Resources to Facilitate Communication and Collaboration

Holly Piza, P.E.

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Colorado *E. coli* Toolbox: A Practical Guide for Colorado MS4s

Prepared by
Wright Water Engineers, Inc.
Geosyntec Consultants

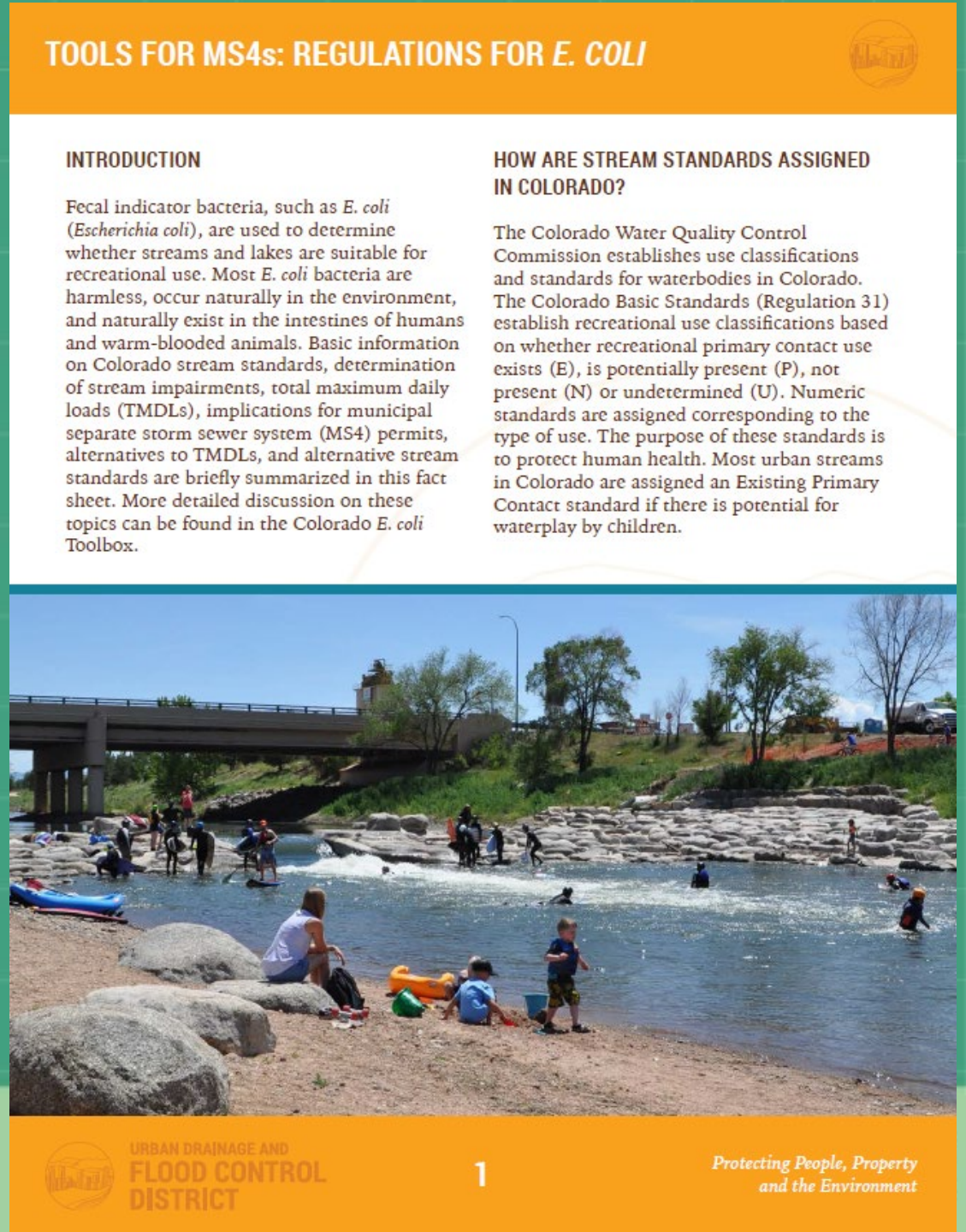
Prepared for
Urban Drainage and Flood Control District
City and County of Denver

July 2016

More comprehensive coverage of *E. coli* specifically for Colorado

Regulations for *E. coli*

- How are Stream Standards Assigned
- Basis of the Standard
- How is attainment accessed
- What is a TMDL
- Regulatory alternatives for impaired waterbodies (other than a TMDL)
- Options for site-specific stream standards



TOOLS FOR MS4s: REGULATIONS FOR *E. COLI*

INTRODUCTION

Fecal indicator bacteria, such as *E. coli* (*Escherichia coli*), are used to determine whether streams and lakes are suitable for recreational use. Most *E. coli* bacteria are harmless, occur naturally in the environment, and naturally exist in the intestines of humans and warm-blooded animals. Basic information on Colorado stream standards, determination of stream impairments, total maximum daily loads (TMDLs), implications for municipal separate storm sewer system (MS4) permits, alternatives to TMDLs, and alternative stream standards are briefly summarized in this fact sheet. More detailed discussion on these topics can be found in the Colorado *E. coli* Toolbox.

HOW ARE STREAM STANDARDS ASSIGNED IN COLORADO?

The Colorado Water Quality Control Commission establishes use classifications and standards for waterbodies in Colorado. The Colorado Basic Standards (Regulation 31) establish recreational use classifications based on whether recreational primary contact use exists (E), is potentially present (P), not present (N) or undetermined (U). Numeric standards are assigned corresponding to the type of use. The purpose of these standards is to protect human health. Most urban streams in Colorado are assigned an Existing Primary Contact standard if there is potential for waterplay by children.

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Protecting People, Property and the Environment

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Microbial Source Tracking

- What is it?
- When is it most effective?
- Limitations?
- What are the sources of *E. coli*?
- What tools are used?
- How to make it successful
- Expected Outcomes

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TOOLS FOR MS4s: MICROBIAL SOURCE TRACKING

WHY DOES THE SOURCE OF *E. COLI* MATTER?

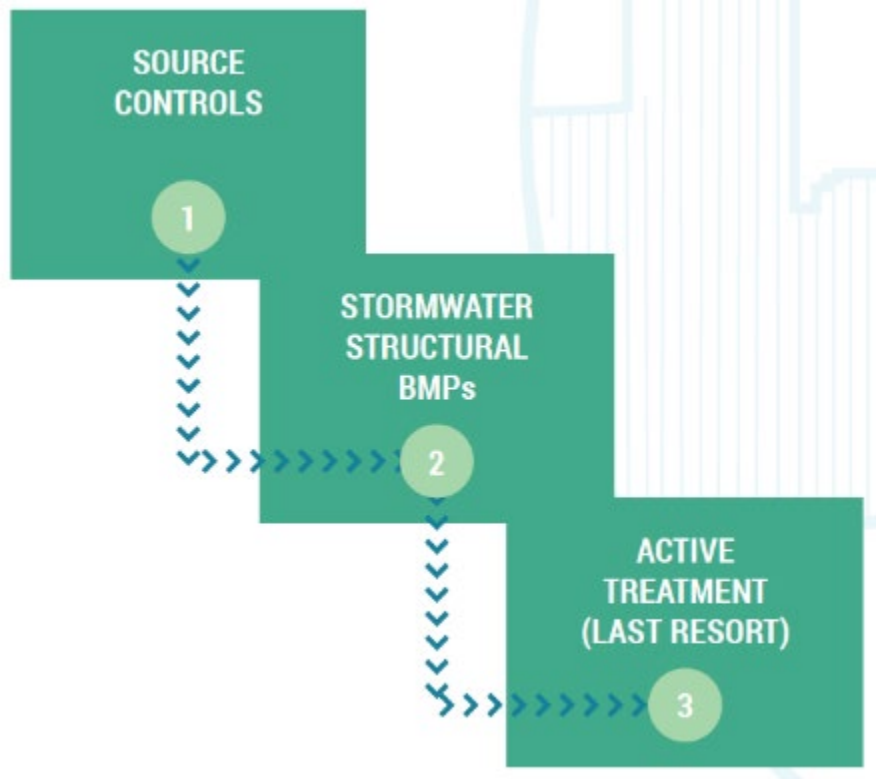
Elevated levels of fecal indicator bacteria (FIB), including *E. coli*, are one of the most common causes of water quality impairment in surface waters across the United States. While some sources of FIB can be identified through a sanitary survey, sources of FIB in many watersheds remain unknown and thus cannot be effectively controlled through targeted management actions. FIB results alone give no indication of the fecal source (human vs non- human). In addition, the health risk associated with exposure to water containing human waste is much greater than that of most non-human sources. Therefore, identifying the source(s) of fecal contamination in waters with chronically high FIB levels is of critical importance to meet recreational water quality criteria and reduce human health risk.

WHAT IS MICROBIAL SOURCE TRACKING?

Microbial source tracking (MST) uses a set of tools that allow for sources of fecal waste to be distinguished. These tools include conventional methods (e.g., ammonia, CCTV, dye testing) that have been used to identify illicit discharges for the past 20+ years, as well as more recently developed advanced laboratory methods that measure DNA specific to humans and other animals known as "markers" to identify sources. However, MST is more than just a set of tools or methods. MST is a process by which potential waste sources are systematically tested and investigated to identify and locate the origin of fecal bacteria in a contaminated water.

Stormwater BMPs

- Effective treatment strategies
- Effectiveness for various BMPs
- Active Treatment
- Diverting to sanitary



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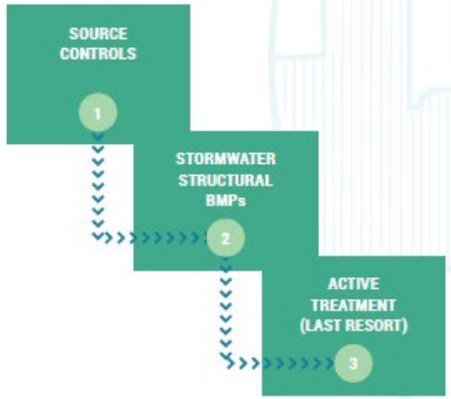
TOOLS FOR MS4s: STORMWATER BMPs FOR *E. COLI*

INTRODUCTION

Local governments with municipal storm sewer systems (MS4s) discharging to waterbodies that are impaired due to elevated *E. coli* are often faced with the challenge of reducing *E. coli* loading to these waterbodies. Source controls are an essential step for reducing *E. coli*. Structural control practices to reduce *E. coli* loading from wet weather flows include options for treating urban runoff through "passive" stormwater best management practices (BMPs) such as those included in the Urban Drainage and Flood Control District's (UDFCD's) Urban Storm Drainage Criteria Manual Volume 3. Active treatment options, which are typically considered a last resort for managing dry weather flows, include low-flow diversions to the sanitary sewer and active treatment using disinfection at the outfall. This fact sheet provides information on approaches to reducing *E. coli* loads from MS4s, expectations for stormwater BMP performance and various treatment options.



WHAT IS THE BEST APPROACH FOR REDUCING *E. COLI* LOADING FROM MS4S?

The first step is source controls, which benefit both dry and wet weather discharges from MS4s. This typically requires an investigation of dry weather discharges to identify the causes of elevated *E. coli* and correct these sources. These efforts can be implemented as part of Illicit Discharge Detection and Elimination (IDDE) programs already required under MS4 permits. One of the most important source control measures is identifying sanitary sewer leaks intercepted by the storm drain system and, in some cases, erroneous plumbing of the sanitary sewer to the storm drain. More diffuse sources can include transient encampments, drainage from dumpsters, and wildlife and pets. (See Colorado *E. coli* Toolbox for a complete list to consider as part of IDDE and source investigations.)

Implementation of structural stormwater BMPs to improve water quality under wet weather conditions is also a fundamental part of stormwater management programs. Stormwater BMPs can help reduce *E. coli* loading to streams, although consistent attainment of instream primary contact recreation standards at end of pipe under wet weather conditions is typically not realistic. This is one of the reasons some communities nationally have focused on green infrastructure approaches that encourage runoff volume reduction to reduce pollutant loads.

Using GIS for E. coli Source Investigations and Controls

- Inventorying potential sources
- Accessing publically available data
- Prioritizing sources for investigation
- Using GIS to track investigations and corrective measures

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TOOLS FOR MS4s: USING GIS FOR *E. COLI* SOURCE INVESTIGATIONS AND CONTROLS

INTRODUCTION

Approximately 90 stream segments in Colorado are either impaired for recreational use due to elevated *E. coli* concentrations or identified as needing additional monitoring and evaluation of *E. coli* to assess impairment. Local health departments, municipal separate storm sewer system (MS4) permit managers, public works officials and others are increasingly faced with the challenge of identifying the sources of *E. coli* loading to streams and correcting those sources. These requirements may be voluntary, required under MS4 discharge permits or based on a Total Maximum Daily Load (TMDL) for *E. coli*. This fact sheet provides basic guidance and resources that local governments can use to organize information pertinent to *E. coli* source investigations. This "desktop" information can be combined with field investigations and monitoring programs, including microbial source tracking efforts, to support *E. coli* source identification and corrective measures. Ideally, tools such as Geographic Information Systems (GIS) are used to support hypothesis formation regarding sources, to organize initial investigations and then to track activities and improvements over time. Typically, these efforts require coordination across city departments; therefore, understanding how various types of data and information fit together is important. This fact sheet proves a brief overview of how GIS can be used to support *E. coli* source investigations and track corrective measures to reduce loading.

INVENTORYING POTENTIAL *E. COLI* SOURCES

One of the challenges of *E. coli* source identification is that there are many diffuse sources of *E. coli* in both urban and natural watersheds. The starting point for effective *E. coli* source identification and load reduction is developing a reasonable understanding of the sources of *E. coli* in the watershed, as well as understanding sources of flows transporting *E. coli* to receiving waters. Table 1 provides a list of sources of *E. coli* in urban areas. Not all sources will be present in all urban areas, but the table provides an initial checklist of potential sources. From a regulatory perspective, MS4 permittees are not required to address all of these sources (e.g., non-point sources); however, it is beneficial for MS4 permittees to have a broad understanding of the diverse sources of bacteria that may be present in impaired waterbodies that receive discharges from the MS4.

The next step is to begin compiling and reviewing information available in the study area of interest. This includes integrating available water quality data with other relevant information geospatially. GIS can be used as a tool to overlay various types of geolocated information in a manner than can help support field investigations of sources contributing to MS4 outfalls. By mapping water quality data with other geospatial information, hypotheses can be formed regarding potential sources, and areas in need of additional monitoring (data gaps) can be identified.

Homelessness and Stormwater

- Camping near streams is dangerous
- Trash can cause flooding
- Trash necessitates clean-up
- Encampments are a point-source of pollution

Metro Denver – The Numbers

Year	2015	2016	2017	2018
Total Homeless	6004	5467	5116	5317

Note: State Demography Office shows a 5% increase in population in the Denver Metro area between 2014 -2017

25% without shelter (2018)

Source: Everyone Counts Metro Denver's 2018 Point in Time Report (Denver Metro Homeless Initiative)

Los Angeles County– The numbers

52,765 homeless

75% without shelter

Source: Greater Los Angeles Homes Count – Los Angeles County (2018) https://www.lahsa.org/documents?id=2001-2018-greater-los-angeles-homeless-count-los-angeles-county.pdf

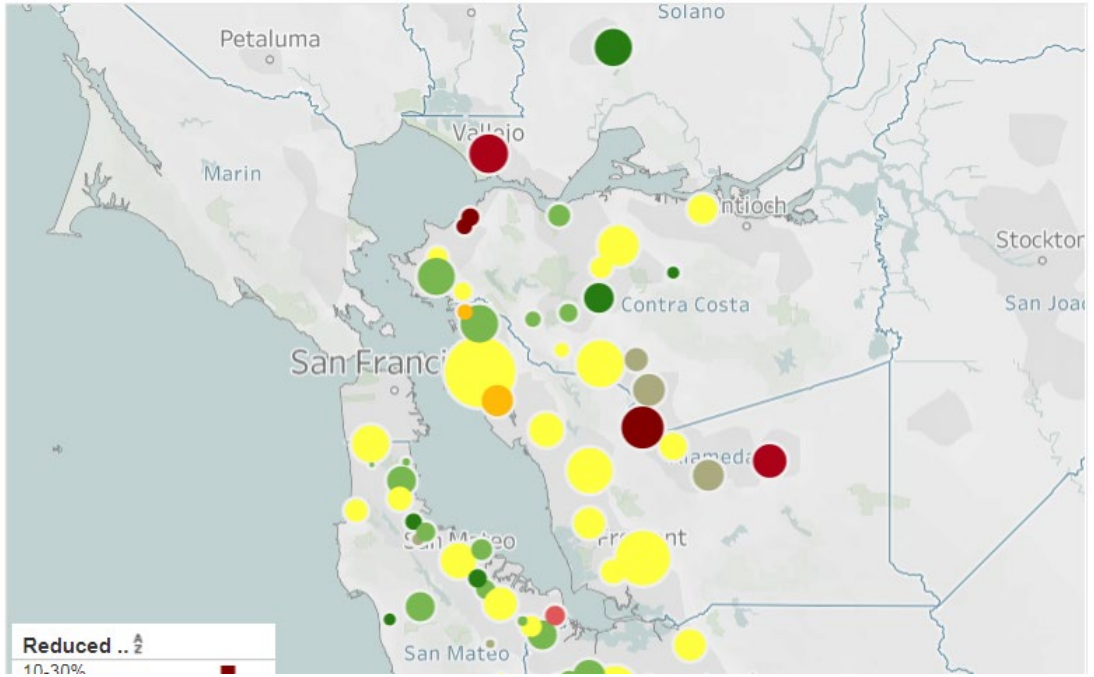
California Partnerships

Bay Area cities and county storm drains trash-free by 2022

The State of Trash in 2017: Bay Area Progress in Reducing Trash Flows to the Bay

By Johnneson Mymala, Bay Smart Fellow | March 6, 2018

2017 Reductions in Trash by City



https://blog.savesfbay.org/2018/03/state-trash-2017-bay-area-progress-reducing-trash-flows-bay/

Lessons Learned from Contra Costa

- Encampment typology is important
  - Old-timer
  - Newcomer
  - Veteran

Source: Devuono-powell, Homeless Encampments in Contra Costa Waterways: Regulatory Constraints, Environmental Imperatives and Humane Strategies (2013)

“the effectiveness of evictions will depend in part on what policies are in place and on the specific population of the camp”

Source: Devuono-powell, Homeless Encampments in Contra Costa Waterways: Regulatory Constraints, Environmental Imperatives and Humane Strategies (2013)

Lessons Learned from Contra Costa

- Seasonality impacts effectiveness
- Bring outreach to abatements
- Multi-agency garbage collection
- Landscape Solutions
    - Paths near streams

Source: Devuono-powell, Homeless Encampments in Contra Costa Waterways: Regulatory Constraints, Environmental Imperatives and Humane Strategies (2013)

Recommendations from Contra Costa

Develop an interagency council

Develop encampment protocol

1. Ascertain resources (shelter available)
2. Ensure residents don't simply move across political boundaries

Source: Devuono-powell, Homeless Encampments in Contra Costa Waterways: Regulatory Constraints, Environmental Imperatives and Humane Strategies (2013)

"The adoption of a protocol that covers all forms of contact with encampment residents and is adopted by all agencies so residents are able to predict how agencies will interact with them, creating consistency would be beneficial in creating predictability."

Source: Devuono-powell, Homeless Encampments in Contra Costa Waterways: Regulatory Constraints, Environmental Imperatives and Humane Strategies (2013)

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Thank You

Holly Piza, P.E.

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