Approved January 21, 2015

Implementation Plan for Five Total Maximum Daily Loads for Bacteria in Four Austin Streams

Spicewood Tributary to Shoal Creek, Segment 1403J

Assessment Unit 1403J_01

Taylor Slough South, Segment 1403K

Assessment Unit 1403K_01

Walnut Creek, Segment 1428B

Assessment Units 1428B_01, 1428B_02, 1428B_ 03, 1428B_ 04 and 1428B_05

Waller Creek, Segment 1429C

Assessment Units 1429C_02 and 1429C_03

Produced by the Improving Austin Streams Coordination Committee in cooperation with the Total Maximum Daily Load Program, Office of Water, Texas Commission on Environmental Quality

Produced by the Improving Austin Streams Coordination Committee, a stakeholder group organized through public meetings of citizens.

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TMDL implementation plans are also available on the TCEQ website at:
<www.tceq.texas.gov/implementation/water/tmdl/>

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This implementation plan was produced by the Improving Austin Streams Coordination Committee, a stakeholder group organized through public meetings of citizens.

The plan is based on submissions from the following four stakeholder work groups organized by the IAS Coordination Committee:

Public Lands Management
Resident Activities
Stormwater Treatment
Wastewater Infrastructure.

Details about the IAS Coordination Committee and work groups efforts can be found on the IAS Web page: <www.utexas.edu/law/centers/cppdr/services/tmdl.php>

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List of Commonly Used Abbreviations

ANC	Austin Neighborhoods Council
APF	Austin Parks Foundation
AU	assessment unit
AWU	Austin Water Utility (City of Austin)
BMP	best management practice
cfu	colony-forming units
CIP	Capital Improvements Project (City of Austin)
COA	City of Austin
COA PARD	COA Parks and Recreation Department
COA WPD	City of Austin Watershed Protection Department
CPPDR	Center for Public Policy Dispute Resolution, University of Texas School of Law
dL	deciliter (equal to 100mL)
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
EQP	Environmental Quality Program (Travis County)
ETJ	extraterritorial jurisdiction
ft.	feet
GIS	geographic information system
I-Plan	implementation plan
KAB	Keep Austin Beautiful
LA	load allocation
LCRA	Lower Colorado River Authority
LDC	load duration curve
mL	milliliter
MOS	margin of safety
MPN	most probable number
MS4	municipal separate storm sewer system
NOVs	notices of violation
OFPC	Office of Facilities Planning and Construction (UT System)
OSSF	on-site sewage facility
PODER	People Organized in Defense of Earth and Her Resources
QAPP	Quality Assurance Project Plan
SSO	sanitary sewer overflow
SWMP	storm water management plan
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
Title 30	Title 30 TAC
TLGC	Texas Local Government Code
TMDL	total maximum daily load
TNR	Transportation and Natural Resources Department (Travis County)
TPDES	Texas Pollutant Discharge Elimination System
UTA	University of Texas at Austin
UTA-EHS	UTA Environmental Health and Safety
UTA-PMCS	UTA Project Management and Construction Services
UTA-UEM	UTA Utilities and Energy Management
UT System	University of Texas System
WLA	waste load allocation

Executive Summary

The Texas Commission on Environmental Quality (TCEQ) is required to regularly identify water bodies in Texas that do not support their designated uses. Human contact recreation impairment due to elevated levels of fecal indicator bacteria is the most common water quality impairment in Texas. The following four Austin creeks (shown in Figure 1) have been identified as having fecal bacteria levels higher than allowed under the contact recreation category of use assigned to them, in all or parts of their reaches:

- Walnut Creek,
- Spicewood Tributary (also known as Foster Branch) to Shoal Creek,
- Waller Creek, and
- Taylor Slough South.

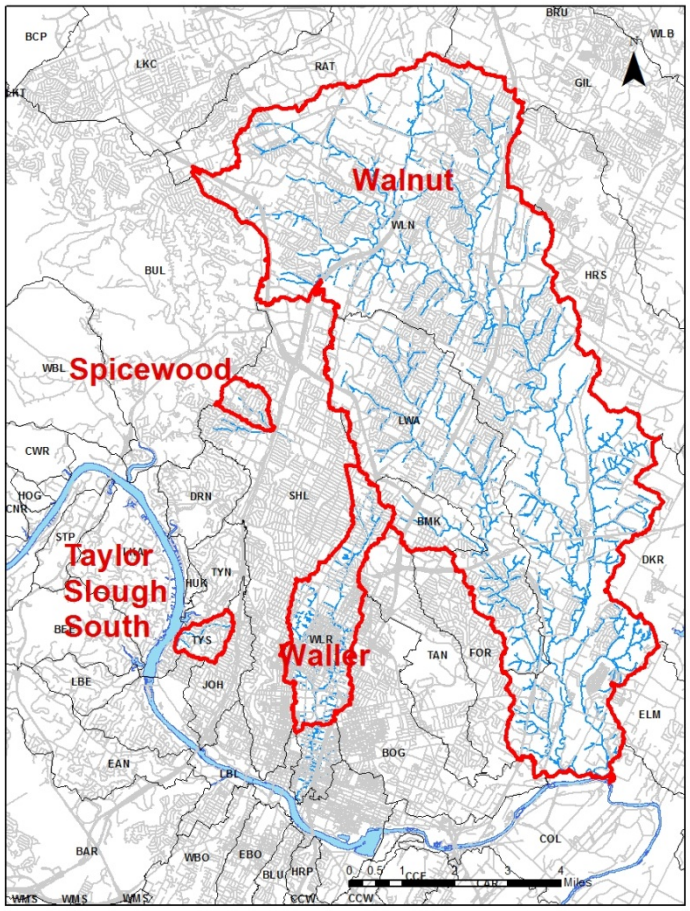

Figure 1. Map of watersheds in Austin listed as impaired for contact recreation by the TCEQ.

The Clean Water Act requires the TCEQ to develop a total maximum daily load (TMDL) for these streams because they do not support their designated uses. The TMDLs are the calculation of the maximum amount of fecal bacteria pollution that these water bodies can receive and still safely meet state water quality standards.

The City of Austin requested the TCEQ to develop both a TMDL and to initiate an Implementation Plan (I-Plan) process for these four creeks. A Coordination Committee was formed with public input to guide development of the I-Plan simultaneously with the TCEQ's development of the TMDL. The Coordination Committee established as its goal "to develop and implement strategies to reduce fecal contamination such that the affected watersheds fully meet the contact recreation water quality standard."

This I-Plan recommends five sets of voluntary management measures to reduce nonpoint source fecal bacterial contamination in these four water bodies, relating to:

1. **Riparian zone restoration**. Natural riparian buffer areas can reduce instream *E. coli* bacteria concentrations when stormwater runoff is diverted through them prior to discharge into the receiving water. Urbanization has caused a degradation of some of Austin's riparian buffer zones. The restoration and enhancement of functional riparian buffers is a primary strategy in this I-Plan to reduce *E. coli* bacteria concentrations in these streams and citywide.

2. **Wastewater infrastructure**, focusing on:
    a. failing on-site sewage facilities or systems which do not meet capacity requirements;
    b. inspection and repair of wastewater collection lines;
    c. response to sanitary sewer overflows;
    d. reducing contamination from failing private laterals through inspection initiated by backups, stoppage or overflows, and legal requirements on property owners to ensure repair of private laterals, including a lien program;
    e. providing public toilets to reduce fecal contamination from human outdoor defecation
3. **Domestic pet waste**. Uncollected domestic pet waste is a significant contributor to fecal contamination in streams. Public education may be an effective tool at reducing the fecal bacteria contamination from domestic pets. This I-Plan focuses on reducing contamination from dog waste in parks and public areas through education, installation of pet waste collection bag dispensers and educational kiosks, and efforts to educate commercial and nonprofit organizations to encourage distribution of educational materials to their customers.
4. **Resident outreach**. Positive actions by area residents are essential to improve the quality of Austin streams. The I-Plan educational efforts are designed to let Austin residents, including neighborhood groups, school children, and the homeless, know how they can make a difference.
5. **Stormwater treatment**. Stormwater runoff is the dominant mechanism by which nonpoint source fecal loads are transported to receiving waters. Management of stormwater to reduce bacteria can be achieved with non-structural best management practices (BMPs) like riparian zone enhancement or preservation, or with structural BMPs like sedimentation/filtration basins.

The total TMDL for all watersheds combined is 2.2×10^{11} MPN/day. In total, the proposed management measures included in this I-Plan are estimated to result in a reduction of *E. coli* 3.7×10^{16} MPN/day. Although tracking the progress of the proposed management measures over time in coordination with monitoring the improvement in instream fecal indicator bacteria will be necessary to determine if the I-Plan achieves the stated goal, this I-Plan appears to achieve the load reduction of the TMDL.

In addition to these four streams, City of Austin Watershed Protection Department monitoring has identified a wider range of watersheds in Austin that have levels of fecal indicator bacteria above State of Texas long-term standards (Figure 2), but which technically do not come within this TMDL process. The City plans to use appropriate strategies developed in this I-Plan effort for improving all streams in Austin.

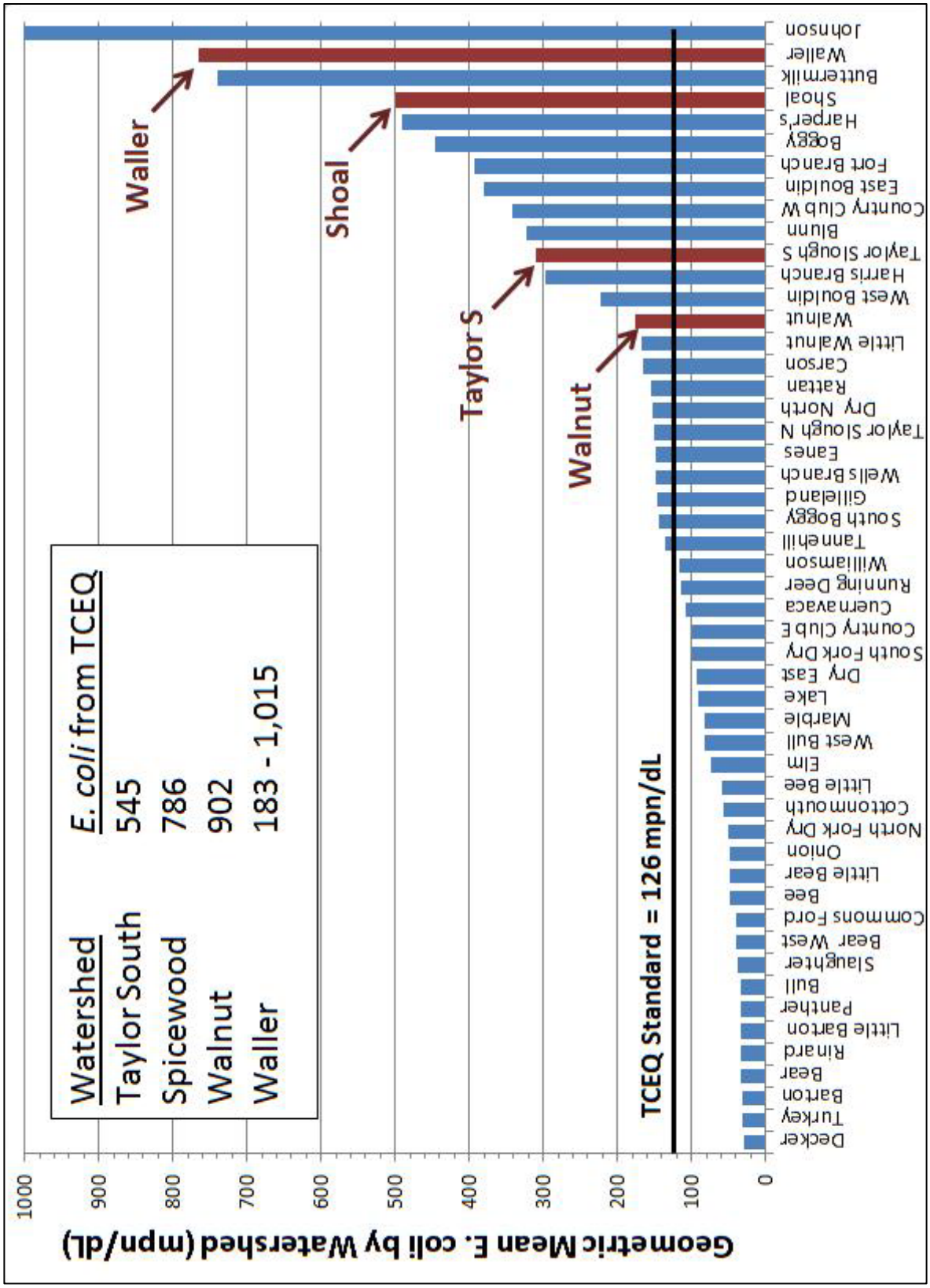

Figure 2. Chart of average *E. coli* by watershed in Austin.

The four identified by TCEQ as impaired are shown in red.

Table 1. Management Measures in a Nutshell

The IAS Coordination Committee proposes five categories of solutions to reduce bacterial levels, organized around how they will reduce pollution.

1.0 Riparian Zone Restoration	
Instream bacteria concentrations are reduced when stormwater runoff filters through natural riparian buffers (vegetated areas along the creek's edge) before entering the stream. Restoring and enhancing riparian buffers along Austin-area streams is a primary strategy for the four creeks in this I-Plan and citywide.	
1.1	Increase riparian zones in Austin parks by expanding Grow Zone initiative [1]
1.2	Recruit adopters for all creeks and parks in the watersheds[2]
1.3	Use volunteers to help expand Grow Zone riparian initiative[2]
1.4	Increase riparian buffer zone width for new development[1]
1.5	Increase waterway setbacks in Walnut Creek[3]
2.0 Wastewater Infrastructure	
The I-Plan focuses on means to reduce sewage contamination of creeks through the following means:	
2.1	Require failing OSSFs to connect to City sewer lines, and provide incentives for connection when new mains are installed[1]
2.2	Provide incentives in Walnut Creek area for OSSF repair and improvements[3]
2.3/ 2.4	Inspect & repair sewer lines[1,4]
2.5/ 2.6	Respond to sewer overflows[1,4]
2.7	Reduce contamination from private sewage laterals through inspection when overflows occur, ensuring repair when needed[1]
2.8	Design & construct outdoor public toilets in high-use locations in Waller Creek: pilot program[1]
3.0 Domestic Pet Waste	
Pet waste contributes significantly to stream contamination. Education is a central focus of the I-Plan efforts, as is installing Mutt Mitts.	
3.1	Educate park users through signs and citywide "Scoop the Poop" efforts, enforce requirements in parks to remove pet waste[1]
3.2	Install pet waste bags dispensers in all City parks in watersheds[1]
3.3	Place educational kiosks in Walnut Creek Park off-leash area[5, 1]
3.4	Educate pet-care businesses about pet waste management, seek their cooperation to distribute educational materials to their customers[10, 11]

4.0 Resident Outreach	
The I-Plan focuses on education of residents, whose actions are essential to reduce bacteria in the creeks. Educational efforts will be through:	
4.1	Austin Neighborhoods Council[6]
4.2	Austin Environmental Board[7]
4.3	Homeless survival guides[1]
4.4	Earth Camp and other AISD campus outreach[1]
4.5	Austin Parks Foundation & Keep Austin Beautiful[2]
4.6	Community communication[8]
4.7	People Organized in Defense of Earth and Her Resources[9]
5.0 Stormwater Treatment	
Most fecal material enters the streams through stormwater runoff. Nonstructural and structural BMPs will be important to reducing bacteria in the creeks.	
5.1	Install or retrofit water quality structural controls on public lands[1]
5.2	Inspect existing city-owned and commercial water quality controls, and repair problems as feasible[1]
5.3	Inspect and ensure proper operation of private water quality treatment and flood detention structures in Travis County jurisdiction[3]
5.4/ 5.5	Dry-weather inspection of storm drain outfalls to identify illicit connections[1,4]
5.6	Pilot program test new roadway bacteria reduction technology[3]
5.7	Street sweeping on University of Texas-Austin campus[4]
5.8	Construction site inspection & monitoring[1]
5.9	Inspect commercial and industrial facilities for illicit discharges[3]

Responsible Organization

1 City of Austin
2 Austin Parks Foundation, Keep Austin Beautiful
3 Travis County
4 University of Texas at Austin
5 Friends of Austin Dog Parks
6 Austin Neighborhoods Council
7 City of Austin Environmental Board
8 Shoal Creek Conservancy/ Pease Park Conservancy
9 People in Defense of Earth and Her Resources
10 Sierra Club, Austin Chapter
11 Austin Chamber of Commerce

Introduction

The following four Austin creeks have been identified as having fecal bacteria levels higher than allowed under the contact recreation category of use assigned to them, in all or parts of their reaches:

- Walnut Creek,
- Spicewood Tributary (also known as Foster Branch) to Shoal Creek,
- Waller Creek, and
- Taylor Slough South.

At the request of the City of Austin (COA), the TCEQ initiated a process under the federal Clean Water Act to calculate the maximum amount of fecal bacteria that these streams can receive and still safely meet water quality standards, known as a total maximum daily load, or TMDL. Affected stakeholders developed this I-Plan to guide how to reduce pollutants as determined by the TMDL.

I-Plan Overview

The Introduction Chapter will describe the process used to develop the I-Plan. The I-Plan is further organized into these major components:

- **Summary of the TMDLs**, which includes a description of the watersheds, the potential sources of fecal bacteria, and an expression of the TMDL.
- **Management Measures**. Five chapters are devoted to the management measures which will be implemented, organized by approach to reduction of the pollutant:
  - *Riparian zone restoration* (Management Measure 1.0)
  - *Wastewater infrastructure* (Management Measure 2.0).
  - *Domestic pet waste* (Management Measure 3.0)
  - *Resident outreach* (Management Measure 4.0)
  - *Stormwater treatment* (Management Measure 5.0)

  Management measures are organized around a narrative description and a table summarizing each management measure in a format containing the nine elements for watershed-based plans prescribed by *Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories* issued in 2013. These tables describe:

  - the management measure itself;
  - schedule for implementation;
  - potential load reduction;
  - technical and financial assistance needed;
  - educational components;
  - interim, measureable milestones;
  - progress indicators;

  - monitoring component; and
  - responsible organization.
- **Adaptive management**, which describes how the TCEQ and Coordination Committee will periodically assess the results of planned activities, and make needed adjustments to move toward the I-Plan's goal.
- **Implementation tracking**, which describes how each implementation activity will be tracked over time, often defined by whether the 'milestones' were reached.
- **Water quality indicators**, which outline further monitoring plans. These are the numerical results obtained through the monitoring.
- **Communication strategy**, which describes how information will be distributed in the future to help stakeholders, including the broad public, understand the I-Plan and its progress.
- **Literature cited**.
- **Appendices**, with letters of support for the plan and public comments and responses.

Public Processes

The TCEQ launched development of the I-Plan by asking the Center for Public Policy Dispute Resolution (CPPDR) to facilitate a process where the public identified needed interests to be represented on a coordination committee that would guide and develop the plan. During widely publicized meetings hosted by CPPDR, the TCEQ, and City of Austin in November 2012 and January 2013, interested members of the public identified the following categories of stakeholder interests that should be represented on the coordination committee: parks, environmental, community/neighborhood, City of Austin, Travis County, dog off-leash groups, state /university, developers, and business. Public participants suggested names of who those representatives should be. Using the input from these meetings, CPPDR brought together an initial Coordination Committee, which was invited to add persons the group felt were important. Other participants interested in the process were encouraged to join the effort on work groups.

The Coordination Committee named its process "Improving Austin Streams," and established a webpage to keep the public informed of its progress. Links to meeting agendas, notes and technical materials for the Coordination Committee and its work groups, as well as background on the project as a whole, are found at www.utexas.edu/law/centers/cppdr/services/tmdl.php

In addition to having voices through Coordination Committee members, the Austin-area community participated in a meeting on October 9, 2013, to receive information about the draft I-Plan and to provide the Coordination Committee with its input. The public was also invited to submit input on the plan via email and the website.

Coordination Committee Membership and Process

The Coordination Committee is composed of representatives of the interests identified at public meetings, and often of specific persons identified in those meetings. The Committee met to organize and begin learning and discussing the issues involved in the bacterial contamination of these Austin streams on January 25, 2013. The Coordination Committee met frequently during

its first six weeks to adopt guidelines by which it would operate, receive educational information, and discuss issues involving water quality in the impacted streams. On March 4, the committee formed four work groups to develop draft strategies for the Coordination Committee's consideration. Committee members often served on one or more work groups, and were also responsible for keeping those whose interests they represented informed about the implementation plan development. The Coordination Committee began meeting monthly beginning with its receipt of work group draft strategies on June 10.

The committee adopted the following statement to serve as its goal:

> *The goal of the Coordination Committee is to develop and implement strategies to reduce fecal contamination such that the affected watersheds fully meet contact recreation water quality standards.*

The Coordination Committee approved a draft I-Plan for public input on August 26, 2013. Committee members disseminated the draft report to their constituencies, and held a public educational and input meeting on October 9, 2013. On December 10, 2013, the Coordination Committee agreed by consensus of a quorum present to recommend a draft plan to the TCEQ for further public comment.

The following persons serve as Coordination Committee members or alternates:

Table 2. Coordination Committee Membership

Interest	Representatives	Organization
Parks	Monnie Anderson	Shoal Creek Conservancy & Pease Park Conservancy
Environmental	Lauren Ross *Alternate: Roy Waley*	Austin Sierra Club
Community & neighborhood	Susana Almanza	People in Defense of Earth and Her Resources (PODER)
	Joyce Basciano	Austin Neighborhood Council
City of Austin	Chris Herrington *Alternate: Mateo Scoggins*	Watershed Protection
	Dana White	Austin Water Utility
Austin City Council citizen advisory board	Mary Ann Neely	Austin Environmental Board
Travis County	Tom Weber	Transportation & Natural Resources
Dog off-leash group	Bill Fraser	Friends of Austin Dog Parks
State	Jim Crisp *Replacing Gary Lantrip*	Texas Department of Transportation
University	Chip Rogers *Alternates: Nena Anderson* *Scott Wiedeman*	University of Texas at Austin, Environmental Health & Safety
Developers	Rick Coneway	Home Builders Association of Greater Austin & Real Estate Council of Austin
Business	Mark Ramseur	Austin Chamber of Commerce

Work Group Process and Membership

The four work groups met three to four times each to develop draft strategies that they presented to the Coordination Committee. Work group members were identified by the Coordination Committee, were recruited by other work group members, or were self-appointed to work in this process. Additionally, some technical and public members assisted the work groups in a consultation role, or by providing public input. CPPDR organized and facilitated the work group process and all meetings, as it did for the Coordination Committee.

The following lists the work groups formed by the Coordination Committee and those who participated in the work group process:

Public Lands Management work group members and participants

Monnie Anderson	Pease Park Conservancy and Shoal Creek Conservancy
Joyce Basciano	Austin Neighborhoods Council
Brian Block	COA Parks and Recreation Department
Chris Herrington	COA Watershed Protection Department
Mary Ann Neely	COA Environmental Board
Mateo Scoggins	COA Watershed Protection Department
Bill Stout	Austin Parks Foundation
Charles Vaclavik	COA Parks and Recreation Department
Dana White	COA Austin Water Utility
Ladye Anne Wofford	Keep Austin Beautiful

Resident Activities work group members and participants

Susana Almanza	PODER
Monnie Anderson	Shoal Creek Conservancy
Joyce Basciano	Austin Neighborhoods Council
Bill Fraser	Friends of Austin Dog Parks
Lisa Harris	Hyde Park Neighborhood Association and Austin Neighborhoods Council
Chris Herrington	COA Watershed Protection Department
Mateo Scoggins	COA Watershed Protection Department
Katie Sternberg	COA Watershed Protection Department
Dana White	COA Austin Water Utility
Jessica Wilson	COA Watershed Protection Department
Travis Tidwell	Meadows Center for Water and the Environment, Texas State University

Stormwater Treatment work group members and participants

Monnie Anderson	Pease Park Conservancy and Shoal Creek Conservancy
Nena Anderson	University of Texas at Austin (UTA) Environmental Health and Safety
Joyce Basciano	Austin Neighborhoods Council
Jim Crisp	Texas Department of Transportation
Chris Herrington	COA Watershed Protection Department
Mike Kelly	COA Watershed Protection Department
Gary Lantrip	Texas Department of Transportation

Lee Lawson	COA Watershed Protection Department
Mike Mullone	Baer Engineering
Mark Ramseur	Austin Chamber of Commerce
Lauren Ross	Austin Sierra Club
Mateo Scoggins	COA Watershed Protection Department
Anna Stehouwer	UTA graduate student - Engineering/Water Quality
Tom Weber	Travis County
Dana White	COA Austin Water Utility
Mel Vargas	Parsons Engineering
Gian Villarreal	RBF Consulting/a Michael Baker Corp
Scott Wiedeman	UTA Environmental Health and Safety

Wastewater Infrastructure work group members & participants

Monnie Anderson	Pease Park Conservancy and Shoal Creek Conservancy
Nena Anderson	UTA Environmental Health and Safety
Joyce Basciano	Austin Neighborhoods Council
Raj Bhattarai	COA Austin Water Utility
Rick Coneway	Home Builders Assn. of Greater Austin/Real Estate Council of Austin
Chris Herrington	COA Watershed Protection Department
Reyna Holmes	COA Austin Water Utility
Katherine Jashinski	COA Austin Water Utility
Bart Jennings	COA Austin Water Utility
Tejashri Kyle	UTA Utilities and Energy Management
Thain Maurer	COA Watershed Protection Department
Jill Mayfield	COA Austin Water Utility
Richard Price	COA Austin Water Utility
Mateo Scoggins	COA Watershed Protection Department
Steve Schrader	COA Austin Water Utility
Paul Shropshire	COA Austin Water Utility
Soo Koon Soon	COA Austin Water Utility
Mel Vargas	Parsons Engineering
Tom Weber	Travis County
Dana White	COA Austin Water Utility
Scott Wiedeman	UTA Environmental Health and Safety

Summary of the TMDLs

This section summarizes the TMDL expression developed by the TCEQ.

Watershed Summary

The four watersheds included in this plan total approximately 32 miles in stream length and cover 63 square miles. They are almost entirely within the City of Austin city limits and Travis County, except that the Walnut Creek watershed includes very small portions of Williamson County. Directly or indirectly, all of these streams drain into the Colorado River. Walnut Creek (1428B) drains directly into the Colorado River (1428). Waller Creek (1429C) drains into Lady Bird Lake (1429), which is a reservoir on the Colorado River. Spicewood Tributary drains in to

Shoal Creek (1403J), which drains into Lady Bird Lake, which is a reservoir on the Colorado River. Taylor Slough South (1403K) drains into Lake Austin (1403), which is a reservoir on the Colorado River.

The assessment units (AUs) included in this plan are:

- Segment 1403J, Spicewood Tributary to Shoal Creek: From the confluence of an unnamed tributary west of the MoPac Expressway in north Austin in Travis County upstream to the head waters north of Williamsburg Circle in Travis
  - 1403J_01: Entire water body

- Segment 1403K, Taylor Slough South: From the confluence of Lake Austin in Travis County to the headwaters near South Meadow Circle on the Texas Department of Aging and Disability Services campus in Austin in Travis County
  - 1403K_01: Entire water body

- Segment 1428B, Walnut Creek: From the confluence of the Colorado River in east Austin in Travis County to the upstream perennial portion of the stream in north Austin in Travis County
  - 1428B_01: From the Colorado River upstream to FM 969
  - 1428B_02: From FM 969 upstream to Old Manor Rd.
  - 1428B_03: From old Manor Road upstream to Dessau Road
  - 1428B_04: From Dessau Rd. upstream to MoPac/Loop 1
  - 1428B_05: From MoPac/Loop 1 upstream to Union Pacific Railroad tracks south of McNeil Drive

Walnut Creek (Segment 1428B) AUs 1428B_01, 1428B_02, 1428B_03, and 1428B_04 are currently listed as supporting the contact recreation use (TCEQ, 2012a) and not listed in the 2012 303(d) list (TCEQ, 2012b). However, they have been both on and off the list in previous assessments, so the City of Austin requested that they be included in the TMDL.

- Segment 1429C, Waller Creek: From the confluence of Lady Bird Lake in central Austin in Travis County to the upstream portion of the stream in north Austin in Travis County
  - 1429C_01: From the confluence with Lady Bird Lake to East MLK Blvd. Waller Creek AU 1429C_01 is included in the 2012 303(d) list, but omitted from this TMDL because the City of Austin Waller Creek Tunnel will significantly change both its hydrology and assimilative capacity.
  - 1429C_02: From East MLK Blvd. to East 41st Street
  - 1429C_03: Upper portion of creek

Construction of the Waller Creek Flood Control Tunnel and associated redevelopment will dramatically change the hydrodynamics of the lower portion of Waller Creek. Under high flow conditions, stormwater will be diverted through the tunnel to bypass the lowest AU of Waller Creek and reduce flooding. Under low flow conditions, water from the Colorado River will be pumped upstream to supplement natural flow, which will reduce bacteria concentrations. Because of these major changes already in progress, the lowest AU of Waller Creek, 1429C_01, is not included in the TMDL.

Stream flow within the Colorado River Basin, including the four Austin streams, generally follows the rainfall pattern in the area. The natural flow of these streams is highly variable. Many of the smaller streams cease to flow within a few days or weeks without rain. However, other streams are spring fed and have small perennial base flows. The Spicewood Tributary to Shoal Creek, Taylor Slough South and the headwaters of the Walnut Creek watersheds are located over the Northern Edwards Aquifer Recharge Zone.

The lowest AU of Walnut Creek (1428B_01) receives a small amount of bacteria free industrial wastewater effluent from Freescale Semiconductor, which has only a modest effect on streamflow. While, the City of Austin Walnut Creek wastewater treatment facility is physically located within the watershed, it discharges its effluent directly into the nearby Colorado River, having no effect on Walnut Creek stream flow. The other streams do not receive any industrial or sanitary wastewater discharges, so all flow is a result of stormwater or spring water.

The dominant land use varies significantly among the watersheds. Spicewood Tributary to Shoal Creek and Taylor Slough South watersheds are dominated by residential land use. Waller Creek watershed land uses are mixed, and portions of the Walnut Creek watershed are undeveloped.

Table 3 presents a summary of all ambient *E. coli* indicator bacteria data for monitoring stations in the four Austin streams, which should be compared to the *E. coli* standard of 126 colony-forming units (cfu)/100 milliliter (mL) as a geometric mean. These tables contain data from not only the TCEQ Surface Water Quality Monitoring Information System (SWQMIS) database, but also supplemental data collected by the City of Austin. Temporally, they contain all dates available, including dates both before and after the 2012 assessment period.

Table 3. Summary of all *E. coli* monitoring data available (includes data not used in the 2012 assessment)

TCEQ Station ID	COA Station ID	Station Description	Station AU	No. of Samples	Date Range	*E. coli* Max (MPN/dL) [a]	*E. coli* Geometric Mean [b] (MPN/dL) [a]
16316	930, 582	Spicewood Tributary below Spicewood Spring	1403J_01	56	4/29/97 - 8/18/10	2,420	637
17294	890, 318	Taylor Slough South below Reed Park	1403K_01	39	3/10/04 - 9/12/12	2,900	442
12222	38, 485	Waller Creek below 3rd Street	1429C_01	84	12/18/03 - 9/21/11	24,200	841
15962	624, 4349	Waller Creek at 24th Street	1429C_02	43	12/18/03 - 8/18/10	24,000	839
12228	N/A	Waller Creek at Denson Avenue	1429C_03	1	2/22/2006	100	100
16331	781	Waller Creek at Shipe Park	1429C_03	51	12/18/03 - 8/18/10	6,500	303

TCEQ Station ID	COA Station ID	Station Description	Station AU	No. of Samples	Date Range	*E. coli* Max (MPN/dL) [a]	*E. coli* Geometric Mean [b] (MPN/dL) [a]
12231	4021	Walnut Creek South of FM 969	1428B_01	16	3/23/04 - 12/1/10	2,200	129
N/A	503	Walnut Creek Upstream of Freescale	1428B_01	30	3/23/04 - 3/23/11	2,200	135
17469	502	Walnut Creek at Old Manor Rd	1428B_03	33	3/23/04 - 6/7/11	1,600	123
15743	464	Walnut Creek at IH35	1428B_04	47	3/23/04 - 3/23/11	580	130
N/A	895	Walnut Creek Downstream of Metric Blvd	1428B_04	30	3/23/04 - 9/21/11	4,839	267
17251	N/A	Walnut Creek Downstream of Loop 1	1428B_05	19	9/8/04 - 6/7/11	3,500	807

[a] dL = deciliter; MPN = most probable number

[b] The following units are equivalent: CFU/100 mL, CFU/dL, MPN/100 mL, and MPN/dL.

[c] The *E. coli* standard is 126 MPN/dL.

Potential Sources of Fecal Bacteria

The Freescale Semiconductor plant on Ed Bluestein Boulevard discharges bacteria-free industrial process water into Walnut Creek (1428B_01). The Freescale plant is the only regulated industrial facility that discharges into any of the four streams. The Walnut Creek Wastewater Treatment Facility, operated by the City of Austin, discharges its effluent directly into the Colorado River instead of Walnut Creek. The City of Austin will not build or permit any such discharges into these four streams in the future.

Sources of fecal bacteria in the affected watersheds include sanitary sewer overflows, leaking or illicit discharge from centralized wastewater collection lines, unmanaged wildlife, managed livestock, domestic pets, failing on-site sewage facilities, and direct human contributions. Sanitary sewer overflows (SSOs) are unauthorized discharges from the wastewater collection system. SSOs in dry weather most often result from blockages in the sewer collection lines caused by tree roots, grease, and other debris. Inflow and infiltration of stormwater through leaky sewer collection lines are typical causes of SSOs under conditions of high flow. Blockages in lines may exacerbate the inflow and infiltration problem. Other causes, such as a collapsed sewer lines, may occur under any conditions. Based on City of Austin data on reported SSOs, there were 88 SSOs in the affected watersheds from 1998 to 2011 totaling an estimated 1,126,031 gallons of wastewater.

On-site sewage facilities (OSSFs), or septic systems, may contribute fecal bacteria if they are not properly maintained or fail. Failing OSSFs are not considered a major source of bacteria loading

in the affected watersheds because most of these watersheds are in areas served by centralized wastewater collection systems. There are an estimated 908 in-service OSSFs in the Walnut Creek watershed, of which 894 are estimated to be within City of Austin regulatory jurisdiction.

E. coli bacteria are common inhabitants of the intestines of all warm blooded animals. The TMDL estimates some cattle and feral hogs may inhabit the Walnut Creek watershed although none are assumed to inhabit the other three more urban affected watersheds. Deer and other wildlife including raccoons, rats, and birds are likely to be present in all four of the affected watersheds.

Domestic pets occur in all four of the affected watersheds. The TMDL estimates the number of domestic dogs and cats in the affected watersheds based on the number of households from US Census data (Table 4).

Table 4. Estimated households and pet populations within TMDL watersheds

AU	Estimated Number of Households	Estimated Dog Population	Estimated Cat Population
1403J_01	1,129	714	805
1403K_01	769	486	548
1428B_01	2,129	1,346	1,518
1428B_02	28,887	18,257	20,596
1428B_03	4,406	2,785	3,141
1428B_04	21,314	13,470	15,197
1428B_05	17,429	11,015	12,427
1429C_01	2,608	1,648	1,860
1429C_02	8,042	5,083	5,734
1429C_03	6,151	3,887	4,386

Evidence of direct human defecation near creeks has been observed at multiple monitoring locations in the affected watersheds (Jackson and Herrington 2011). Direct human contributions are likely to be concentrated in intense urban areas with higher densities of homeless residents, but may also occur in parks and greenbelts without restroom facilities regardless of the presence of homeless residents.

TMDL Expression

Load duration curves (LDCs) were used to generate the TMDL for the four affected watersheds. The LDC method allows for estimation of existing loads and TMDL loads by utilizing the cumulative frequency distribution of stream flow and measured pollutant concentration data (Cleland, 2003).

The median loading of the critical very-high flow regime (0-10% exceedance) was used for the TMDL calculations of the impaired AUs in the Austin streams watersheds, because the source

loads are the highest under these flow conditions. Bacteria load contributions from non-regulated stormwater sources are greatest during runoff events. Rainfall runoff, depending upon the severity of the storm, has the capacity to carry indicator bacteria from the land surface into the receiving stream and increases the likelihood of SSOs because of inflow and infiltration into the sanitary sewer system.

LDCs were developed by multiplying the stream flows by the *E. coli* criterion (126 MPN/100 mL). The resulting values were then multiplied by a conversion factor to convert the loading to colonies per day. Continuous daily stream flow was derived for use in the LDC from City of Austin Soil and Water Assessment Tool (SWAT) hydrodynamic models. The TMDL includes the load allocation (LA) from unregulated sources, the wasteload allocation (WLA) for regulated sources, including permitting stormwater runoff (municipal separate storm sewers, or MS4s), an allowance for future growth in the watershed and an additional fixed percentage loading to provide a margin of safety (MOS). The TMDL for the four affected watersheds is presented in Table 5.

Table 5. Final TMDL allocations for all AUs for non-supporting water bodies

Stream	AU	TMDL [a] (Billion MPN/day)	WLA_{SW} [b]	LA_{Total} [c] (Billion MPN/day)	MOS [d] (Billion MPN/day)
Spicewood Tributary to Shoal Creek	1403J_01	11.93	11.33	0.00	0.60
Taylor Slough South	1403K_01	9.93	9.43	0.00	0.50
Walnut Creek	1428B_05	74.91	71.16	0.00	3.75
Waller Creek	1429C_02	90.29	50.72	36.90	2.67
Waller Creek	1429C_03	36.90	35.05	0.00	1.85

[a] Total TMDL allowed from all sources, calculated from median high flow

[b] Permitted loads from MS4 stormwater;

[c] Non-permitted loads from all sources, including non-MS4 stormwater

[d] MOS

The total TMDL reduction for all watersheds combined is 220 billion MPN/day. In total, the proposed management measures included in this I-Plan are estimated to result in a reduction of *E. coli* 370,000 billion MPN/day. Although tracking the progress of the proposed management measures over time in coordination with monitoring the improvement in instream fecal indicator bacteria will be necessary to determine if the I-Plan achieves the stated goal, this I-Plan appears to achieve the load reduction of the TMDL.

Management Measures 1.0 - Riparian Zone Restoration

A result of an expanding and increasingly urbanized metropolitan area, the riparian vegetation communities of Austin-area streams continue to transform further from their natural state (Duncan et al. 2011). Riparian systems provide a suite of ecosystem services including stabilized stream banks, diverse animal assemblages, and groundwater recharge (Richardson et al. 2007) in

addition providing a range of water quality benefits to streams (Mayer et al. 2005, Meyer et al. 2007) including reduction of bacteria concentrations through stormwater filtration, dilution, and reduction of suspended sediments (Casteel et al. 2005, Lee et al. 2003, Meals 2001, Young et al. 1980).

Through decades of urban development with limited protective setbacks from riparian areas and inappropriate maintenance practices, riparian buffers on public and private lands have been severely degraded throughout the entire region. In Austin increased urbanization represented by the percent impervious cover within the watershed is related to changes in hydrology resulting in shifts in vegetation composition (Sung et al. 2011), and impervious cover within riparian zones has been directly related to bacteria concentrations in streams (Porras et al. 2013).

The more degraded an ecosystem, the more fundamentally altered the basic services will become (Hobbs and Cramer 2008). The reduction or elimination of activities causing the degradation or prevention of natural recovery may be all that is necessary to restore riparian function and improve water quality (Kauffman et al. 1997, Richardson et al. 2007) although more active restoration efforts may be necessary to restore ecological function when environmental disturbance is extreme (Hobbs and Prach 2008).

Natural riparian buffer areas have been shown to reduce instream *E. coli* bacteria concentrations when stormwater runoff is diverted through buffers prior to discharge into the receiving water (Casteel et al. 2005). Vegetative filter strips have been demonstrated to reduce fecal coliform bacteria by 69% in feedlot runoff (Young et al. 1980). Stream bank restoration, livestock exclusion and riparian restoration were demonstrated to reduce *E. coli* bacteria concentrations in Missiquoi River tributaries in Vermont by 49 to 52% between treatment and control watersheds (Meals 2001). The restoration and enhancement of functional riparian buffers along Austin area streams is a primary strategy the City of Austin Watershed Protection Department is implementing through a combination of targeted restoration and regulatory actions as part of this Plan to reduce *E. coli* bacteria concentrations citywide.

1.1 Increase riparian zones in City of Austin parks by expanding the Grow Zone initiative (COA)

As part of this Plan, the City of Austin will increase the number of parks in the affected watersheds for which riparian restoration “Grow Zones” have been created. The purpose of the Grow Zone program is to restore riparian zone function along stream corridors in parks that have historically been degraded due to maintenance practices like mowing and overuse by park users (www.austintexas.gov/blog/grow-zones).

For Grow Zone project areas, the City of Austin has established buffer areas along both banks of a creek for which passive plant growth is allowed without regular mowing. Grow Zones are typically 25 ft. in width to allow for compatibility with other park uses in a limited space, although fully functional riparian zones may need to be 300 ft. in width or wider (Duncan et al. 2012). Change over time is monitored by City of Austin staff (Richter and Duncan 2012), and adaptive management is applied when necessary including coordination of periodic trash removal, invasive vegetation management or native vegetative planting. Educational signage is installed to demarcate efforts and inform the public that the initial growth stages are intentional modifications in park land management by the City of Austin.

This management measure will be implemented by the City of Austin Watershed Protection Department (COA WPD) in collaboration with the City of Austin Parks and Recreation Department (COA PARD). The template for this approach has been established through initiation of the Grow Zone effort in 18 parks citywide in 2012. Through this strategy, the City of Austin will add 13 more parks within the 4 affected watersheds to the Grow Zone program over the 5-year time frame of this Plan. The goal of this strategy is to add approximately 3 parks per year to the Grow Zone program and to have all 13 integrated into the Grow Zone program by the end of the 5-year time frame of this I-Plan. The primary action this strategy uses to reduce fecal bacteria loads to streams is to enhance the density, diversity and health of riparian vegetation and soil by reducing destructive maintenance, managing vegetation succession and enhancing soil carbon and nutrient dynamics (Duncan et al. 2011; Duncan 2012; Richter and Duncan 2012; Duncan et al. 2012; Wagner 2013; Williams et al. 2013).

This effort is primarily managed by the City of Austin, but also utilizes a range of local and regional stakeholders including neighborhood associations, adopt-a-park groups, adopt-a-creek groups, the Austin Parks Foundation, Keep Austin Beautiful, Tree Folks, and others. These groups assist with tree planting, invasive species control, litter pick-up, and educational efforts which are all critical to both water quality improvement and public acceptance of the change in maintenance practices. The Grow Zone program has the ability to reduce any source of fecal bacteria in park areas including fecal bacteria from pet waste, wastewater, human waste, and wildlife, as long as stormwater is directed through the vegetated buffer areas. The Grow Zone program approach is very efficient as it is primarily a passive, managed succession strategy that requires little maintenance or inputs, and reduces mowing and staff time relative to historic active maintenance practices.

The potential load reduction estimated for this management measure was derived by multiplying the average bacteria load in stormwater by an estimated 49% removal efficiency (Meals 2001) for restored riparian areas for each of the 13 parks in the affected watersheds to be included in the Grow Zone program. The average log-normal event mean concentration for fecal coliform bacteria in stormwater runoff from undeveloped land use of 19,961 fecal coliform cfu/dL was derived from City of Austin monitoring (City of Austin 2009), and converted to *E. coli* bacteria using a regionally-established conversion factor (Richter 2013) yielding an event mean concentration of 9,291 *E. coli* cfu/dL. Annual runoff volumes were estimated for undeveloped areas at 2.76 inches based on an average estimated impervious cover of 10% (City of Austin 2009). Runoff from an estimated 420 acres of park land will be positively affected by the Grow Zone program with the 13 additional parks proposed to be included under this Plan. Based on these assumptions, the estimated annual *E. coli* load reduction for this management measure is 11,000 billion cfu/year. This fecal bacteria load reduction would be in addition to the wide variety of enhanced ecological services resulting from the restoration of riparian areas.

Table 6. Summary of Management Measure 1.1

Management Measure	1.1 Increase riparian zones in COA parks by expanding the Grow Zone initiative.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Determine feasibility of expanding passive riparian zone restoration Grow Zone initiatives to all applicable parks in affected watersheds, and develop plan to implement expansion.	Implement in 25% of planned parks in affected watersheds.	Implement in 50% of planned parks in affected watersheds.	Implement in 75% of planned parks in affected watersheds.	Implement in 100% of planned parks in affected watersheds.
Potential Load Reduction (cfu/day)	No additional load reduction this year as plan is being developed	Intervening drainage area captured by restored riparian areas multiplied by an estimated 49% removal efficiency of fecal bacteria			
Technical and Financial Assistance Needed	Technical COA WPD to identify restoration plans for each park. COA PARD to assist with implementation. Financial If existing funding or labor resources are insufficient to implement, COA will pursue partnerships with volunteer groups, neighborhoods.				
Education Component	Present overall plan to citizen advisory boards for input	- Reach out to individual neighborhood groups, stakeholders in proximity to new Grow Zone initiative parks and Park/Creek Adopters. - Maintain citywide educational efforts including website and pamphlet distribution at area garden stores on benefits and appropriate management of riparian zones.			
Interim, Measurable Milestones	Completion of plan	% of Grow Zones actually implemented versus current year goal			
Progress Indicators	N/A	- Reduction in *E. coli* concentrations in the affected watersheds - Increased riparian zone plant abundance and diversity to improve stormwater infiltration and removal of fecal indicator bacteria			
Monitoring Component	N/A	- Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the Lower Colorado River Authority. - COA WPD staff will perform annual inspections of Grow Zone areas per year. - COA PARD will report problems observed in Grow Zones during regular maintenance visits to WPD for resolution.			
Responsible Organization	COA PARD, COA WPD				

1.2 Prioritizing the affected watersheds without current adopters for park and creek adoption recruitment (APF, KAB)

The Austin Parks Foundation (APF) is a non-profit organization devoted to building public/private partnerships to develop and maintain parks, trails, and open space in Austin and Travis County. APF connects people to resources and partnerships to develop and improve parks. Since 1992, APF has initiated, promoted, and facilitated physical improvements, new programming, and greater community involvement for Austin's 19,000+ acres of parkland. Each year, APF generates millions of dollars in volunteer time, in-kind donations, and financial support for city parks.

Keep Austin Beautiful (KAB) was established by the Greater Austin Chamber of Commerce in 1985 to preserve Austin's quality of life. KAB provides resources and education to inspire individuals and the Greater Austin community toward greater environmental stewardship in three focus areas which include litter abatement, beautification and restoration, and education.

APF and KAB are committed to educating community volunteers on practices which support fecal load reduction such as riparian zone restoration efforts and pet waste collection. Both organizations will incorporate curriculum provided by the COA WPD into volunteer workdays and meetings. Watersheds in the affected areas will be targeted as high priority areas for recruitment and participation for both the Adopt-A-Park and Adopt-A-Creek programs. All volunteer groups who have adopted creeks or parks or are otherwise working within the affected areas will be encouraged to support the existence and expansion of Grow Zones. AFP and KAB will track and report the number of new adoptions, as well as volunteer workdays and annual meetings at which riparian zone restoration or domestic pet waste education is discussed.

With two large active volunteer bases, APF and KAB are in an advantageous position to effectively distribute educational information to the community, particularly those residents frequenting park and creek areas. Increasing communication with the Adopt-A-Creek, Adopt-A-Park, and neighborhood leaders can efficiently and successfully disseminate the plan's goals and benefits to the community. APF and KAB will implement this measure by recruiting additional park and creek adopters, by information on website, using printed and social media, and with specific outreach events in parks in the targeted watersheds.

Table 7. Summary of Management Measure 1.2

Management Measure	1.2 Prioritize the affected watersheds without current adopters for park and creek adoption recruitment				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Reach out to all parks within the affected watersheds that are currently without adopters.	Recruit and commit 33% of un-adopted parks within the affected watersheds to either or both programs.	Recruit and commit 66% of un-adopted parks within the affected watersheds to either or both programs.	Recruit and commit 100% of un-adopted parks within the affected watersheds to either or both programs.	Evaluate and renew groups that are eligible.
Potential Load Reduction	This strategy will enhance COA riparian restoration program effectiveness. Refer to COA riparian zone restoration strategies for load reduction quantification.				
Technical and Financial Assistance Needed	Technical Assistance COA will provide inventory of parks in affected watersheds. COA will provide necessary riparian zone educational materials. Financial Assistance None				
Education Component	Utilize COA public education materials focused on the impact of certain activities on bacteria levels of waterways and geared towards volunteer service groups. Conduct outreach to volunteer service organizations regarding the regions bacteria TMDL and its causes.				
Interim, Measurable Milestones	Number of service groups contacted and engaged	Number of parks or creek reaches with new adopters			
Progress Indicators	Decrease in fecal bacteria load from enhanced riparian zone effectiveness				
Monitoring Component	APF and KAB will track number of new creek or park adopters in affected watersheds.				
Responsible Organization	APF, KAB				

1.3 Supporting the expansion of our Grow Zones to all of the applicable parks in the affected watersheds currently without Grow Zones (APF, KAB)

As described in the management measure narrative for 1.2, APF and KAB will also support expansion of the City of Austin Grow Zone program to parks within the affected watersheds as described in Table 8.

Table 8. Summary of Management Measure 1.3

Management Measure	1.3 Support expansion of Grow Zones to all applicable parks in the affected watersheds currently without Grow Zones				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Reach 33% of un-adopted parks within the affected watersheds to either or both programs.	Reach 66% of un-adopted parks within the affected watersheds to either or both programs.	Reach 100% of un-adopted parks within the affected watersheds to either or both programs.	Continue efforts to encourage expansion.	
Potential Load Reduction (cfu/day)	This strategy will enhance COA riparian restoration program effectiveness. Refer to COA riparian zone restoration strategies for load reduction quantification.				
Technical and Financial Assistance Needed	Technical COA will provide inventory of parks in affected watersheds. COA will provide necessary riparian zone educational materials. Financial None				
Education Component	Utilize COA Public Education materials focused on the impact of certain activities of bacteria levels of waterways and geared towards volunteer service groups. Conduct outreach to volunteer service organizations regarding the regions bacteria TMDL and its causes.				
Interim, Measurable Milestones	- Number of service groups contacted and engaged - Number of park or creek reaches with new adopters in the affected watersheds				
Progress Indicators	Decrease in fecal bacteria load from enhanced riparian zone effectiveness				
Monitoring Component	APF, KAB will track number of creek reaches or parks with new adopters in the affected watersheds.				
Responsible Organization	APF, KAB				

1.4 Increase protected riparian buffer zone width for new development (COA)

The City of Austin is a home-rule city that derives its land use control and development authority from the Texas Constitution as articulated in the City of Austin Charter. The City of Austin protects water quality through the Land Development Code which governs zoning, subdivision, and the construction process. City of Austin water quality ordinances have evolved over time (austintexas.gov/page/watershed-protection-ordinance).

In 2013, the City of Austin adopted phase 1 of a new watershed protection ordinance that will improve creek and floodplain protection, including critical headwater areas, to protect water quality and reduce erosion, flooding and long-range infrastructure maintenance costs (www.austintexas.gov/page/ watershed-protection-ordinance-0). The new watershed protection ordinance seeks not only to encourage land development patterns that provide improved preservation of floodplains and creeks, but also simplifies development regulations where possible to minimize the impact of changes on the ability to develop private land.

The Watershed Protection Ordinance will protect stream buffers in smaller headwater streams up to 64 acres in drainage area versus the 320 acre minimum drainage area protected by current city code. The new ordinance effectively protects riparian buffer areas along streams from modification by future development reducing an increase in future fecal bacteria loading. Residential and commercial areas have higher measured stormwater runoff concentrations of E. coli in Austin of 24,111 MPN/dL and 38,592 MPN/dL for commercial and residential land uses, respectively (see management measures section 8.2), than undeveloped land use runoff E. coli concentrations of 9,291 MPN/dL (see management measures section 4.1). The new ordinance will primarily affect new development in the Walnut Creek watershed, which has more undeveloped land than the more urban Waller, Taylor Slough South, and Spicewood watersheds. As part of this I-Plan, the City of Austin will implement phase 1 of the Watershed Protection Ordinance and the amount of riparian buffer now protected from new development will be tracked and reported annually as a measurable milestone of this I-Plan.

Functional riparian buffers are assumed to have a 49% removal efficiency for *E. coli* bacteria from stormwater runoff (Meals 2001). An estimated 46 stream miles along the main stem and tributaries of Walnut Creek will maintain protected riparian buffers of 100 ft. on each side of the creek under the new ordinance. If the area of the riparian buffers protected under the new ordinance were allowed to be developed as residential land use, the *E. coli* load could be approximated as 380,000 billion cfu/year (see management measure 8.2). If the same area of land were allowed to remain undeveloped, the *E. coli* load could be approximated as 29,000 billion cfu/year. By protecting riparian zones along the additional 46 stream miles of Walnut Creek under the new ordinance, a future potential estimated load increase of 350,000 billion cfu/year would be prevented. In addition to this load reduction, stormwater runoff from an estimated 7,342 acres of currently undeveloped land in the Suburban Regulation Area within the Walnut Creek watershed could on full build-out potentially be diverted through the newly protected riparian buffers reducing fecal bacteria loads. Enhanced stormwater runoff treatment for this land area with the additional protected buffers could result in prevention of an additional estimated potential future load of *E. coli* of 1,200,000 billion cfu/year. With this management measure, an estimated increase in total load of *E. coli* of 1,600,000 billion cfu/year would eventually be prevented.

Table 9. Summary of Management Measure 1.4

Management Measure	1.4 Increase protected riparian buffer zone width for new development.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Document number of linear miles of protected/restored riparian buffer added per year.				Provide final report on success/progress of legislation.
Potential Load Reduction (cfu/day)	Linear feet of riparian buffer protected x removal factor				
Technical and Financial Assistance Needed	Technical None Financial None				
Education Component	Continue citywide education about benefits of functional riparian zone				
Interim, Measurable Milestones	Linear feet of protected riparian zone buffer				
Progress Indicators	Increase in riparian zone buffers to reduce bacteria, reduction in instream fecal bacteria concentrations				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the Lower Colorado River Authority (LCRA).				
Responsible Organization	COA WPD				

1.5 Increase waterway setbacks in Walnut Creek (Travis County)

Through Travis County regulation, setbacks (buffer zones) are being established through the development review process from the centerline of each minor, intermediate, and major waterway within the Walnut Creek watershed in Travis County jurisdiction, including in each municipal extra-territorial jurisdiction (ETJ). In 2012, Travis County regulations established these setbacks in this watershed as 100 feet for a minor waterway (defined as 64 to 320 acres drainage), 200 feet for an intermediate waterway (320 – 640 acres) and 300 feet for a major waterway (>640 acres). While these standards are applicable to all other development proposals and all ETJs, the changes are not currently applicable to a subdivision proposal within the City of Austin ETJ. Such changes must be jointly adopted by the City and County under Austin City Code, Title 30, Austin/Travis County Subdivision Regulations (Title 30)

This management measure includes the adoption in 2014 of changes in the joint code applicable to subdivision proposals in the Austin ETJ and ongoing implementation activities associated with these revisions, including technical assistance, public outreach, and reporting of progress. The requirements are implemented when a person applies for approval of a subdivision plan or a commercial construction plan. It may also apply to a single family residence on a parcel not in a subdivision. The requirement would not be implemented when Texas state law prohibits the imposition of new development standards ("grandfathering" provisions of Texas Local Government Code Chapter 245).

This management measure, for which the Environmental Quality Program (EQP) of Travis County's Transportation and Natural Resources (TNR) department is responsible, will remove some potential for pollutants, including human-generated *E. coli*, to discharge in runoff into Walnut Creek and its tributaries. Providing an undeveloped and more natural riparian area eliminates impervious cover and allows upgradient runoff to discharge in a more sheet-flow pattern facilitating pollutant attenuation similar to that provided by vegetative filter strips. Since the subdivision, commercial, and other home development and associated impervious cover does not exist at this time, this measure will not reduce existing pollutant loads but instead would eliminate an increase in bacteria associated with new construction. Prevention of new pollutant loading will be calculated by tracking the linear feet of setback area and applying an *E. coli* reduction factor from studies or literature associated with filter strips.

Table 10. Summary of Management Measure 1.5

Management Measure	1.5 Increase waterway setbacks in Walnut Creek to prevent an increase in bacteria load associated with new development. Setbacks will be implemented from the centerline of each minor, intermediate, and major waterway within the Walnut Creek watershed in Travis County jurisdiction, including each municipal ETJ. In 2012, Travis County already increased these setbacks in this watershed to 100 feet for a minor waterway (defined as 64 to 320 acres drainage), 200 feet for an intermediate waterway (320 – 640 acres) and 300 feet for a major waterway (>640 acres). While these standards are applicable to all other development proposals and all ETJs, the changes are not currently applicable to a subdivision proposal within the COA ETJ. Such changes must be jointly adopted by the City and County under Austin City Code, Title 30, Austin/Travis County Subdivision Regulations (Title 30). This proposed management measure outlines the adoption and implementation activities associated with these revisions, including technical assistance, public outreach, and reporting of progress.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	A. Implement 2012 Travis County Code setbacks on all new development proposals subject to the setback requirements. B. Propose and adopt revisions in Title 30 to apply to Austin ETJ subdivisions following adoption of the City's Watershed Protection Ordinance currently under development.	Implement 2012 Travis County Code setbacks and 2014 Title 30 setbacks on all new development proposals subject to the setback requirements (Note: unless restricted by state law under Texas Local Government Code Chapter 245).			
Potential Load Reduction (cfu/day)	Sum of all added setbacks in linear feet *x* bacteria reduction/square ft. based on appropriate literature value				
Technical and Financial Assistance Needed	Existing Travis County staff and resources				
Education Component	Improve development application information and web-based technical information to make development applicants aware of waterway setback requirements.	- Keep technical information up-to-date. - Host at least two technical assistance workshop inviting area builders, developers, and consultants who design and submit applications and construct land development projects. - Develop and distribute brochures and establish web-based information oriented to public, describing activities that should be avoided and are prohibited in setback areas (protective easements on lots, tracts).			
Interim, Measurable Milestones	- Date of Commissioners Court Public Hearing on Title 30 Proposal - Date of Commissioners Court Adoption of Title 30 TAC Revisions - Number of Development Applications and linear feet of setback area on each tract subject to waterway setback. - Dates of application material and website updates - Dates of workshops, brochure distribution, and website upload or update of new information	- Number of Development Applications and linear feet of setback area on each tract subject to waterway setback - Dates of application material and website updates - Dates of workshops, brochure distribution, and website upload or update of new information			
Progress Indicators	The increase in the amount of prevented bacteria load that results from the land transformation and new development				
Monitoring Component	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	TNR, EQP				

Management Measures 2.0 – Wastewater Infrastructure

2.1 On-site sewage facilities cutover to sanitary sewer (COA)

The City of Austin Water Utility regulates OSSFs generating less than 5,000 gallons of wastewater per day. The City of Austin is an Authorized Agent of the TCEQ, and the Austin Water Utility (AWU) is a Designated Representative to administer the program. The program falls primarily under the authority of the TCEQ rules contained within Texas Administrative Code, Title 30, Chapter 285: On-Site Sewage Facilities (30 TAC 285) Additional regulatory authority is derived from Texas Health and Safety Code, Title 5, Chapter 341 and Chapter 366 of Sanitation and Environmental Quality. The Austin City Ordinance No. 990211-E and the Austin City Code, Chapter15-5, adopt the current 30 TAC 285 as its local rule.

OSSF effluent may contain human pathogenic bacteria or viruses (Hagedorn 1984, Corapcioglu et al 1997). According to the U.S. Environmental Protection Agency (EPA), properly designed, sited and maintained OSSFs are not likely to be sources of fecal contamination to surface water and are a cost-effective long-term option for waste disposal that meet public health and water quality goals (EPA 1997). Failing or improperly managed OSSFs may pose a threat to water quality and public safety as nonpoint sources of pollution (Alhajjar et al. 1990, EPA 2005). Fecal contamination from OSSFs is of additional concern as the typical treatment mechanisms may result in inherent selection for environmental persistence of fecal bacteria (Gordon et al. 2002). Case studies in Florida have documented chronic fecal indicator bacteria levels exceeding contact recreation standards in waters impacted by failing OSSFs (Propst et al. 2011).

Within the four affected watersheds, known operating OSSFs occur only within the Walnut Creek watershed. The City has records for 894 total OSSFs within the Austin jurisdictional boundaries of Walnut Creek watershed. As part of this Plan and consistent with current City of Austin regulations, any property owner that has a failing or substantially modified OSSF will have to properly abandon the OSSF and connect their property to a centralized wastewater collection line when one is available within 100 feet of the property. There are currently 530 OSSFs in the Walnut Creek watershed within 100 feet of a centralized wastewater collection line. The number of cutovers to centralized wastewater collection within the Walnut Creek watershed will be reported annually. There are approximately 3,150 OSSFs in service within the City of Austin jurisdiction (within the corporate limits and limited purpose annexation areas for public health and safety) and on average, 50 OSSF cutovers to centralized wastewater collection systems occur annually representing 1.6% of the total.

The Austin Water Utility will continue to support Austin City Council policies waiving wastewater capital recovery fees (approximately $2,000 per connection) after full purpose annexation as an incentive to abandon existing OSSFs and connect to the City of Austin-owned centralized wastewater collection system as new wastewater mains become available in recently annexed areas. The City of Austin will continue to promote the 3-1-1 call system and the 512-974-2550 Environmental Hotline for reporting potential wastewater problems, so that failing OSSFs may be identified.

The potential load reduction achieved through this strategy is calculated by estimation of the number of OSSFs within 100 ft. of existing or proposed wastewater mains multiplied by the

estimated rate of cutover multiplied by the estimated bacteria load in OSSF effluent. There are 750 OSSFs within current or proposed wastewater mains in the affected watersheds, and 1.6% are estimated to cut over to centralized wastewater collection annually. COA WPD staff have measured *E. coli* concentrations in OSSF effluent from a conventional system at 44,000 cfu/dL. Wastewater generation rates may be estimated using the COA *Utilities Criteria Manual* at 245 gal/day per household. Based on Austin Water Utility inspector experience, approximately 5% of OSSFs required to cut over to centralized wastewater collection are assumed to otherwise have resulted in complete failure, with failure occurring for 1 day until remediation and an arbitrarily determined 25% of the sewage from a failing system is assumed to become available for transport to a receiving water. Based on these gross assumptions, the potential load reduction from this strategy is estimated to be 0.06 billion cfu/year.

Table 11. Summary of Management Measure 2.1

Management Measure	2.1 OSSF cut over to sanitary sewer. Continue to require failing OSSFs and OSSFs that do not meet current capacity requirements (as determined during the COA permitting process) and are located within100 feet of COA centralized wastewater collection lines to cut over to the COA and properly abandon the OSSF. Continue to support Austin City Council's policy waiving wastewater capital recovery fees for a two-year period after full purpose annexation as an incentive to abandon existing OSSFs and connect to the COA wastewater collection system as new wastewater mains become available in recently annexed areas.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	-As full purpose annexation occurs or -When an OSSF fails or does not meet COA capacity requirements and COA wastewater collection mains are located within 100 ft. of the property				
Potential Load Reduction (cfu/day)	Estimated number of systems meeting Management Measure criteria *x* typical flow rate *x* bacterial load in OSSF effluent *x* adjustment factor				
Technical and Financial Assistance Needed	Technical Austin Water Utility to identify failing OSSFs, inadequate capacity OSSFs, and OSSFs eligible for waived wastewater capital recovery fees to cut over to COA wastewater collection mains (within City's OSSF jurisdiction). Financial Utilize City Council authorized capital recovery fee waiver for connection to new COA wastewater collection mains in recently full purposed annexed areas.				
Education Component	Continue to promote cutover for functioning systems to COA wastewater collection system as new City wastewater collection mains become available. Continue to promote 3-1-1 and the Environmental Hotline to report potential wastewater issues. Continue OSSF education efforts as needed.				
Interim, Measurable Milestones	Number of OSSFs cut over to City wastewater collection system per year				
Progress Indicators	-Reduction in *E. coli* concentrations in the affected watersheds -Removal of failing or aging OSSFs				
Monitoring Component	-Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. -AWU staff will track the number of OSSF cutovers per year.				
Responsible Organization	COA, AWU				

2.2 Incentivize onsite sewerage facility repair and improvements (Travis County)

Travis County's TNR has responsibility as the OSSF Authorized Agent in unincorporated Travis County. TNR will implement an initiative to incentivize the connection of OSSFs into the City of Austin centralized wastewater collection system. Travis County will increase awareness to the public and OSSF owners of AWU programs for cutover and will incentivize proactive OSSF repairs by waiver of permit fees. If an OSSF owner proposes repairs or improvements to a failing or deficient OSSF, prior to citation or Notice of Violation, the $500 permit fee will be waived.

The program will focus on the Walnut Creek watershed and will be an ongoing initiative through the course of the five-year TMDL implementation. TNR will use existing staff resources to promote the initiative which will involve gaining Commissioners Court approval of fee waivers, keeping a website up-to-date, and preparing an accurate mailing list of OSSF owners in the area.

The strategy seeks to address a potential source of elevated *E. coli* that may result from surface runoff from failing septic tank and drain field systems on individual lots. It is difficult to assess the significance of this problem since OSSFs on private property are not inspected except when someone complains about a problem. This initiative, if promoted in a targeted manner, may help owners to choose a proactive remedy to address the problem rather than deferring action on repairs until cited in violation. The reduction in pollutant load would be estimated by using a literature value for *E. coli* loading that a failing system generates and multiplying this load by 25% as an estimate of the amount that may actually flow off land to a surface water body.

Table 12. Summary of Management Measure 2.2

Management Measure	2.2 Incentivize OSSF repair improvements: Travis County will increase awareness to the public and OSSF owners of COA Water Utility programs for cutover and will incentivize proactive OSSF repairs by waiver of permit fees. If an OSSF owner proposes repairs or improvements to a failing or deficient OSSF, prior to citation or notice of violation, the $500 permit fee will be waived.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	- Recommend Commissioners Court adopt permit fee waiver for proactive repairs to systems. - Prepare up-to-date mailing list for each property with an OSSF in unincorporated areas of Walnut Creek watershed. - Update County website to describe COA cutover and County fee waiver incentives for proactive repairs.	- Continue fee waiver program. - Keep website information on COA and County incentives up-to-date. -Mail out information on COA and County incentives to all addressees in unincorporated areas of Walnut Creek watershed.	- Continue fee waiver program. - Keep website information on COA and County incentives up-to-date.		
Potential Load Reduction (cfu/day)	Estimated cfu/day/failing OSSF *x* 0.25 (amount of load reaching surface water) *x* number of systems either repaired or cutover				
Technical and Financial Assistance Needed	Existing Travis County staff and resources				
Education Component	See second and third items under Schedule of Implementation.				
Interim, Measurable Milestones	- Adoption of fee change - Website changes completed - Mailing list completed - No. systems in watershed either repaired or cut over	- Mail out completed - Number of systems in watershed either repaired or cut over			
Progress Indicators	Calculation of *E. coli* load reduction achieved by either system repair or cut over of OSSFs to centralized wastewater collection system.				
Monitoring Component	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	Travis County-TNR, OSSF Program				

2.3 Wastewater infrastructure inspection and repair (COA)

The fee-funded AWU maintains centralized wastewater collection lines and wastewater treatment plants for the City of Austin. There are approximately 3.2 million feet of centralized wastewater collection lines (see management measure section 5.7) maintained by the City of Austin in the affected watersheds. Pipe material varies but is predominantly reinforced concrete, concrete steel cylinder, and vitrified clay. Pipe diameters range from 3 to 96 inches.

Damage due to root penetration, corrosion, exposure of wastewater lines in creek channels from bank erosion and aging may lead to release of raw sewage from the collection system. Leaking sanitary sewer lines may be a source of fecal contamination to receiving waters resulting in instream bacteria concentrations in excess of contact recreation standards during non-storm conditions (Propst et al. 2011). Defective wastewater infrastructure also allows for infiltration of rainwater into the collection system potentially compromising treatment plant operations or leading to SSOs (Metcalf and Eddy Inc., 1979).

The AWU personnel and private contractors perform closed-circuit television inspection and cleaning of the wastewater collection system piping. The program is part of a preventative maintenance effort to minimize SSOs by repairing or replacing defective piping that may impact water quality or wastewater system reliability. Defects that are observed in the wastewater piping are recorded in a database and prioritized for repair. Inspection is conducted on approximately 2.5 million feet of wastewater lines per year citywide, representing approximately 12.5% of the total system length. Rehabilitation projects are conducted on approximately 40,000 to 50,000 feet of wastewater lines per year citywide to prevent SSOs and infiltration and inflow of rainwater. Rehabilitation projects are prioritized based on overall condition and criticality of the line. Expanded maintenance activities or increase in the frequency of inspection of the collection system could be accomplished with increased funding.

As part of this Plan, the AWU will identify the length of wastewater lines inspected within the affected watersheds, the number of problems identified and corrected with spot repairs, and the length of wastewater lines replaced or upgraded annually. This strategy will reduce the frequency of SSOs and reduce the probability of sewage leaking from the collection system.

The potential load reduction for this strategy cannot be quantitatively estimated with reasonable accuracy. Infrastructure inspection not only identifies active failures resulting in loss of raw sewage to the environment, but also proactively identifies failures that have not yet occurred but are likely to occur in the future. The rate of occurrence and size of active and potential failures is highly variable over time and space, and is dependent on the age of infrastructure, pipe material, and surrounding conditions. Both active and potential infrastructure failures will be addressed by this measure. Because of the high concentration of *E. coli* in raw wastewater, with examples ranging from .006 billion MPN/dL (Sobsey et al., 1998) to 0.028 billion MPN/dL (Olańczuk-Neyman et al., 2001), raw wastewater can have substantial impacts on receiving water fecal bacteria concentrations.

Table 13. Summary of Management Measure 2.3

Management Measure	2.3 Inspect wastewater infrastructure in the affected watersheds and prioritize repairs as problems are encountered based on overall condition and criticality.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Inspect COA-owned wastewater infrastructure in affected watersheds and make repairs when failures are encountered.				
Potential Load Reduction (cfu/day)	This strategy mitigates active wastewater infrastructure failures and prevents future failures by proactive inspection. The quantitative load reduction cannot be estimated because the rate of occurrence and size of active or potential failures is highly variable over time and space.				
Technical and Financial Assistance Needed	Technical AWU to inspect infrastructure, identify failures and repair. Financial Inspection and repair would be done with existing programs and not require additional financial resources.				
Education Component	- Continue citywide public education efforts to reduce potential for sanitary sewer overflows with campaigns like "Ban the Blob." - Continue promotion of COA WPD environmental hotline and 3-1-1 for citizens to report wastewater overflows.				
Interim, Measurable Milestones	- Number of feet of wastewater lines inspected - Number of problems encountered and repaired (spot repairs) - Number of feet of wastewater mains replaced/upgraded in affected watersheds				
Progress Indicators	- Reduction in *E. coli* concentrations in the affected watersheds - Repairs of failing wastewater infrastructure made				
Monitoring Component	- Water quality monitoring will continue in each of the affected watersheds as part of Watershed Protection Department participation in the Texas Clean Rivers Program in partnership with the LCRA. - AWU staff will track inspection and repair measures annually.				
Responsible Organization	COA				

2.4 Inspect wastewater infrastructure in the Waller Creek watershed (UTA main campus) and make repairs as problems are encountered

The UTA Utilities and Energy Management (UTA-UEM) department inspects university – owned wastewater infrastructure throughout the entire main campus area every five years. UTA-owned wastewater infrastructure is cleaned and televised during this project. Areas with pipe failures, cracks, sags, and manholes needing repair or rehabilitation are identified in this process. UTA-UEM then makes the repairs or hires a contractor to complete the repairs, as needed. In between inspections, UTA-UEM staff conducts preventative maintenance, by cleaning wastewater lines in areas that have been identified as problems due to past back-ups.

The UTA Environmental Health and Safety (UTA-EHS) department works with clients across campus to educate them on the prohibition on disposing of grease to the sewer system rather than the grease trap. Both UTA-EHS and UTA-UEM track the inspection and repair measures annually. All these measures are aimed at reducing SSOs and the resulting bacterial loading to the Waller Creek watershed.

Table 14. Summary of Management Measure 2.4

Management Measure	2.4 Inspect wastewater infrastucture in the Waller Creek watershed (main campus) and make repairs as problems are encountered.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Inspect UTA-owned wastewater infrastructure on main campus (Waller Creek watershed) and make repairs when failures are encountered. Current cycle for inspections and cleaning is once every 5 years.				
Potential Load Reduction (cfu/day)	Estimated number of failures encountered *x* volume of wastewater released *x* bacteria load in wastewater				
Technical and Financial Assistance Needed	Technical UTA-UEM to inspect UTA sanitary infrastructure, identify failures, and make the necessary repairs. Financial Inspection and repair would be done with existing preventative maintenance programs and not require additional financial resources.				
Education Component	Continue with monitoring and servicing schedule of main campus grease traps to reduce and continue educating operators to minimize untreated grease disposal to sanitary sewer.				
Interim, Measurable Milestones	-Number of feet wastewater lines inspected -Number of problems encountered and repaired				
Progress Indicators	-Reduction in *E. Coli* concentrations in the Waller Creek Watershed - Repairs of failing wastewater infrastructure made				
Monitoring Component	-Water quality monitoring is conducted in the Waller Creek Watershed as part of the COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. -UTA UEM and EHS staff will track inspection and repair measures annually.				
Responsible Organization	UTA-UEM and UTA-EHS				

2.5 Sanitary sewer overflow response (COA)

SSOs occur when equipment failures, blockages, breaking, or inflow and infiltration of rainwater or groundwater that overwhelms the capacity of wastewater lines, cause a release of sewage from the wastewater collection system (EPA 2004). Fecal contamination of receiving waters from SSO may contribute to fecal bacteria levels in excess of contact recreation standards (EPA 2004).

The City of Austin responds to SSOs. AWU personnel are on duty or on call 24 hours a day, 7 days a week, to respond to SSOs. The objective of the AWU response program is to arrive at the source of the wastewater emergency within one hour of receiving the call and control the overflow as soon as possible by starting wastewater bypass pumping systems, locating and eliminating the cause of the interrupted wastewater service, and recovering or disinfecting spilled wastewater as soon as possible. AWU personnel have equipment and staff to control most wastewater emergencies, but may also utilize private contractors for pumping and hauling wastewater as needed.

The COA WPD receives notification from the AWU of all SSO events. COA WPD staff investigates any SSO greater than 50 gallons, as well as any SSO which may affect a storm sewer or water body, to ensure impacts to receiving waters are minimized. Watershed Protection Department also directly investigates citizen complaints of polluting discharges, and reports to the AWU if illicit sanitary sewer connections to the storm drain system are detected or if SSOs are observed. The COA will remediate if the SSO is from privately owned system and the private entity cannot or will not remediate. COA through various departments will require repairs of private wastewater infrastructure if failures are clearly documented.

From 2003 to 2011, there were 100 reportable SSO events in which an estimated 1,167,031 gallons of sewage were recovered within the four affected watersheds. The SSO response efforts of the City of Austin recover on average 145,879 gallons of sewage annually from the four affected watersheds.

As part of this Plan, the City of Austin will continue to promote the use of the 3-1-1 call system and the 24-hour 512-974-2550 environmental hotline to provide for citizen reporting of SSOs. The City of Austin will continue public education efforts to reduce the likelihood of SSOs with educational campaigns like the Ban the Blob initiative (austintexas.gov/department/stop-grease-blob) to reduce disposal of grease into the sanitary sewers.

As part of this Plan, the City of Austin will track the number of SSOs that occur within the affected watersheds and the volume of sewage recovered from SSOs annually. By recovering wastewater from SSOs, the City of Austin will reduce the fecal bacteria load to the affected watersheds from SSOs. The potential load reduction is estimated based on the annual average volume of wastewater recovered multiplied by the average *E. coli* bacteria concentration in raw wastewater of .006 billion MPN/dL (Sobsey et al., 1998). The estimated potential load reduction from this strategy for the four affected watersheds is 33,000 billion MPN/year.

Table 15. Summary of Management Measure 2.5

Management Measure	2.5 Respond to sanitary sewer overflows in affected watersheds and remove sewage from creeks during overflow events when feasible				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	AWU to investigate and remediate SSOs in affected watersheds as they are discovered. AWU to notify Watershed Protection Department for all known SSOs. COA WPD to assess environmental impacts of SSO and advise AWU on sewage removal if necessary. The COA will remediate if SSO is from privately owned system and the private entity cannot or will not remediate. COA through various departments will require repairs of private wastewater infrastructure if failures are clearly documented.				
Potential Load Reduction (cfu/day)	Estimated number SSO events *x* volume of events recovered *x* estimated bacteria load in sewage				
Technical and Financial Assistance Needed	Technical COA to utilize existing staff experts. Financial COA to utilize existing programs; COA may award grants to qualified customers to make necessary repairs to private wastewater infrastructure.				
Education Component	-Continue citywide public education efforts to reduce potential for sanitary sewer overflows like the "Ban the Blob" campaign. -Continue promotion of COA WPD environmental hotline and 3-1-1 for citizens to report wastewater overflows.				
Interim, Measurable Milestones	Volume of wastewater recovered after overflow events in the affected watersheds				
Progress Indicators	-Reduction in *E. coli* concentrations in the affected watersheds -Removal of sewage from SSOs				
Monitoring Component	-Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. -AWU staff will track SSO volume and recovery volume measures annually.				
Responsible Organization	COA				

2.6 Sanitary sewer overflow response (UTA)

The UTA-EHS department is involved in the investigation and remediation of any SSOs in the Waller Creek watershed, if they originate from university-owned infrastructure. EHS also notifies the COA WPD of any known SSO entering the creek. EHS and COA WPD collaborate to assess impacts of these overflows and remove contaminants from the creek when appropriate.

As a preventive measure, EHS engages clients across campus to educate them on the prohibition of disposing of grease into the sanitary sewer system.

Table 16. Summary of Management Measure 2.6

Management Measure	2.6 Respond to sanitary sewer overflows on main campus in the (Waller Creek watershed) and remove contaminant from creek when feasible during an overflow event originating from UTA owned sanitary lines.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	UTA to investigate and remediate SSOs in the Waller Creek watershed if they are found to be originating from the UTA sanitary system of as a result of activities on the UTA Main Campus. UTA to notify COA WPD for all known SSOs entering Waller Creek. UTA will work with COA WPD to assess the impacts and coordinate contaminant removal if found to be necessary.				
Potential Load Reduction (cfu/day)	Number of SSO events *x* volume of events *x* bacteria load in sewage				
Technical and Financial Assistance Needed	Technical UTA EHS and UEM will serve as staff experts. Financial Response would be accomplished with existing spill response financial resources.				
Education Component	Continue with monitoring and servicing schedule of Main Campus grease traps to reduce sewer stoppage and continue educating operators to prohibit grease disposal to sanitary sewer untreated and thus reducing SSO.				
Interim, Measurable Milestones	Volume of wastewater recovered after overflow event in Waller Creek watershed				
Progress Indicators	-Reduction in *E. Coli* concentrations in the Waller Creek Watershed -Removal of sewage from SSOs				
Monitoring Component	-Water quality monitoring is conducted in the Waller Creek Watershed as part of the COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. -UTA UEM and EHS staff will track volume and recovery volume measures annually.				
Responsible Organization	UTA-UEM and UTA-EHS				

2.7 Private lateral inspection (COA)

A private lateral is the wastewater line that connects a building to the City of Austin centralized wastewater collection system. Private laterals are not owned by the City of Austin. Failures in private sewer infrastructure are known sources of fecal contamination, and may not be directly observed by routine inspection of publicly-owned infrastructure (Propst et al. 2011). The AWU performs investigations of private laterals for City of Austin retail wastewater customers when there is a wastewater overflow on private property or when there is a problem with the City of Austin wastewater system that could affect a private lateral (austintexas.gov/department/private-lateral-program).

The City of Austin private lateral program exists to ensure defective private wastewater lines are repaired to reduce the chance of wastewater overflows and so that inflow and infiltration of rainwater into the centralized wastewater collection system are reduced. This subsequently decreases wastewater overflow incidents and reduces fecal contamination of area water bodies.

AWU personnel respond to wastewater trouble calls from citizens who experience or witness wastewater overflows, backups, or stoppages. As part of the response, the AWU crews perform an assessment of the city-owned portion of the collection system as well as the private sewer lateral inside the customer's property. In addition to identifying and repairing defects in the city-owned sewer service line or sewer main, the AWU communicates with the property owner if the private sewer lateral needs to be repaired. Under the City of Austin Private Lateral Ordinance, enforcement action may be taken to encourage the property owner to repair the defective private lateral. An AWU grant program is available to fund repairs for qualified property owners with incomes equal to or less than 80% of the Austin median family income amount.

The COA WPD receives notification from the AWU of all sewage spills from private lateral failures, and investigates any incident resulting in more than 50 gallons of sewage being spilled or any sewage spill which may affect a storm sewer or water body. The COA WPD also directly investigate citizen complaints of polluting discharges, and report to the AWU if illicit sanitary sewer connections to the storm drain system are detected or if failing private lateral wastewater lines are suspected.

On average, an estimated 5,000 gallons of sewage annually are spilled in the four affected watersheds as a result of private lateral failures.

As part of this Plan, the City of Austin will continue to jet clean and conduct televised inspections of private laterals initiated by private lateral backups, stoppage, or overflows at no additional charge to the affected customers. The City of Austin will continue to repair city wastewater infrastructure. When problems are identified in private lateral lines, the City of Austin will continue to enforce legal requirements on property owners to ensure the proper repair of the private lateral. The City of Austin will initiate a program to place liens on properties in which a private lateral failure has been identified and verified when, after municipal court action, the private lateral repair has not been completed. The City of Austin will contract for the repairs to such private laterals and place a lien on the properties for the actual cost of repair plus administrative and interest-related expenses.

The City of Austin will annually report the number of private lateral failures identified and the number of liens placed on private properties in the affected watersheds. The estimated potential load reduction of this strategy is estimated based on the average volume of wastewater spilled as a result of private lateral failure in the four affected watersheds multiplied by the average *E. coli* bacteria concentration in raw wastewater .006 billion MPN/dL (Sobsey et al., 1998). The estimated potential load reduction from this strategy for the four affected watersheds is 1,100 billion MPN/year.

Table 17. Summary of Management Measure 2.7

Management Measure	2.7 Continue to jet clean and conduct TV inspections of private laterals initiated by private lateral backups, stoppage, or overflows at no additional charge to the affected customers. Continue to repair city infrastructure before customers are required to fix their private lateral. Continue to enforce legal requirements on property owners with verified private lateral failures to ensure the proper repair of the private lateral. Initiate program to place liens on property in which a private lateral failure has been identified and verified, and after municipal court action the private lateral repair has not been completed. The COA will contract for the repairs to such private lateral and place a lien on the property for the actual cost of repair plus administrative and interest-related expenses.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	The jet cleaning and TV inspection of private laterals will continue. In Year One, the program related to the placement of liens on private property with unresolved private lateral failures will be fully implemented.				
Potential Load Reduction (cfu/day)	Estimated number of systems meeting Management Measure criteria *x* typical flow rate *x* bacterial load in OSSF effluent *x* adjustment factor				
Technical and Financial Assistance Needed	Technical COA provides customer assistance by identifying private lateral failures. Financial -COA will continue to provide funding to repair private laterals for grant eligible customers. -COA to provide funding to repair private laterals for which the City has placed liens on properties meeting the management measure listed above.				
Education Component	Continue private lateral and on-site sewage facility education efforts as needed.				
Interim, Measurable Milestones	AWU will track number of private laterals failures identified per year and number of liens placed on private property as part of this strategy.				
Progress Indicators	Reduction in *E. coli* concentrations				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	COA				

2.8 Design and construct outdoor public toilets in high-use locations in the Waller Creek watershed as a pilot program (COA)

COA WPD field sampling staff have observed human campsites and evidence of defecation adjacent to Waller Creek particularly in the more densely populated urban areas (Jackson and Herrington, 2012). The downtown entertainment district within the Waller Creek Watershed generates substantial traffic, with few restroom facilities available for public use after 2 am. There are public toilets available in only 7 of the 52 City of Austin parks in the affected watersheds, and only 2 public toilets in parks in the Waller Creek Watershed. Although some businesses have restrooms for customers, limited operating hours and occasional denial of service to the homeless restricts availability. The Austin Homeless Management Information System reports that more than 5,800 persons access homeless services annually, with more than 2,300 persons living on the streets or shelters on any given night and more than 900 persons considered chronically homeless. Increasing the availability of public toilets in high-density areas near creeks will reduce human defecation and associated fecal bacteria loading to the affected watersheds by providing access to sanitary sewer facilities.

Public toilets have been installed in various forms across the United States with varying degrees of success. San Francisco, California installed 25 automated, self-cleaning public toilets in 1995 with maintenance costs deferred in part by advertising on the units. Numerous public complaints about the cleanliness and functionality of the San Francisco units have been reported. Similar issues occurred in Seattle, Washington, where $5 million was spent in 2004 to install automated public toilets. In Seattle, the toilets were removed in 2008 due to complaints from citizens that they were dirty and dangerous.

However, the patented Portland Loo was developed and installed with notable success in Portland, Oregon, with at least five units installed since 2008. The highly utilitarian units have no running water inside, no mirror, bars at the top and bottom of the structure to allow transmittal of sound and visibility, a graffiti proof coating, and surfaces made from heavy-gauge stainless steel. Some are decorated with artwork on the exterior. The units initially cost $140,000 although they are now available for $60,000 and require approximately $12,000 per unit in annual maintenance. New York, New York, also found success via a different approach utilizing supervised public toilets in Bryant Park. The Bryant Park toilets have been touted as the cleanest public toilets in the world.

As part of this Plan, the City of Austin proposes to cooperate with the private Waller Creek Conservancy (www.wallercreek.org/) to evaluate the feasibility of including public toilets as part of the redevelopment of the Waller Creek Watershed made possible by the construction of a new flood diversion tunnel. The tunnel is being constructed by the City of Austin and is anticipated to begin operation in 2014 (www.austintexas.gov/department/waller-creek).

In the first year of the Plan, the City of Austin and the Waller Creek Conservancy will evaluate the feasibility of inclusion of public toilets in the redevelopment and stream restoration plans for Waller Creek building on the experiences of other cities. Included will be the feasibility of installing public showers associated with the toilets to reduce use of waterways for bathing (thus promoting general stream quality) and also making the toilet facilities more attractive to use and hence reducing *E-coli* contamination. Preliminary engineering and design of the units will continue through years 2 through 4 of the plan. Year 5 of the Plan will include solicitation for

funding to construct and maintain the units. The proposed schedule may be accelerated, if possible, following the schedule of implementation for Waller Creek redevelopment planning. This project is intended to serve as a pilot effort that if successful could be extended to other high-traffic areas in Austin. No quantitative load reduction is estimated for this strategy within the 5-year time frame of this Plan as the facility is not planned to be constructed within that time frame.

Table 18. Summary of Management Measure 2.8

Management Measure	2.8 Design and construct outdoor public toilets in high-use locations in the Waller Creek watershed if feasible as a pilot project, and consider for deployment in other affected watersheds if successful.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	COA and Waller Creek Conservancy to collaboratively develop plan to implement public toilet if feasible.	Conduct feasibility analysis and preliminary engineering review to identify potential alternatives for public toilets, locations, and operation plans.		Prepare design of identified solution.	Pursue contributions necessary to fund construction and maintenance.
Potential Load Reduction (cfu/day)	When constructed, the potential fecal load reduction may be estimated from the predicted or actual number of users *x* the bacteria load in human waste				
Technical and Financial Assistance Needed	Technical Technical input may be needed from various COA departments on design, location, and operation. Design should be consistent with Waller Creek Conservancy plans, and may require input or cooperation from Waller Creek design contractors. Financial Private entity financial contributions in combination with capital funding or staff support from the COA or the TCEQ 319(h) grant funding may be needed to fund design, construction, and operation.				
Education Component	Public education on water quality impact from human defecation near creeks will continue during the development process.				
Interim, Measurable Milestones	Development of a plan to pursue public toilet installation	Initiation of feasibility study	Completion of feasibility study and preliminary engineering review if appropriate	Initiation of design for public toilet	Initiation of fund raising efforts necessary to construct public toilet if feasible
Progress Indicators	Reduction in *E. coli* concentrations from direct human defecation in the Waller Creek Watershed				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	CCOA WPD, Waller Creek Conservancy				

Management Measures 3.0 - Domestic Pet Waste

Domestic pets like dogs and cats can be a source of fecal pathogen contamination to natural waters (EPA 2001; TCEQ 2010). Genetic analysis of urban runoff to a reservoir in New York estimated that 95% of fecal coliform found in urban storm water was of non-human origin (Alderiso et al. 1996). TMDL analyses in Maryland found domestic pet contributions to fecal bacteria loads ranged from 12 to 33%, while wildlife contributions ranged from 4 to 52% (Dalmasy et al. 2007). A bacteria source tracking study for an urban watershed in Seattle estimated that 20% of fecal bacteria in runoff originated from dogs (Samadpour and Checkowitz 1998). As much as 22% of the fecal load from contributing watersheds to the Peconic Estuary was derived from dogs (Cameron Engineering & Associates 2012).

A dog off-leash area immediately adjacent to Bull Creek in Austin likely contributed to elevated levels of fecal bacteria in a popular swimming area (City of Austin 2011). Cats may have contributed to fecal contamination of a Florida creek (PBS&J 2010). One gram of dog waste contains an estimated 23 million fecal coliform bacteria (van der Wel 1995), and the U.S. Food and Drug Administration estimates that on average domestic dogs excrete 340 grams of feces daily.

The number of domestic animals in Austin may be estimated by combining human and animal census estimates (Herrington et al. 2010). Based on national averages, it may be assumed that 37.2% of households have dogs and 32.4% of households have cats (AMVA 2007). The 2010 US Census estimates that there are 354,241 housing units in Austin. Households with dogs were assumed to have 1.7 dogs, and households with cats were assumed to have 2.2 cats (AMVA 2007). Based on these assumptions in combination with US Census results from Austin, there are approximately 224,000 dogs in Austin generating 76,000 Kg of fecal waste or 1.75×10^{15} cfu of *E. coli* daily. This estimated fecal loading rate is consistent with the 4 billion cfu *E. coli* per dog per day derived from a study of the Peconic Estuary (Cameron Engineering & Associates 2012).

By Austin City Code 3-4-6, it is a Class C misdemeanor punishable by a fine up to $500 for not promptly and sanitarily disposing of dog or cat feces on private or public property other than property owned by the handler or owner of the dog. A Chesapeake Bay study found that 41% of dog walkers did not pick up dog waste (Swann 1999). Public education may be an effective tool at reducing the fecal bacteria contamination from domestic pets. There was a 31% increase in the number of respondents who believed that uncollected dog waste was a potential water quality problem after a public education campaign at a metropolitan park in Austin, with 60% of respondents claiming to pick up dog waste more frequently than before the education campaign (City of Austin 2011).

3.1 Dog waste education in parks (COA)

As part of this Plan, the City of Austin will continue public education efforts to reduce fecal contamination from domestic dogs. Public education is an effective tool to reduce fecal contamination from domestic animals (City of Austin 2011). The City of Austin will continue "Scoop the Poop" citywide education efforts annually (www.ScoopThePoopAustin.org). Previous education activities conducted for "Scoop the Poop" include radio and television public service announcements, social media outreach, giveaways at public events, public art, print media ads, brochures, partnerships with animal-focused non-profit organizations and a wide

variety of signage. The number of citywide campaign efforts completed annually will be tracked and reported as an interim milestone of this Plan.

There are 52 City of Austin parks in the four affected watersheds. The COA WPD will develop over the 5-year time frame of this Plan customized signage for each park in the affected watersheds for installation by the COA PARD. The signs will include location specific information in addition to web links to City of Austin water quality monitoring information. The number of customized signs installed in parks will be tracked and reported as an interim milestone of this Plan.

The City of Austin Park Ranger Program (www.austintexas.gov/parkrangers) was created to provide educational services, safety, and security in Austin parks. Park rangers will continue to provide education and share information on park rules related to proper disposal of pet waste to park users.

The potential load reduction associated with this education measure is based on the frequency of visitation to Austin parks times the fecal load in pet waste. It is estimated by COA PARD staff that 3% of Austin residents visit a park daily. Parks in the affected watersheds represent by land area 16% of the total area of Austin parks. An estimated 50% of dog owners do not walk their dogs, and 41% of dog owners who walk dogs do not collect dog waste (Swann 1999). The daily *E. coli* fecal load from dogs is estimated to be 4 billion cfu *E. coli* per dog per day (Cameron Engineering & Associates 2012). Education is assumed to be 60% effective at encouraging proper disposal of pet waste based on previous City of Austin (2011) outreach assessments. As a conservative adjustment factor, it is assumed that 20% of visitors read park signage based on a user survey of the frequency of reading interpretive signs from Pennsylvania (York County Department of Parks and Recreation 2012). Combining these assumptions, the potential load reduction from signage in parks is estimated to be 780,000 billion cfu *E. coli* per year. This potential load reduction estimate does not include the additional load reduction from Austin residents properly disposing of pet waste on private property, as the effectiveness of citywide education efforts has not been quantified.

Table 19. Summary of Management Measure 3.1

Management Measure	3.1 Continue dog waste collection education efforts in COA parks in affected watersheds				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Develop updated and customized "Scoop the Poop" signage and implement in 10% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 25% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 50% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 75% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 100% of parks in affected watersheds.
	Perform on-site inspection by park rangers in parks.				
	Conduct citywide "Scoop the Poop" public outreach campaign.				
Potential Load Reduction (cfu/day)	- Number of parks with signage *x* estimated number of visitors *x* estimate of signage education effectiveness - Estimate of education campaign effectiveness *x* scope of education efforts (estimated target audience)				
Technical and Financial Assistance Needed	Technical COA WPD to develop education materials and campaigns. Financial Additional funding may be necessary to expand Park Ranger Program for increased enforcement and outreach. Additional Capital Improvement Project funds may be necessary to expand education programs.				
Education Component	This is a measure focused on public education and outreach. Customized signage may include links to web sites where updated local monitoring information is available.				
Interim, Measurable Milestones	- Percentage of parks planned for signage that get signs - Number of park ranger inspections - Number of education campaign events				
Progress Indicators	- Reduction in *E. coli* concentrations in the affected watersheds - Reduced amount of uncollected domestic pet waste				
Monitoring Component	- Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. - COA WPD staff will track education and signage efforts. - COA PARD will track Park Ranger inspections.				
Responsible Organization	COA PARD, COA WPD				

3.2 Install pet waste bag dispensers in City of Austin parks (COA)

The COA WPD has purchased and cooperated with the COA PARD to install 850 dispensers of pet waste collection bags (Mutt Mitts) in Austin parks citywide. The dispensers are maintained by COA PARD staff during routine park maintenance visits. The COA WPD purchases 1,500,000 disposable bags annually for use in the dispensers at no charge to park users. Making disposable bags available to park users at no charge is intended to be an incentive for the proper collection and disposal of dog waste in city parks.

As part of this Plan, the City of Austin will continue to make pet waste collection bags available at no charge in Austin parks. COA PARD staff will identify which, if any, of the 52 parks in the affected watersheds do not currently have pet waste bag dispensers. There is currently no centralized inventory of where pet waste bag dispensers have been installed to date. Over the 5-year time frame of this Plan, the City of Austin will install and maintain pet waste bag dispensers in all parks in the affected watersheds. The number of dispensers installed and number of bags distributed will be tracked and reported annually as a measurable milestone of this Plan. Educational signage will be associated with the dispensers or otherwise be installed in the parks (see management measure 3.1).

The potential load reduction estimate associated with this management measure is based on the number of bags distributed annually, adjusted for the number likely to be distributed through parks in the affected watersheds, multiplied by the fecal load of dog waste. The 52 parks in the affected watersheds represent 19.2% of the total number of parks in Austin. It is assumed that all of the 1,500,000 bags dispensed annually are used for dog waste, and that the bag collects all of the dog waste for the animal for the day or 4×10^9 cfu *E. coli* per bag. Thus, the potential load reduction from this strategy is 1,000,000 billion cfu *E. coli* per year.

The potential exists for overlap between the estimates in Management Measures 3.1 and 3.2. This overlap cannot be quantified. These are, however, two distinct efforts.

Table 20. Summary of Management Measure 3.2

Management Measure	3.2 Install and maintain Mutt Mitt dog waste collection stations in COA parks in affected watersheds where appropriate.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Inventory Mutt Mitt dispensers and associated trash cans in COA parks in affected watersheds.	Install and maintain Mutt Mitt dispensers and associated trash cans in 25% of parks.	Install and maintain Mutt Mitt dispensers and associated trash cans in 50% of parks.	Install and maintain Mutt Mitt dispensers and associated trash cans in 75% of parks.	Install and maintain Mutt Mitt dispensers and associated trash cans in 100% of parks.
Potential Load Reduction (cfu/day)	N/A	Number of bags distributed x mass of dog feces x amount of *E. coli* in dog feces			
Technical and Financial Assistance Needed	Technical - COA PARD to complete inventory - COA WPD to create geographic information system (GIS) layer Financial Additional temporary staff may be necessary to complete inventory	Technical COA PARD to develop mechanism to track bag distribution by park. Financial Additional funding for new staff or volunteers may be necessary to maintain increased number of bag dispensers.			
Education Component	Knowledge of location of Mutt Mitt dispensers will aid in prioritizing future efforts; dispensers contain educational signage.	Dispensers contain educational signage.			
Interim, Measurable Milestones	- GIS layer of Mutt Mitt locations - Plan to install Mutt Mitt dispensers in remaining parks	Number of bags distributed in parks in affected watersheds			
Progress Indicators	N/A	-Reduction in *E. coli* concentrations in the affected watersheds -Reduction of the amount of uncollected domestic pet waste in parks			
Monitoring Component	Assessment of Mutt Mitt locations	-Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. -COA WPD staff will track number of Mutt Mitt bags distributed.			
Responsible Organization	COA PARD, COA WPD				

3.3 Walnut off-leash area kiosk (COA, Friends of Austin Dog Parks)

"Friends of Austin Dog Parks" is placing kiosks in five locations, one of which is in the designated watersheds: Walnut Creek, Red Bud Isle, Far West, Zilker Park, and West Austin dog parks. These kiosks represent an amenity standard selected by Parks and Recreation. This amenity will serve as a centralized information outlet for both city and advocate related information. The four sides will be utilized for messaging as follows:

City of Austin - Sides 1 & 2

- Watershed Protection - "Scoop the Poop", Water Quality (both general and specific as it relates to the dog park) and other environmental issues determined by the department
- Austin Animal Services – Spay/Neuter, Pet Adoption, Pet Chipping
- Parks and Recreation – Dog Park Rules/Etiquette, Curfew, Emergency Services, Park Maintenance/Closures

Community – Sides 3 & 4

- Park Adopter – Volunteer Events, Meet-Ups, Lost and Found, etc.
- Friends of Austin Dog Parks – Fund-raising Events, Donor Recognition, News and Events relating to Dog Parks

"Friends of Austin Dog Parks" is a collaboration between advocates of Austin's off-leash areas and the Austin's Parks and Recreation Department. Its mission centers on the tenets of outreach, education, off-leash area park adoption and fundraising. Through a collaborative effort with its partners, the APF and COA PARD, it seeks to inform and engage off-leash advocates in activities that highlight Austin's twelve extraordinary off-leash areas. "Friends of Austin Dog Parks" educates the community on owner/handler/K9 safety, and the importance of protecting the natural beauty of Austin's parkland. Its fundraising activities are through a partnership with APF. Distribution of donations to a specific off-leash area is determined by the needs identified by the community of K9 owners/handlers using the off-leash area, with the intent to improve the parkland experience. The kiosks will enhance the educational efforts in Management Measures 3.1 and 3.2 and reduce the amount of dog waste in Austin parks.

Table 21. Summary of Management Measure 3.3

Management Measure	3.3 Install and maintain educational kiosks in dog off-leash areas of COA public parks in the affected watersheds to inform users of rules and regulations and encourage proper collection and disposal of dog waste.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Install and maintain educational kiosks in dog off-leash areas of public parks in the affected watersheds with information regarding park rules including proper collection and disposal of dog waste.				
Potential Load Reduction (cfu/day)	Annual number of park users with dogs *x* mass of dog poop per visit *x* amount of bacteria in dog poop *x* effectiveness of education				
Technical and Financial Assistance Needed	Technical COA PARD staff to help install and maintain signs; COA WPD to help with kiosk content and updates as needed. Financial Friends of Austin Dog Parks to solicit private funds to purchase and maintain the kiosks; COA to contribute funds to assist with purchase and maintenance of kiosks.				
Education Component	This is an education measure targeting users of dog off-leash areas.				
Interim, Measurable Milestones	Number of kiosks installed and maintained in affected watersheds				
Progress Indicators	-Reduction in *E. coli* concentrations in the affected watersheds -Increased educational outreach to dog owners and dog off-leash area park users				
Monitoring Component	-Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. -Dog off-leash area park adopter to inspect signs on regular basis and report maintenance needs.				
Responsible Organization	-COA PARD will assist with installation and maintenance of signs. -COA WPD will assist with content development as needed. -Dog off-leash area adopters will monitor signs, report maintenance needs. -Friends of Austin Dog Parks will coordinate purchase, installation, and update of content for kiosk as needed.				

3.4 Waste collection in commercial and non-profit pet facilities

The purpose of this management measure is to educate pet businesses regarding potential effects of their pet waste management on stream water quality. At a minimum, every pet business should understand that 1) pet waste contains bacteria whose presence in creeks, pools, and lakes can impair their contact recreation use; 2) the number of bacteria in creeks, pools, and lakes is regulated by the State of Texas by establishment of a contact recreation standard for fecal indicator bacteria; 3) and proper management of pet waste can protect stream quality.

Every business will be given City of Austin information on proper pet waste management methods to implement in their own business, and to share with their customers.

Responsible parties for this management measure are the Sierra Club, the Austin Chamber of Commerce, the City of Austin, and as yet unidentified pet businesses or nonprofit organizations.

The Sierra Club and the Austin Chamber of Commerce will work together with volunteers from their communities to identify a list of pet operations in the Austin area. Pet operations, based on priorities determined by the volunteer organizations, will be contacted by phone. At the invitation of the pet operation, volunteers will visit the operation manager, discuss waste management options, and leave City of Austin literature on proper waste management for the business, their clients, and customers.

In Year One, Sierra Club, Austin Chamber of Commerce and a pet organization will compile a list of Austin-area pet operations. Based on volunteer availability, pet operations will be prioritized and contacted by phone. The volunteer will discuss proper pet waste management methods. If acceptable to the pet operation, a volunteer will visit the site and deliver City of Austin literature.

A short summary report will be prepared annually documenting the pet operations contacted, the number of businesses accepting brochures, and the number of brochures distributed to the pet businesses.

In Years Two through Five, volunteers will complete the same activities as in Year One. The list of pet operations will be updated with new businesses and closed businesses will be deleted. The contacted businesses will be a mix of both operations contacted in the previous year, and operations not yet contacted.

Table 22. Summary of Management Measure 3.4

Management Measure	3.4 Educate Austin-area pet businesses[1] regarding the importance of proper pet waste management to protect creeks and streams. Provide COA information to the businesses for distribution to their customers and clients.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Identify pet organization allies. Identify pet businesses. Contact each business by phone. Set up and complete a meeting to educate and distribute brochures.	Identify pet businesses. Contact each business by phone. Set up and complete a meeting to educate and distribute brochures.			
Potential Load Reduction (cfu/day)	This project will enhance existing COA education and outreach efforts and programs, and thus no separate load reduction is estimated for this management measure.				
Technical and Financial Assistance Needed	Technical Brochures to be provided by the COA. Financial Effort to be completed by volunteers.				
Education Component	Provide education and brochures to pet businesses. Provide brochures to pet businesses for distribution to their customers.				
Interim, Measurable Milestones	-Number of businesses contacted -Number of businesses agreeing to offer brochures to customers -Number of educational brochures distributed				
Progress Indicators	-Reduction in *E. coli* concentrations in the affected watersheds -Increased educational outreach to dog owners and dog off-leash area park users				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	Sierra Club, Chamber of Commerce, unidentified pet allies				

[1] Pet businesses include kennels, boarding operations, veterinarian clinics, supply stores, breeders, and pet adoption agencies in Travis County.

Management Measures 4.0 – Resident Outreach

4.1 Austin Neighborhoods Council meetings educational outreach (ANC)

The Austin Neighborhoods Council (ANC) generally employs two ways to distribute educational material and program information on water quality issues: passively, in which COA staff members set up information tables at monthly general membership meetings to engage interested ANC members before the meeting or by broadcast to member neighborhood associations by internet communication and actively, when ANC invites COA staff to present information and distribute material and answer questions during general membership or sector meetings. This strategy addresses active distribution. It envisions at least one annual visit by COA staff to address water quality issues.

The ANC acts as a coordinating body for the efforts of Austin-area neighborhood groups, as a clearinghouse for information and to give guidance in all matters of concern and wellbeing to individual neighborhoods and/or the City of Austin. The ANC is comprised of volunteer representatives of member neighborhood associations. Member neighborhood associations are organized into 10 geographic sectors, each sector being represented on the ANC Executive Committee.

Meetings of the ANC are open to the public. Meeting notices and agendas are published in advance on the Austin Neighborhoods Council website (www.ancweb.org) and emailed to representatives of member neighborhood associations. Meeting minutes are available on the ANC website.

The ANC researches plans, resolutions, ordinances, and legislation which affect neighborhoods in the Austin area and makes specific recommendations. ANC strives to make a positive contribution to Austin through the betterment of our neighborhoods by promoting civic awareness and education through forums, seminars, workshops, etc., on those subjects relating to neighborhood concerns. The ANC encourages and endorses individuals who are responsive to the needs of the neighborhoods.

As part of this Plan, the ANC will request annual briefings from the City of Austin staff on specific topics relevant to the fecal bacteria TMDL including riparian zone restoration, pet waste collection, water quality structural BMP retrofits, fecal contamination reduction public education, wastewater infrastructure maintenance, development of public toilets and in-stream fecal bacteria monitoring results. These strategies address a wide range of potential sources of fecal contamination.

Briefings will occur at regular monthly general membership meetings of the ANC at least once per year for 5 years. For those sectors that meet, staff will also be invited to give briefings at sector meetings at least once per year for 5 years. It is within the existing purview of the ANC to request briefings from city staff. While the ANC does not make city policy, it may enhance the fecal load reduction from other City of Austin initiated implementation strategies by providing an additional means of public education and outreach and offering a potential public venue for adaptive management discussions should strategies be determined to need modification during implementation. The ANC may, as a result of briefings, act to offer guidance to City of Austin

staff, initiate sub-committee discussions on a particular action, offer letters of support, or make resolutions advising the Austin City Council on specific issues needing additional attention.

Table 23. Summary of Management Measure 4.1

Management Measure	4.1 The ANC will invite COA–WPD staff to attend one citywide general meeting and one meeting for each sector (or group of sectors) per year to provide information on COA programs that may reduce fecal contamination and ways in which citizens or neighborhood associations may voluntarily participate. Topics for discussion by City staff may include riparian zone restoration efforts, pet waste collection, environmental problem identification and reporting, private wastewater lateral inspections, and instream monitoring results.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	ANC will invite COA WPD staff to brief each the citywide general meeting and each sector (or group of sectors) once per year on COA environmental programs and ways citizens may help to reduce fecal contamination.				
Potential Load Reduction (cfu/day)	No quantifiable load reduction will occur as a result of this strategy, although this action does support other COA fecal load reduction measures and may provide opportunities for citizens to voluntarily implement fecal load reduction measures. Refer to the COA strategies addressing these topics for specific, quantified load reduction.				
Technical and Financial Assistance Needed	Technical COA staff needed to present information as requested on the identified topics. Financial None				
Education Component	Presentations on the status of COA programs included in the I-Plan measures will serve as a means to inform and update the public, and provide a means for citizens to voluntarily implement fecal reduction measures through COA volunteer programs. COA may provide content for neighborhood association newsletters, or links to COA web-based content for email notifications.				
Interim, Measurable Milestones	The number of briefings to ANC citywide general meeting and individual sector meetings per year will be measured and reported.				
Progress Indicators	COA strategies propose to reduce fecal loads to creeks and reduce instream fecal indicator bacteria concentrations. This strategy contains public education elements that will support those actions.				
Monitoring Component	- The number of briefings to ANC sectors will be tracked annually. - Water quality monitoring will continue in each of the affected watersheds as part of COA participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	ANC				

4.2 City staff presentations to Austin Environmental Board (Environmental Board)

The City of Austin Environmental Board is composed of designated volunteer Austin residents appointed by Austin City Council to advise on environmental issues. Meetings of the board are open to the public in accordance with Open Meeting and Austin City Code rules. Meeting notices and agendas are published in advance on the City of Austin webpage (www.austintexas.gov/envboard), meetings are televised live on Channel 6 and webcasts are archived and available for viewing from the City of Austin webpage. The Environmental Board serves not only as an important independent reviewer of City of Austin actions that may affect the environment, but also as a means for disseminating information on City of Austin activities to the public.

As part of this Plan, the City of Austin Environmental Board will request annual briefings from City of Austin staff on specific topics relevant to the fecal bacteria TMDL including riparian zone restoration efforts, pet waste collection, water quality structural BMP retrofits, fecal contamination reduction public education, wastewater infrastructure maintenance, development of public toilets and instream fecal bacteria monitoring results. These strategies address a wide range of potential sources of fecal contamination.

Briefings will occur at regular meetings of the Environmental Board at least once per year for 5 years. It is within the existing purview of the Environmental Board to request briefings from city staff. While the Environmental Board does not make city policy, it may enhance the fecal load reduction from other City of Austin initiated implementation strategies by providing an additional means of public education and outreach and offering a potential public venue for adaptive management discussions should strategies be determined to need modification during implementation. The Environmental Board may, as a result of briefings, act to offer guidance to City of Austin staff, initiate sub-committee discussions on a particular action, offer letters of support, or make resolutions advising Austin City Council on specific issues needing additional attention.

Table 24. Summary of Management Measure 4.2

Management Measure	4.2 As an independent citizen advisory board, the COA Environmental Board will request periodic briefings or reports from appropriate COA departments on the progress of proposed COA fecal contamination reduction strategies and take appropriate action. Topics for individual annual briefings to the Environmental Board include: • riparian zone restoration efforts • pet waste collection in parks • water quality BMP retrofits • fecal bacteria related public education including Earth Camp • development of public toilets in the affected watersheds • instream fecal bacteria monitoring results • wastewater infrastructure maintenance programs				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Environmental Board will request annual briefing on each of the identified topics, and provide supporting letters, resolutions, and public education as appropriate.				
Potential Load Reduction (cfu/day)	No specific, quantifiable load reduction will occur as a result of this strategy, although this action does support other COA fecal load reduction measures. Refer to the COA strategies addressing these topics for specific, quantified load reduction.				
Technical and Financial Assistance Needed	Technical COA staff needed to present information as requested on the identified topics. Financial None				
Education Component	Environmental Board meetings are public meetings, advertised on web, televised and available for viewing by the public. Presentations on the status of I-Plan measures will serve as a means to inform and update the public.				
Interim, Measurable Milestones	The number of briefings on the identified topics per year will be measured and reported.				
Progress Indicators	COA strategies propose to reduce fecal loads to creeks and reduce instream fecal indicator bacteria concentrations. This strategy contains public education elements that will support those actions.				
Monitoring Component	- The number of staff briefings or reports on the identified topics will be tracked annually. - Water quality monitoring will continue in each of the affected watersheds as part of COA participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	COA Environmental Board				

4.3 Homeless Survival Guide outreach (COA)

The COA WPD has created a variety of public outreach materials available via website, posters, and brochures that address a range of environmental issues including fecal contamination of area creeks (austintexas.gov/department/scoop-the-poop). However, the City of Austin does not currently have educational materials for distribution to the homeless that relates the negative water quality impacts of defecation near creeks.

Similarly, the 501(c)(3) advocacy group House the Homeless (www.housethehomeless.org/) has created successful laminated multi-fold pocket guides for homeless residents that provide useful contact information for accessing social services, legal aid, medical care, shelter, and reacting to City of Austin "No Sit/No Lie" ordinances. Thousands of guides have been printed and are distributed via area shelters and homeless outreach efforts.

The Austin Homeless Management Information System reports that more than 5,800 persons access homeless services annually, with more than 2,300 persons living on the streets or shelters on any given night and more than 900 persons considered chronically homeless. The lack of availability of public toilets or businesses that allow homeless to use restroom facilities (see management measure section 5.8) exacerbates problems with human defecation near area creeks.

Enforcement of City of Austin codes that may affect trespassing, camping, or public defecation will proceed through existing efforts and are not included as part of this Plan. Completely disconnected from code enforcement efforts, the City of Austin proposes to create new educational materials to educate the homeless about the negative environmental and human health consequences of outdoor defecation in riparian areas following the successful model of the House the Homeless laminated guides. Mixing of education and enforcement efforts simultaneously is likely to reduce the credibility of the education material.

The new educational materials will be produced as a collaborative effort between multiple City of Austin departments with community homeless advocate groups like House the Homeless. To increase appeal and usability with the target audience, the guides will include not only fecal contamination of creek information, but also additional information useful for residents living outdoors like fire safety and dealing with hazardous weather. The City of Austin will design and print the guides, and make them available to area homeless advocate organizations and area shelters for distribution. Distribution of the guides through existing outreach channels is intended to increase the credibility and acceptance of the messaging.

It is estimated by area experts that roughly 50% of the homeless residents of Austin could be beneficially impacted by this form of educational materials (Richard Troxell, personal communication). Effectiveness of environmental public outreach programs in affecting behavior change is frequently difficult to quantify. In a North Carolina assessment of the effectiveness of educational magazine articles in affecting positive behavior change relative to coastal water quality issues, 61% of survey respondents reported moderate or better behavior change after reading the outreach materials (Graefe and Vogelsong, 2007).

Adult humans generate 100 to 250 grams of feces per day, and there is an estimated 0.1 billion *E. coli* cfu/grams feces (Adlerberth and Wold, 2009) or approximately 1000 billion *E. coli* cfu/day. Assuming the population of chronically homeless in Austin to be 900 persons in Austin, with 50% reachable by educational materials, 61% of those reached having some moderate

behavior change or better such that at least 10% of the time defecation is done in sanitary facilities or in a way that does not negatively impact water quality, the estimated potential load reduction from this strategy is approximated at 25,000,000 billion *E. coli* cfu per year.

Table 25. Summary of Management Measure 4.3

Management Measure	4.3 "Homeless Survival Guide" outreach to homeless which includes educational materials on the water quality impacts from outdoor defecation				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Develop public education materials.	Distribute educational materials through area homeless advocate organizations.			
Potential Load Reduction (cfu/day)	None, as materials are being developed	Number of homeless in Austin x fraction in affected watersheds x percent reachable by educational materials x effectiveness of educational materials			
Technical and Financial Assistance Needed	Technical Work with area homeless advocates to determine relevant messaging; work with other City departments to include other safety information (fire, police, health).	Technical Partner with area homeless advocates to distribute. Financial Sponsors needed to pay for printing, laminating.			
Education Component	Measure is education based in an attempt to positively impact behavior.				
Interim, Measurable Milestones	Completion of public education materials	Number of fliers distributed			
Progress Indicators	Reduction in the amount of human fecal matter deposited directly in or near creeks; reduction in instream fecal bacteria concentration				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.	- Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA. - COA WPD staff will track number of handouts distributed.			
Responsible Organization	COA WPD				

4.4 Earth Camp, Earth School and Clean Creek Campus outreach (COA)

COA WPD educational staff have been developing and implementing targeted water quality outreach to Austin Independent School District (AISD) students for 15 years. Ongoing City of Austin outreach programs include Earth Camp and Earth School for 5th grade students, the Clean Creek Campus program for grades 3 through 8 and the Hydrofiles program for high school students. These programs are carried out throughout the AISD jurisdiction and reach over 8,500 students at more than 90 campuses annually. Earth Camp is a four day "water quality" immersion camp for select Title 1 schools currently reaching approximately 1,800 students annually. Earth School is a one hour classroom presentation for schools that do not receive Earth Camp reaching approximately 5,400 students annually. The Clean Creek Campus is a service learning program where approximately 1,500 students receive two hands-on lessons and complete a service project.

As part of this Plan, the curriculum of existing COA WPD outreach programs to AISD students will also include educational components addressing fecal loading sources like domestic pets with the goal of positively impacting individual behavior. Students will be instructed on fecal bacteria sources and methods by which individuals may reduce fecal contamination.

In addition to current City of Austin outreach levels, additional funding sources will be sought out to increase the number of students reached annually. If sufficient funding existed, the Earth Camp program could be expanded citywide to an additional 10 schools annually, some of which would be in the affected watersheds. Expansion of Earth Camp would require the addition of one full time COA WPD staff member and a part-time seasonal temporary employee at a total projected cost of $107,390, an additional $1,000 annually for course materials, and $15,000 for additional bus transport costs. Approximately $5,000 would be needed to prepare an additional cave for entry by the students, as cave access is a part of the existing curriculum.

Quantifying load reduction from education programs is difficult, but public education is an effective long-term solution directly addressing individual behavior. The potential load reduction estimation for this management measure is calculated based on the number of students reached annually multiplied by a loading rate for the number of students with dogs multiplied by the effectiveness of the education program to modify behavior. The daily *E. coli* fecal load from dogs is estimated to be 4 billion cfu *E. coli* per dog per day (Cameron Engineering & Associates 2012). Education is assumed to be 60% effective at encouraging proper disposal of pet waste based on previous City of Austin (2011) outreach assessments. Based on national averages, it may be assumed that 37.2% of households have on average 1.7 dogs (AMVA 2007). The potential load reduction for this management measure based on these assumptions is 4,700,000 billion cfu/year.

Table 26. Summary of Management Measure 4.4

Management Measure	4.4 Continue Earth Camp direct outreach to Austin Independent School District children, include fecal load reduction messaging, and consider expansion pending additional funding partners to reach a larger number of students.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Add fecal bacteria curriculum to Earth Camp Program. Find partners willing to financially sponsor expansion of existing Earth Camp education efforts to increase direct outreach to Austin school children.				
Potential Load Reduction (cfu/day)	Number Students Served *x* Fecal Bacteria reduction estimate from domestic animals				
Technical and Financial Assistance Needed	Financial Need additional funding from AISD or other entity to expand Earth Camp program to pay for student busing.				
Education Component	This is an education measure consisting of direct outreach to Austin ISD school children through the existing Earth Camp program.				
Interim, Measurable Milestones	Number of students served by Earth Camp				
Progress Indicators	Reduction in domestic animal pet waste and increased awareness of fecal contamination sources via education; reduction in fecal bacteria instream concentrations.				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	COA WPD				

4.5 Riparian and Scoop education in volunteer workdays and annual meetings (KAB, APF)

The APF is a non-profit organization devoted to building public/private partnerships to develop and maintain parks, trails, and open space in Austin and Travis County. APF connects people to resources and partnerships to develop and improve parks. Since 1992, APF has initiated, promoted, and facilitated physical improvements, new programming, and greater community involvement for Austin's 19,000+ acres of parkland. Each year, APF generates millions of dollars in volunteer time, in-kind donations, and financial support for city parks.

KAB was established by the Greater Austin Chamber of Commerce in 1985 to preserve Austin's quality of life. KAB provides resources and education to inspire individuals and the Greater Austin community toward greater environmental stewardship in three focus areas which include litter abatement, beautification and restoration, and education.

APF and KAB are committed to educating community volunteers on practices which support fecal load reduction such as riparian zone restoration efforts and pet waste collection. Both organizations will incorporate curriculum provided by the COA WPD into volunteer workdays and meetings. Watersheds in the affected areas will be targeted as high priority areas for recruitment and participation for both the Adopt-A-Park and Adopt-A-Creek programs. All volunteer groups who have adopted creeks or parks or are otherwise working within the affected areas will be encouraged to support the existence and expansion of Grow Zones. AFP and KAB will track and report the number of new adoptions, as well as volunteer workdays and annual meetings at which riparian zone restoration or domestic pet waste education is discussed.

With two large active volunteer bases, APF and KAB are in an advantageous position to effectively distribute educational information to the community, particularly those residents frequenting park and creek areas. Increasing communication with the Adopt-A-Creek, Adopt-A-Park, and neighborhood leaders can efficiently and successfully disseminate the plan's goals and benefits to the community. The entities will incorporate riparian and "scoop the poop" educational messaging into volunteer workdays and annual meetings.

Table 27. Summary of Management Measure 4.5

Management Measure	4.5 Incorporating riparian and "Scoop the Poop" educational messaging into volunteer workdays and annual meetings				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Reach 33% of un-adopted parks within the affected watersheds to either or both programs.	Reach 66% of un-adopted parks within the affected watersheds to either or both programs.	Reach 100% of un-adopted parks within the affected watersheds to either or both programs.	Continue efforts to encourage expansion.	
Potential Load Reduction (cfu/day)	This strategy will enhance COA riparian restoration and "Scoop the Poop" educational program effectiveness. Refer to COA riparian zone restoration and pet waste education strategies for load reduction quantification.				
Technical and Financial Assistance Needed	Technical COA may provide education materials as needed. Financial None				
Education Component	Utilize COA Public Education materials focused on the impact of certain activities of bacteria levels of waterways and geared towards volunteer service groups. Conduct outreach to volunteer service organizations regarding the regions bacteria TMDL and its causes.				
Interim, Measurable Milestones	Number of workdays or annual meetings associated with affected watersheds or where riparian zone restoration and "Scoop the Poop" education programs are discussed				
Progress Indicators	Reduction in fecal bacteria loading from stormwater with enhanced riparian zone effectiveness and reduction in fecal bacteria loading from increased domestic pet waste collection and proper disposal				
Monitoring Component	APF and KAB will track the number of volunteer workdays and annual meetings at which riparian zone restoration or domestic pet waste education is discussed.				
Responsible Organization	APF, KAB				

4.6 Community communication plan (Shoal Creek Conservancy & others)

There are generally two ways to distribute COA educational material and program information on water quality issues: passively, in which persons call or visit the COA WPD Education office for more information on material and programs that they heard or read about, e.g., in a news article or on the COA WPD and other COA websites, and actively, in which material and information is broadcasted to organizations that should be made aware of the information. This strategy addresses active distribution. It envisions a comprehensive database of contact information (mail, email, phone, etc.) for any organization that can evaluate and distribute the information to their members. Contacts would be categorized to minimize the need to broadcast to the entire database, and organizations would be able to opt out of the network.

Table 28. Summary of Management Measure 4.6

Management Measure	4.6 Develop email—and mail-based communications system to distribute COA educational material and program information on water quality and protection issues to community organizations within the affected watersheds for distribution by them to their members.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Identify organizations such as neighborhood associations, service organizations, environmental and conservancy groups, churches, pet service and other businesses, etc. Collect their contact information into a database that can be used with a mailing application.	Distribute COA education material and notifications to identified organizations using the created communication tool.			
Potential Load Reduction (cfu/day)	No load reduction during initial planning phases	This will increase effectiveness of COA public education measures. Refer to specific COA strategies for quantitative load reduction estimates.			
Technical and Financial Assistance Needed	Technical May need assistance from COA in identifying community organizations. May need assistance in developing effective means of mass communication.	Technical May need assistance from COA to provide education materials, notifications. Financial May need assistance in paying for technology associated with communication tool.			
Education Component	This strategy will provide an additional means of providing COA educational materials to community organizations.				
Interim, Measurable Milestones	Completion of target list, identification of technology appropriate to distribute information	-Number of organizations contacted -Number of communication events completed			
Progress Indicators	This strategy will enhance COA programs to reduce fecal loading from a variety of sources.				
Monitoring Component	COA WPD to conduct in-stream fecal bacteria monitoring as part of Clean Rivers Program.				
Responsible Organization	Shoal Creek Conservancy (Monnie Anderson), other unidentified organizations				

4.7 People Organized in Defense of Earth and Her Resources (PODER) educational outreach efforts

PODER is a grassroots environmental justice organization in East Austin, led by women of color, that defines the "environment" as the place we live, work, learn, play, and pray; and for that reason it addresses multiple social and environmental issues affecting the communities as basic human rights.

PODER is a member of the Hispanic Advocates Business Leaders of Austin (HABLA), which is a "Think Tank" group and forum made up of local Hispanic/Latino community and business leaders committed to discussing and developing sustainable solutions on current affairs, public policies, and quality of life issues impacting the local Austin Hispanic/Latino community. HABLA members meet monthly at Juan in a Million Restaurant.

PODER is also a member of La Raza Roundtable which brings together community organizations, community leaders, elected officials private, and public sector representatives in leadership capacities that impact positive change for La Raza. La Raza Roundtable meets every Saturday at Mexitas Bingo Hall.

As part of this Plan, PODER will request annual briefings from the City of Austin staff on specific topics relevant to the fecal bacteria TMDL including riparian zone restoration, pet waste collection, water quality structural BMP retrofits, fecal contamination reduction public education, wastewater infrastructure maintenance, development of public toilets and in-stream fecal bacteria monitoring results. These strategies address wide range potential sources of fecal contamination. PODER will distribute updates at the HABLA and La Raza Roundtable meetings. PODER will provide links on its website (www.poder-texas.org) regarding the Austin bacteria TMDL I-Plan and other available resources.

Table 29. Summary of Management Measure 4.7

Management Measure	**4.7** PODER will request annual briefings from the COA staff on specific topics relevant to the fecal bacteria TMDL including riparian zone restoration, pet waste collection, water quality structural BMP retrofits, fecal contamination reduction public education, wastewater infrastructure maintenance, development of public toilets and in-stream fecal bacteria monitoring results. These strategies address wide range potential sources of fecal contamination. PODER will distribute updates at the HABLA and La Raza Roundtable meetings. PODER will provide links on its website (www.poder-texas.org) regarding the Austin bacteria TMDL I-Plan and other available resources.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	PODER will: -Request annual briefings by COA WPD staff on COA environmental programs and ways citizens may help to reduce fecal contamination. -Distribute updates at the HABLA and La Raza Roundtable meetings annually. -Provide links on its website (www.poder-texas.org) regarding the Austin bacteria TMDL I-Plan and other available resources.				
Potential Load Reduction (cfu/day)	No quantifiable load reduction will occur as a result of this strategy, although this action does support other COA fecal load reduction measures and may provide opportunities for citizens to voluntarily implement fecal load reduction measures. Refer to the COA strategies addressing these topics for specific, quantified load reduction.				
Technical and Financial Assistance Needed	Technical COA staff needed to present information as requested on the identified topics. PODER representatives to provide information to HABLA and La Raza.				
Education Component	Presentations on the status of COA programs included in the I-Plan measures will serve as a means to inform and update the public, and provide a means for citizens to voluntarily implement fecal reduction measures through COA volunteer programs. COA may provide content for PODER, HABLA and La Raza meetings and links to COA web-based content.				
Interim, Measurable Milestones	The number of briefings to PODER per year will be measured and reported. The number of updates by PODER to HABLA, La Raza and others per year will be reported.				
Progress Indicators	COA strategies propose to reduce fecal loads to creeks and reduce instream fecal indicator bacteria concentrations. This strategy contains public education elements that will support those actions.				
Monitoring Component	-The number of briefings to PODER by COA staff will be tracked annually, as will be updates distributed by PODER to other organizations. -Water quality monitoring will continue in each of the affected watersheds as part of COA participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	PODER				

Management Measures 5.0 - Stormwater Treatment Strategies

Stormwater runoff is the dominant mechanism by which nonpoint source fecal loads are transported to receiving waters. Management of stormwater to reduce bacteria can be achieved with non-structural BMPs like riparian zone enhancement or preservation (see Management Measure 1.0) or with structural BMPs like sedimentation/filtration basins. Fecal bacteria are strongly associated with stream sediment (Byappanahalli and Ishii 2011), and removal of sediment from stormwater runoff may reduce bacteria loads. Structural stormwater BMP effectiveness in bacteria removal is variable depending in part on retention time and mechanism of treatment, as shown in the following Figure 3 and Table 30, which are based on the International BMP Database.

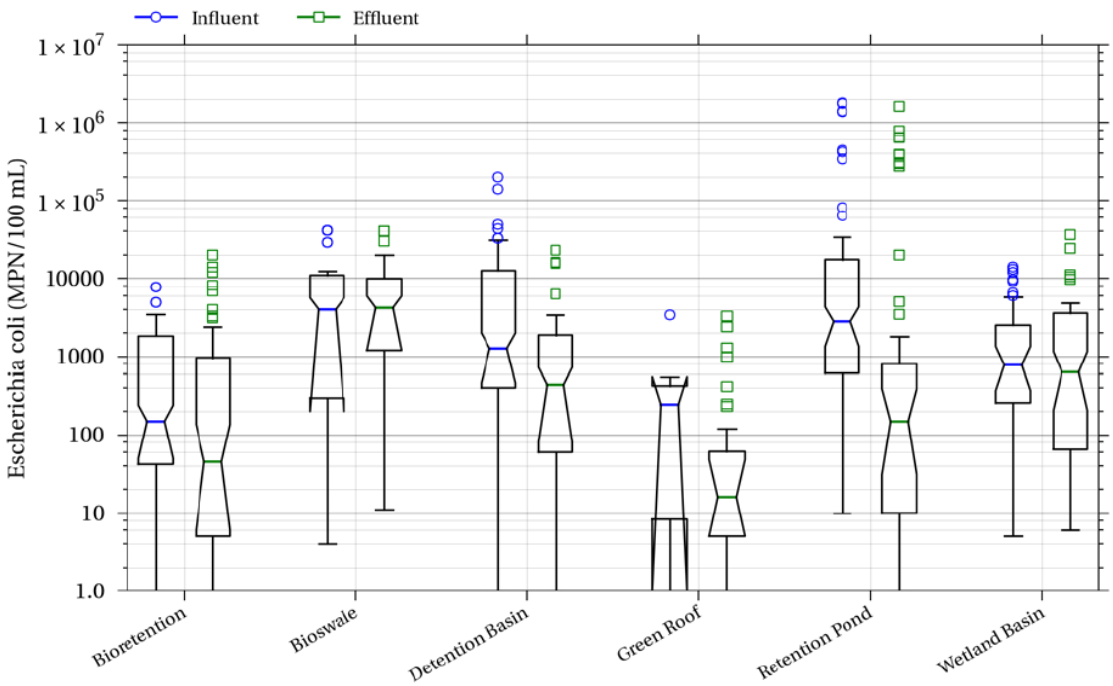

Figure 3. Box plot explanation of influent and effluent data.

The bottom line of each box represents the first quartile (25th percentile), the blue or green line represents the second quartile (the median), and the top line of the box represents the third quartile (75th percentile). This figure was taken from: http://www.bmpdatabase.org/Docs/2012%20Water%20Quality%20Analysis%20Addendum/BMP%20Database%20Categorical_SummaryAddendumReport_Final.pdf

Table 30. Summary of BMP bacteria removal effectiveness

Derived by Geosyntec Consultants and Wright Water Engineers (2012), prepared by Anna Stehouwer (University of Texas at Austin).

BMP Type	Bacteria	Number of Studies	Bacteria Concentration		95% Confidence Intervals		Decrease in Bacteria
			Entering (MPN/dL)	Exiting (MPN/dL)	Enter (MPN/100 mL)	Exit (MPN/100 mL)	
Bioretention	Ent.	48	13,700	8,740	3,060 - 25,300	1,610 - 16,800	Yes
Bioswale	*E. coli*	39	9,300	9,000	5,410 - 13,330	5,390 - 13,000	No
Composite BMPs	FC	52	28,100	14,600	17,600 - 40,300	10,700 - 18,600	No
Detention Basin	*E. coli*	32	18,300	2,540	5,150 - 33,000	839 - 4,440	Yes
Grass Strips	FC	13	104,000	169,000	286,000 - 184,000	17,900 - 360,000	No
Green Roof	*E. coli*	6 - 39	667	245	8 - 1,709	63 - 464	Yes
Manufactured Device: Disinfection	FC	32	4,930	28.2	1,370 - 10,300	14.7 - 43.1	Yes
Manufactured Device: Inlet Inserts/Filtration	FC	47	8,390	17,800	1,470 - 16,200	7,100 - 29,600	No
Manufactured Device: Physical	FC	59	10,700	21,600	5,420 - 17,100	11,000 - 32,500	No
Media Filter	FC	187	14,300	5,900	8,660 - 21,000	4,100 - 7,750	Yes
Retention Pond	*E. coli*	68	117,000	77,800	36,400 - 211,000	24,300 - 135,000	Yes
Wetland Basin	*E. coli*	42	2,510	3,830	1,410 - 3,680	1,660 - 6,210	No

5.1 Retrofit existing or install new stormwater structure on city lands (COA)

The COA WPD is a fee-funded municipal drainage utility. For fiscal year 2012, approximately $2.2 million in departmental Capital Improvement Project (CIP) funds were appropriated for structural stormwater treatment facilities, also known as stormwater BMPs. The COA WPD regularly identifies opportunities for retrofitting existing BMPs to enhance performance or constructing new BMPs on public lands. Common structural stormwater treatment BMPs in Austin include sedimentation/filtration basins, wet ponds and retention/irrigation systems, although newer innovative methods including infiltration and biofiltration methods are constructed with increasing frequency.

As prescribed in the COA WPD Master Plan (austintexas.gov/department/master-plan-0), the COA WPD initially identifies and prioritizes areas in which to evaluate BMP retrofits or additions based on need determined by field sampling data collected under the Environmental Integrity Index (EII) program (austintexas.gov/department/environmental-integrity-index). The EII includes biennial sampling of 121 reaches across 48 watersheds in Austin for a range of water quality, sediment quality, physical integrity, and biological metrics. For problem areas, further evaluation considers feasibility and cost-benefit in determining which sites will be targeted for BMP retrofit or addition activities by the City of Austin. The typical life cycle for watershed protection stormwater CIP projects once a location has been identified consists of a preliminary engineering review with hydraulic analyses, design, permitting, construction, and maintenance.

As part of this Plan, the City of Austin will investigate additional opportunities on public lands within the affected watersheds for retrofitting an existing stormwater BMP to enhance bacteria removal or construction of a new BMP to serve a previously untreated drainage area. Identified BMP opportunities will follow the existing citywide prioritization process for stormwater BMP projects. If an opportunity is found and prioritized, the new or retrofit BMP will follow the typical project life cycle of preliminary engineering review, design, construction, and maintenance with completion of each phase being the measurable milestone reported annually. No quantitative load reduction is estimated for this strategy as the individual BMP retrofit or addition opportunities have not been created, although once identified the load reduction for the controls could be estimated following the procedures described in management measures section 5.2.

Table 31. Summary of Management Measure 5.1

Management Measure	5.1 Identify and implement water quality structural controls on public lands within the affected watershed areas using CIP funds.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Assess opportunity and prioritize water quality structural control installations or retrofits on public lands in affected watersheds.	Complete preliminary engineering review of prioritized water quality structural control installation/retrofit(s).	Complete design of selected water quality structural control installation/retrofit(s).	Begin construction of selected water quality control.	Complete construction of selected water quality control.
Potential Load Reduction (cfu/day)	No reduction until structural control is implemented			No reduction until structural control is implemented	Volume of stormwater captured by control *x* fecal bacteria removal effectiveness
Technical and Financial Assistance Needed	Technical COA WPD to assess feasibility. Financial None	Technical COA WPD to review alternatives. Financial Additional CIP funds necessary for preliminary engineering review.	Technical COA WPD to complete design. Financial Additional CIP funds necessary for design.	Technical COA to install/manage construction. Financial Additional CIP funds necessary for construction and any Chapter 26 parkland mitigation fees.	
Education Component	N/A	Consider explanatory educational signage associated with control, use as demonstration project.			
Interim, Measurable Milestones	Identification and prioritization of water quality structural control options	Completion of preliminary engineering review of alternatives	Completion of design for selected alternative(s)	Initiation of construction	Completion of construction
Progress Indicators	N/A			-Reduction of *E. coli* in the affected watersheds -Increase in volume of stormwater treated for fecal bacteria	
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	COA PARD, COA WPD				

5.2 Inspect existing city-owned and commercial water quality controls in affected watersheds (COA)

Consistent with the City of Austin Texas Pollutant Discharge Elimination System (TPDES) Municipal Separate Storm Sewer System (MS4) stormwater discharge permit, the COA WPD routinely inspects structural stormwater BMP controls within the full purpose jurisdiction and ETJ to reduce stormwater pollutant loads. Stormwater structural controls may reduce bacteria concentrations in stormwater runoff (see introduction section 5.0). Routine inspection and maintenance to correct problems are necessary to maintain structural control effectiveness over time.

COA WPD field inspections of BMPs include checks for sediment build-up, structural integrity, erosion, blockage of the inlet, blockage of the outlet, functioning riser pipe, and trash rack, presence of excessive trash, and excessive vegetation growth impairing function. Problems observed for City of Austin owned facilities are addressed by City of Austin field operations staff. If maintenance issues are identified for residential or commercial facilities not owned by the City of Austin, a notice of violation is issued to the responsible party by City of Austin field operations staff and corrective action is taken to ensure continued functionality and compliance with city code. Commercial facilities are inspected once every 3 years. Residential and City-owned facilities are inspected annually. Additional financial resources allocated to this program could increase the frequency of inspection.

Complaints are received by City of Austin through the 3-1-1 call system. Complaint calls about structural BMPs are investigated by field staff within several days of receiving notification, and appropriate corrective action is taken as needed.

Within the four affected watersheds, there are 1,958 identified structural BMPs serving commercial areas and 116 serving residential areas. The total surface area of structural BMPs in the affected watersheds is approximately 628 acres capturing runoff from a total drainage area of approximately 13,800 acres. Approximately 37% of identified structural BMPs in the affected watersheds include a water quality treatment component. Multiple types of stormwater structural BMPs exist in Austin (Table 32. Summary of structural stormwater BMPs in the affected watersheds.).

Pollutant load reduction from this activity was derived based on the assumption that this activity maintains fully functioning stormwater controls that reduce bacteria loading in runoff. Load reduction was estimated by calculating the load delivered to structural controls multiplied by an estimated removal factor for bacteria. The average log-normal event mean concentration for fecal coliform bacteria in stormwater runoff by contributing land use was derived from City of Austin monitoring (City of Austin 2009), and converted to *E. coli* bacteria using a regionally-established conversion factor (Richter 2013). This resulted in event mean concentrations in stormwater runoff for *E. coli* of 24,111 MPN/dL and 38,592 MPN/dL for commercial and residential land uses, respectively. Annual runoff volumes were estimated for commercial areas to be 19.24 inches based on an average estimated impervious cover of 85% and estimated for residential areas to be 8.67 inches based on an average estimated impervious cover of 40% (City of Austin 2009). Using these approximations, an estimated 1,000,000 billion MPN *E. coli* per year would be transported to the identified controls. Removal factors were derived from monitoring data available in the International BMP Database (see introduction section 5.0) by

BMP type and used to estimate a potential load reduction. The potential load reduction from stormwater controls inspected or maintained by the City of Austin in the affected watersheds is estimated to be 4,000,000 billion MPN/year. This strategy is intended to continue to reduce fecal bacteria loading to the affected watersheds.

Table 32. Summary of structural stormwater BMPs in the affected watersheds.

Land Use	Pond Type	Number	Treated Area (acres)
COMMERCIAL	BIOFILTRATION	9	21
COMMERCIAL	FILTRATION/DETENTION	1	3
COMMERCIAL	FILTRATION_ONLY	24	45
COMMERCIAL	FLOOD_DETENTION	1025	4601
COMMERCIAL	INFILTRATION/DETENTION	2	5
COMMERCIAL	PARKING_LOT_DETENTION	204	124
COMMERCIAL	POROUS_PAVEMENT	2	1
COMMERCIAL	RETENTION/IRRIGATION	4	17
COMMERCIAL	SEDIMENT/DETENTION	5	23
COMMERCIAL	SEDIMENTATION/SAND_FILTRATION	573	2719
COMMERCIAL	SEDIMENTATION_ONLY	17	265
COMMERCIAL	VEGETATIVE_FILTER_STRIP	15	41
COMMERCIAL	WET_POND	54	3072
COMMERCIAL	OTHER	23	Unknown
RESIDENTIAL	FILTRATION_ONLY	2	2
RESIDENTIAL	FLOOD_DETENTION	49	1225
RESIDENTIAL	PARKING_LOT_DETENTION	5	2
RESIDENTIAL	SEDIMENTATION/SAND_FILTRATION	35	220
RESIDENTIAL	SEDIMENTATION_ONLY	17	190
RESIDENTIAL	VEGETATIVE_FILTER_STRIP	2	3
RESIDENTIAL	WET_POND	5	1241
RESIDENTIAL	OTHER	1	Unknown

Table 33. Summary of Management Measure 5.2

Management Measure	5.2 Inspect existing City-owned and commercial water quality controls in affected watersheds				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Inspect existing City-owned and commercial water quality structural controls and repair problems as feasible.				
Potential Load Reduction (cfu/day)	Number of water quality controls in affected watersheds x contributing drainage area x annual bacteria load by land use x percent removal by BMP type				
Technical and Financial Assistance Needed	Technical None Financial None				
Education Component	Continue citywide education efforts about good housekeeping measures to reduce bacteria loads in stormwater.				
Interim, Measurable Milestones	-Number of ponds inspected -Number of maintenance items corrected				
Progress Indicators	Continued load reduction via structural water quality control treatment of runoff; reduction in fecal bacteria instream concentrations.				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	COA WPD				

5.3 Inspect and ensure proper operation of privately owned permanent water quality treatment and flood detention structures (Travis County)

Travis County will implement a focused assessment of privately-owned permanent storm water control structures within its jurisdiction in the Walnut Creek watershed to determine if these structures (generally, flood detention and water quality treatment impoundments) are properly operated and maintained. When not functioning or maintained properly in accordance with their design, Travis County will seek corrective action and compliance from the owner.

Travis County is the operator of a Small MS4 and already implements its responsibilities through inspection of permanent water quality control facilities. Based upon its interest in addressing the *E. coli* impairment of Walnut Creek, Travis County will add a focused inspection initiative in this watershed.

Travis County has located and mapped all permanent controls in its jurisdiction and identified there are 16 privately-owned flood detention and 6 privately-owned water quality treatment facilities, including ones owned by municipal utility districts (MUDs). Travis County does not own any of these facilities in this particular watershed. Under this measure, staff will review and compile accessible data sets and compliance records, coordinate with the City of Austin, and will identify and notify the owners of the initiative. Environmental Specialists will inspect 50% of the facilities in Year 1 and the remaining 50% in Year 4. Additional follow-up inspections of non-compliant facilities will also occur as necessary. The inspections also result in efforts to seek compliance from responsible parties either through informal tools such as notices of violation (NOVs), or formally through civil suit by the Travis County Attorney's Office.

The management measure will be beneficial in reducing pollutant loading of *E. coli* that occurs due to improper functioning or treatment of storm water conveyed to the facilities. The pollutant load reduction will be calculated based upon the number of facilities inspected, the size of the contributing drainage area, the estimated load of *E. coli* to the control facility based upon land use and appropriate literature values, and the estimated removal factor for bacteria achieved by the facility (based on BMP type).

Table 34. Summary of Management Measure 5.3

Management Measure	5.3 Inspect and ensure proper operation and maintenance of privately-owned permanent water quality treatment and flood detention structures: Travis County will carry out inspections of these facilities in its jurisdiction in the Walnut Creek watershed, notify owners of operation or maintenance deficiencies, and seek correction using informal or formal enforcement mechanisms.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	-Identify owners of record of 22 known pond facilities -Coordinate with COA and MUDs to finalize Travis County inspection list -Obtain any specialized maintenance plans and facility records that are available.	-Inspect 50% of pond facilities. -Notify facility owners of violations.	-Identify the pond facilities considered compliant. -Conduct verification inspections to assess compliance with NOVs. -Refer non-compliant pond facilities to COA (if Travis County expectations cannot be enforced). -Alternatively, escalate non-compliance to civil enforcement if pond facility non-compliances are not eliminated using informal/NOV tools (if necessary).	-Inspect remaining 50% of pond facilities. -Notify facility owners of violations (NOVs). -Complete civil suits on pond facilities (if necessary).	-Identify the pond facilities considered compliant. -Conduct verification inspections to assess compliance with NOVs. -Refer non-compliant pond facilities to COA (if Travis County expectations cannot be enforced). -Escalate non-compliance to civil enforcement if illicit discharges not eliminated using informal/NOV tools (if necessary).
Potential Load Reduction (cfu/day)	Number of water quality control facilities *x* contributing drainage area *x* some literature value identifying cfu/day loading by land use *x* percent removal by land use type				
Technical and Financial Assistance Needed	Existing Travis County staff and resources				
Education Component	Send letter and information to each pond facility owner identifying the I-Plan bacteria reduction strategy and notify them of inspection strategy.		Send letter and information to the 2nd 50% of pond facility owners identifying the I-Plan bacteria reduction strategy and notify them of inspection strategy.		
Interim, Measurable Milestones	-Dataset completed -Date Informational letters mailed -Maintenance plans obtained	-Number of inspections completed -Number of NOVs issued	-Verification inspections completed -Number of civil or inter-jurisdictional enforcement referrals -Date 2nd Batch of Informational letters mailed	-Number of inspections completed -Number of NOVs issued -Number of enforcement cases completed	-Verification inspections completed -Number of civil or inter-jurisdictional enforcement referrals
Progress Indicators			Calculate load reduction from efforts.		

Monitoring Component	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	Travis County TNR, EQP	Travis County TNR, EQP	Travis County TNR, EQP; Travis County Attorney; COA	Travis County TNR, EQP; Travis County Attorney; COA	Travis County TNR, EQP; Travis County Attorney; COA

5.4 Dry weather storm drain outfall screening (COA)

The COA WPD conducts dry weather screening of storm drain outfalls greater than or equal to 36 inches in diameter (or equivalent cross-sectional area for non-circular outfall structures). This activity is consistent with TPDES MS4 permit requirements related to illicit discharge detection and elimination, and is conducted following established protocols (Brown et al. 2004). Dry weather screening consists of physical inspection of storm drain outfalls during periods without antecedent rainfall to identify outfalls discharging water when no storm water runoff is expected. Dry weather screening is a means to identify and remediate illicit connections, potentially including sanitary sewer cross connections, to the storm drain system and thereby reduce fecal contamination of water ways (Sercu et al. 2009).

When dry weather flow is found during inspection, the City of Austin samples the flow for surfactants (soap), ammonia, potassium, fluoride, chlorine, pH, temperature, total dissolved solids and chromium. Though fecal bacteria is not included, these parameters are usually sufficient to identify if the water type is potable water, gray water (e.g., from car wash operations) or wastewater following methodology outlined by Lalor and Pitt (1999). If the type is determined to be non-natural, additional investigations are conducted to identify the source and appropriate corrective action is taken. An individual outfall is typically inspected once every 1.5 to 3 years depending on rainfall conditions, and at least once every 5 years.

At least 940 storm drain outfalls with cross sectional areas equivalent to 36 inches in diameter have been identified in Austin, with 196 identified in the affected watersheds. One large outfall has been identified in the Spicewood Springs watershed, 3 large outfalls are known in the Taylor Slough South watershed, 23 are known in the Waller Creek watershed upstream of 15th Street, and 169 have been identified in the Walnut Creek watershed.

To identify and reduce illicit cross-connections of sanitary sewers to the storm drain system, the City of Austin will inspect each storm drain outfall 36 inches in diameter or equivalent cross sectional area within the affected watersheds at least once during the five-year period. The number of outfalls inspected within the affected watersheds will be reported annually. The potential load reduction from this activity is estimated as the number of outfalls inspected multiplied by the percentage of inspections on average that identify non-natural dry weather flow multiplied by the fecal bacteria load in sanitary sewers. With additional resources, the City of Austin could increase the frequency of inspection for the large outfalls, or could expand inspection to include smaller diameter outfalls.

Table 35. Summary of Management Measure 5.4

Management Measure	5.4 Conduct dry weather screening of storm drain outfalls > 36" in affected watersheds				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Screen all 36" stormwater outfalls in affected watersheds at least once during the five-year period during dry weather conditions.				
Potential Load Reduction (cfu/day)	Number outfalls *x* average number illicit discharges discovered *x* fecal bacteria load				
Technical and Financial Assistance Needed	Technical None Financial None				
Education Component	Continue citywide education efforts about good housekeeping measures to reduce bacteria loads in stormwater.				
Interim, Measurable Milestones	Number of outfalls screened				
Progress Indicators	Identification and remediation of any illicit discharges discovered; reduction in instream fecal bacteria concentration				
Monitoring Component	Water quality monitoring will continue in each of the affected watersheds as part of COA WPD participation in the Texas Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	COA WPD				

5.5 Dry weather screening of storm drain outfalls (UTA)

The UTA-EHS Department monitors dry weather flows and completes field analysis on any flows identified. Dry weather screening attempts to identify cross connections between sanitary sewers and UTA's MS4 system. UTA's TPDES MS4 permit requires that the entire MS4 system to be screened every five years. UTA screens major outfalls, those ≥36 inches in diameter, once a year. Potentially illicit discharges or cross connections detected are addressed expeditiously to reduce fecal bacteria loads. The UTA-EHS receives technical assistance from UTA-UEM, or the Facility Services Department to make the necessary corrections. UTA -EHS will continue to screen dry weather flows from University drainage outfalls and perform colorimetric analysis for pH, chlorine, copper, phenol, detergents, and ammonia. A possible future strategy may be to implement GPS coordinate mapping of all MS4 system outfalls to ensure the entire system is being screened to capture all possible load reduction opportunities.

Table 36. Summary of Management Measure 5.5

Management Measure	5.5 UTA Dry Weather Screening				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	20% of Outfalls screened	40% of outfalls Screened	60% of outfalls Screened	80% of outfalls screened	Entire MS4 completely Screened
Potential Load Reduction (cfu/day)	Number outfalls *x* average number illicit discharges discovered *x* fecal bacterial load				
Technical and Financial Assistance Needed	Technical Update drawings as needed to identify all outfalls.	Technical GPS coordinate mapping.			
Education Component	Inter-departmental collaboration when issues are found to correct issues				
Interim, Measurable Milestones	Number of outfalls screened				
Progress Indicators	Continue to monitor dry weather flows and analyze any identified to ensure additional improper connections are not made to the MS4 system. Prevent an increase in fecal bacteria concentrations with the ultimate goal supported in the I-Plan.				
Monitoring Component	-UTA will screen dry weather flows form University drainage system outfalls, and perform colorimetric analysis for pH, chlorine, copper, phenol, detergents, and ammonia. - Results of the screening and any analysis performed will be retained by UTA-EHS. - Any illicit discharge identified will be addressed expeditiously.				
Responsible Organization	UTA-EHS, UTA-UEM, UTA-PMCS, UT System Office of Facilities Planning and Construction.				

5.6 New roadway bacteria reduction BMPs (Travis County)

Travis County TNR will pilot new structural BMPs that have shown success in other applications. For water quality volume credit and complementing traditional permanent water quality controls, Travis County will design and build the Arterial A roadway to include bacteria reducing bioretention technology in locations most proximal to Walnut Creek or tributaries. Arterial A will run south to north from U.S. 290 East to the City of Austin just north of Cameron Rd within the Walnut Creek watershed. Currently, the roadway design has been funded and inclusion of the technology is to be incorporated into the design. To implement the strategy will require funding for right of way acquisition and construction, a matter for a future bond issue. This strategy will extend longer than the 5-year time frame for the I-Plan based on roadway approval/funding processes and construction.

The selected technology will include incorporating a biomedia within small roadside below-grade vaults to treat runoff that passes through selected curb inlets. The piloting of this technology will allow Travis County to evaluate the performance and maintenance associated with the technology on a small scale basis. To calculate load, Travis County will fund basic monitoring of the BMP performance and obtain results in bacteria reduction in effluent from this technology compared to effluent from more traditional sedimentation/filtration treatment. Since this roadway and its impervious cover does not exist at this time, this strategy will not reduce existing pollutant loads but instead would potentially eliminate an increase in bacteria associated with wash off from newly constructed hard surfaces.

The strategy is beneficial in evaluating a technology that is more specifically focused on bacteria reduction rather than permanent water quality treatment systems that are designed for sediment removal. If shown to be effective, it would be chosen for use more often in other area roadway construction or to retrofit existing roadways.

5.7 Street sweeping (UTA)

The UTA’s Street Sweeping Program is largely maintained by the Facilities Landscaping Department with a mission to sweep University-owned streets, mall areas, sidewalks, and parking garages on a semi-annual and as needed basis. The University utilizes owned equipment or contractors to sweep streets and impervious surfaces with the goal of removing sediment, trash, and organic detritus hence reducing potential fecal bacteria loads to surface waterways. UTA’s Facilities Service Department will continue to weigh and monitor pounds of debris, trash, and animal waste collected to estimate load reduction.

Table 37. Summary of Management Measure 5.6

Management Measure	5.6 New roadway bacteria reduction BMPs: For water quality volume credit and complementing traditional permanent water quality controls, Travis County will design and build Arterial A to include bacteria reducing bioretention technology on selected storm drain inlets in locations most proximal to Walnut Creek or tributaries. Arterial A would run south to north from U.S. 290 East to the COA just north of Cameron Rd within the Walnut Creek watershed. Note: This strategy will have a duration longer than 5 years based on roadway approval/funding processes and construction.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	-Complete design of Arterial A anticipated to be a 1,422-ft. multi-lane roadway with 12 of 37 storm drain inlets using the chosen technology. -Review environmental design for adequacy.	Identify funding for right-of-way acquisition and construction.	Obtain funding for right-of-way acquisition and construction.	-Initiate right-of-way acquisition.	-Complete right-of-way acquisition and initiate construction contract process. -Establish construction time line Year 6: Initiate construction of Arterial A including the permanent water quality controls.
Potential Load Reduction (cfu/day)					The bioretention technology would eliminate a potential increase in loading that would result from the additional impervious cover and roadway drainage.
Technical and Financial Assistance Needed	Travis County 2011 Bonds resulted in funding of the design work.		An estimated $23 million is necessary to build the roadway; Travis County anticipates its next road bond election in 2016 (based on historical cycle).		
Education Component					
Interim, Measurable Milestones	-Report completion of roadway design - Report bioretention technology has been incorporated into design		Report results funding by voters		Report completion of right-of-way acquisition
Progress Indicators					Construction of roadway and permanent water quality controls is completed (possibly Year 7 to Year 8).

Monitoring Component	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.	-Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA. -Year 8: Develop post-BMP monitoring protocol to compare Arterial A and bacteria to the performance on another recently completed roadway.
Responsible Organization	Travis County TNR; COA CIP	Travis County TNR; COA CIP	Travis County TNR; COA CIP	Travis County TNR; COA CIP	Travis County TNR; COA CIP Year 8 Monitoring: Travis County TNR and EQP

Table 38. Summary of Management Measure 5.7

Management Measure	5.7 UTA Austin Street Sweeping				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Continue to sweep University owned streets on a semiannual basis and as needed.				
Potential Load Reduction (cfu/day)	Amount of trash/debris disposed of or recycled properly per year				
Technical and Financial Assistance Needed	Financial Introducing pervious pavement projects on new and existing sites on campus.				
Education Component	Inter-departmental collaboration when issues are found. Continue to educate students, staff, and faculty on eliminating litter on UTA campus through the "Longhorns Don't Litter" campaign.				
Interim, Measurable Milestones	The appropriate UTA department will continue to weigh the amount of debris, trash, and animal waste removed				
Progress Indicators	Utilize owned equipment or contractor to sweep streets and impervious surfaces; prevent an increase in fecal bacteria concentrations with the ultimate goal supported in the I-Plan.				
Monitoring Component	UTA Facilities Services will continue to weigh and monitor how much sediment, trash, and organic detritus is collected on University owned streets, mall areas, sidewalks, and parking garages.				
Responsible Organization	UTA-EHS, UTA –Facilities Services (Landscaping)				

5.8 Construction site inspection and monitoring (UTA)

UTA-EHS requires cooperation from multiple University departments to inspect, monitor, and enforce storm water compliance on all UTA construction sites to minimize storm water runoff, pollution, and/or sanitary waste from entering UTA's MS4. UTA requires the installation of BMPs on all sites with soil disturbance and ensures controls are maintained in accordance with the requirements of the TPDES MS4 permit through construction plan review, monthly site investigation, and continued education/training. Illicit discharge detection allows for decreased fecal bacteria loads, and continued inspection of sites for compliance with BMP phase control, installation, and maintenance will be critical in providing additional load reduction in the future.

Table 39. Summary of Management Measure 5.8

Management Measure	5.8 UTA Construction Site Controls				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	Continue to inspect, monitor, and enforce storm water compliance on all UTA construction site projects to minimize storm water runoff, pollution, and sanitary waste from entering UTA's MS4.				
Potential Load Reduction (cfu/day)	Number of inspections *x* illicit discharges discovered *x* fecal bacteria load				
Technical and Financial Assistance Needed	N/A				
Education Component	-The University document *University Construction Site Procedures for Contractors* is distributed to construction site superintendents by project managers prior to initiation of the project. -UTA –EHS provides briefs and training workshop(s) as requested to UTA construction inspectors and coordinators on construction site pollution control BMPs and other requirements. -UTA-PMCS issues new contractors a *Contractors Handbook* that includes several environmental topics with protection of storm water as a recurring topic.				
Interim, Measurable Milestones	Report number of construction inspections conducted annually.				
Progress Indicators	Continued inspection of construction sites for compliance with BMP phase control, installation, and maintenance. Prevent an increase in fecal bacteria concentrations with the ultimate goal supported in the I-Plan.				
Monitoring Component	UTA continues to require installation of BMPs on all construction sites with soil disturbance. Through construction plan review, site investigation, and responses to calls received, EHS representatives ensure that BMPs are installed and maintained according to storm water management plan (SWMP) requirements.				
Responsible Organization	UTA–EHS, UTA-PMCS, Housing & Food, UTA-UEM, Facilities Services, UT System Office of Facilities Planning and Construction.				

5.9 Detection of illicit commercial/industrial discharges and construction site sanitary waste management (Travis County)

Travis County will implement a focused assessment of commercial and industrial facilities within its jurisdiction in the Walnut Creek watershed to determine if inappropriate sanitary waste management results in illicit discharges to its MS4. Additionally, it will update its construction site inspection practices to evaluate sanitary waste management practices by construction site owners and operators.

Travis County is the operator of a Small MS4 and already implements its responsibilities through inspection of construction sites and by inspecting and evaluating commercial and industrial facilities to determine if illicit discharges are prevented. These existing inspections also result in efforts to seek compliance from responsible parties either through informal means like NOVs or formally through civil suit by the Travis County Attorney's Office. Based upon its interest in addressing the *E. coli* impairment of Walnut Creek, Travis County will add a focused inspection initiative in this watershed. Particularly, inspectors will review the manner in which sanitary waste or other potential sources of *E. coli* are controlled and managed to prevent unauthorized discharges. Using appropriate, accessible data sets and field reconnaissance, commercial and industrial operations will be identified and inspected. Regarding construction sites, Travis County will update its inspection checklists so that inspectors consistently and comprehensively review the sanitary waste practices while carrying out pre-construction conferences and ongoing monitoring inspections of disturbed sites through the course of the construction period.

The management measure will be beneficial in eliminating actual sources of human-generated *E. coli*, should any be occurring. The pollutant load reduction will be calculated based upon the number of wastewater discharges eliminated, the estimated daily volume of discharges, and a literature value identifying *E. coli* concentration in untreated sewage.

Table 40. Summary of Management Measure 5.9

Management Measure	5.9 Detection of Illicit Commercial/industrial Discharges and Construction Site Sanitary Waste Management: Travis County will implement a focused assessment of commercial and industrial facilities within its jurisdiction in the Walnut Creek watershed to determine if inappropriate sanitary waste management results in illicit discharges to its MS4. Additionally, it will update its construction site inspection practices to evaluate sanitary waste management practices by construction site owners/operators.				
Schedule	**Year One**	**Year Two**	**Year Three**	**Year Four**	**Year Five**
Schedule of Implementation	-Develop dataset identifying commercial and industrial facilities. -Update existing construction site checklists to incorporate inspection of sanitary waste practices.	-Inspect the commercial and industrial facilities. -Inspect construction sites pursuant to Travis County SWMP. -Notify facility owners of violations.	-Continue to inspect construction sites pursuant to Travis County SWMP; address non-compliance. -Identify the commercial and industrial facilities considered compliant. -Conduct verification inspections to assess compliance with NOVs. -Escalate non-compliance to civil enforcement if illicit discharges not eliminated using informal/NOV tools (if necessary).	-Complete civil suits on commercial and industrial facilities (if necessary). -Continue to inspect construction sites pursuant to Travis County SWMP; address non-compliance.	-Re-inspect commercial and industrial facilities identified in Year 2 as non-compliant. -Re-inspect a subset of commercial and industrial facilities determined in Year 2 as compliant. -Continue to inspect construction sites pursuant to Travis County SWMP; address non-compliance.
Potential Load Reduction (cfu/day)	Number of wastewater discharges eliminated as a result of inspection/violation notifications *x* estimated volume/day *x* some literature value identifying cfu/day in sewage				
Technical & Financial Assistance Needed	Existing Travis County staff and resources				
Education Component	Send letter and information to each commercial/industrial entity identifying the I-Plan bacteria reduction strategy and notify them of inspection strategy.				
Interim, Measurable Milestones	-Dataset completed -Informational letters mailed	-Number of inspections completed -Number of NOVs issued	-Number of inspections completed -Number of NOVs issued -Commercial/ industrial compliance verification inspections completed -Number of civil enforcement referrals	-Number of civil suits completed -Number of inspections completed -Number of NOVs issued	-Number of inspections completed -Number of NOVs issued
Progress Indicators	Calculate load reduction from efforts. Identify the increase in compliance noted over the period of this initiative.				

Monitoring Component	Water quality monitoring will continue in the Walnut Creek watershed as part of the COA WPD participation in the Clean Rivers Program in partnership with the LCRA.				
Responsible Organization	Travis County TNR & EQP	Travis County TNR, EQP	Travis County TNR & EQP; Travis Co. Attorney	Travis County TNR & EQP; Travis County Attorney	Travis County TNR & EQP

Adaptive Management

The TCEQ will facilitate the stakeholders effort to periodically assess the results of the planned activities and other sources of information to evaluate the effectiveness and efficiency of the I-Plan and post the relevant information on the TCEQ website. The stakeholders will evaluate several factors, such as the pace of implementation, the effectiveness BMPs, load reductions, and progress toward meeting water quality standards. The stakeholders will document the results of these evaluations and the rationale for maintaining or revising elements of the I-Plan.

The TCEQ and stakeholders will track the progress of the I-Plan using both implementation milestones and water quality indicators. These terms are defined as:

- **Implementation Milestones** — a measure of adminsitrative actions undertaken to improve water quality.
- **Water Quality Indicator** — A measure of water quality conditions for comparison to pre-existing conditions, constitutent loadings, and water quality standards.

Some areas specifically noted by the Coordination Committee for future exploration and consideration in future amendments to the I-plan include:

- Encouraging private sector promotion of inspections of private laterals during real estate transactions.
- Expanding Management Measure 3.4 to more aggressively promote reduction in pet waste from commercial and nonprofit pet facilities if research indicates this is warranted.
- Soliciting the development and implementation of additional management measures from MUDs within the Walnut Creek watershed, particularly those MUDs with MS4 responsibilities under TCEQ's TPDES program.
- Instituting public education on cat waste management.

Implementation Tracking

Implementation tracking provides information that can be used to determine if progress is being made toward meeting the goals of the TMDL. Tracking also allows stakeholders to evaluate the actions taken, identify those actions which may not be working, and make any changes that may be necessary to get the plan back on target. Schedules of implementation activities and milestones for this I-Plan are included in the individual tables associated with each management measure.

Water Quality Indicators

Routine fecal indicator bacteria monitoring will occur within each of the identified impaired assessment units included in this I-Plan to track the success of management measures over time. The COA WPD will collect *E. coli* samples from established monitoring sites (Table 41. Monitoring locations for *E. coli*) four times per year. *E. coli* samples will be collected under an approved Texas Clean Rivers Program Quality Assurance Project Plan (QAPP) following TCEQ Surface Water Quality Monitoring Procedures Manual guidelines. *E. coli* samples will be analyzed by an approvedlaboratoryaccredited by the National Environmental Laboratory Accreditation Program, as specified in the approved QAPP. Results will be submitted to TCEQ for inclusion in future 303(d)/305(b) assessments through the Texas Clean Rivers Program. Additional conventional water quality parameters including nutrients and physiochemical parameters may be collected to assist with continued fecal load source identification.

Table 41. Monitoring locations for E. coli

Segment	TCEQ Station Location ID	Site Name	Latitude	Longitude
1403J_01	16316	Spicewood Trib Downstream of Ceberry Drive	30.36203	-97.7483
1403K_01	17294	Taylor Slough South Downstream of Pecos Street	30.30483	-97.7702
1429C_03	16331	Waller Creek at Avenue H	30.30688	-97.7253
1429C_02	15962	Waller Creek at 24th Street	30.28714	-97.7334
1429C_01	12222	Waller Creek at 2nd Street	30.26269	-97.7385
1428B_05	17251	Walnut Creek Downstream of Loop 1	30.40977	-97.7105

Communication Strategy

A central tenet of this plan is communication and education. Most management measures incorporate education, and the following measures use education as a key focus:

Management Measures 1.0 - Riparian Zone Restoration
Table 7. Summary of Management Measure 1.2

Management Measures 3.0 - Domestic Pet Waste
- 3.1 Dog waste education and enforcement in parks (COA)
- 3.3 Walnut off-leash area kiosk (COA, Friends of Austin Dog Parks)
- 3.4 Waste collection in commercial and non-profit pet facilities

Management Measures 4.0 – Resident Outreach
- 4.1 ANC Meetings Educational Outreach (ANC)
- 4.2 City staff presentations to Austin Environmental Board (Environmental Board)
- 4.3 Homeless Survival Guide Outreach (COA)
- 4.4 Earth Camp, Earth School, and Clean Creek Campus Outreach (COA)

4.5 Riparian and Scoop education in volunteer workdays and annual meetings (KAB, APF)
4.6 Community Communication Plan (Shoal Creek Conservancy & others)
4.7 PODER Educational Outreach Efforts

Communication is necessary to ensure stakeholders understand the I-Plan and its progress in restoring water quality conditions. The TCEQ will obtain information derived from tracking I-Plan activities during the annual meetings. This information will be posted on the TCEQ website for interested parties, including watershed stakeholders, state leadership, government agencies, non-governmental organizations, and individuals. The TMDL Program will summarize all actions taken to address the impairment, which are discussed at the annual meeting and will report trends observed in the water quality data collected to track the progress of implementation as needed. Responsible parties are committed to providing appropriate information to the TCEQ to update these progress assessments and communicating information at annual meetings.

The TCEQ will be responsible for hosting annual meetings for up to the next five years so stakeholders may evaluate their progress. Stakeholders will continue to take part in the annual meetings over the five-year period to evaluate implementation efforts and to revise the plan as needed. At the completion of the scheduled I-Plan activities, stakeholders will assemble and evaluate the actions, overall impacts, and results of their implementation efforts.

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Appendix A. Resolutions/ Letters of Support for the plan

The following are resolutions or letters of support for the I-Plan from organizations represented on the Improving Austin Streams Coordination Committee.

(Letters of support received through February 12, 2014 are attached to this draft I-Plan. A letter of support from Pease Park Conservancy has also been received and will be added to the plan submitted to the TCEQ.)

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GREATER AUSTIN

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December 10, 2013

Improving Austin Streams Coordination Committee
c/o Suzanne Schwartz
Environmental Program Director
Center for Public Policy Dispute Resolution
The University of Texas School of Law
727 E. Dean Keeton St., Austin, TX 78705

Dear Coordination Committee Members,

This letter of support is being provided by the Home Builders Association (HBA) of Greater Austin as a participant in the Texas Commission on Environmental Quality (TCEQ) Implementation Plan (I-Plan) for Austin area urban creeks.

The TCEQ is charged by the Clean Water Act with developing a total maximum daily load (TMDL) for streams not supporting their designated uses. To do so for Austin Urban Creeks, TCEQ has been working with local stakeholders (Coordination Committee [CC]) to develop an I-Plan, designed to reduce pollutants in four local streams. The creeks are: Walnut Creek, Spicewood Tributary (also known as Foster Branch) to Shoal Creek, Waller Creek, and Taylor Slough South.

In addition to those four streams, City of Austin Watershed Protection Department (WPD) monitoring has identified a wider range of watersheds in Austin that have levels of fecal indicator bacteria above State of Texas long-term standard, but which do not come within this TMDL process. The City plans to use appropriate strategies developed in the I-Plan effort for improving all streams in Austin.

After an initial examination of the water pollutants in the key streams, the Coordination Committee established as its goal "to develop and implement strategies to reduce fecal contamination such that the affected watersheds fully meet the contact recreation water quality standard." The I-Plan recommends five sets of voluntary management measures to reduce nonpoint source fecal bacterial contamination in these four water bodies, relating to: Riparian Zone Restoration, Wastewater Infrastructure, Domestic Pet Waste, Resident Outreach, and Stormwater Treatment. Moreover, the City of Austin anticipates extending the strategies to all nonconforming streams within its jurisdiction.

Key items behind the support by the HBA are that the I-Plan is not regulatory in nature and is limited to four waterways that are already largely developed. The HBA remains interested in future efforts to improve other streams in the Austin area and would expect to participate in any expanded applications.

Sincerely,

Kathey Comer,
Executive Vice President

Cc: John Sparrow
President

December 16, 2013

To: Improving Austin Streams Coordination Committee

On behalf of the Austin Regional Group of the Sierra Club, I want to express our appreciation for the opportunity to support the TMLD Implementation Plan for Waller Creek, Walnut Creek, Taylor Slough and the Spicewood Tributary to Shoal Creek. It was a rewarding experience to participate with the diverse groups in a process that's yielded such promise for reducing bacteria levels in these Austin area streams.

We trust that TCEQ will use this plan as a minimum standard and if more stringent regulations can be applied they will be. The health of our waterways and environment is basic to the health of our community.

Thank you again.

Roy Waley
Chair-Conservation Committee
Austin Regional Group-Sierra Club
rwaley@hotmail.com
512-657-9578

#14

RESOLUTION

A RESOLUTION OF TRAVIS COUNTY TO SUPPORT THE AUSTIN URBAN WATERSHEDS TOTAL MAXIMUM DAILY LOAD (TMDL) IMPLEMENTATION PLAN PROPOSED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ).

Whereas, The Spicewood Tributary to Shoal Creek, Taylor Slough South, Walnut Creek, and Waller Creek total approximately 30 miles in length with watersheds covering 63 square miles nearly all within Travis County;

Whereas, The 2012 Texas Integrated Report of Surface Water Quality identifies bacteria impairments of these four streams resulting in non-support of contact recreation uses such as swimming;

Whereas, Travis County has worked with the TCEQ and local stakeholders to develop a TMDL Implementation Plan (I-Plan) as a member of the Improving Austin Streams Coordination Committee and this committee prepared management measures for eliminating or reducing bacteria pollutant loads associated with the impairments;

Whereas, Travis County staff is committed to addressing the impairment of Walnut Creek by establishing specific management measures to include development requirements, compliance evaluations, and incentives to owners of on-site sewerage facilities within County jurisdiction; and

Whereas, On December 20, 2013, the Improving Austin Streams Coordination Committee submitted a draft I-Plan to the TCEQ entitled *Draft Implementation Plan for Four Urban Watersheds in the City of Austin.*

NOW, THEREFORE BE IT RESOLVED BY THE TRAVIS COUNTY COMMISSIONERS COURT, THAT the Court supports the approval by the TCEQ of the December 20, 2013, *Draft Implementation Plan for Four Urban Watersheds in the City of Austin* and pledges its participation to implement the management measures in the I-Plan.

Resolved, this 7th day of January, 2014.

SAMUEL T. BISCOE

County Judge

RON DAVIS
Commissioner, Precinct One

BRUCE TODD
Commissioner, Precinct Two

GERALD DAUGHERTY
Commissioner, Precinct Three

MARGARET J. GÓMEZ
Commissioner, Precinct Four

Austin Chamber

February 6, 2014

Suzanne Schwartz
Environmental Program Director
Center for Public Policy Dispute Resolution
727 East Dean Keeton Street
Austin, TX 78705

Dear Ms. Schwartz,

The Austin Chamber of Commerce appreciates the opportunity to participate in the Improving Austin Streams Coordinating Committee for the past year. Ensuring our region's quality of life is vitally important to the Chamber in promoting both the City of Austin and the Central Texas region as great places to do business and prosper.

Through its economic development policies and agreements, the City of Austin and Travis County have prioritized the location of partnering companies in the Desired Development Zone. As such, the Chamber supports the efforts to plan for a mix of uses including office, retail, and residential in these urban watershed areas to allow for the long-term vitality of our community.

Thank you for your consideration.

Sincerely,

Jeremy Martin
Senior Vice President
Austin Chamber of Commerce

Austin Chamber of Commerce • 535 East 5th Street • Austin, Texas 78701 • Ph: 512-478-9383 • austinchamber.com

Austin Neighborhoods Council

January 28, 2014

Dear Improve Austin Streams Coordination Committee Members,

The Austin Neighborhoods Council (ANC) supports the Texas Commission on Environmental Quality (TCEQ) Implementation Plan (I-Plan) that is designed to reduce mainly non-point source fecal bacteria (E.coli) pollution in Austin area creeks. The TCEQ Plan will be implemented first in Walnut Creek, Waller Creek, the Spicewood Tributary of Shoal Creek, Taylor Slough South, and possibly in other streams with excessive pollution levels throughout Austin.

The water quality of Austin's streams is an important health issue to ANC members, since many neighborhoods rely on their local streams and greenbelts for recreational use. As part of the Resident Outreach of the I-Plan, ANC will invite city staff to present an educational briefing on water quality issues and an update on the progress of the five management measures of the TCEQ I-Plan at a general membership meeting.
ANC looks forward to continued work with the TCEQ and city staff for ensuring good quality water in all of our watersheds.

Respectfully,

Mary Ingle
ANC President

P.O. Box 301975
Austin, Texas 78703
www.ancweb.org

Presented to the ANC Executive Committee, January 12, 2014
Adopted by the ANC Executive Committee, January 12, 2014
Sponsored by Joyce Basciano, ANC Vice President 1

City of Austin

Mayor Lee Leffingwell · 301 Willie Nelson Boulevard, Austin, Texas 78701 · www.mayorleffingwell.com
Office (512) 974-2250 · Fax (512) 974-2337 · Lee.Leffingwell@austintexas.gov

February 19, 2014

Improving Austin Streams Coordinating Committee
c/o Suzanne Schwartz, Environmental Program Director
Center for Public Policy Dispute Resolution
The University of Texas School of Law
727 E. Dean Keeton St.
Austin, TX 78705

RE: City of Austin Support for the Austin Urban Creek Fecal Bacteria Implementation Plan

Dear Coordinating Committee Members:

The City of Austin continues to invest in programs and projects to restore and improve the water quality of Austin's creeks. City of Austin staff from multiple departments actively participated in the development of the Implementation Plan to reduce fecal bacteria in Waller Creek, Walnut Creek, Taylor Slough South and the Spicewood Tributary to Shoal Creek.

The City of Austin understands that the Implementation Plan is a planning tool that includes voluntary management measures to reduce fecal contamination in the four affected Austin creeks, and that there is no legal or financial obligation to comply with the proposed actions in the plan. However, the City of Austin recognizes the importance of maintaining the quality of our surface water resources, and welcomes continued collaboration with regional stakeholders to achieve the contact recreation standard in these and all of Austin's creeks.

Sincerely,

Lee Leffingwell
Mayor

cc: Victoria J. Li, P.E., Director, Watershed Protection Department
Greg Meszaros, Director, Austin Water Utility
Sara L. Hensley, CPRP, Director, Austin Parks and Recreation Department

The City of Austin is committed to compliance with the American with Disabilities Act.
Reasonable modifications and equal access to communications will be provided upon request.

ENVIRONMENTAL HEALTH AND SAFETY
THE UNIVERSITY OF TEXAS AT AUSTIN
P.O. Box 7729 • Austin, TX 78713-7729 • (512) 471-3511 • Fax (512) 471-6918

Mr. Ron Stein
TMDL Project Manager
Texas Commission on Environmental Quality, MC-203
P.O. Box 13087
Austin TX 78711-3087

February 10, 2014

Dear Mr. Stein,

The purpose of this letter is to express support and to pledge The University of Texas at Austin's participation in the Improving Austin Streams Implementation Plan. The University of Texas at Austin is committed to the reduction of bacteria concentrations in the Waller Creek watershed through the Management Measures outlined in the "Implementation Plan for Four Urban Watersheds in the City of Austin". Protection of our water resources is a high priority for the University.

The University of Texas at Austin understands that the "Implementation Plan for Four Urban Watersheds in the City of Austin" document is a planning tool that contains feasible proposals for bacteria reduction in the four affected watersheds, that participation in the plan is strictly voluntary, and that, if funding cannot be secured for any reason for the measures contained in the plan, there is no legal obligation to comply with the provisions of the plan. The University of Texas at Austin also understands that under 30 TAC §309.2(b), the TCEQ has the legal authority to set effluent criteria stringent enough to protect contact recreation in the impaired creeks if voluntary measures do not result in the achievement of Water Quality Standards in the four creeks identified in the plan.

Sincerely,

Dr. Pat Clubb
Vice President University Operations

cc:
Dr. Steven Kraal, Senior Associate Vice President, University Operations
Dr. Gerald Harkins, Associate Vice President, University Operations
Juan Ontiveros, Executive Director, Utilities and Energy Management
Mike Miller, Director, Facility Services
John Salsman, Director Environmental Health & Safety

Appendix B. Public Comment and Responses

Following its August 26, 2013 adoption of a draft I-Plan, the Coordination Committee solicited public comment by emailing to a broad list of potentially interested persons, and with a targeted focus on the list of persons who had expressed a desire to receive continuing emails regarding I-Plan development. The Coordination Committee also held a public forum/open house on October 9 to share information with the public about the draft I-Plan and to receive comments from the public. The following are the comments received, and the Coordination Committee's response.

Comment	Coordination Committee Response
Consider including 319(h) grant as funding source for water quality retrofits. Including this in the I-Plan may increase the likelihood of winning the grant.	Enhancing management measures through 319(h) grant funding is noted as a possible avenue for providing needed financial assistance in multiple management measures in the I-Plan.
Try to get more communities/City of Austin to build rain gardens similar to KC 10000 rain gardens project.	The City of Austin is currently evaluating the efficiency and effectiveness of distributed green infrastructure like rain gardens relative to conventional structural water quality BMPs. The City is looking for green infrastructure installation or retrofits opportunities including biofiltration as a management measure of this plan.
Designate the Colorado River from Longhorn Dam to Montopolis as a wild and scenic river. • Access to river in designated areas only • No dogs and only guided river tours • Have UTA study before and after implementation	No changes were made to the draft I-Plan in response to this comment for the following reasons: • The area is outside the four watersheds comprising the I-Plan. This area of the Colorado River is downstream to (three or all) of the I-Plan watersheds. • Designation of wild and scenic rivers is through federal legislation, and beyond the scope of the I-Plan process.
Clean up Country Club Creek watershed to keep this area pristine.	This creek is outside the watershed comprising the I-Plan, but is being evaluated by the City of Austin as part of the Environmental Integrity Index program to find and remediate water quality pollution sources.

Appendix C. Implementation Timeline

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
COA PARD & WPD	1.1 Increase riparian zones in COA parks by expanding the Grow Zone initiative	Determine feasibility of expanding passive riparian zone restoration Grow Zone initiatives to all applicable parks in affected watersheds, and develop plan to implement expansion.	Implement in 25% of planned parks in affected watersheds.	Implement in 50% of planned parks in affected watersheds.	Implement in 75% of planned parks in affected watersheds.	Implement in 100% of planned parks in affected watersheds.
APF; KAB	1.2 Prioritize the affected watersheds without current adopters for park and creek adoption recruitment	Reach out to all users of parks within the affected watersheds that are currently without adopters.	Recruit and commit 33% of un-adopted parks within the affected watersheds to either or both programs.	Recruit and commit 66% of un-adopted parks within the affected watersheds to either or both programs.	Recruit and commit 100% of un-adopted parks within the affected watersheds to either or both programs.	Evaluate and renew groups that are eligible.
APF; KAB	1.3 Supporting the expansion of our Grow Zones to all the applicable parks in the affected watersheds, currently without Grow Zones	Reach 33% of un-adopted parks within the affected watersheds to either or both programs.	Reach 66% of un-adopted parks within the affected watersheds to either or both programs.	Reach 100% of un-adopted parks within the affected watersheds to either or both programs.	Ongoing efforts to encourage expansion.	
COA WPD	1.4 Increase protected riparian buffer zone width for new development	Document number of linear miles of protected/restored riparian buffer added per year.		Provide final report on success/progress of legislation.		
Travis County TNR & EQP	1.5 Increase waterway setbacks in Walnut Creek	-Implement 2012 Travis County Code setbacks -Propose and adopt revisions in Title 30 TAC to apply to Austin ETJ subdivisions following adoption of COA Watershed Protection Ordinance		Implement 2012 Travis County Code setbacks and 2014 Title 30 TAC setbacks on all new development proposals subject to the setback requirements (Note: unless restricted by state law under TLGC Chapter 245).		

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
COA, AWU	2.1 Onsite sewage facilities cut over to sanitary sewer	As full purpose annexation occurs Or When an OSSF fails or does not meet COA capacity requirements and COA wastewater collection mains are located within 100 ft. of the property				
Travis County TNR & OSSF Program	2.2 Incentivize onsite sewerage facility repair and improvements	-Recommend Commissioner Court adopt permit fee waiver for proactive repairs to systems. -Prepare up-to-date mailing list for each property with an OSSF in unincorporated areas of Walnut Creek watershed. -Update Travis County website to describe COA cutover and County fee waiver incentives for proactive repairs.	-Continue fee waiver program. -Keep website information on COA and County incentives up-to-date. -Mail out information on COA and County incentives to all addressees in unincorporated areas of Walnut Creek watershed.	-Continue fee waiver program. -Keep website information on COA and County incentives up-to-date.		
AWU	2.3 Wastewater infrastructure and inspection and repair	Inspect COA-owned wastewater infrastructure in affected watersheds and make repairs when failures are encountered.				
UTA-UEM & UTA-EHS	2.4 Inspect wastewater infrastructure in the Waller Creek watershed (main campus) and make repairs as problems are encountered	Inspect UTA-owned wastewater infrastructure on Main Campus (Waller Creek Watershed) and make repairs when failures are encountered. Current cycle for inspections and cleaning is once every 5 years.				
AWU	2.5 Sanitary sewer overflow response	AWU to investigate and remediate SSOs in affected watersheds as they are discovered. AWU to notify WPD for all known SSOs. WPD to assess environmental impacts of SSOs and advise AWU on sewage removal if necessary. The COA will remediate if SSO is from privately owned system if private entity cannot or will not remediate. COA through various departments will require repairs of private wastewater infrastructure if failures are clearly documented.				

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
UTA-UEM & UTA-EHS	2.6 Sanitary sewer overflow response	UTA to investigate and remediate SSOs in the Waller Creek Watershed if they are found to be originating from the UTA sanitary system of as a result of activities on the UTA Main Campus. UTA to notify COA WPD for all known SSOs entering Waller Creek. UTA will work with COA WPD to assess the impacts and coordinate contaminant removal if found to be necessary.				
AWU	2.7 Private lateral inspection	The jet cleaning and TV inspection of private laterals will continue. In Year One, the program related to the placement of liens on private property with unresolved private lateral failures will be fully implemented.				
COA WPD; Waller Creek Conservancy	2.8 Design and construct outdoor public toilets in high-use locations in the Waller Creek watershed as a pilot program	COA and Waller Creek Conservancy will collaboratively develop plan to implement public toilet if feasible.	Conduct feasibility analysis and preliminary engineering review to identify potential alternatives for public toilets, locations, and operation plans.		Prepare design of identified solution.	Pursue contributions necessary to fund construction and maintenance.
COA PARD & COA WPD	3.1 Dog waste education and enforcement in parks	Develop updated and customized "Scoop the Poop" signage and implement in 10% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 25% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 50% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 75% of parks in affected watersheds.	Develop updated and customized "Scoop the Poop" signage and implement in 100% of parks in affected watersheds.
		Perform on-site inspection by park rangers in parks.				
		Conduct citywide "Scoop the Poop" public outreach campaign.				
COA PARD & COA WPD	3.2 Pet waste bag dispensers in COA parks	Inventory Mutt Mitt dispensers and associated trash cans in COA parks in affected watersheds.	Install and maintain Mutt Mitt dispensers and associated trash cans in 25% of parks.	Install and maintain Mutt Mitt dispensers and associated trash cans in 50% of parks.	Install and maintain Mutt Mitt dispensers and associated trash cans in 75% of parks.	Install and maintain Mutt Mitt dispensers and associated trash cans in 100% of parks.
COA PARD & COA WPD; Dog off-leash area adopter; Friends of Austin Dog Parks	3.3 Walnut Creek off-leash area kiosks	Install and maintain educational kiosks in dog off-leash areas of public parks in the affected watersheds with information regarding park rules including proper collection and disposal of dog waste.				

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
Sierra Club; Chamber of Commerce; unidentified pet organization allies	3.4 Waste collection in commercial and non-profit pet facilities	Identify pet organization allies. Identify pet businesses. Contact each business by phone. Set up and complete a meeting to educate and distribute brochures.	Identify pet businesses. Contact each business by phone. Set up and complete a meeting to educate and distribute brochures.			
ANC	4.1 ANC meetings educational outreach	ANC will invite COA WPD staff to brief each sector (or group of sectors), and one citywide general meeting once per year on COA environmental programs and ways citizens may help to reduce fecal contamination.				
COA Environmental Board	4.2 City staff presentations to Austin Environmental Board	Environmental Board will request annual briefing on each of the identified topics, and provide supporting letters, resolutions, and public education as appropriate.				
COA WPD	4.3 Homeless Survival Guide Outreach	Develop public education materials.	Distribute educational materials through area homeless advocate organizations.			
COA WPD	4.4 Earth Camp, Earth School, and Clean Creek Campus outreach	Add fecal bacteria curriculum to Earth Camp Program. Find partners willing to financially sponsor expansion of existing Earth Camp education efforts to increase direct outreach to Austin school children				
APF; KAB	4.5 Riparian and scoop education in volunteer workdays and annual meetings	Reach 33% of un-adopted parks within the affected watersheds to either or both programs.	Reach 66% of un-adopted parks within the affected watersheds to either or both programs.	Reach 100% of un-adopted parks within the affected watersheds to either or both programs.	Continue efforts to encourage expansion.	
Shoal Creek Conservancy (Monnie Anderson); other unidentified organizations	4.6 Community communication plan	-Identify organizations such as neighborhood associations, service organizations, environmental and conservancy groups, churches, pet service and other businesses, etc. -Collect their contact information into a database that can be used with a mailing application.	Distribute COA education material and notifications to identified organizations using the created communication tool.			

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
PODER	4.7 PODER educational outreach efforts	-Request annual briefings by COA WPD staff on COA environmental programs, and ways citizens may help reduce fecal contamination. -Distribute updates at the HABLA and La Raza Roundtable meetings annually. -Provide links on PODER website regarding the Austin bacteria TMDL I-Plan and other available resources.				
COA PARD & COA WPD	5.1 Retrofit existing or install new stormwater BMPs on city lands.	Assess opportunity and prioritize water quality structural control installations or retrofits on public lands in affected watersheds.	Complete preliminary engineering review of prioritized water quality structural control installation/retrofit(s).	Complete design of selected water quality structural control installation/retrofit(s).	Begin construction of selected water quality control.	Complete construction of selected water quality control.
COA WPD	5.2 Inspect existing City-owned and commercial water quality controls in affected watersheds.	Inspect existing city-owned and commercial water quality structural controls and repair problems as feasible.				
Travis County TNR & EQP; Travis County Attorney; COA	5.3 Inspect and ensure proper operation of privately owned permanent water quality treatment and flood detention structures	-Identify owners of record of 22 known pond facilities. -Coordinate with COA and MUDs to finalize Travis County inspection list. -Obtain any specialized maintenance plans and facility records that are available	-Inspect 50% of pond facilities. -Notify facility owners of violations (NOVs).	-Identify the pond facilities considered compliant. - Conduct verification inspections to assess compliance with NOVs. -Refer non-compliant pond facilities to COA. Alternatively, escalate non-compliance to civil enforcement if pond facility non-compliances are not eliminated using informal/NOV tools.	-Inspect remaining 50% of pond facilities. -Notify facility owners of violations. -Complete civil suits on pond facilities.	-Identify the pond facilities considered compliant. -Conduct verification inspections to assess compliance with NOVs. -Refer non-compliant pond facilities to COA. -Escalate non-compliance to civil enforcement if illicit discharges not eliminated using informal/NOV tools.
COA WPD	5.4 Dry weather storm drain outfall screening	Screen all 36” stormwater outfalls in affected watersheds at least once during the five-year period during dry weather conditions				

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
UTA-EHS, UTA-UEM, UTA-PMCS; UT System OFPC	5.5 Dry weather screening of storm drain outfalls	20% of Outfalls screened	40% of outfalls screened	60% of outfalls screened	80% of outfalls screened	Entire MS4 completely screened
Travis County TNR & EQP; COA CIP	5.6 New roadway bacteria reduction BMPs	-Complete design of Arterial A anticipated to be a 1422 ft. multi-lane roadway with 12 of 37 storm drain inlets using the chosen technology. -Conduct environmental review of design for adequacy.	Identify funding for right-of-way acquisition and construction.	Obtain funding for right-of-way acquisition and construction.	Initiate right-of-way acquisition.	-Complete right-of-way acquisition and initiate construction contract process. -Establish construction time line. Year 6: Initiate construction of Arterial A including the permanent water quality controls.
UTA-EHS & Facilities Services	5.7 Street sweeping	Continue to sweep UTA-owned streets on a semiannual basis and as needed				
UTA-EHS, UTA-PMCS, Housing & Food, UTA-UEM, UT System OFPC	5.8 Construction site inspection and monitoring.	Continue to inspect, monitor, and enforce storm water compliance on all UTA construction site projects to minimize storm water runoff, pollution, and sanitary waste from entering UTA's MS4.				

Organization	Management Measure	Year 1	Year 2	Year 3	Year 4	Year 5
Travis County TNR & EQP; Travis County Attorney	5.9 Detection of illicit commercial/industrial discharges and construction site sanitary waste management	-Develop dataset identifying commercial and industrial facilities. -Update existing construction site checklists to incorporate inspection of sanitary waste practices.	-Inspect the commercial and industrial facilities. -Inspect construction sites pursuant to Travis County SWMP. -Notify facility owners of violations.	-Continue to inspect construction sites pursuant to Travis County SWMP; address non-compliance. -Identify the commercial and industrial facilities considered compliant. -Conduct verification inspections to assess compliance with NOVs. -Escalate non-compliance to civil enforcement if illicit discharges not eliminated using informal/NOV tools.	-Complete civil suits on commercial and industrial facilities. -Continue to inspect construction sites pursuant to Travis County SWMP; address non-compliance.	-Re-inspect commercial and industrial facilities identified in Year 2 as non-compliant. -Re-inspect a subset of commercial and industrial facilities determined in Year 2 as compliant. -Continue to inspect construction sites pursuant to Travis County SWMP; address non-compliance.

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