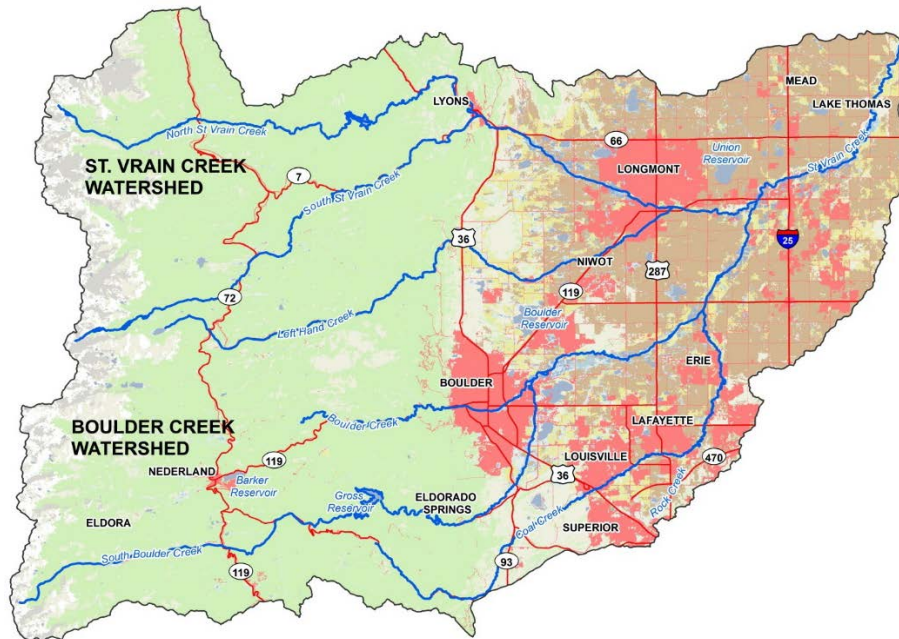


SECTION 319 NONPOINT SOURCE POLLUTION CONTROL PROGRAM  
ASSESSMENT/PLANNING PROJECT FINAL REPORT

St. Vrain Basin Watershed-Based Plan:  
Boulder Creek, St. Vrain Creek and Tributaries



By  
City of Boulder  
Boulder County  
Keep It Clean Partnership  
Wright Water Engineers, Inc.

February 25, 2016

This project was conducted in cooperation with the State of Colorado and the United States Environmental Protection Agency, Region 8.

Grant # 13 FAA 56804

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See <http://www.keepitcleanpartnership.org/watershed/> to access the following documents:

- St. Vrain Basin Watershed-Based Plan: Boulder Creek, St. Vrain Creek and Tributaries
- Boulder Creek-St. Vrain Creek Watershed Coordinated Monitoring Framework

## EXECUTIVE SUMMARY

PROJECT TITLE St. Vrain Watershed-Based Plan: Boulder Creek, St. Vrain Creek and Tributaries

(Grant Application Title: St. Vrain Watershed Plan)

PROJECT START DATE June 15, 2013 PROJECT COMPLETION DATE December 31, 2015

FUNDING:	TOTAL BUDGET <u>\$158,325</u>
TOTAL EPA GRANT	<u>\$94,995</u>
TOTAL EXPENDITURES OF EPA FUNDS	<u>\$94,995</u>
TOTAL SECTION 319 MATCH ACCRUED	<u>\$85,010</u>
BUDGET REVISIONS	<u>Additional match by project sponsors = \$21,680</u>
TOTAL EXPENDITURES	<u>\$180,005</u>

### SUMMARY ACCOMPLISHMENTS

1. Developed a coordinated monitoring approach for the overall watershed, including identification of data gaps and data management needs.
2. Improved understanding of existing water quality issues in the watershed through data sharing among stakeholders and by consolidating watershed information into one consolidated reference, including supporting maps.
3. Identified steps necessary to improve water quality or otherwise resolve stream segments designated as impaired. This included recommendations for additional source identification for certain pollutants and a menu of BMPs suitable for addressing pollutant sources.
4. Developed a framework for implementing recommendations from the plan.

## 1.0 INTRODUCTION

The 980-square-mile St. Vrain Basin includes two major subwatersheds: 1) Boulder Creek and 2) St. Vrain Creek. The 8-digit hydrologic unit code (HUC) for the St. Vrain Basin is 10190005. Boulder Creek and its tributaries flow through the southern portion of Boulder County, and St. Vrain Creek and its tributaries flow through the northern portion of Boulder County. The two streams join to form the main stem of St. Vrain Creek, just east of the Boulder-Weld County line, and flow into the South Platte River downstream of Platteville, Colorado. (See Figure A-1 provided in the appendix.) Colorado's 2012 303(d) List of Impaired Segments and Monitoring and Evaluation (M&E) List identifies 23 segments in the overall watershed that do not attain (or potentially do not attain) stream standards.

This Watershed-Based Plan (Plan) has been developed to provide a framework for better understanding and addressing impairments for the flowing stream segments on this list. Because of the large watershed area, the primary focus of this Plan is the western edge of the urbanized areas in the foothills eastward to Interstate 25 (I-25); however, background information on the overall watershed is also provided. As part of this Plan, a Monitoring Plan for the St. Vrain Basin was been developed to support coordinated watershed efforts.

The Keep It Clean Partnership (KICP)<sup>1</sup> is a partnership of communities sharing, coordinating, and developing resources to reduce stormwater pollution within the Boulder Creek and St. Vrain Creek watersheds. KICP has led the effort to develop this Plan, incorporating the U.S. Environmental Protection Agency's "Nine Elements of a Watershed Plan," to meet the following objectives:

1. Develop a coordinated monitoring approach for the overall watershed, including identification of data gaps and data management needs.
2. Improve understanding of existing water quality issues in the watershed.
3. Identify steps necessary to improve water quality or otherwise resolve stream segments designated as impaired.
4. Develop a framework for implementing these measures.

In addition to meeting these objectives, this Plan serves as a broad reference (guide) for watershed stakeholders to obtain consolidated information on topics such as:

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<sup>1</sup> The KICP Partners includes the communities of Boulder, Boulder County, Erie, Lafayette, Longmont, Louisville and Superior.

- Maps of land use, soils, mine locations, fire hazard areas, agricultural area, open space.
- Wastewater treatment plant and municipal stormwater discharge permits.
- Summaries of various planning efforts in the watershed.
- Stakeholders and monitoring data sources in the watershed.
- Stream standards and impairments, along with data analysis for selected pollutants.
- Strategies to reduce pollutant loading and to refine understanding of pollutant sources.

## 2.0 PROJECT GOALS, OBJECTIVES, AND ACTIVITIES

The long-term environmental goal of this Plan is restoration of stream health in the overall St. Vrain Basin. As part of this effort, a strong baseline data inventory and long-term, coordinated Monitoring Plan for the overall St. Vrain Basin have been completed.

### Goals of Watershed-Based Plan

Environmental Goal 1: Restore beneficial uses for the overall St. Vrain Basin. Impaired beneficial uses include aquatic life, domestic water supply and recreation.

Programmatic Goal 1: Involve stakeholders throughout the overall St. Vrain Basin to develop a watershed-based plan that properly inventories and integrates existing watershed efforts and resources.

Programmatic Goal 2: Develop a long-term monitoring, assessment and data management plan that is consistently followed in the overall St. Vrain Creek watershed to support scientifically sound decision-making.

Programmatic Goal 3: Complete an implementation-ready, holistic watershed-based plan that is practical and readily usable by watershed stakeholders.

Four objectives were developed to support the project goals and comply with EPA's Nine Elements of a Watershed Plan. These objectives are defined below, along with tasks completed to achieve these objectives, as part of this effort.

**Objective 1: Stakeholder and Public Involvement and Education.** In order to effectively address non-point sources of pollution, stakeholder and public involvement is essential. Building upon the existing stakeholder framework of the KICP, the project co-sponsors reached out to other stakeholders and used existing communications pathways to involve and educate the public regarding non-point source issues. To support this objective, a project webpage was developed, eight stakeholder meetings were held, and a public education and outreach plan was developed as part of the Implementation Plan (see Chapter 7 of Plan).

**Objective 2: Watershed Characterization and Assessment and Priority Identification.** One of the primary obstacles to moving forward with solutions to stream impairments in the watershed is inadequate characterization of the sources and extent of impairments, due to piecemeal monitoring and independent assessment efforts in the watershed. Thus, a primary objective of this Plan was to properly characterize and assess causes and sources of pollutants and identify the relative priorities for restoration, building upon the priorities developed on Colorado’s 2012 303(d) List. Key tasks completed to support this objective include:

- a. Identify the causes and sources of pollutants. The first step in watershed characterization included inventorying existing data in the watershed and compiling a master database for available electronic data. These data were then combined with existing GIS land use coverages available from the cities and counties to develop a general understanding of likely causes and sources of pollution in the watershed. For *E. coli*, some significant data gaps were identified and are included in recommendations for future monitoring.
- b. Estimate pollutant load reductions needed. Based on available data, best estimates of load reductions needed to meet water quality standards that protect beneficial uses or restore impaired beneficial uses were made for selected pollutants in Chapter 5 of the Plan, within the constraints of available water quality and hydrologic data. (Note: advanced modeling was beyond the scope/budget of this Plan. However, such modeling could be conducted in the future to refine load estimates in subsequent efforts.)
- c. Identify nonpoint source management measures to achieve load reductions. Based on identified and anticipated sources of pollutants, nonpoint source management measures expected to be useful in reducing pollutant loads were inventoried in Chapters 6 and 7 of the Plan and integrated into the Implementation Plan in Chapter 8. (Note: Because sources of *E. coli* are not currently well defined in the watershed, a “menu” of BMPs was provided that can be used to select appropriate practices once the sources are better defined.)

**Objective 3: Watershed-Based Plan Development and Implementation and Evaluation**

**Approaches.** In order to effectively move forward with nonpoint source pollution control measures, an Implementation Plan was developed in Chapter 8 of this Plan. Development of the Implementation Plan included these tasks:

- a. Estimate technical and financial resources needed to implement the Plan. As part of the Plan, a tabular summary was prepared with estimates of technical and financial resources necessary to implement recommended load reduction measures.
- b. Develop implementation schedule for management measures. A schedule for implementation of management measures was developed for the initial release of the Plan, along with recommendations to update the schedule as a refined understanding of pollutant sources is developed.

- c. Develop measurable milestones for measures identified in the Plan. Interim measurable milestones were developed for each key component of the Plan.
- d. Develop criteria to assess load reductions and measurable progress. Through stakeholder input, criteria to assess the success of nonpoint source control measures and measurable progress were defined. Ultimately, these criteria are based on compliance with stream standards; however, measurable milestones also include concepts such as a decrease in the number of standards exceedance days.

**Objective 4: Monitoring and Data Management.** Project co-sponsors identified an integrated, watershed-scale monitoring and data management approach as a high-priority objective for meeting environmental goals in the overall St. Vrain Creek watershed. Essentially, if watershed conditions have not been effectively measured, they are unlikely to be effectively managed. Additionally, due to the size of the watershed, an integrated data management approach was identified as a key need, both for baseline data and for future monitoring to assess effectiveness of control measures implemented in the watershed.

The St. Vrain Basin Coordinated Monitoring Program was developed with significant stakeholder input to meet this objective. Stakeholders provided information on existing monitoring programs in the watershed so that a master watershed monitoring plan could be developed and adopted by stakeholders. In 2015, the Coordinated Monitoring Plan was followed to enable preparation of the KICP's first annual water quality report (KICP and WWE 2015). The second annual water quality report is underway for 2016.

## **2.1 PLANNED AND ACTUAL MILESTONES, PRODUCTS, AND COMPLETION DATES**

The scope of the project evolved over time, resulting in two funding phases. The first phase focused on the Boulder Creek sub-basin and the second phase focused on the St. Vrain sub-basin. The two phases combined allowed an integrated plan for the overall St. Vrain Basin. As a result of the evolution of the project, milestones are provided based on the final timeline of the Phase 2 funding. Table 1 summarizes the contractual deliverable date and completion date. Figure 1 summarizes the project milestones, including the active (non-administrative) contract periods for the two phases and identifies the impact of the September 2013 flood on initial project progress.



**Table 1. Project Deliverables Schedule in Phase 2 Contract**

Deliverables	Contractual Completion Date	Actual Completion Date
1. St. Vrain Watershed-Based Plan 2. St. Vrain Watershed Sampling and Analysis Project Plan	October 1, 2015	September 29, 2015*

\*The Division provided comments on the Plan in late December 2015, following the contractual completion date. These comments will be addressed during March 2016 and a revised version of the Plan will be posted to the project website.

**Figure 1. Project Milestones**

Year	2013								2014								2015														
Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Active Contract Phases																															
Project Meetings																															
Project Webpage																															
Draft Monitoring Plan																															
Draft Watershed Plan																															
Final Draft Monitoring Plan																															
Final Draft Watershed Plan																															

\* Notice to Proceed occurred shortly before the September 2013 Flood, limiting stakeholder availability for project meetings.

Additionally, the City of Boulder provided project management throughout the course of the project, including progress-related deliverables culminating in this final project report and a project fact sheet in February 2016.

## 2.2 EVALUATION OF GOAL ACHIEVEMENT

Table 2 provides a summary evaluation of goal achievement, following completion of the Plan. Table 3 provides additional information on specific activities specified in the contract. Overall, the project goals were met.

**Table 2. Evaluation of Goal Achievement**

<b>Goal</b>	<b>Evaluation of Goal Achievement</b>
Environmental Goal 1: Restore beneficial uses for the overall St. Vrain Basin. Impaired beneficial uses include aquatic life, domestic water supply and recreation.	This is a long-term goal, which was not intended to be achieved during the project timeframe. The Plan provides an improved understanding of impairments in the watershed and provides a framework for continued pollutant source characterization, as well as information on BMPs that could be implemented to reduce loading from those sources.
Programmatic Goal 1: Involve stakeholders throughout the overall St. Vrain Basin to develop a watershed-based plan that properly inventories and integrates existing watershed efforts and resources.	This goal was achieved through multiple stakeholder meetings, increased coordination of monitoring efforts, and compilation of multiple watershed references and information sources into a consolidated plan.
Programmatic Goal 2: Develop a long-term monitoring, assessment and data management plan that is consistently followed in the overall St. Vrain Creek watershed to support scientifically sound decision-making.	This goal was achieved through completion of a coordinating monitoring framework for the basin. In 2015, the first annual water quality report for the basin was completed as a direct result of the monitoring plan and a second annual report is in progress for 2016. These reports are publically accessible at: <a href="http://www.keepitcleanpartnership.org/watershed/">http://www.keepitcleanpartnership.org/watershed/</a> .
Programmatic Goal 3: Complete an implementation-ready, holistic watershed-based plan that is practical and readily usable by watershed stakeholders.	This goal was achieved through completion of the Watershed-Based Plan, which included an implementation plan with near-term, mid-term and long-term activities. (All future activities are funding-dependent.)

**Table 3. Contract-specified Activities to Support Goals**

<b>Primary Activity</b>	<b>Status</b>	<b>Comment</b>
No later than the 90 days before the expiration date of this contract, complete final drafts of the St. Vrain Watershed-Based Plan and the Monitoring Plan.	Complete	Both plans accessible at: <a href="http://www.keepitcleanpartnership.org/watershed/">http://www.keepitcleanpartnership.org/watershed/</a> .
Organize stakeholders and use existing communication pathways to involve and educate the public regarding nonpoint source issues.	Complete	Project webpage developed as part of broader KICP effort. Also, 8 meetings/outreach efforts completed.
Characterize and assess causes and sources of pollutants, and identify their relative priorities for restoration.	Complete	See Chapters 5 through 7 of Watershed-Based Plan. Additional source characterization identified as a mid-term future need.
Develop a calculated estimate of the technical and financial resources needed to implement the Watershed-Based Plan, with associated implementation milestones and timeline including identifying criteria for assessing measurable progress and identifying necessary plan revisions.	Complete	See Chapter 7 of Watershed-Based Plan.
Develop an integrated, watershed-scale monitoring and data management plan for St. Vrain Creek watershed.	Complete	See Monitoring Plan, accessible at <a href="http://www.keepitcleanpartnership.org/watershed/">http://www.keepitcleanpartnership.org/watershed/</a> .
Manage the project successfully, reporting on the status of the project and progress toward completing deliverables products at required intervals.	Complete	Regular invoices submitted to Division, along with progress descriptions, fact sheet and this final report.

## **2.3 SUPPLEMENTAL INFORMATION**

Due to the breadth of topics covered in the Plan, readers are directed to the Plan for supplemental information.

## **3.0 MONITORING RESULTS**

Nonpoint Source (NPS) funds were not used for water quality sample collection or laboratory analysis. However, as a first step in developing this Plan and the Monitoring Plan, data from multiple organizations conducting monitoring in the watershed were inventoried. This required

a substantial effort and was conducted for the overall St. Vrain Basin. Table 4 summarizes these data sources.

**Table 4. Monitoring Data Sources in St. Vrain Basin**

<b>Water Quality Data</b>
<b>Keep It Clean Partnership Partner Water Quality Data Sources</b>
City of Boulder
City of Longmont
Town of Superior
City of Louisville
City of Lafayette
Town of Erie
<b>Other Water Quality Data Sources</b>
Denver Water
Colorado Water Quality Control Division (via Colorado Data Sharing Network and/or STORET)
Riverwatch (via Colorado Data Sharing Network)
Northern Colorado Water Conservancy District
<b>Biological Monitoring</b> (Timberline Aquatics for local governments)
Boulder, Longmont, Superior, Louisville, Lafayette, Erie
<b>Stream Gauge Flow Data</b>
U.S. Geological Survey (and some water quality data)
Colorado Division of Water Resources
OneRain Gauge Network
City of Louisville Gauge (COC-1, operated by municipality)

### 3.1 SURFACE WATER CHEMISTRY

As noted above, NPS funds were not used for water quality sample collection or laboratory analysis. Instead, the project participants provided water quality monitoring data funded by their individual programs to support evaluation of surface water chemistry in the watershed. The primary water quality issues identified and explored in this Plan include:

- E. coli* (fecal indicator bacteria):** The most common water quality issue in the watershed is *E. coli* concentrations exceeding primary contact recreational standards. Impairments for *E. coli* are generally located in the urban and agricultural areas between the foothills and I-25. Although the City of Boulder is working to address elevated *E. coli* under a Total Maximum Daily Load (TMDL) for Boulder Creek from 13<sup>th</sup> Street to the confluence with South Boulder Creek, other streams also have elevated *E. coli* such as portions of Rock Creek, Coal Creek, Boulder Creek (additional segments), Dry Creek, Left

Hand Creek and St. Vrain Creek. This Plan identifies portions of segments with elevated *E. coli* and identifies general reductions needed in various stream reaches to attain the stream standard.

Additional monitoring is needed to better target the sources of *E. coli* in each segment. Source identification for *E. coli* is essential for identifying and implementing effective load reduction strategies, given the wide range of potential *E. coli* sources in a watershed. Typically, municipal wastewater treatment plant discharges are not the cause of elevated *E. coli*; however, leaking sanitary infrastructure may be a source in some areas. In urban areas, dogs, homeless or transient encampment areas, urban wildlife, waste management practices and urban runoff are representative sources potentially contributing to elevated *E. coli*. In agricultural areas, livestock, manure spreading, and failing septic systems are potential sources. This Plan includes recommendations for improved source identification and best management practices that can be implemented once sources of *E. coli* are better understood.

- **Nutrients:** In 2012, Colorado adopted nutrient interim values for total phosphorus, total nitrogen and chlorophyll-*a*. Because these criteria are being adopted as stream standards in a phased approach, there are no current impairments for nutrients in the basin. Nonetheless, analysis in this Plan demonstrates that stream segments below municipal wastewater treatment plants are likely to exceed nutrient criteria for total phosphorus and total nitrogen, and possibly chlorophyll-*a*, if adopted as standards in the future.
- **Metals:** Although stream standards for metals are attained for most of the overall St. Vrain Basin, several types of metals issues are present in the watershed in various locations, with differing solutions. For example, portions of the watershed where historic mining occurred, such as in the Left Hand Creek subbasin, exceed standards for several metals and are the focus of a recent TMDL. The 2005 Left Hand Creek Watershed Plan recommended practices to reduce metals loading from abandoned mines in these areas, but remediation of these areas requires significant funding to complete and remains a need in the watershed. Selenium in Rock Creek and the portion of Coal Creek below Rock Creek presents a different impairment scenario. In this case, elevated selenium is expected to be due to naturally occurring conditions and exploration of an ambient-based, site-specific standard may be a more realistic solution. A third scenario for metals impairment may occur in the upper pristine portion of the watershed outside of the “mining belt” where extremely low hardness values result in very low hardness-based metals standards (e.g., copper). A similar situation occurs for arsenic on stream segments where extremely stringent “water plus fish” standards apply. (Most of these segments currently have a temporary modification for arsenic.) In these situations, even low-level metals detections may exceed stream standards.

As noted above, the primary focus of the implementation plan was *E. coli*. Because *E. coli* originates from many sources, it can be challenging to identify the source and type without

relatively in-depth special sampling. Following the Load Duration Curve methodology developed by Cleland and often used by EPA in TMDLs, multiple sources of *E. coli* are suspected in the various stream segments, with the load duration curve method used in the Plan generally being inconclusive (which is not unexpected for a highly variable parameter such as *E. coli*). Given the complex water rights administration for the streams in this watershed, it was not feasible to reliably pair flow and water quality at the level of analysis being used for this Plan for multiple monitoring locations. For this reason, concentration-based reductions were calculated for sampling locations on the stream, as summarized in Table 5 and Table 6 for the past five years of data.

**Table 5. Estimated Instream *E. coli* Reductions Needed to Meet Primary Contact Recreation Standard for Boulder Creek Watershed Segments**

Sample Location	n =	Rec. Geomean (2010-2014)	% Reduction Needed During Rec. Season	Location and Data Notes
<b>Boulder Creek</b>				
BC-Can	29	44	NA	Canyon Road
BC-Lib	21	74	NA	Library; 2004-2014 (above TMDL)
BC-CU	29	132	5%	University of Colorado (in TMDL)
BC-47	20	218	42%	47 <sup>th</sup> Ave.; 2004-2014 (in TMDL)
BC-61	30	169	25%	61 <sup>st</sup> Ave. (below TMDL & below S. Boulder Creek)
BC-aWWTP	30	94	NA	Above Boulder 75 <sup>th</sup> St. WWTP
BC-aDC	30	114	NA	Below Boulder 75 <sup>th</sup> St. WWTP
BC-95	30	79	NA	95 <sup>th</sup> Street
BC-107	30	114	NA	107 <sup>th</sup> Street
BC-Ken	27	89	NA	Kenosha Rd.
BC-bCC	30	230	45%	Below Coal Creek
BC-CNTYLN	8	233	46%	At County Line (Division); 2004-2014
<b>Coal Creek</b>				
Superior	15	163	23%	Hwy 36 South of Bridge
1A	15	413	70%	Hwy 36 North of Bridge
2A	16	66	NA	Dillon Rd. at Foot Bridge
3A	16	112	NA	Andrews St.
4A	16	221	43%	Foot Bridge-Golf Course
5A	15	188	33%	Augusta Ln
6A	11	26	NA	Near Dutch Creek
10A	16	149	16%	96th Street
11A	15	107	NA	Footbridge Hwy 42
12A	16	232	46%	Above May Hoffer Spring
1-CC	7	898	86%	Above Louisville WWTP; (If 2004-014, 75% Reduction).
2-CC	7	435	71%	Below Louisville WWTP; (If 2004-2014, 62% Reduction)
3-CC	17	213	41%	Above Confl. with Rock Creek
6-CC	17	395	68%	Above Lafayette WWTP
7-CC	17	443	72%	Below Lafayette WWTP
CC-Ken	30	380	67%	Coal Creek above Confl. with Boulder Creek (at Kenosha Rd.)
<b>Rock Creek</b>				
5-RC	17	486	74%	Above Confl. with Coal Creek

Note: For South Boulder Creek, no load reductions are needed. For Coal Creek, drainage/outfall sample locations are not shown. Site 1-CC is also elevated during the winter (Geometric mean = 167 MPN/100 mL).

**Table 6. Estimated Instream *E. coli* Reductions Needed to Meet Primary Contact Recreation Standard for St. Vrain Watershed Segments**

Sample Location	n =	Rec. Geomean (2010-2014)	% Reduction Needed During Rec. Season	Note
<b>St. Vrain</b>				
M9.5-SV	4	170	26%	Western edge of urban area
M8.9-SV	22	378	67%	Near Golden Ponds
M8.4-SV	21	189	33%	Boston Ave.
M8.2-SV	21	276	54%	Pratt Parkway
M8-SV	29	161	22%	Above Left Hand Creek & WWTP Effluent
M7-SV	6	150	16%	Below Longmont WWTP
M6-SV	25	191	34%	@ 119
M4-SV	18	385	67%	Above Confluence with Boulder Creek
<b>Left Hand Creek</b>				
T11-LH	28	242	48%	Enters St. Vrain Creek between M8-SV and Longmont WWTP
<b>Dry Crk</b>				
Dry Crk	28	517	75%	Enters St. Vrain Creek between M8.2-SV and M8-SV

### 3.2 GROUNDWATER

Groundwater monitoring was not conducted for this project.

### 3.3 STREAM PHYSICAL/BIOLOGICAL MONITORING OTHER MONITORING

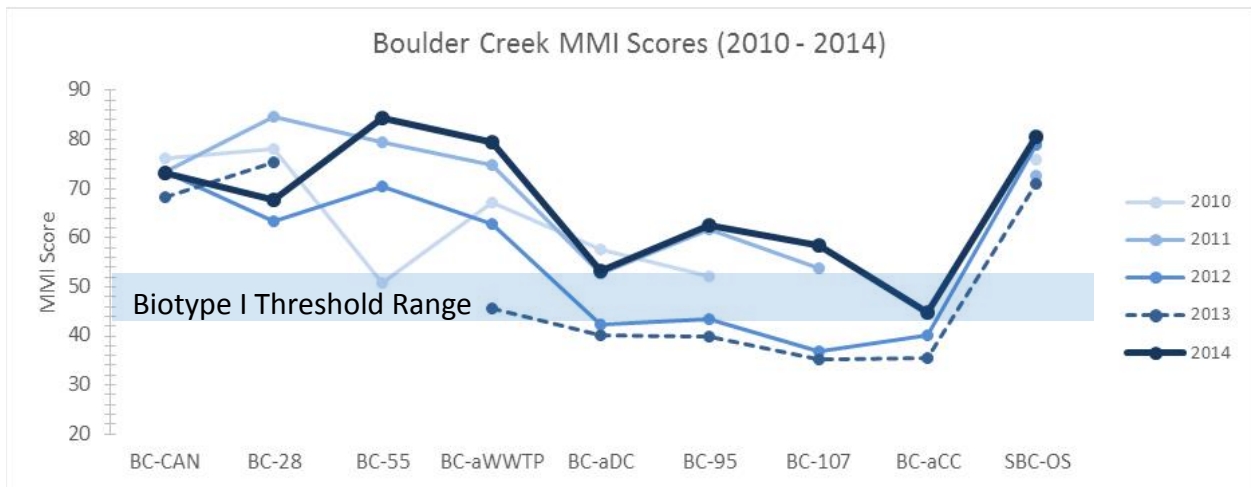
On behalf of local governments in the watershed, Timberline Aquatics conducts biological monitoring of Boulder Creek and South Boulder Creek, Coal Creek and Rock Creek and St. Vrain Creek and Left Hand Creek. This voluntary monitoring program is conducted using comparable methods for all of the streams, which are described in the individual biological monitoring reports for each basin. Monitoring locations are shown on Figure C-1 in the appendix to this report. The Plan highlights key findings from the latest report for each stream, focusing primarily on comparison of the multi-metric index (MMI) scores to thresholds for various biotypes defined in *Policy 10-1, Aquatic Life Use Attainment, Methodology to Determine Use Attainment for Rivers and Streams* (WQCD 2010). Policy 10-1 should be referenced for more detailed guidance on the interpretation of MMI scores. Based on biological monitoring results



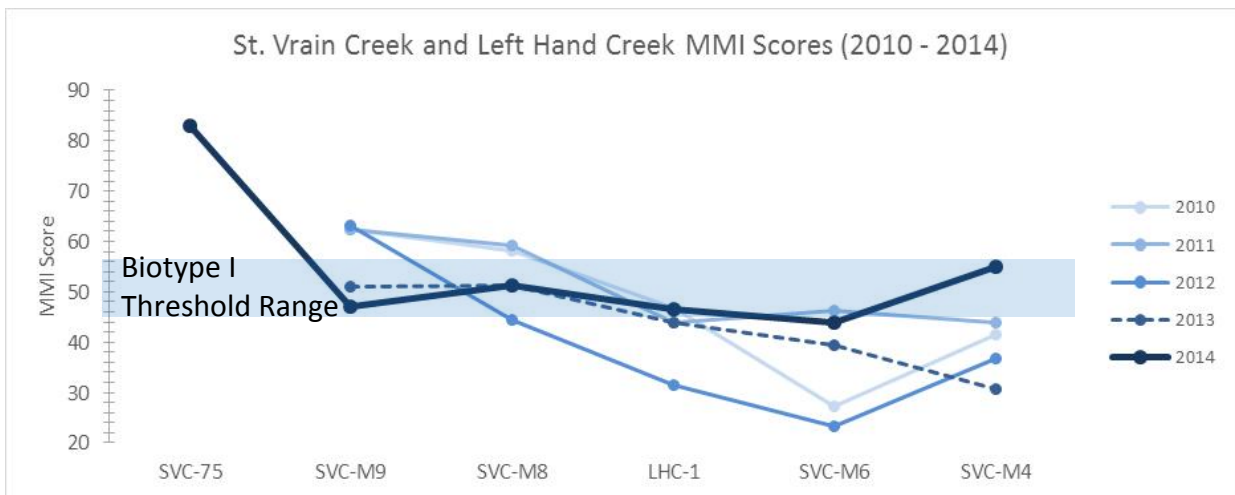
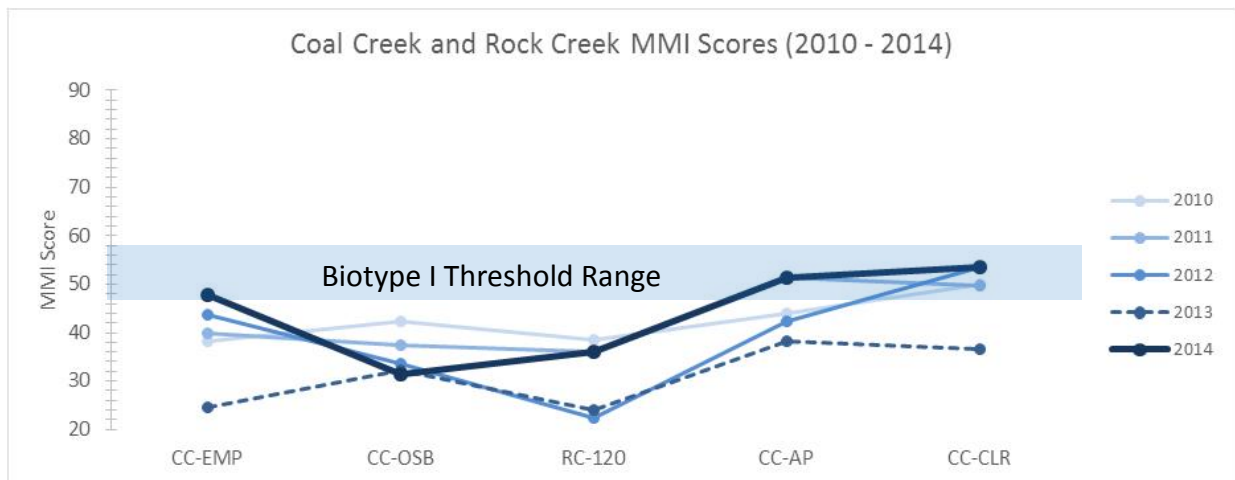
for 2014, portions of Coal Creek, Rock Creek, St. Vrain Creek and Left Hand Creek would be identified as impaired for aquatic life. One location on Boulder Creek above Coal Creek may also be impaired for aquatic life, depending on the biotype assumptions used in the analysis. As biological monitoring of these stream segments continues into the future, evaluation of the causes of poor MMI scores should continue to be evaluated to determine if these are due to water quality impacts, habitat limitations (e.g., flow conditions), or biotype classification (e.g., Biotype 1 vs. 3). Trends related to biological monitoring are summarized for each stream in the Figure 2a-c below, with higher scores representing better aquatic life conditions. See the Plan for additional discussion of findings.

Flow data at multiple locations on the streams in the watershed were also downloaded from the USGS and Colorado Division of Water Resources websites. Flow data are summarized in Appendix B of the Plan, but are not included in this final report.

**Figure 2-a-c. MMI Scores for Streams in St. Vrain Basin (2010-2014)**



\*Does not show the "0" MMI score for BC-55 following the September 2013 flood.



### 3.4 QUALITY ASSURANCE REPORTING

Water quality sampling was not funded using Nonpoint Source funds, so quality assurance reporting is not provided in this report.

Voluntary instream monitoring being funded by stakeholders includes quality assurance provisions as described in the Monitoring Plan.

### 3.5 PUBLIC INVOLVEMENT AND COORDINATION

During development of this Plan, primary outreach activities focused on intergovernmental communication and cooperation to develop the Plan through a series of meetings, supplemented by small group meetings on specific topics. Table 7 summarizes meetings supporting development of this Plan. Other outreach activities have included increasing interdepartmental communication within local governments (e.g., parks and open space, wastewater, stormwater). In January 2015, the Boulder County Consortium of Cities Water Stewardship Initiative hosted a workshop where progress on the Plan was shared with a larger group of stakeholders. Watershed-related information is also being shared through a new watershed page on the KICP website (see <http://www.keepitcleanpartnership.org/watershed/>).

**Table 7. Major Meetings Supporting Development of the Watershed-Based Plan**

Date	Topic	Location
11/21/2013	Kick-off Boulder Creek Portion of Plan	75 <sup>th</sup> Street WWTP, Boulder, CO
7/8/2014	Review of Draft Monitoring Plan with Keep It Clean Partners	75 <sup>th</sup> Street WWTP, Boulder, CO
7/22/2014	Agricultural Stakeholder Input and Information Sharing on BMPs/Stream Protection	75 <sup>th</sup> Street WWTP, Boulder, CO
8/12/2014	Monitoring Plan Wrap Up and Watershed-Based Plan Progress (Boulder Creek)	75 <sup>th</sup> Street WWTP, Boulder, CO
1/21/2015	Overview of Watershed-Based Plan Effort: Boulder County Consortium of Cities Water Stewardship Initiative (attendance >150 people)	Conference Center, Longmont, CO
2/12/2015	Kick-off St. Vrain Portion of Watershed-Based Plan	Training Center, Longmont, CO
5/28/2015	2014 Data Analysis from Monitoring Plan Developed under Watershed-Based Plan (in-kind) and Update on 319 Plan Progress	Training Center, Longmont, CO
8/4/2015	Review of Draft Watershed-Based Plan	75 <sup>th</sup> Street WWTP, Boulder, CO

Note: additional small group meetings have also been held, but Table 7 summarizes the primary outreach meetings.

### **3.5.1 STATE AGENCIES**

The Colorado Water Quality Control Division Nonpoint Source Project Manager provided input on the Plan and attended the project kick-off meeting. Additionally, interviews were also conducted with staff at the Colorado State University Extension - Boulder County. Their input was particularly relevant to small acreages for grazing management, weed control and other topics. The Colorado Parks and Wildlife provided information and data related to a “Data Swap” that had occurred among watershed stakeholders prior to the project.

### **3.5.2 FEDERAL AGENCIES**

The primary federal agency providing input on the Plan is the U.S. Geological Survey (USGS). The USGS has played a key role in supporting characterization of the St. Vrain Basin, as well as in conducting cutting-edge studies such as microbial source tracking in Boulder Creek. Previous work by the USGS was referenced throughout the Plan and USGS scientist Sheila Murphy also provided input on the Plan at various stages of the project.

The other federal agency that provided support was the USDA NRCS (Longmont Field Office - Boulder County). Although the NRCS did not participate in stakeholder meetings, they provided input related to agricultural BMPs via phone interviews. The NRCS provides a variety of technical and financial assistance for agricultural landowners and managers in the watershed.

Although the primary focus of the Plan was within municipal and county boundaries in the more populated portion of the watershed, the upper portion of the watershed in the mountains also includes land managed by the U.S. Forest Service (USFS). Due to the potential for wildfire in the upper watershed, the USFS is another federal agency important to the long-term health of the watershed. A portion of the upper watershed also includes some land in Rocky Mountain National Park, managed the National Park Service.

### **3.5.3 LOCAL GOVERNMENTS; INDUSTRY, ENVIRONMENTAL, AND OTHER GROUPS; AND PUBLIC-AT-LARGE**

Most of the partners for development of this Plan are members of the KICP, which is a group of communities located along the Colorado Front Range dedicated to protecting water quality and reducing stormwater pollution. The partnership includes Boulder, Erie, Lafayette, Longmont, Louisville, Superior, and Boulder County. The KICP already has an outreach framework in place, including a maintained website (<http://www.keepitcleanpartnership.org/>).

Other watershed groups active in the St. Vrain portion of the watershed include the James Creek Watershed Initiative (JCWI) and the Left Hand Watershed Oversight Group (LWOG). The partners also reached out to the Left Hand Ditch Company, Denver Water (due to Gross Reservoir) and Xcel Energy (discharges to St. Vrain Creek near the confluence with the South Platte).

The Left Hand Watershed Oversight Group is a citizen-based nonprofit group working with residents and partners to improve water quality, watershed health, and watershed awareness along Left Hand, James, and Little James Creeks in Boulder County, Colorado. Key funding sources for Left Hand Watershed Oversight Group include the Left Hand Water District and Boulder County.

### **3.5.4 OTHER SOURCES OF FUNDS**

Boulder County provided \$25,000 in funding to support the project. Additionally, in-kind contributions from stakeholders in the form of project management (City of Boulder and KICP), meeting attendance by stakeholders, review of deliverables by stakeholders, compilation and retrieval of existing data and GIS files, independently funded data analysis integrated into the Plan, and other project related activities totaled approximately \$60,010. In-kind match has been documented during the course of the project as part of invoice submittals and progress reports to the Division. The cumulative in-kind match totals \$85,010.

### **4.0 ASPECTS OF THE PROJECT THAT DID NOT WORK WELL**

There were two significant challenges associated with this project. The first was the September 2013 flood, which caused widespread damage throughout Boulder County and placed a significant burden on participating communities, both financially and with regard to staff time constraints. The second challenge was maintaining project momentum between the first and second phases of 319 funding, which put the project on hold for several months. Despite these two challenges, the project participants believe that the goals and objectives of the project were accomplished.

### **5.0 FUTURE ACTIVITY RECOMMENDATIONS**

Given the size of the watershed and the breadth of water quality issues that this Plan could potentially address, the primary focus of the implementation elements for this Plan is *E. coli*, since it is the most common water quality impairment in the overall watershed and is considered a high priority on the 303(d) List. Nonetheless, best management practices (BMPs) that reduce *E. coli* may also help to reduce nutrient loading and improve aquatic life conditions.

The on-going monitoring program adopted by the KICP as part of this Plan will be a key tool to refine the understanding of pollutant sources, trends and effectiveness of BMPs in the future. This information can be used to refine updates of this Plan. The KICP's goal is to provide a forum to facilitate minor updates to this Plan on a five-year cycle, with major updates at ten-year intervals.

From the information provided the Plan, a summary of key elements and associated costs based on this Plan includes:

#### Near Term (Beginning year 1 and on-going):

- Baseline Annual Funding for Outreach and Education: \$100,000.

- Baseline Annual Water Quality Report: \$20,000 to 30,000.

Mid-Term (2-5 years):

- Enhanced Monitoring for Metals in Left Hand Watershed: \$61,300.
- Enhanced Monitoring for *E. coli*: \$10,000 to 50,000 per targeted segment, depending on type and extent of effort.
- 5-year Review and Update Watershed-Based Plan: \$20,000 to 30,000.

Long-Term BMP implementation (Extending 20 years or longer)

- Estimated Cost Range per Square Mile of *E. coli* Reduction in Urban Areas: \$1 to 8 million/square mile of targeted area, with improvements phased at \$500,000 to \$1,000,000/year.
- Estimated Cost Range per Square Mile of *E. coli* Reduction in Agricultural Areas: Cost varies per square mile of targeted area, with improvements phased at \$25,000 to \$100,000/year.

Monitoring is a key component of this Plan at all stages of the Plan. Monitoring components include:

- Baseline coordinated monitoring program.
- Enhanced monitoring to refine understanding of pollutant sources (described above).
- Monitoring to evaluate success of implemented BMPs—although the baseline monitoring program can be used to evaluate success in terms of attainment of stream standards, which is the ultimate metric to determine whether designated beneficial uses are being attained, additional monitoring of specific practices will also be useful for determining which practices provide the greatest benefit per cost.

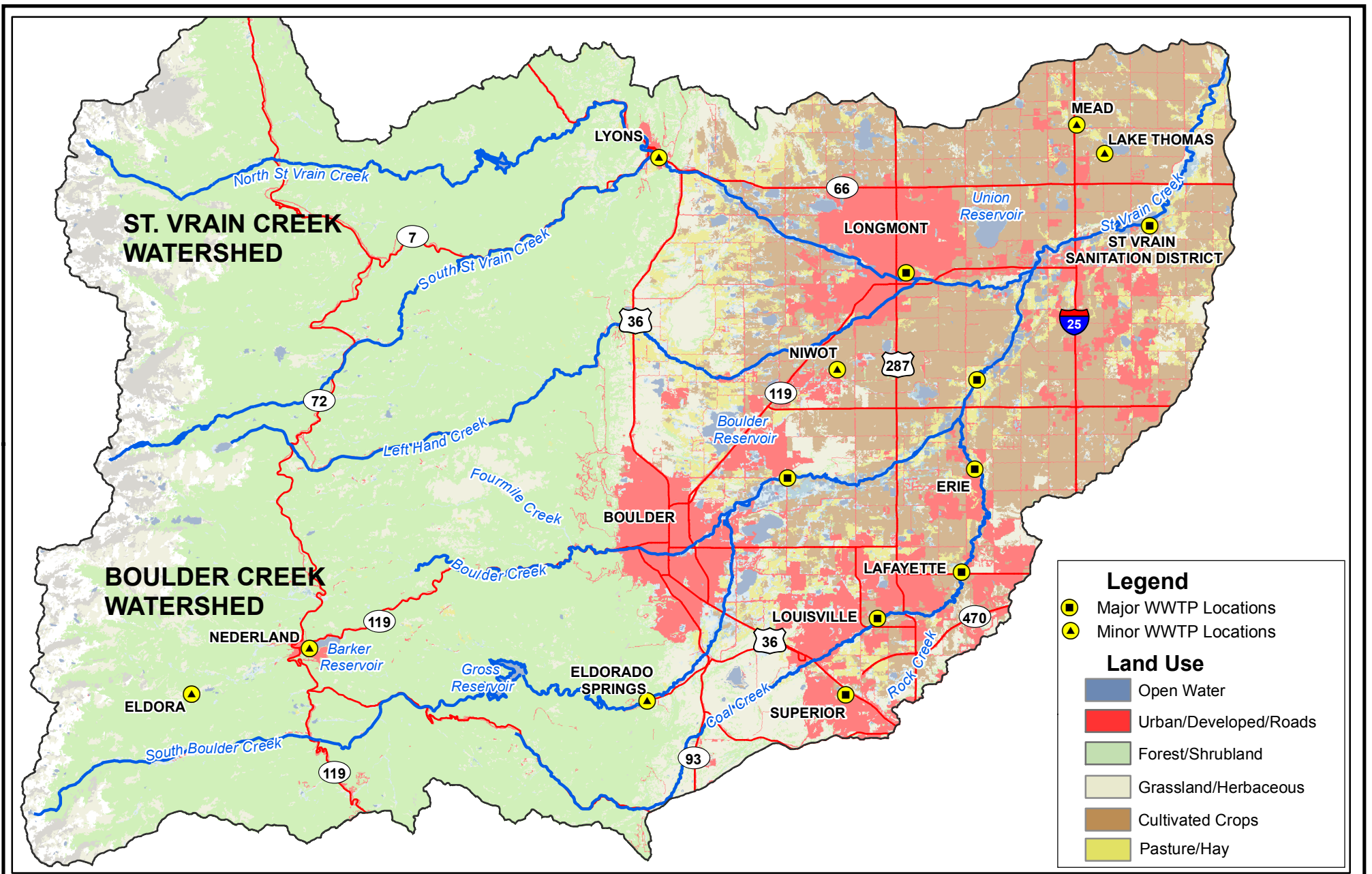
Implementation of each of these activities is dependent upon available funding. At the time that this report was completed, near-term funding had been secured, but not interim or long-term funding.

**6.0 LITERATURE CITED**

See the reference list in the Plan for a 10-page list of over 120 references used to support development of the Plan. These references included documents specific to the St. Vrain Watershed, as well as literature sources related to BMP performance for various practices and pollutants. One of the key benefits of the Plan was to compile and synthesize the many planning documents and water quality related efforts in the watershed.

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Appendix  
(Selected Maps from Plan)



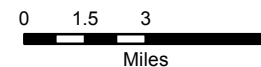
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Base Map: National Land Cover Dataset



WRIGHT WATER ENGINEERS, INC.  
2490 W 26TH AVE 100A  
DENVER, CO. 80211  
(303) 480-1700

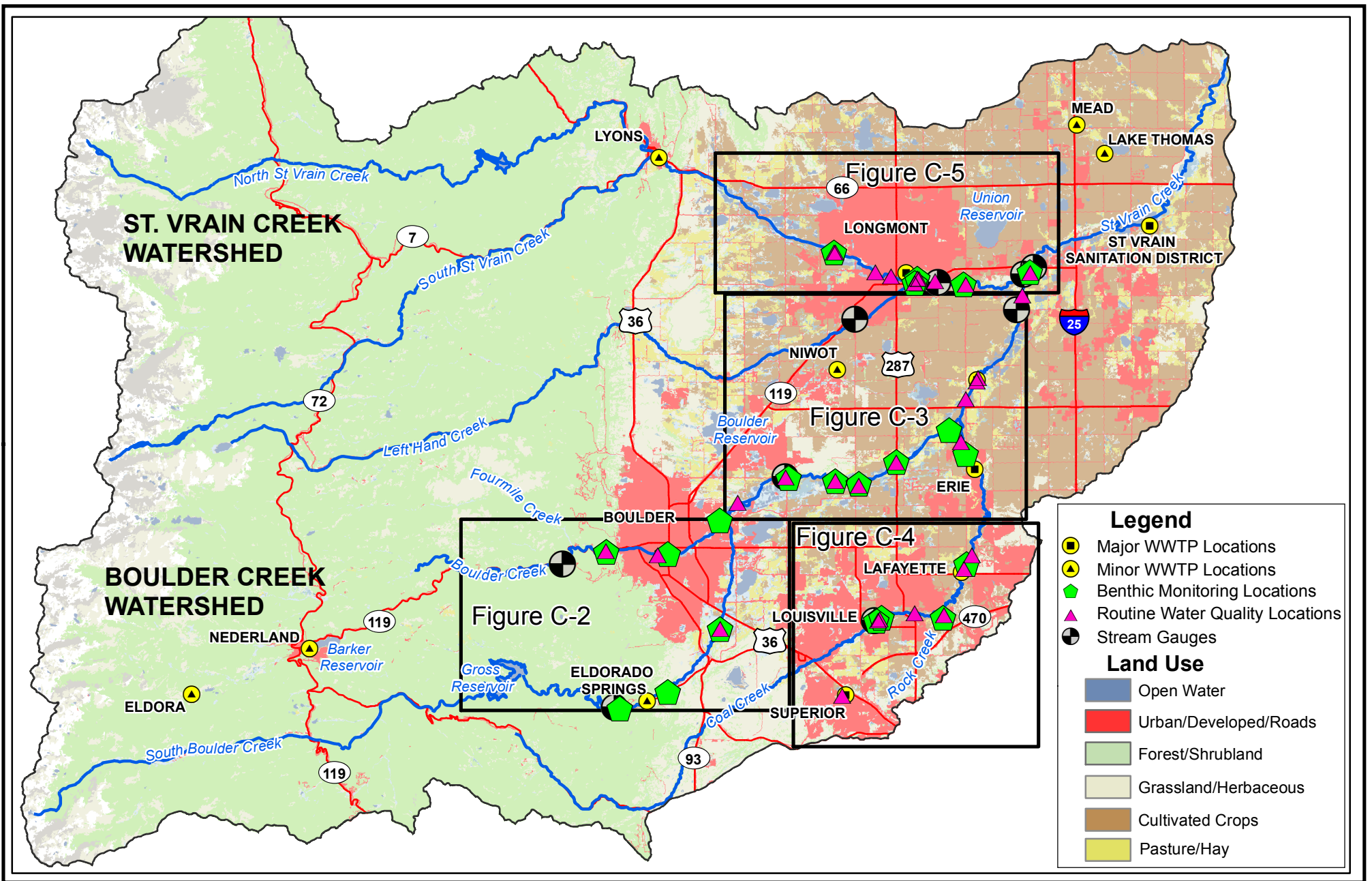
# ST. VRAIN BASIN OVERVIEW MAP



PROJECT NO.  
121-002.010

FIGURE  
A-1





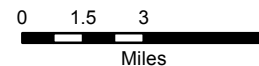
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Base Map: National Land Cover Dataset



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# ST. VRAIN-BOULDER WATERSHED JOINT MONITORING PLAN LOCATIONS



PROJECT NO.  
121-002.010

FIGURE  
C-1