Fountain Creek Watershed

EPA Nine-Element
Watershed Plan
for the Management of
Escherichia coli

Prepared for

Section 319 Nonpoint Source Pollution Control Program,
Water Quality Control Division
Colorado Department of Public Health and Environment

Prepared by

Arkansas-Fountain Coalition for Urban Rivers Evaluation
with support from Brown and Caldwell
through the Pikes Peak Regional Water Authority

Presentation Prepared by

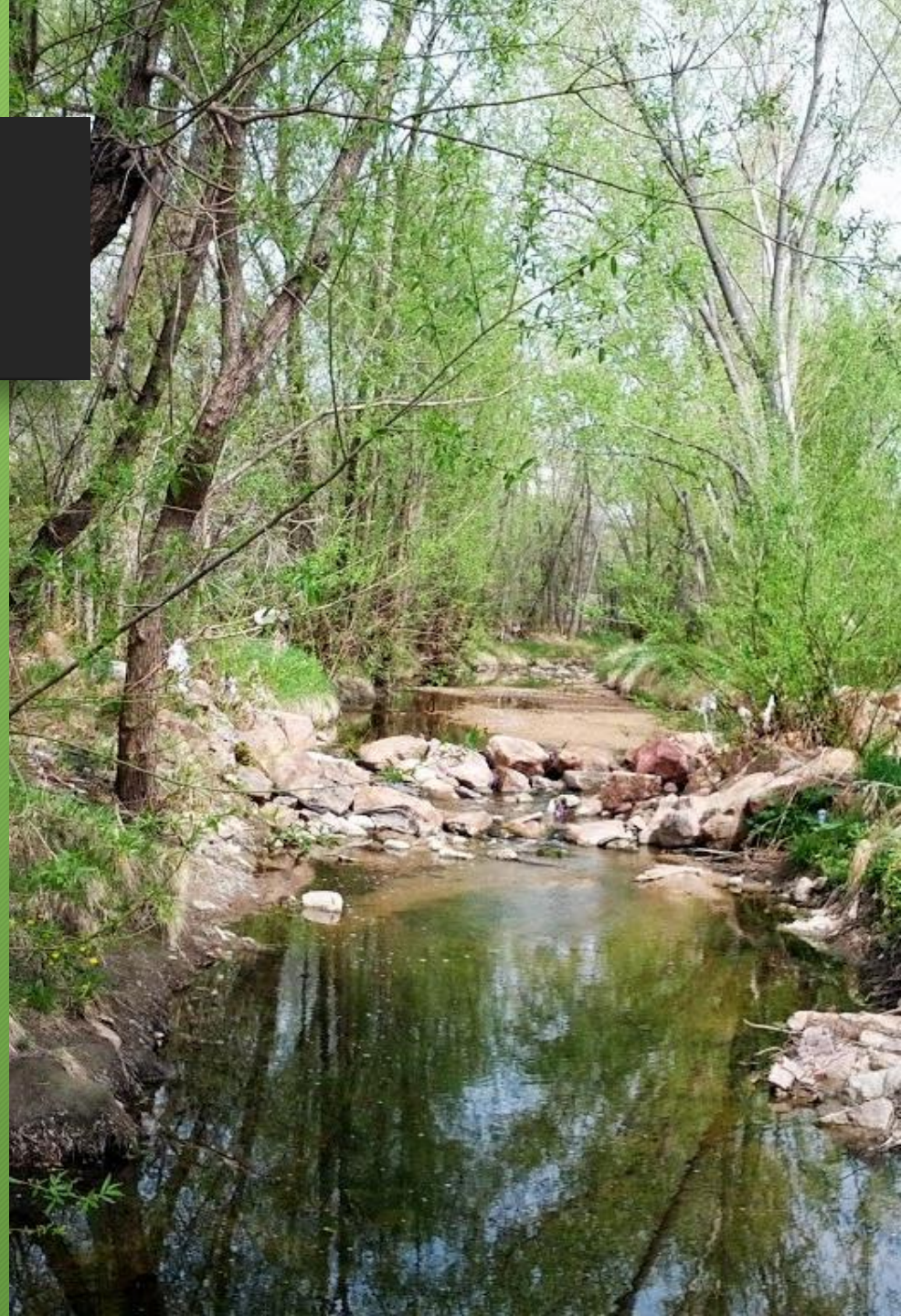
Watershed Planning

Colorado Springs Utilities

May 2019

Presentation Overview

- Stakeholders
- Watershed Information in General and Fountain Creek
- Regulatory Framework
- Watershed Plan Purpose and Intended Results
- EPA Nine-Element Plan
- Pollution Sources – Regulated Point and Unregulated Nonpoint Sources
- Data Analysis and Methodology
- Data Findings
- Strategies for Improvement
- Best Management Practices and Monitoring Plans
- Measuring Progress
- Next Steps



Stakeholder Process

Arkansas and Fountain Coalition for Urban River Evaluation

- Who is AF CURE?
  - Ten independent permitted wastewater entities located in El Paso and Pueblo counties
  - Convened in 2012 to promote and coordinate regional efforts regarding changing water quality regulations – especially nutrients
- AF CURE members identified and engaged key regional stakeholders that have critical roles in achieving watershed-wide water quality management goals

This Plan will serve as an important communication tool for increasing collaboration of partners through its presentation of technical material, planning processes and recommended best management practices for water quality managers in the region.

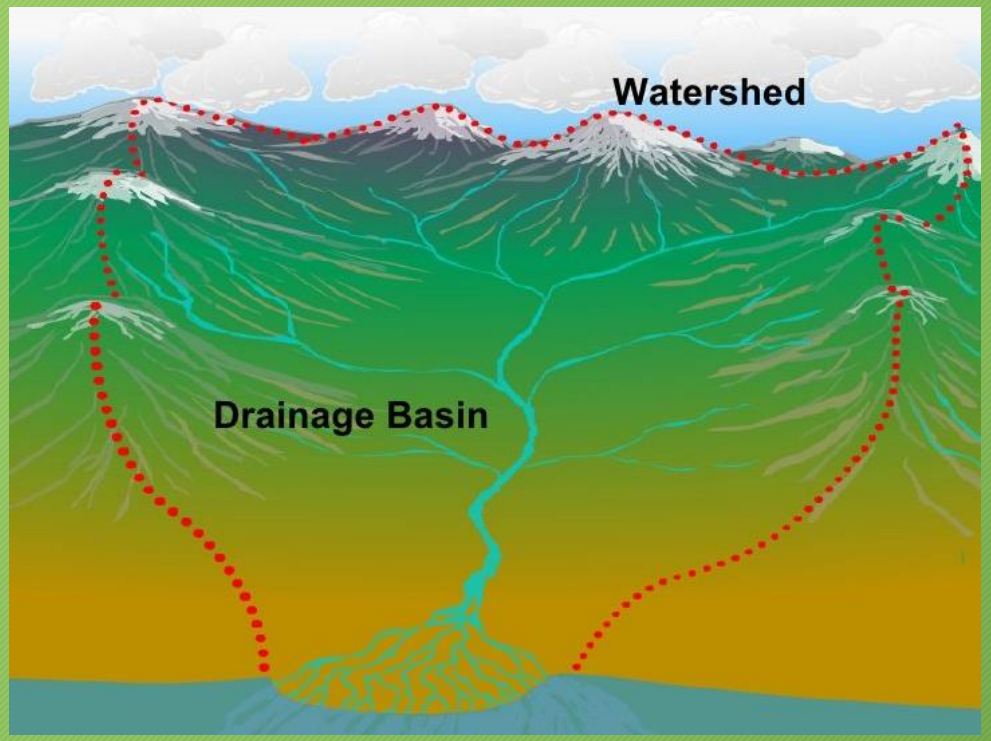
Stakeholders

A committee formed out of AF CURE to develop the Plan in a collaborative manner, with those entities having jurisdictional oversight within the Fountain Creek Watershed.

- Brown and Caldwell
- Cherokee Metropolitan District
- Colorado Department of Transportation, (CDOT) Region 2
- City of Colorado Springs
- City of Fountain
- City of Manitou Springs
- City of Pueblo
- Colorado Parks and Wildlife
- Colorado State Extension
- Donala Water and Sanitation District
- El Paso County Public Health Department
- El Paso County
- Fort Carson Director of Public Works (DPW) Planning
- Fort Carson
- Fountain Sanitation District
- Fountain Creek Watershed District
- GMS, Inc.
- Individual Citizens
- Lower Fountain Metropolitan Sewage Disposal District
- Peterson Air Force Base
- Pueblo Community College
- Pueblo County
- Pueblo Department of Public Health and Environment
- Pueblo West Metropolitan District
- School Districts 2, 3, 11, 12, 20, 49
- Security Water and Sanitation Districts
- The Greenway Fund
- Town of Palmer Lake
- Triview Metropolitan District
- United States Air Force Academy (USAFA)
- University of Colorado, Colorado Springs

Watersheds Defined

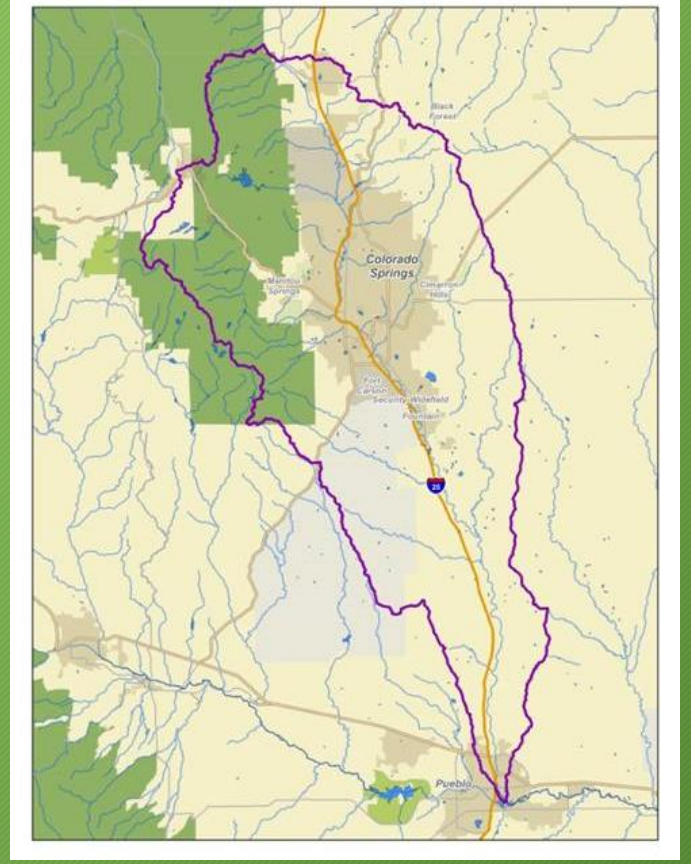
A watershed is the land area that drains to a common water body

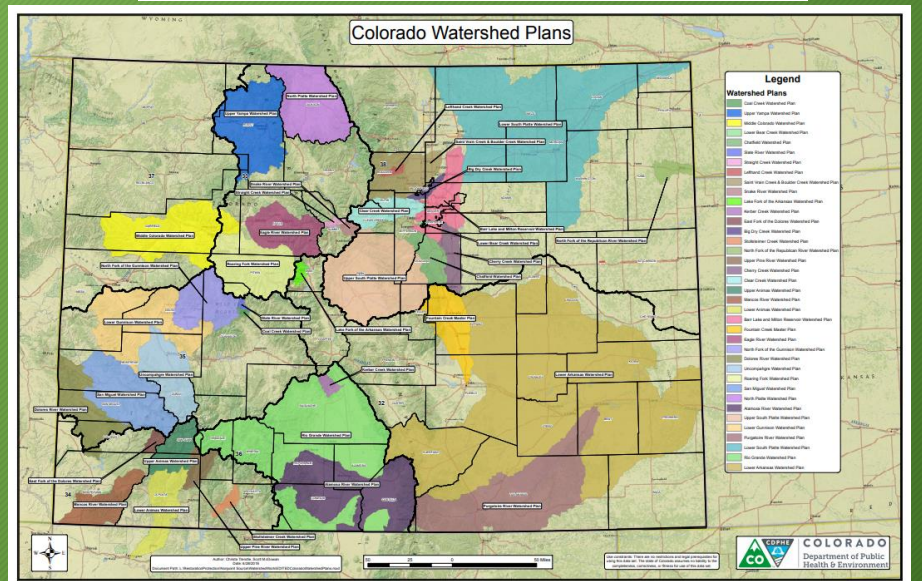


The Fountain Creek Watershed is a part of the Arkansas River Basin, which is part of the Mississippi-Missouri Drainage Basin that drains to the Gulf of Mexico.

Fountain Creek Watershed

- 930 Square Miles
- 15” average annual precipitation
- 2 Major Creeks: Monument Creek and Fountain Creek
  - 50+ waterways, some intermittent & ephemeral
- 13% of the total population of Colorado
- Pikes Peak 14,114 ft to Arkansas River at 4,640 ft
  - 9400+ ft elevation change in 50 miles.
- Primary Concerns: Water Quality, Erosion and Sedimentation, and Flooding
- Fire and Flood
  - Waldo Canyon Fire 2012
  - Black Forest Fire 2013
  - Major Flooding 2013 & 2015





Regulatory Framework -Swimmable Fishable

Regulation 31: The Basic Standards and Methodologies for Surface Water

Identifies stream standards or goals.

E. coli standard of 126 CFU/100mL

- Protect primary contact (i.e. ingestion of small quantities of water likely to occur) during recreational activities.

Regulation 32: Classification and Numeric Standards of the Arkansas River Basin

Implements statewide surface water standards of Regulation 31 for water body segments (streams & lakes) throughout the Arkansas River basin.

Regulation 93: The 303(d) List of Impaired Waters and Monitoring and Evaluation List

Identifies water bodies that exceed water quality standards (303(d)) and those that may be impaired but require additional data (M&E List).

Regulatory Framework

Fountain Creek Water Quality Impairments

- Arsenic (total)
- E. coli
- Manganese (dissolved)
- Zinc (dissolved)
- Iron (dissolved and total)
- Temperature
- Macroinvertebrates (provisional)
- Selenium (dissolved)

Table 2-3: *E. coli* Impaired Segments within Fountain Creek Watershed

Segment	Description/Listed Portion	Category/ Impairment Status	Classifications	Designation
COARFO01a	Mainstem of Fountain Creek from source to above Monument Creek	303(d) / *E. coli*, Manganese (Mn, dissolved), Arsenic (As, total)	Agriculture Aq Life Cold 1 Recreation E Water Supply	Reviewable
COARFO01b	Severy Creek and all tributaries from the source to a point just upstream of where US Forest Service Road 330 crosses the stream.	303(d) / Zinc (dissolved)	Agriculture Aq Life Cold 1 Recreation E Water Supply	Outstanding Waters
COARFO02a	Mainstem of Fountain Creek from a point immediately above the confluence with Monument Creek to a point immediately above the State Highway 47 Bridge	303(d) / *E. coli*	Agriculture Aq Life Warm 2 Recreation E Water Supply	Reviewable
COARFO02b	Mainstem of Fountain Creek from a point immediately above the State Highway 47 Bridge to the confluence with the Arkansas River	303(d) / *E. coli* (May-October), Iron (dissolved and total), Temperature	Agriculture Aq Life Warm 2 Recreation E Water Supply	Reviewable

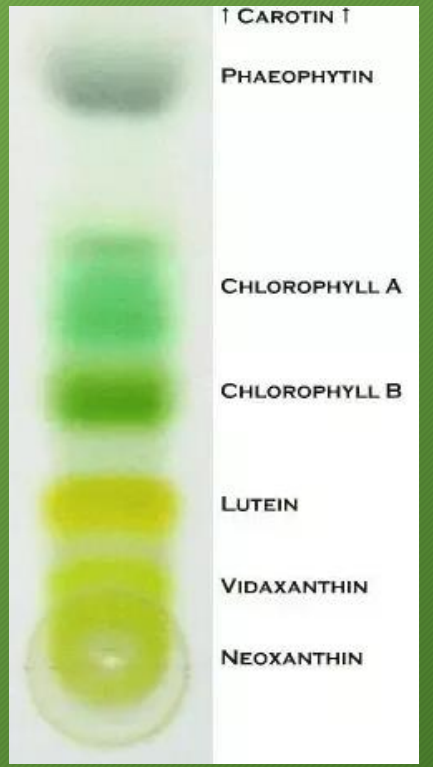
Regulatory Framework

Other Water Quality Concerns

- Nutrients
  - Phosphorus, Inorganic Nitrogen and Chlorophyll *a*
- Metals
  - Copper, Iron, Manganese, and Selenium
- Temperature
  - Data is limited, but it indicates that impairments may exist.

E. coli

- No Total Maximum Daily Load (TMDL)
  - significant amount of water quality monitoring going back to the early 1920's.
- This Plan is a proactive effort in advance of a TMDL



Fountain Creek Watershed Plan Purpose

- Provides a reference and guide for the following:
  - Available data
  - Stream standards
  - Impairments
  - Point and nonpoint sources
- Provides implementation strategies to reduce pollutant loading
- Identifies data gaps and the need for additional monitoring

1. Provide an appropriate planning framework around addressing *E. coli* sources

2. Identify possible sources of *E. coli* as well as locations that need further investigation

3. Identify projects and activities which may be implemented to improve in-stream *E. coli* levels

4. Prioritize projects and expansion or implementation of programs and best management practices targeted at the reduction of *E. coli* within the watershed

The results of the Plan are designed to provide a solid foundation for future development of stakeholder-approved pollutant management strategies.

Fountain Creek Watershed Plan

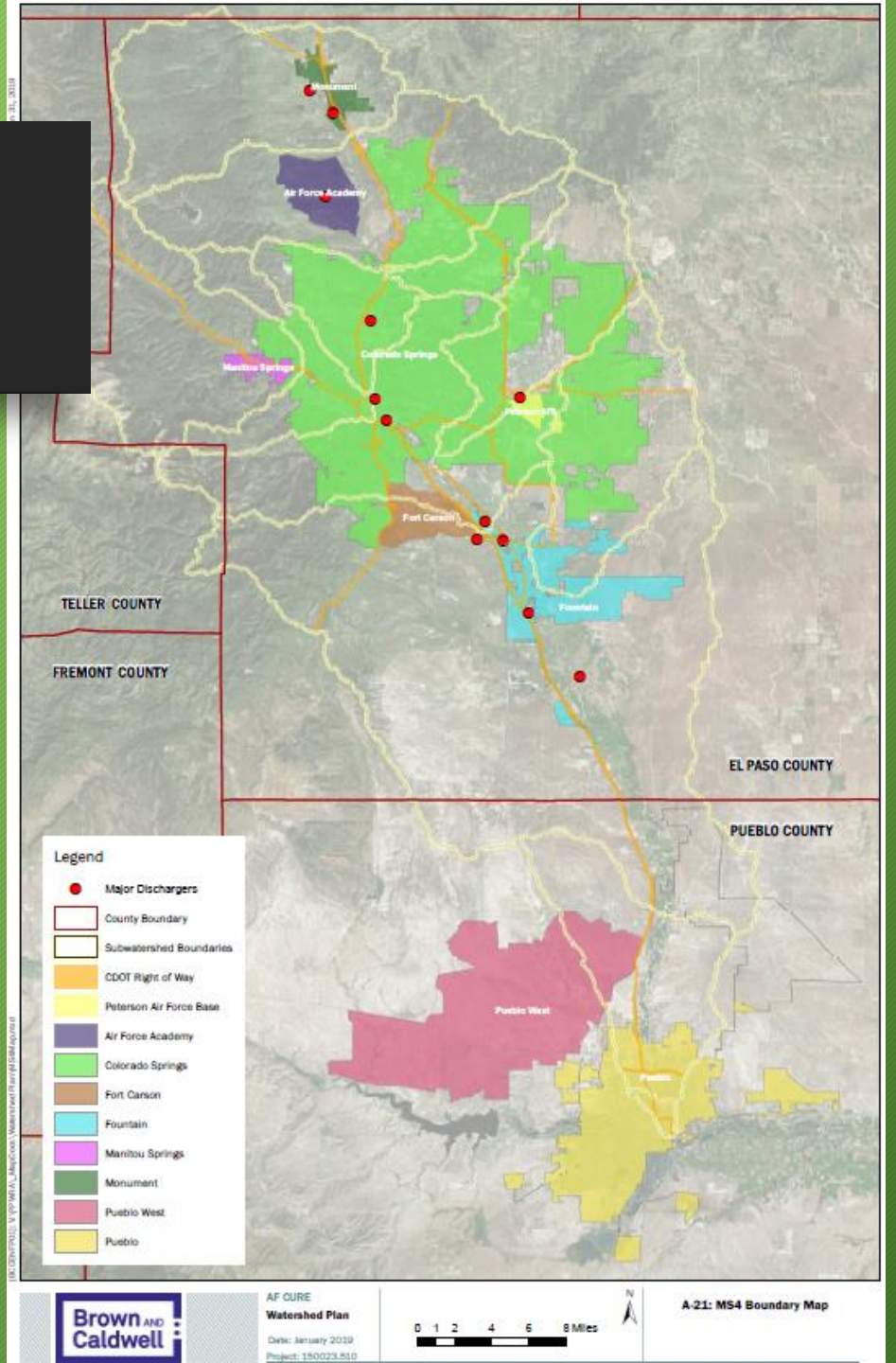
Water Quality Purpose

Fountain Creek Watershed Plan Purpose - A Watershed Approach

EPA Watershed Plan Nine Required Elements	Section in the Fountain Creek Watershed Plan
1) Identify causes and sources of pollution	2.5, 3, 4.2, 4.3, 5.1
2) Estimate pollutant loading into the watershed and the expected load reductions	5.3
3) Describe management measures that will achieve load reductions and targeted critical areas	6.1, 6.3
4) Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan	Appendix C
5) Develop an information/education component	Appendix C
6) Develop a project schedule	6.3, Appendix C
7) Describe the interim, measurable milestones	6.3, Appendix C
8) Identify indicators to measure progress	6.3, Appendix C
9) Develop a monitoring component	7

Pollution Sources - Regulated Point Sources

- Ten (10) major domestic wastewater treatment dischargers
- Two (2) Phase I MS4 permit holders –
  - Colorado Springs
  - Department of Transportation
- Ten (10) Phase II MS4 permit holders
- Numerous Non-Standard MS4 permitholders
  - School Districts and Colleges



Pollution Sources
-Unregulated Nonpoint Sources

Human Waste
Homeless camps, leaking On-site Wastewater Treatment Systems (septic systems), illicit dumping (RV).

Pet Waste
~350,000 dogs in the Colorado Springs area, averaging ~0.75 pounds of waste daily, producing ~92,400 pounds per year of waste.

Wildlife
Waste from birds, raccoons, deer, geese, and other fauna living on or near water can contaminate waterways with their feces.

Livestock
Waste from pets, farm animals, and manure applications can be sources of *E coli*.

Only waste sources located in areas ***outside*** of MS4 boundaries or
in areas where the waste can directly enter the creek (not through a discrete conveyance) are included.

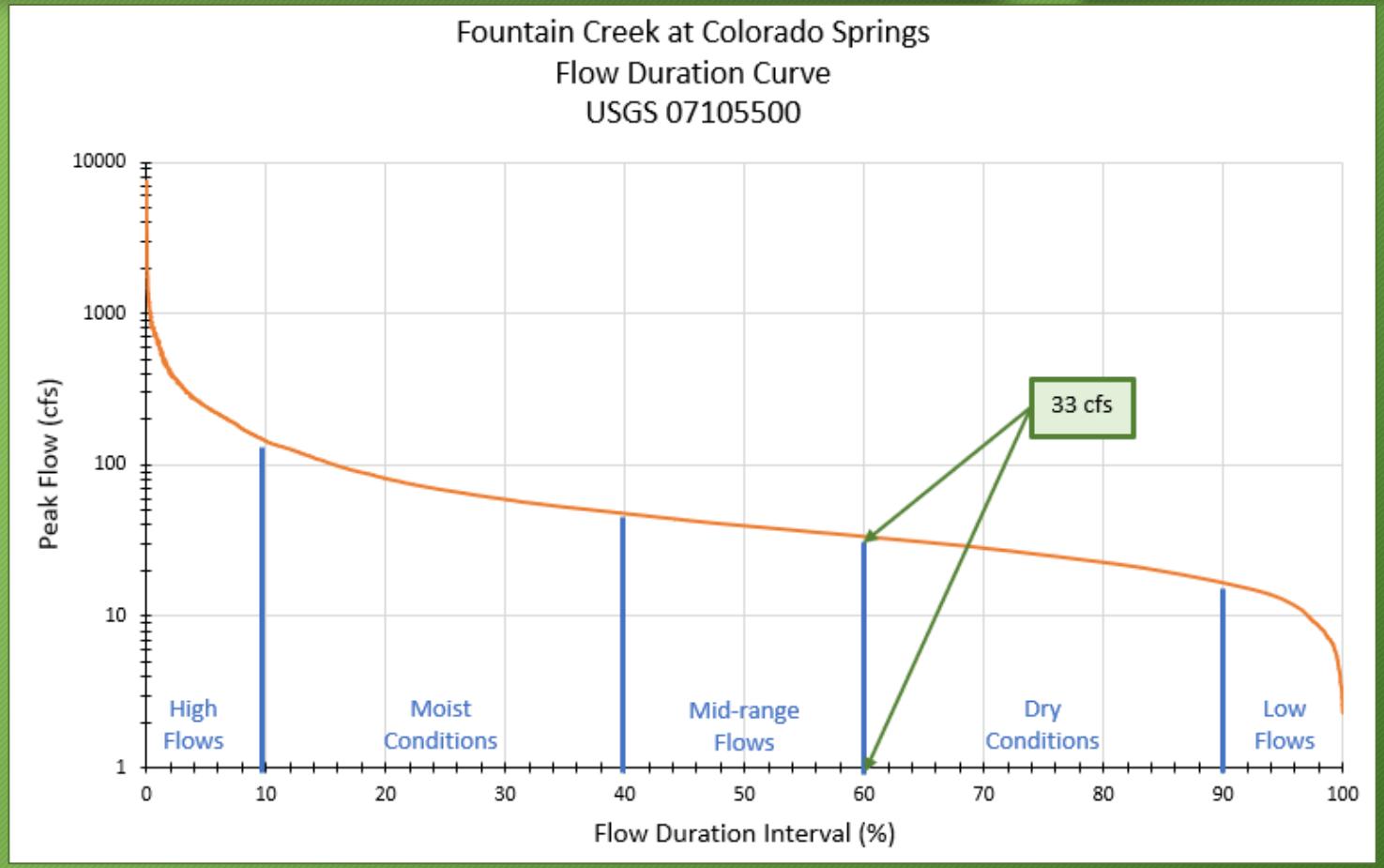
Data Analysis and Methodology

Flow Duration Curves

- Ten years of flow data.
- January 2006 to April 2017
  - provided consistency between gages and determined to be representative

Flow Regimes[1]

a) High Flows occur 0-10% of the time
b) Moist Conditions occur 10-40%
c) Mid-Range Conditions occur 40-60%
d) Dry Conditions occur 60-90%
e) Low Flows occur 90-100% of the time



[1]EPA's Guide "An Approach for Using Load Duration Curves in the Development of TMDLs"

Data Analysis & Methodology

- Existing loads were determined by multiplying the mean daily flow and *E. coli* concentrations from each sampling location
- Allowable loads were determined for each flow regime at each sampling location
  - Median flow for each regime multiplied by the 126 CFU/100 mL standard
- Percent reductions were determined by subtracting the existing load at each location from the allowable load

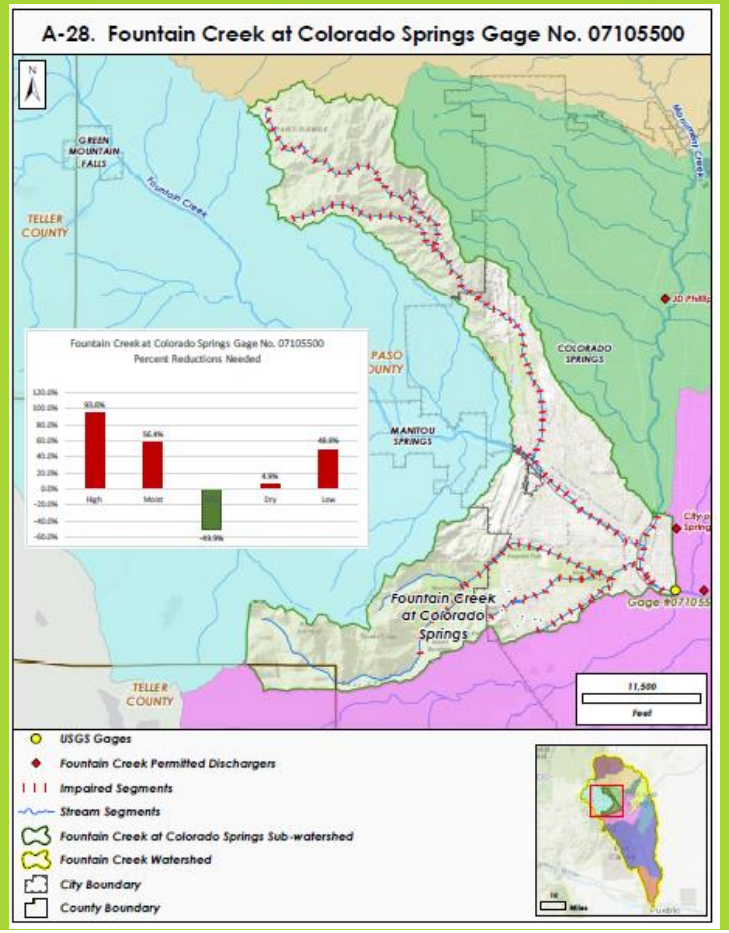


Table 5-8: Load Reduction Results for Fountain Creek at Colorado Springs (Gage 07105500).

Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	267	74.7	48.7	37.2	26
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	83.05E+10	23.23E+10	15.15E+10	11.57E+10	8.087E+10
Existing Load at FC at COS[13]	1301E+10	53.27E+10	10.10E+10	12.16E+10	15.83E+10
Difference	1218E+10	30.03E+10	-5.043E+10	0.5905E+10	7.739E+10
Percent Reduction	93.6%	56.4%	-49.9%	4.9%	48.9%

Summary of Data Findings

- Load reductions during high flow events needed at 11 out of 12 stream sampling locations
- Increases in wet weather loading starts at the Monument Creek at North Gate location through the urban corridor
- Loading largely attenuates through the rural reach of the Fountain Creek Corridor
- Loads slightly increase from the Fountain Creek at Pueblo location to the confluence with the Arkansas River
- Upper Fountain Creek impaired during all flow regimes

Summary of Data Findings

- Most exceedances occur during the recreation season of May-October
- Wastewater treatment facilities must meet permit limits and report permit violations
  - No wastewater effluent reported as exceeding stream standard
  - At multiple locations effluent contributes flow with very low *E. coli* levels, diluting overall concentrations
- A 2007-2008 USGS *E. coli* DNA study suggests high *E. coli* concentrations in Upper Fountain Creek during warm months is likely attributable to birds not humans or ruminants[2]

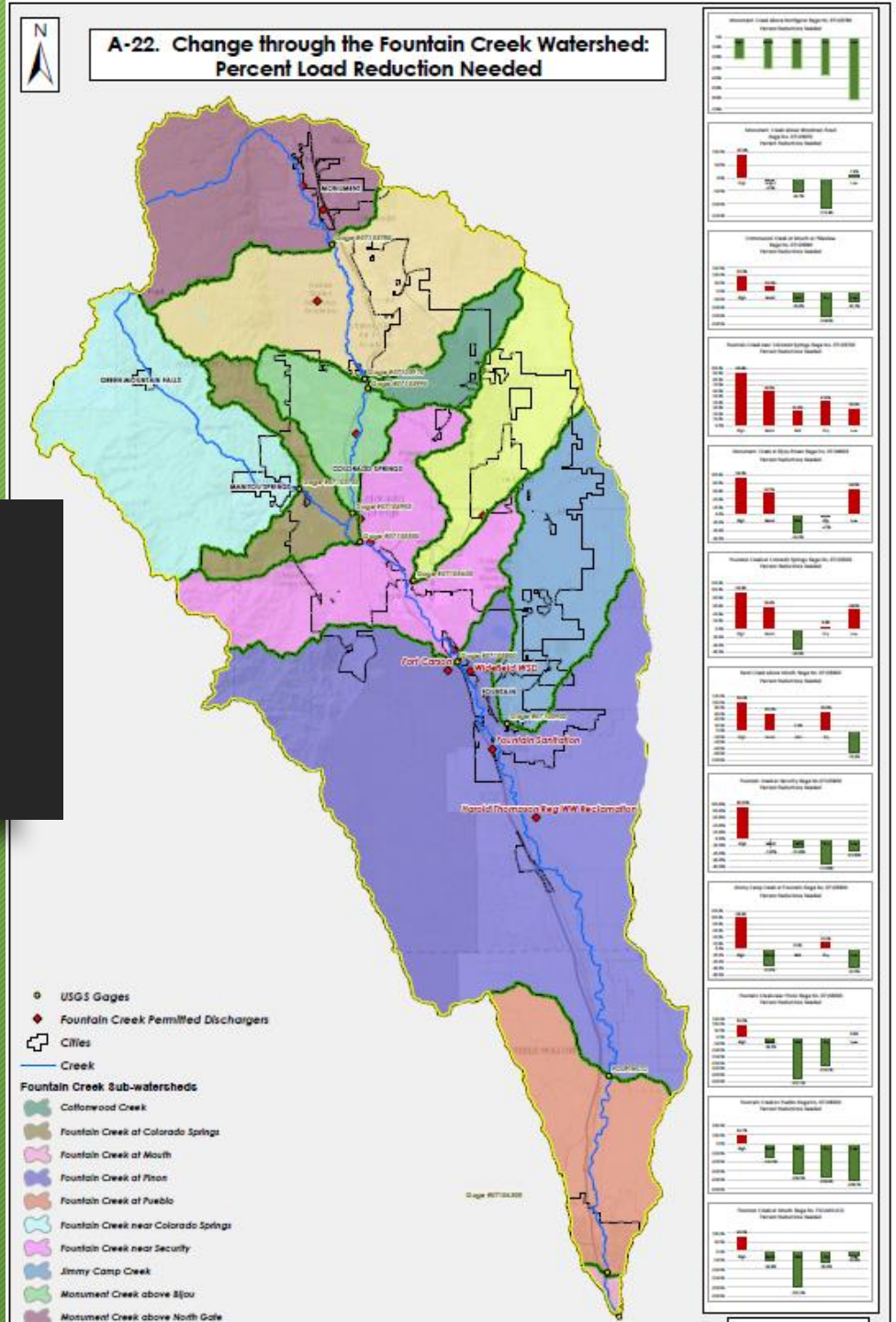
https://www.5280.com/2014/04/the-one-that-almost-got-away/ Illustration By James Prosek

[2] https://pubs.usgs.gov/fs/2011/3095/fs2011-3095.pdf

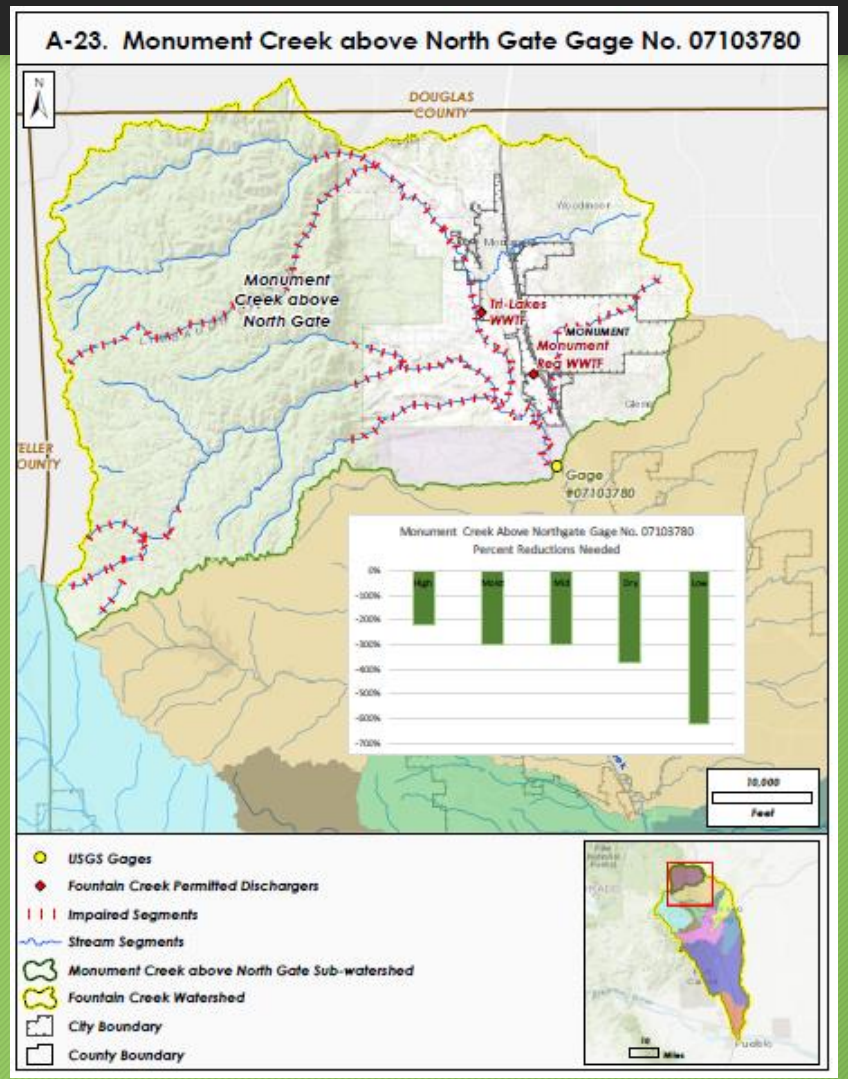
Data Findings

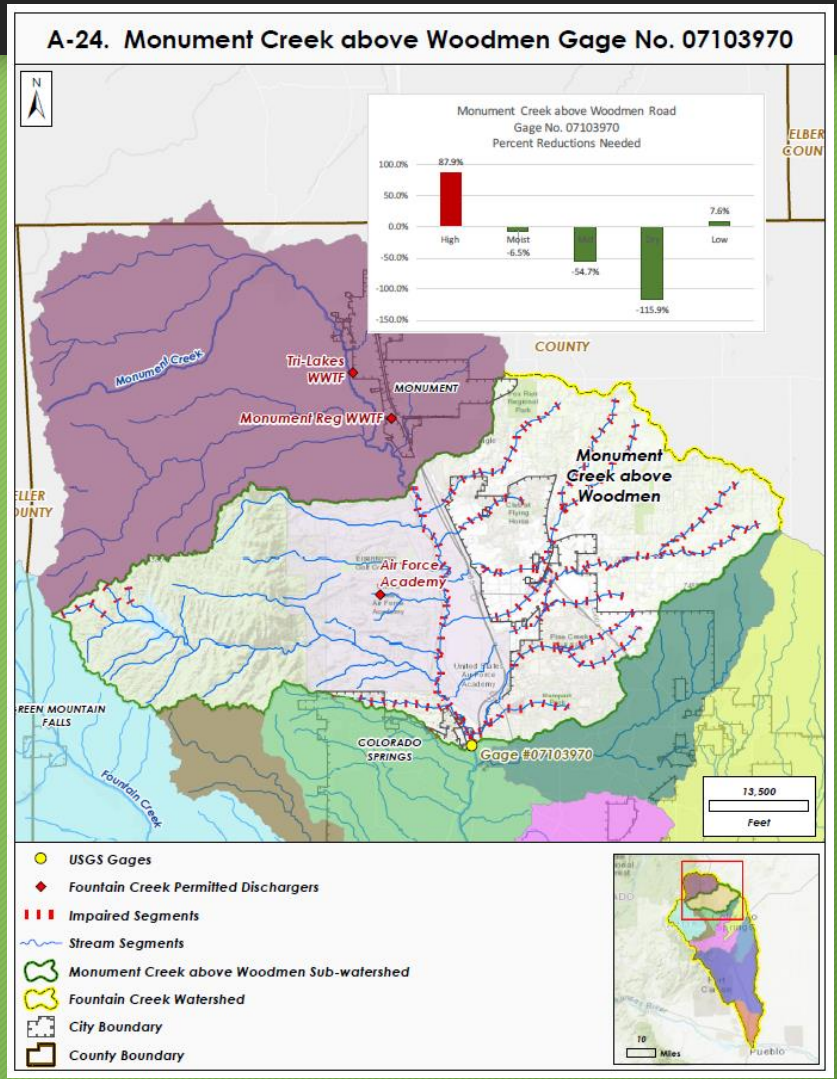
Maps A-22 through A-34 show percent load reductions needed at each sampling location throughout the watershed

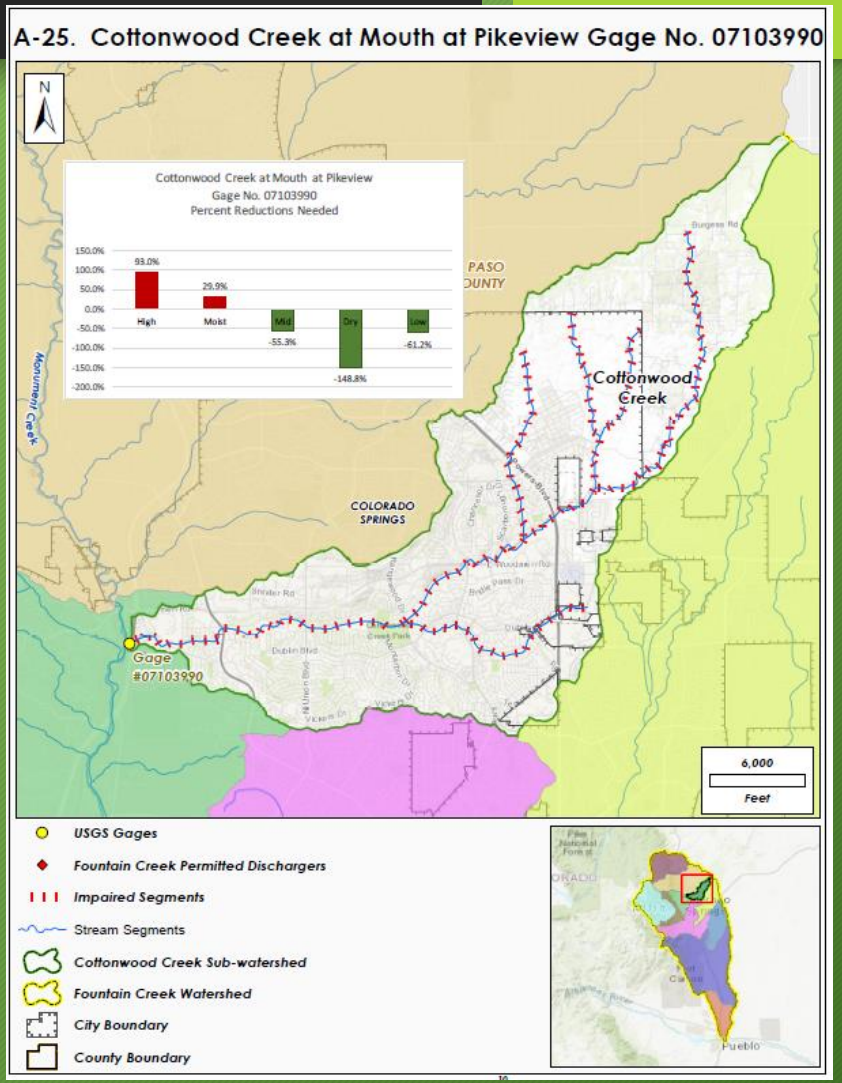
The *E. coli* impairment changes in different parts of Fountain Creek suggesting different contributing sources



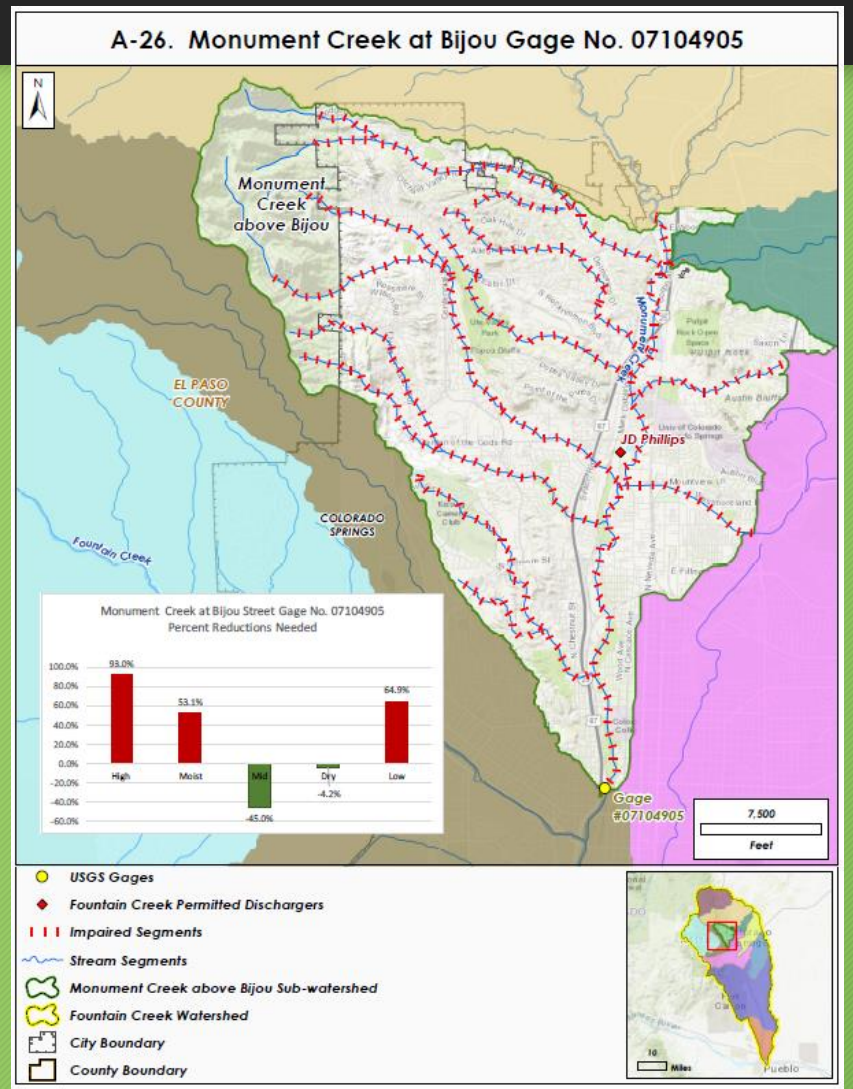
Data Findings – Upper Watershed

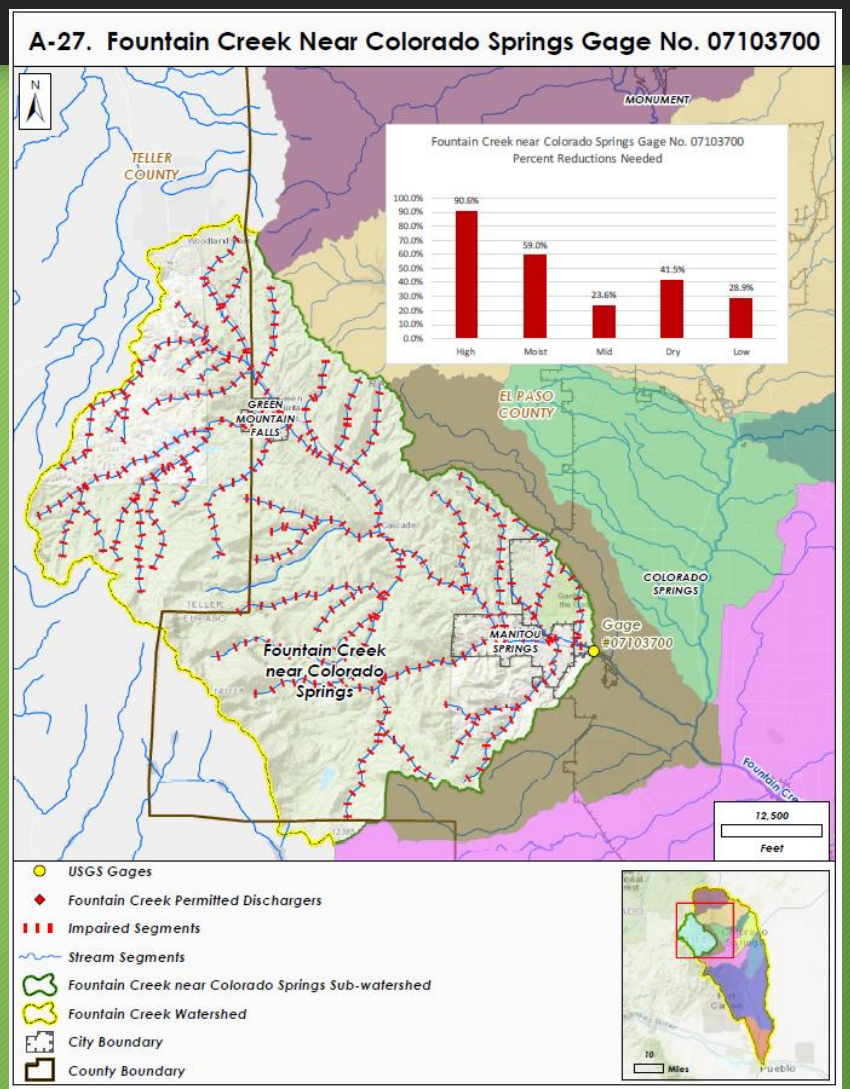


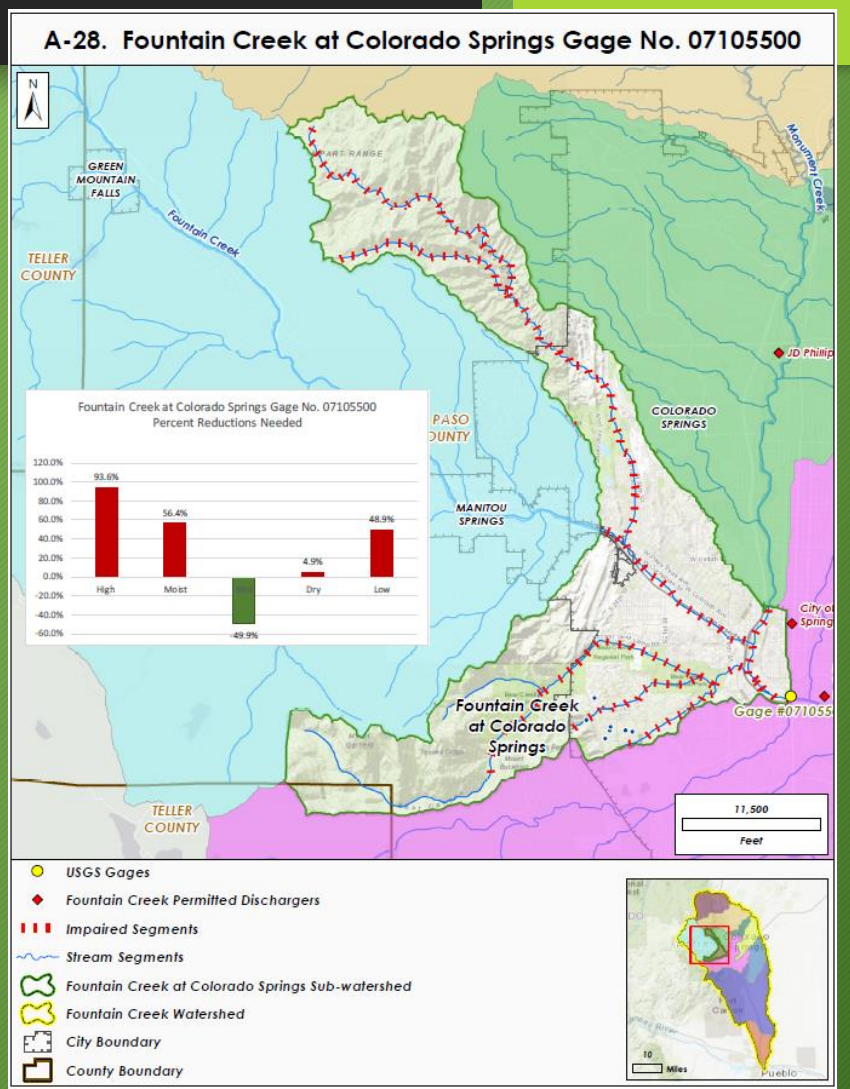




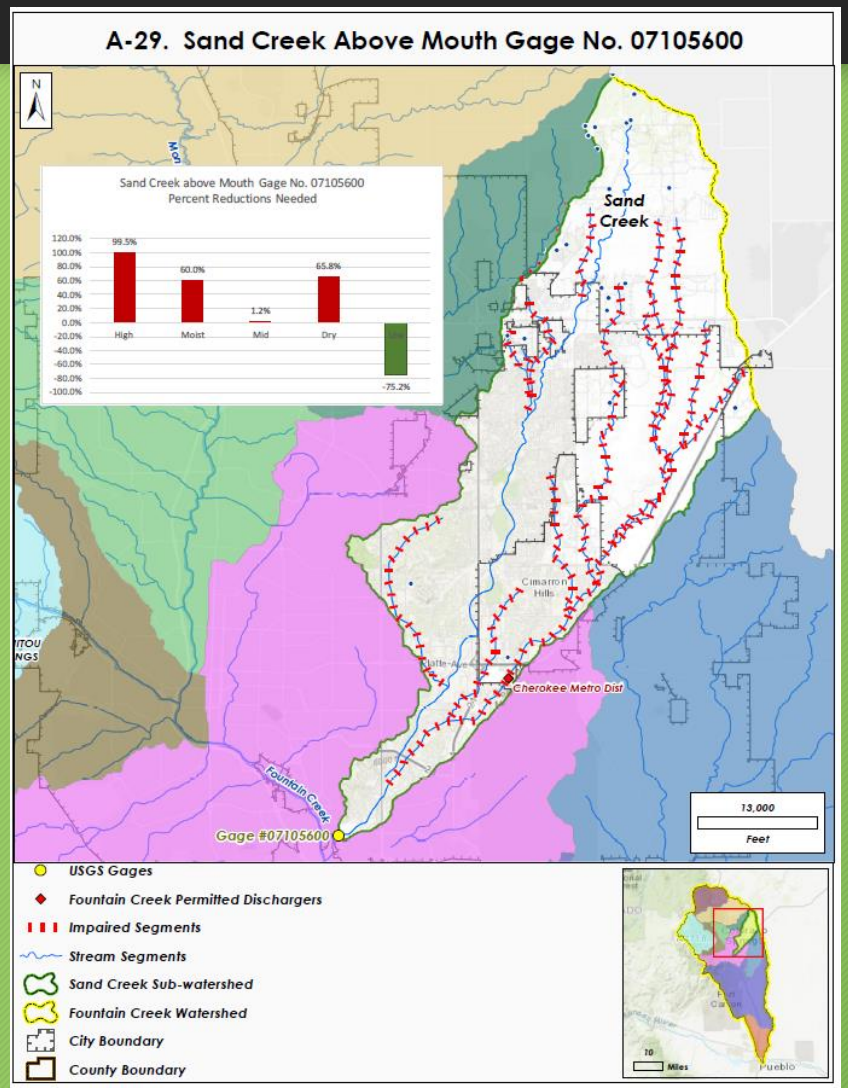
Data Findings – Middle Watershed

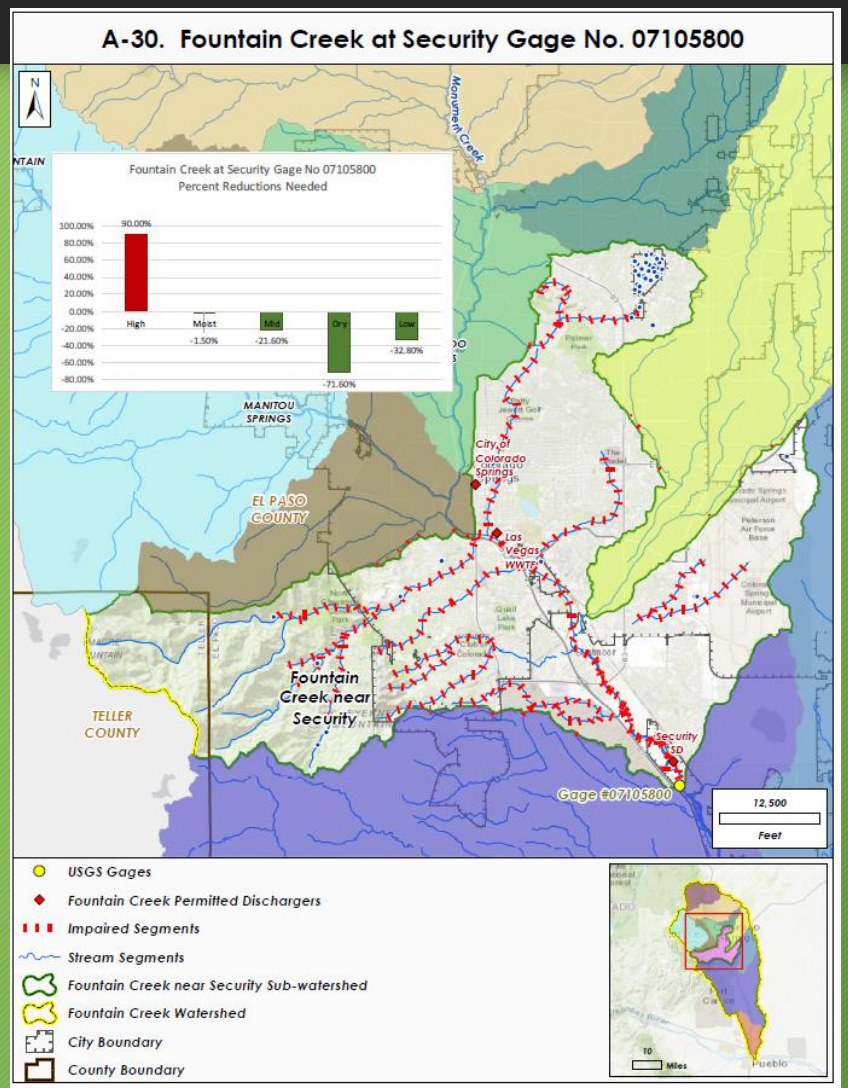


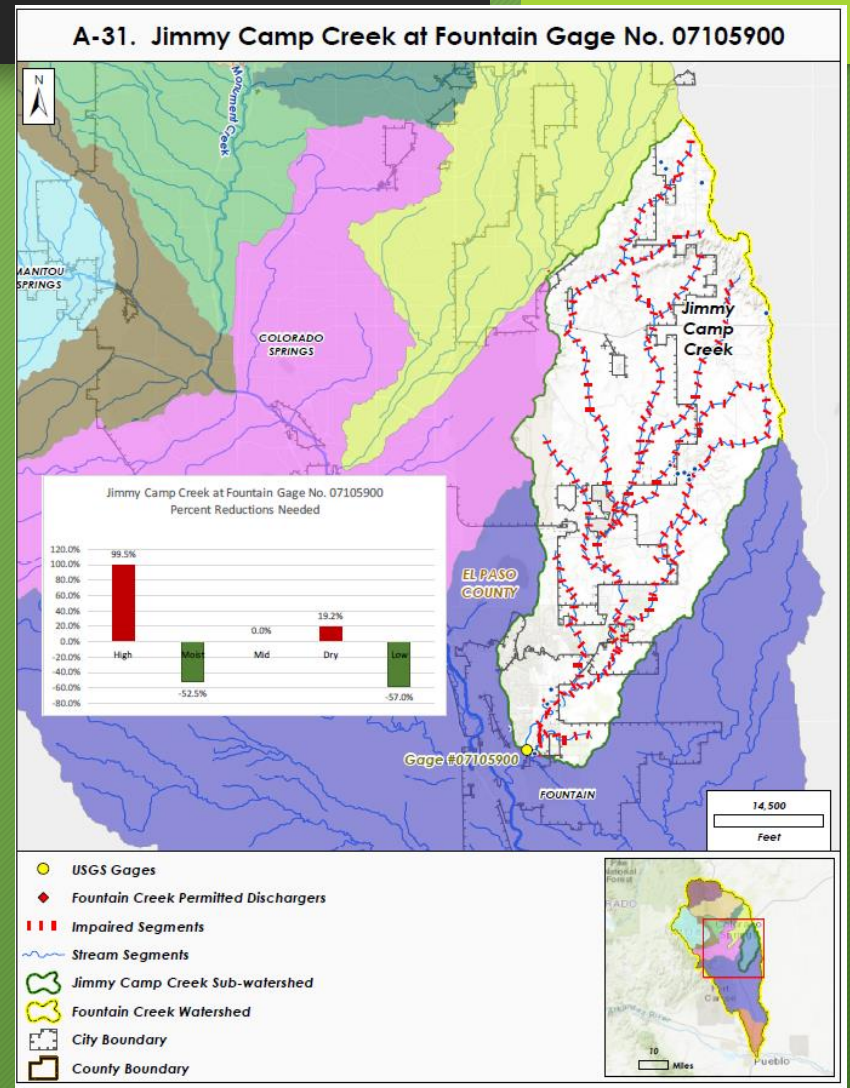




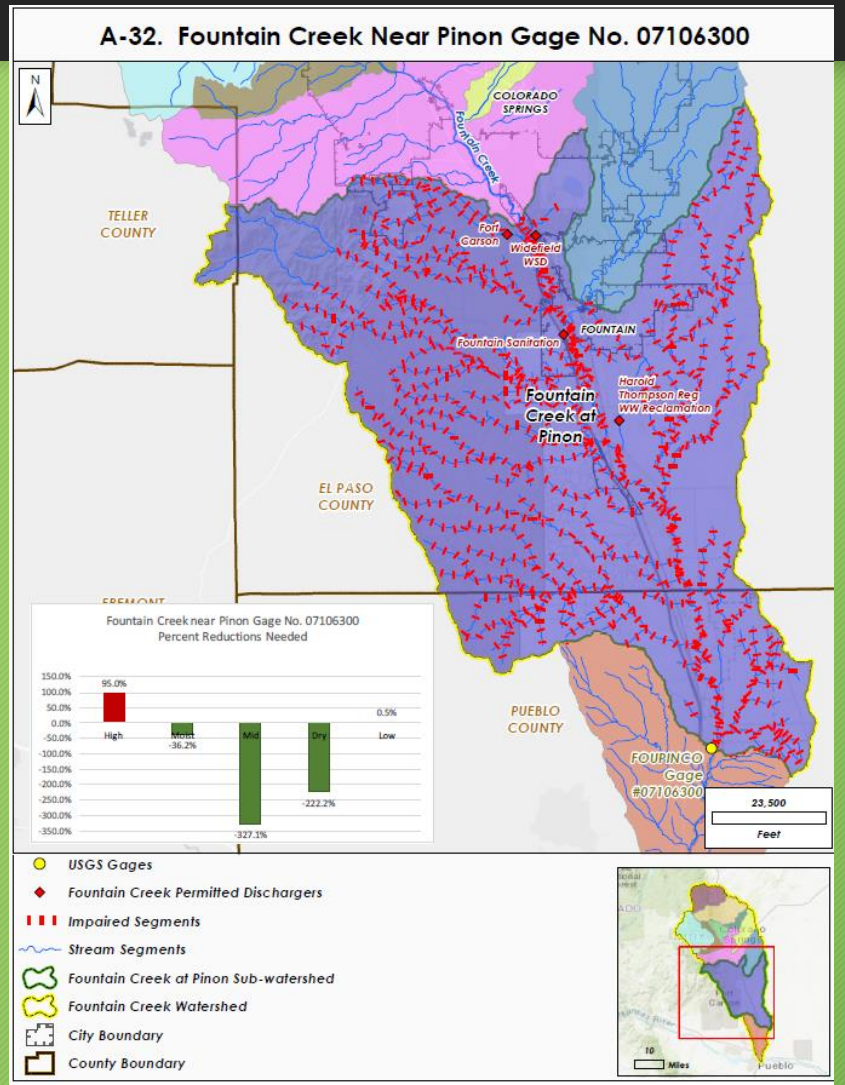
Data Findings – Middle Watershed

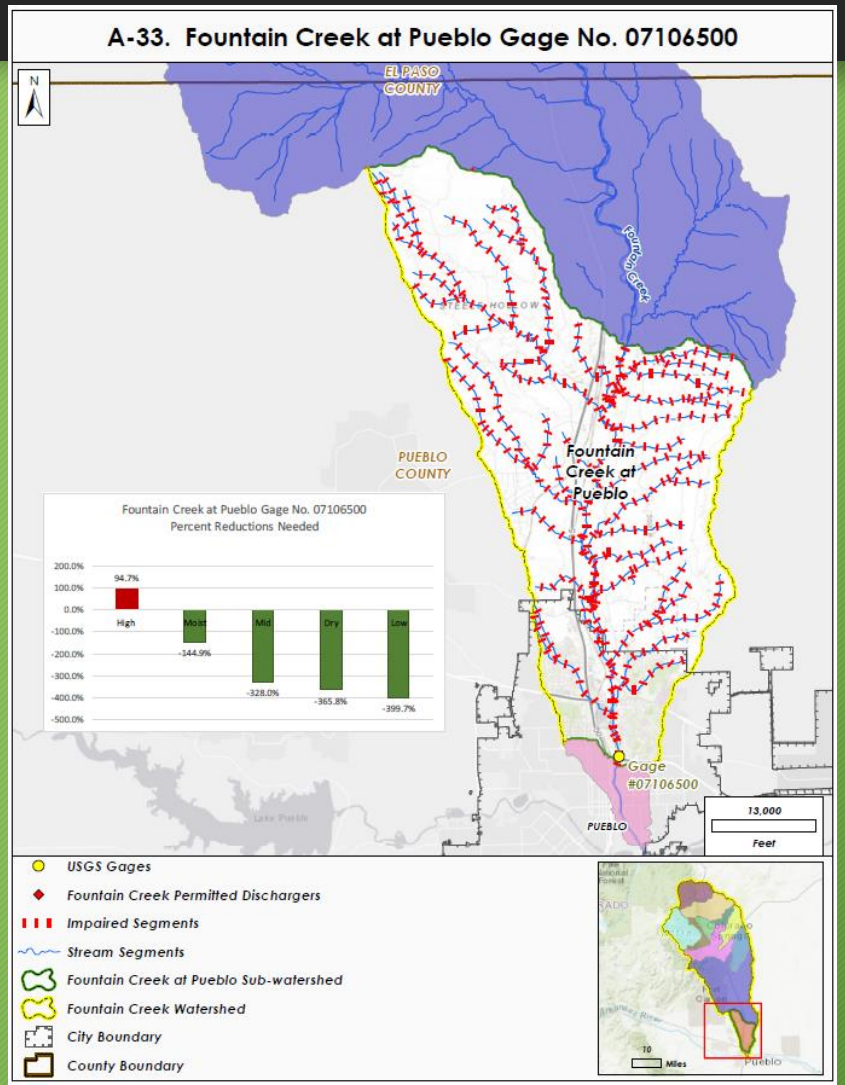


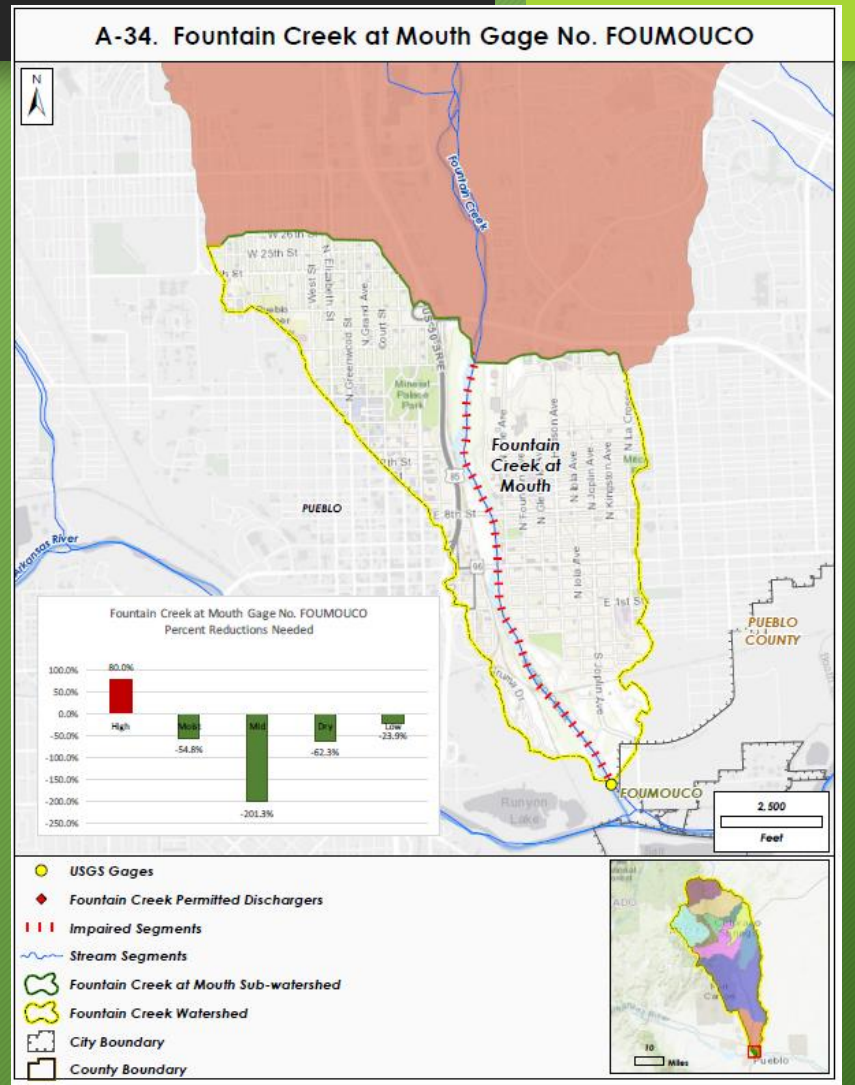




Data Findings – Lower Watershed







Strategies for Water Quality Improvements -Nonpoint

Onsite Wastewater Treatment Systems (OWTS)

Over 50,000 OWTSs in El Paso and Pueblo Counties

Potential Control Measures:

- Identify potentially failing OWTS:
  - Review permits and maintenance records, aerial photography, and dye testing.
- Mapping identifying locations, ages, and historical information.
- Provide education and outreach to owners of OWTS, homeowners, and RV parks.

Homeless Camping

Homeless camping has increased significantly along many waterways throughout the watershed

Potential Control Measures:

- Encourage the development of additional shelters and support services
- Partner with organizations to address homelessness
- Perform ongoing cleanup of homeless camps
- Provide increased access to public restrooms/alternative waste disposal
- Adopt and enforce codes that prohibit camping near public waterways

Strategies for Water Quality Improvements -Nonpoint

Livestock

Potential Control Measures:

- Fence off stream corridors to exclude livestock from riparian areas
- Divert runoff away from pens and manure stockpiles
- Remove manure from drainage ditches and stream channels

Pet Waste

Potential Control Measures:

- Install signs instructing pet owners to pick up pet waste, pet waste bags and disposal containers
- Adopt and enforce pet waste ordinances
- Establish Education/Outreach programs
- Develop Standard Operating Procedures (SOPs) for dog parks
- Locate dog parks away from environmentally sensitive areas
- Maintain vegetative buffers along streams to discourage access
- Explore options for pet waste composting.

Wildlife

Potential Control Measures:

- Reduce food sources available to rural wildlife
  - manage garbage, dumpsters and litter
- Install bird roosting deterrent,
- Consider population controls and habitat modifications that may reduce bird waste inputs

Strategies for Water Quality Improvements - Wastewater/Stormwater

Cross Connections

- Direct - wastewater and stormwater systems improperly connected during construction
- Indirect – leaks from old or damaged wastewater system infiltrate stormwater system

Potential Control Measures:

- Programmatic wastewater collection system inspection, evaluation, repair and rehabilitation programs
- Cross-connection complaint response programs

CSU Creek Crossing Inspection Program

E. coli Best Management Practice Identification and Priorities

- Sources of *E. coli* correlate to land use types and activities
- Identified potential sources to develop reduction strategies; measure load reductions achieved and refine strategies
- Successful long-term implementation of the Plan will require a focus on monitoring and regular data
- Develop information for public Education and Outreach (E/O)

- Proactive load reduction strategies have been identified as associated to three themes of management:
  1. Human behavior changes
  2. Resourcing existing or new programs
  3. Infrastructure improvements

Many stakeholders identified the primary *E. coli* sources of concern and have developed their own implementation plan including: current efforts, 1-5 year priorities, 6-10 year priorities, and Monitoring Plans.

E. coli Best Management Practice Identification and Priorities

Example of

"*E. coli* Planning Implementation by Jurisdiction"

Appendix C

Colorado Springs Utilities Current *E. coli Reduction* Efforts			
Responsible Party	**Management Tool**	**Extent of Program/Tool (membership, funding, events)**	**Metrics**
Colorado Springs Utilities	E/O with partners, stakeholders, homeless service providers	Presentations, tabling at events, summer intern, cleanups across the watershed	25 events and 6,735 contacts in 2018
	Leading Edge Teen Volunteer Program - Raingarden	Designed and installed a demonstration raingarden at Milibo Art Theater	Educational brochure on site, thousands of visitors annually
	Pet waste bag dispenser distributions	Thousands purchased annually and distributed at events watershed-wide	Distributed 2,000 dispensers in 2017; 2,500 in 2018
	Sanitary Sewer Evaluation and Rehabilitation Program (SSERP)	Evaluates and repairs wastewater system	30% of system each year (Spent $74.85M since 2000)
	Sanitary Sewer Creek Crossings Program (SSCC)	Monitors and addresses wastewater pipes that cross creeks and those running parallel to creeks. $3.3 million spent annually	Repaired or rehabilitated 5 creek crossings in 2017 at a cost of $3.9M. (Total cost since 2008 $45.4M)
	Local Collectors Evaluation and Rehabilitation Program (LCERP)	Reducing sanitary sewer overflows through a systematic inspection, rehabilitation, replacement and monitoring program. $3.32 million spent annually	Repaired or rehabilitated 75,807' of <10" pipe at a cost of $3.106M in 2017
	Collection System Rehabilitation and Replacement Program	Large diameter pipes. Annual budget $1.25 million	Spent $3.191M in 2017 replacing 1691' of 12-inch, 2,995' of 42-inch, 540' of 60-inch pipes.
	Manhole Evaluation and Rehabilitation Project (MHERP)	Rehabilitate sanitary sewer manholes throughout the collection system.	$1.16M spent in 2018

Monitoring Plans

This coalition, entities of AF CURE, and other stakeholders have conducted water quality monitoring in the Fountain Creek watershed with the purpose of collecting reliable data for use in assessing water quality.



While data for *E. coli* have been collected at many monitoring sites within the watershed, the Fountain Creek *E. Coli* Watershed Plan identifies locations where additional monitoring is needed to further identify potential nonpoint sources of *E. coli*.

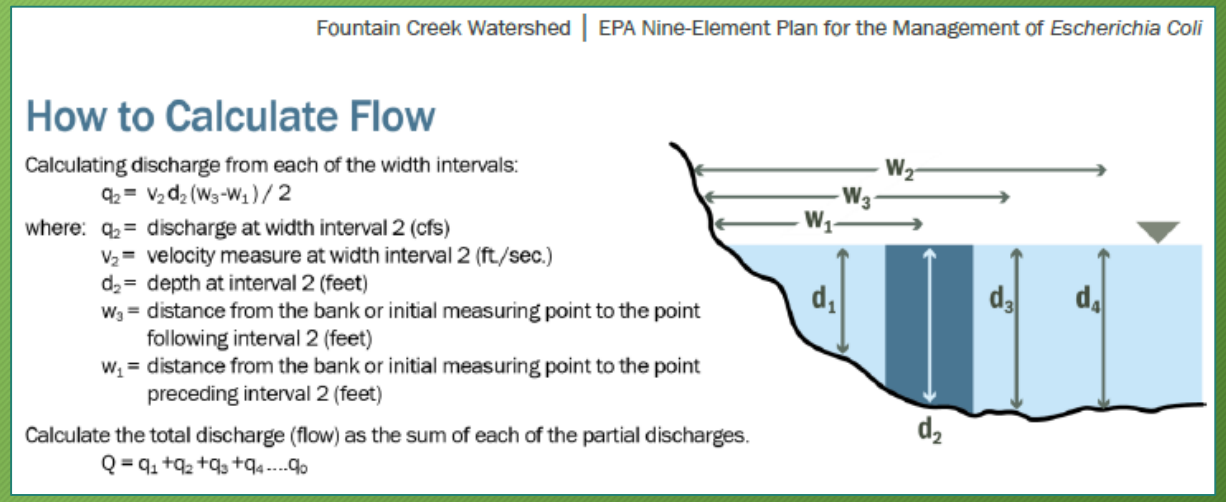
http://www.ppacg.org/index.php?option=com_content&view=article&id=1061
was used as a guide to inform this monitoring effort

Monitoring Plans

The Monitoring Plan provides a general description sampling efforts to meet the needs of the Watershed Plan

- Intended to be a guide
  - sampling protocol, quality assurance/quality control (QA/QC) measures, and data quality objectives

- Each watershed stakeholder organization will utilize their own entity-specific Sampling and Analysis Plans (SAPs) and Quality Assurance Project Plans (QAPPs) as available



Updating and maintenance of the individual SAPs/QAPPs is the responsibility of each jurisdiction.

Measuring Progress

Given the size of the watershed, the complexity of contributing *E. coli* sources within the watershed, and the multitude of unknowns, progress will be measured by:

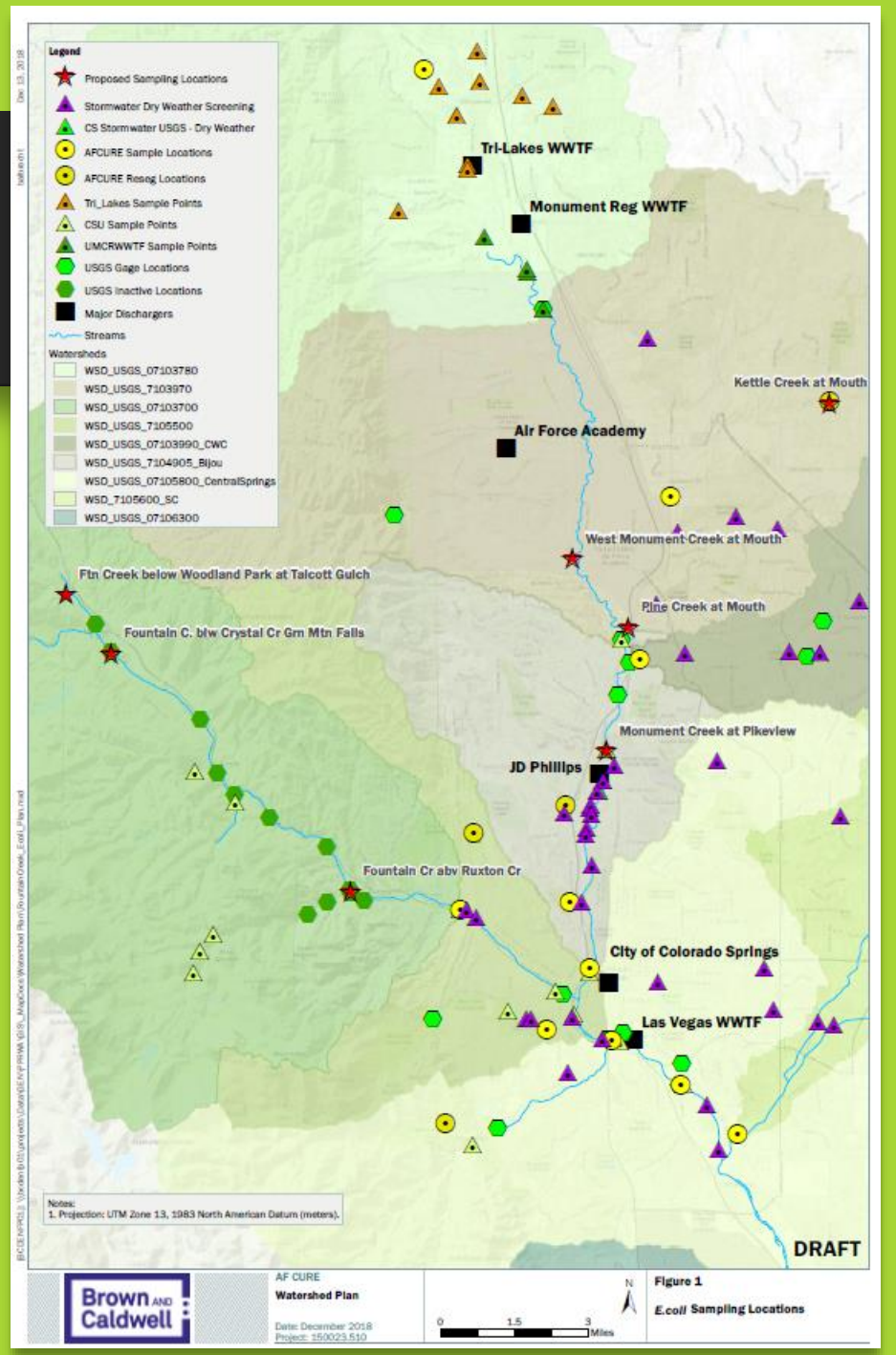
1) Any reduction in *E. coli* concentrations within the watershed

2) A more comprehensive understanding of the nonpoint sources contributing to increased loading

3) Education of citizens about their role in helping to reduce *E. coli* levels

Next Steps

- Need for additional data collection and analysis
- Verify locations and ages of OWTS throughout the watershed (knowledge/data gap)
  - Review locations of active/inactive wells, map infrastructure, obtain additional water quality data, and review records
  - Review available data, consider additional sampling, and engage additional appropriate stakeholders
- Based on this stakeholder process, a map has been developed proposing new sampling locations
- Much of this work will require resources so exploring grant opportunities is high priority



Questions

Photo from: https://koa.com/campgrounds/colorado-springs/photos/0b0a7c16-ae9b-46fe-9590-eded0d19ea45/