CACHE LA POUDRE RIVER WATERSHED IMPLEMENTATION PLAN

DRAFT REPORT RSI-3521

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LIST OF ABBREVIATIONS

µg/L	micrograms per liter
ACEP	Agricultural Conservation Easement Program
AFA	Alternative Funding Arrangement
AFO	animal feeding operation
AFP	Announcement for Funding Proposals
AML	abandoned mine land
AWEP	Agricultural Water Enhancement Program
BMP	best management practice
BMPDB	Best Management Practices Database
CAFO	concentrated animal feed operation
CASTNET	Clean Air Status and Trends Network
CAWA	Colorado Ag Water Alliance
CCR	Code of Colorado Regulation
CDPHE	Colorado Department of Public Health and Environment
cfu/head/day	colony-forming units per head per day
CIG	Conservation Innovation Grants
CPPE	Conservation Practice Physical Effects
CPRW	Coalition for the Poudre River Watershed
CPS	Conservation Practice Standard
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program
CSU	Colorado State University
CTA	Conservation Technical Assistance
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
CWSRF	Clean Water State Revolving Fund
DRUM	Defense-Related Uranium Mine
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESRI	Environmental Systems Research Institute, Inc.
EWP	Emergency Watershed Protection Program
FEMA	Federal Emergency Management Agency
FRPP	Farm and Ranch Lands Protection Program
GRP	Grass Reserve Program
HUC	Hydrologic Unit Code
lb/year	pounds per year
LID	Low Impact Development
mg/L	milligrams per liter
mi^2	square miles
MIDS	Minimal Impact Design Standards
mL	milliliter
mpn	most probable number

LIST OF ABBREVIATIONS (CONTINUED)

MS4	Municipal Separate Storm Sewer System
NADP	National Atmospheric Deposition Program
NLCD	National Land Cover Dataset
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
OWTS	Onsite Wastewater Treatment System
PEPO	Public Education, Participation, and Outreach
PFAS	per- and polyfluoroalkyl substances
PLET	Pollutant Load Estimation Tool
RCD	Resource Conservation and Development
RCPP	Regional Conservation Partnership Program
SSURGO	Soil Survey Geographic Database
SWAP	Source Water Assessment and Protection
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load
TSS	total suspended solids
US	United States
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WFPO	Watershed Protection and Flood Prevention Operations
WHIP	Wildlife Habitat Incentive Program
WHRB	Watershed Rehabilitation
WQ	water quality
WRP	Wetlands Reserve Program
WRSF	Water Supply Reserve Funds
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

The primary purpose of this implementation plan is to recommend best management practices (BMPs) that would reduce pollutants of concern within the Cache la Poudre River Watershed (Hydrologic Unit Code [HUC] 10190007) from nonpoint sources (NPSs). Although this implementation plan is a stand-alone NPS plan, water planning should be done in a holistic manner, with teamwork between point and NPSs of pollution. Pollution reductions from NPSs upstream of point sources reduce the strain on the point sources. Municipal, industrial, and agricultural entities working together toward the shared goal of protecting waterbodies before they become impaired will reduce future regulations on these entities.

The implementation plan is based on an adaptive approach that emphasizes making continued progress toward achieving milestones and load reduction by identifying the most impactful implementation measures for priority areas. This implementation plan summarizes past conservation accomplishments and recommends implementation actions that can assist residents, landowners, and stakeholders in the project area to improve water quality. Private, local, state, and federal partnership efforts should continue to support and promote the implementation of management measures while additional water quality monitoring is conducted to guide watershed plan revisions and assess adaptive implementation activities.

The implementation plan builds on past conservation accomplishments in the project area and compliments water quality efforts by the following organizations, as well as the local communities:

- Boxelder Sanitation District
- Carestream
- City of Fort Collins
- City of Greeley
- Coalition for the Poudre River Watershed (CPRW)
- Colorado Ag Water Alliance (CAWA)
- Colorado Department of Public Health and Environment (CDPHE)
- Colorado Livestock Association
- Colorado Parks & Wildlife
- Colorado Rural Water Association
- Colorado State University (CSU)
- Colorado Watershed Assembly
- Colorado Wheat Administrative Committee
- Davies Mobile Home Park
- Drala Mountain Center
- Ducks Unlimited
- Eaton
- Fox Acres

- FPAC-NRCS, CO
- Fresh Water Trust
- JBS Greeley Beef Plant
- Larimer County
- Peaks to People Water Fund
- Poudre Heritage Alliance
- South Fort Collins Sanitation District
- South Platte Basin Round Table
- Town of Timnath
- Town of Ault
- Town of Severance
- Town of Timnath
- Town of Wellington
- Town of Windsor
- Trout Unlimited
- Water Quality Trading in the Cache la Poudre with Fort Collins
- Weld County
- Xcel Energy

This implementation plan also incorporates the strategies, goals, and objectives of CDPHE's *Colorado's Nonpoint Source Management Plan: 2022* and addresses the U.S. Environmental Protection Agency's (EPA's) nine key elements outlined in the management plan [CDPHE, 2022]. Table 1-1 describes these nine key elements and their corresponding locations within this implementation plan [EPA, 2008].

This implementation plan is not intended to identify which specific BMPs or remediation actions should be included in certain discharge permits, ordinances, stormwater pollution prevention plans (SWPPPs), or conservation plans. Rather, the plan provides an adaptive implementation approach with suggested structural and nonstructural BMPs necessary to address the NPSs of pollutants of concern. For the purposes of this implementation plan, BMPs refer to structural and nonstructural actions or measures installed or implemented to reduce the delivery of sediment and nutrients to waterbodies in the project area. Sources of available funding and technical assistance for and associated estimated costs of these BMPs are included to provide landowners, residents, stakeholders, community leaders, and public agencies perspectives on the technical and economic demands of this watershed plan.

Essential to the development of this implementation plan is ascertaining and collecting feedback and input from a cross section of stakeholders including cities, counties, sanitation districts, towns, watershed organizations, and others who will identify, fund, and prioritize projects to implement these practices and BMPs. As a part of this project, two surveys were sent to stakeholders. Results of the surveys are found throughout the report and in more detail in Chapter 10.0, Information, Education, and Outreach.

- Survey #1, in 2022, was more general and included questions related to pollutants, issues, and areas of concern.
- Survey #2, in 2024, was more specific and included questions regarding past and current planning, use of technical and financial assistance, and ideal BMPs.

Survey #1 was distributed to 96 organizations in 2022. The purpose of this survey was to better understand concerns, issues, and resources and the stakeholders' priorities. Building on the conclusions from this survey was the impetus for helping to develop a nine key elements plan.

Survey #2 was distributed to 48 organizations in March 2024 asking them to complete the following items:

- Characterize their existing watershed projects and sources of pollution
- Rank cropland, urban, pastureland, feedlot, and forest BMPs
- Identify benefits and impacts of existing BMPs
- Identify existing outreach and education efforts
- Identify technical and financial assistance needed and utilized

Table 1-2 lists the stakeholders who received each survey. Information derived from the surveys is included throughout the report, and responses are an integral part of this project. Survey questions are included in Appendix A.

To help promote the novel regional watershed plan, the project team participated in the annual American Water Resources Association – Colorado Groundwater Association Conference. The team discussed the project objectives, watershed characteristics, nine key elements, and outreach efforts.

Table 1-1. Sections of the Implementation Plan That Fulfill the U.S. Environmental Protection Agency's Nine Key Elements for Watershed Planning

EPA Element Number	EPA's Nine Key Elements Plan	Applicable Section of Implementation Plan
1	Identify the causes and sources of pollution that need to be controlled to achieve load reductions and other goals (e.g., recreational, economic, ecological) identified in the plan.	5.0 Source Assessment 6.0 Priority Areas for Implementation
2	Estimate load reductions expected from the action strategy identified.	6.0 Priority Areas for Implementation 7.0 Best Management Practices Load Reductions
3	Describe NPS management measures, including operation/maintenance requirements, and targeted critical areas (i.e., action strategy) needed to achieve identified load reductions.	6.0 Priority Areas for Implementation 7.0 Best Management Practices Load Reductions 8.0 Past and Current Best Management Practices 9.0 Recommended Best Management Practices
4	Estimate technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the watershed-based plan.	13.0 Technical and Financial Assistance Sources
5	Develop an information and education component that will be used to enhance public understanding of the NPS management measures and encourage their early and continued participation in selecting, designing, and implementing the Action Strategy.	10.0 Information, Education, and Outreach
6	Develop a project schedule.	11.0 Criteria to Assess Progress
7	Describe interim, measurable milestones.	11.0 Criteria to Assess Progress
8	Identify a set of criteria to assess progress/effectiveness in achieving water quality standards or other appropriate end targets.	11.0 Criteria to Assess Progress
9	Develop a monitoring component to evaluate the effectiveness of the implementation efforts over time and measured against the criteria established to document load reductions.	12.0 Monitoring Best Management Practices Effectiveness

Table 1-2. Stakeholder Recipients of Two Surveys With Responses Represented by an "X" (Page 1 of 3)

Organization	Took Survey #1 (2022)	Took Survey #2 (2024)
Big Thompson Watershed Coalition		
Boxelder Sanitation District	X	
Brighton		
Brink Corp		
Carestream		
CDPHE		
City & County of Broomfield	X	
City of Dacono		
City of Evans	X	X

Table 1-2. Stakeholder Recipients of Two Surveys With Responses Represented by an "X" (Page 2 of 3)

Organization	Took Survey #1 (2022)	Took Survey #2 (2024)
City of Fort Collins		X
City of Fort Lupton	X	X
City of Greeley	X	X
City of Longmont	X	
City of Loveland	X	X
City of Northglenn		X
Coalition for the Poudre River Watershed		
Colorado Ag Water Alliance		
Colorado Livestock Association		
Colorado Parks & Wildlife		
Colorado Rural Water Association	X	
Colorado State University	X	
Colorado Watershed Assembly		X
Colorado Wheat Administrative Committee		X
Davies Mobile Home Park		X
Drala Mountain Center	X	
Ducks Unlimited		
Eaton		
Estes Park		
Estes Park Sanitation District	X	
Estes Valley Watershed Coalition	X	X
Fox Acres	X	
FPAC-NRCS, CO		
Fresh Water Trust	X	
Galeton Water & Sanitation District	X	
JBS Greeley Beef Plant		X
Keenesburg		
Larimer County		X
LaSalle		
Left Hand Water District	X	
Little Thompson Watershed Coalition		
Los Rios Farm		X
Metro Water Recovery	X	
Northern Colorado Water Conservancy District	X	X
Peaks to People Water Fund		X
Poudre Heritage Alliance		

Table 1-2. Stakeholder Recipients of Two Surveys With Responses Represented by an "X" (Page 3 of 3)

Organization	Took Survey #1 (2022)	Took Survey #2 (2024)
Resource Colorado Water & Sanitation Metro District		
RNC Consulting, LLC		X
South Fort Collins Sanitation District	X	X
South Platte Basin Round Table		
St. Vrain Creek & Boulder Creek Watershed		
St. Vrain Sanitation District	X	
Thompson School District		X
Timnath		
Town of Ault	X	
Town of Berthoud	X	X
Town of Erie	X	
Town of Estes Park		X
Town of Firestone		
Town of Frederick		
Town of Hudson	X	
Town of Johnston	X	
Town of Lochbuie	X	
Town of Mead	X	
Town of Milliken		
Town of Pierce	X	
Town Of Platteville		X
Town of Severance	X	
Town of Timnath		
Town of Wellington		X
Town of Windsor	X	
Trout Unlimited		
Upper Thompson Sanitation District	X	
Water Quality Trading in the Cache la Poudre w/Fort Collins		
WCDPHE	X	
Weld County	X	
Wright Water Engineers/Cherry Creek Basin Water Quality Authority		X
Xcel Energy		X

2.0 WATERSHED CHARACTERIZATION

For the purposes of this implementation plan, the project area is shown in Figure 2-1, which includes the area within Larimer and Weld Counties that intersect the Cache la Poudre River Watershed (HUC 10190007) in north-central Colorado. The Cache la Poudre River flows east to its confluence with the South Platte River. Ten HUC10 watersheds are in the Cache la Poudre HUC8: South Fork Cache la Poudre River (1019000701), Headwaters Cache la Poudre River (1019000702), Gordon Creek-Cache la Poudre River (1019000703), Dale Creek (1019000704), Upper North Fork Cache la Poudre River (1019000705), Lone Pine Creek (1019000706), Rabbit Creek-North Fork Cache la Poudre River (1019000707), Horsetooth Reservoir-Cache la Poudre River (1019000708), Boxelder Creek (1019000709), and City of Greeley-Cache la Poudre River (1019000710). Although the figures in this document show information within the HUC10 watersheds overlapping Larimer and Weld Counties, the tables summarize only information from the HUC10 watersheds within Larimer and Weld Counties. The total area of the HUCs is 1,209,008 acres, but within Larimer and Weld Counties, it encompasses only 1,128,817 acres according to GIS layer analysis. The watershed is a part of the Colorado-Big Thompson Project that delivers water from Grand Lake to the eastern slope through Adams Tunnel to supply water to the Front Range Tunnel [Hawley and Rodriguez-Jeangros, 2021].

A summary of the project area's land cover characteristics was completed using the 2019 National Land Cover Dataset (NLCD). The NLCD is a 16-category, multilayer land cover classification dataset derived from Landsat imagery and ancillary data for consistent land cover data for all 50 states. The land cover is depicted in Figure 2-2 [Multi-Resolution Land Characteristics Consortium, 2019]. In the project area (including the Municipal Separate Storm Sewer System [MS4s]), approximately 34 percent of the area is forest; 25 percent is herbaceous; 20 percent is scrub/shrub; 12 percent is cultivated crops; 3 percent is developed; and barren, pasture/hay, wetlands, and open water/ice each make up 2 percent or less. Fort Collins, Colorado, is the largest urban area in the watershed, with a 2020 census population of 169,810 and an area of approximately 57 square miles (mi^2) [U.S. Census Bureau, 2020]. Other populated areas in the watershed include Greeley (113,712 people, 49.0 mi^2, growing at 2.2 percent annually) and Severance (6,674 people, 8.7 mi^2, growing at 11.1 percent annually), and Timnath (4,549 people, 6.3 mi^2, growing at 62.3 percent annually). The watershed transitions from forest within higher elevations in the west to scrub/shrub/herbaceous within the mid-range elevations and crops within the lower elevations in the east. Fort Collins is located near the transition between the scrub/shrub/herbaceous and cropland areas. Most of the land is privately owned (90 percent) with 7 percent being federally owned and other ownership categories making up only 3 percent. This was calculated using a combination of public parcels [Colorado Geospatial Portal, 2024] and from the Environmental Systems Research Institute, Inc.'s (ESRI's) data portal for USA Federal Lands [ESRI, 2014].

As indicated in Figure 2-3, precipitation varies throughout the project area. Typical annual precipitation is between 52 inches in the lower, western part of the watershed to 12 inches per year in the lower, eastern portion [PRISM Climate Group, 2024]. Maximum monthly average precipitation generally occurs in the summer months. However, the largest flows typically occur from winter snowmelt in the spring. According to the Cache la Poudre Watershed-Based Plan from April 2020, "50-90% of stream water in the Poudre River comes from snowmelt"; however, drought is still common. Three different types of snow zones contribute to precipitation: persistent, transitional, and intermittent. The persistent zone has consistent snow cover during winter months and at high elevations, even for warmer months. The snow from this zone is the primary source of water to downstream cities and farms. The transitional zone has a higher temperature and less precipitation, where snow at these lower elevations does not stay on the ground long. The intermittent snow zone occurs at even lower elevations mainly in foothill areas, so snow accumulation and persistence are highly variable. According to CPRW, “Approximately seventy-five percent of annual precipitation occurs from mid-April through late September” [CPRW, 2020]. During a typical year, approximately 1,225,000 acre-feet are used for irrigation in the South Platte Basin [Colorado Water Plan, 2015]. In 2013, extensive flooding along the Front Range caused significant damage. The flood led to restoration work and continues to cause sediment movement.

The bedrock geology of the project area is displayed in Figure 2-4 [Horton et al., 2017]. In the Cache la Poudre River HUC8, the mountainous portions consist mostly of intrusive igneous and undifferentiated metamorphic material, and the transitional area consists mostly of undifferentiated sedimentary and clastic sedimentary material. The lower, agricultural area consists of clastic sedimentary and undifferentiated unconsolidated material. The South Platte River originates in the mountains of central Colorado at the Continental Divide and flows approximately 450 miles northeast across the Great Plains to its confluence with the North Platte River at North Platte, Nebraska. The basin includes two physiographic provinces: the Front Range Section of the Southern Rocky Mountain Province and the Colorado Piedmont Section of the Great Plains Province [U.S. Geological Survey Colorado Water Science Center, 2000].

Hydrologic soil groups can significantly impact the amount of water that infiltrates or runs off during precipitation events. Type A soils are generally sand or sandy loams with high infiltration rates; B soils are silt loam or loam soils with moderate rates; C soils are generally sandy, clay loams with low infiltration rates; and D soils are heavy soils, clay loams, silty, clay soils with low infiltration rates. The project area comprises 14 percent A, 21 percent B, 28 percent C, and 37 percent D soil types. Figure 2-5 shows the distribution of hydrologic soil groups in the watershed using the Soil Survey Geographic Database (SSURGO) [NRCS, 2024a].

Survey #2 inquired about what concerns stakeholders had with the watershed, including issues related to wastewater discharges and MS4 areas. Specifically relating to the Cache la Poudre River HUC8, stakeholders mentioned various concerns for both point sources and NPSs. The City of Fort Collins mentioned they are concerned with unpermitted industries and construction projects, urban corrals (i.e., private property with animals and manure) through which a creek flows, community-supported agriculture that discharges stormwater runoff, dog daycare discharge runoff with pet waste, horse manure along river trails, and raccoon populations. The City of Greeley specified concerns with permits of industrial users who discharge into their MS4 as well as *E. coli* and nutrients within water bodies that cause eutrophication and other algae problems.

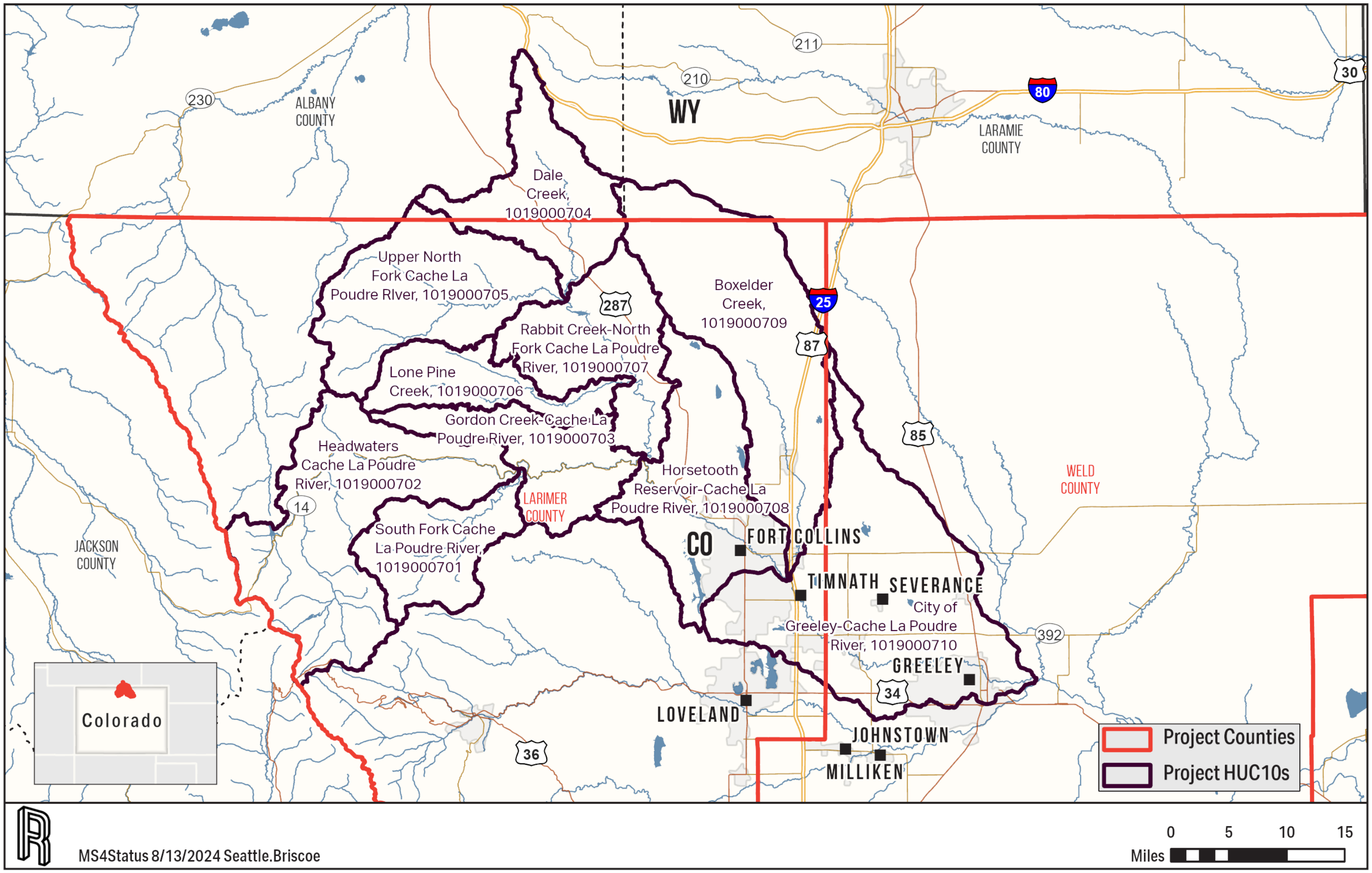

Figure 2-1. Cache la Poudre River HUC8 Project Area.

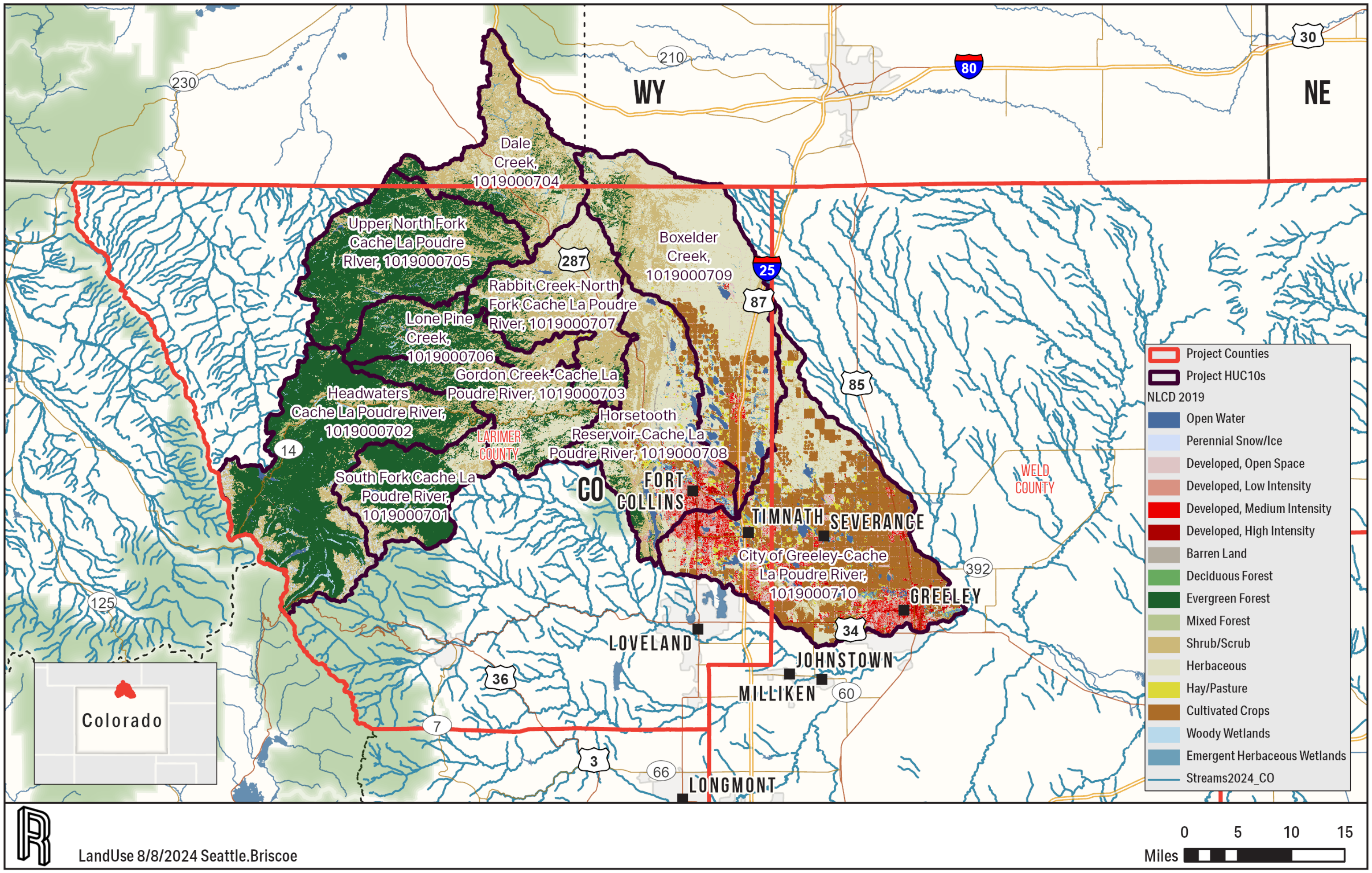

Figure 2-2. National Land Cover Dataset 2019 Land Use.

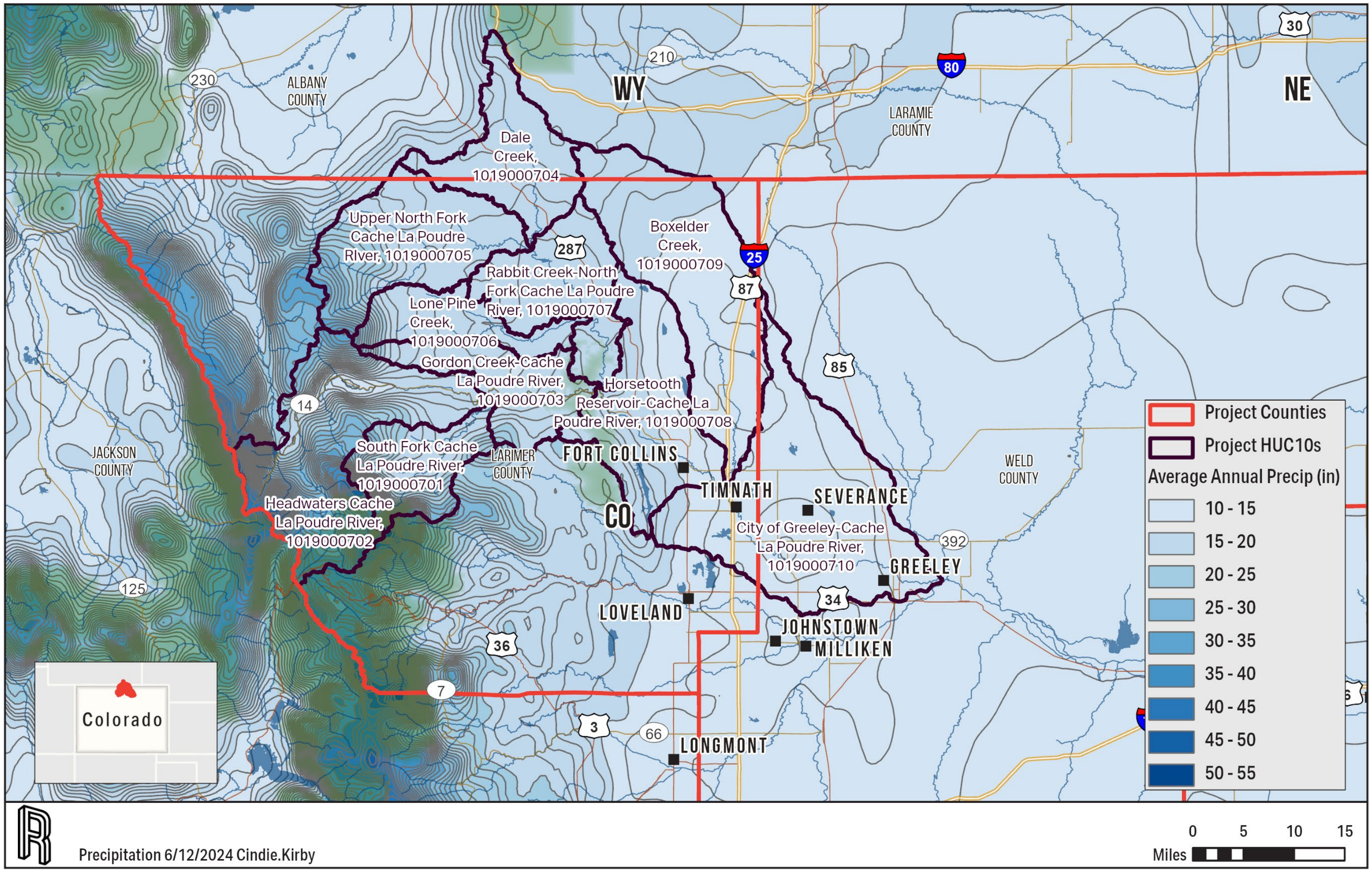

Figure 2-3. Average Annual Precipitation (1981 to 2010).

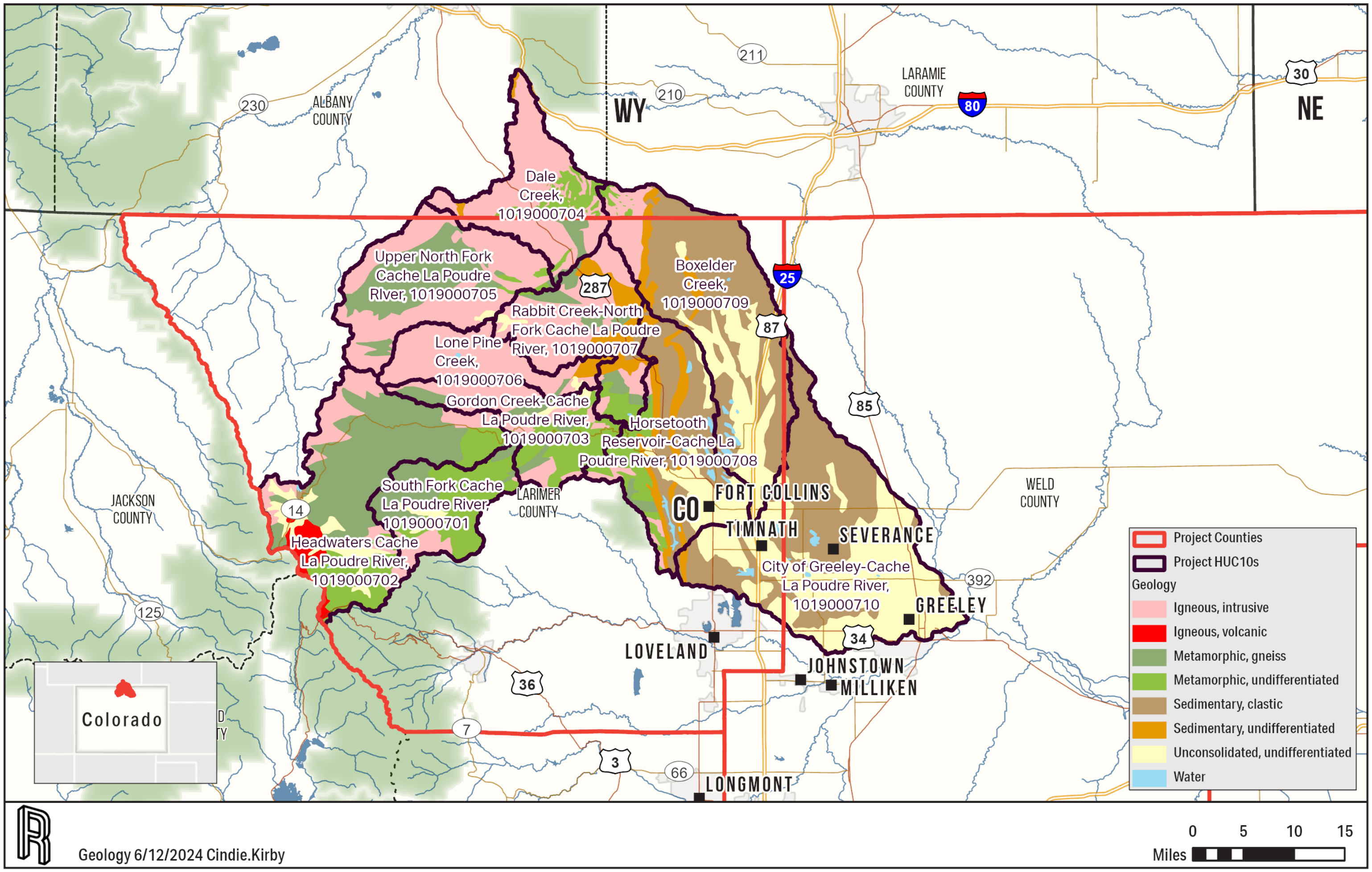

Figure 2-4. Geology.

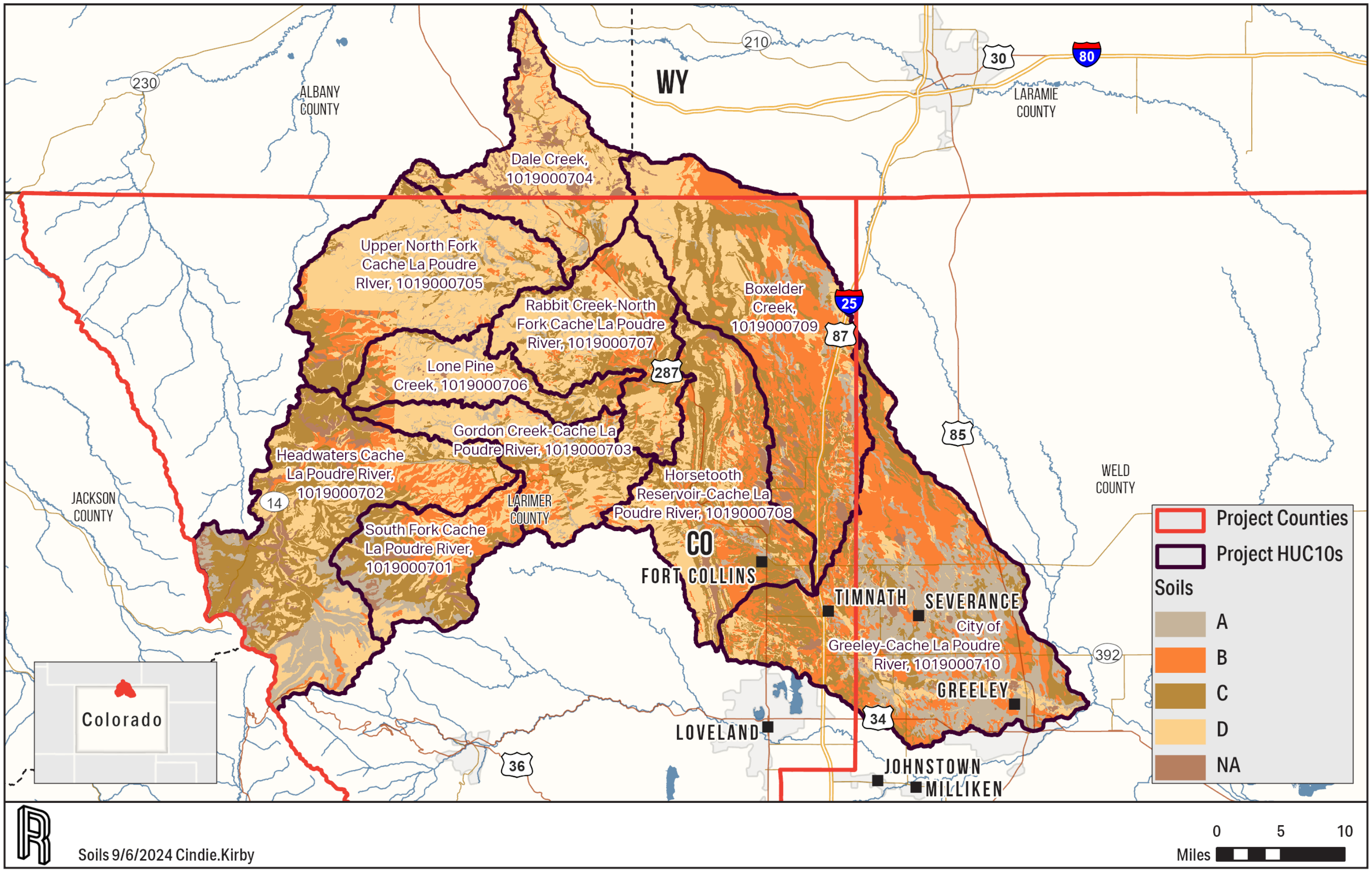

Figure 2-5. Hydrologic Soil Group.

3.0 EXISTING WATERSHED PLANS AND PROJECTS

Many conservation accomplishments have been achieved within the project area, which can be attributed to the local planning and implementation efforts of the community, state, and federal partners. Projects outlined on the CPRW website are listed in Table 3-1. More information about work done in the Cache la Poudre Watershed is available on the CPRW All CPRW Projects webpage. Table 3-2 shows links to planning projects [CPRW, 2024].

Table 3-1. Watershed Planning and Major Projects in the Cache la Poudre River HUC8

Project Type	Name	Year Completed
Planning	Upper Poudre Watershed Resilience Plan	2024
Planning	Lower Poudre Watershed Resilience Plan	2017
River	Godfrey Ditch Restoration Project	2021
River	Whitney and B.H. Eaton Ditch Restoration Project	Ongoing
River	"Reach 13" Phase 2 Design Project	Ongoing
River	Poudre River Downtown Project – Reach 3	2020
Forest	Swanson Ranch Forest Restoration	2023
Forest	W.O.L.F. Sanctuary Wildfire Mitigation Project	2023
Forest	Lazy D Ranch Forest Restoration	2024
Forest	Horsetooth Mountain Park	2018
Forest	Elkhorn Creek Forest Health Initiative	Ongoing
Forest	Lory State Park Forest Management	2019
Wildfire	Cameron Peak Post-Fire Restoration	2022
Wildfire	Skin Gulch Post-Fire Restoration	2016
Wildfire	Seaman Reservoir Delta Stabilization Project	2018
Wildfire	Unnamed Tributary 3	2019
Wildfire	2020 Post-Fire Restoration Lessons Learned	2020
Other	Green Ditch Rehabilitation and Fish Passage Project	2018
Other	Josh Ames Diversion Removal on Poudre River and North Sterling Pond Restoration	2013
Community Outreach	Poudre River Mural	2023

Table 3-2. Links to Cache la Poudre Planning Projects

Plan	Web Link
CPRW Strategic Plan 2023-2028	https://www.poudrewatershed.org/strategic-plan
Upper Poudre Watershed Resilience Plan	https://www.poudrewatershed.org/upper-watershed-resilience-plan
Lower Poudre Watershed Resilience Plan	https://www.poudrewatershed.org/lower-watershed-resilience-plan
High Park Post-Fire Prioritization Plan	https://www.poudrewatershed.org/high-park-post-fire-plan
Cache la Poudre River Non-Point Source 319 Watershed-Based Plan	https://static1.squarespace.com/static/5af07ab53917ee099d13c874/t/5eb1e67095ae0505f397957a/1588717186644/Final+CPRW+Watershed+Plan+-+April+2020.pdf
North Fork of the Cache la Poudre River Conservation Plan	https://drive.google.com/file/d/120udbAjb1wKxqxdYmgiRhhpAX_UOsdom/view

Numerous conservation measures have been completed and are currently being implemented within the project area. These projects have been made possible through CDPHE with EPA's Section 319 NPS implementation grants and CDPHE grants. Previous conservation efforts have occurred in the project area, and each project helped to improve water quality and make progress toward restoring and protecting local waterbodies. Tables 3-3 and 3-4 discuss these implementations within the project area [EPA, 2024a].

Table 3-3. Nonpoint Source Grants Implemented in the Cache la Poudre River HUC8

Conservation Projects	Grant Number	Completion Year	Pollution Category	Section 319 Expenditures ($)	Total Expenditures ($)	Project Accomplishments
Characterizing Bioaccumulation of Mercury In Sport Fish - Informing TMDL Development	99818610	2015	Other NPS Pollution	286,353	286,353	The project created a predictive model to manage mercury bioaccumulation in Colorado sport fish, incorporating biotic and abiotic data. The project assessed strategies to lower mercury levels and communicated results with stakeholder reports and presentations.
Tools to Address Agricultural Nutrient Nonpoint Source Contamination	99818612	2017	Agriculture	80,138	263,261	The project created a decision support tool and nutrient BMP clearinghouse to manage agricultural nutrient NPS pollution in Colorado, facilitating site-specific BMP assessments via GIS. Stakeholder acceptance was garnered through an advisory task force, and project outcomes were effectively communicated through reports and outreach efforts.
2012 Colorado Wildfires - Reclamation at the High Park Burn Area	99818613	2018	Other NPS Pollution	200,000	371,445	The project effectively addressed the impacts of the 2012 wildfires in the Poudre River subwatersheds through revegetation, erosion control, and sediment reduction activities. It collaborated with partners to implement BMPs, improved soil stability, promoted native vegetation, and conducted comprehensive monitoring of water quality and vegetation growth, with results accessible online.
Upper Cache la Poudre River Watershed Plan	99818615	2020	Other NPS Pollution; Resource Extraction	65,419	115,927	The project developed a comprehensive watershed plan for the Poudre River, incorporating stakeholder input and EPA's nine key elements of a Watershed Plan. It engaged key stakeholders and assessed existing conditions to create a strong foundation for future watershed health restoration activities.
Cameron Peak Fire Post-Wildfire Implementation in the Poudre River Watershed	99818621	2025	Other NPS Pollution	274,063	521,434	This project addresses post-wildfire water quality impacts in the South Platte Basin following the Cameron Peak Fire, using NPS BMPs to mitigate debris flows, runoff, sedimentation, and nutrient loading. Stakeholder input, Burned Area Emergency Response Reports, and predictive models guide the prioritization of subwatersheds for BMP implementation, supported by interagency coordination through the Larimer Recovery Collaborative.

Table 3-4. Other Nonpoint Source Projects (South Platte and/or Statewide)

Project Title	Project Sponsor	Basin	NPS Funding ($)	Match on 09/30/2022 ($)	Status on 09/30/2022 (MM/YYYY)
Little Thompson and St. Vrain Watershed Resilience Initiative	Colorado State University	South Platte	294,940	61,367	Expected Completion 03/2023
Water Quality, Soil Health and Regenerative Agriculture: A Nexus for Sustainability	Colorado State University	South Platte	306,518	68,010	Expected Completion 06/2024
Implementing Agricultural BMPs in a Colorado Soil Health Pilot Program	Colorado Department of Agriculture	Various	34,4894	286,427	Expected Completion 06/2025
Brush Wetland Demonstration Project	Ducks Unlimited	South Platte	80,000	18,167	Expected Completion 06/2025
Nutrient Management on Irrigated Pastures	Colorado Ag Water Alliance	Various	266,355	95,912	Expected Completion 01/2026

4.0 STANDARDS AND IMPAIRMENTS

Impairment locations throughout the project area are shown in Figure 4-1. Impaired stream segments and lakes in the project area are shown in Table 4-1, with impairments including heavy metals like arsenic, silver, iron, manganese, and selenium, and other water quality parameters such as macroinvertebrates, sediment, temperature, and *E. coli*. Selenium is measured in fish tissue, as a standard, and in water quality samples. Individual maps and box plots of each impaired parameter are included in Appendix B and Appendix C, respectively.

In Survey #1, local stakeholders noted their primary parameters of concern. Each parameter occurrence was counted, and the four parameters that appeared the most were nitrogen, phosphorus, total suspended solids (TSS), and *E. coli*. Others that showed up less than the most predominant parameters included temperature, emerging contaminants, metals, and per- and polyfluoroalkyl substances (PFAS). Emerging contaminants are the different types of chemicals (e.g., medication, personal care products, home cleaning products, lawn care products, and agricultural products, such as insecticides and herbicides) that end up in waterbodies but are not generally treated in wastewater facilities. PFAS and emerging contaminants of concern are not included in this report. Some emerging contaminants are treated by drinking water and/or wastewater facilities, but these chemicals are not well regulated or understood. A new EPA limit for PFAS of 4 parts per trillion was released in 2024 [EPA, 2024b].

Water quality standards for parameters of concern are based on beneficial-use tiers. More information on these standards and tiers, visit the CDPHE's Water Quality Control Commission's 5 Codes of Colorado Regulation (CCR) 1002-31 website, last updated June 14, 2023. Access the CDPHE's Water Quality Control Commission Regulation No. 38 website, last updated April 30, 2024, for information on Classifications and numeric standards for South Platte River Basin, Laramie River Basin, Republican River Basin, and Smoky Hill River Basin (5 CCR 1002-38).

The beneficial-use tiers for aquatic life, recreation, and domestic water supply are listed as follows:

- Aquatic Life
  - C1 – Class 1 Cold Water
  - C2 – Class 2 Cold Water
  - W1 – Class 1 Warm Water
  - W2 – Class 2 Warm Water
- Recreation
  - E – Existing Primary Contact Use (since November 28, 1975)
  - P – Potential Primary Contact Use
  - N – Not Primary Contact Use
  - U – Undetermined Use
- Domestic Water Supply
  - Direct Use Water Supply Lakes and Reservoirs

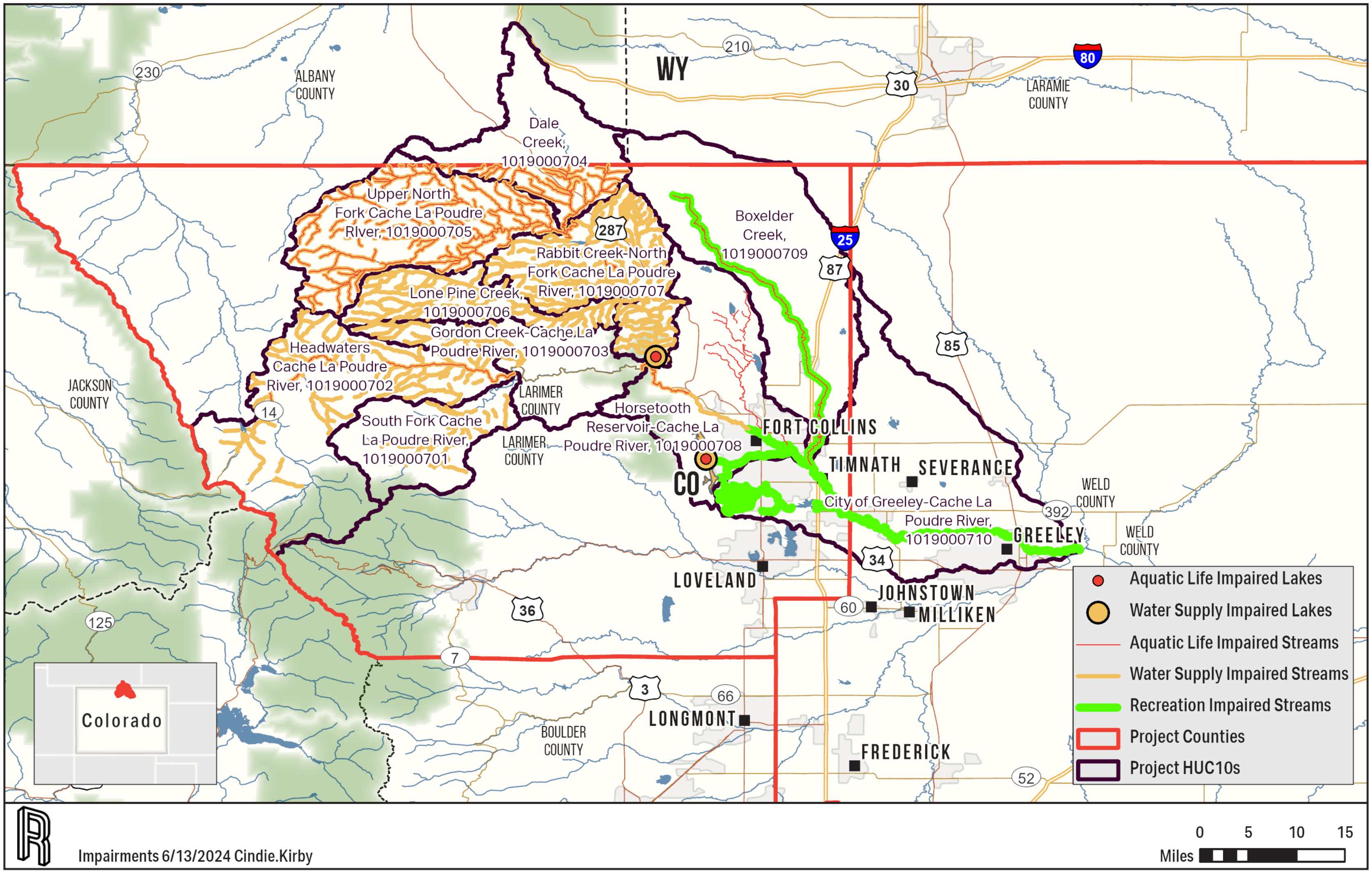

Figure 4-1. Impaired Waterbodies.

Table 4-1. Clean Water Act Section 303(d)-Impaired Waterbodies Summary (Page 1 of 3)

Impairment I.D./ HUC10s	Aquatic Life Tier/ Rec Tier	Description	Aquatic Life Impairments	Recreation Impairment	Water Supply Impairment
COSPCP02a_B/ 1019000701 and 1019000702	C1/E	Mainstem of the Cache la Poudre River from the boundaries of Rocky Mountain National Park, and the Rawah, Neota, Comanche Peak, and Cache la Poudre Wilderness Areas to a point immediately below the confluence with the South Fork Cache la Poudre River	Macroinvertebrates	NA	Arsenic (T)
COSPCP02a_C/ 1019000701 and 1019000702	C1/E	All tributaries and wetlands of the Cache la Poudre River from the boundaries of Rocky Mountain National Park, and the Rawah, Neota, Comanche Peak, and Cache la Poudre Wilderness Areas to a point immediately below the confluence with the South Fork Cache la Poudre River	Arsenic(T)	NA	NA
COSPCP03_B/ 1019000703	C1/E	Elkhorn Creek, including all tributaries and wetlands, from the source to a point immediately above the confluence with Manhattan Creek	NA	NA	Arsenic (T)
COSPCP06_A/ 1019000704 and 1019000705 and 1019000707	C1/E	North Fork of the Cache la Poudre River, including all tributaries and wetlands, from the source to the inlet of Halligan Reservoir	Silver (D)	NA	Arsenic (T)
COSPCP07_C/ 1019000707	C1/E	Mainstem of the North Fork of the Cache la Poudre River, including wetlands, from immediately below the outlet of Halligan Reservoir to a point five miles downstream	Sediment (TMDL), Silver (D)	NA	Arsenic (T), Iron (D), Manganese (D)
COSPCP07_D/ 1019000706 and 1019000707	C2/E	Tributaries to the North Fork of the Cache la Poudre River, including wetlands, from the inlet of Halligan Reservoir to the confluence with the Cache la Poudre River, except Lone Pine Creek, Rabbit Creek, and listings in segments 8 and 20	NA	NA	Arsenic (T)
COSPCP07_E/ 1019000706 and 1019000707	C1/E	Mainstem of the North Fork of the Cache la Poudre River from a point five miles downstream of Halligan Reservoir to Seaman Reservoir	NA	NA	Arsenic (T)
COSPCP07_F/ 1019000707	C1/E	Mainstem of the North Fork of the Cache la Poudre River from below Seaman Reservoir to the confluence with the Cache la Poudre River	Temperature	NA	Arsenic (T), Manganese (D)

Table 4-1. Clean Water Act Section 303(d)-Impaired Waterbodies Summary (Page 2 of 3)

Impairment I.D./ HUC10s	Aquatic Life Tier/ Rec Tier	Description	Aquatic Life Impairments	Recreation Impairment	Water Supply Impairment
COSPCP07_G/ 1019000706	C1/E	Mainstem of Lone Pine Creek, including wetlands, from the confluence of North Fork Lone Pine Creek and South Fork Lone Pine Creek to the confluence with the North Fork of the Cache la Poudre River	NA	NA	Arsenic (T), Iron (D)
COSPCP07_H/ 1019000707	C1/E	Mainstem of Rabbit Creek, including wetlands, from the source to the confluence with the North Fork of the Cache la Poudre River	NA	NA	Arsenic (T)
COSPCP08_B/ 1019000703 and 1019000706 and 1019000707	C2/E	Middle Fork of Rabbit Creek, including all tributaries and wetlands, from the source to the confluence with Rabbit Creek. Stonewall Creek, including all tributaries and wetlands, from the source to the confluence with the North Fork of the Cache la Poudre River. North Fork Lone Pine Creek and South Fork Lone Pine Creek, including all tributaries and wetlands, from the source to the confluence with Lone Pine Creek	NA	NA	Arsenic (T)
COSPCP10a_A/ 1019000703 and 1019000707 and 1019000708	C1/E	Mainstem of the Cache la Poudre River from the Munroe Gravity Canal Headgate (also known as the North Poudre Supply Canal diversion; 40.691700, -105.255292) to a point immediately above the Larimer County Ditch diversion (40.656612, -105.185244)	Temperature	NA	Arsenic (T)
COSPCP10b_A/ 1019000708	C2/E	Mainstem of the Cache la Poudre River from a point immediately above the Larimer County Ditch diversion (40.656612, -105.185244) to Shields Street in Ft. Collins, Colorado	NA	NA	Arsenic (T)
COSPCP11_B/ 1019000708	C1/E	Mainstem of the Cache la Poudre River from Shields Street in Ft. Collins to Prospect Road	NA	*E. coli*	NA
COSPCP12a_A/ 1019000709 and 1019000710	W1/E	Mainstem of the Cache la Poudre River from Project Road to U.S. Hwy 85 in Greely	NA	*E. coli* (May - October)	NA
COSPCP12a_B/ 1019000708 and 1019000709	W1/E	Mainstem of the Cache la Poudre River from Prospect Road to Boxelder Creek	NA	*E. coli*	NA
COSPCP12b_A/ 1019000710	W1/E	Mainstem of the Cache la Poudre River from U.S. Hwy 85 in Greeley to the confluence with the South Platte River	NA	*E. coli* (May - October)	NA

Table 4-1. Clean Water Act Section 303(d)-Impaired Waterbodies Summary (Page 2 of 3)

Impairment I.D./ HUC10s	Aquatic Life Tier/ Rec Tier	Description	Aquatic Life Impairments	Recreation Impairment	Water Supply Impairment
COSPCP13a_B/ 1019000708	W1/E	Dry Creek and all tributaries	Selenium (D)	NA	NA
COSPCP13a_D/ 1019000708	W1/E	Spring Creek and all its tributaries	NA	*E. coli* (May - October)	NA
COSPCP13a_E/ 1019000710	W1/E	Fossil Creek and its tributaries	NA	*E. coli* (May - October)	NA
COSPCP13b_C/ 1019000709	C1/E	Mainstem of Boxelder Creek from its source to a point immediately above Slab Canyon Wash	Selenium (D), Macroinvertebrates	*E. coli*	NA
COSPCP13c_B/ 1019000709	W1/P	Mainstem of Boxelder Creek from a point immediately above Slab Canyon Wash to the confluence with the Cache la Poudre River	Selenium (D), Macroinvertebrates	*E. coli*	NA

D = dissolved
T = total
TMDL = total maximum daily load

5.0 SOURCE ASSESSMENT

Only NPS pollutants are addressed in this report. Point sources and areas with MS4s are addressed in the 208 Areawide Water Quality Management Plan, 2022 Update [North Front Range Water Quality Planning Association, 2022]. Outside of MS4 permitted areas, NPSs of nutrients are generally related to runoff from cropland, pastureland, developed land, and other similar lands. NPSs of sediment consist of sediment contributions through wash off as well as bed and bank erosion during high flows. Sometimes sources are from natural causes. Natural causes are the physical, chemical, or biological conditions that would exist in a waterbody in the absence of measurable impacts from human activity or influence.

5.1 NUTRIENTS AND SEDIMENT

The EPA's Pollutant Load Estimation Tool (PLET) was used to estimate nutrient and sediment loads from different land uses by HUC10, and later to evaluate load reductions that would result from the implementation of various BMPs [US EPA, 2022].

For the Cache la Poudre River HUC8 in PLET, all 10 HUC10 watersheds were represented: South Fork Cache la Poudre River (1019000701), Headwaters Cache la Poudre River (1019000702), Gordon Creek-Cache la Poudre River (1019000703), Dale Creek (1019000704), Upper North Fork Cache la Poudre River (1019000705), Lone Pine Creek (1019000706), Rabbit Creek-North Fork Cache la Poudre River (1019000707), Horsetooth Reservoir-Cache la Poudre River (1019000708), Boxelder Creek (1019000709), and City of Greeley-Cache la Poudre River (1019000710). The following inputs to the PLET model were included for each HUC10:

- Watershed land-use areas (acres)
  - Urban (non-MS4)
  - Cropland
  - Pastureland
  - Forest
  - Feedlots
  - Other (all other land uses)
- Prominent hydrologic soil group (A-D)
- Average annual rainfall (inches)
- Rain days/year
- Number of agricultural animals
  - Beef cattle
  - Dairy cattle
  - Swine
  - Sheep
  - Horse
  - Chicken

- Turkey
- Duck

- Number of septic systems
- Population per septic system
- Septic rate failure
- Urban land-use distribution
- Irrigated cropland
- Water depth per irrigation (inches)
- Irrigation days/year

Sediment erosion can be estimated in PLET; however, gullies and streambank erosion were not included because of a lack of data. Wildlife density (animals per square mile) was also not included because of a lack of data and because wildlife is considered a natural source.

Source assessment modeling results for the 10 HUC10 watersheds are summarized using the following categories: urban areas (not including permitted MS4 areas), cropland, pastureland, forest (including scrub/shrub), feedlots, and a combination of all other land uses. The other land uses consist of barren, herbaceous, and wetlands which typically are not the highest contributors per acre; therefore, BMP planning does not generally focus on these land uses even though they can make up a fairly large portion of the area. Because this is a NPS plan, permitted MS4s, which are permitted and have limits to meet, are exempt from inclusion in this plan. The permitted MS4s in the project area not included are Fort Collins and Greeley, Colorado. MS4 areas were developed using a combination of the MS4 layer from ERAMS [Catena Analytics, 2024] (developed with the 2010 Census urban areas), the 2020 urban areas [U.S. Census Bureau, 2020], and a layer sent from the town of Timnath [Smith, 2024]. The excluded area used to represent these MS4s was approximately 118 mi^2, primarily located in the City of Greeley in the Cache la Poudre River HUC10. Table 5-1 shows the percentage of each land-use source per HUC10 (in Larimer and Weld Counties only). The only source not associated with an area is septic systems. The quantified sources of nitrogen, phosphorus, and sediment are listed in Tables 5-2, 5-3, and 5-4 in order of the HUC10 watersheds. The western watersheds (South Fork Cache la Poudre River, Headwaters Cache la Poudre River, Gordon Creek-Cache la Poudre River, Dale Creek, Upper North Fork Cache la Poudre River, Lone Pine Creek, and Rabbit Creek-North Fork Cache la Poudre River) are dominated by forest, while the eastern watersheds (Horsetooth Reservoir-Cache la Poudre River, Boxelder Creek, and City of Greeley-Cache la Poudre River) are dominated by other land or croplands.

In the western seven watersheds (South Fork Cache la Poudre River, Headwaters Cache la Poudre River, Gordon Creek-Cache la Poudre River, Dale Creek, Upper North Fork Cache la Poudre River, Lone Pine Creek, and Rabbit Creek-North Fork Cache la Poudre River), the forest lands dominate the source loads for nutrients and sediment. The only exceptions are in the Gordon Creek-Cache la Poudre River, Dale Creek, and Rabbit Creek-North Fork Cache la Poudre River watersheds where other land dominates sediment sources. In the two mid-east watersheds (Horsetooth Reservoir-Cache la Poudre River and Boxelder Creek), the primary land cover is other land but cropland dominates the source loads for nutrients and sediment. In the easternmost watershed, City of Greeley-Cache la Poudre River, the primary land cover is cropland, which dominates the source loads for nutrients and sediment.

Table 5-1. Land Cover

HUC101	Description	Area (mi^2)	Urban Non-MS4 (%)	Cropland (%)	Pastureland (%)	Forest (%)	Feedlots (%)	Other Land Uses (%)
1019000701	South Fork Cache la Poudre River	102	<1	0	0	83	<1	17
1019000702	Headwaters Cache la Poudre River	262	1	0	0	91	<1	8
1019000703	Gordon Creek-Cache la Poudre River	113	2	0	<1	64	<1	34
1019000704	Dale Creek	42	<1	0	<1	69	<1	30
1019000705	Upper North Fork Cache la Poudre River	188	<1	0	<1	94	<1	5
1019000706	Lone Pine Creek	86	2	<1	<1	88	<1	10
1019000707	Rabbit Creek-North Fork Cache la Poudre River	148	<1	<1	<1	65	<1	33
1019000708	Horsetooth Reservoir-Cache la Poudre River	151	6	6	3	38	<1	47
1019000709	Boxelder Creek	251	5	14	2	19	<1	61
1019000710	City of Greeley-Cache la Poudre River	273	10	55	5	3	<1	27

Table 5-2. Nitrogen Sources

HUC10	Description	Area (mi²)	Urban Non-MS4 (%)	Cropland (%)	Pastureland (%)	Forest (%)	Feedlots (%)	Other Land Uses (%)	Septic (%)
1019000701	South Fork Cache la Poudre River	102	9	0	0	62	13	15	<1
1019000702	Headwaters Cache la Poudre River	262	23	0	<1	61	9	6	<1
1019000703	Gordon Creek-Cache la Poudre River	113	17	0	1	39	14	24	6
1019000704	Dale Creek	42	11	0	3	47	15	24	1
1019000705	Upper North Fork Cache la Poudre River	188	9	0	1	70	15	4	2
1019000706	Lone Pine Creek	86	14	5	8	46	14	6	6
1019000707	Rabbit Creek-North Fork Cache la Poudre River	148	7	16	3	29	27	17	<1
1019000708	Horsetooth Reservoir-Cache la Poudre River	151	20	32	12	6	14	9	6
1019000709	Boxelder Creek	251	17	49	5	2	18	8	2
1019000710	City of Greeley-Cache la Poudre River	273	15	65	3	<1	14	<1	2

Table 5-3. Phosphorus Sources

HUC10	Description	Area (mi^2)	Urban Non-MS4 (%)	Cropland (%)	Pastureland (%)	Forest (%)	Feedlots (%)	Other Land Uses (%)	Septic (%)
1019000701	South Fork Cache la Poudre River	102	3	0	0	73	6	17	<1
1019000702	Headwaters Cache la Poudre River	262	10	0	<1	78	5	7	<1
1019000703	Gordon Creek-Cache la Poudre River	113	7	0	<1	50	7	30	6
1019000704	Dale Creek	42	4	0	1	58	7	29	1
1019000705	Upper North Fork Cache la Poudre River	188	3	0	<1	83	7	5	2
1019000706	Lone Pine Creek	86	6	2	2	66	8	8	7
1019000707	Rabbit Creek-North Fork Cache la Poudre River	148	3	9	<1	44	17	25	<1
1019000708	Horsetooth Reservoir-Cache la Poudre River	151	13	31	4	13	12	18	9
1019000709	Boxelder Creek	251	11	50	2	4	15	15	3
1019000710	City of Greeley-Cache la Poudre River	273	10	71	1	<1	12	2	4

Table 5-4. Sediment Sources

HUC10	Description	Area (mi^2)	Urban Non-MS4 (%)	Cropland (%)	Pastureland (%)	Forest (%)	Feedlots (%)	Other Land Uses (%)	Septic (%)
1019000701	South Fork Cache la Poudre River	102	9	0	0	54	0	36	0
1019000702	Headwaters Cache la Poudre River	262	28	0	<1	57	0	16	0
1019000703	Gordon Creek-Cache la Poudre River	113	18	0	<1	29	0	52	0
1019000704	Dale Creek	42	9	0	1	37	0	53	0
1019000705	Upper North Fork Cache la Poudre River	188	16	0	<1	71	0	13	0
1019000706	Lone Pine Creek	86	21	7	5	49	0	18	0
1019000707	Rabbit Creek-North Fork Cache la Poudre River	148	10	18	1	26	0	44	0
1019000708	Horsetooth Reservoir-Cache la Poudre River	151	16	57	5	4	0	18	0
1019000709	Boxelder Creek	251	9	74	2	1	0	14	0
1019000710	City of Greeley-Cache la Poudre River	273	5	91	2	<1	0	2	0

A less obvious contributor of nutrients and sediment to waterbodies is wildland fires. Wildland fires significantly reduce well-established root systems in areas impacted and, as a result, soil erosion is much more likely during precipitation events, carrying nutrients with it. The Cache la Poudre River watershed has already experienced post-wildfire flooding, debris flows, and associated economic impacts from the largest fire in Colorado: Cameron Peak to the southwest. Table 5-5 provides the total number of fire acres for each year past 2000 where any existed per HUC10 [National Interagency Fire Center, 2024]. The physical location of the watershed within a wildfire-prone area of Colorado and its past encounters with natural calamities make having a plan of action for any future wildfire risks imperative. The CPRW has made many post-fire recovery, mitigation, and restoration efforts since the Cameron Peak fire, including facilitation of the "Water Recovery Group"; completion of a "Cameron Peak Watershed Hazards, Treatments and Targeting Prioritization" analysis; and active fundraising, outreach, and education. Projects are still ongoing and can be found on the CPRW All CPRW Projects webpage [CPRW, 2021].

Table 5-5. Total Fire Acres per HUC10 per Year (2000-2021)

HUC10	1019000701	1019000702	1019000703	1019000704	1019000705	1019000706	1019000707	1019000708
2000			64				24	
2002	50		673					
2004			14				11,038	6,894
2005					41	48		
2009			34					
2011			17					
2012	22,280	5,568	76,230				10,728	34,188
2016					301			
2018			187				44	
2019	100					1		
2020	32,406	94,248	9,005		18	2,202		
2021				32	1			

Although nitrate impairments do not exist within the Cache la Poudre River HUC8, addressing why these should continue to be avoided for future water quality considerations is important. Nitrates can enter surface waters from animal manure, nitrogen fertilizers, wastewater, and decomposed plant residues and organic matter [University of Missouri Extension, 2024]. Only one location is impaired with sediment in HUC10 1019000707: COSPCP07_C. No other nutrient- or sediment-impaired waterbodies occur in the Cache la Poudre River HUC8, but nutrients and sediment were identified as priority parameters of concern.

Atmospheric deposition is also a source of nutrients. EPA's Clean Air Status and Trends Network (CASTNET) and the National Atmospheric Deposition Program (NADP) monitor nitrogen deposition (ammonia and nitrate) at locations throughout the United States. The SPARROW model published by the United States Geological Survey (USGS) estimated that in the Cache la Poudre River Watershed, more than 190,000 pounds of nitrogen were delivered to the stream from atmospheric deposition [USGS, 2019]. Some practices can help reduce nutrients in atmospheric deposition; however, these practices are not a focus in this plan because their impacts are less local than other BMPs.

5.2 E. COLI

Bacteria comes from the intestines of humans and warm-blooded animals. NPSs of bacteria consist primarily of waste that is transported through wash-off from cropland, pastureland, and developed land, as well as septic systems and direct defecation from livestock and wildlife. For the purposes of this project, bacteria from wildlife are assumed to be a natural background source and are not included in the assessment.

E. coli from human and animal waste are dispersed throughout the landscape, spread by humans, and/or treated in facilities. Once *E. coli* are in the environment, their accumulation on land and delivery to the stream are affected by die-off and decay, surface imperviousness, detention time, ultraviolet exposure, and other mechanisms. Quantifying *E. coli* sources using PLET is not recommended [Tetra Tech, Inc., 2022], so an assessment of bacteria production within the watershed was completed per HUC10. This assessment included humans (Wastewater Treatment Plants [WWTPs] and Onsite Wastewater Treatment Systems [OWTSs]), pets (dogs and cats), and livestock (cattle, horses, poultry, sheep, and hogs); however, wildlife was not included, as wildlife was assumed to be a natural source of bacteria. Publicly owned WWTPs are highly regulated and are not a significant source of *E. coli*. In some cases, WWTPs even provide dilution from other sources. OWTS contributions are largely dependent on soil and geology in an area, as well as their proximity to a waterbody. Additionally, point sources are not a focus of this study; therefore, WWTP estimates were added primarily as a comparison to the production of bacteria sent to an OWTS.

Livestock contribute *E. coli* loads directly by defecating in streams and indirectly by defecating on cropland or pastures where *E. coli* can wash off during precipitation events, snowmelt, or irrigation. Spreading livestock manure on cropland or pasture also contributes *E. coli* to waterbodies. The livestock in the project area mainly consists of cattle, poultry, hogs, horses, sheep, and goats, which are grazed and/or confined, and manure is spread on crops and pastures.

Pet waste is another potential source of *E. coli*. Pet waste is often left in yards, in parks, and along trails, and can be carried with stormwater to local storm drains and waterbodies.

Natural background sources are inputs that would be expected under natural, undisturbed conditions and include *E. coli* loading from wildlife in the area. Wildlife (e.g., waterfowl and large-game species) also contribute *E. coli* loads directly by defecating while wading or swimming in a stream and indirectly by defecating on lands that produce watershed runoff during precipitation events.

A GIS-based assessment was completed within each impaired drainage area to estimate livestock, wildlife, human, and pet populations. Animal populations were multiplied by average excretion rates from scientific literature to estimate the amount of *E. coli* produced by each source type in each HUC10 watershed. The reported literature values for fecal coliform excretion were converted to *E. coli* excretion by using a fecal coliform to *E. coli* ratio of 200:126 most probable number (mpn)/100 milliliter (mL). Note that the loads produced by humans are usually treated by WWTPs and OWTSs.

Annual excretion estimates for livestock (excluding hogs) and wildlife were obtained from *BSLC: A Tool for Bacteria Source Characterization for Watershed Management* [Zeckoski et al., 2005], and bacteria estimates for humans and hogs were obtained from *Wastewater Engineering: Treatment, Disposal, and Reuse* [Metcalf and Eddy, Inc., 1991]. Annual excretion rates for dogs and cats were sourced from *Identification and Evaluation of Nutrient and Bacterial Loadings to Maquoit Bay, New Brunswick and Freeport, Maine* [Horsley and Witten, Inc., 1996]. Literature values for bacteria excretion rates are estimates and do not represent all sources and dynamics of bacteria in a natural system. Table 5-6 provides the literature rates of *E. coli* (converted from fecal coliform) produced by each animal per day, as well as the respective sources.

Table 5-6. *E. coli* Production Rates From Literature Sources

Category	Subcategory	*E. coli* Production Rate (cfu/head/day)	Source
Humans	WWTP	1,260,000,000	Metcalf and Eddy, Inc., 1991
Humans	OWTS	1,260,000,000	Metcalf and Eddy, Inc., 1991
Pets	Cats	3,150,000,000	Horsley and Witten, Inc., 1996
Pets	Dogs	3,150,000,000	Horsley and Witten, Inc., 1996
Livestock	Cattle	20,790,000,000	Zeckoski et al., 2005
Livestock	Horses	26,460,000,000	Zeckoski et al., 2005
Livestock	Poultry	58,590,000	Zeckoski et al., 2005
Livestock	Sheep	7,560,000,000	Zeckoski et al., 2005
Livestock	Goats	17,640,000,000	Zeckoski et al., 2005
Livestock	Hogs	5,607,000,000	Metcalf and Eddy, Inc., 1991
Wildlife	Deer	220,500,000	Zeckoski et al., 2005
Wildlife	Ducks	1,512,000,000	Zeckoski et al., 2005
Wildlife	Geese	504,000,000	Zeckoski et al., 2005

cfu/head/day = colony-forming units per head per day

Livestock numbers were obtained from the PLET database by HUC12 and aggregated up to the HUC10 level. Livestock counts available in PLET included cattle, horses, poultry, sheep, and hogs. PLET animal data are from 2014 USDA National Agricultural Statistics Service, for which county animal data are summarized at the HUC12 level based on the pastureland area weighted ratio [EPA, 2022].

Hogs and poultry are typically kept in a total confinement facility, with their manure collected in a liquid manure storage area and later spread and/or incorporated on or into agricultural land. Grazed animals can also be kept in sheltered areas but are more likely to be pastured or have access to waterbodies than hogs and poultry. Manure that has been incorporated or spread into or on agricultural fields can contribute *E. coli* to waterways, but incorporation decreases the likelihood of transport. Livestock numbers include both animal feeding operations (AFOs) and concentrated animal feed operations (CAFOs); both are relevant because manure is applied to croplands and pasturelands and reaches surface waters even when the manure comes from a zero-runoff feedlot.

Individuals on domestic wastewater sewers within each HUC10 were estimated by summing the population for all of the 2020 US Census Block Centroid Population points that fall within census urban areas which were assumed to be connected to the WWTPs in applicable drainage areas [US Census, 2020]. Bacteria within wastewater in urban areas with a WWTP were assumed to be treated to the WWTP's permit requirement.

People using an OWTS were estimated by Larimer and Weld Counties' OWTS within each HUC10 and multiplying the total by 3.31, which is the number of individuals assumed to be on each OWTS in the applicable counties [Thomas, 2024]. This evaluation represents all OWTSs, including compliant systems.

Pet populations were estimated by calculating the number of households from the 2020 Census Block Centroid Population points within each applicable impairment drainage area and assuming 0.58 dogs (36.5 percent of households times 1.6 dogs per household) and 0.64 cats (30.4 percent of households times 2.1 cats per household) per household [American Veterinary Medical Association, 2016].

Table 5-7 summarizes the number of animals, estimated *E. coli* produced, and percent of the total *E. coli* from each animal type within each HUC10. These estimates provide watershed managers with the relative magnitudes of total production by source and do not account for treatment by WWTPs or OWTSs, wash off, delivery, instream growth, or die-off dynamics that occur with *E. coli* and substantially affect its delivery to surface waters.

Several factors affect whether *E. coli* reach a stream. The analysis illustrates that across the entire project area, the amount of *E. coli* produced by livestock is substantially greater than the *E. coli* produced by humans or pets. Only two HUC10s—1019000708 (Horsetooth Reservoir-Cache la Poudre River) and 1019000710 (City of Greeley-Cache la Poudre River)—have higher production from humans or pets than from livestock. Both Larimer and Weld Counties are Right-to-Farm counties, which protects certain types of operations from nuisance suits when their activities impact neighboring property through activities like noise or odor.

Table 5-7. Estimated Number of Animals, *E. coli* Produced, and Percent of *E. coli* Produced in Each HUC10 (Page 1 of 4)

HUC10	Description	Category	Subcategory	Count	Total *E. coli* Produced (cfu/day)	Total *E. coli* Produced (%)
1019000701	South Fork Cache la Poudre River	Humans	OWTS	530	6.7E+11	4%
1019000701	South Fork Cache la Poudre River	Humans	WWTP	0	0.0E+00	0%
1019000701	South Fork Cache la Poudre River	Pets	Dogs	93	2.9E+11	2%
1019000701	South Fork Cache la Poudre River	Pets	Cats	102	3.2E+11	2%
1019000701	South Fork Cache la Poudre River	Livestock	Cattle	681	1.4E+13	77%
1019000701	South Fork Cache la Poudre River	Livestock	Horses	102	2.7E+12	15%
1019000701	South Fork Cache la Poudre River	Livestock	Poultry	126	7.4E+09	0%
1019000701	South Fork Cache la Poudre River	Livestock	Sheep	40	3.0E+11	2%
1019000701	South Fork Cache la Poudre River	Livestock	Goats	0	0.0E+00	0%
1019000701	South Fork Cache la Poudre River	Livestock	Hogs	6	3.4E+10	0%
1019000702	Headwaters Cache la Poudre River	Humans	OWTS	1165	1.5E+12	4%
1019000702	Headwaters Cache la Poudre River	Humans	WWTP	0	0.0E+00	0%
1019000702	Headwaters Cache la Poudre River	Pets	Dogs	204	6.4E+11	2%
1019000702	Headwaters Cache la Poudre River	Pets	Cats	225	7.1E+11	2%
1019000702	Headwaters Cache la Poudre River	Livestock	Cattle	1508	3.1E+13	76%
1019000702	Headwaters Cache la Poudre River	Livestock	Horses	228	6.0E+12	15%
1019000702	Headwaters Cache la Poudre River	Livestock	Poultry	282	1.7E+10	0%
1019000702	Headwaters Cache la Poudre River	Livestock	Sheep	90	6.8E+11	2%
1019000702	Headwaters Cache la Poudre River	Livestock	Goats	1	1.8E+10	0%
1019000702	Headwaters Cache la Poudre River	Livestock	Hogs	15	8.4E+10	0%
1019000703	Gordon Creek-Cache la Poudre River	Humans	OWTS	5131	6.5E+12	14%
1019000703	Gordon Creek-Cache la Poudre River	Humans	WWTP	0	0.0E+00	0%
1019000703	Gordon Creek-Cache la Poudre River	Pets	Dogs	899	2.8E+12	6%
1019000703	Gordon Creek-Cache la Poudre River	Pets	Cats	992	3.1E+12	7%
1019000703	Gordon Creek-Cache la Poudre River	Livestock	Cattle	1294	2.7E+13	60%
1019000703	Gordon Creek-Cache la Poudre River	Livestock	Horses	195	5.2E+12	11%

Table 5-7. Estimated Number of Animals, *E. coli* Produced, and Percent of *E. coli* Produced in Each HUC10 (Page 2 of 4)

HUC10	Description	Category	Subcategory	Count	Total *E. coli* Produced (cfu/day)	Total *E. coli* Produced (%)
1019000703	Gordon Creek-Cache la Poudre River	Livestock	Poultry	244	1.4E+10	0%
1019000703	Gordon Creek-Cache la Poudre River	Livestock	Sheep	77	5.8E+11	1%
1019000703	Gordon Creek-Cache la Poudre River	Livestock	Goats	2	3.5E+10	0%
1019000703	Gordon Creek-Cache la Poudre River	Livestock	Hogs	12	6.7E+10	0%
1019000704	Dale Creek	Humans	OWTS	305	3.8E+11	3%
1019000704	Dale Creek	Humans	WWTP	0	0.0E+00	0%
1019000704	Dale Creek	Pets	Dogs	53	1.7E+11	1%
1019000704	Dale Creek	Pets	Cats	59	1.9E+11	2%
1019000704	Dale Creek	Livestock	Cattle	430	8.9E+12	77%
1019000704	Dale Creek	Livestock	Horses	65	1.7E+12	15%
1019000704	Dale Creek	Livestock	Poultry	80	4.7E+09	0%
1019000704	Dale Creek	Livestock	Sheep	25	1.9E+11	2%
1019000704	Dale Creek	Livestock	Goats	3	5.3E+10	0%
1019000704	Dale Creek	Livestock	Hogs	4	2.2E+10	0%
1019000705	Upper North Fork Cache la Poudre River	Humans	OWTS	3641	4.6E+12	7%
1019000705	Upper North Fork Cache la Poudre River	Humans	WWTP	0	0.0E+00	0%
1019000705	Upper North Fork Cache la Poudre River	Pets	Dogs	638	2.0E+12	3%
1019000705	Upper North Fork Cache la Poudre River	Pets	Cats	704	2.2E+12	4%
1019000705	Upper North Fork Cache la Poudre River	Livestock	Cattle	2263	4.7E+13	75%
1019000705	Upper North Fork Cache la Poudre River	Livestock	Horses	228	6.0E+12	10%
1019000705	Upper North Fork Cache la Poudre River	Livestock	Poultry	246	1.4E+10	0%
1019000705	Upper North Fork Cache la Poudre River	Livestock	Sheep	146	1.1E+12	2%
1019000705	Upper North Fork Cache la Poudre River	Livestock	Goats	4	7.1E+10	0%
1019000705	Upper North Fork Cache la Poudre River	Livestock	Hogs	9	5.0E+10	0%
1019000706	Lone Pine Creek	Humans	OWTS	5081	6.4E+12	13%
1019000706	Lone Pine Creek	Humans	WWTP	3509	4.4E+12	9%

Table 5-7. Estimated Number of Animals, *E. coli* Produced, and Percent of *E. coli* Produced in Each HUC10 (Page 3 of 4)

HUC10	Description	Category	Subcategory	Count	Total *E. coli* Produced (cfu/day)	Total *E. coli* Produced (%)
1019000706	Lone Pine Creek	Pets	Dogs	1505	4.7E+12	9%
1019000706	Lone Pine Creek	Pets	Cats	1661	5.2E+12	10%
1019000706	Lone Pine Creek	Livestock	Cattle	1161	2.4E+13	48%
1019000706	Lone Pine Creek	Livestock	Horses	176	4.7E+12	9%
1019000706	Lone Pine Creek	Livestock	Poultry	220	1.3E+10	0%
1019000706	Lone Pine Creek	Livestock	Sheep	70	5.3E+11	1%
1019000706	Lone Pine Creek	Livestock	Goats	5	8.8E+10	0%
1019000706	Lone Pine Creek	Livestock	Hogs	11	6.2E+10	0%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Humans	OWTS	1509	1.9E+12	2%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Humans	WWTP	0	0.0E+00	0%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Pets	Dogs	264	8.3E+11	1%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Pets	Cats	292	9.2E+11	1%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Livestock	Cattle	4772	9.9E+13	80%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Livestock	Horses	722	1.9E+13	15%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Livestock	Poultry	897	5.3E+10	0%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Livestock	Sheep	284	2.1E+12	2%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Livestock	Goats	6	1.1E+11	0%
1019000707	Rabbit Creek-North Fork Cache la Poudre River	Livestock	Hogs	44	2.5E+11	0%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Humans	OWTS	19231	2.4E+13	6%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Humans	WWTP	100349	1.3E+14	30%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Pets	Dogs	20954	6.6E+13	16%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Pets	Cats	23121	7.3E+13	17%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Livestock	Cattle	5290	1.1E+14	26%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Livestock	Horses	800	2.1E+13	5%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Livestock	Poultry	995	5.8E+10	0%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Livestock	Sheep	315	2.4E+12	1%

Table 5-7. Estimated Number of Animals, *E. coli* Produced, and Percent of *E. coli* Produced in Each HUC10 (Page 4 of 4)

HUC10	Description	Category	Subcategory	Count	Total *E. coli* Produced (cfu/day)	Total *E. coli* Produced (%)
1019000708	Horsetooth Reservoir-Cache la Poudre River	Livestock	Goats	7	1.2E+11	0%
1019000708	Horsetooth Reservoir-Cache la Poudre River	Livestock	Hogs	49	2.7E+11	0%
1019000709	Boxelder Creek	Humans	OWTS	9870	1.2E+13	4%
1019000709	Boxelder Creek	Humans	WWTP	9099	1.1E+13	3%
1019000709	Boxelder Creek	Pets	Dogs	3324	1.0E+13	3%
1019000709	Boxelder Creek	Pets	Cats	3668	1.2E+13	4%
1019000709	Boxelder Creek	Livestock	Cattle	11152	2.3E+14	71%
1019000709	Boxelder Creek	Livestock	Horses	1521	4.0E+13	12%
1019000709	Boxelder Creek	Livestock	Poultry	8566	5.0E+11	0%
1019000709	Boxelder Creek	Livestock	Sheep	1189	9.0E+12	3%
1019000709	Boxelder Creek	Livestock	Goats	8	1.4E+11	0%
1019000709	Boxelder Creek	Livestock	Hogs	101	5.7E+11	0%
1019000710	City of Greeley-Cache la Poudre River	Humans	OWTS	29664	3.7E+13	3%
1019000710	City of Greeley-Cache la Poudre River	Humans	WWTP	239214	3.0E+14	27%
1019000710	City of Greeley-Cache la Poudre River	Pets	Dogs	47115	1.5E+14	13%
1019000710	City of Greeley-Cache la Poudre River	Pets	Cats	51988	1.6E+14	14%
1019000710	City of Greeley-Cache la Poudre River	Livestock	Cattle	19287	4.0E+14	35%
1019000710	City of Greeley-Cache la Poudre River	Livestock	Horses	615	1.6E+13	1%
1019000710	City of Greeley-Cache la Poudre River	Livestock	Poultry	114513	6.7E+12	1%
1019000710	City of Greeley-Cache la Poudre River	Livestock	Sheep	7236	5.5E+13	5%
1019000710	City of Greeley-Cache la Poudre River	Livestock	Goats	9	1.6E+11	0%
1019000710	City of Greeley-Cache la Poudre River	Livestock	Hogs	186	1.0E+12	0%

5.3 HEAVY METALS

Heavy metal sources are typically from abandoned mines, runoff from developed areas, and contributions from soils. Heavy metals that can be sourced from irrigation on Pierre Shale areas (selenium and arsenic) would also benefit from changing irrigation practices. Flood irrigation typically results in substantial irrigation return flows, which can be high in selenium or arsenic when soils in the irrigated fields have high selenium or arsenic content. The conversion to more modern center-pivot and side-roll sprinkler systems would help decrease the volume of selenium or arsenic-rich return flows entering waterbodies [Hawley and Rodriguez-Jeangros, 2021].

Heavy metals are also not addressed with PLET. Larimer and Weld Counties have a rich mining history dating back to the mid-1800s. Commodities consisting of beryllium, coal, copper, gold, iron, lead, manganese, molybdenum, rare earth elements, silica, silver, tungsten, uranium, vanadium, and zinc were mined [The Diggings, 2024].

Sources of some heavy metals also according to a publication within Heliyon, [Briffa et al., 2020] and the Big Thompson State of the Watershed Report [Hawley and Rodriguez-Jeangros, 2021] include:

- Silver – mining, metal/jewelry production, and manufacturing processes
- Selenium – animal feed/supplement production, manufacturing processes, fossil fuel combustion, and irrigation return flows in areas with Pierre Shale
- Arsenic – pressure-treated wood, glass/pesticide production, doping, pyrotechnics, and Pierre Shale
- Iron – mining, manufacturing processes, and metal/supplement/food production
- Manganese – alloy manufacturing processes, metal/fertilizer/firework/pesticide/cosmetic production

The CDPHE Water Quality Control Commission has designated several streams within both counties as impaired (see Clean Water Act (CWA) Section 303(d) list and 5 CCR 1002-93) for these elements (Table 4-1), suggesting that mined lands or abandoned mine lands (AMLs) are a potential source of NPS pollution. Several federal and state agencies have mapped and cataloged abandoned mines within Colorado and quantified the AMLs in Larimer and Weld Counties. To determine areas most likely polluted by AMLs, known AML locations were summarized per HUC10. Although not all AMLs have been discovered and mapped, an assumption was made that the more points in a HUC10, the more likely that HUC10 was polluted by AMLs. Table 5-8 lists the number of AMLs for each HUC10 [Graves, 2024].

Table 5-8. Number of Identified Abandoned Mine Lands per HUC10

HUC10	Description	Count
1019000701	South Fork Cache la Poudre River	0
1019000702	Headwaters Cache la Poudre River	35
1019000703	Gordon Creek-Cache la Poudre River	23
1019000704	Dale Creek	0
1019000705	Upper North Fork Cache la Poudre River	1
1019000706	Lone Pine Creek	5
1019000707	Rabbit Creek-North Fork Cache la Poudre River	6
1019000708	Horsetooth Reservoir-Cache la Poudre River	4
1019000709	Boxelder Creek	6
1019000710	City of Greeley-Cache la Poudre River	26

In *Colorado's Nonpoint Source Program: 2022 Annual Report* [Moore, 2022], the recommended BMPs associated with pollution from AMLs are hydrologic controls (diversion ditches, mine tailings removal, erosion and sediment control, and revegetation) and passive treatments (aerobic wetlands, anaerobic wetlands, and aeration and settling ponds).

6.0 PRIORITY AREAS FOR IMPLEMENTATION

Priority areas are locations that significantly contribute to the water quality parameters identified as pollutants of concern. The following sources were used to identify priority areas for BMP implementation:

- The PLET model (for nutrients and sediment)
- The production per HUC10 assessment (for *E. coli*)
- The AML density assessment (for heavy metals)

Point source permittees should compare the cost options of upstream NPS BMPs to the cost of mechanical treatment. Such collaborations and coordinated efforts may improve economic feasibility for improving water quality regionally.

6.1 NUTRIENTS AND SEDIMENT

The PLET model indicates that throughout the entire Cache la Poudre River HUC8 within Larimer and Weld Counties, the primary source of nutrients and sediment is cropland; however, cropland only makes up approximately 12 percent of the total area. Figures 6-1, 6-2, and 6-3 show the total daily loads per HUC10 of nitrogen, phosphorus, and TSS, respectively, from PLET [US EPA, 2022]. Priority areas for the reduction of nutrients and sediment are HUC10s 1019000709 (Boxelder Creek) and 1019000710 (City of Greeley-Cache la Poudre River) on cropland. The source figures from PLET only represent areas that are not MS4s. Data trends from the Cache la Poudre Watershed-Based Plan from April 2020 show similar trends for nutrient and sediment as PLET results, with nutrients and sediment increasing in the eastern watersheds [CPRW, 2020].

6.2 E. COLI

The bacteria production assessment revealed that, overall, throughout the Cache la Poudre River HUC8, cattle are the primary producers of bacteria. Figure 6-4 provides the total production of bacteria per HUC10 based on the assessment within GIS. HUC10s 1019000708 (Horsetooth Reservoir-Cache la Poudre River), 1019000709 (Boxelder Creek), and 1019000710 (City of Greeley-Cache la Poudre River) have the highest production rates overall and primarily from cattle; therefore, practices related to cattle exclusion from streams, such as fencing, off-stream watering, and seasonal riparian area management, should be a priority. The *E. coli*-impaired waterbodies align well with the bacteria production analysis and exist in HUC10s 1019000708 (Horsetooth Reservoir-Cache la Poudre River), 1019000709 (Boxelder Creek), and 1019000710 (City of Greeley-Cache la Poudre River).

6.3 HEAVY METALS

The AML density identified HUC10s 1019000702 (Headwaters Cache la Poudre River) and 1019000703 (Gordon Creek-Cache la Poudre River) as the HUC10 watersheds with the highest densities of AMLs and, therefore, should be the primary targets in continuing AML identification and practice implementation to reduce heavy metals in waters. Waterbodies impaired with heavy metals for aquatic life constituents (dissolved silver and selenium; and total arsenic) align well with the AML density analysis and primarily exist in HUC10 watersheds with identified AMLs. Similarly, waterbodies impaired with heavy metals for water supply constituents (dissolved iron and manganese; and total arsenic) occur in almost all HUC10 watersheds, whether or not AMLs were identified. The density of AMLs per square mile is illustrated in Figure 6-5 [Graves, 2024]. Priority watersheds for heavy metal-reducing BMPs should be the areas with the highest density of AMLs. Additionally, where selenium- and arsenic-impaired waters exist with high levels of irrigated lands, more efficient irrigation practices should be considered.

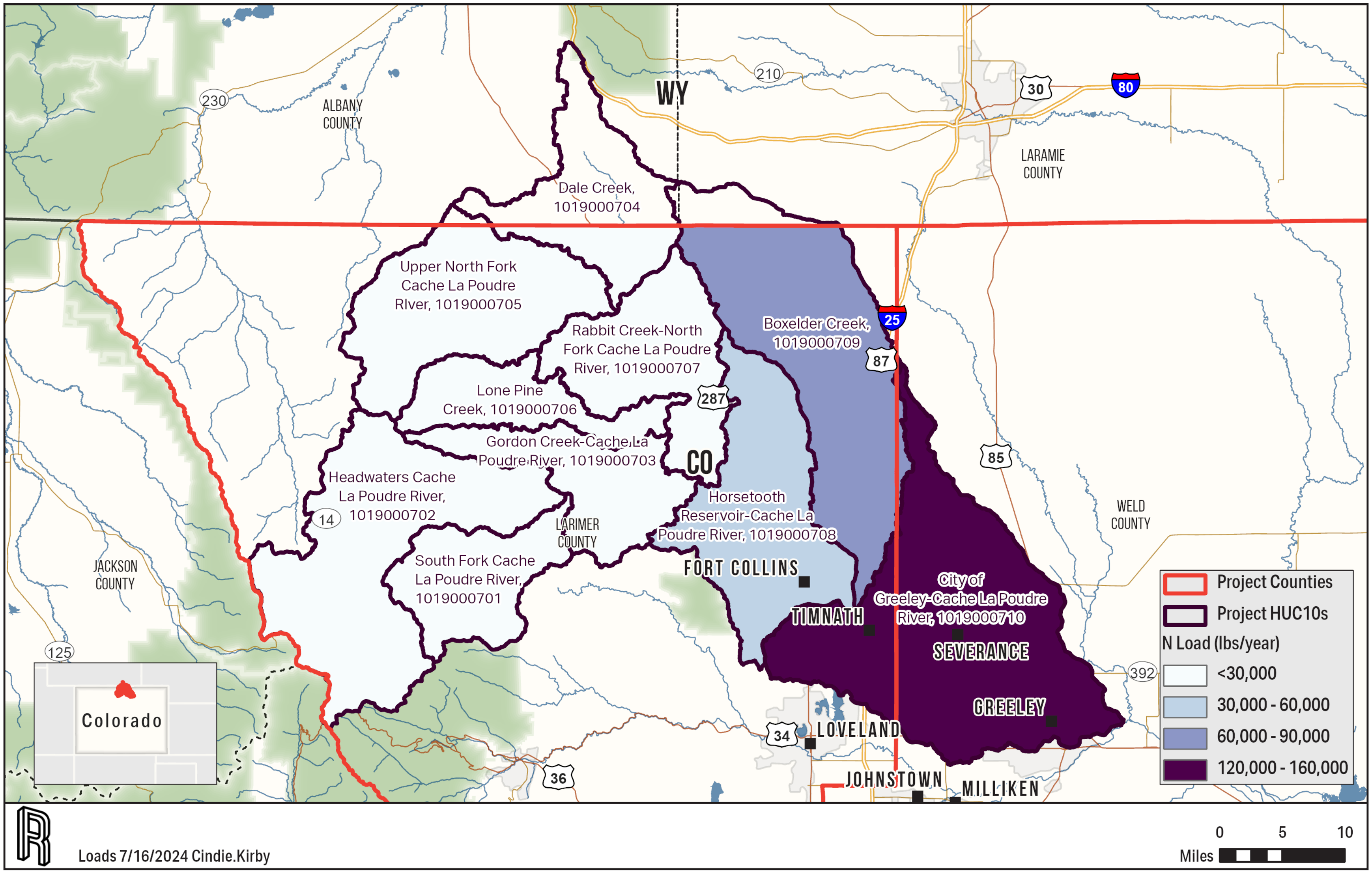

Figure 6-1. Nitrogen Contributions per HUC10.

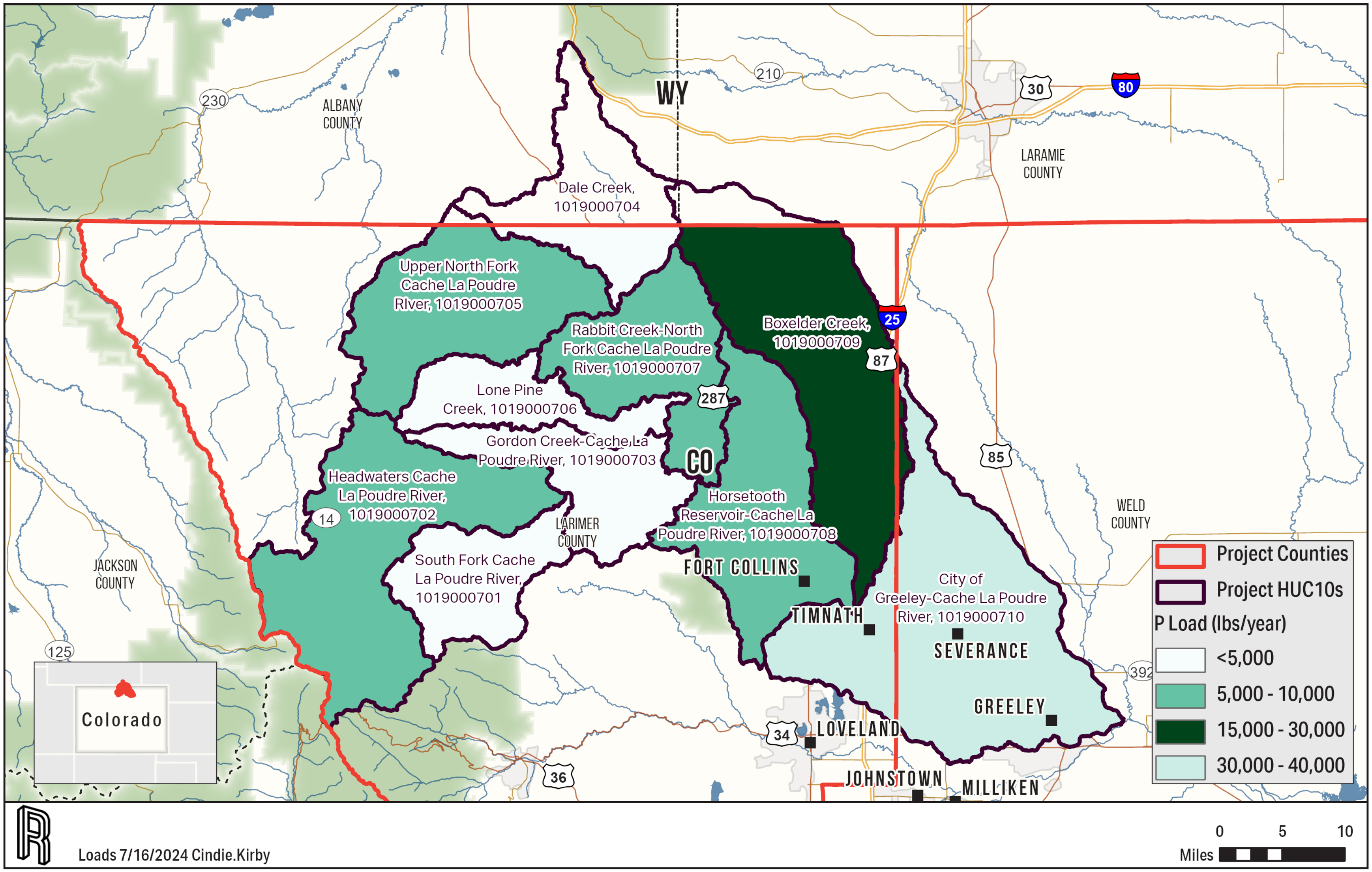

Figure 6-2. Phosphorus Contributions per HUC10.

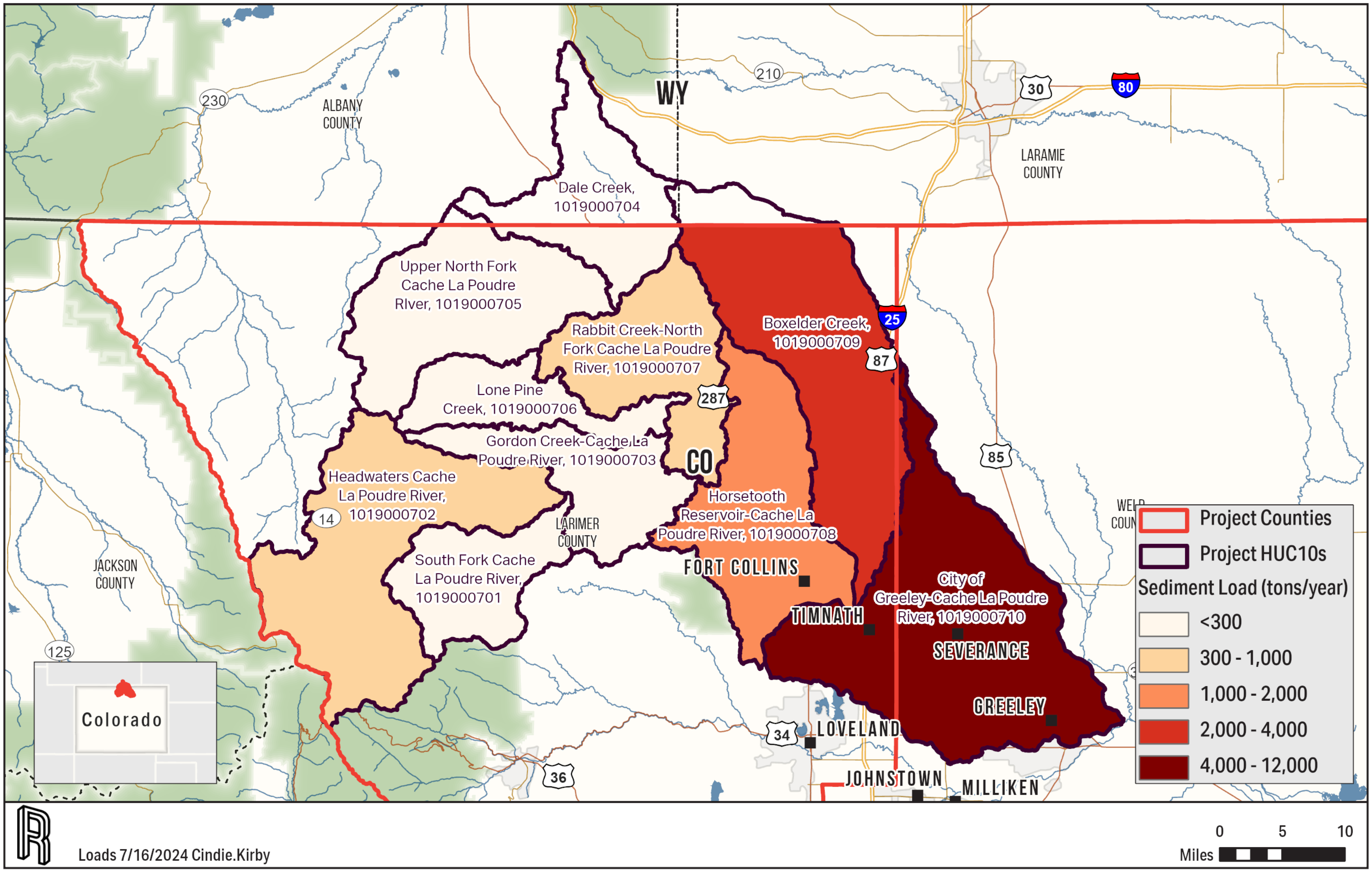

Figure 6-3. Sediment Contributions per HUC10.

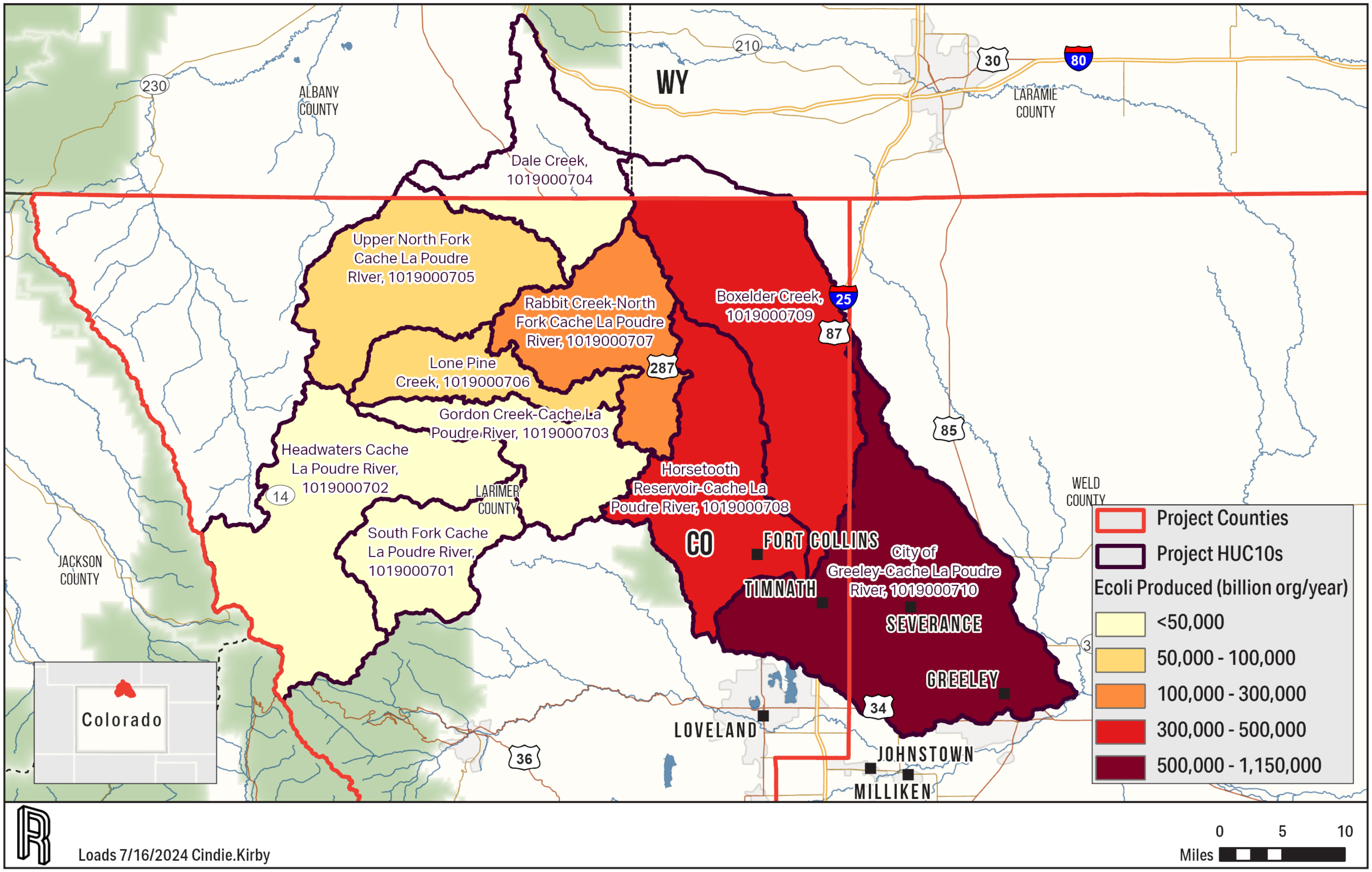

Figure 6-4. Bacteria Produced per HUC10.

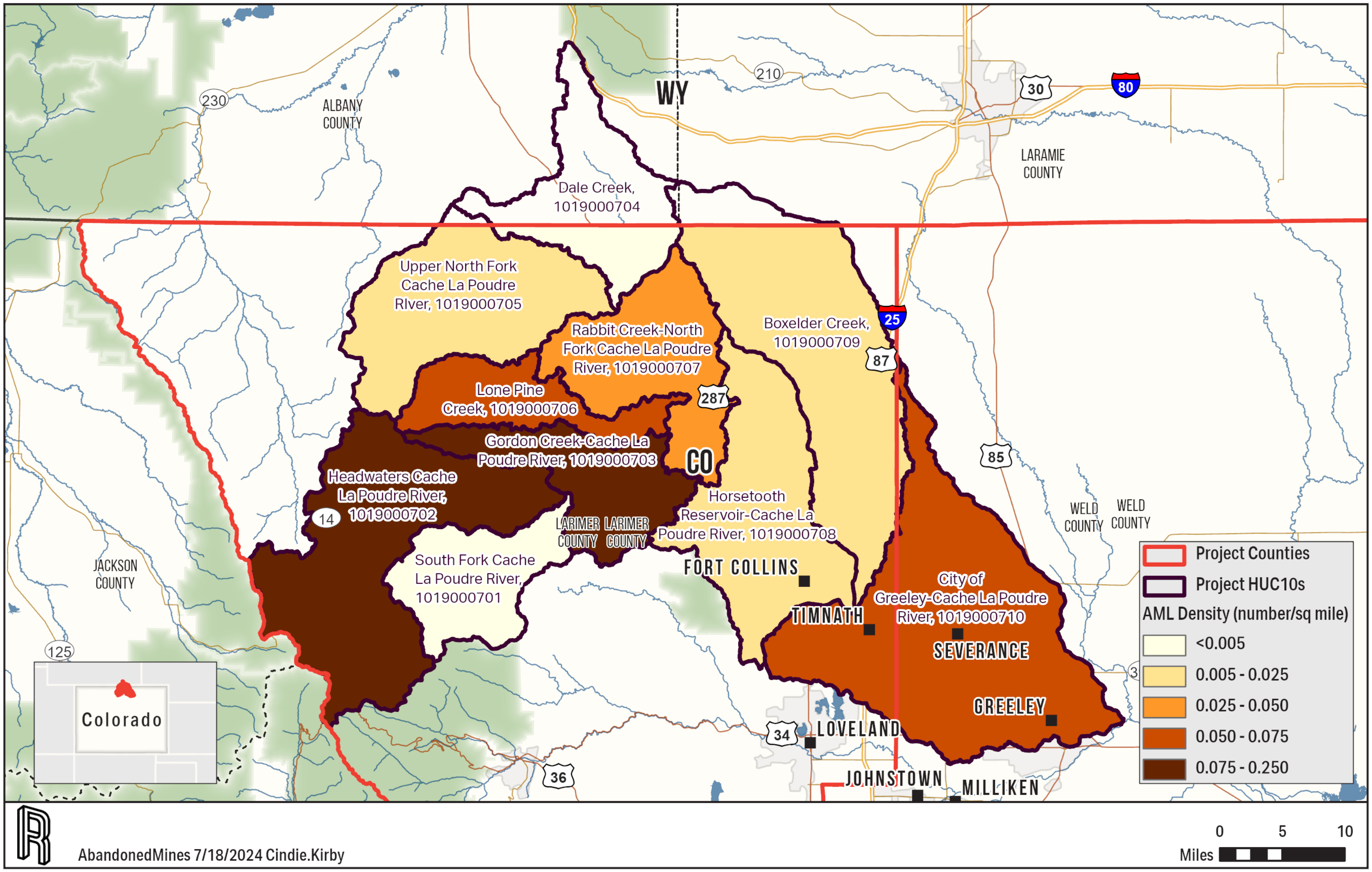

Figure 6-5. Density of Abandoned Mine Lands for Each HUC10.

7.0 BEST MANAGEMENT PRACTICES LOAD REDUCTIONS

Numerous resources exist in Colorado and nationally that provide information on BMPs. Some give data about implementation, and others inform on expected load reductions. The following websites were used to summarize the BMP options:

- Colorado Department of Agriculture BMPs
- Colorado Water Conservation Board Floodplain Stormwater and Criteria Manual
- Colorado Water Conservation Board BMPs
- Colorado Waterwise Guidebook of Best Practices for Municipal Water Conservation in Colorado
- Colorado Ag Water Quality BMPs for Colorado
- Colorado Forestry Best Management Practices 2018 Field Monitoring Report
- Colorado Wetland Information Center Wetland BMPs
- Colorado Stormwater Center
- Colorado Department of Transportation Erosion Control and Stormwater Quality Guide
- Upper South Platte BMPs for Protecting Source Water Quality
- International Stormwater BMP Database
- One Water Solutions Institute
- EPA Menu of Stormwater BMPs
- USDA Stream Restoration Manual
- Natural Resources Conservation Service Conservation Practice Standards
- USDA Colorado Field Office Technical Guide
- Pollution Load Estimator Tool

7.1 NUTRIENTS AND SEDIMENT

For this project, nutrient and sediment BMPs available in PLET were prioritized using multiple metrics, including stakeholder input and BMP effectiveness. The BMP reduction factors for PLET BMPs are listed in Tables 7-1 through 7-5 for cropland, pastureland, feedlots, forest, and urban lands. The average of the nitrogen, phosphorus, and sediment reduction factors was the first metric used for prioritization. The average survey score based on Survey #2 results was the second metric. The final score, the reduction survey, was the product of the two metrics. The following practices were chosen and run in PLET based on reduction survey scores: the top two cropland, top two pasture, top feedlot practice, top two forest, and top three urban. These priority PLET practices for each respective land use are in bold under the column headings of Tables 7-1 through 7-5. The priority PLET practices were run on 25 percent of each applicable land cover, and the reductions are provided in Table 7-6. Several of the practice reduction factors suggest that reducing sediment loading would simultaneously reduce nutrient loading. PLET BMP descriptions and the reduction fractions can be found in the Best Management Practice Definition Document for Pollution Load Estimation Tool [EPA, 2023].

Table 7-1. PLET Cropland Best Management Practices and Average Reduction Metric

Practice	Nitrogen Reduction (Fraction)	Phosphorus Reduction (Fraction)	Sediment Reduction (Fraction)	Average Reduction (Fraction)	Average Survey Score	Reduction Survey Score
Streambank Stabilization and Fencing	0.75	0.75	0.75	0.75	2.0	1.5
Buffer - Grass (35 feet wide)	0.34	0.44	0.53	0.44	3.0	1.3
Contour Farming	0.34	0.46	0.41	0.40	2.0	0.8
Terrace	0.27	0.31	0.41	0.33	2.0	0.7
Controlled Drainage	0.39	0.35	0	0.25	2.5	0.6
Conservation tillage 1 (30-59% residue)	0.07	0.36	0.46	0.30	2.0	0.6
Conservation Tillage 2 (equal or more than 30% residue)	0.13	0.69	0.79	0.54	1.0	0.5
Nutrient Management 2 (determined rate plus additional considerations)	0.22	0.56	0	0.26	2.0	0.5
Buffer – Forest (100 feet wide)	0.49	0.47	0.6	0.52	1.0	0.5
Nutrient Management 1 (determined rate)	0.15	0.45	0	0.20	2.0	0.4
Bioreactor	0.45	0	0	0.15	1.0	0.2
Two-Stage Ditch	0.12	0.28	0	0.13	1.0	0.1
Cover Crop 1 (group A commodity; high till only for sediment)	0.0078	0	0	0.00	0.0	0.0
Cover Crop 2 (group A traditional normal planting time; high till only for total phosphorus and sediment)	0.2	0.07	0.1	0.12	0.0	0.0
Cover Crop 3 (group A traditional early planting time) (high till only for total phosphorus and sediment)	0.2	0.15	0.2	0.18	0.0	0.0

Table 7-2. PLET Pasture Best Management Practices and Average Reduction Metric

Practice	Nitrogen Reduction (Fraction)	Phosphorus Reduction (Fraction)	Sediment Reduction (Fraction)	Average Reduction (Fraction)	Average Survey Score	Reduction Survey Score
Streambank Stabilization and Fencing	**0.75**	**0.75**	**0.75**	**0.75**	**3.0**	**2.3**
Buffer – Grass (minimum 35 feet wide)	**0.87**	**0.89**	**0.65**	**0.80**	**2.8**	**2.2**
Livestock Exclusion Fencing	0.2	0.43	0.64	0.42	3.4	1.4
Buffer – Forest (minimum 35 feet wide)	0.45	0.4	0.53	0.46	2.2	1.0
Streambank Protection Without Fencing	0.15	0.22	0.58	0.32	2.8	0.9
Critical Area Planting	0.18	0.2	0.42	0.27	3.3	0.9
Grazing Land Management (rotational grazing with fenced areas)	0.43	0.26	0	0.23	3.8	0.9
Heavy Use Area Protection	0.18	0.19	0.33	0.23	3.5	0.8
Prescribed Grazing	0.41	0.23	0.33	0.32	2.5	0.8
Multiple Practices	0.25	0.2	0.22	0.22	3.6	0.8
Winter Feeding Facility	0.35	0.4	0.4	0.38	2.0	0.8
Use Exclusion	0.43	0.08	0.51	0.34	1.7	0.6
30-meter Buffer With Optimal Grazing	0.16	0.65	0	0.27	1.5	0.4
Alternative Water Supply	0.18	0.13	0.2	0.17	2.0	0.3
Pasture and Hayland Planting (also called Forage Planting)	0.18	0.15	0	0.11	3.0	0.3
Litter Storage and Management	0.14	0.14	0	0.09	3.4	0.3

Table 7-3. PLET Feedlot Best Management Practices and Average Reduction Metric

Practice	Nitrogen Reduction (Fraction)	Phosphorus Reduction (Fraction)	Sediment Reduction (Fraction)	Average Reduction (Fraction)	Average Survey Score	Reduction Survey Score
Waste Management System	**0.8**	**0.9**	**0**	**0.57**	**3.6**	**2.0**
Waste Storage Facility	0.65	0.6	0	0.42	3.6	1.5
Diversion	0.45	0.7	0	0.38	3.5	1.3
Terrace	0.55	0.85	0	0.47	2.8	1.3
Filter Strip	0	0.85	0	0.28	4.0	1.1
Runoff Management System	0	0.83	0	0.28	3.3	0.9
Solids Separation Basin With Infiltration Bed	0	0.8	0	0.27	3.0	0.8
Solids Separation Basin	0.35	0.31	0	0.22	3.0	0.7

Table 7-4. PLET Forest Best Management Practices and Average Reduction Metric

Practice	Nitrogen Reduction (Fraction)	Phosphorus Reduction (Fraction)	Sediment Reduction (Fraction)	Average Reduction (Fraction)	Average Survey Score	Reduction Survey Score
Site Preparation/Straw/Crimp Seed/Net	0	0	0.93	0.31	3.7	1.1
Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants	0	0	0.95	0.32	3.0	1.0
Road Grass and Legume Seeding	0	0	0.71	0.24	3.7	0.9
Site Preparation/Straw/ Polymer/Seed/Fertilizer/ Transplants	0	0	0.86	0.29	3.0	0.9
Site Preparation/Hydro Mulch/ Seed/Fertilizer	0	0	0.71	0.24	3.5	0.8
Site Preparation/Steep Slope Seeder/ Transplants	0	0	0.81	0.27	3.0	0.8
Site Preparation/Straw/ Net/Seed/Fertilizer/Transplants	0	0	0.83	0.28	2.8	0.8
Site Preparation/Hydro Mulch/ Seed/Fertilizer/Transplants	0	0	0.69	0.23	3.2	0.7
Road Hydro Mulch	0	0	0.41	0.14	4.3	0.6
Road Tree Planting	0	0	0.5	0.17	3.4	0.6
Road Straw Mulch	0	0	0.41	0.14	4.0	0.5
Road Dry Seeding	0	0	0.41	0.14	3.6	0.5

Table 7-5. PLET Urban Best Management Practices and Average Reduction Metric

Practice	Nitrogen Reduction (Fraction)	Phosphorus Reduction (Fraction)	Sediment Reduction (Fraction)	Average Reduction (Fraction)	Average Survey Score	Reduction Survey Score
Extended Wet Detention	**0.55**	**0.69**	**0.86**	**0.70**	**3.8**	**2.7**
Infiltration Basin	**0.6**	**0.65**	**0.75**	**0.67**	**3.3**	**2.2**
Concrete Grid Pavement	**0.9**	**0.9**	**0.9**	**0.90**	**2.3**	**2.1**
Low Impact Development - Infiltration Swale	0.5	0.65	0.9	0.68	2.9	2.0
Porous Pavement	0.85	0.65	0.9	0.80	2.2	1.8
Bioretention Facility	0.63	0.8	0	0.48	3.6	1.7
Infiltration Trench	0.55	0.6	0.75	0.63	2.6	1.6
Infiltration Devices	0	0.83	0.94	0.59	2.7	1.6
Vegetated Filter Strips	0.4	0.45	0.73	0.53	2.9	1.5
Settling Basin	0	0.52	0.82	0.45	3.3	1.5
Low Impact Development - Infiltration Trench	0.5	0.5	0.9	0.63	2.3	1.4
Dry Detention	0.3	0.26	0.58	0.38	3.7	1.4
Wetland Detention	0.2	0.44	0.78	0.47	2.9	1.4
Sand Filter/Infiltration Basin	0.35	0.5	0.8	0.55	2.5	1.4
Low Impact Development - Filter/Buffer Strip	0.3	0.3	0.6	0.40	3.3	1.3
Low Impact Development - Bioretention	0.43	0.81	0	0.41	3.1	1.3
Low Impact Development - Dry Well	0.5	0.5	0.9	0.63	1.9	1.2
Grass Swales	0.1	0.25	0.65	0.33	3.5	1.2
Alum Treatment	0.6	0.9	0.95	0.82	1.4	1.1
Wet Pond	0.35	0.45	0.6	0.47	2.3	1.1
Sand Filters	0	0.38	0.83	0.40	2.6	1.0
Low Impact Development - Wet Swale	0.4	0.2	0.8	0.47	2.1	1.0
Water Quality Inlet With Sand Filter	0.35	0	0.8	0.38	2.5	1.0
Low Impact Development - Vegetated Swale	0.08	0.18	0.48	0.25	3.3	0.8
Filter Strip – Agricultural	0.53	0.61	0.65	0.60	1.3	0.8
Water Quality Inlets	0.2	0.09	0.37	0.22	3.3	0.7
Oil/Grit Separator	0.05	0.05	0.15	0.08	3.7	0.3
Weekly Street Sweeping	0	0.06	0.16	0.07	2.9	0.2

Table 7-6. Reductions From Priority PLET Best Management Practices Run on 25 Percent of Each Applicable Land Cover

Land Use	Percent of Total Area	Practice	Nitrogen Load (lb/year)	Percent Nitrogen Reduction	Phosphorus Load (lb/year)	Percent Phosphorus Reduction	Sediment Load (tons/year)	Percent Sediment Reduction
All	N/A	Base Load (no BMPs)	334,904	NA	90,435	NA	17,404	NA
Cropland	12	Stream Stabilization and Fencing	307,157	8.3	83,443	7.7	14,893	14.4
Cropland	12	Buffer - Grass (35 feet wide)	320,290	4.4	85,962	5.0	15,629	10.2
Pasture	1	Stream Stabilization and Fencing	332,197	0.8	90,171	0.3	17,343	0.4
Pasture	1	Livestock Exclusion Fencing	334,067	0.3	90,263	0.2	17,351	0.3
Feedlot	<1	Waste Management System	324,550	3.1	88,105	2.6	17,404	0.0
Forest	55	Site Prep/Straw/ Crimp Seed/Net	334,239	0.2	90,179	0.3	17,196	1.2
Forest	66	Site Prep/Straw/ Crimp Seed/Fertilizer/ Transplants	334,225	0.2	90,173	0.3	17,191	1.2
Urban	4	Extended Wet Detention	331,065	1.2	89,677	0.8	17,167	1.4
Urban	4	Infiltration Basin	330,708	1.3	89,719	0.8	17,197	1.2
Urban	4	Concrete Grid Pavement	328,623	1.9	89,446	1.1	17,156	1.4

lb/year = pounds per year

Numerous BMPs that reduce nutrient and sediment NPS loads exist from other sources not included in PLET. Nutrient and sediment load reductions from BMPs are ranked in the Natural Resources Conservation Service (NRCS) Conservation Practice Physical Effects (CPPE) [NRCS, 2024b] as substantial, moderate to substantial, moderate, slight to moderate, and slight. Similarly, reductions expected from urban practices are provided in the International Best Management Practices Database (BMPDB) [International Stormwater BMPDB, 2024]. Tables 7-7 and 7-8 list the most effective CPPE practices (i.e., substantial, moderate to substantial, and moderate reductions) and urban practices for sediment reduction. Table 7-9 shows the most effective CPPE practices (i.e., substantial, moderate to substantial, and moderate reductions) for nutrient reduction, and Tables 7-10 and 7-11 provide the urban practices for nitrogen and phosphorus reduction, respectively [NRCS, 2024b]. Irrigation practices are important in the project area for reduction of nutrients and sediment but were not available in PLET. The NRCS Irrigation Water Management practice code Number 449 has slight to moderate improvement (less than every other practice listed in CPPE practices tables) for sediment and nutrients. However, the NRCS Irrigation Water Management practice code Number 449 has been added to these tables because of its high usage in the project area. Other practices with slight to moderate improvement should not be discouraged, even though they are not included in the tables of this section.

Practices associated with reducing wildfire impacts comprise of a susceptibility analysis, pre-disaster planning and mitigation, and a post-fire hazard analysis. Post-fire hazards consist of flooding, sediment/hillslope erosion, debris flow, fluvial hazard zones, water quality issues, and risk to water infrastructure. The susceptibility analysis includes determining the assets at risk from fire and the risk severity of post-fire impacts, such as flooding, loss of life, loss of property, damage to infrastructure, utility interruptions, and water quality and quantity issues. Post-fire BMPs should involve slope stabilization and reforestation.

Table 7-7. Most Effective Sediment to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects (Page 1 of 2)

Practice	Practice Code	Unit	Effect	Rationale
Constructed Wetland	656	Acre	Substantial Improvement	The system traps and holds suspended materials from entering surface waters.
Filter Strip	393	Acre	Substantial Improvement	Vegetation protects the soil surface and traps sediment, nutrients, and other materials.
Grassed Waterway	412	Acre	Substantial Improvement	Erosion is controlled, vegetation traps sediment, and runoff is delivered at a safe velocity.
Lined Waterway or Outlet	468	Feet	Substantial Improvement	Erosion is controlled, vegetation traps sediment, and runoff is delivered at a safe velocity.
Riparian Forest Buffer	391	Acre	Substantial Improvement	Vegetation protects the soil surface and traps sediment, nutrients, and other materials.
Anionic Polyacrylamide Erosion Control	450	Acre	Moderate to Substantial Improvement	The action reduces erosion and sediment load.
Conservation Cover	327	Acre	Moderate to Substantial Improvement	Less erosion and runoff reduce sediment.
Critical Area Planting	342	Acre	Moderate to Substantial Improvement	Vegetation reduces erosion and sediment delivery.
Forest Farming	379	Acre	Moderate to Substantial Improvement	Varied canopy layers and surface cover and organic matter management reduce sediment-laden runoff from reaching surface water conveyances.
Grazing Land Mechanical Treatment	548	Acre	Moderate to Substantial Improvement	Improved hydrologic indicators increase infiltration and decrease runoff.
Land Reclamation, Abandoned Mined Land	543	Acre	Moderate to Substantial Improvement	Erosion control and revegetation will reduce concerns about sediments.
Land Reclamation, Currently Mined Land	544	Acre	Moderate to Substantial Improvement	Erosion control and revegetation will reduce concerns about sediments.
Land Reclamation, Landslide Treatment	453	N/A	Moderate to Substantial Improvement	Erosion control and increased cover will reduce runoff and sediment.
Residue and Tillage Management, No Till	329	Acre	Moderate to Substantial Improvement	Less erosion and runoff reduce the transport of sediment.
Riparian Herbaceous Cover	390	Acre	Moderate to Substantial Improvement	Vegetation protects the soil surface and traps sediment, nutrients, and other materials.
Sediment Basin	350	N/A	Moderate to Substantial Improvement	The basin retains sediment, decreasing runoff turbidity.
Stormwater Runoff Control	570	N/A	Moderate to Substantial Improvement	Controlling erosion and runoff will reduce off-site sediment.
Vegetative Barrier	601	Feet	Moderate to Substantial Improvement	Vegetation slows runoff and filters sediment.
Water and Sediment Control Basin	638	N/A	Moderate to Substantial Improvement	The basin retains sediment and minimizes turbidity.
Access Control	472	Acre	Moderate Improvement	Excluding animals, people and vehicles influence the vigor and health of vegetation and soil conditions, reducing sediment supply to surface waters when applied with other management practices.
Alley Cropping	311	Acre	Moderate Improvement	Vegetation inhibits sediment-laden water to allow it to drop sediment load.
Conservation Crop Rotation	328	Acre	Moderate Improvement	Depending on crop rotation and biomass produced, crop rotation reduces erosion and runoff, which reduces transport of sediment.
Contour Buffer Strips	332	Acre	Moderate Improvement	Contour buffer strips reduce sheet and rill erosion and slow the velocity of runoff, thereby reducing the transport of sediment to surface water.

Table 7-7. Most Effective Sediment to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects (Page 2 of 2)

Practice	Practice Code	Unit	Effect	Rationale
Contour Orchard and Other Perennial Crops	331	Acre	Moderate Improvement	Contouring reduces sheet and rill erosion and slows the velocity of runoff, thereby reducing the transport of sediment to surface water.
Field Border	386	Feet	Moderate Improvement	Vegetation protects the soil surface and traps sediment.
Residue and Tillage Management, Reduced Till	345	Acre	Moderate Improvement	Less erosion and runoff reduce the transport of sediment.
Road/Trail/Landing Closure and Treatment	654	Feet	Moderate Improvement	Vegetation and other treatments reduce erosion and sediment delivery.
Silvopasture	381	Acre	Moderate Improvement	On sites that previously lacked permanent vegetation, establishing a combination of trees or shrubs and compatible forages will reduce the erosive force of water and reduce sedimentation.
Stripcropping	585	Acre	Moderate Improvement	Stripcropping reduces erosion and slows water and wind velocities, increasing infiltration.
Surface Roughening	609	Acre	Moderate Improvement	The formation of clods will reduce wind -borne sediment.
Tree/Shrub Establishment	612	Acre	Moderate Improvement	Vegetation provides cover, reduces wind velocities, and increases infiltration.
Wetland Wildlife Habitat Management	644	Acre	Moderate Improvement	Improved vegetative cover will reduce of runoff and sedimentation.
Irrigation Water Management	449	Acre	Slight to Moderate Improvement	Water is applied at rates that minimize soil erosion.

Table 7-8. Most Effective Sediment (Greater Than 10 Percent) Reducing Urban Best Management Practices From the International Best Management Practice Database

BMP Category	Concentration In (mg/L)	Concentration Out (mg/L)	Reduction (%)
High-Rate Biofiltration	30.8	3.8	88
Media Filter	44	7.2	84
Bioretention	44	10	77
Retention Pond	49	12	76
Porous Pavement	77	22	71
Detention Basin	65.1	22	66
Wetland Basin	35.5	14	61
High-Rate Media Filtration	44	18	59
Oil-Grit Separator	36	15.5	57
Grass Strip	48	23	52
Grass Swale	26	13.7	47
Hydrodynamic Separator	63.9	39	39

mg/L = milligrams per liter

Table 7-9. Most Effective Nutrient to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects (Page 1 of 2)

Practice	Practice Code	Unit	Effect	Rationale
Filter Strip	393	Acre	Substantial Improvement	Solid organics and sediment-attached nutrients are filtered out; soluble nutrients infiltrate the soil and may be taken up by plants or used by soil organisms.
Nutrient Management	590	Acre	Substantial Improvement	The right amount, source, placement, and timing (4Rs) provide nutrients when plants need them most.
Riparian Forest Buffer	391	Acre	Substantial Improvement	Plants and soil organisms in the buffer will use nutrients; the buffer will filter out suspended particles to which nutrients are attached.
Riparian Herbaceous Cover	390	Acre	Substantial Improvement	Permanent vegetation will uptake excess nutrients.
Saturated Buffer	604	Feet	Substantial Improvement	The buffer removes 60-100% of nitrogen from drain pipe discharge.
Sediment Basin	350	N/A	Substantial Improvement	The action will tend to accumulate contaminants attached to sediments, and infiltrating waters will remove soluble contaminants.
Conservation Cover	327	Acre	Moderate to Substantial Improvement	Less erosion and runoff reduce the transport of nutrients; permanent cover can take up excess nutrients and convert them to stable organic forms.
Constructed Wetland	656	Acre	Moderate to Substantial Improvement	The action traps nutrients and organics, which are broken down and used by wetland plants.
Short-Term Storage of Animal Waste and Byproducts	318	Cu. Yard	Moderate to Substantial Improvement	Short-term storage provides flexibility in rate, timing, and location of waste application, with the potential for reductions of contaminants available for transport.
Vegetated Treatment Area	635	Acre	Moderate to Substantial Improvement	Infiltration and plant uptake in the treatment area will remove contaminants from polluted runoff and wastewater.
Waste Storage Facility	313	#	Moderate to Substantial Improvement	Storage provides flexibility in rate, timing, and location of waste application, with the potential for reductions of contaminants available for transport.
Waste Treatment Lagoon	359	#	Moderate to Substantial Improvement	Storage provides flexibility in rate, timing, and location of waste application, with the potential for reductions of contaminants available for transport.
Watering Facility	614	#	Moderate to Substantial Improvement	When used in place of an instream water source, this action decreases manure deposition in the stream.
Alley Cropping	311	Acre	Moderate Improvement	Plants and soil organisms uptake nutrients.
Conservation Crop Rotation	328	Acre	Moderate Improvement	Nitrogen-demanding or deep-rooted crops can remove excess nitrogen; legumes in rotation will provide slow-release nitrogen and reduce the need for additional nitrogen.
Denitrifying Bioreactor	605	#	Moderate Improvement	Reactors remove 30 to 60% of the nitrogen load coming from a drain pipe.
Diversion	362	Feet	Moderate Improvement	The action diverts surface water away from feedlots and reduces 5-day Biological Oxygen Demand (BOD5); total phosphorous and total nitrogen load to receiving surface waters.

Table 7-9. Most Effective Nutrient to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects (Page 2 of 2)

Practice	Practice Code	Unit	Effect	Rationale
Grazing Land Mechanical Treatment	548	Acre	Moderate Improvement	Modifications to soil conditions will increase infiltration and reduce runoff; improved plant growth will better use nutrients, decreasing the potential for losses in runoff.
Livestock Shelter Structure	576	#	Moderate Improvement	Moving livestock away from streams and riparian areas will decrease the probability of excess manure nutrients in the water.
Silvopasture	381	Acre	Moderate Improvement	Depending on previous vegetative conditions, whether forestland or pasture, the permanent silvopasture vegetation may take up comparatively greater amounts of nutrients.
Wetland Creation	658	Acre	Moderate Improvement	Wetland systems will use dissolved nutrients and trap sediment-attached nutrients and organics.
Wetland Enhancement	659	Acre	Moderate Improvement	Wetland systems will use dissolved nutrients and trap sediment-attached nutrients and organics.
Wetland Restoration	657	Acre	Moderate Improvement	Wetland systems will use dissolved nutrients and trap sediment-attached nutrients and organics.
Irrigation Water Management	449	Acre	Slight to Moderate Improvement	Water is applied at rates that reduce the potential for erosion and detachment, and minimize nutrient transport to surface water.

Table 7-10. Most Effective Nitrogen (Greater Than 10 Percent) Reducing Urban Best Management Practices From the International Best Management Practice Database

BMP Category	Concentration In (mg/L)	Concentration Out (mg/L)	Reduction (%)
High-Rate Media Filtration	1.88	1	47
Retention Pond	1.63	1.2	26
Bioretention	1.26	0.96	24
Wetland Channel	1.76	1.45	18
Media Filter	1.06	0.89	16
Grass Strip	1.47	1.27	14
Grass Swale	0.71	0.63	11

Table 7-11. Most Effective Phosphorus (Greater Than 10 Percent) Reducing Urban Best Management Practices From the International Best Management Practice Database

BMP Category	Concentration In (mg/L)	Concentration Out (mg/L)	Reduction (%)
Oil-Grit Separator	0.316	0.115	64
Retention Pond	0.246	0.12	51
High-Rate Biofiltration	0.099	0.05	49
Media Filter	0.165	0.09	45
Porous Pavement	0.17	0.1	41
High-Rate Media Filtration	0.12	0.08	33
Wetland Basin	0.17	0.122	28
Detention Basin	0.25	0.186	26
Hydrodynamic Separator	0.23	0.176	23

7.2 E. COLI

E. coli load reductions from BMPs are ranked in the NRCS CPPE as substantial, moderate to substantial, moderate, slight to moderate, and slight. Table 7-12 lists the most effective practices (i.e., substantial, moderate to substantial, and moderate reductions) [NRCS, 2024b]. *E. coli* reductions expected from the International BMP Database's urban practices are summarized in Table 7-13 [International Stormwater BMPDB, 2024]. Unlike the sediment and nutrient reductions, *E. coli* reductions are not quantified using the PLET model; therefore, priority BMPs should be those with the highest amount of reduction in the priority areas on the relative land cover. The NRCS Irrigation Water Management practice code Number 449 has slight to moderate improvement for bacteria, and it was included in Table 7-12 because of its high probability of installation. Practices with slight to moderate improvement should not be discouraged, even though they are not included in the tables of this section.

Table 7-12. Most Effective Bacteria (Pathogen) to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects (Page 1 of 2)

Practice	Practice Code	Unit	Effect	Rationale
Vegetated Treatment Area	635	Acre	Substantial Improvement	Infiltration and plant uptake in the treatment area will remove contaminants from polluted runoff and wastewater.
Constructed Wetland	656	Acre	Moderate to Substantial Improvement	Pathogens are trapped in the wetland.
Filter Strip	393	Acre	Moderate to Substantial Improvement	Filter strips capture and delay pathogen movement, but mortality may also be delayed because vegetative cover may protect pathogens from desiccation.
Nutrient Management	590	Acre	Moderate to Substantial Improvement	Proper application of manure, compost, and bio-solids should reduce or eliminate pathogens and/or chemicals (if present in source material) from moving into surface water.

Table 7-12. Most Effective Bacteria (Pathogen) to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects (Page 2 of 2)

Practice	Practice Code	Unit	Effect	Rationale
Waste Treatment Lagoon	359	N/A	Moderate to Substantial Improvement	Storage provides flexibility in rate, timing, and location of waste application, with the potential for reductions of contaminants available for transport.
Alley Cropping	311	Acre	Moderate Improvement	Ground vegetation captures and delays pathogen movement and thereby increases their mortality.
Forest Farming	379	Acre	Moderate Improvement	Management of multi-layered canopy cover and organic matter impedes the movement of harmful pathogens.
Land Reclamation, Abandoned Mined Land	543	Acre	Moderate Improvement	Reconstructed mine land provides reduced runoff and erosion, and the filtering effects of vegetation reduce the risk of harmful levels of pathogens entering surface water.
Land Reclamation, Currently Mined Land	544	Acre	Moderate Improvement	Reconstructed mine land provides reduced runoff and erosion, and the filtering effects of vegetation reduce the risk of harmful levels of pathogens entering surface water.
Riparian Forest Buffer	391	Acre	Moderate Improvement	Riparian areas capture and delay pathogen movement and thereby increase their mortality.
Riparian Herbaceous Cover	390	Acre	Moderate Improvement	Vegetation traps pathogens providing increased opportunity for solar and microbial action to destroy some.
Irrigation Water Management	449	Acre	Slight to Moderate Improvement	Water is applied at rates that minimize pathogens transport to surface water.

Table 7-13. Most Effective *E. coli* (Greater Than 10 Percent) Reducing Urban Best Management Practices From the International Best Management Practice Database

BMP Category	Concentration In (mpn/100 mL)	Concentration Out (mpn/100 mL)	Reduction (%)
Wetland Basin	6,210	884	86
Retention Pond	4,110	708	83
Media Filter	570	215	62
Detention Basin	900	500	44
Bioretention	275	158	43
Hydrodynamic Separator	2,400	1,700	29

7.3 HEAVY METALS

There are several risks associated with abandoned mines. To prioritize public safety, specific locations of abandoned mines are not disclosed; however, taking action to mitigate potential dangers is important. The efforts of groups like Defense-Related Uranium Mines (DRUMs) are crucial in sealing off dangerous openings, identifying hazards, and implementing safety measures to protect the public and environment. This approach balances transparency with the need to safeguard communities from potential harm and is more focused on water quality and heavy-metal-impaired waterbodies. When waters are exposed to rocks containing sulfide minerals, they tend to become acid-rich. This occurrence is called acid rock drainage and is prevalent in mined areas where spent materials were left unclaimed. When the waters become acidic, they are more capable of gathering up and carrying heavy metals, including those that impair the waterbodies on the 303(d) list within the project area.

The AML implementation should be guided by the NRCS Code 543 practices. The NRCS Conservation Practice Standard (CPS) states the following options for land reclamation of AML [NRCS, 2024c]:

> **Public health and safety:** Prior to beginning onsite investigations, identify possible hazards and implement appropriate safety precautions.
>
> **Erosion and sediment control practices:** Control or treat runoff and sedimentation from treatment areas, soil material stockpiles, access roads, and permanent impoundments. Use sediment-trapping practices, such as filter strips, riparian forest buffers, contour buffer strips, silt fences, sediment basins, or similar practices. Include temporary practices necessary during earth moving activities and permanent practices necessary to stabilize the site and control runoff from the site after reclamation.
>
> Control the generation of particulate matter and fugitive dust during removal and replacement of soil and other materials.
>
> **Site preparation**: Identify areas for preservation during construction. Include areas containing desirable trees, shrubs, grasses, stream corridors, natural springs, historic structures, or other important features that will be protected during construction activities.
>
> Remove trees, logs, brush, rubbish, and other debris that interfere with reclamation operations. Dispose of debris material in a way that does not create a resource problem or interfere with reclamation activities and the planned land use.
>
> **Storage of soil materials:** Stockpile soil or fill materials until needed for reclamation. Protect stockpiles from wind and water erosion, dust generation, unnecessary compaction, and contamination by noxious weeds, invasive species, or other undesirable materials.
>
> **Highwall treatment**: Prior to backfilling, rock walls should have horizontal:vertical slopes of 0.5:1 or less. before placing backfill against the wall. Determine the thickness and density of lifts for fill material to limit the deep infiltration of precipitation and to limit settlement of the completed fill to acceptable levels, based on the available fill material and planned land use.
>
> **Shafts and adits:** Use NRCS CPS Mine Shaft and Adit Closing (Code 457) to close/seal a shaft or adit. Divert runoff away from the shaft or adit.
>
> **Placement of surface material:** Develop a grading plan that returns the site, including any off-site borrow areas, to contours that are suitable for the planned land use and control soil loss.

Include the spreading of stockpiled topsoil material as the final layer. Treat graded areas to eliminate slippage surfaces and promote root penetration before spreading surface material. Spread surface soil without causing over-compaction.

Shape the land surface to provide adequate surface drainage and to blend into the surrounding topography. Use erosion control practices to reduce slope lengths where sheet and rill erosion exceeds acceptable levels. If settlement is likely to interfere with the planned land use, develop surface drainage or water disposal plans that compensate for the expected settlement.

If the subsurface material is not a source of contamination, improve soil permeability after placing backfill material by using deep ripping tools to decrease compaction, promote infiltration, and encourage root development. Do not plan practices that promote infiltration if seepage through cover materials has the potential to develop or exacerbate acid mine drainage loading or treatment.

Restoration of borrow material: If cover or fill material is taken from areas outside the reclamation site, stockpile the topsoil from the borrow area separately, and replace it on the borrow area after the area is restored for its intended purpose. Grade and shape the borrow area for proper drainage, and revegetate the site to control erosion.

Establishment of vegetation: Prepare a revegetation plan for the treated areas. Select plant materials suitable for the specified end land use according to local climate potential, site conditions, and local NRCS criteria. Use native species where possible. Avoid use of invasive species.

Use the criteria in NRCS CPS Critical Area Planting (Code 342) to establish grasses and forbs. Use NRCS CPS Tree-Shrub Establishment (Code 612) for the establishment of trees and shrubs. If vegetation cannot be established, use NRCS CPS Mulching (Code 484).

Control of toxic aqueous discharge: Identify and document water quality and quantity and releases from seeps, overland, and mine shafts. Quantify water impacts such as low pH, arsenic, etc. Identify measures that may affect treatment such as dissolved oxygen, iron, aluminum, magnesium, manganese, etc.

Methods for treatment of toxic aqueous discharge depend upon the type and extent of the contamination. When control of toxic mine drainage is needed, use BMPs that comply with state regulatory requirements. Evaluate the consequences of each potential treatment method to avoid creating a secondary problem. Select a method that can adequately treat the water based on the quantity and chemistry of the mine water and that is suitable for the planned level of operation and maintenance. Size the treatment area and settling basin(s) to allow for the volume of flow and treatment rate. Include a plan for disposal of the precipitated metals and spent treatment material.

Reduce the volume of contaminated water by diverting clean water away from the contaminated area or by limiting the opportunity for water to contact contaminated soil materials. Install practices, such as diversions, underground outlets, lined waterways, or grade stabilization structures, to control surface runoff. To the extent possible, divert clean upslope runoff away from the treated area.

- **Contaminated soil materials:** Remove, bury, or treat soil materials that adversely affect or have the potential to adversely affect water quality or plant growth. Bury materials containing heavy metals below the root zone, add suitable soil amendments, or both, to minimize the negative effect of this material. Separate soils with high electrical conductivity, calcium carbonate, sodium, or other restrictive properties, and treat, if practicable.
- Add a layer of compacted clay or a landfill cover over the contaminated material to deter infiltration. Place an earthfill blanket over the compacted clay to support plant growth. For each layer, identify the lift thickness and density needed to limit deep infiltration of precipitation and excessive settlement of the completed fill.
- **Mine sealing:** If clean water is entering a mine opening, divert the water away. If contaminated water is exiting the mine, it may be necessary to seal the mine to prevent water movement. Use NRCS CPS Mine Shaft and Adit Closing (Code 457) to design the mine seal. Divert surface water away from the mine seal.
- **Neutralization and precipitation:** Precipitate toxic metals and neutralize acidity in mine drainage using chemical or biological treatment. Select a method that can adequately treat the water based on the quantity and chemistry of the mine water and that is suitable for the planned level of operation and maintenance. Size the treatment area and settling basin(s) to allow for the volume of flow and treatment rate. Include a plan for disposal of the precipitated metals and spent treatment material.

Aside from AMLs, heavy metals also come from agricultural lands and urbanized areas. Heavy metal load reductions from BMPs are ranked in the NRCS CPPE as substantial, moderate to substantial, moderate, slight to moderate, and slight. Table 7-14 lists the most effective practices (i.e., substantial, moderate to substantial, and moderate reductions) [NRCS, 2024b]. Heavy metal reductions expected from the International BMP Database's urban practices are summarized in Table 7-15 [International Stormwater BMPDB, 2024]. Heavy metal reductions are not quantified using the PLET model; therefore, priority BMPs should be those with the highest amount of reduction in the priority areas on the relative land cover. The NRCS Irrigation Water Management practice code Number 449 has slight to moderate improvement for heavy metals. Irrigation management is the only NRCS practice included with less than moderate improvement. It was included because of its high probability of installation in the project area. Practices with slight to moderate improvement should not be discouraged, even though they are not included in the tables of this section.

Table 7-14. Most Effective Heavy Metals to Surface Water Reducing Agricultural Best Management Practices From the Colorado Natural Resources Conservation Service Conservation Practice Physical Effects

Practice	Practice Code	Unit	Effect	Rationale
On-Farm Secondary Containment Facility	319	N/A	Substantial Improvement	Provides for spill containment of petroleum products.
Constructed Wetland	656	Acre	Moderate to Substantial Improvement	Vegetation and anaerobic conditions trap heavy metals.
Irrigation and Drainage Tailwater Recovery	447	N/A	Moderate to Substantial Improvement	The action captures irrigation and/or drainage runoff and associated metal-laden sediment.
Land Reclamation, Landslide Treatment	453	N/A	Moderate to Substantial Improvement	Increased vegetation increases infiltration and reduces runoff and erosion.
Land Reclamation, Toxic Discharge Control	455	N/A	Moderate to Substantial Improvement	Control of discharge and reduction in infiltration reduce off-site movement of contaminated water.
Riparian Forest Buffer	391	Acre	Moderate Improvement	The action filters sediment, and some plants may uptake heavy metals.
Road/Trail/Landing Closure and Treatment	654	Feet	Moderate Improvement	Decreased erosion and runoff reduce heavy metal delivery to surface water; increased soil organic matter increases the capacity of soils to retain heavy metals; permanent vegetation can uptake heavy metals.
Irrigation Water Management	449	Acre	Slight to Moderate Improvement	Water is applied at rates that minimize heavy metals transport to surface water.

Table 7-15. Most Effective Heavy Metal (Greater Than 10 Percent) Reducing Urban Best Management Practices From the International Best Management Practice Database

Category	BMP Category	Concentration In (µg/L)	Concentration Out (µg/L)	Reduction (%)
Arsenic (T)	Media Filter	0.9	0.765	15
Arsenic (T)	Retention Pond	1	0.87	13
Arsenic (T)	Grass Swale	1.11	1	10
Cadmium (D)	Grass Swale	0.2	0.116	42
Cadmium (D)	Grass Strip	0.114	0.07	39
Cadmium (D)	Media Filter	0.2	0.128	36
Cadmium (D)	Oil-Grit Separator	0.155	0.101	35
Cadmium (D)	Hydrodynamic Separator	0.137	0.0933	32
Cadmium (D)	Retention Pond	0.163	0.125	23
Cadmium (D)	Detention Basin	0.117	0.0942	19
Copper (D)	Wetland Basin	3.95	2.29	42
Copper (D)	Grass Strip	12	7.4	38
Copper (D)	Retention Pond	5.08	3.5	31
Copper (D)	Detention Basin	3.96	2.99	24
Copper (D)	High-Rate Biofiltration	4.5	3.4	24
Copper (D)	Media Filter	3.86	3	22
Copper (D)	Grass Swale	6.5	5.63	13
Iron (T)	Retention Pond	1050	285	73
Iron (T)	Media Filter	685	195	72
Iron (T)	Grass Strip	746	320	57
Iron (T)	Grass Swale	216	136	37
Zinc (D)	Media Filter	32	7.15	78
Zinc (D)	Porous Pavement	17.8	4.09	77
Zinc (D)	Wetland Basin	22.6	8.35	63
Zinc (D)	High-Rate Biofiltration	189	79	58
Zinc (D)	Grass Strip	33.6	17	49
Zinc (D)	Grass Swale	34.2	19.8	42
Zinc (D)	Bioretention	20.8	12.5	40
Zinc (D)	Retention Pond	23.4	16	32
Zinc (D)	Detention Basin	12.1	9.38	22

µg/L = micrograms per liter

8.0 PAST AND CURRENT BEST MANAGEMENT PRACTICES

A significant amount of BMPs have been, and are currently being, implemented in the Cache la Poudre HUC8 Watershed. Based on Survey #2 provided to the stakeholders, the following BMPs have been or are being implemented in the Cache la Poudre River Watershed project area:

- Regional Stormwater Detention
- Extended Detention Basins
- Retention Ponds
- Bioretention
- Hydrodynamic Separators
- Inlet Filters
- Sand Filters
- Bioswales
- Other Structural Stormwater BMPs
- Pollution Prevention Programs
- Spill Response
- Public Education

The surveys also provided planned, near-future projects (including continuation of existing programs) and a pilot program to use water treatment residuals as filter media in bioretention basins to sequester phosphorus from stormwater runoff.

Although this list includes some of the implementation accomplishments within the project area, it does not include all of the BMPs that have been or are currently being implemented.

Practices implemented by watershed and/or by county were not available from the NRCS; however, they were available for the State of Colorado. An assumption was made that the more likely a practice is to be implemented in Colorado, the more likely it would be implemented in the project area. Funding sources and programs involved in implementing practices in Colorado include the Agricultural Conservation Easement Program (ACEP), Agricultural Water Enhancement Program (AWEP) Conservation Reserve Program (CRP), Conservation Stewardship Program (CSP), Conservation Technical Assistance (CTA), Emergency Watershed Protection Program (EWP), Environmental Quality Incentives Program (EQIP), Farm and Ranch Lands Protection Program (FRPP), Grass Reserve Program (GRP), Regional Conservation Partnership Program (RCPP), Resource Conservation and Development (RCD) Program, Watershed Protection and Flood Prevention Operations (WFPO) Program, Watershed Rehabilitation (WHRB), Wetlands Reserve Program (WRP), and Wildlife Habitat Incentive Program (WHIP). Table 8-1 lists the practices implemented on more than 500 mi^2 in Colorado since 2005, which should continue to be implemented for water quality improvement [USDA, 2024].

Table 8-1. Best Management Practices Implemented Annually on More Than 500 Square Miles in Colorado Since 2005 (Page 1 of 2)

Practice Name	Practice Code	Colorado (mi^2)	Associated Land Use	Percent of Associated Area (%)	Project Area Land Use (mi^2)	Project Area Practice (Available Remaining) (mi^2)
Prescribed Grazing	528	1,169	Pasture	100	23.9	-
Upland Wildlife Habitat Management	645	433	Pasture	38	23.9	9.0
Conservation Crop Rotation	328	287	Cropland	2	194.0	4.4
Watering Facility	614	286	Pasture	25	23.9	5.9
Livestock Pipeline	516	210	Pasture	18	23.9	4.4
Fence	382	194	Pasture	17	23.9	4.0
Pest Management Conservation System	595	180	Cropland	1	194.0	2.8
Conservation Cover	327	154	Cropland	1	194.0	2.4
Access Control	472	154	Pasture	13	23.9	3.2
Nutrient Management	590	134	Cropland	1	194.0	2.1
Pumping Plant	533	121	Cropland	1	194.0	1.9
Brush Management	314	118	Forest	<1	552.8	1.2
Residue and Tillage Management, Reduced Till	345	104	Cropland	<1	194.0	1.6
Residue and Tillage Management, No Till	329	99	Cropland	<1	194.0	1.5
Irrigation Water Management	449	98	Cropland	<1	194.0	1.5
Residue Management, Seasonal	344	85	Cropland	<1	194.0	1.3
Prescribed Grazing - Enhancements	E528	81	Pasture	7	23.9	1.7
Early Successional Habitat Development-Mgt	647	72	Other	<1	788.6	1.7
Pest Management Conservation System - Enhancements	E595	68	Cropland	<1	194.0	1.0
Herbaceous Weed Treatment	315	66	Cropland	<1	194.0	1.0
Nutrient Management - Enhancements	E590	57	Cropland	<1	194.0	0.9
Water Well	642	55	Cropland	<1	194.0	0.8

Table 8-1. Best Management Practices Implemented Annually on More Than 500 Square Miles in Colorado Since 2005 (Page 2 of 2)

Practice Name	Practice Code	Colorado (mi^2)	Associated Land Use	Percent of Associated Area (%)	Project Area Land Use (mi^2)	Project Area Practice (Available Remaining) (mi^2)
Range Planting	550	51	Pasture	4	23.9	1.1
Cover Crop	340	49	Cropland	<1	194.0	0.8
Forage Harvest Management	511	47	Forest	<1	552.8	0.5
Structure for Water Control	587	33	Cropland	<1	194.0	0.5
Irrigation Pipeline	430	30	Cropland	<1	194.0	0.5
Forest Stand Improvement	666	27	Forest	<1	552.8	0.3

9.0 RECOMMENDED BEST MANAGEMENT PRACTICES

This implementation plan provides recommendations for NPS implementation practices to reduce loads of pollutants of concern. The recommended implementation practices are based on practices that are the most likely to be implemented and most impactful in reducing pollutants of concern.

9.1 FUTURE MUNICIPAL SEPARATE STORM SEWER SYSTEM AREAS

Stormwater resulting from rainfall, snowmelt, or other surface water runoff and drainage originates from impervious areas in towns; cities; residential developments; and industrial, manufacturing, or agricultural facilities. Stormwater flows accumulate from streets, parking lots, rooftops, catch basins, curbs, gutters, ditches, drainage channels, storm drains, and other impervious surfaces that may play a role in the contribution of pollutant loading because of the proximity of these impervious areas to the impaired waterbodies. Stormwater discharges are permitted under numerous MS4 permits in Colorado, which include the statewide standard MS4 general permit (COR090000) and statewide nonstandard MS4 general permit (COR070000). Areas covered by MS4 permits are not considered NPSs.

No areas within the Cache la Poudre HUC8 have been identified to become MS4s in the near future (5 to 15 years); however, town decision-makers should be proactive by using development practices that will minimally impact water quality in areas where an MS4 is possible. Less effort would be needed to retrofit BMPs after an area becomes a designated MS4 if more implementation is completed upfront. Low Impact Development (LID) is an approach to stormwater management that mimics a site's natural hydrology while the landscape is developed and preserves and protects environmentally sensitive site features, such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, floodplains, woodlands, and highly permeable soils. Minimal Impact Design Standards (MIDS) is a new concept being used in the state of Minnesota, which emphasizes keeping a raindrop where it falls to minimize stormwater runoff and pollution as well as preserve natural resources. Because Minnesota has been successful in implementing water quality practices using MIDS, developing communities in the North Front Range Association watersheds would likely also benefit from evaluation of the following four main elements of MIDS [Minnesota Pollution Control Agency, 2024]:

- Stormwater volume performance goals for new development, redevelopment, and linear projects
- New credit calculations that standardize the use of a range of structural stormwater techniques
- Design specifications for a variety of green infrastructure BMPs
- An ordinance guidance package to help developers and communities implement MIDS

9.2 DEVELOPED

Throughout the Cache la Poudre River HUC8, approximately 54 mi^2 of non-MS4 developed land exist. MS4 areas are not represented in the project models. BMPs recommended for MS4 and non-MS4 developed areas are similar to those outlined in Section 10.1. For nutrients and sediment, priority developed practices from PLET should be those with the highest rankings and reduction scores (i.e., extended wet detention, infiltration basins, and concrete gird pavement). For *E. coli*, priority developed practices should be those resulting in the largest reductions within the International BMP Database (i.e., wetland basin and retention pond). For heavy metals, priority developed practices should also be practices that resulted in the largest reductions of heavy metals in the International BMP Database (depending on pollutants of concern in downstream waterbodies). Practices do not need to be limited to these recommendations, and any practice resulting in reductions of pollutants of concern can be considered.

9.3 AGRICULTURAL (CROPLAND, PASTURELAND, AND FEEDLOT BEST MANAGEMENT PRACTICES)

Throughout the Cache la Poudre River HUC8, approximately 206 mi^2 of cropland exist and are all within the easternmost HUC8 watersheds. Similarly, approximately 29 mi^2 of pastureland exist, primarily in the easternmost HUC8 watersheds. Only approximately 40 acres are feedlots. For sediment and nutrients, priority agricultural practices from PLET should be those with the highest rankings and reduction scores (i.e., streambank stabilization and fencing and 35-foot grass buffers for cropland, 35-foot grass buffers and livestock exclusion fencing for pasture, and waste management systems for feedlots). For *E. coli* and heavy metals, priority agricultural practices should be the most effective agricultural BMPs from the Colorado NRCS CPPE for reducing *E. coli*. Additionally, practices that switch from flood irrigation to more efficient irrigation methods would be beneficial in reducing both *E. coli* and heavy metals such as selenium and arsenic. Although these practices are the most effective, BMPs do not need to be limited to these recommendations.

9.4 FOREST

Throughout the Cache la Poudre River HUC8, approximately 553 mi^2 of forest land exist. Although forest land is less likely to contribute sediment, nutrients, and bacteria per acre of contributing area, BMPs are still beneficial, especially when considering historical fires, fire potential, abandoned mines, recreation, and grazing activities. For nutrients and sediment, priority forest practices from PLET should be those with the highest ranking and reduction scores (i.e., a combination of site preparation/straw/crimp seed/net/fertilizer/transplants). For *E. coli*, priority forest practices are not prioritized but should include those that exclude forest-grazing livestock from accessing streams and septic assessments. Forest practices should also focus on pre- and post-fire activities outlined on the Cameron Peak Fire Update: CPRW's Role in Post-Fire Recovery & Restoration webpage [CPRW, 2021].

9.5 ABANDONED MINE LANDS

Most AMLs in the watershed have not yet been identified, as several are located on private land or in very remote locations. The primary practice completed on identified AMLs is to seal off dangerous openings, identify hazards, and implement safety measures to protect the public and environment. To improve water quality, identifying AMLs should become a higher priority. Although AML BMPs are not prioritized because of the variable nature of AML lands, each site should be assessed, and practices should be chosen that target specific issues related to each site. For heavy metals, priority practices should focus on AMLs, as outlined in Section 8.3.

10.0 INFORMATION, EDUCATION, AND OUTREACH

Current communication, education, and outreach efforts established in the Cache la Poudre River HUC8 should continue and be expanded to incorporate effectiveness and user feedback surveys that would complement current area outreach programs. Coordinated outreach efforts should increase the awareness of specific audiences regarding water quality problems and solutions as well as available BMP technical and financial assistance programs for urban/residential areas, cropland, pasture and range lands, AMLs, and riparian areas. Stakeholders should continue to expand on their public outreach efforts and communications with the public by implementing inclusive and new engagement tactics to reach a broad audience. Education and outreach activities should target individuals and groups to evaluate effective outreach methods.

Stakeholder responses were used to rank a list of information, education, and outreach options using Survey #2. The following survey ranking is from highest to lowest:

1. Water Quality Awareness Signage in Parks by Streams
2. Social Media Posts (Sent to Partners)
3. Website Updates
4. Educational Campaigns
5. Newsletters and Mailers
6. Pet-Waste Pickup Stations
7. Volunteer Cleanup Programs
8. School Visits
9. Project Story Map
10. Report a Concern Website
11. Radio Advertisements and Interviews
12. Tours and Field Trips

Entities within the watershed that are interested in collaborating with other stakeholder groups and hosting or participating in events include the City of Greeley, City of Fort Collins, Colorado Watershed Assembly, and Colorado Wheat Administrative Committee. Participating in existing events can also expand outreach efforts. Northern Water has an annual water quality efficiency stakeholder meeting in the spring, as well as a spring and fall water symposium and a children's water festival. Each fall, a Sustaining Colorado Watersheds conference is held in Avon, Colorado. A Lower South Platte River Water Festival is also held for children in the community.

Because of the substantial size of the project area, a multi-tiered approach to reduce the pollutants of concern is recommended. The approach includes outlining priority management areas, recommending BMPs by land use, updating and revising local watershed plans, describing milestone measures, and monitoring BMP effectiveness. Successfully achieving load reductions depends on several factors such as the amount of voluntary participation, availability of technical and financial assistance, and effectiveness of BMPs intended to reduce applicable loads.

An implementation schedule is recommended to reduce pollutants of concern by implementing NPS BMPs. Table 10-1 provides a list of implementations that would be most likely to benefit the area over the next 10 years options by land-use category. Tables 10-2, 10-3, and 10-4 give the top two sources for each parameter group and the top practices to implement.

Table 10-1. Implementation Actions (Page 1 of 2)

Land-Use Category	Source	Recommended Implementation Activity (NRCS Practice #)
Future Stormwater/ Developed/Urban/Residential	PLET and Survey	Extended Wet Detention Ponds
Future Stormwater/ Developed/Urban/Residential	PLET and Survey	Infiltration Basins
Future Stormwater/ Developed/Urban/Residential	PLET and Survey	Concrete Grid Pavement
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	High-Rate Biofiltration
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	Media Filter
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	Oil-Grit Separator
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	Retention Pond
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	High-Rate Media Filtration
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	Wetland Basin
Future Stormwater/ Developed/Urban/Residential	International Urban BMP Database	Grass Swale
Future Stormwater/ Developed/Urban/Residential	Other	LID Practices
Future Stormwater/ Developed/Urban/Residential	Other	Septic Upgrades
Ag - Cropland	PLET and Survey	Streambank Stabilization and Fencing
Ag – Cropland	PLET and Survey	Buffer - Grass (35 feet wide)
Ag – Cropland	NRCS	Constructed Wetland (656)
Ag – Cropland	NRCS	Filter Strip (393)
Ag – Cropland	NRCS	Vegetated Treatment Area (635)
Ag – Cropland	NRCS	On-Farm Secondary Containment Area (319)
Ag – Cropland	NRCS	Irrigation Water Management (449)
Ag - Pasture	PLET	Buffer - Grass (35 feet wide)
Ag – Pasture	PLET	Livestock Exclusion Fencing
Ag – Pasture	PLET and Survey	Streambank Stabilization and Fencing
Ag - Feedlot	PLET and Survey	Waste Management System

Table 10-1. Proposed Actions (Page 2 of 2)

Land-Use Category	Source	Recommended Implementation Activity (NRCS Practice #)
Forest	PLET and Survey	Site Preparation/Straw/Crimp Seed/Net
Forest	PLET and Survey	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants
AML	NRCS	Storage of Soil Materials
AML	NRCS	Placement of Surface Material
AML	NRCS	Restoration of Borrow Material
AML	NRCS	Establishment of Vegetation
AML	NRCS	Control of Toxic Aqueous Discharge
Monitoring	Other	Water Quality Sampling (base and storm events)
Monitoring	Other	Discharge Measurement (base and storm events)
Monitoring	Other	Monitor Implemented Agricultural BMP effectiveness
Monitoring	Other	Monitor Implemented Urban BMP Effectiveness
Monitoring	Other	Monitor Implemented AML BMP Effectiveness
Outreach	Survey	Social Media Posts
Outreach	Survey	Website Updates
Outreach	Survey	Educational Campaigns
Outreach	Survey	Newsletters and Mailers
Outreach	Survey	Pet-Waste Pickup Stations
Outreach	Survey	Volunteer Cleanup Programs
Outreach	Survey	School Visits
Outreach	Survey	Project Story Map
Outreach	Survey	Report a Concern Website

Table 10-2. Dominant Land Uses, Sources, and Priority Practices by HUC10 for Nutrients and Sediment (Page 1 of 2)

Watershed	Dominant Land Uses	Top Sediment Sources	Top Phosphorus Sources	Top Nitrogen Sources	Priority Practices
1019000701 South Fork Cache la Poudre River	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Feedlots	Forest and Feedlots	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Extended Wet Detention Infiltration Basins Waste Management System
1019000702 Headwaters Cache la Poudre River	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Urban non-MS4	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Extended Wet Detention Infiltration Basins
1019000703 Gordon Creek-Cache la Poudre River	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Feedlots	Forest and Urban non-MS4	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Extended Wet Detention Infiltration Basins
1019000704 Dale Creek	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Feedlots	Forest and Feedlots	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Extended Wet Detention Infiltration Basins Waste Management System
1019000705 Upper North Fork Cache la Poudre River	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Feedlots	Forest and Feedlots	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Extended Wet Detention Infiltration Basins Waste Management System
1019000706 Lone Pine Creek	Forest and Urban non-MS4	Forest and Urban non-MS4	Forest and Feedlots	Forest and Urban non-MS4	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Extended Wet Detention Infiltration Basins Waste Management System

Table 10-2. Dominant Land Uses, Sources, and Priority Practices by HUC10 for Nutrients and Sediment (Page 2 of 2)

Watershed	Dominant Land Uses	Top Sediment Sources	Top Phosphorus Sources	Top Nitrogen Sources	Priority Practices
1019000707 Rabbit Creek-North Fork Cache la Poudre River	Forest and Urban non-MS4	Forest and Cropland	Forest and Feedlots	Forest and Feedlots	Site Preparation/Straw/Crimp Seed/Net Site Preparation/Straw/Crimp Seed/Fertilizer/Transplants Streambank Stabilization and Fencing Buffer-Grass (35 feet wide) Waste Management System
1019000708 Horsetooth Reservoir-Cache la Poudre River	Forest and Cropland	Cropland and Urban non-MS4	Cropland and Feedlots	Cropland and Urban non-MS	Streambank Stabilization and Fencing Buffer-Grass (35 feet wide) Extended Wet Detention Infiltration Basins Waste Management System
1019000709 Boxelder Creek	Forest and Cropland	Cropland and Urban non-MS4	Cropland and Feedlots	Cropland and Feedlots	Streambank Stabilization and Fencing Buffer-Grass (35 feet wide) Extended Wet Detention Infiltration Basins Waste Management System
1019000710 City of Greeley-Cache la Poudre River	Cropland and Urban non-MS	Cropland and Urban non-MS4	Cropland and Feedlots	Cropland and Urban non-MS4	Streambank Stabilization and Fencing Buffer-Grass (35 feet wide) Extended Wet Detention Infiltration Basins Waste Management System

Table 10-3. *E. coli* Impairment Status, Primary Sources, Associated Land Use, and Priority Practices by HUC10

Watershed	*E. coli* Impaired	Primary *E. coli* Sources	Associated Land Use (*E. coli*)	Priority Practices
1019000701 South Fork Cache la Poudre River	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000702 Headwaters Cache la Poudre River	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000703 Gordon Creek-Cache la Poudre River	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000704 Dale Creek	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000705 Upper North Fork Cache la Poudre River	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000706 Lone Pine Creek	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000707 Rabbit Creek-North Fork Cache la Poudre River	N	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000708 Horsetooth Reservoir-Cache la Poudre River	Y	Humans (more WWTP) Pets (more Cats	Urban non-MS4 Urban non-MS4	Wetland Basin Retention Pond
1019000709 Boxelder Creek	Y	Livestock (more Cattle) Humans (more OWTS)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Septic Upgrades WWTF Connections
1019000710 City of Greeley-Cache la Poudre River	Y	Livestock (more Cattle) Humans (more WWTP)	Agricultural Land Urban non-MS4	Vegetated Treatment Area Constructed Wetlands Wetland Basin Retention Pond

Table 10-4. Dominant Land Uses, Metal Impairments, Associated Causes, and Priority Practices by HUC10 (Page 1 of 2)

Watershed	Dominant Land Uses	Metal Impairments	Associated Cause	Priority Practices
1019000701 South Fork Cache la Poudre River	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000702 Headwaters Cache la Poudre River	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000703 Gordon Creek-Cache la Poudre River	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000704 Dale Creek	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000704 Dale Creek	Forest and Urban non-MS4	Silver	Mining, Manufacturing Processes, Material Production	AML BMPs
1019000705 Upper North Fork Cache la Poudre River	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000705 Upper North Fork Cache la Poudre River	Forest and Urban non-MS4	Silver	Mining, Manufacturing Processes, Material Production	AML BMPs
1019000706 Lone Pine Creek	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000706 Lone Pine Creek	Forest and Urban non-MS4	Iron	Mining, Manufacturing Processes, Material Production	AML BMPs
1019000707 Rabbit Creek-North Fork Cache la Poudre River	Forest and Urban non-MS4	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000707 Rabbit Creek-North Fork Cache la Poudre River	Forest and Urban non-MS4	Silver	Mining, Manufacturing Processes, Material Production	AML BMPs
1019000707 Rabbit Creek-North Fork Cache la Poudre River	Forest and Urban non-MS4	Iron	Mining, Manufacturing Processes, Material Production	AML BMPs
1019000707 Rabbit Creek-North Fork Cache la Poudre River	Forest and Urban non-MS4	Manganese	Manufacturing Processes, Material Production	Discontinue Use

Table 10-4. Dominant Land Uses, Metal Impairments, Associated Causes, and Priority Practices by HUC10 (Page 1 of 2)

Watershed	Dominant LUs	Metal Impairments	Associated Cause	Priority Practices
1019000708 Horsetooth Reservoir-Cache la Poudre River	Forest and Cropland	Arsenic	Pressure-Treated Wood, Material Production, Pierre Shale, etc.	Irrigation Water Management
1019000708 Horsetooth Reservoir-Cache la Poudre River	Forest and Cropland	Selenium	Material Production, Manufacturing Processes, Gas Combustion, Pierre Shale	Irrigation Water Management
1019000709 Boxelder Creek	Forest and Cropland	Selenium	Material Production, Manufacturing Processes, Gas Combustion, Pierre Shale	Irrigation Water Management
1019000710 City of Greeley-Cache la Poudre River	Cropland and Urban non-MS	None	None	None

11.0 CRITERIA TO ASSESS PROGRESS

Milestones toward progress can be shown in many different ways. In these watersheds, options for measurable milestones can include progress toward meeting water quality criteria set by the state, trends toward improvement, and progress in the installation of implementation practices that are expected to improve water quality parameters of concern. Table 10-1 in the previous chapter shows practices that could be implemented to make progress and count as measurable milestones. Because goals in this watershed for this plan are very broad (the plan is not being written as a part of a specific Total Maximum Daily Load [TMDL] with a specified goal), milestones are less specific and more general. Any practice implemented will be a part of progress toward the ultimate goal of improving water quality and ensuring water quality does not worsen. Relative implementation should be tracked, and this plan should be revisited after the first 5 years to ensure progress is being made. Reductions from NPS loadings will most likely require a significant, increased amount of technical and financial program assistance; BMP implementation through on-the-ground projects; proper watershed planning; and cooperation with willing landowners and land management agencies.

In Survey #2, organizations were asked about interim measurable criteria/goals and what progress would look like after 5 and 10 years. The City of Greeley stated that continuing localized improvements will help reduce *E. coli* and nutrient loads to ponds and lakes with respect to NPSs. They also supported continued outreach with NPS dischargers and successful implementation plans across the watersheds to align with CDPHE goals and help share the load between point and NPS dischargers. The City of Fort Collins mentioned that monitoring pollutant hotspots, implementing BMPs, and conducting follow-up monitoring would be helpful in accessing goal achievement and that progress would be the identification of potential sources and implementation of practices/programs to minimize those pollutants at the source. The City of Fort Collins also stated that a proactive program with an engaged community that works together to prevent water pollution at the source would exemplify progress. The Colorado Wheat Administrative Committee advised that monitoring water quality, reducing pollutants of concern loads, and meeting water quality criteria would display progress.

12.0 MONITORING BEST MANAGEMENT PRACTICES EFFECTIVENESS

Monitoring should be completed before and after implementing BMPs to evaluate the effectiveness of priority practices. Monitoring BMP effectiveness (up- and downstream of BMPs) helps evaluate the adequacy of the implementation strategies targeted to reduce loads or transport. BMP effectiveness data will improve the understanding of implementation and management measures. Other ideal locations for monitoring include areas that have been monitored historically near the HUC10 watershed outlets and along impaired waterbodies. More information about monitoring NPSs is included in on EPA's Nonpoint Source Monitoring: TechNOTES webpage. Existing water quality monitoring occurring for the North Front Range Water Quality Planning Association's 208 Areawide Water Quality Management Plan is available on their website.

Additional monitoring and evaluation efforts should occur within the communities that are the most likely to become MS4 areas. Monitoring sites up- and downstream of areas where storm drains and tributaries enter the mainstem Big and Little Thompson Rivers would help evaluate contributions. Monitoring locations in storm drains throughout urbanized areas where two possible sources come together would also help isolate sources of pollution. A detailed monitoring plan that identifies the locations of additional monitoring sites should be compiled.

Continuous discharge data across a broad range of flows are helpful for calculating loads. Future monitoring should include instantaneous discharge measurements at water quality sampling areas. Continuous stage recorders should be installed at key locations in the watershed and stage-discharge relationships should be developed to convert continuous stage data to continuous flow data. Relatively low-cost, low-maintenance technologies are available to record continuous stage data. Instantaneous and continuous flow data will increase the accuracy of future load calculations and the evaluation of BMPs and implementation practices.

Survey #2 had a question regarding in-stream monitoring activities that different entities would consider implementing. The City of Greeley would be interested in quarterly sampling to be analyzed by a local laboratory. The City of Fort Collins would be interested in the installation, maintenance, and operation of a monitoring station.

13.0 TECHNICAL AND FINANCIAL ASSISTANCE SOURCES

Technical and financial assistance sources are available to implement BMPs. Numerous private companies and organizations as well as local, state, and federal agencies provide technical assistance to address NPS pollution. A few of these organizations and agencies also provide financial assistance. Table 13-1 lists the agencies and organizations with technical and financial programs that may assist with conservation and water quality implementation projects. The following sections describe the information regarding incentive programs and funding to implement NPS projects identified in this plan. Funding includes but is not limited to the CDPHE's Nonpoint Source Pollution Program and their annual grants, the South Platte Basin Round Table grants, and the CAWA programs. The NPS Program funds support staffing costs and programmatic priorities including the Mini Grant Program, the NPS Watershed Planning and Tool Development Program, and the NPS Program's Success Story Initiative.

13.1 INCENTIVE PROGRAMS

Incentive programs are formal programs used to promote specific actions or behaviors. Participation in incentive programs is voluntary. Various mechanisms can be used to conduct incentive programs, including financial assistance or providing benefits for enrolling in programs. These programs are relatively easy for users to take advantage of. Dollars are generally allocated annually.

13.1.1 COST-SHARE PROGRAMS

In a cost-share program, the costs of systems or practices for water quality improvements are shared between the landowner, state (percentage), or federal programs (flat rate). State-funded nonstructural land management cost sharing is also typically based on a flat rate. Landowners seeking cost-share assistance should contact their county conservation district office to get information on available programs. The BMPs and conservation practices that are typically eligible are those that avoid, control, and trap nutrients, sediment, and *E. coli* from entering surface water and groundwater. Eligibility may vary depending on local priorities and needs.

13.1.2 FEE DISCOUNTS

Local governments or nonprofit entities may offer reduced fees for implementing projects and practices that align with program goals. For instance, stormwater fees could be reduced if a landowner voluntarily converts cropped acres to a permanent vegetative cover.

13.1.3 LOW-INTEREST LOANS

Low-interest loans may be available through various state agencies to landowners for agricultural BMPs, septic system updates/replacement, or other projects that meet funding eligibility criteria.

13.1.4 WATER QUALITY TRADING

Point source permittees should be mindful that options are available to use money available for upstream NPS implementation to improve water quality for a smaller potential cost. These options need to be further evaluated and quantified.

13.2 POTENTIAL FUNDING

Funding is available from private, local, county, state, and federal sources to implement projects for improving water quality. The following sections discuss these sources. Other funding sources not noted here may be available. The state of Colorado maintains a Grants Information page on its website.

13.2.1 CITIES

Municipalities often collect stormwater utility fees to build, repair, operate, and maintain stormwater management systems. Such fees should be set using reasonable calculations based on runoff volume or pollution quantities, property classifications, or both.

13.2.2 COUNTIES, WATERSHED DISTRICTS, AND AUTHORITIES

In other areas of Colorado, authorities have been developed, such as the Cherry Creek Basin Water Quality Authority and the Chatfield Watershed Authority. These authorities can levy funds for priority projects and assist with program implementation. The North Front Range Water Quality Planning Association and other 208 planning agencies cannot levy funds or taxes for projects, but they have voluntary feeds and dues that contribute to planning and implementation. Recently, the Chatfield Watershed Authority also added an entrance fee to the state park to assist with protecting water quality.

13.2.3 STATE

The State of Colorado funds watershed management programs through various capacities, programs, and agencies.

The CDPHE has numerous NPS funding opportunities, which include watershed implementation projects (restoration and protection), watershed planning and tool development, and education and outreach. The primary CDPHE opportunities consist of the Source Water Assessment and Protection (SWAP) program; the Water Quality Grants and Loans Unit; CSU's Colorado Wetland Information Center; CSU's Colorado State Forest Service; the Department of Natural Resources' Colorado Water Conservation Board (CWCB); Colorado Water Plan Grants; and Colorado Watershed Restoration Grants. More information regarding each program is provided in CDPHE [2022]. Funds from the Water Supply Reserve Fund (WSRF) are issued through the South Platte Basin Round Table. CDPHE has a state revolving fund that includes a Water Pollution Control revolving fund that completes many OWTS to sewer projects.

Under the Colorado Natural Resources Department, the CWCB also administers the Federal Technical Assistance Grant Program, consisting of Local Capacity Grants and Technical Assistance Grants. Federal American Rescue Plan Act funding of $5 million is available for these two grants in Colorado. The grantee must provide a minimum of 25 percent matching funds. Grants will be awarded on a rolling basis through December 2024; grant funds must be fully expended by December 2026. Local Capacity Grants are direct awards to grantees to secure the resources needed (contractors or otherwise) to develop projects and submit competitive federal grant applications. Technical Assistance Grants are awards to grantees who want to use a contractor hired by the CWCB. This contractor can provide a wide variety of water project services, such as federal grant opportunity research, project design, partial engineering, cost estimation, and federal application development/grant writing.

Statewide education grants and outreach initiative grants are available through the Public Education, Participation, and Outreach (PEPO) Grant Program, which is administered through the CWCB. The PEPO Grant Program also financially supports designated individual coordinators who support basin-specific outreach and education efforts alongside each of the state's basin roundtables. The Colorado Department of Natural Resources also maintains a Water Funding Opportunity Navigator, which lists potential federal and state grant opportunities.

Other state funding opportunities include the Colorado Healthy Rivers Fund. This program grants money to local watershed organizations to provide clean water, protect habitat, and improve recreation and accessibility throughout Colorado. Project grants and planning grants are available under the program.

13.2.4 FEDERAL

Federal agencies can provide funding and technical assistance for projects and monitoring. These agencies include U.S. Fish and Wildlife, USGS, NRCS, Farm Service Agency, EPA, and others. The USGS is more likely to provide support for data acquisition and monitoring programs, while the US Fish and Wildlife may provide land retirement program funds. The NRCS helps with applying conservation practices, and the EPA assists with studies to identify more localized sources of pollution in impaired waterbodies. The following sections provide information regarding federal NPS funding.

13.2.4.1 ENVIRONMENTAL PROTECTION AGENCY

The EPA provides funding opportunities for watershed restoration and protection on its funding resource webpage for NPS pollution.

Additional funding opportunities are available online on the Equity Action Plan webpage and Environmental Justice Grants, Funding and Technical Assistance webpage.

The EPA also has a funding opportunity through the Office of Wetlands, Oceans, and Watersheds' Fiscal Year 2024 Building Partner Capacity and Promoting Resiliency and Equity under the CWA. The EPA is soliciting applications from eligible applicants to provide support for training and related activities to build the capacity of agricultural partners; state, territorial, and Tribal officials; and nongovernmental stakeholders in activities to be carried out to support the goals of the CWA Section 319 NPS program.

The EPA also has funding from the Clean Water State Revolving Fund (CWSRF) accessible via the About the Clean Water State Revolving Fund (CWSRF) webpage. These generally include funds for municipal wastewater facility construction, control of NPS pollution, decentralized wastewater treatment systems, green infrastructure projects, project estuaries, and other water quality projects.

13.2.4.2 UNITED STATES DEPARTMENT OF AGRICULTURE'S NATURAL RESOURCES CONSERVATION SERVICE

The NRCS's natural resources conservation programs help individuals reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damage caused by floods and other natural disasters. More information is available on the USDA Programs & Initiatives webpage.

The following technical and financial assistance programs are generally awarded annually through NRCS:

- **Agricultural Conservation Easement Program (ACEP).** Applications are accepted on a continuous basis, with application cutoffs established from January through March. ACEP easement agreements are typically awarded annually by the fall.
- **Conservation Stewardship Program (CSP).** The CSP helps agricultural producers maintain and improve existing conservation systems and adopt additional conservation activities to address priority resource concerns. Participants earn CSP payments for conservation performance—the higher the performance, the higher the payment. There are different enrollment opportunities for CSP Classic, CSP Renewals and CSP Grasslands. Applications are accepted on a continuous basis, with application cutoffs established from January through March. CSP contracts are awarded by June or July.
- **Conservation Technical Assistance (CTA).** The CTA provides the nation's farmers, ranchers, and forestland owners with the knowledge and tools they need to conserve, maintain, and restore the natural resources on their lands and improve the health of their operations for the future. NRCS offers this assistance at no cost to the producers served.
- **Environmental Quality Incentives Program (EQIP).** EQIP provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits, such as improved water and air quality; conserved ground and surface water; increased soil health; reduced soil erosion and sedimentation; improved or created wildlife habitat; and mitigation against increasing weather volatility. Applications are accepted on a continuous basis, with application cutoff for funding evaluation typically set in November of each year. EQIP contracts are typically awarded by April or May.
- **Regional Conservation Partnership Program (RCPP).** RCPP promotes coordination of NRCS conservation activities with partners that offer valuable contributions to expand the collective ability to address on-farm, watershed, and regional natural resource concerns. Announcements for Funding Proposals (AFPs) for RCPP Classic are typically advertised in October through November and awarded in June through August. RCPP Alternative Funding Arrangement (AFA) AFPs are typically announced March through May, with agreements awarded by September and, in some cases, the funds are carried over and awarded from October to December of the following fiscal year.
- **Watershed Operations PL-566 Program.** The Watershed Protection and Flood Prevention Act (PL-566) authorizes the USDA–NRCS to help local organizations and units of government plan and implement watershed projects. PL-566 watershed projects are locally led to solve natural and human resource problems in watersheds up to 250,000 acres (less than 400 mi^2). At least 20 percent of any project benefits must relate directly to agriculture, including rural communities. A local sponsoring organization is needed to carry out, maintain, and operate works of improvement. The program has two main components, and each is funded separately: (1) watershed surveys and planning and (2) watershed and flood prevention operations and construction.
- **Conservation Innovation Grants (CIG)**. CIG is a competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. Through creative problem-solving and innovation, CIG partners work to address the nation's water quality, air quality, soil health, and wildlife habitat challenges while improving agricultural operations. Three program types are available: (1) national, (2) state, and (3) CIG On-Farm Conservation Innovation Trials.

- **Rural Development.** For OWTS funding, USDA Rural Development has a 504 Single Family Program, a Community Development Program, a Home repair Loan/Grant Program, a Community Pass-through Program, and Water Well Trust program. Income eligibility for these programs is often a sliding scale.

Other federal agency funding includes the U.S. Bureau of Reclamation (USBR) WaterSMART. Through WaterSMART, the USBR leverages federal and nonfederal funding to work cooperatively with states, tribes, and local entities as they plan for and implement actions to increase water supply sustainability through investments in existing infrastructure and attention to local water conflicts.

13.2.5 PRIVATE/OTHER SOURCES

Foundations, nonprofit organizations, and private contributions, including those from landowners and corporate entities, will be sought for plan implementation activities. Local foundations may fund education, civic engagement, and other local priority efforts. Such organizations acquire their own funding and may have project dollars and technical assistance that can be used. Major cooperators and funding sources include private landowners who typically contribute a percentage of project costs and may donate land, services, or equipment for projects or programs.

Some of the stakeholder questions asked in Survey #2 were related to the technical and financial assistance needed or used and how they used it. The City of Greeley is unsure of any financial assistance needs but has received federal relief or grants for fire recovery actions in the High Mountain Reservoir area. The City of Fort Collins does not need financial assistance for in-stream monitoring of BMP implementation but is aware of 319 NPS grants through the EPA for eligibility concerns and MS4 requirements. The City of Fort Collins has received grants from the LID program for pilot projects that test the effectiveness of LID technologies, as well as assistance from consultants, internal experts, CSU, field experts, and the International Stormwater BMPDB. However, the City would like more resources for agriculture and forest practices in urban environments. Colorado Watershed Assembly has received CWCB and NPS funds and other funds from the Cherry Creek Basin Water Quality Authority, Great Outdoors Colorado along with county and municipal funding and technical assistance. The Colorado Watershed Assembly tracks various federal grant opportunities and has used the CWCB and NPS Program for technical assistance. The Colorado Wheat Administrative Committee is aware of financial assistance from the conservation districts, NRCS, crop consultants, and NRCS Agricultural Research Service but has yet to secure funding.

The following are private foundations with available funding programs:

- The Laura Jane Musser Fund, a foundation based in Minnesota, assists public or not-for-profit entities to initiate or implement projects that enhance the ecological integrity of publicly owned open spaces, while encouraging compatible human activities. The fund’s goal is to promote public use of open space that improves a community’s quality of life and public health, while also ensuring the protection of healthy, viable, and sustainable ecosystems by defending or restoring habitat for the diversity of plant and animal species.
- The Moore Charitable Foundation works to preserve and protect natural resources for future generations. This foundation and its affiliates support nonprofit organizations that protect land, wildlife, habitat, and water resources in several regional planning areas, including Colorado. The foundation also supports educational and community programs in these areas.

- The Colorado River Basin Salinity Control Act, established in 1974, provides authorization for enhancing and protecting numerous salinity control projects in Colorado and other states. High levels of salinity in water can reduce crop yields, limit the choice of crops that can be grown, and, at higher concentrations over long periods, can kill trees and make the land unsuitable for agricultural purposes. Through strong partnerships between the NRCS, private landowners, USBR, CWCB, and several local conservation districts, financial and technical assistance funds have been used to install irrigation improvements, such as the installation of pipelines, more efficient irrigation systems, and lining of ditches and small laterals.
- The Colorado Watershed Assembly routinely posts funding opportunities through their bimonthly newsletter available on the Colorado Watershed Assembly homepage.
- The South Platte Basin Roundtable offers two funding cycles annually and information can be found on the South Platte Basin homepage.

Table 13-1. Sources of Technical and Financial Assistance (Page 1 of 3)

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
LOCAL									
City of Fort Collins	www.fcgov.com	Financial, Technical	X					X	X
Larimer County	www.larimer.gov	Financial, Technical	X	X	X	X	X	X	X
Weld County	www.weld.gov	Financial, Technical	X	X	X	X	X	X	X
Coalition for the Poudre River Watershed	www.poudrewatershed.org	Technical	X	X	X	X	X	X	X
Poudre Heritage Alliance	poudreheritage.org	Technical	X	X	X	X	X	X	X
South Platte Basin Round Table	www.southplattebasin.com	Technical	X	X	X	X	X	X	X
Larmer Conservation District (Previously Fort Collins and Big Thompson Conservation Districts)	https://www.larimercd.org/	Financial, Technical		X	X	X	X	X	X
West Greeley Conservation District	www.wgcd.org	Financial, Technical		X	X	X	X	X	X
Platte Valley Conservation District	www.coloradolandcan.org/local-resources/Platte-Valley-Conservation-District/3610	Financial, Technical		X	X	X	X	X	X
Southeast Weld Conservation District	seweldcd-co.org	Financial, Technical		X	X	X	X	X	X

Table 13-1. Sources of Technical and Financial Assistance (Page 2 of 3)

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
STATE									
Colorado State University Extension	extension.colostate.edu	Technical	X	X	X	X	X	X	X
Colorado State University	www.colostate.edu	Technical	X	X	X	X	X	X	X
Colorado Association of Conservation Districts	coloradoacd.org	Financial, Technical	X	X	X	X	X	X	X
Colorado Department of Public Health and Environment	cdphe.colorado.gov	Financial, Technical	X	X	X	X	X	X	X
Colorado Parks and Wildlife	cpw.state.co.us	Financial, Technical					X	X	X
Colorado Livestock Association	www.coloradolivestock.org	Technical				X		X	X
Colorado Department of Agriculture	ag.colorado.gov	Financial, Technical		X	X	X		X	X
Colorado Water Center	watercenter.colostate.edu	Technical						X	X
Colorado Rural Water Association	www.crwa.net	Technical						X	X
Colorado Department of Natural Resources	dnr.colorado.gov	Financial, Technical	X	X	X	X	X	X	X
Colorado Energy and Carbon Management Commission	ecmc.state.co.us	Financial, Technical		X	X	X			
Colorado Geological Survey	coloradogeologicalsurvey.org	Financial, Technical						X	
Colorado Bureau of Land Management	www.blm.gov	Financial, Technical					X	X	X
Colorado Division of Reclamation, Mining, and Safety	drms.colorado.gov	Financial, Technical					X	X	X
Colorado State Land Board	slb.colorado.gov	Financial							X

Table 13-1. Sources of Technical and Financial Assistance (Page 3 of 3)

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
FEDERAL									
US Army Corps of Engineers	www.usace.army.mil	Financial, Technical						X	X
USDA–NRCS	www.nrcs.usda.gov	Financial, Technical		X	X	X	X	X	X
USDA–Farm Service Agency	www.fsa.usda.gov	Financial, Technical		X	X	X		X	X
USDA–Rural Development	www.rurdev.usda.gov	Financial, Technical						X	X
USDA–Bureau Land Management	www.blm.gov	Financial, Technical					X	X	X
USDI–Bureau of Reclamation	www.usbr.gov	Financial, Technical	X	X			X	X	X
US EPA	www.epa.gov	Financial, Technical	X	X	X	X	X	X	X
USDA–Forest Service	www.fs.fed.us	Financial, Technical					X	X	X
US Fish & Wildlife Service	www.fws.gov	Financial, Technical						X	X
USGS	www.usgs.gov	Technical						X	X
PRIVATE									
Ducks Unlimited	www.ducks.org	Financial, Technical						X	X
Colorado Trout Unlimited	coloradotu.org	Financial, Technical						X	X
Fresh Water Trust	www.thefreshwatertrust.org	Financial, Technical	X	X	X	X	X	X	X
Mule Deer Foundation	www.muledeer.org	Financial, Technical					X	X	X
Rocky Mountain Elk Foundation	www.rmef.org	Financial, Technical					X	X	X
National Fish and Wildlife Foundation	www.nfwf.org	Financial, Technical						X	X

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APPENDIX A

SURVEY QUESTIONS

2022 SURVEY

1. Agency/organization's name
2. Website URL
3. Contact person(s), name(s)
4. Email address(s)
5. Phone number(s)
6. Which of the following watersheds is/are the focus of your organization
    a. Big and Little Thompson
    b. Middle South Platte
    c. Cache la Poudre
    d. St. Vrain Creek
    e. Other
7. If known, please list the waterbody name and segment identification (AUID) (i.e., COSPUS15) if it was selected from question #6, please provide the watershed name.
8. Does your agency have an existing watershed plan, source water plan, NPS plan, or other?
9. Please provide the link to the watershed plan(s) if available below or send a copy to Mark Thomas at: mthomas@nfrwqpa.org
10. Is the plan under development if you agency does not have an existing watershed plan identified in question #8?
11. What level of impact do the following nonpoint sources have on water quality in your watershed? (check one for each row)
    a. Abandoned mine lands
    b. Agriculture (including agricultural return flows and agricultural stormwater runoff)
    c. Hydromodification (diversions including transbasin diversions)
    d. Habitat alteration
    e. Urbanization
    f. Onsite wastewater systems (aka septic systems)
    g. Runoff from roadways
    h. Post wildfire impacts (includes post-wildfire flooding)
    i. Climate change
    j. Hazardous household or industrial wastes (pharmaceuticals, oil, paint, acids, pesticides, etc.)
12. What are the major pollutants of concern? (check all that apply)
    a. Sediment (includes ash from wildfire)
    b. Total suspended solids (TSS)
    c. Nitrogen
    d. Phosphorus
    e. Temperature
    f. Metals
    g. E. coli
    h. Emerging contaminants
    i. Other
13. Please check all water quality parameters/analytes that your group measures:
    a. Sediment (includes ash from wildfire)
    b. Total suspended solids (TSS)

c. Nitrogen
d. Phosphorus
e. Temperature
f. Metals
g. E. coli
h. Emerging contaminants
i. Other

14. If known, what is the period of record for each of the analytes listed above?
15. Is the data publicly available on the Colorado Data Sharing Network (CDSN)?
16. If the data is not publicly available, would you be willing to share your data with NFRWQPA?
17. What types of watershed projects have been completed?
    a. Habitat improvements
    b. Bank stabilization - grading
    c. Bank stabilization – vegetation
    d. Installation of drop or other in rivers
    e. Vegetation buffers
    f. Agricultural tailwater BMPs
    g. Unknown
18. What projects are high priority for your organization/watershed group?
19. What barriers from question (#18) may be preventing the project?
    a. Funding
    b. Technical resources
    c. Instrumentation
    d. Staffing/volunteer time
    e. No barriers are preventing the project
    f. Other
20. Does your organization/agency provide any of the following services:
    a. BMP recommendations
    b. Technical advice
    c. Water quality sampling
    d. Public education
    e. Other
21. Do you have policies, guidelines, or governing codes related to nonpoint source water quality adoption? Please, provide sources or weblinks.
22. Does your jurisdiction's county/municipal code reference the NFRWQPA 208 Areawide Water Quality Management Plan?
23. What can a regional NPS watershed plan help your watershed organization accomplish?
24. If known, provide or identify areas of special interest that need to be protected from NPS pollutants.
25. Why does your watershed organization value water quality?
26. What is the public perception of your watershed's water quality?
27. What other issues or concerns would you like NFRWQPA to be aware of?
28. If you want to be added to the email/ notification/distribution list regarding meetings and updates concerning the Regional NPS Watershed Plan, please provide your email below.

2024 SURVEY

1. Email address
2. First name
3. Last name
4. Please provide your contact information
5. Are you interested in participating with the NFRWQPA Technical Advisory Committee in guiding the Nonpoint Source plan best management practices (BMPs) for the Larimer and Weld County region and participating in the final report review for this project? If yes, please provide your name and email address.
6. What watershed are you most concerned with? Select all that apply.
    a. Middle South Platte - Cherry (Area of Concern: 10190003)
    b. St. Vrain (Area of Concern: 10190005)
    c. Big Thompson (Area of Concern: 10190006)
    d. Cache la Poudre (Area of Concern: 10190007)
    e. Lone Tree-Owl (Area of Concern: 10190008)
    f. Crow (Area of Concern: 10190009)
    g. Middle South Platte Sterling (Area of Concern: 10190012)
    h. Other (please specify)
7. Aside from watershed plans, what other major projects have you done or are you aware of that has or may improve water quality in the watershed?
8. When were they completed?
9. What is the approximate area impacted by the project?
10. What is the approximate area impacted by the project? Please describe.
11. Are there current plans for a watershed plan or update of an existing plan in your area?
12. How many months a year do agriculture producers typically apply manure on crops?
13. Rank the likelihood of each following cropland BMPs to be implemented in your area from 1 to 5, with 1 being unlikely and 5 being very likely
    a. List of BMPs from PLET
14. Does your watershed have BMPs for non-point source pollution? The following would be important to attain if available (including list/count estimate).
15. What BMPs have been implemented in your watershed? Please describe.
16. Approximately how many of each BMP type/technology (many are included in Section 5 questions) have been implemented in your HUC8?
17. What area of concern and/or water bodies are benefiting from the implemented BMPs? Please describe.
18. What land use(s) are the BMPs developed for? Select all that apply.
    a. Cropland
    b. Pasture
    c. Forest
    d. Urban
    e. Feedlot
    f. Other (please specify)
19. Please estimate the approximate area impacted by the implemented BMPs.
20. Is there any monitoring associated with determining pollutant load reductions and/or do the BMPs have estimated pollutant load reductions?

RESPEC

21. If you answered no, do you need technical and financial assistance to conduct monitoring?
22. What were the costs associated with the BMPs?
23. Are there noticeable improvements associated with implementing the BMPs? If yes, please describe.
24. Are there other BMPs you would like to see in addition to those currently constructed or implemented?
25. Please list any funded projects, activities, or next steps for non-point source pollution in your watershed in the next five years.
26. What types of information/education/outreach do you see being the most effective? Please check all that apply.
    a. Water Quality Awareness Signage in Parks by Streams
    b. Educational Campaign
    c. Social Media
    d. Story Map
    e. Newsletters, Mailers, Blurbs
    f. Website Update
    g. Park Signage
    h. "Report a Concern" Website
    i. Volunteer Cleanup Programs
    j. School Visits
    k. Pet-waste Pickup Stations
    l. Other (please specify)
27. Are you interested in collaboration with other stakeholder groups and hosting/participation in events?
28. Do you have any annual events/activities we could attend? If yes, please provide date/time/location/contact information.
29. Please describe what interim measurable criteria/milestones are used to determine goal achievement.
30. In 5 years, what does progress look like to you regarding pollution loading reduction in your area of concern?
31. In 10 years, what does progress look like to you regarding pollution loading reduction in your area of concern?
32. Which of the following in-stream monitoring activities would you likely consider implementing in your area of concern? Please select one or both options.
33. Do you need technical and financial assistance to conduct in-stream monitoring? If yes, please describe.
34. To develop/implement BMPs, do you need any financial assistance? If yes, please describe.
35. What financial assistance have you received for watershed improvement projects?
36. What are sources of financial assistance you know of but have not used?
37. What technical resources are needed to develop/implement BMPs?
38. What sources of technical assistance have you received in the past?
39. What are sources of technical assistance you know of but have not used?
40. Are there point discharges you are concerned about in your watershed (even in areas that are MS4 permitted)? If yes, please explain.

41. Are there non-point sources that you are concerned about in your watershed (even in areas that are MS4 permitted)? If yes, please explain.
42. Are you aware of abandoned mined land in your area?
43. If yes, are you aware of abandoned mined land BMP strategies implemented in your area?
44. What are the results of implementing such abandoned mined land BMP strategies?
45. Are you aware of agricultural practices (Cropland, Pasture, and/or Feedlot) in your area?
46. From the highest concern to the lowest, please rank the following agricultural concerns with 1 being the largest and 3 being the smallest: Cropland, Pasture, Feedlot.
47. Are you aware of agricultural BMP strategies implemented in your area?
48. If yes, what are the results of implementing such agricultural BMP strategies?
49. Are you aware of atmospheric deposition in your area?
50. If yes, are you aware of atmospheric deposition BMP strategies implemented in your area?
51. What are the results of implementing such atmospheric deposition BMP strategies?
52. Are you aware of forestry non-point source in your area?
53. If yes, are you aware of forestry non-point source BMP strategies implemented in your area?
54. Are you aware of hydromodification and habitat alteration in your area?
55. If yes, are you aware of hydromodification and habitat alteration BMP strategies implemented in your area?
56. If yes, what are the results of implementing such hydromodification and habitat alteration BMP strategies?
57. Are you aware of urbanization in your area?
58. If yes, are you aware of urbanization BMP strategies implemented in your area?
59. If yes, what are the results of implementing such urbanization BMP strategies?

APPENDIX B
MAPS OF IMPAIRED PARAMETERS

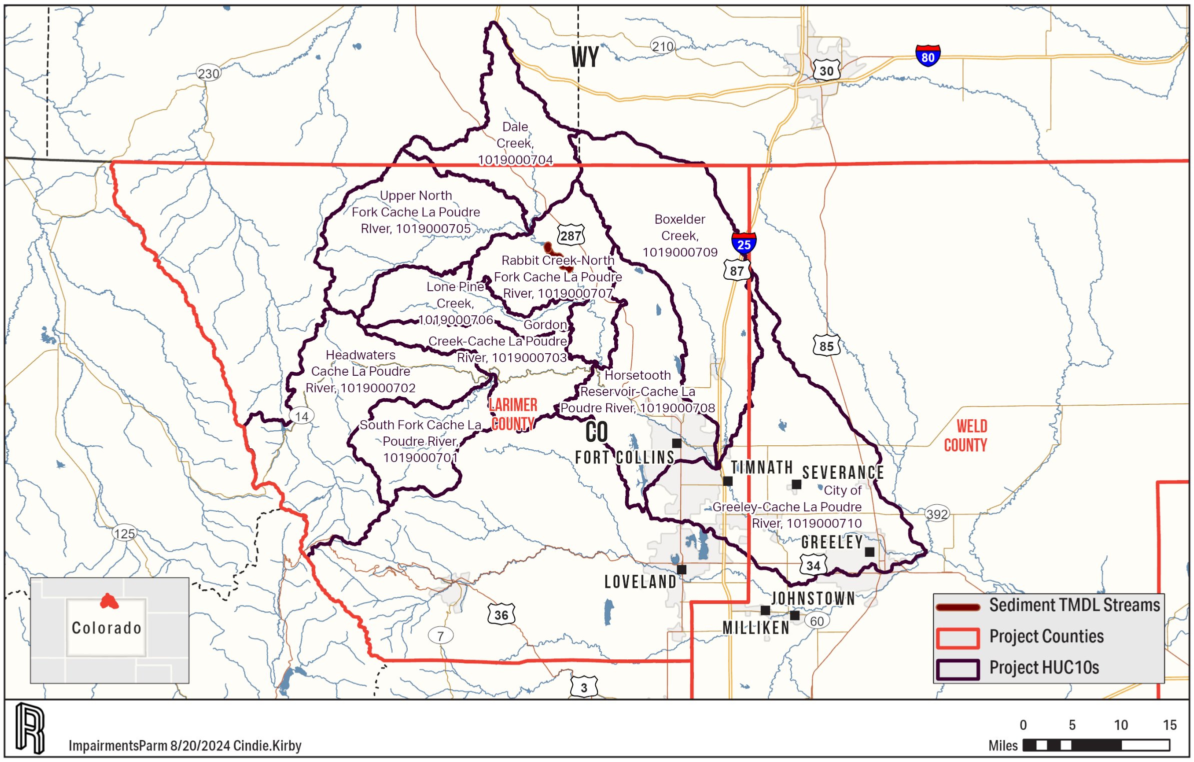


Figure B-1. Sediment Impairments.

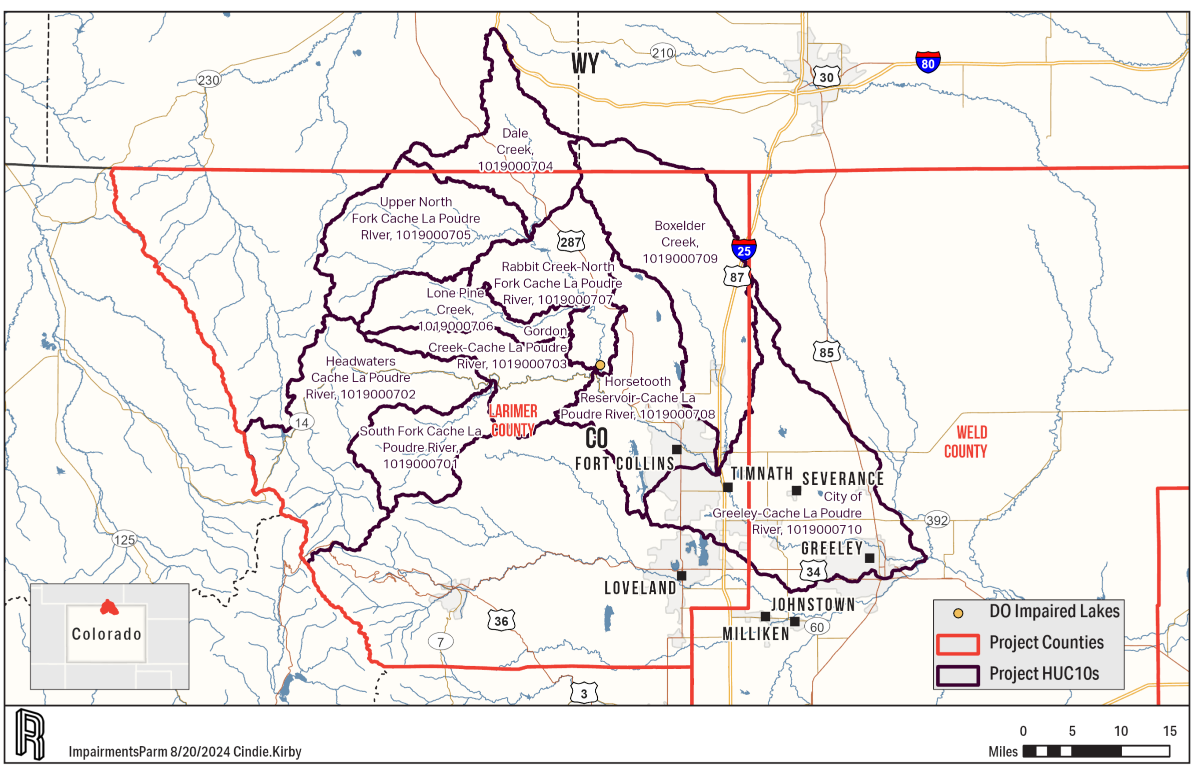


Figure B-2. Dissolved Oxygen Impairments.

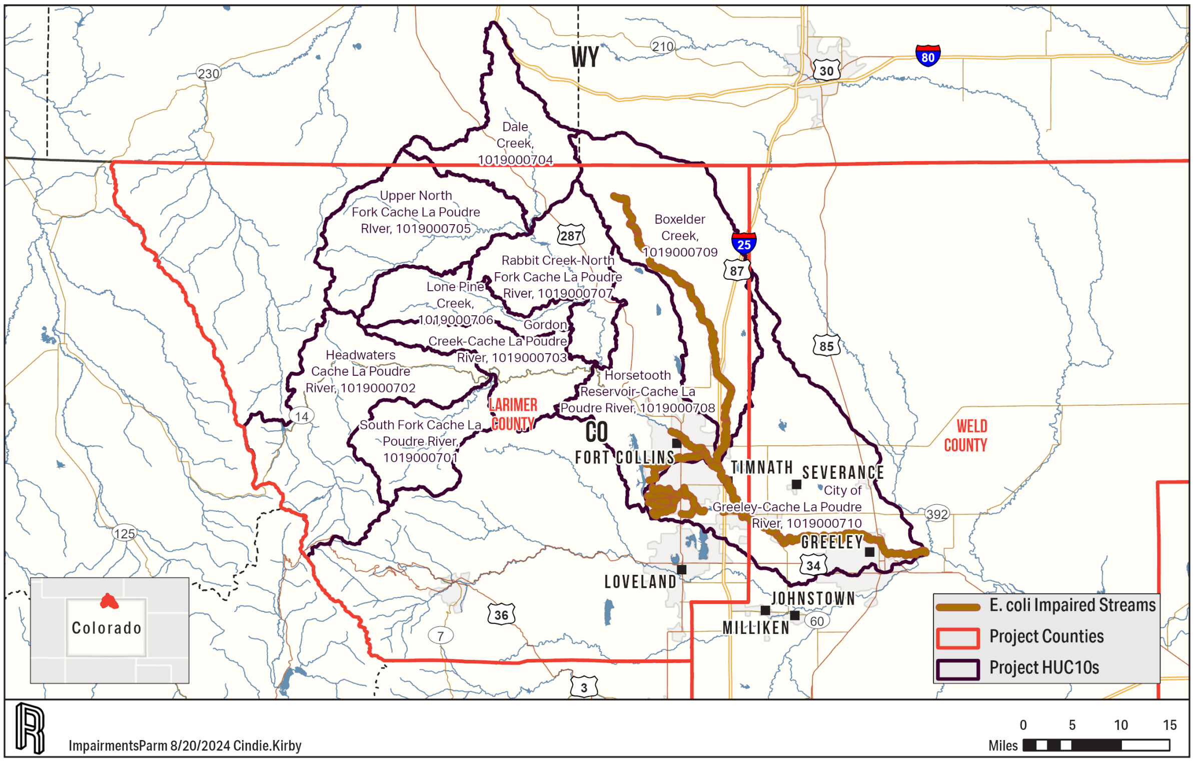


Figure B-3. *E. coli* Impairments.

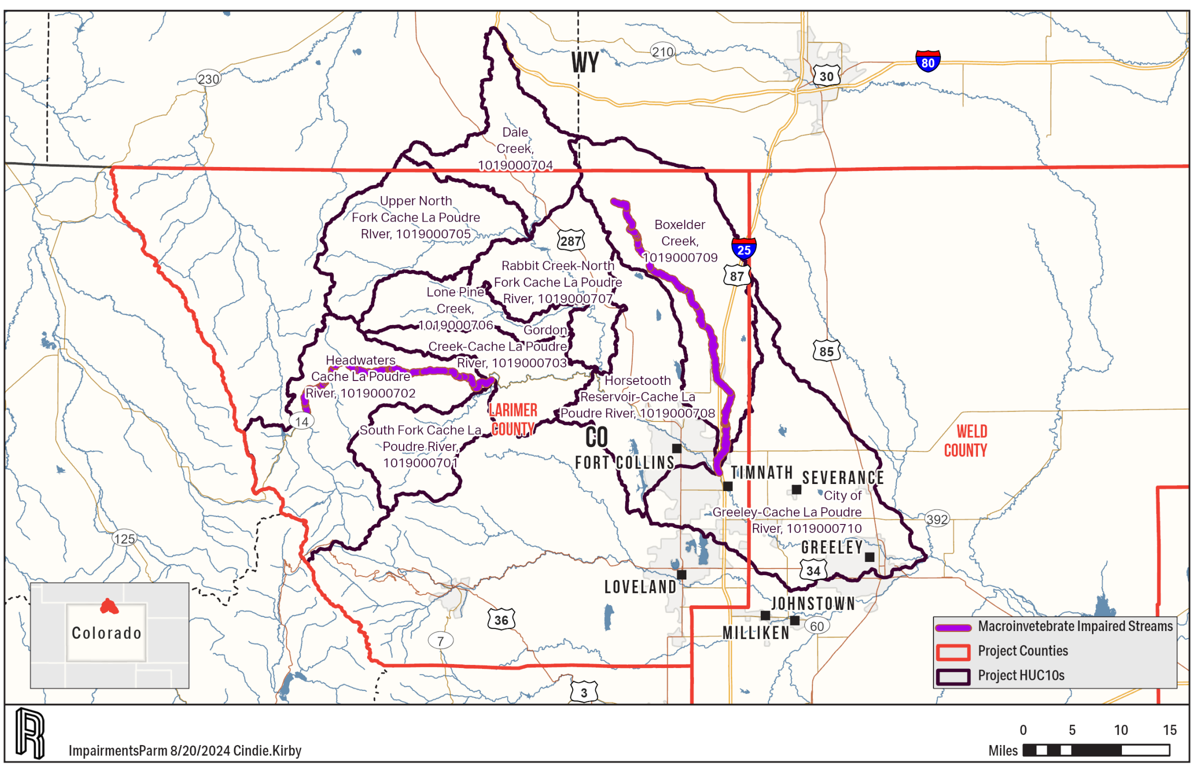


Figure B-4. Macroinvertebrate Impairments.

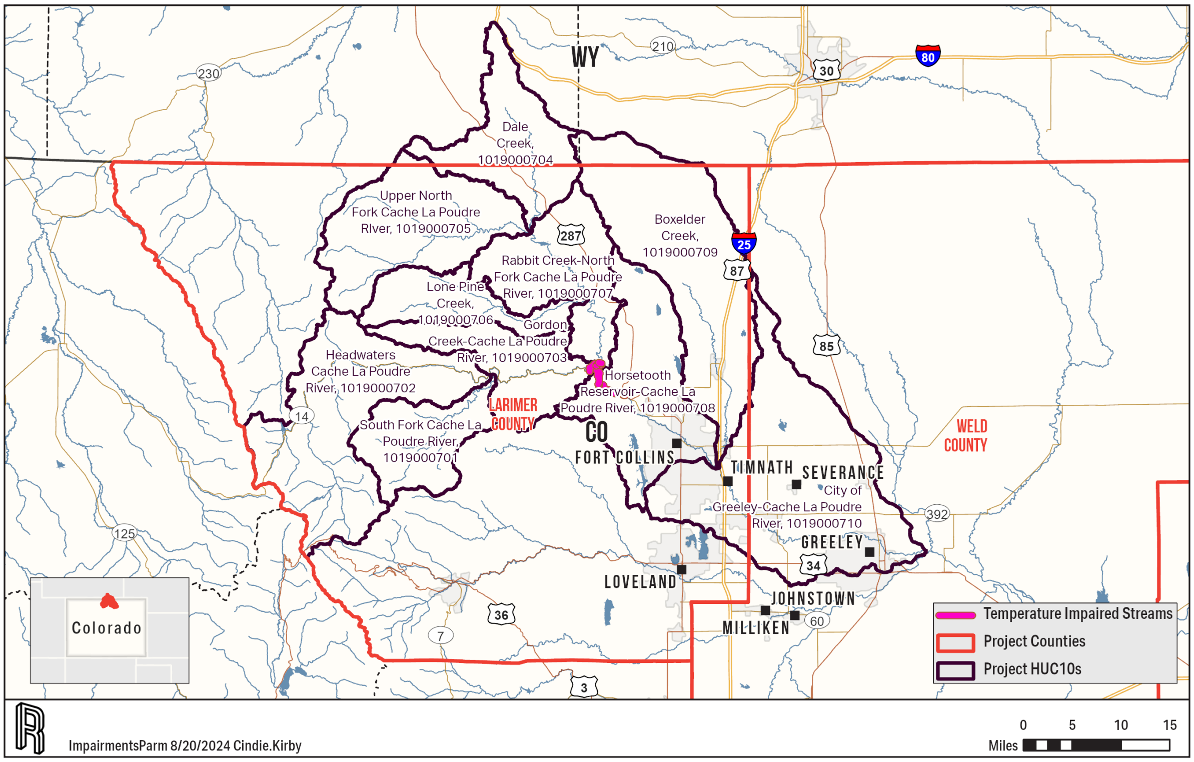


Figure B-5. Temperature Impairments.

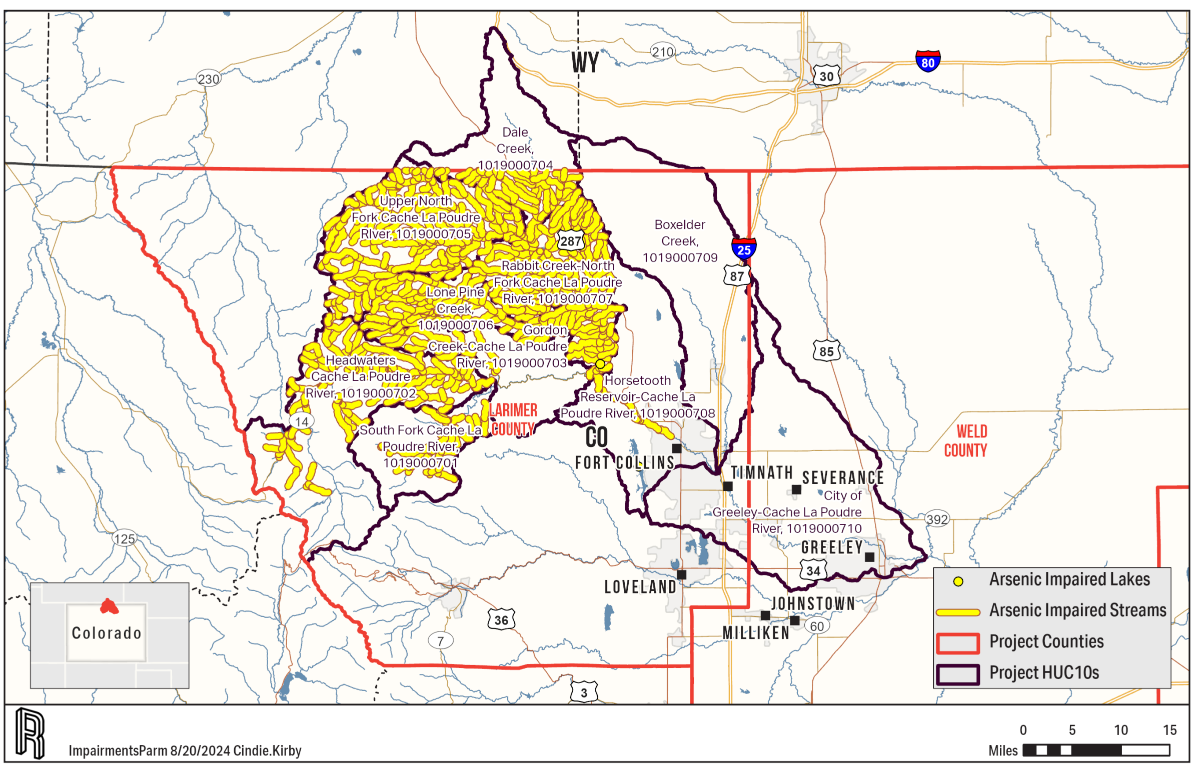


Figure B-6. Arsenic Impairments.

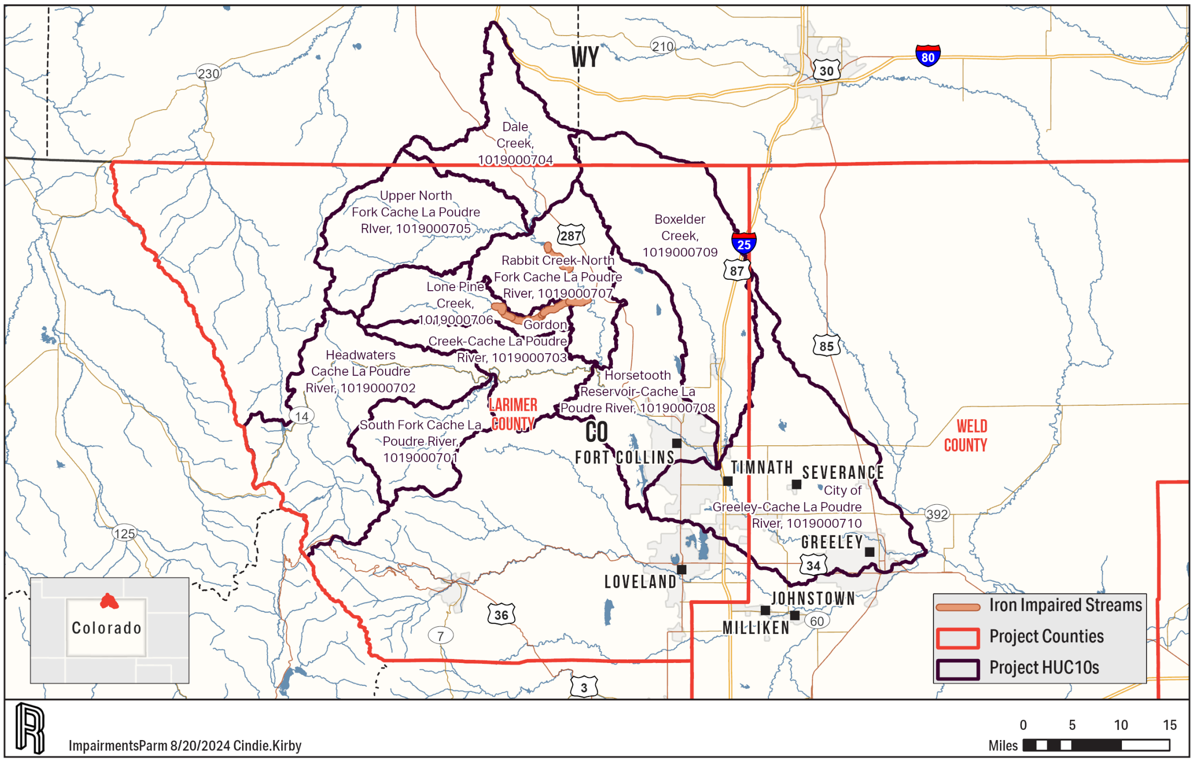


Figure B-7. Iron Impairments.

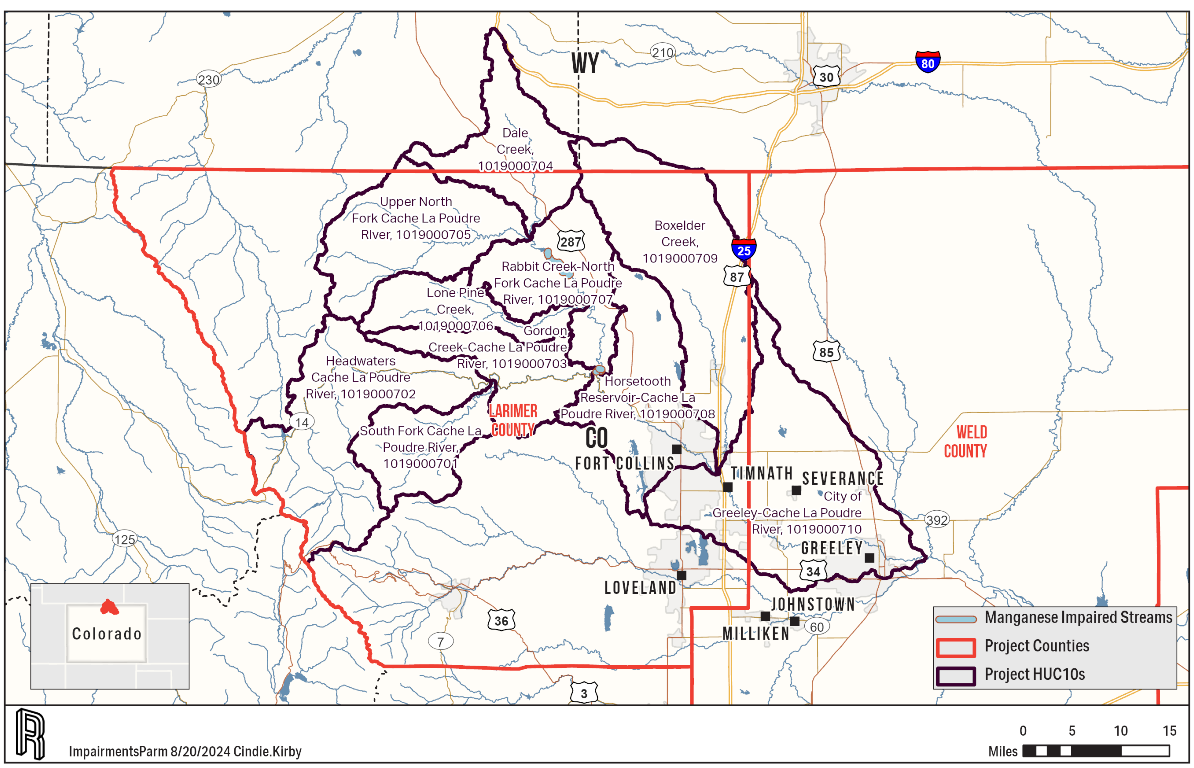


Figure B-8. Manganese Impairments.

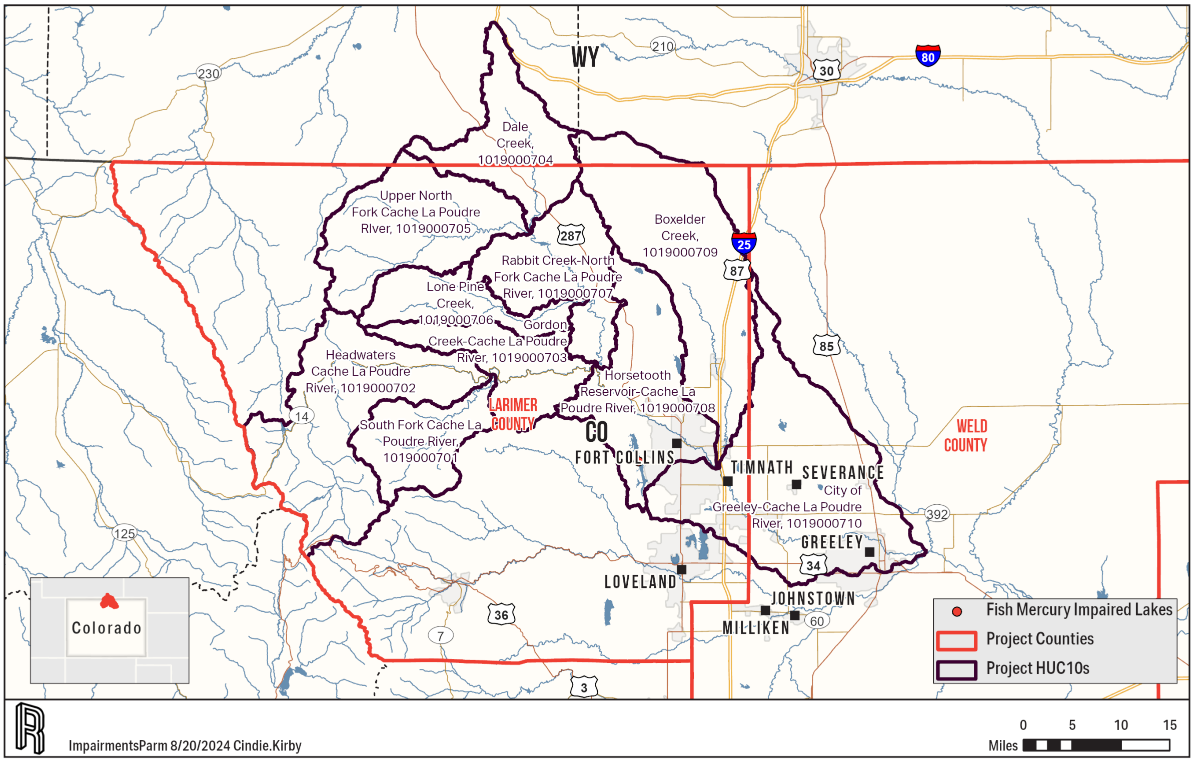


Figure B-9. Mercury Impairments.

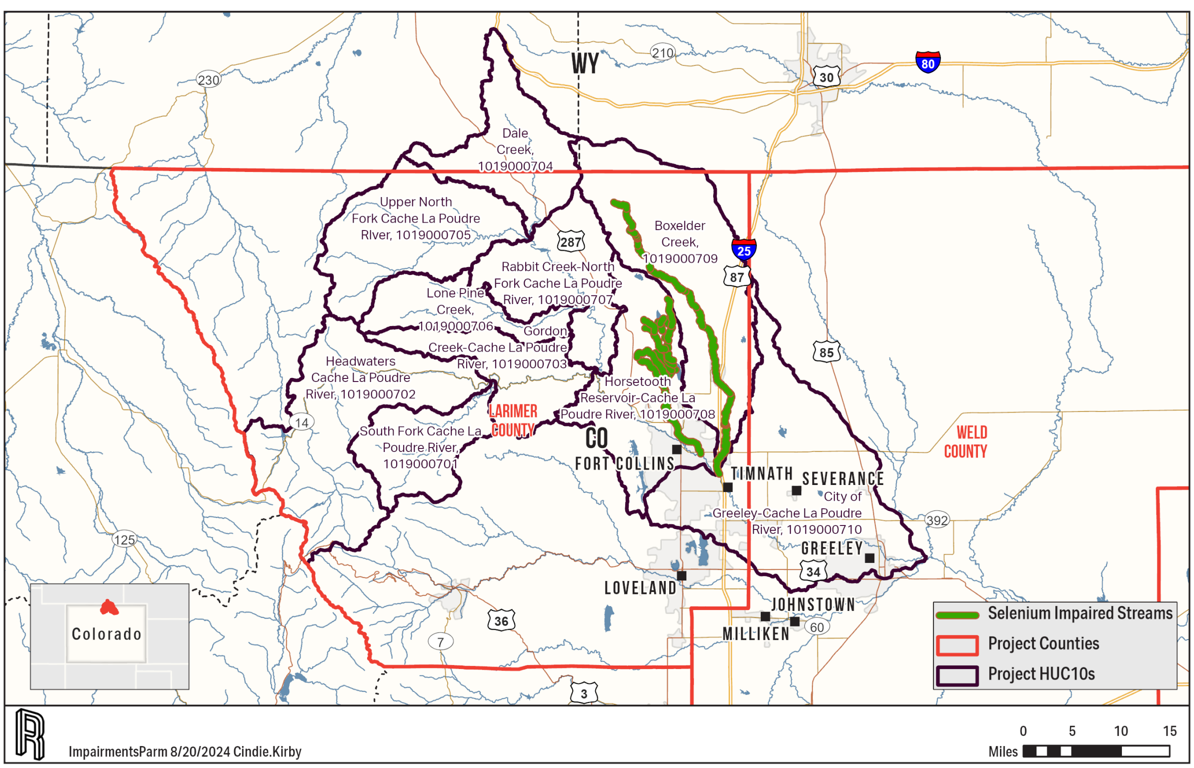


Figure B-10. Selenium Impairments.

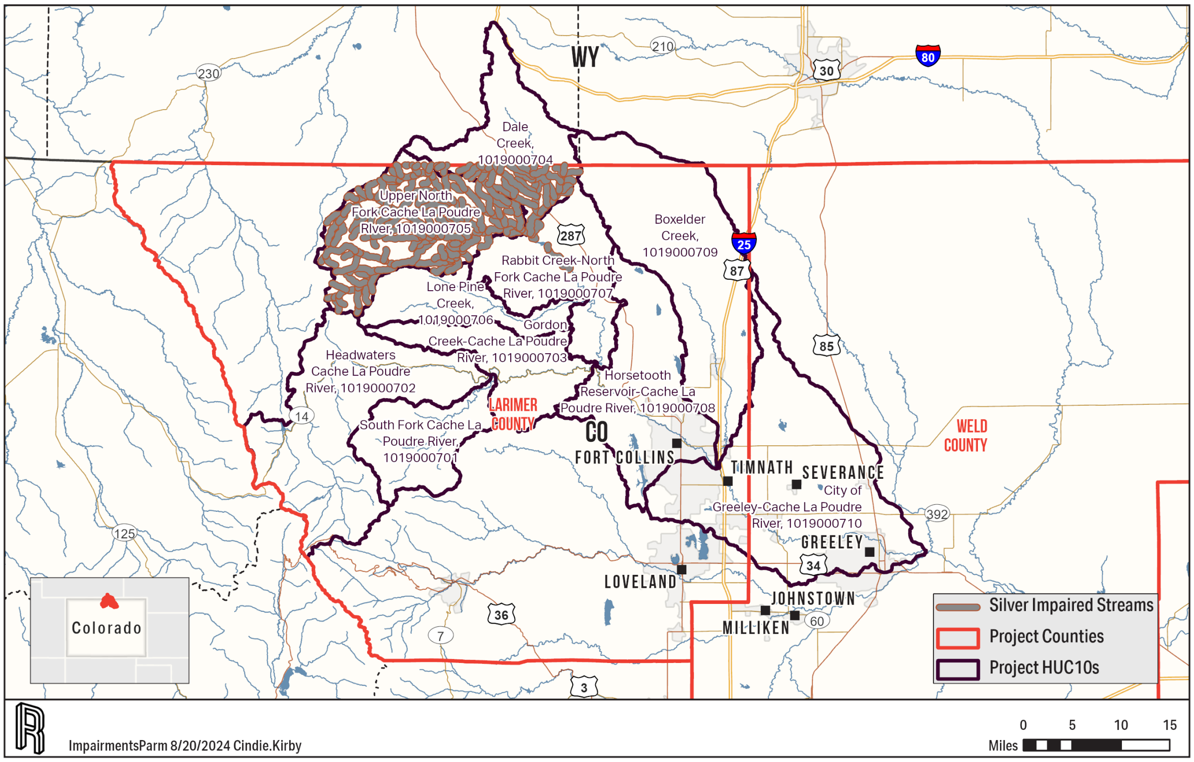
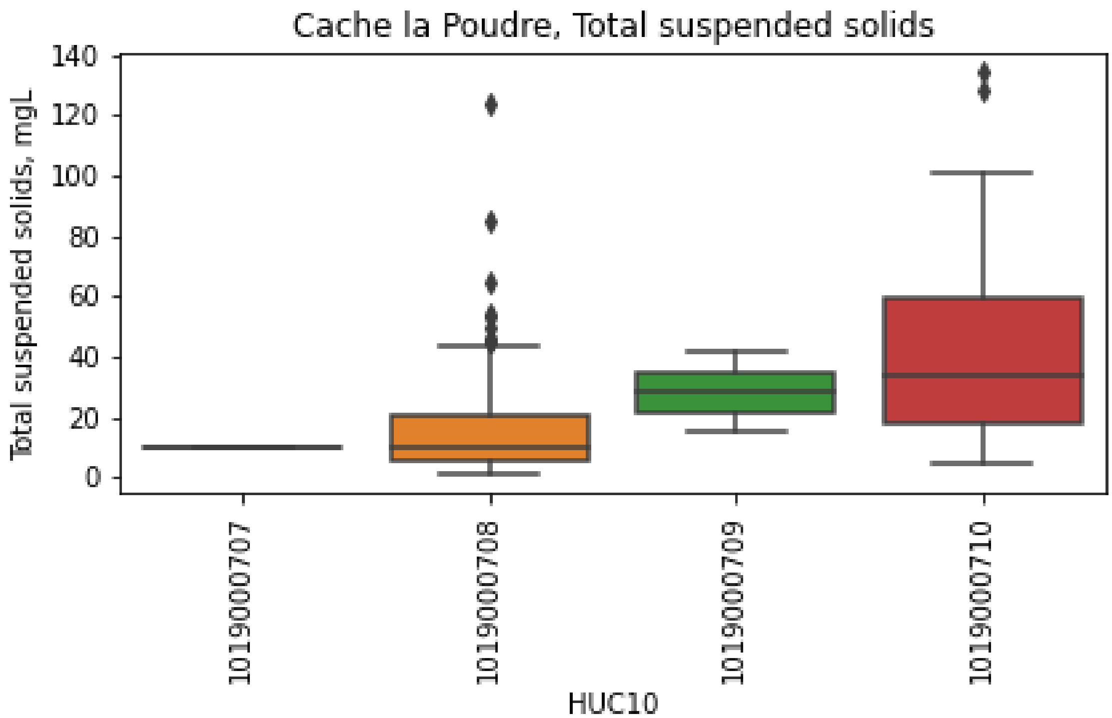


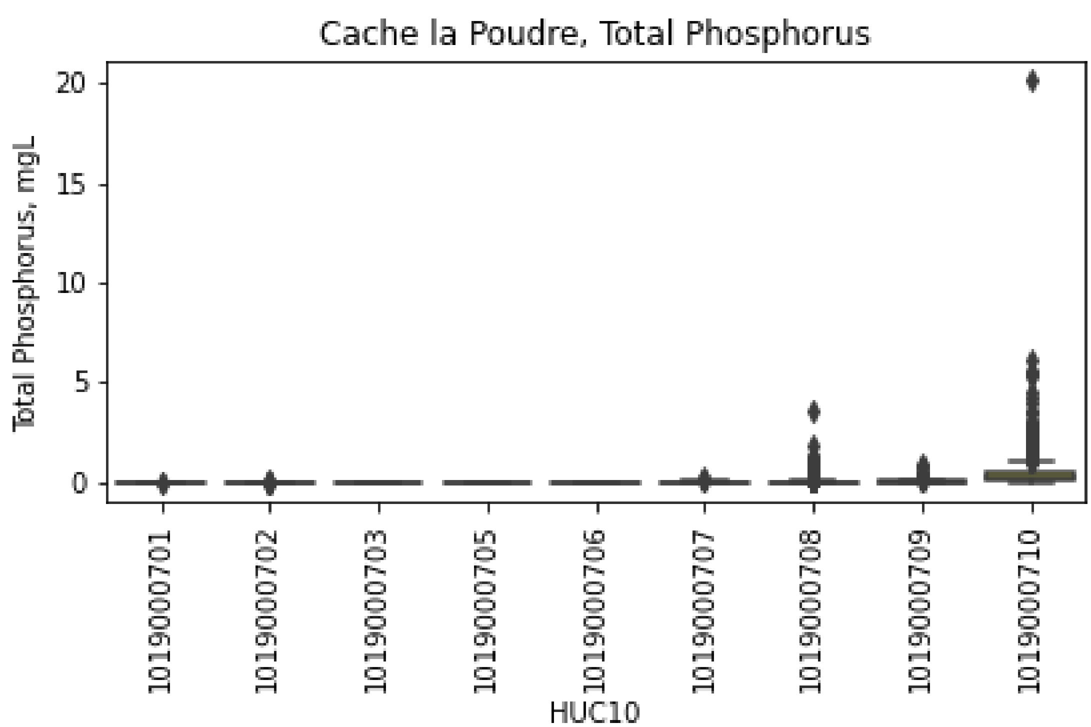
Figure B-11. Silver Impairments.

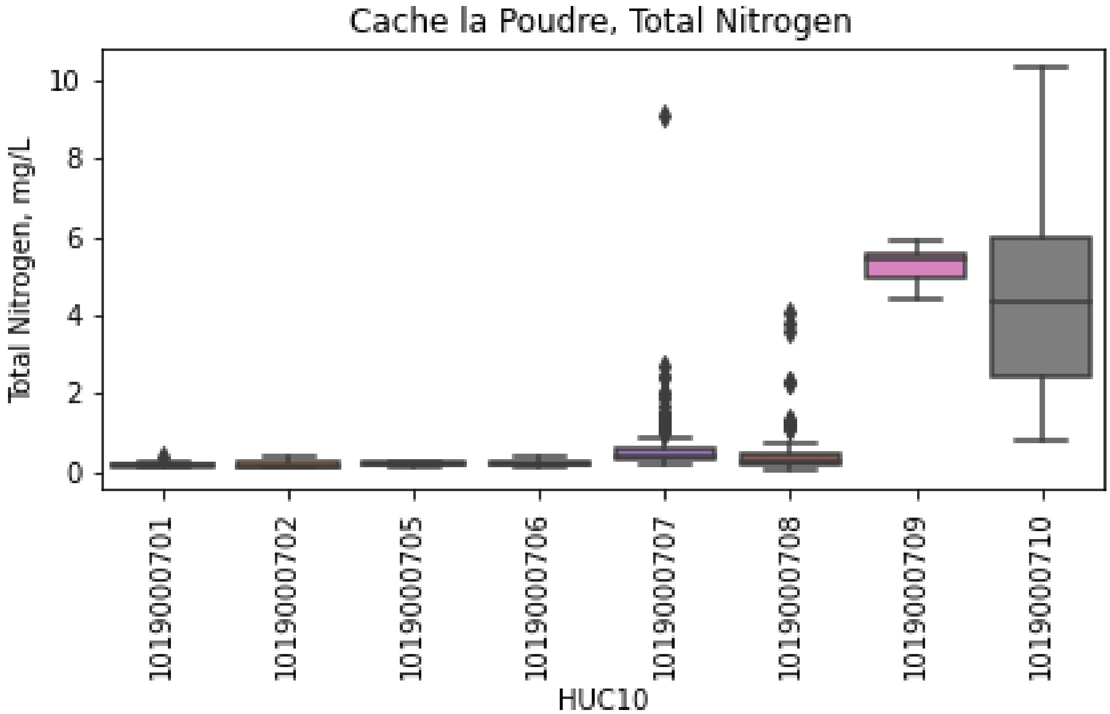
APPENDIX C

APPLICABLE WATER QUALITY BOX PLOTS BY HUC10

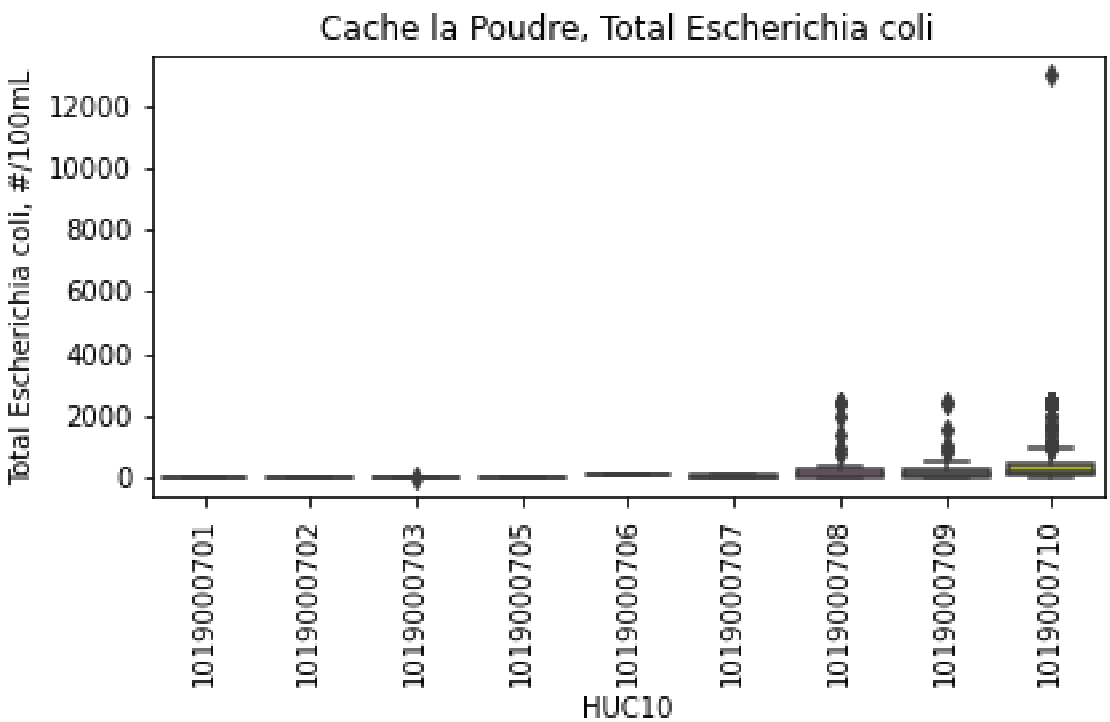
PLET PARAMETERS





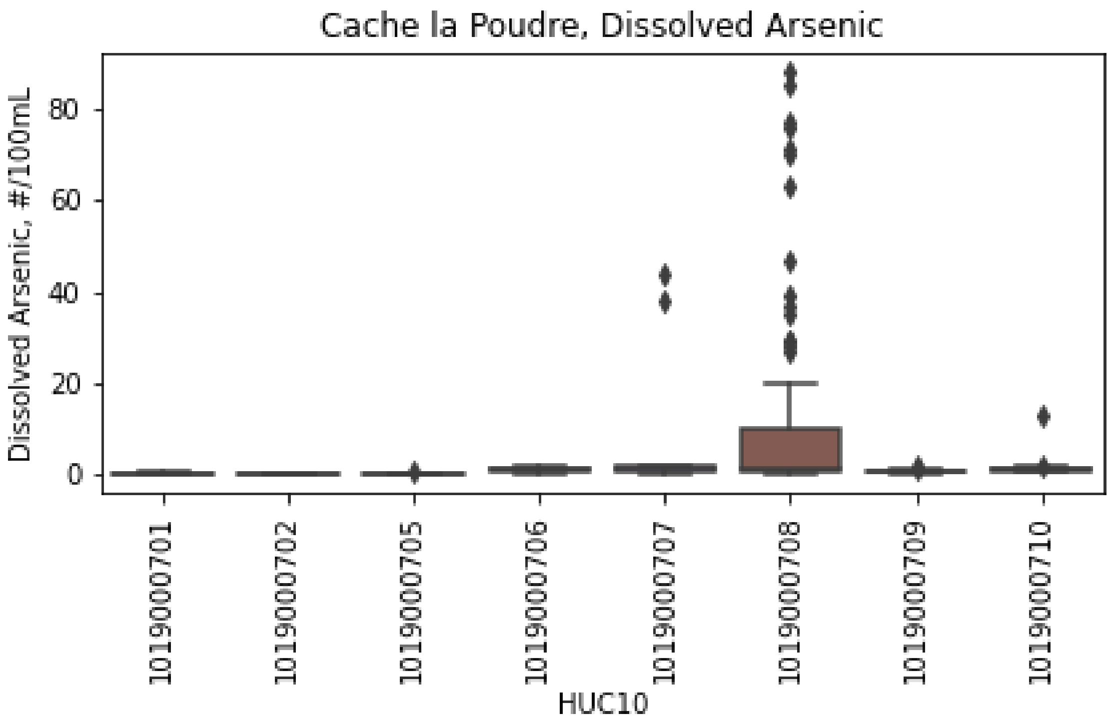


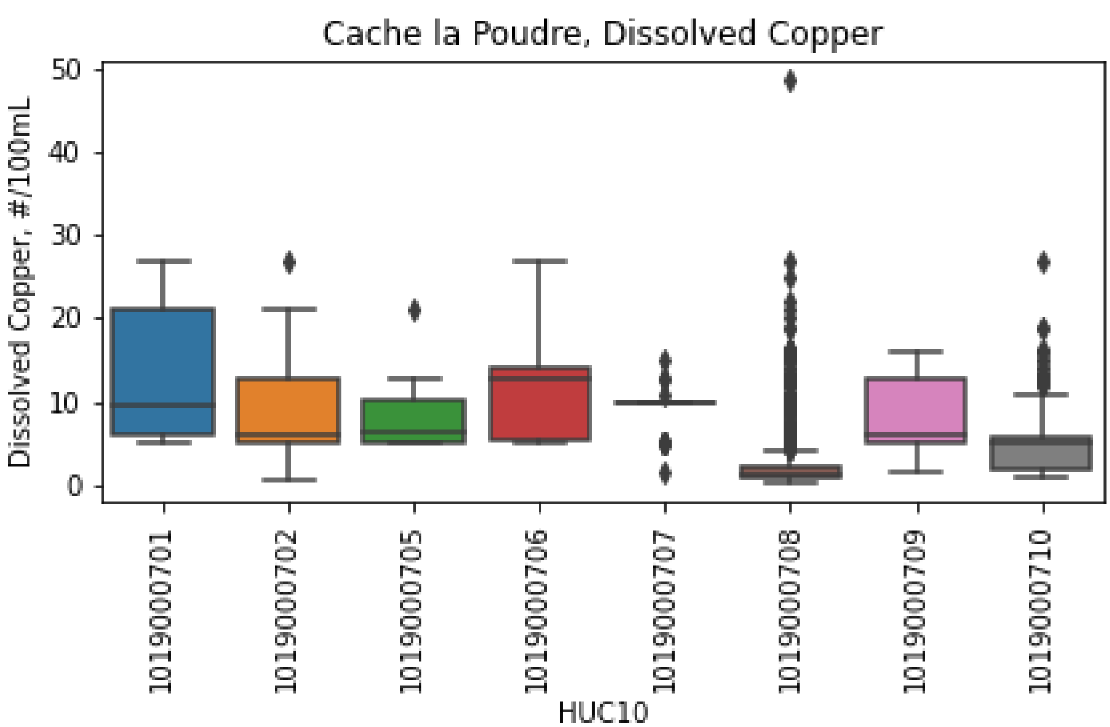
Cache la Poudre, Total Nitrogen
Total Nitrogen, mg/L
0
2
4
6
8
10
1019000701
1019000702
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10

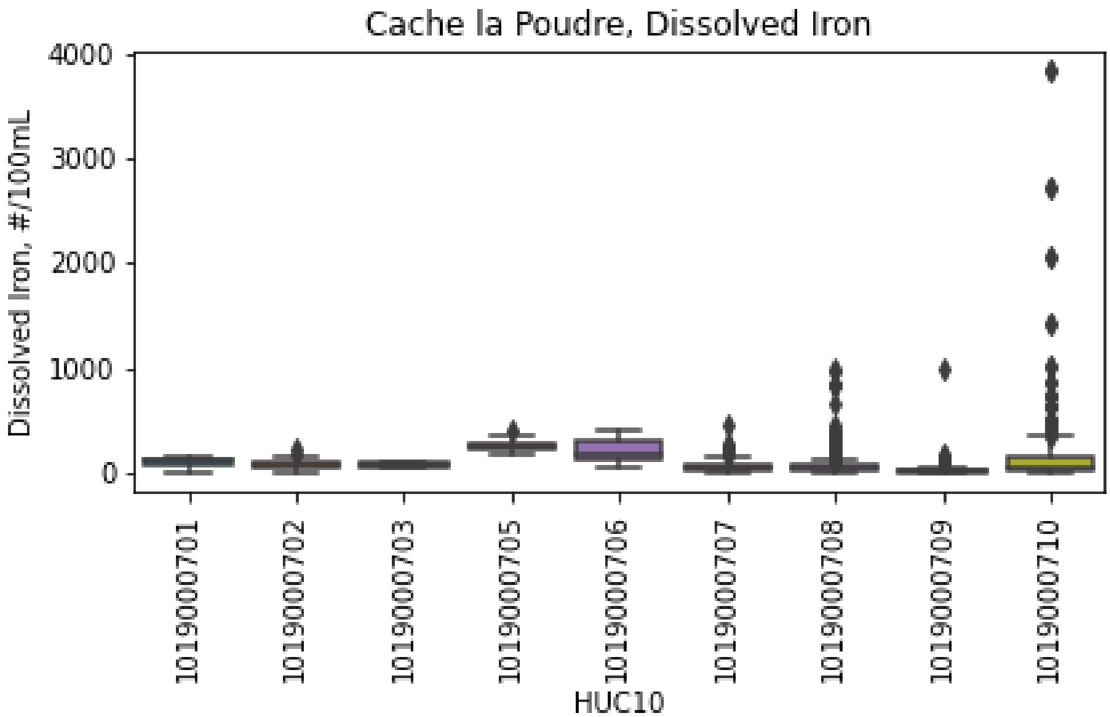


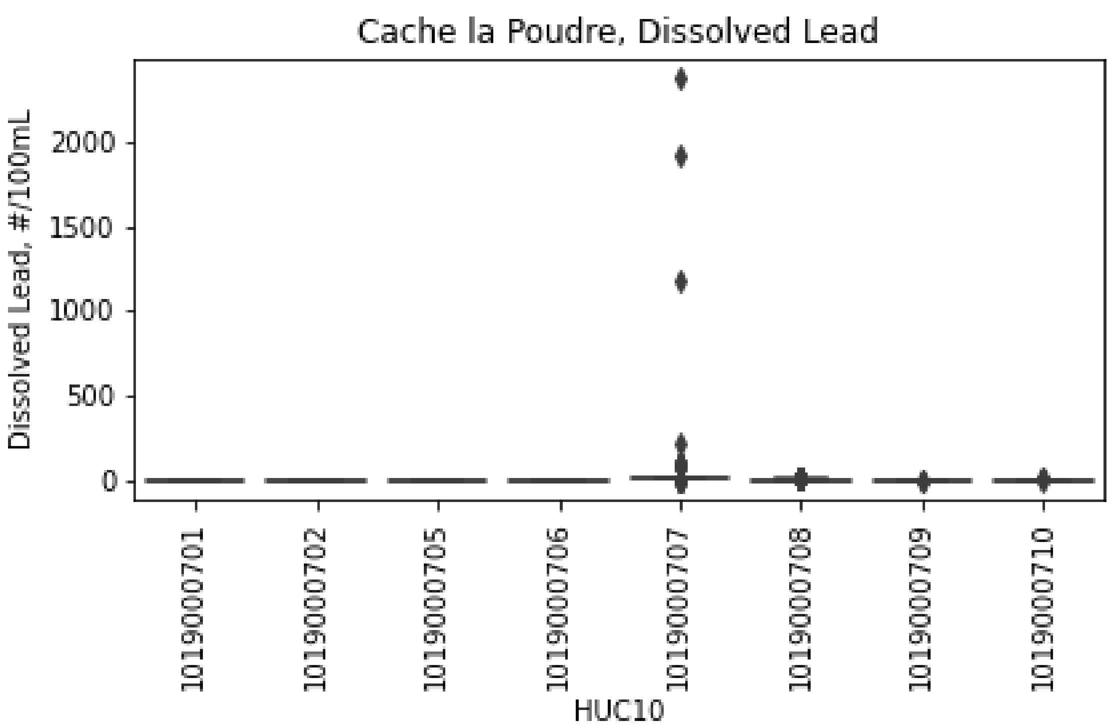
Cache la Poudre, Total Escherichia coli
Total Escherichia coli, #/100mL
0
2000
4000
6000
8000
10000
12000
1019000701
1019000702
1019000703
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10

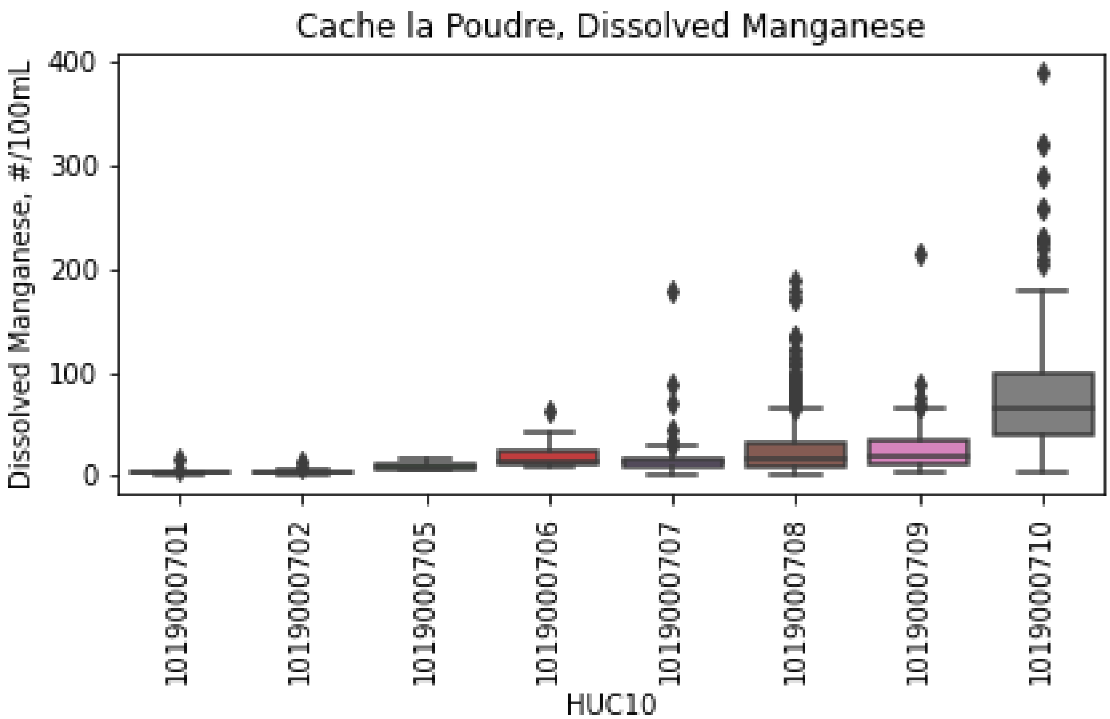
HEAVY METALS

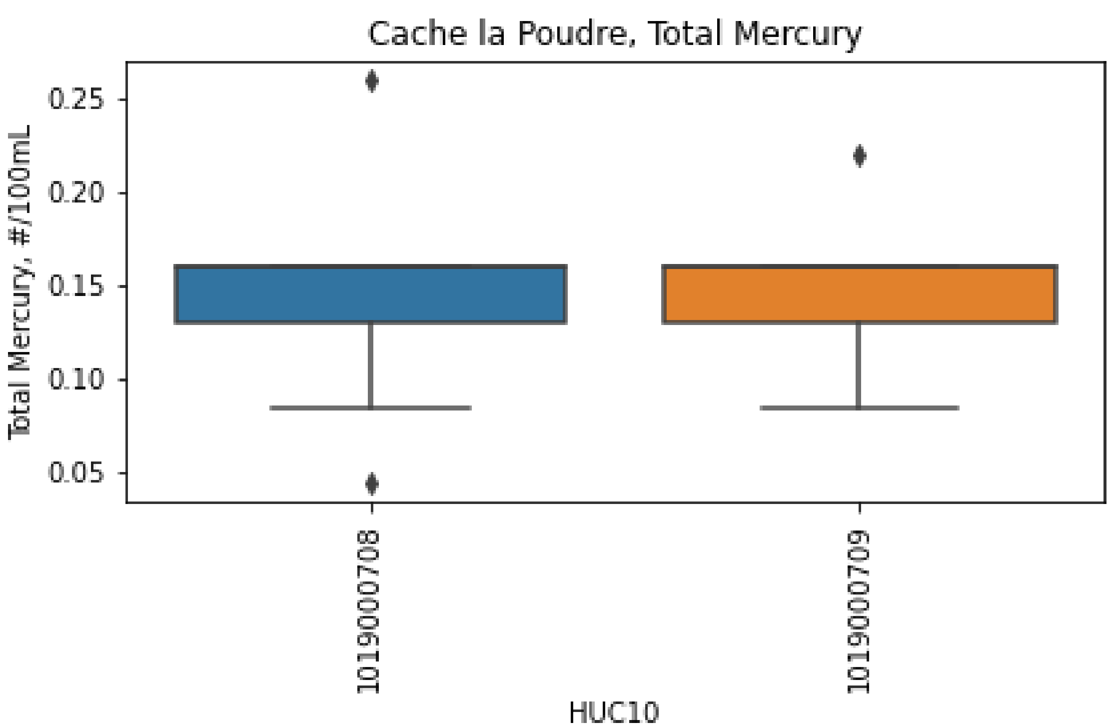


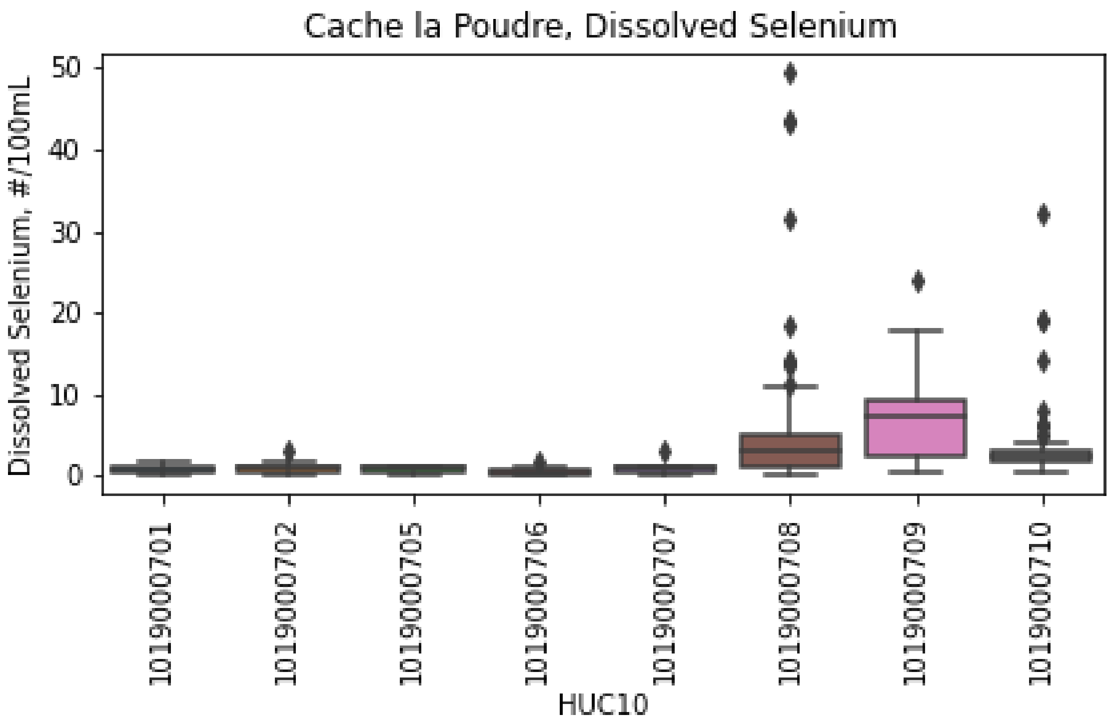


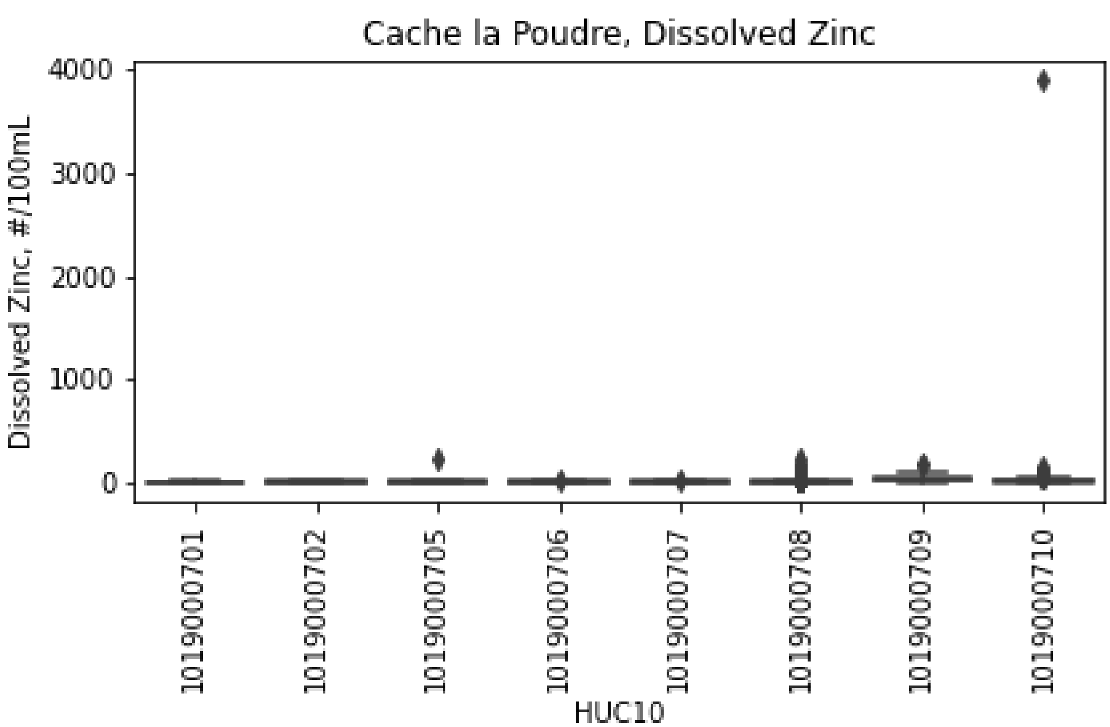

Cache la Poudre, Dissolved Iron
Dissolved Iron, #/100mL
4000
3000
2000
1000
0
1019000701
1019000702
1019000703
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10


Cache la Poudre, Dissolved Lead
Dissolved Lead, #/100mL
2000
1500
1000
500
0
1019000701
1019000702
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10


Cache la Poudre, Dissolved Manganese
Dissolved Manganese, #/100mL
0
100
200
300
400
1019000701
1019000702
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10


Cache la Poudre, Total Mercury
Total Mercury, #/100mL
0.05
0.10
0.15
0.20
0.25
1019000708
1019000709
HUC10


Cache la Poudre, Dissolved Selenium
Dissolved Selenium, #/100mL
50
40
30
20
10
0
1019000701
1019000702
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10


Cache la Poudre, Dissolved Zinc
Dissolved Zinc, #/100mL
4000
3000
2000
1000
0
1019000701
1019000702
1019000705
1019000706
1019000707
1019000708
1019000709
1019000710
HUC10

APPENDIX D
PLET SCENARIO REDUCTIONS

Table D-1. PLET Scenario Reductions (Page 1 of 4)

Land Use	Practice	HUC10	% N Reduction	% P Reduction	% Sediment Reduction
Cropland	Streambank Stabilization and Fencing	1019000701	0	0	0
Cropland	Streambank Stabilization and Fencing	1019000702	0	0	0
Cropland	Streambank Stabilization and Fencing	1019000703	0	0	0
Cropland	Streambank Stabilization and Fencing	1019000704	0	0	0
Cropland	Streambank Stabilization and Fencing	1019000705	0	0	0
Cropland	Streambank Stabilization and Fencing	1019000706	0.89	0.47	1.24
Cropland	Streambank Stabilization and Fencing	1019000707	2.96	1.63	3.46
Cropland	Streambank Stabilization and Fencing	1019000708	6.07	5.87	10.75
Cropland	Streambank Stabilization and Fencing	1019000709	9.27	9.47	13.9
Cropland	Streambank Stabilization and Fencing	1019000710	12.19	13.35	17.13
Cropland	35 ft Buffers	1019000701	0	0	0
Cropland	35 ft Buffers	1019000702	0	0	0
Cropland	35 ft Buffers	1019000703	0	0	0
Cropland	35 ft Buffers	1019000704	0	0	0
Cropland	35 ft Buffers	1019000705	0	0	0
Cropland	35 ft Buffers	1019000706	0.42	0.29	0.88
Cropland	35 ft Buffers	1019000707	1.4	0.99	2.44
Cropland	35 ft Buffers	1019000708	3.06	3.68	7.6
Cropland	35 ft Buffers	1019000709	4.75	5.98	9.82
Cropland	35 ft Buffers	1019000710	6.53	8.61	12.1
Pasture	Streambank Stabilization and Fencing	1019000701	0	0	0
Pasture	Streambank Stabilization and Fencing	1019000702	0.05	0.01	0.03
Pasture	Streambank Stabilization and Fencing	1019000703	0.19	0.04	0.09
Pasture	Streambank Stabilization and Fencing	1019000704	0.53	0.12	0.25

Table D-1. PLET Scenario Reductions (Page 2 of 4)

Land Use	Practice	HUC10	% N Reduction	% P Reduction	% Sediment Reduction
Pasture	Streambank Stabilization and Fencing	1019000705	0.2	0.04	0.12
Pasture	Streambank Stabilization and Fencing	1019000706	1.58	0.4	1.02
Pasture	Streambank Stabilization and Fencing	1019000707	0.52	0.14	0.28
Pasture	Streambank Stabilization and Fencing	1019000708	2.23	0.82	0.91
Pasture	Streambank Stabilization and Fencing	1019000709	0.96	0.38	0.37
Pasture	Streambank Stabilization and Fencing	1019000710	0.59	0.28	0.3
Pasture	35 ft Buffers	1019000701	0	0	0
Pasture	35 ft Buffers	1019000702	0.06	0.01	0.02
Pasture	35 ft Buffers	1019000703	0.22	0.05	0.08
Pasture	35 ft Buffers	1019000704	0.6	0.14	0.22
Pasture	35 ft Buffers	1019000705	0.24	0.05	0.11
Pasture	35 ft Buffers	1019000706	1.82	0.45	0.88
Pasture	35 ft Buffers	1019000707	0.6	0.16	0.24
Pasture	35 ft Buffers	1019000708	2.56	0.92	0.79
Pasture	35 ft Buffers	1019000709	1.1	0.42	0.32
Pasture	35 ft Buffers	1019000710	0.66	0.29	0.26
Pasture	Livestock Exclusion	1019000701	0	0	0
Pasture	Livestock Exclusion	1019000702	0.01	0.01	0.02
Pasture	Livestock Exclusion	1019000703	0.06	0.03	0.07
Pasture	Livestock Exclusion	1019000704	0.16	0.08	0.22
Pasture	Livestock Exclusion	1019000705	0.06	0.03	0.11
Pasture	Livestock Exclusion	1019000706	0.46	0.25	0.87
Pasture	Livestock Exclusion	1019000707	0.15	0.09	0.24
Pasture	Livestock Exclusion	1019000708	0.65	0.51	0.77
Pasture	Livestock Exclusion	1019000709	0.29	0.24	0.31
Pasture	Livestock Exclusion	1019000710	0.2	0.19	0.26
Feedlot	Waste Management System	1019000701	2.65	1.43	0
Feedlot	Waste Management System	1019000702	1.89	1.1	0
Feedlot	Waste Management System	1019000703	2.75	1.62	0
Feedlot	Waste Management System	1019000704	2.9	1.65	0

Table D-1. PLET Scenario Reductions (Page 3 of 4)

Land Use	Practice	HUC10	% N Reduction	% P Reduction	% Sediment Reduction
Feedlot	Waste Management System	1019000705	2.95	1.6	0
Feedlot	Waste Management System	1019000706	2.81	1.83	0
Feedlot	Waste Management System	1019000707	5.5	3.82	0
Feedlot	Waste Management System	1019000708	2.88	2.65	0
Feedlot	Waste Management System	1019000709	3.58	3.39	0
Feedlot	Waste Management System	1019000710	2.85	2.7	0
Forest	Site Preparation/Straw/Crimp/Net	1019000701	1.25	1.15	12.58
Forest	Site Preparation/Straw/Crimp/Net	1019000702	0.91	0.91	13.17
Forest	Site Preparation/Straw/Crimp/Net	1019000703	0.59	0.59	6.82
Forest	Site Preparation/Straw/Crimp/Net	1019000704	0.92	0.9	8.63
Forest	Site Preparation/Straw/Crimp/Net	1019000705	0.89	0.83	16.42
Forest	Site Preparation/Straw/Crimp/Net	1019000706	0.75	0.84	11.48
Forest	Site Preparation/Straw/Crimp/Net	1019000707	0.4	0.48	6.07
Forest	Site Preparation/Straw/Crimp/Net	1019000708	0.11	0.18	1.01
Forest	Site Preparation/Straw/Crimp/Net	1019000709	0.05	0.07	0.29
Forest	Site Preparation/Straw/Crimp/Net	1019000710	0	0	0.01
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000701	1.27	1.18	12.85
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000702	0.93	0.93	13.46
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000703	0.6	0.6	6.97
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000704	0.94	0.91	8.82
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000705	0.91	0.85	16.77
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000706	0.77	0.85	11.72
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000707	0.41	0.49	6.2
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000708	0.12	0.18	1.03
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000709	0.05	0.07	0.3
Forest	Site Preparation/Straw/Crimp Seed/Fertilizer/Transplant	1019000710	0	0.01	0.01
Urban	Extended Wet Detention	1019000701	1.33	0.63	2.65

Table D-1. PLET Scenario Reductions (Page 4 of 4)

Land Use	Practice	HUC10	% N Reduction	% P Reduction	% Sediment Reduction
Urban	Extended Wet Detention	1019000702	1.94	0.96	5.35
Urban	Extended Wet Detention	1019000703	2.09	1.08	4.81
Urban	Extended Wet Detention	1019000704	1.14	0.57	2.1
Urban	Extended Wet Detention	1019000705	1.33	0.64	4.86
Urban	Extended Wet Detention	1019000706	2.04	1.17	6.15
Urban	Extended Wet Detention	1019000707	0.88	0.54	2.62
Urban	Extended Wet Detention	1019000708	2.23	1.81	3.9
Urban	Extended Wet Detention	1019000709	1.12	0.93	1.42
Urban	Extended Wet Detention	1019000710	0.71	0.59	0.61
Urban	Infiltration Basin	1019000701	1.45	0.6	2.31
Urban	Infiltration Basin	1019000702	2.11	0.91	4.67
Urban	Infiltration Basin	1019000703	2.28	1.02	4.2
Urban	Infiltration Basin	1019000704	1.24	0.53	1.83
Urban	Infiltration Basin	1019000705	1.51	0.63	4.41
Urban	Infiltration Basin	1019000706	2.22	1.1	5.36
Urban	Infiltration Basin	1019000707	0.96	0.51	2.28
Urban	Infiltration Basin	1019000708	2.43	1.7	3.4
Urban	Infiltration Basin	1019000709	1.22	0.88	1.23
Urban	Infiltration Basin	1019000710	0.78	0.56	0.53
Urban	Concrete Grid Pavement	1019000701	2.18	0.83	2.77
Urban	Concrete Grid Pavement	1019000702	3.17	1.26	5.6
Urban	Concrete Grid Pavement	1019000703	3.42	1.41	5.04
Urban	Concrete Grid Pavement	1019000704	1.86	0.74	2.2
Urban	Concrete Grid Pavement	1019000705	2.18	0.83	5.08
Urban	Concrete Grid Pavement	1019000706	3.33	1.52	6.44
Urban	Concrete Grid Pavement	1019000707	1.44	0.7	2.74
Urban	Concrete Grid Pavement	1019000708	3.65	2.36	4.08
Urban	Concrete Grid Pavement	1019000709	1.83	1.22	1.48
Urban	Concrete Grid Pavement	1019000710	1.16	0.77	0.63