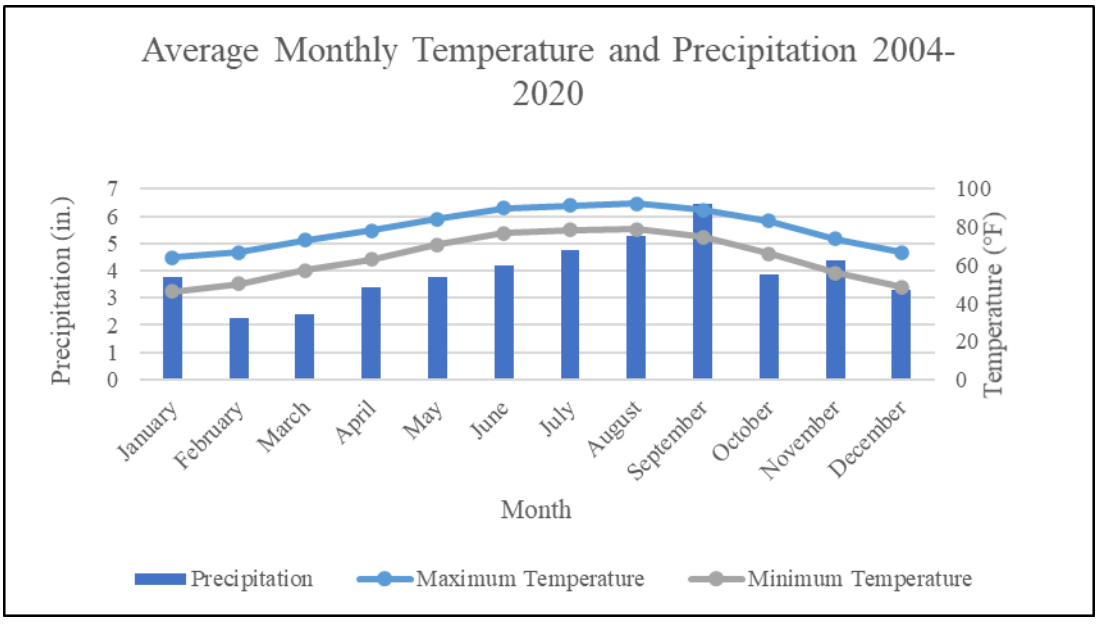

Figure II-3. Average monthly temperature and precipitation (2004-2020) at the City of Freeport

Population and Population Projections

The TMDL watershed is located within portions of Brazoria, Matagorda, and Wharton counties. Based on Houston-Galveston Area Council's (H-GAC's) 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.

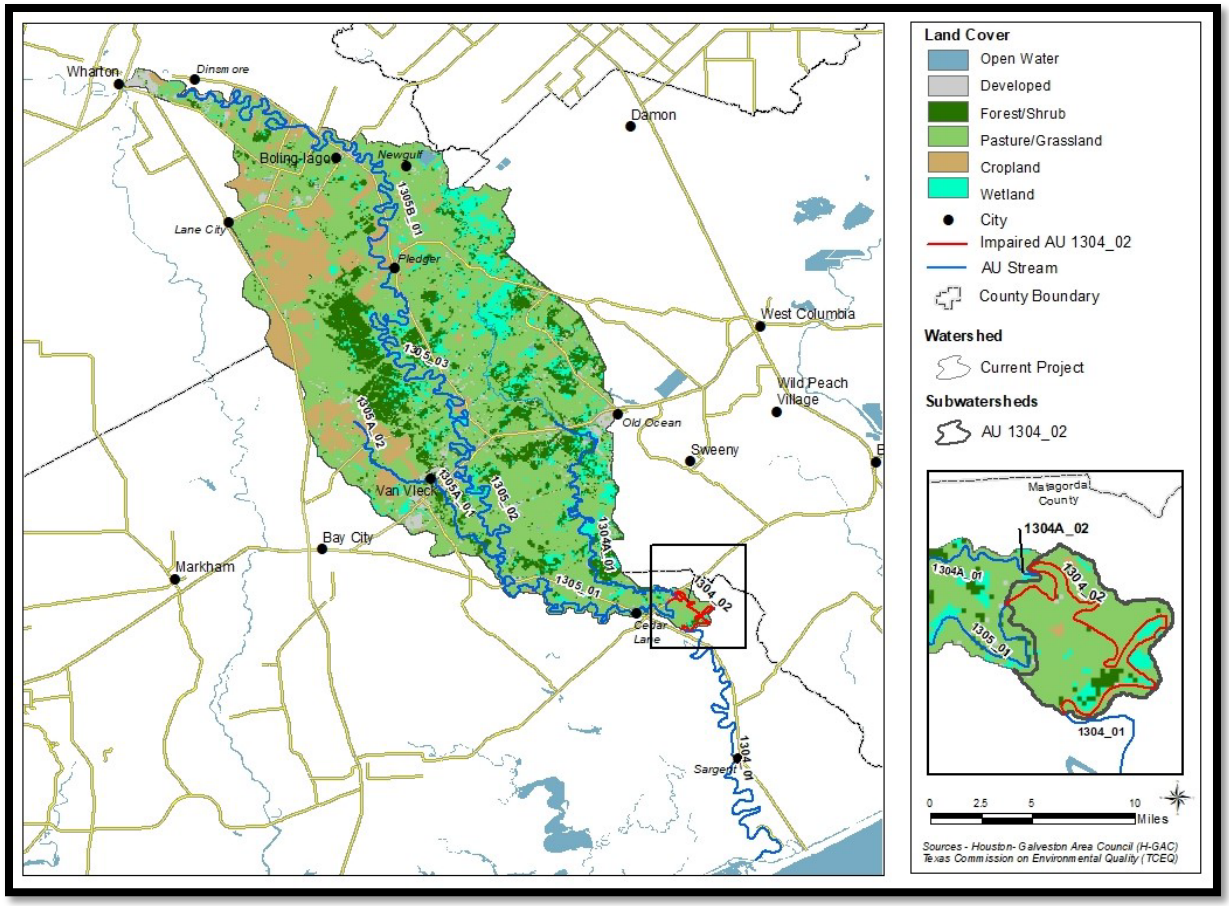

Figure II-4. 2018 land cover

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 TPDES program. 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 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 (*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

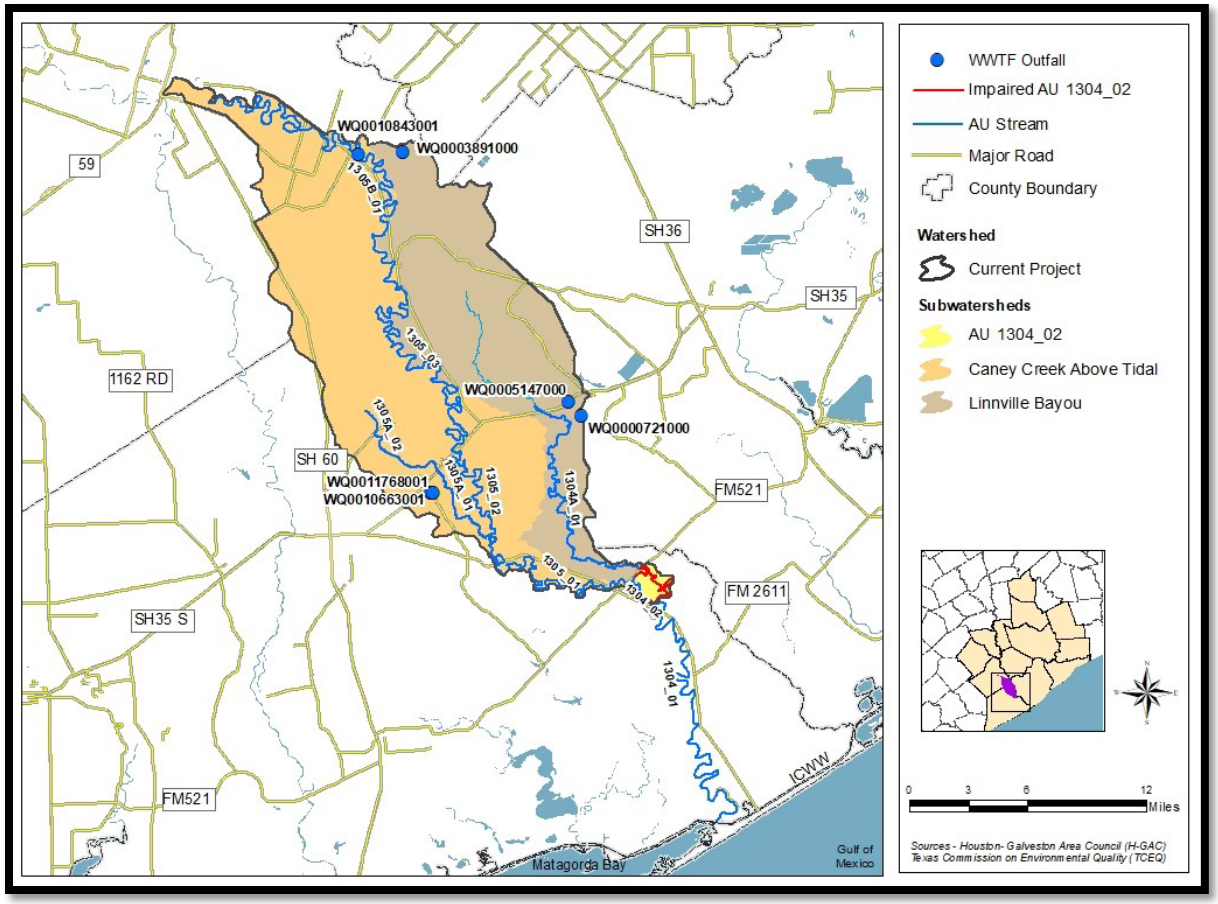

Figure II-5. WWTFs in the TMDL watershed

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 on-site 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 U.S. 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).

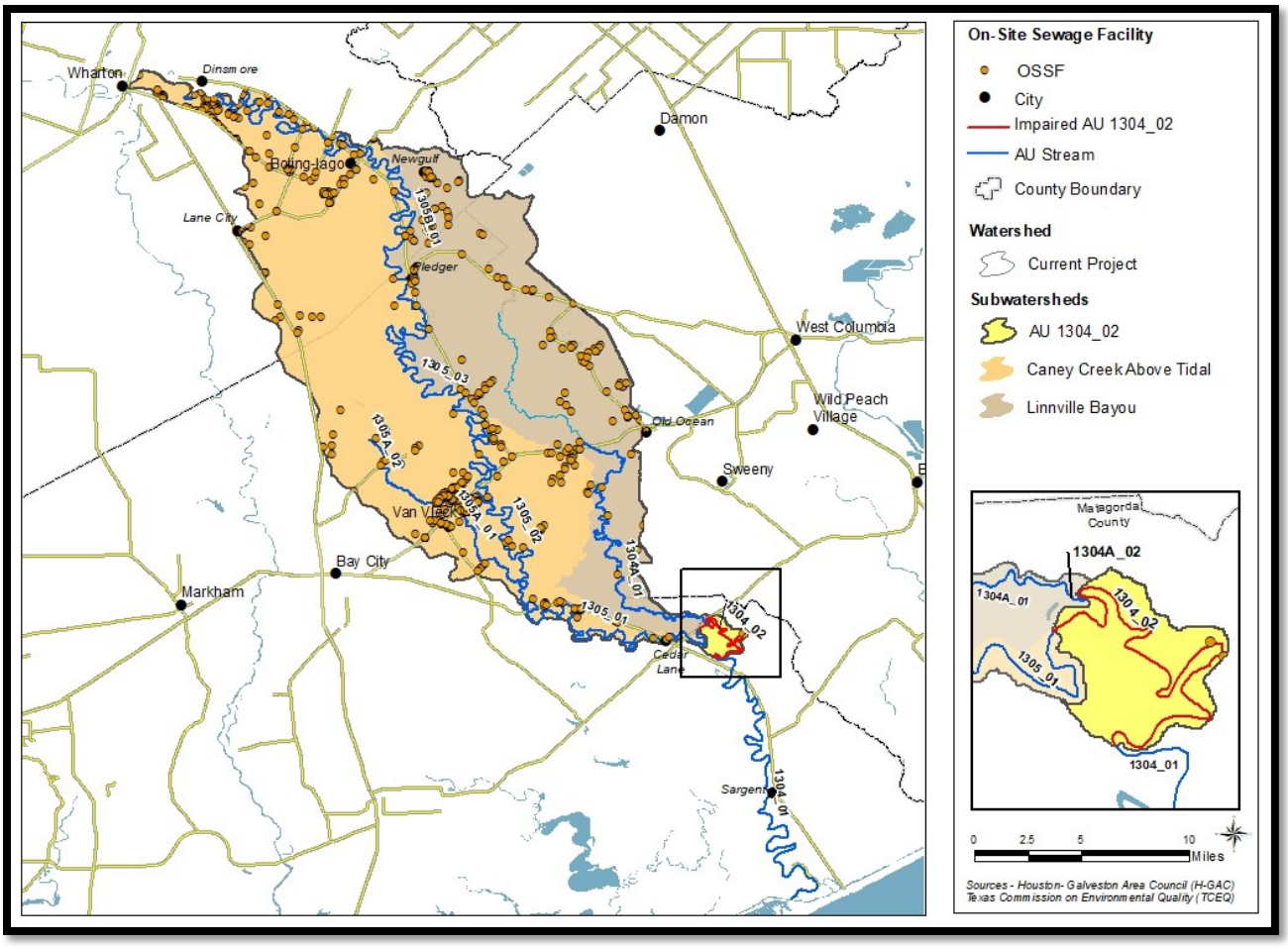

Figure II-6. Documented OSSFs located within the TMDL watershed

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.

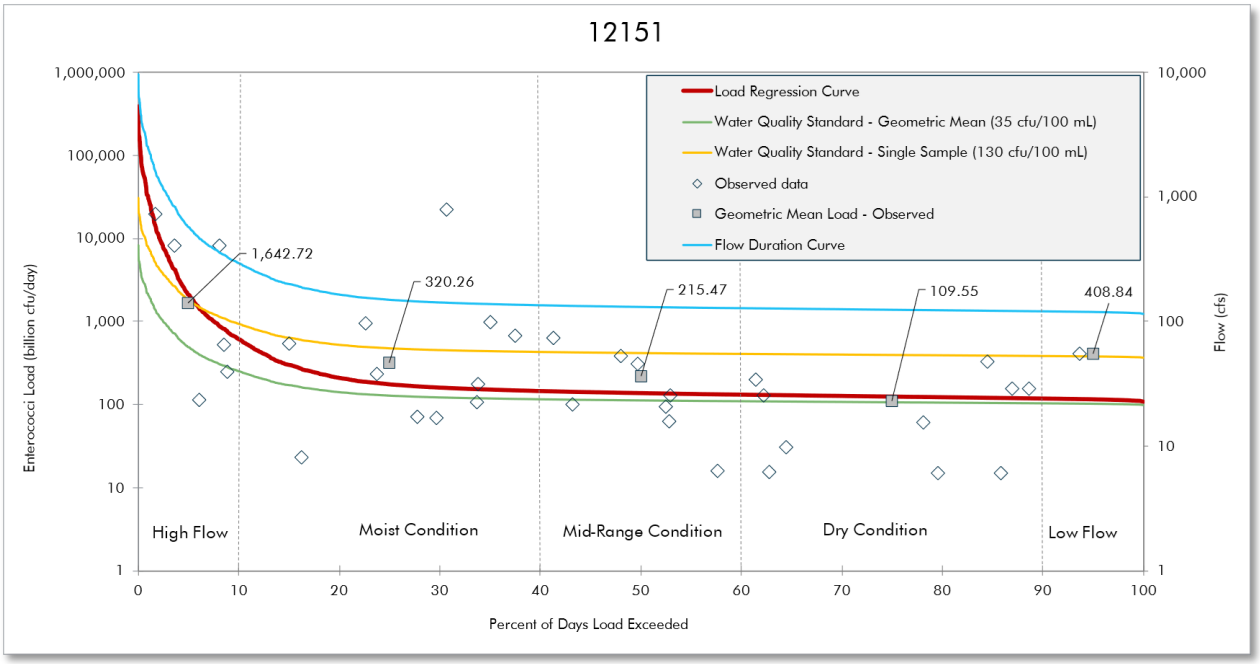

Figure II-7. LDC at SWQM Station 12151

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 November 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 August 24, 2022. The public had an opportunity to comment on this addendum during the public comment period (February 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.[d] Notice of the comment period, along with the document, was also posted on the WQMP Updates webpage.[e] TCEQ accepted public comments on the original TMDL report from February 12 through March 16, 2021. Twelve comments were submitted, and none of them referred directly to the AU in this TMDL addendum.

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

[d] www.tceq.texas.gov/waterquality/tmdl/tmdlnews.html

[e] www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html

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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Appendix III. Addendum One to Four Total Maximum Daily Loads for Indicator Bacteria in Tributaries of the Neches River below Lake Palestine

Adding one TMDL for AU 0604A_03

One TMDL for Indicator Bacteria in Cedar Creek

Introduction

TCEQ adopted *Four Total Maximum Daily Loads for Indicator Bacteria in Tributaries of the Neches River below Lake Palestine* (TCEQ, 2022a) on October 5, 2022. EPA approved the TMDLs on June 7, 2023.

This first addendum includes information specific to one additional AU for indicator bacteria for Cedar Creek (AU 0604A_03; also referred to in this addendum as the TMDL watershed). This AU is located within the watershed of the approved original TMDLs for the Tributaries of the Neches River below Lake Palestine. 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 Total Maximum Daily Load for Indicator Bacteria in Cedar Creek*[f] (Yang and Schramm, 2023). 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 Cedar Creek in the *2022 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (Texas Integrated Report; TCEQ, 2022b), the latest EPA-approved edition. The impaired AU is 0604A_03. The water body includes only three AUs. The downstream AU 0604A_02 was addressed in the original TMDL. Figure III-1 shows the watershed added in this addendum in relation to the entire watershed of the original TMDLs.

[f] www.tceq.texas.gov/downloads/water-quality/tmdl/lufkin-area-watersheds-recreational-118/as-485-118h-cedar_creek_tsd.pdf

The TSWQS (TCEQ, 2022c) 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 TSWQS. *E. coli* are the indicator bacteria for assessing primary contact recreation 1 use in freshwater.

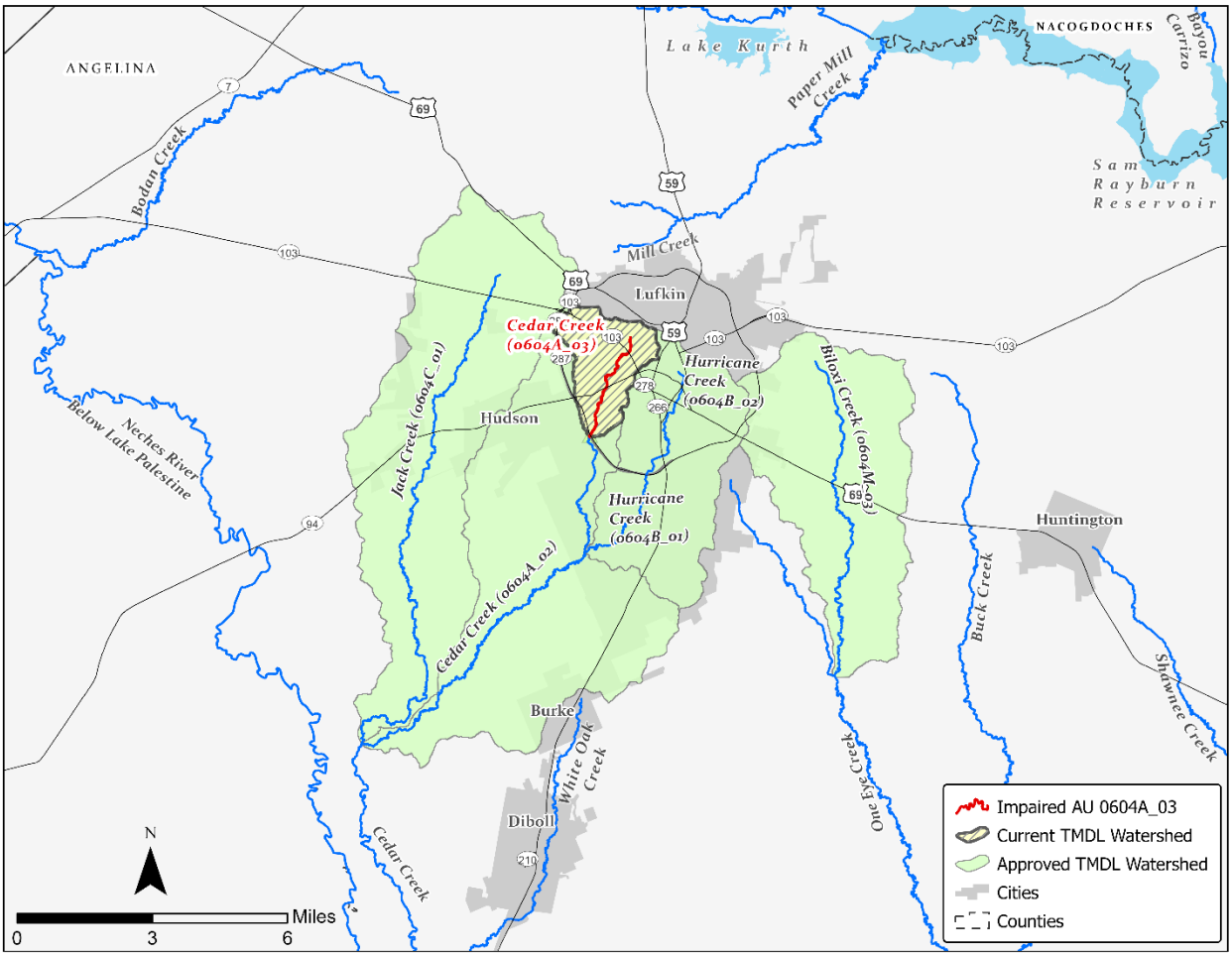

Figure III-1. Map showing the previously approved TMDL watersheds and the Cedar Creek 0604A_03 watershed added by this addendum

Table III-1 summarizes the ambient water quality data for the TCEQ SWQM stations in the water body, as reported in the 2022 Texas Integrated Report. The data from the assessment indicate nonsupport of the primary contact recreation 1 use for the AU, because the geometric mean concentration for *E. coli* exceeds the freshwater geometric mean criterion of 126 cfu/100mL of water. Figure III-2 shows the locations of the TCEQ SWQM stations that were used in evaluating water quality in the 2022 Texas Integrated Report for the water body added by this addendum.

Table III-1. 2022 Texas Integrated Report summary

AU	TCEQ SWQM Station	Parameter	Number of Samples	Date Range	*E. coli* Geometric Mean (cfu/100 mL)
0604A_03	10479 21434	*E. coli*	56	12/01/2013 - 11/30-2020	186.67

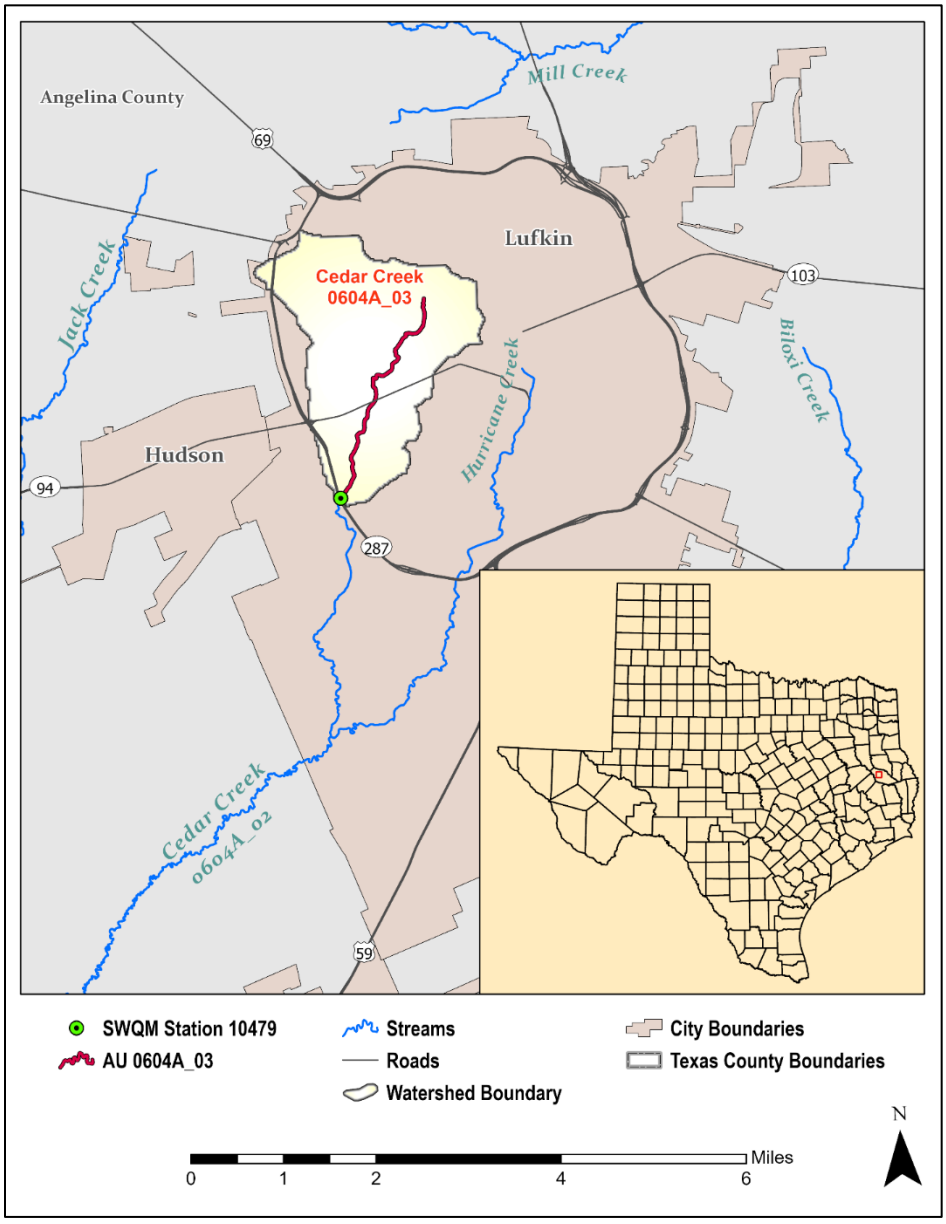

Figure III-2. Active TCEQ SWQM stations

Watershed Overview

The impaired AU (0604A_03) is almost entirely located within the City of Lufkin in Angelina County and measures about 2.79 miles in length. The total area of the Cedar Creek watershed is around 2,509 acres.

The 2022 Texas Integrated Report (TCEQ, 2022b) has the following water body and AU descriptions:

- Cedar Creek – From the confluence of the Neches River southwest of Lufkin in Angelina County to the upstream perennial portion of the stream in Lufkin in Angelina County.
    - AU 0604A_03 – From the confluence with unnamed tributary adjacent to State Highway Loop 287 upstream to headwaters near Hoo Hoo Ave in the City of Lufkin.

Climate

The TMDL watershed is in east Texas primarily under the impact of humid subtropical with hot summers based on the Köppen-Geiger climate classification. Precipitation and temperature data were acquired from the NOAA National Climatic Data Center database for January 2002 – December 2021. The nearest weather station to the TMDL watershed is USW00093987 located in the Angelina County Airport (NOAA, 2022). As shown in Figure III-3, monthly low temperatures ranged between 37.3°F (January) and 72.6°F (July); meanwhile, monthly high temperatures ranged between 60.6°F (January) and 94.5°F (August). Mean precipitation ranged between 3.53 inches (August) and 5.75 inches (May).

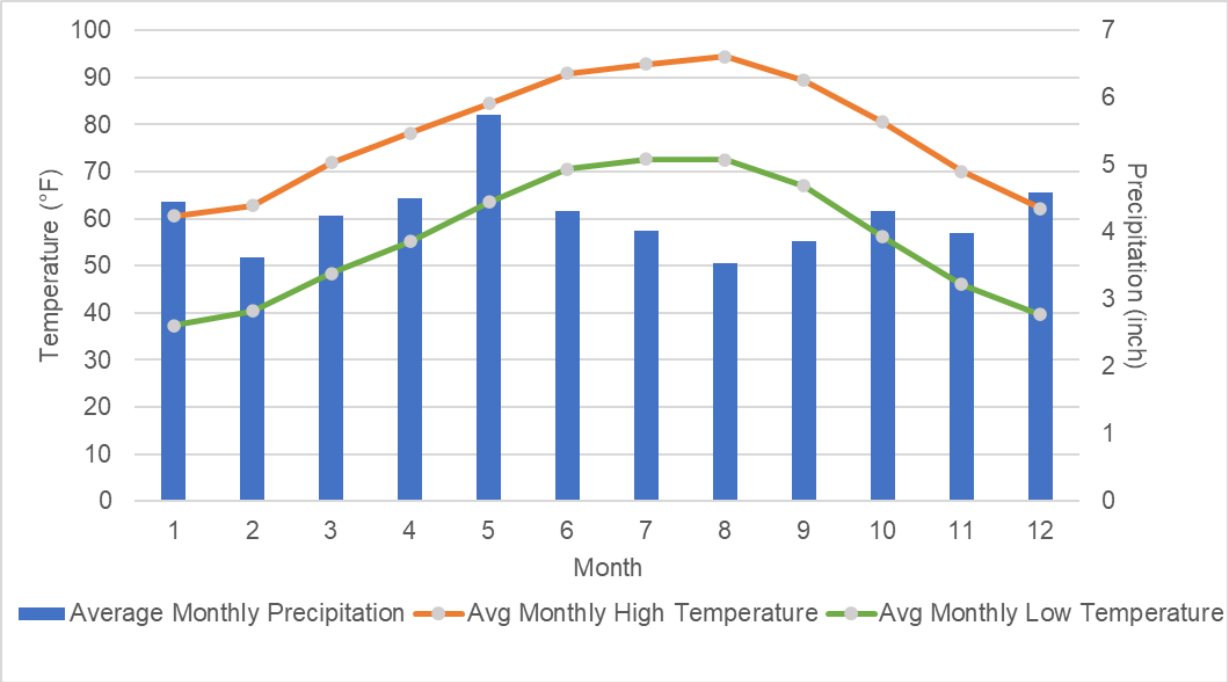

Figure III-3. Average monthly temperature and precipitation (2002–2021) at weather station USW00093987

Population and Population Projections

The TMDL watershed is located within Angelina County. Watershed population estimates were developed using the USCB 2020 census blocks data (USCB, 2020). Using the methodology described later in this section, the population of the TMDL watershed in 2020 was estimated to be 4,784.

A population projection through 2070 was developed using data from the TWDB (2019) to be consistent with the original TMDLs. Table III-2 provides a summary of the population projection for the added TMDL watershed.

Table III-2. 2020 – 2070 population projection

Area	2020 Estimated Population	2070 Projected Population	Projected Population Increase	Percent Change
Cedar Creek AU 0604A_03	4,784	6,089	1,305	27.28%

The following steps detail the method used to estimate the 2020 and projected 2070 populations in the TMDL watershed.

1. The 2020 USCB block level population data was obtained for Angelina County.
2. The 2020 watershed population was estimated by adding the total population of the census blocks located entirely within the watershed.

3. For the census blocks partially located in the watershed, the block population was determined by multiplying the total block population by the proportion of the block area within the watershed. This was added to the population estimate from step 2.
4. Decadal population projections for Angelina County between 2020-2070 were obtained from the TWDB county population projections dataset (TWDB, 2019).
5. Projected decadal population percentage increases in Angelina County were calculated for each decade between 2020-2070.
6. The county level projected population percentage increases calculated in Step 5 were added to the 2020 watershed population determined in steps 1-3 to obtain population projections for the TMDL watershed.

Land Cover

The land cover data for the TMDL watershed were obtained from the U.S. Geological Survey 2019 National Land Cover Database (NLCD; USGS, 2021) The land cover for the addendum TMDL watershed is shown in Figure III-4. A summary of the land cover data is provided in Table III-3 and indicates that the addendum TMDL watershed is mostly developed (79.45%) with some Mixed Forests (8.09%) and Evergreen Forests (7.84%).

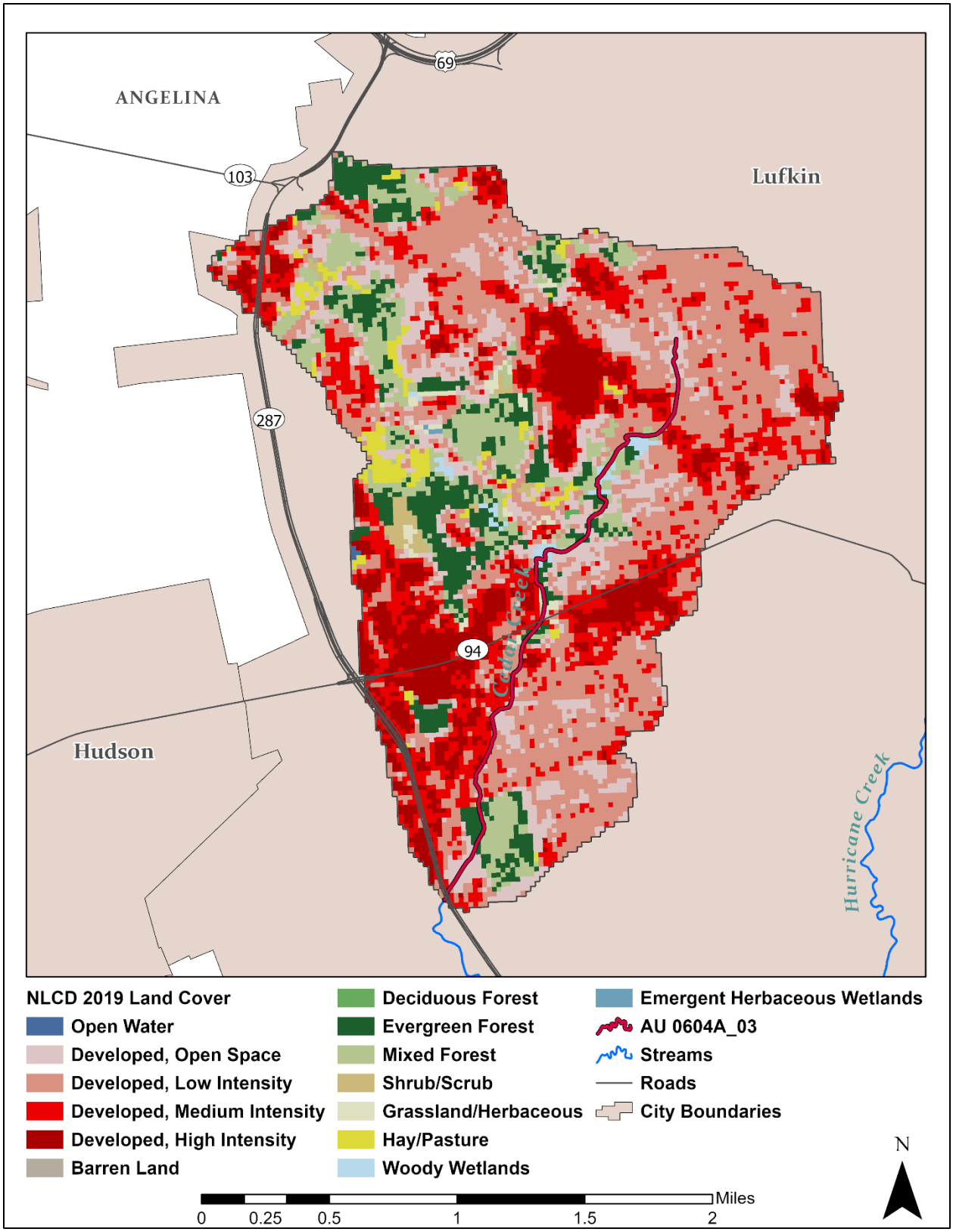

Figure III-4. Land cover map showing classifications

Table III-3. Land cover classification by area and percentage

NLCD 2019 Land Classification	Area (Acres)	% of Total
Open Water	0.89	0.04%
Developed, Open Space	322.02	12.84%
Developed, Low Intensity	891.77	35.55%
Developed, Medium Intensity	462.34	18.43%
Developed, High Intensity	316.90	12.63%
Barren Land	2.89	0.12%
Deciduous Forest	0.89	0.04%
Evergreen Forest	196.59	7.84%
Mixed Forest	203.04	8.09%
Shrub/Scrub	18.24	0.73%
Grassland/Herbaceous	19.35	0.77%
Pasture/Hay	56.49	2.25%
Woody Wetlands	16.46	0.66%
Emergent Herbaceous Wetlands	0.89	0.04%
Total	2,508.76	100%

Endpoint Identification

The endpoint for the TMDL is to maintain the concentration of *E. coli* below the geometric mean criterion of 126 cfu/100 mL, which is protective of the primary contact recreation 1 use in freshwater.

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 TPDES program. 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 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 SSOs, stormwater discharge from industrial and regulated sites and other miscellaneous sources.

Domestic and Industrial WWTFs

As of November 2022, there were no WWTFs with TPDES permits within the TMDL watershed (TCEQ, 2022d; EPA, 2022).

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, 2022e) in the TMDL watershed as of November 2022, found one general permit authorization for a concrete production facility. This facility, however, does not have bacteria reporting requirements or limits in its permit; therefore, it is assumed to contain inconsequential amounts of indicator bacteria in the effluent. Therefore, it was considered unnecessary to allocate bacteria loads to this facility. There are no other active general wastewater permit authorizations found in the TMDL watershed.

Sanitary Sewer Overflows

A summary of SSO incidents that occurred during a six-year period from 2016 through 2022 in TMDL watershed was obtained from TCEQ Central Office in Austin. The summary data indicated four SSO incidents had been reported within the TMDL watershed. The SSOs had a total discharge of 2,501 gallons with a minimum of one gallon and a maximum of 1,500 gallons.

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 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 –MSGP for industrial facilities
- TXR150000 – 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, 2022e) in the TMDL watershed as of December 2021, found five active MSGP authorizations and two CGP authorizations within the watershed. There are currently no Phase I MS4 permits or Phase II MS4 authorizations within the TMDL watershed.

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.

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 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 but are considered to have a minimal impact given how developed the TMDL watershed is.

Table III-4 provides estimated numbers of selected livestock in the watershed based on the 2017 Census of Agriculture conducted by U.S. Department of Agriculture (USDA, 2019). The county-level estimated livestock populations were reviewed by Texas State Soil and Water Conservation Board (TSSWCB) staff and were distributed based on Geographic Information System (GIS) calculations of pastureland in the watershed, based on the 2019 NLCD (NLCD, 2019). These livestock numbers, however, were not used to develop an allocation of allowable bacteria loading to livestock.

Table III-4. Estimated livestock populations

AU	Cattle and Calves	Hogs and Pigs	Goats and Sheep	Horses
0604A_03	15	0	2	2

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 III-5 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 2020 Census data (USCB, 2020). The actual contribution and significance of bacteria loads from pets reaching the TMDL watershed is unknown.

Table III-5. Estimated households and pet population

Estimated Households	Estimated Dog Population	Estimated Cat Population
2,136	1,312	976

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, AgriLife Extension estimates one hog per 39 acres as a statewide average density for feral hogs (Timmons et.al., 2012). Suitable habitats for feral hogs include the

following: Hay/Pasture, Shrub/Scrub, Grassland/Herbaceous, Deciduous Forest, Evergreen Forest, Mixed Forest, Woody Wetlands, and Emergent Herbaceous Wetlands defined in NLCD (2019). The estimated feral hog density was applied to the area suitable (511.95 acres) for feral hog habitat which estimated that there are approximately 13 feral hogs in the watershed.

For deer, TPWD provided deer population density estimates by Resource Management Unit (RMU) and Ecoregion in the state (TPWD, 2020). The TMDL watershed lies entirely in RMU 14 with an average deer density of 20.98 deer per 1,000 acres over the period 2005 through 2018 (TPWD, 2020). Applying this value to the suitable habitat area (511.95 acres) of the TMDL watershed estimates that there are approximately 11 deer within the watershed. The *E. coli* contribution from feral hogs and wildlife in the TMDL watershed could not be determined based on existing information.

On-site Sewage Facilities

Failing OSSFs were not considered a major source of bacteria loading in the TMDL watershed because the entire watershed area is served by a wastewater collection and treatment system. Estimates of the number of OSSFs in the TMDL watershed were determined using GIS datasets, including 911 addresses (TNRIS, 2021), city boundaries, Certificates of Convenience and Necessity (CCN) boundaries (PUC, 2017), and aerial imagery. Address data points located outside of the city and CCN boundaries were manually examined on the aerial imagery to determine whether they were located on residential buildings or businesses, which were assumed to have been equipped with OSSFs. Data from these sources indicated that there may not be any OSSFs within the TMDL watershed, as the watershed completely lies within the city limit of Lufkin and is almost completely within the CCN boundary except for its northwestern corner near State Loop 287, which is approximately 11 acres or 0.4% of the watershed.

Linkage Analysis

The 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. The technical support document for this addendum (Yang and Schramm, 2023) provides details about the linkage analysis along with the LDC method and its application.

The *E. coli* event data plotted on the LDC for TCEQ SWQM Station 10479 in Figure III-5 show exceedances of the geometric mean criterion have occurred regardless of streamflow conditions. However, bacteria loads were the most elevated under high-flow and the upper end of moist conditions. Meanwhile, under other flow conditions, most bacteria loads were not significantly above the geometric mean criterion and some loads were below the criterion. The allowable load at the single sample criterion (399 cfu/100 mL) is included on the LDC for comparison with individual *E. coli* samples, although it is not used for assessment or allocation purposes.

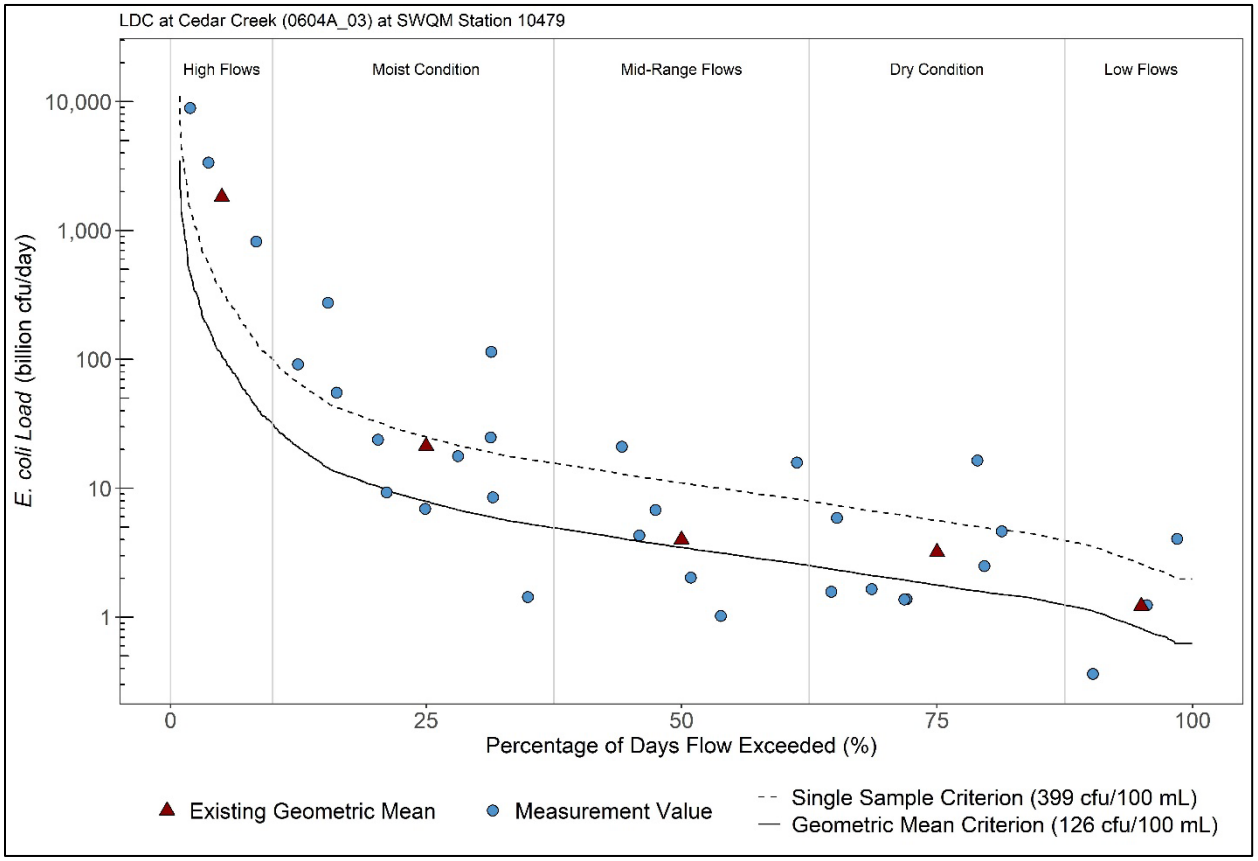

Figure III-5. LDC for TCEQ SWQM Station 10479

Margin of Safety

The 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 Cedar Creek was derived using the median flow within the high flow regime (or 5% load duration exceedance) of the LDC developed for TCEQ SWQM Station 10479. This station represents the location within the TMDL watershed where an adequate number of *E. coli* samples were 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 (126 cfu/100 mL for *E. coli*). Due to the absence of any permitted dischargers in the TMDL watershed, the WLA_{WWTF} component is zero.

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 MSGP authorizations (30.345 acres), and CGP authorizations (11.300 acres) were estimated by importing location information into GIS and measuring the estimated disturbed area from available aerial imagery. The percentage of land under the jurisdiction of stormwater permits (a total of 41.645 acres) in the TMDL watershed is 1.66%.

Load Allocation

The 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 the population projections for the entire TMDL watershed. Due to the absence of any WWTFs in the TMDL watershed, the FG component considers the potential construction of a new WWTF. New WWTFs are to be designed for a daily wastewater flow of 75-100 gallons per capita per day [gpcd; 30 TAC 217.32(a)]. Conservatively taking the higher daily wastewater flow capacity (100 gpcd) and multiplying it by a potential population change gives an FG flow. Based on the information in Table III-2, the projected population change within the TMDL watershed for the time period 2020-2070 is 1,305. Multiplying the projected population growth by the higher daily wastewater flow capacity yields a value of 0.131 MGD, or 0.622 billion cfu/day of *E. coli*. This value would be considered the full permitted discharge of a potential future WWTF.

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 III-6 summarizes the TMDL calculations for the TMDL watershed. The TMDL was calculated based on the median flow in the 90-percentile range (5% exceedance, high flow regime) from the LDC developed for TCEQ SWQM Station 10479. Allocations are based on the current geometric mean criterion for *E. coli* of 126 cfu/100 mL for each component of the TMDL.

Table III-6. TMDL allocation summary

All loads expressed as billion cfu/day *E. coli*

Water Body	AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA	FG
Cedar Creek	0604A_03	95.705	4.785	0	1.499	88.799	0.622

The final TMDL allocations (Table III-7) needed to comply with federal requirements include the FG component within the WLA_{WWTF} (40 CFR Section 103.7).

Table III-7. Final TMDL allocation

All loads expressed as billion cfu/day *E. coli*

Water Body	AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA
Cedar Creek	0604A_03	95.705	4.785	0.622	1.499	88.799

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 *E. coli* concentrations obtained from eight years (2013 – 2021) 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 *E. coli* 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 *E. coli* data indicated that there was no significant difference (α=0.05) in indicator bacteria between cool and warm weather seasons for Cedar Creek. Seasonal variation was also addressed by using all available flow and indicator bacteria 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 (Yang and Schramm, 2023) was published on the TCEQ website on December 12, 2023. Project staff presented information about this addendum at the Angelina & Neches River Authority's Clean Rivers Program meeting on June 21, 2023. The public had an opportunity to comment on this addendum during the public comment period (February 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.[g] Notice of the comment period, along with the document, was also posted on the WQMP Updates webpage.[h] TCEQ accepted public comments on the original TMDL report from March 25, 2022 through April 25, 2022. No comments were submitted.

Implementation and Reasonable Assurance

The water body covered by this addendum is within the existing bacteria TMDL watershed for the Tributaries of the Neches River below Lake Palestine. That TMDL watershed, including Cedar Creek, is within the area covered by the I-Plan developed by stakeholders for the TMDL watershed, which was approved by the Commission on August 16, 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.

[g] www.tceq.texas.gov/waterquality/tmdl/tmdlnews.html

[h] www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html

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Appendix IV. Updates to Fifteen TMDLs for Indicator Bacteria in Watersheds Upstream of Lake Houston

Segments 1004E, 1008, 1008H, 1009, 1009C, 1009D, 1009E, 1010, and 1011

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Watersheds Upstream of Lake Houston.

The report, *Fifteen Total Maximum Daily Loads for Indicator Bacteria in Watersheds Upstream of Lake Houston for Segment Numbers 1004E, 1008, 1008H, 1009, 1009C, 1009D, 1009E, 1010, and 1011*, was adopted by TCEQ on April 6, 2011 and approved by EPA on June 29, 2011. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated 44 times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. Additionally, TCEQ submitted four addenda to the original TMDL in the October 2013, October 2019, October 2020, and April 2022 WQMP updates. These addenda added 10 new AUs to the original TMDL project.

The purpose of this update is to make the following changes to the TMDL (presented in Table IV-1):

- Add three new permits.
- Remove one expired permit.

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in nine AUs. This was originally presented in Table 18 in the original TMDL document. The nine affected AUs in this update are included here as Table IV-2.

For AUs 1009_02, 1009E_01, 1010_02, and 1010_04, the existing FG allocations were insufficient to cover the increased flow to the AUs for this update. To account for this, the total amount exceeded beyond the original FG allocation was added to the total TMDL allocation for each AU. These changes in flow resulted in a change to the overall TMDL allocation for all four AUs, which have been updated in Tables IV-2 and IV-3. The overall numbers for the other AUs did not change and did not result in a change to the overall TMDL allocations.

Table IV-1 - Changes to individual WLAs for the TMDL watershed

Updates Table 16, p. 49-56 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	Outfall	EPA Permit Number	AU	Permittee Name	Flow (MGD)	WLA	TMDL Comments
15297-001	001	TX0135771	1008_03	GOSLING OFFICE PARK, LLC	N/A	N/A	Expired permit
12600-002	001	TX0145238	1009C_01	ELITE COMPUTER CONSULTANTS, L.P.	0.008	0.019	New permit replacing expired permit 12600-001
16419-001	001	TX0145190	1009E_01	THE MIKE A. MYERS FOUNDATION	0.08	0.191	New permit
16410-001	001	TX0145084	1010_02	Texas Water Utilities, L.P.	0.17	0.405	New permit

Table IV-2 - TMDL summary calculations for nine AUs in the TMDL watershed

Updates Table 18, p. 61 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Sampling Location	Segment Name	TMDL	WLA WWTF	WLA SW	LA	MOS	FG
1008_03	11313	Spring Creek	1420	142.31	322	869	70.9	15.79
1008_04	11312	Spring Creek	1510	177.98	334	902	75.7	20.32
1009_02	11331	Cypress Creek	614.32	117.52	196	270	30.8	0.00
1009_03	11328	Cypress Creek	1340	201.30	415	574	67.0	82.70
1009_04	11324	Cypress Creek	1550	240.63	469	648	77.4	114.97
1009C_01	17496	Faulkey Gully	35.3	16.81	9.44	2.98	1.76	4.31
1009E_01	14159	Little Cypress Creek	92.72	23.60	16.14	48.42	4.56	0.00
1010_02	14241	Caney Creek	248.60	5.50	30	200.8	12.3	0.00
1010_04	11334	Caney Creek	498.34	32.44	57.4	383.8	24.7	0.00

Table IV-3 - TMDL final calculations

Updates Table 19, p. 62 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	TMDL	WLA $_{WWTF}$	WLA $_{SW}$	LA $_{TOTAL}$	MOS
1009_02	614.32	117.52	196	270	30.8
1009E_01	92.72	23.60	16.14	48.42	4.56
1010_02	248.60	5.50	30	200.8	12.3
1010_04	498.34	32.44	57.4	383.8	24.7

In addition, Table IV-4 below provides an update to Table VII-8 found in the April 2022 addendum to this TMDL project (*Addendum Four to Fifteen Total Maximum Daily Loads for Indicator Bacteria in Watersheds Upstream of Lake Houston: One Total Maximum Daily Load for Indicator Bacteria in Caney Creek For AU 1010_03*). One of the permits discussed earlier in this update also affects one AU in this addendum.

Table IV-5 below provides updates to Table VII-9 found in the April 2022 addendum to this TMDL project. The addendum added one AU that was not included in the original TMDL. The AU here (1010_03) was included as it is affected by the upstream loading from 1010_02 in the original TMDL. One of the permits (16410-001/ TX0145084) affects the loading of 1010_03 as well as the original TMDL AU 1010_02.

In Table VII-10 of the April 2022 TMDL addendum, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for FG within the single affected AU. Therefore, these overall numbers did not change, and Table VII-10 of the TMDL addendum remains the same.

Table IV-4 - Changes to individual WLAs in the Caney Creek watershed

Updates Table VII-8, p. 20-21 in the TMDL addendum document.

The WLA is expressed in billion cfu/day *E. coli*.

State Permit Number	Outfall	EPA Permit Number	AU	Permittee Name	Flow (MGD)	WLA	TMDL Comments
16318-001	001	TX0144321	1010_03	UNDINE ENVIRONMENTAL TEXAS LLC	0.24	0.572	New permit

Table IV-5 - TMDL summary calculations for one AU in the Caney Creek watershed

Updates Table VII-9, p. 22 in the TMDL addendum document.

All loads expressed as billion cfu/day *E. coli*.

Water Body	AU	TMDL	MOS	WLA WWTF	WLA SW	LA	FG
Caney Creek	1010_03	237.441	11.872	8.82	12.977	188.219	15.55

Appendix V. Addendum Two to Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers

Adding one TMDL for AU 2004B_01

One TMDL for Indicator Bacteria in Poesta Creek

Introduction

TCEQ adopted *Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers* (TCEQ, 2016) on May 25, 2016. EPA approved the TMDLs on August 9, 2016. An addendum to the original TMDLs was submitted to EPA through the October 2017 WQMP update (TCEQ, 2017). That addendum added two additional AUs. This document is the second addendum to the original TMDL report.

This second addendum includes information specific to one additional AU for indicator bacteria for Poesta Creek (AU 2004B_01). This AU is located within the watershed of the approved original TMDLs for the Mission and Aransas Rivers. 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 Total Maximum Daily Load for Indicator Bacteria in Poesta Creek*[i] (Jain and Schramm, 2023). 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 Poesta Creek AU 2004B_02 in the *2022 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (Texas Integrated Report; TCEQ, 2022a), the latest EPA-approved edition. The water body includes only two AUs. The upstream AU 2004B_02 was addressed in the first addendum. Figure V-1 shows the watershed added in this

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

addendum in relation to the entire watershed of the original TMDLs, and also includes the watershed from the first addendum.

The TSWQS (TCEQ, 2022b) identifies 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 TSWQS. *E. coli* are the indicator bacteria for assessing primary contact recreation 1 use in freshwater.

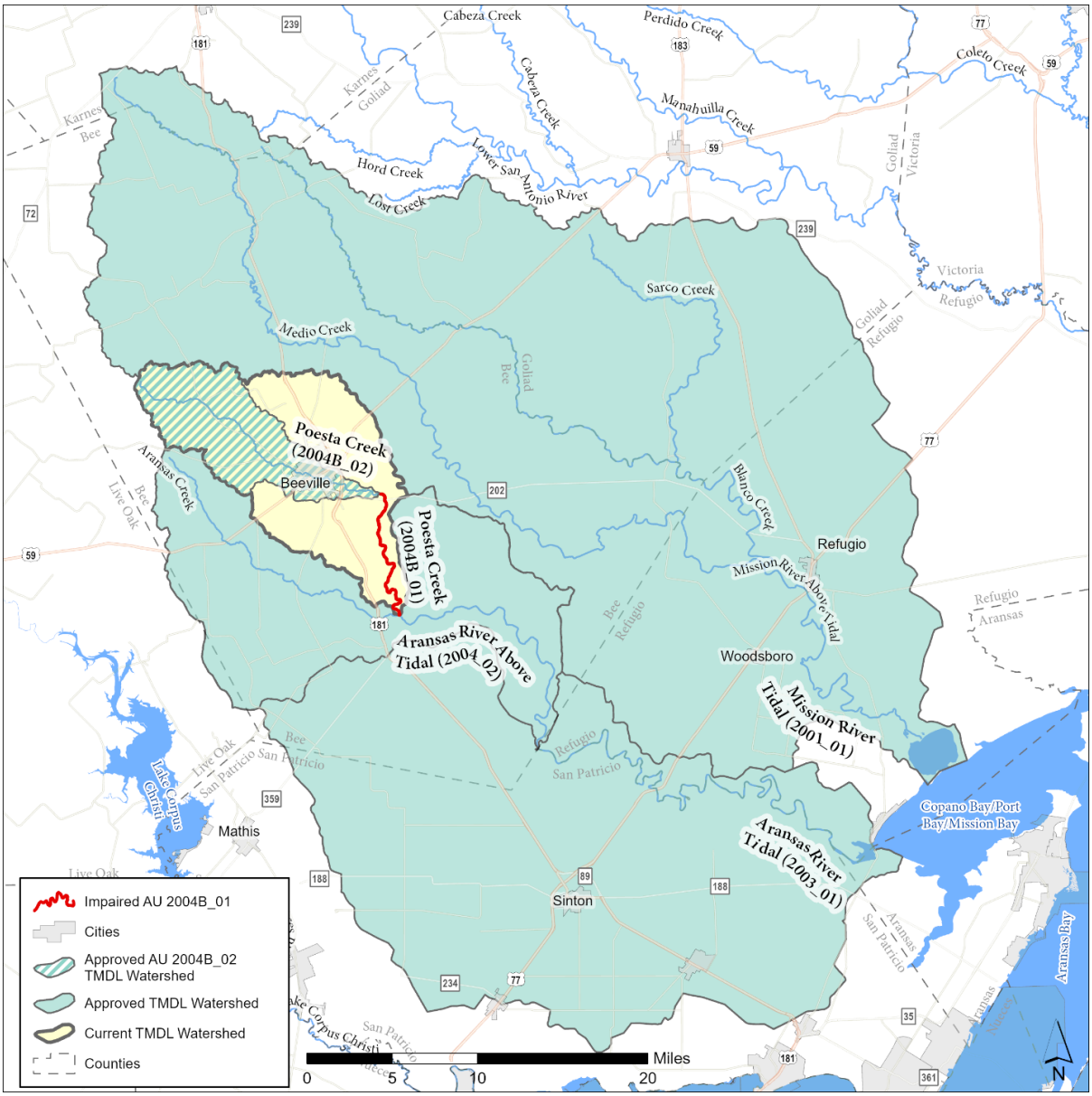

Figure V-1. Map showing the previously approved TMDL watersheds and the Poesta Creek 2004B_01 watershed added by this addendum

Table V-1 summarizes the ambient water quality data for the TCEQ SWQM station in the water body, as reported in the 2022 Texas Integrated Report. The data from the assessment indicate nonsupport of the primary contact recreation 1 use for the AU, because the geometric mean concentration for *E. coli* exceeds the freshwater geometric mean criterion of 126 cfu/100 mL of water. Figure V-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 V-1. 2022 Texas Integrated Report summary

AU	TCEQ SWQM Station	Parameter	Number of Samples	Date Range	*E. coli* Geometric Mean (cfu/100 mL)
2004B_01	12937	*E. coli*	21	12/01/13 – 11/30/20	269.79

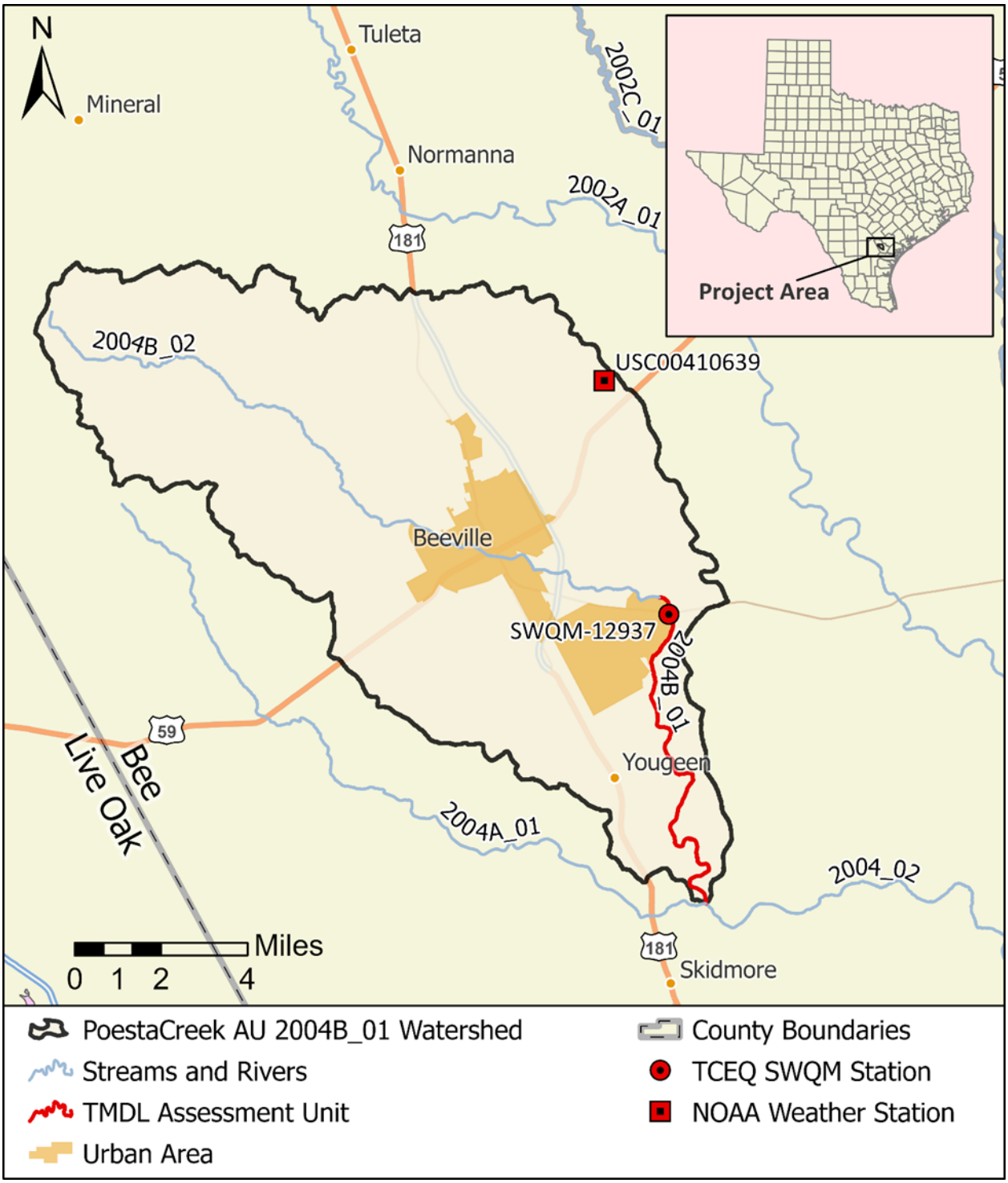

Figure V-2. Active TCEQ SWQM station

Watershed Overview

Poesta Creek runs from northwest of Beeville and flows approximately 28.73 miles southeast to Aransas River Above Tidal (AU 2004_02). It consists of a single segment (2004B) and two AUs (2004B_01 and 2004B_02). This document will consider the

contact recreation use impairment of the downstream AU of Poesta Creek (2004B_01). The drainage area for AU 2004B_01, including the contributing area from upstream AU 2004B_02, is 123.06 square miles (78,765.53 acres) and is located entirely in Bee County. The 2004b_01 watershed along with the upstream catchment area of 2004B_02 will be referred to in this addendum as the TMDL watershed or the Poesta Creek watershed.

The 2022 Texas Integrated Report has the following water body and AU descriptions:

- Poesta Creek (Segment 2004B) – From the confluence with the Aransas River to the headwaters of the stream about 7.5 kilometers upstream of Farm-to-Market Road 673.
    - AU 2004B_01 – From the confluence of the Aransas River to the confluence of Talpacate Creek.
    - AU 2004B_02 – From the confluence with Talpacate Creek to the headwaters of the stream approximately 7.5 kilometers upstream of Farm-to-Market Road 673.

Climate

Regional precipitation and temperature data were obtained from the NOAA National Climatic Data Center database. The precipitation and temperature data were obtained from the Beeville 5 NE, TX weather station (USC00410639) for a 15-year period from 2008 through 2022 (NOAA, 2023). The highest average monthly precipitation is observed in September at 4.02 inches and the lowest monthly precipitation is observed in February at 1.17 inches (Figure V-3). The highest observed monthly maximum temperatures occur in August (96.52 °F) and the lowest average monthly minimum temperatures occur in January (42.59 °F). The mean annual recorded precipitation within the 15-year period between 2008-2022 was 30.28 inches.

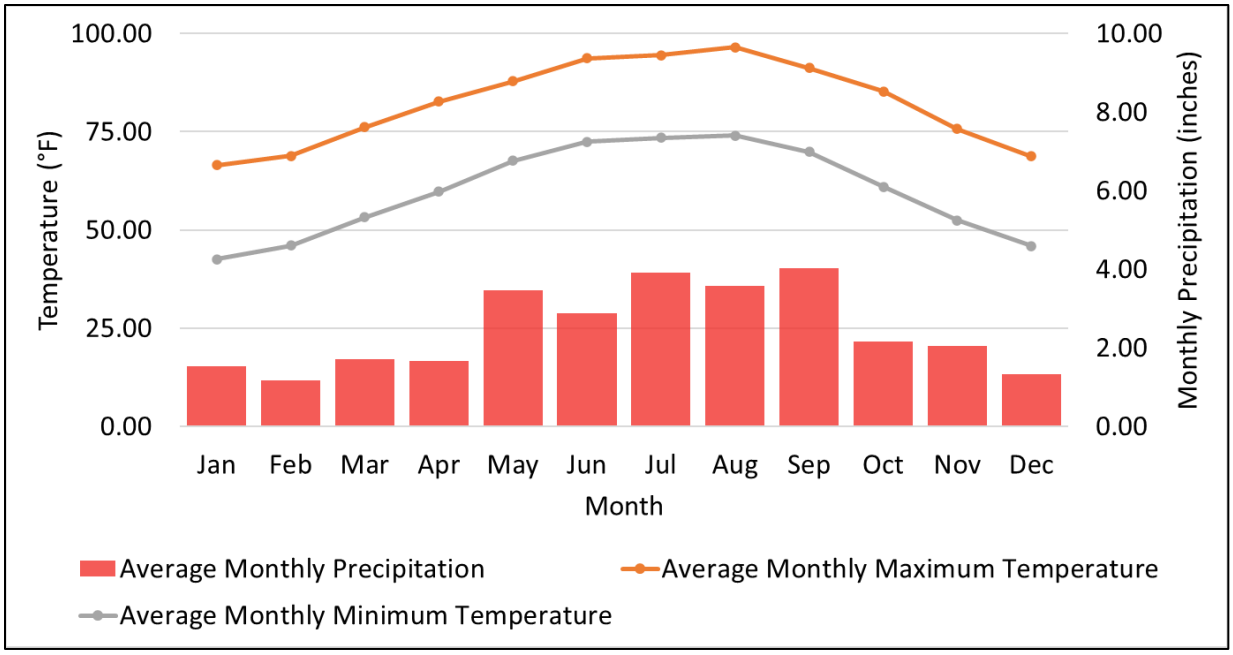

Figure V-3. Average monthly temperature and precipitation (2008-2022) at the Beeville 5 NE, TX station USC00410639 weather station

Population and Population Projections

The TMDL watershed is located within Bee County. Current predominant population densities for this watershed are mostly around the City of Beeville. Using data obtained from the USCB 2020 census blocks (USCB, 2020a) and 2020 decennial population data (USCB, 2020b), the Poesta Creek watershed had an estimated population of 21,357 people in 2020.

A population projection through 2070 was developed using data from USCB to be consistent with the original TMDLs. Table V-2 provides a summary of the population projection for the added TMDL watershed.

Table V-2. 2020 – 2070 population projection

Area	2020 Estimated Population	2070 Projected Population	Projected Population Increase	Percent Change
Poesta Creek Watershed	21,357	22,705	1,348	6.31%

The following steps detail the method used to estimate the 2020 and projected 2070 populations in the Poesta Creek watershed.

1. The 2020 USCB block level population data was obtained for Bee County.

2. The 2020 watershed population was estimated by adding the total population of the blocks located entirely within the watershed.
3. For the census blocks partially located in the watershed, the block population was determined by multiplying the total block population by the proportion of the block area within the watershed. This was added to the population estimate from step 2.
4. Decadal population projections for Bee County between 2020-2070 were obtained from the TWDB county population projections dataset (TWDB, 2021).
5. Projected decadal population percentage increases in Bee County were calculated for each decade between 2020-2070.
6. The county level projected population percentage increases calculated in Step 5 were added to the 2020 watershed population determined in steps 1-3 to obtain population projections for the Poesta Creek watershed.

Land Cover

Land cover data for the TMDL watershed were obtained from the U.S. Geological Survey 2019 NLCD (USGS, 2021). The land cover for the TMDL watershed is shown in Figure V-4. A summary of the land cover data is provided in Table V-3 and indicates that the addendum TMDL watershed is predominantly composed of Shrub/Scrub (39.75%) and Pasture/Hay (31.7%).

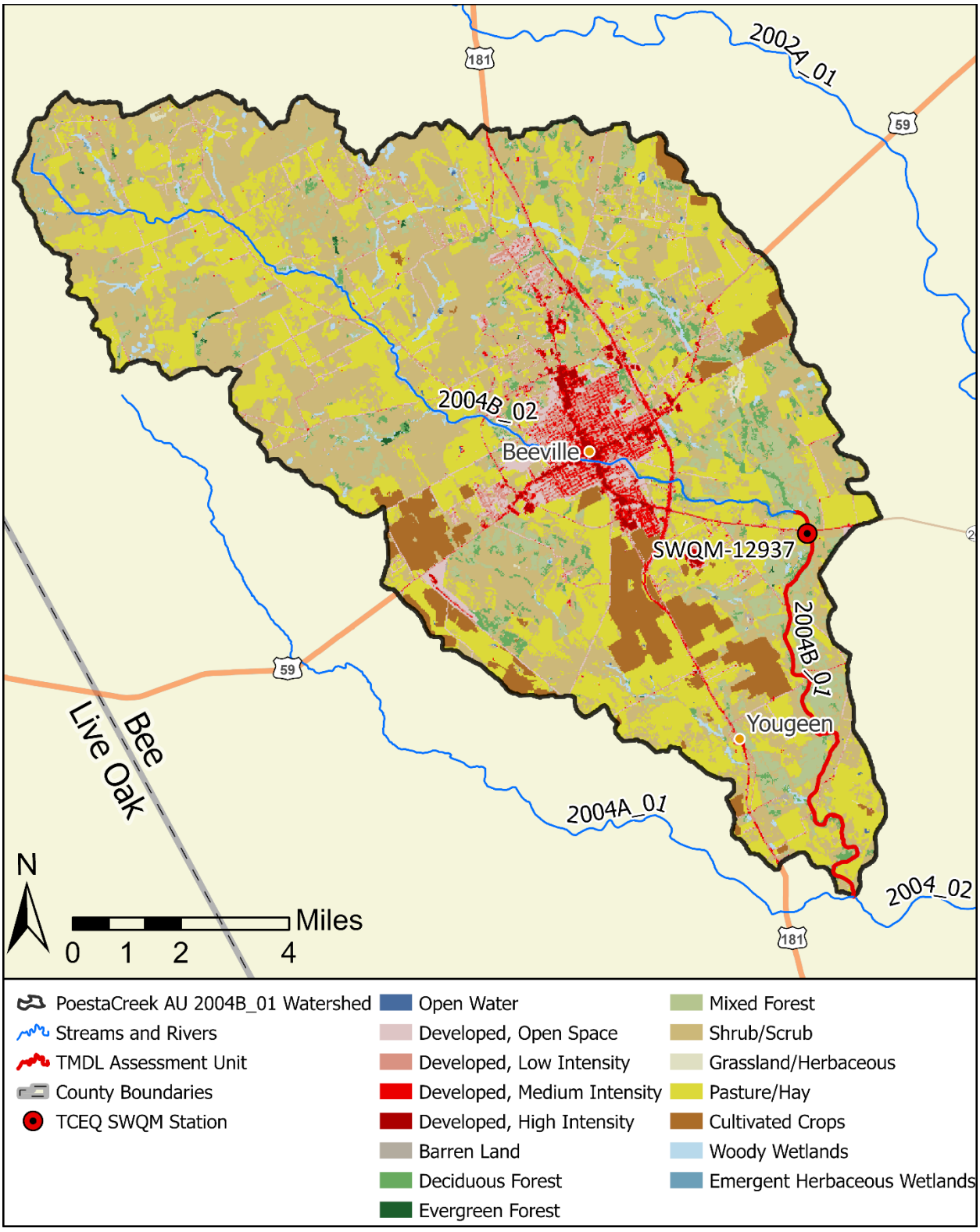

Figure V-4. Land cover map showing classifications

Table V-3. Land cover classification by area and percentage

2019 NLCD Land Cover Classification	Area (Acres)	% of Total
Open Water	43.14	0.05%
Developed, Open Space	3,369.64	4.28%
Developed, Low Intensity	2,788.46	3.54%
Developed, Medium Intensity	1,741.46	2.21%
Developed, High Intensity	567.76	0.72%
Barren Land	142.96	0.18%
Deciduous Forest	2,142.86	2.72%
Evergreen Forest	75.66	0.10%
Mixed Forest	5,165.63	6.56%
Shrub/Scrub	31,312.97	39.75%
Grassland/Herbaceous	173.18	0.22%
Pasture/Hay	24,967.90	31.70%
Cultivated Crops	4,509.02	5.72%
Woody Wetlands	1,702.57	2.16%
Emergent Herbaceous Wetlands	62.32	0.08%
Total	**78,765.53**	**100%**

Endpoint Identification

The endpoint for the TMDL is to maintain the concentration of *E. coli* below the geometric mean criterion of 126 cfu/100 mL, which is protective of the primary contact recreation 1 use in freshwater.

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 TPDES program. 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 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, SSOs, and stormwater discharges from industrial and regulated construction sites.

Domestic and Industrial WWTFs

As of December 2022, there is one WWTF with a TPDES permit within the TMDL watershed (Table V-4 and Figure V-5).

Table V-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)
2004B_02	WQ0010124002	TX0047007	Moore Street WWTF	1	120	Treated domestic wastewater	3.0

[a]NPDES: National Pollutant Discharge Elimination System

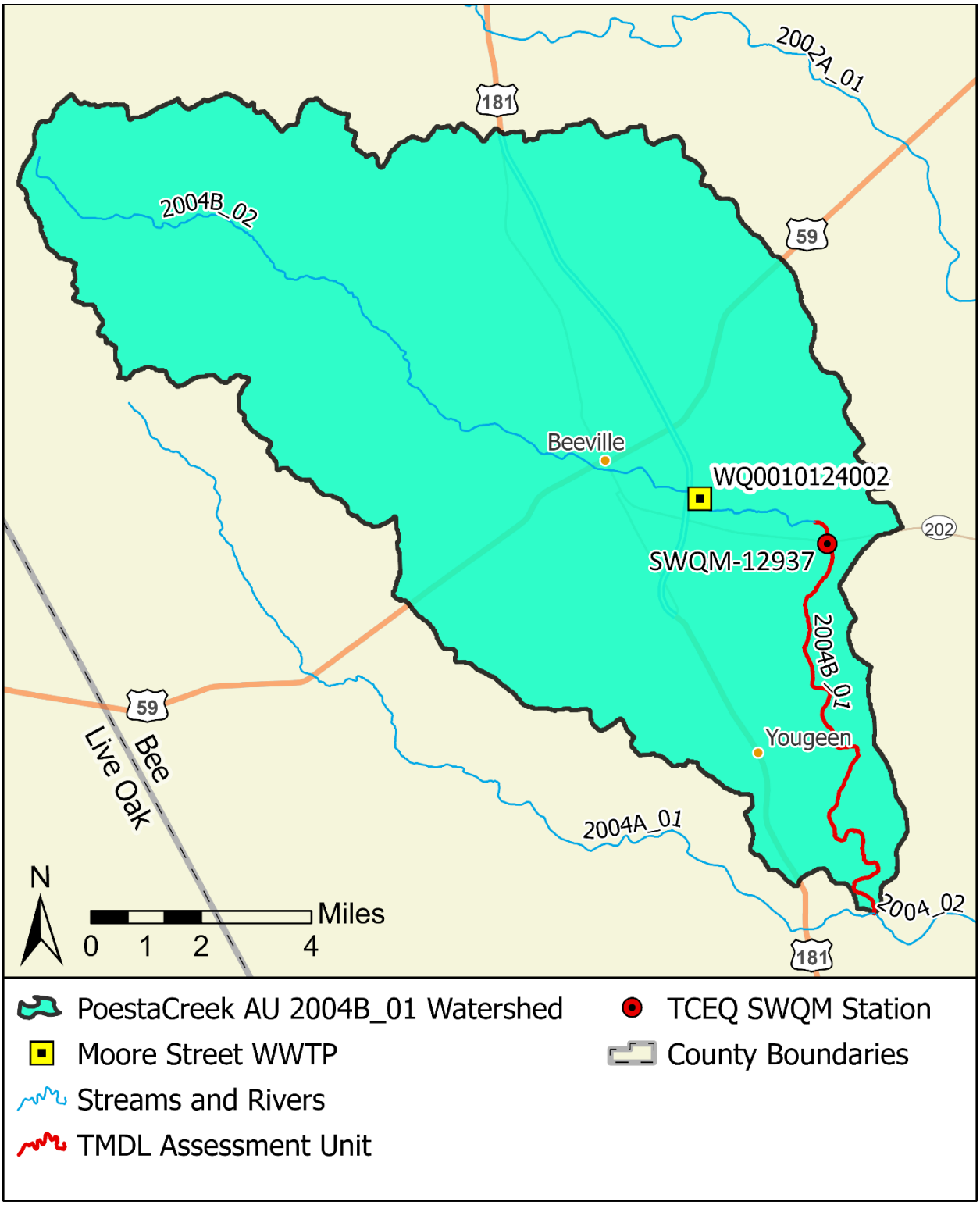

Figure V-5. WWTFs in the TMDL watershed

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 December 2022, found one permittee covered by a general permit. The regulated areas do not have bacteria reporting or limits in their permits. They were assumed to contain inconsequential amounts of bacteria; therefore, it was unnecessary to allocate bacteria loads based on these activities. No other active wastewater general permit authorizations were found.

Sanitary Sewer Overflows

A summary of SSO incidents that occurred during a seven-year period from 2016 through 2022 in the TMDL watershed was obtained from TCEQ Central Office in Austin. The summary data indicated that 22 SSO incidents had been reported within the TMDL watershed. All SSO incidents were due to a temporary blockage of the collection system. The SSOs had a total discharge of 249,480 gallons with a minimum of 30 gallons and a maximum of 93,750 gallons.

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 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 – MSGP for industrial facilities
- TXR150000 – 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, 2022d) in the TMDL watershed as of December 2022 found a total of 26 active MSGP authorizations and CGP authorizations within the watershed. There are currently no Phase I MS4 permits and no Phase II MS4 authorizations within the TMDL watershed.

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.

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 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 V-5 provides estimated numbers of selected livestock in the watershed based on the 2017 Census of Agriculture conducted by USDA (2019). The county-level estimated livestock populations were reviewed by Texas State Soil and Water Conservation Board staff and were distributed based on GIS calculations of pastureland in the watershed, based on the 2019 NLCD (USGS, 2021). These livestock numbers, however, were not used to develop an allocation of allowable bacteria loading to livestock.

Table V-5. Estimated livestock populations

Area	Cattle and Calves	Hogs and Pigs	Poultry	Goats and Sheep	Horses
Poesta Creek Watershed	4,281	50	662	217	135

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 V-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 2020 Census data (USCB, 2020b). The actual contribution and significance of bacteria loads from pets reaching the TMDL watershed is unknown.

Table V-6. Estimated households and pet population

Estimated Households	Estimated Dog Population	Estimated Cat Population
8,003	4,914	3,657

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) estimates one hog per 33.3 acres as the average density for feral hogs in the TMDL watershed. Habitat deemed suitable for hogs includes the following classifications from the 2019 NLCD land cover: Pasture/Hay, Cultivated Crops, Shrub/Scrub, Grassland/Herbaceous, Deciduous Forest, Evergreen Forest, Mixed Forest, Woody Wetlands, and Emergent Herbaceous Wetlands. The estimated feral hog density was applied to the area suitable for feral hog habitat which estimated that there are about 2,105 feral hogs in the Poesta Creek watershed (Table V-7).

For deer, TPWD has published data showing deer population-density estimates by DMU and Ecoregion in the state. TPWD biologists provided estimates for DMUs in Bee County, which included DMUs 8E, 9, 10, and 11 (TPWD, 2021). Based on estimates from

2005 through 2019, an average of one white tail deer per 58.08 acres of habitat was calculated across the watershed. The same 2019 NLCD land cover types used previously for feral hogs are the same types used for deer. Applying this value to the suitable habitat area of the TMDL watershed returns an estimated 1,207 deer within the watershed (Table V-7). The *E. coli* contribution from feral hogs and wildlife in the Poesta Creek watershed could not be determined based on existing information.

Table V-7. Estimated deer and feral hog populations

Area	Estimated White-Tailed Deer	Estimated Feral Hogs
Poesta Creek Watershed	1,207	2,105

On-site Sewage Facilities

The estimated number of OSSFs in the TMDL watershed was determined using data supplied by 911 address points to estimate residential locations (TNRIS, 2021). OSSFs were estimated to be residential and business addresses that were outside of city boundaries and Certificate of Convenience and Necessity areas (PUC, 2022). Data from these sources indicate that there are 1,102 OSSFs located within the Poesta Creek watershed (Figure V-6). 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.

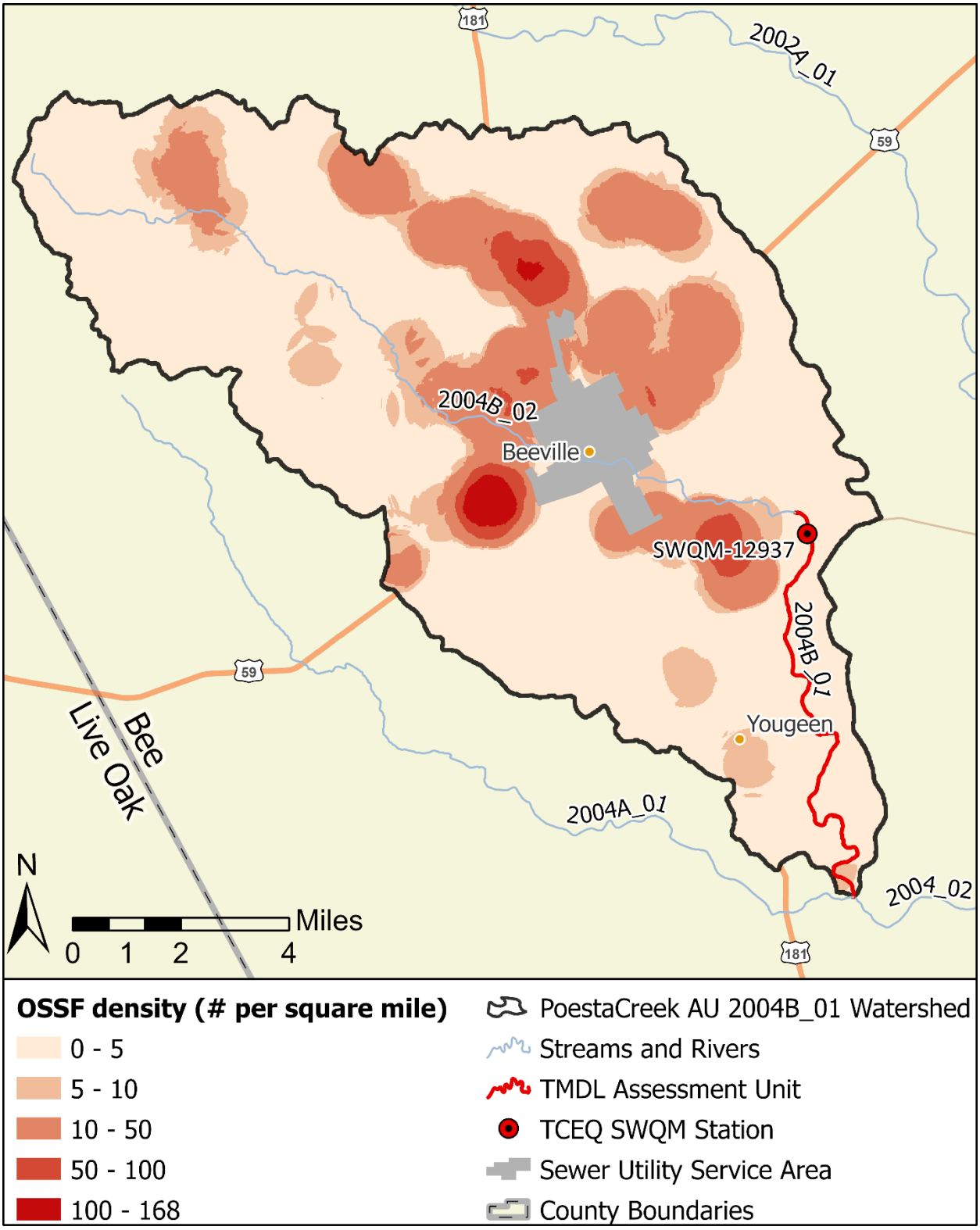

Figure V-6. OSSF densities located within the TMDL watershed

Linkage Analysis

The 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. The technical support document for this addendum (Jain and Schramm, 2023) provides details about the linkage analysis along with the LDC method and its application.

Two separate LDCs were generated for the TMDL watershed. The first LDC utilized *E. coli* data at TCEQ SWQM Station 12937. The *E. coli* event data plotted on the LDC for TCEQ SWQM Station 12937 in Figure V-7 show exceedances of the geometric mean criterion have commonly occurred regardless of streamflow conditions. The allowable load at the single sample criterion (399 cfu/100 mL) is included on the LDC for comparison with individual *E. coli* samples, although it is not used for assessment or allocation purposes. Since TCEQ SWQM Station 12937 is located near the upstream potion of the AU, a second LDC was generated at the AU 2004B_01 watershed outlet for a more appropriate estimate of flows in the watershed (Figure V-8). Bacteria data is not available at the AU 2004B_01 watershed outlet however having an appropriate estimate of flows and allowable pollutant loads will result in a more accurate TMDL calculation.

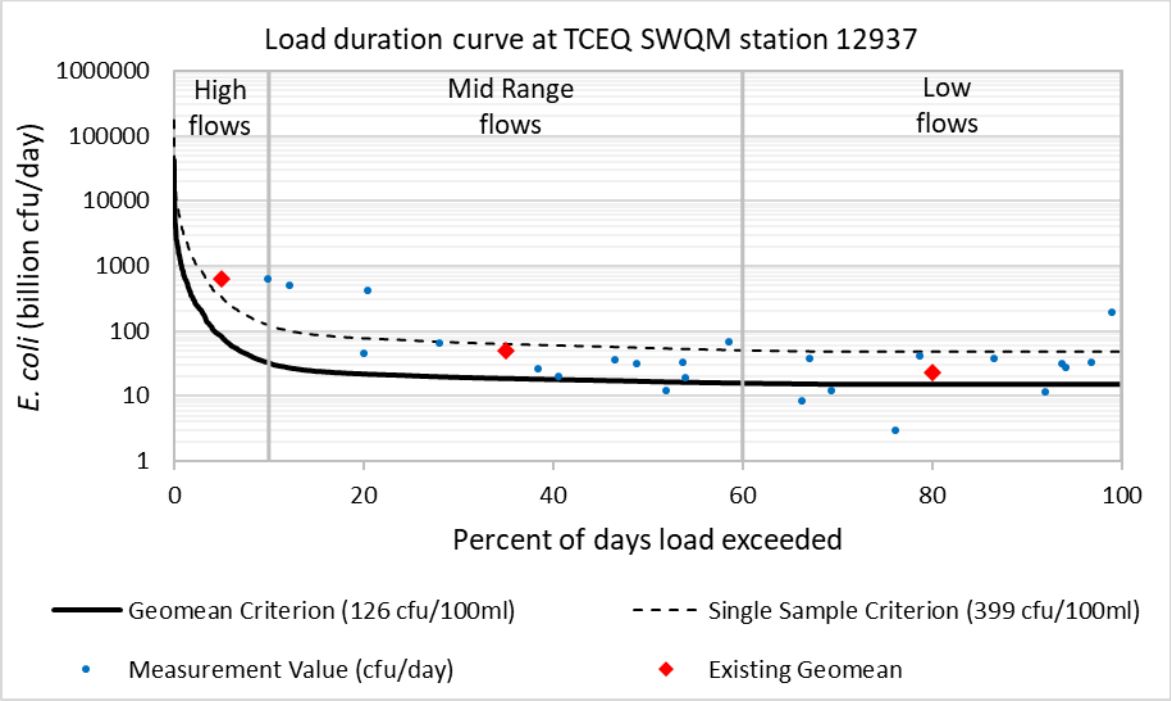

Figure V-7. LDC for TCEQ SWQM Station 12937

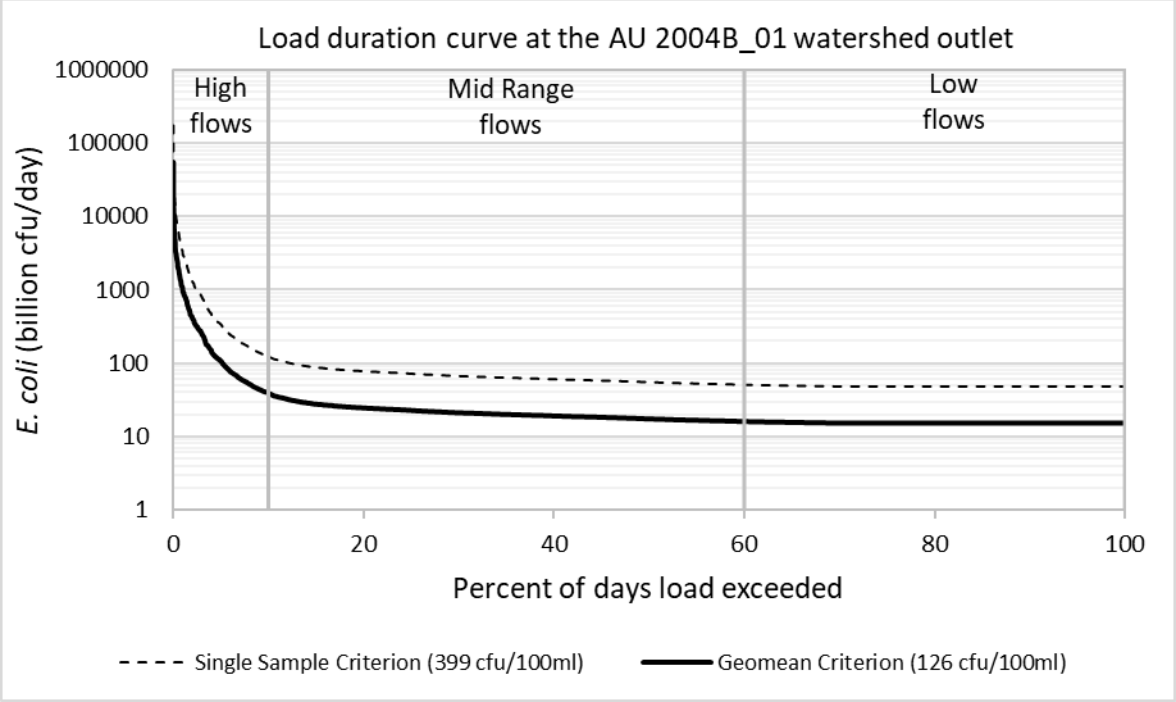

Figure V-8. LDC at the AU 2004B_01 watershed outlet

Margin of Safety

The 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 AU 2004B_01 was derived using the median flow within the high flow regime (or 5% load duration exceedance) of the LDC developed for the AU 2004B_01 watershed outlet. The TMDL watershed outlet was used rather than TCEQ SWQM Station 12937 because it best represents the hydrologic influences for the entire watershed whereas the SWQM station is located near the upstream boundary of the AU2004B_01 watershed. A separate LDC was developed for TCEQ SWQM Station 12937 using available bacteria data and estimated flows to draw conclusions about linkages between broad sources of loadings and pollutant exceedances.

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 (126 cfu/100 mL for *E. coli*). Table V-8 presents the WLAs for the WWTFs.

Table V-8. WLAs for TPDES-permitted facilities

AU	TPDES Number	Permittee	Bacteria Limit (cfu/100 mL *E. coli*)	Full Permitted Flow (MGD)	WLA_{WWTF} (billion cfu/day *E. coli*)
2004B_02	WQ0010124002	Moore Street WWTP	120	3.0	13.593

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 MSGP authorizations (30.43 acres), and CGP authorizations (42.138 acres) were estimated by importing location information into a GIS and measuring the estimated disturbed area from available aerial imagery. The percentage of land under the jurisdiction of stormwater permits (a total of 72.568 acres) in the TMDL watershed is 0.0921%.

Load Allocation

The 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 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 V-2. The projected population percentage increase within the watershed was multiplied by the corresponding WLA_{WWTF} to calculate FG. Similar to WLA_{WWTF} calculations, the water quality criterion (126 cfu/100mL) after accounting for the required reductions for MOS is used as the WWTF target. The permitted flows were increased by the expected population growth between 2020 and 2070 to determine the estimated future flows.

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 V-9 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 AU 2004B_01 watershed outlet. Allocations are based on the current geometric mean criterion for *E. coli* of 126 cfu/100 mL for each component of the TMDL.

Table V-9. TMDL allocation summary

All loads expressed as billion cfu/day *E. coli*

Water Body	AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA	FG
Peosta Creek	2004B_01	106.383	5.319	13.593	0.080	86.533	0.858

The final TMDL allocations (Table V-10) needed to comply with federal requirements include the FG component within the WLA_{WWTF} (40 CFR Section 103.7).

Table V-10. Final TMDL allocation

All loads expressed as billion cfu/day *E. coli*

Water Body	AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA
Poesta Creek	2004B_01	106.383	5.319	14.451	0.080	86.533

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 *E. coli* concentrations obtained from 15 years (2008-2022) 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 *E. coli* 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 *E. coli* data indicated that there was no significant difference (α=0.05) in indicator bacteria between cool and warm weather seasons for Poesta Creek (p=0.07852). Seasonal variation was also addressed by using all available flow and indicator bacteria 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 (Jain and Schramm, 2023) was published on the TCEQ website on December 4, 2023. Project staff presented information about this addendum at an online meeting of the Mission and Aransas Rivers stakeholder group on August 17, 2023. The public had an opportunity to comment on this addendum during the public comment period (February 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.[j] Notice of the comment period, along with the document, was also posted on the WQMP Updates webpage.[k] TCEQ accepted public comments on the original TMDL report from October 23 through November 23, 2015. Two comments were submitted, and neither of them referred directly to the AU in this TMDL addendum.

Implementation and Reasonable Assurance

The water body covered by this addendum is within the existing bacteria TMDL watersheds for the Mission and Aransas Rivers, which drain to Copano Bay. That TMDL watershed, including Poesta Creek, is within the area covered by the implementation

[j] www.tceq.texas.gov/waterquality/tmdl/tmdlnews.html

[k] www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html

plan (I-Plan) developed by stakeholders for the TMDL watershed, which was approved by the Commission on May 25, 2016. 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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