208 REGION 2 — NONPOINT SOURCE WATERSHED PLAN

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EXECUTIVE SUMMARY

This *208 Region 2 – Nonpoint Source Watershed Plan* was completed for the North Front Range Water Quality Planning Association (NFRWQPA) with the purpose of preparing comprehensive U.S. Environmental Protection Agency (EPA) nine key element Watershed Implementation Plans for the Section 208 Region 2 area (hereafter referred to as Watershed Implementation Plans). The NFRWQPA is the designated Section 208 planning agency under the federal Clean Water Act (CWA) for the Larimer and Weld County region. Historically, the NFRWQPA has focused on water quality impacts of water treatment systems and their impact on receiving waters. The plan does not focus on Municipal Separate Storm Sewer Systems (MS4s) and their impacts on receiving waterbodies. This plan also does not focus on water treatment systems, and instead focuses on nonpoint source (NPS) impacts on receiving waterbodies.

Four Watershed Implementation Plans were developed for watersheds draining to the Middle South Platte River within Larimer and Weld counties. The first plan developed was for areas draining to the Big and Little Thompson Rivers. The area in this plan transitions from the upper mountainous, forest areas in the west to more agricultural and developed areas in the lower eastern portions of the watershed. The second and third plans developed were for areas draining to the Cache la Poudre River and St. Vrain Creek. The watershed land cover characteristics in these watersheds are very similar to the Big and Little Thompson Rivers with mountainous forest areas draining easterly toward agricultural and developed areas. The final plan developed was for the other watersheds draining to the Middle South Platte River in Larimer and Weld Counties. These watersheds include the Middle South Platte-Cherry Creek (not including areas from the *Barr Lake and Milton Reservoir Watershed Plan Update* [Barr Lake & Milton Reservoir Watershed Association, 2017] or the *Big Dry Creek Watershed Management Plan* [Wright Water Engineers, 2002], Lone Tree-Owl, Crow, and Middle South Platte-Sterling. The land cover in the Middle South Platte River watershed is primarily cropland and/or herbaceous land, with very little forest cover or development.

Each plan includes an introduction, watershed characterization, summary of existing watershed plans and projects; a summary of standards and impairments; source assessments; priority areas for implementation based upon the source assessments; expected load reductions from best management practices (BMPs); existing BMPs; plans for information, education, and outreach; criteria to assess progress; effective monitoring options; and sources of technical and financial assistance. This Regional NPS Watershed Plan references the plans to suggest how to approach the watersheds regionally and recommend where to look for information for different watersheds and land cover types.

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LIST OF ABBREVIATIONS

ACEP	Agricultural Conservation Easement Program
AFA	Alternative Funding Arrangement
AFP	Announcements for Funding Proposals
AML	abandoned mine land
BIP	Basin Implementation Plan
BMP	best management practices
BTWC	Big Thompson Watershed Coalition
CAWA	Colorado Ag Water Alliance
CCR	Code of Colorado Regulation
CDPHE	Colorado Department of Public Health and Environment
CIG	Conservation Innovation Grants
CPPE	Conservation Practice Physical Effects
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
DNR	Department of Natural Resources
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
HUC	Hydrologic Unit Code
lb/acre	pounds per acre
LID	Low Impact Development
mi^2	square miles
MIDS	Minimal Impact Design Standards
MS4	Municipal Separate Storm Sewer System
NFRWQPA	North Front Range Water Quality Planning Association
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
RCPP	Regional Conservation Partnership Program
RESPEC	RESPEC Company, LLC
SPARROW	SPAtially Referenced Regression on Watershed Attributes
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWAP	Source Water Assessment and Protection
TMDL	total maximum daily load

LIST OF ABBREVIATIONS (CONTINUED)

TSI	Trophic Status Index
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USFWS	U.S. Fish & Wildlife Service
USLE	Universal Soil Loss Equation
WRSF	Water Supply Reserve Fund

1.0 APPLICATION OF THIS REGIONAL PLAN

North Front Range Water Quality Planning Association (NFRWQPA) is the designated Section 208 planning agency under the federal Clean Water Act (CWA) for the Larimer and Weld County region. NFRWQPA represents its member entities in water quality legislative and regulation-setting actions. RESPEC Company, LLC (RESPEC), NFRWQPA, and other community stakeholder groups worked in partnership and coordination to prepare a comprehensive U.S. Environmental Protection Agency (EPA) nine key element Watershed Plan for the Section 208 Region 2 area (hereafter referred to as this plan or Regional NPS Watershed Plan). Historically, the primary tasks performed by the NFRWQPA have focused on point source actions, including wastewater and Municipal Separate Storm Sewer Systems (MS4) areas. Instead, this plan focuses on nonpoint sources (NPSs) and development outside of MS4 areas. Overall, the primary goal is to identify the most feasible and effective NPS management planning mechanisms for areas within the Middle South Platte River Watershed in Larimer and Weld Counties. The project area is shown in Figure 1-1. Four Watershed Implementation Plans were prepared, all for areas within Larimer and Weld Counites. Watersheds addressed include the St. Vrain eight-digit Hydrologic Unit Code (HUC8) (10190005), the Big and Little Thompson HUC8 (10190006), the Cache la Poudre HUC8 (10190007), and a group of remaining HUC8s that drain to the Middle South Platte River within Larimer and Weld Counties (10190003, 10190008, 10190009, and 10190012). The four Watershed Implementation Plans are included as Appendices A through D. Information is provided for the excluded areas (Barr Lake and Milton Reservoir and Big Dry Creek) in Section 3.1, but Watershed Implementation Plans for these specific watersheds were not developed.

The NFRWQPA was awarded Colorado Division of Water Resources and Power Development Authority Funds from the Colorado NPS Program to develop a NPS watershed plan modeled after the EPA nine key element watershed plan guidelines. This overarching Regional NPS Watershed Plan pulls the four Watershed Implementation Plans together to provide a planning framework to address waterbodies impaired by NPS pollution and/or protecting waterbodies affected or threatened by NPS pollution.

This Regional NPS Watershed Plan addresses a wide range of land and water resources, prioritizing sources of parameters of concern and determining solutions for water quality issues. This plan is intended to determine which implementation projects and programs will be best to restore degraded resources and protect high-quality resources from degradation in watersheds in Larimer and Weld Counties. The Colorado NPS Program is prioritizing collaboration with local communities to develop and implement Watershed Implementation Plans that evaluate NPSs of pollution in areas experiencing growth. Therefore, RESPEC paid particular attention to the areas that are not yet permitted MS4s but are likely to become permitted MS4s. Current MS4s and areas that are growing quickly and expected to become MS4s within the next 5 to 15 years (Johnstown and Firestone/Frederick) in the Middle South Platte River project area in Larimer and Weld Counties are shown in Figure 1-1 and Table 1-1. For the purposes of this plan, MS4 areas (not represented in modeling efforts) 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 provided by the Town of Timnath [Smith, 2024]. Water quality impacts in the fast-growing but non-MS4 permitted areas have the potential to be significant; therefore, addressing the potential effects should be part of planning for growth.

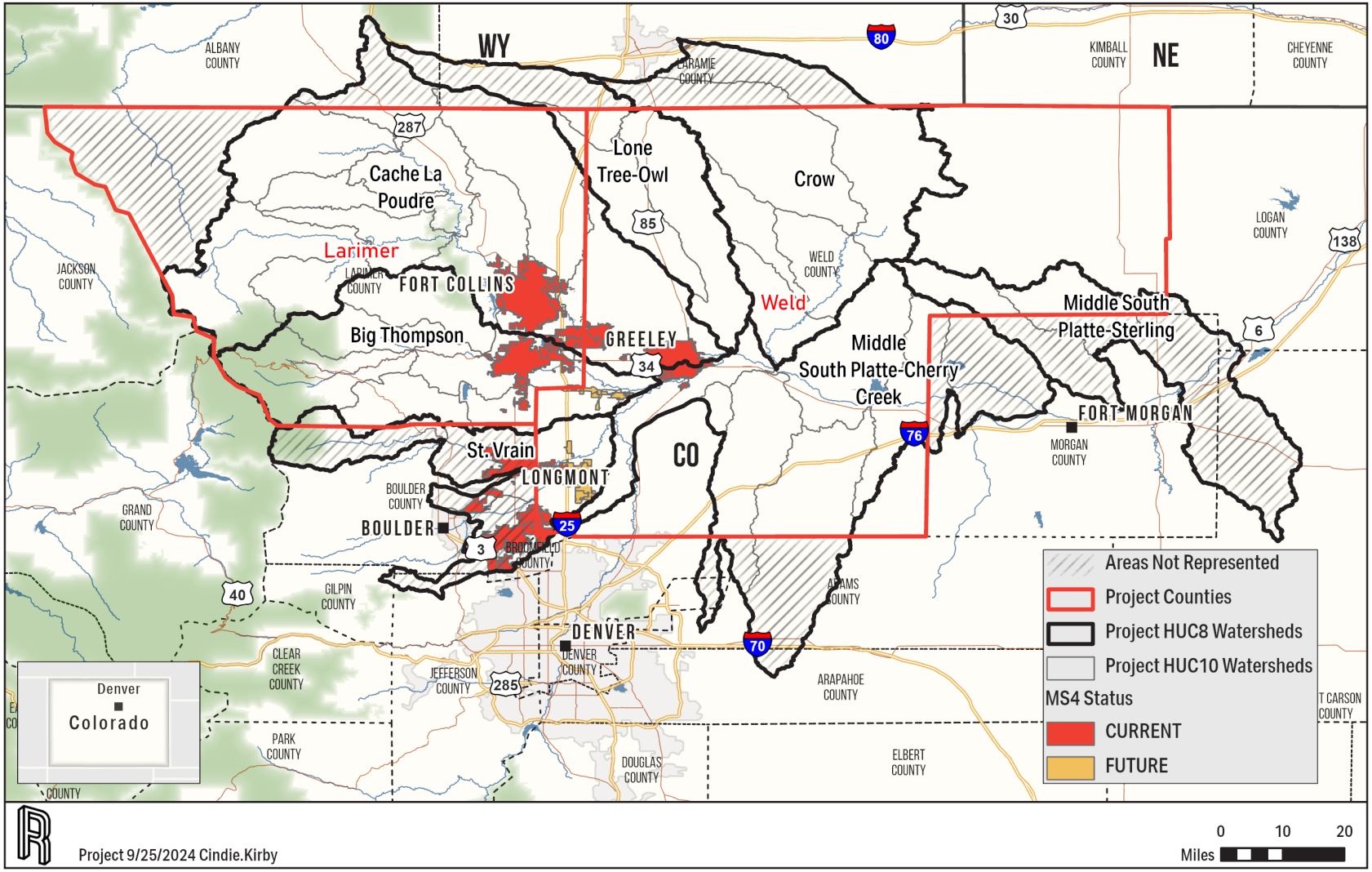

Figure 1-1. Regional Project HUC8 Watersheds and Counties.

Table 1-1. Current and Possible Future MS4s in Larimer and Weld Counties in Applicable HUC8s

MS4 Status	MS4 (Weld and Larimer Counties Only)	HUC8	County	Area (mi^2)
Current	Fort Collins	Big and Little Thompson River and Cache la Poudre River	Mostly Larimer, some Weld	137.3
Current	Greeley	Mainly Cache la Poudre River and some Middle South Platte River	Weld	43.1
Current	Lafayette—Erie--Louisville	St. Vrain Creek	Weld	6.8
Current	Longmont	St. Vrain Creek	Weld	4.0
Possible Future	Firestone/Frederick	Mainly St. Vrain Creek and some Middle South Platte River	Weld	10.1
Possible Future	Johnstown	Mainly Big and Little Thompson River and a sliver of Middle South Platte River	Mostly Weld, some Larimer	7.5

mi^2 = square miles

Developing Regional NPS Watershed Plans is an essential step in identifying priority actions that should be implemented to improve water quality. Watershed Implementation Plans are required if local communities would like to compete for funding assistance administered by the NPS Program to support the implementation of best management practices (BMPs) that directly address NPS pollution. The NPS Program funding assistance is focused on voluntary, non-regulatory actions. Considering several factors is essential when evaluating where an NPS watershed plan should be developed. The nine elements of a watershed-based plan include characterization and goal-setting information to address primary NPSs of pollution in the watershed and determine management strategies needed to reduce NPS pollution to meet water quality goals. The nine elements also ensure that a specific plan of action with measurable targets and milestones is in place and identify the necessary financial and technical resources needed to restore the waterbody. For additional information about the nine elements, review the EPA's A Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters online. This will aid other NPS watershed plans already created in the region. The following are EPA's nine key elements:

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.
2. Estimate load reductions expected from the Action Strategy identified.
3. Describe nonpoint source management measures, including operation/maintenance requirements, and targeted critical areas (i.e., "Action Strategy") needed to achieve identified load reductions.
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.
5. Develop an information and education component that will be used to enhance public understanding of the nonpoint source management measures and encourage their early and continued participation in selecting, designing, and implementing the Action Strategy.
6. Develop a project schedule.

7. Describe interim, measurable milestones.
8. Identify a set of criteria to assess progress/effectiveness in achieving water quality standards or other appropriate end targets.
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.

This Regional NPS Watershed Plan also provides a regional, holistic understanding of the number and types of groups working in this area of the watersheds, the types of water quality projects completed, and anticipated projects. This plan is an evolutionary step in local water planning to streamline facilitation between partners to restore impaired and degraded resources and protect high-quality resources from adverse future impacts. The following government agencies and partners participated in the development of this plan:

- Big Thompson Watershed Coalition (BTWC)
- Big Thompson Watershed Forum (dissolved); access archive information on the Big Thompson Watershed Forum Archive homepage)
- Boxelder Sanitation District
- Brink Corp
- Carestream
- City of Dacono
- City of Fort Collins
- City of Greeley
- City of Longmont
- City of Loveland
- 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
- Community of Fox Acres
- Davies Mobile Home Park
- Drala Mountain Center
- Ducks Unlimited
- Estes Park Sanitation District
- Estes Valley Watershed Coalition

- FPAC-NRCS, CO
- Fresh Water Trust
- JBS Greeley Beef Plant
- Larimer County
- Left Hand Water District
- Little Thompson Watershed Coalition
- Los Rios Farm
- Northern Colorado Water Conservancy District
- Peaks to People Water Fund
- Poudre Heritage Alliance
- RNC Consulting, LLC
- St. Vrain Creek and Boulder Creek Watershed
- St. Vrain Sanitation District
- South Fort Collins Sanitation District
- South Platte Basin Roundtable
- Thompson School District
- Town of Ault
- Town of Berthoud
- Town of Eaton
- Town of Erie
- Town of Estes Park
- Town of Evans
- Town of Firestone
- Town of Frederick
- Town of Gilcrest
- Town of Johnston
- Town of Kersey
- Town of Keenesburg
- Town of La Salle
- Town of Mead
- Town of Milliken
- Town of Pierce
- Town of Severance
- Town of Timnath
- Town of Wellington

- Town of Windsor
- Trout Unlimited
- Upper Thompson Sanitation District
- Weld County
- Xcel Energy

2.0 DATA RESOURCES AND INTEGRATION

A significant amount of data was collected for this project, including spatial and temporal data. The type, description, source, and use for each dataset are shown in Table 2-1. Spatial data were primarily used to characterize potential NPSs in the watershed and generate information by 10-digit HUCs. Similarly, temporal data were used to understand water quality issues and possible sources in the HUC10s. Other data used included reductions expected from different BMPs.

Table 2-1. Data Sources and Uses (Page 1 of 2)

Type	Description	Source	Use
Spatial	Land Use	Multi-Resolution Land Characteristics Consortium [2019]	Watershed Characterization and Modeling
Spatial	Municipal Separate Storm Sewer Systems	Catena Analytics [2024]	Pollutant Load Estimation Tool (PLET) Modeling
Spatial	Hydrologic Soil Group	NRCS [2024a]	PLET Modeling
Spatial	Census Urban Areas	U.S. Census Bureau [2010, 2020]	PLET Modeling
Spatial	Onsite Wastewater Treatment System (OWTS) (Larimer County)	Larimer County [2023]	PLET Modeling and *E. coli* Production Analysis
Spatial	OWTS (Weld County)	Fischer [2023]	PLET Modeling and *E. coli* Production Analysis
Spatial	Precipitation	PRISM Climate Group [2024]	Watershed Characterization
Spatial	Geology	Horton et al. [2017]	Watershed Characterization
Spatial	Animal Units	EPA [2022]	PLET Modeling and *E. coli* Production Analysis
Spatial	303(d) Impairments	CDPHE [2024]	Impairment Summary and Maps
Spatial	Irrigation	Colorado Water Conservation Board [CWCB] and Colorado Division of Water Resources [2023]	PLET Modeling
Spatial	Wildfires	National Interagency Fire Center [2024]	Source Assessment
Spatial	Abandoned Mines	Graves [2024]	Source Assessment
Temporal	Water Quality	Bremser [2023]; Catena Analytics [2024]; Colorado Data Sharing Network [2024]; Fayram [2023], Hathaway [2023]; National Water Quality Monitoring Council [2023]; Northern Water [2024]; South Fort Collins Sanitation District [2023]	Water Quality Boxplots
Temporal	Flow	USGS [2023]	

Table 2-1. Data Sources and Uses (Page 2 of 2)

Type	Description	Source	Use
Other	Bacteria Production by Animal Type	Metcalf and Eddy, Inc. [1991]; Horsley and Witten, Inc. [1996]; Zeckoski et al. [2005]	*E. coli* Production Analysis
Other	Agricultural BMPs and Reductions	EPA [2022]; NRCS [2024b]	BMP Reduction Analysis
Other	Developed BMPs and Reductions	EPA [2022]; International Stormwater Best Management Practices Database [2023]; NRCS [2024b]	BMP Reduction Analysis
Other	Forest BMPs and Reductions	EPA [2022]; NRCS [2024b]	BMP Reduction Analysis
Other	Feedlot BMPs and Reductions	EPA [2022]; NRCS [2024b]	BMP Reduction Analysis
Other	AML BMPs	NRCS [2024c]	BMP Discussion
Other	Atmospheric Deposition	USGS [2019]	SPARROW Estimates

3.0 EXISTING WATERSHED PLANS AND OTHER RELATED PLANS

Numerous watershed plans, master plans, and other plans exist throughout the areas contributing to the South Platte River in Larimer and Weld Counties. Plans are summarized in this chapter. Areas represented in Barr Lake & Milton Reservoir Watershed Association [2017] and Wright Water Engineers [2002] were not included in this plan.

3.1 BARR LAKE AND MILTON RESERVOIR WATERSHED

Barr Lake and Milton Reservoir are two warm-water reservoirs that get their water from the upper South Platte River and its tributaries. The watershed has a variety of land and water uses that contribute to water quality issues in the reservoirs, mainly because of nutrient loading. Nutrients like nitrogen and phosphorus are carried by rivers and canals to the reservoirs, where they are stored and used by algae and other aquatic plants.

In 2002, CDPHE listed both reservoirs on the State's 303(d) list of impaired waters because their pH levels exceeded the upper limit of 9.0. This listing had a medium priority for completing a total maximum daily load (TMDL). Barr Lake & Milton Reservoir Watershed Association [2017] provides guidelines for addressing water quality problems caused by human-induced eutrophication (the aging of lakes/reservoirs because of excessive nutrient addition). The plan also outlines steps for creating an information and education program to increase stakeholder involvement and educate the public on effectively solving water quality issues.

The 2008 version of the plan is the first full iteration. Some parts of the plan are well-developed based on current understanding of watershed issues, and other parts still need to be produced.

The *Barr Lake and Milton Reservoir Watershed Plan* was first written in 2008 [Barr Lake & Milton Reservoir Watershed Association [2008] and was updated in 2017. This update covers all the accomplishments and work done from 2008 to June 2017. It is a comprehensive document that tackles the initial water quality issues, partnerships formed to address them, solutions and goals that emerged, progress made, public involvement, and future steps.

As part of the update, TMDLs and a *BMW Adaptive Implementation Plan for pH TMDL* [Barr Lake & Milton Reservoir Watershed Association, 2013] were developed. A limnocorral study was completed, and phosphorus removal was evaluated. TMDLs were created to address pH and dissolved oxygen issues in the reservoirs. Load and wasteload allocations for total phosphorus were assigned to tackle these problems, and in-lake water quality goals for total phosphorus and chlorophyll a were set. The TMDL implementation plan outlines the steps needed to meet these water quality goals. Additionally, total phosphorus removal evaluation, biomanipulation (removal of carp), and public education have been carried out in recent years [Barr Lake & Milton Reservoir Watershed Association, 2013].

The document lays out a detailed plan to enhance water quality in a specific watershed area. It pinpoints the necessary pollutant reductions and recommends BMPs to achieve these goals. The plan follows the EPA's nine element watershed-based management plan template, which serves as a guide to create a final, approvable watershed plan. Since the project began, water quality in Barr Lake and Milton

Reservoir has improved, which is evident from the decreases in summer season chlorophyll a concentrations, fewer hypereutrophic Trophic Status Index (TSI) scores, and better water clarity. Barr Lake shows significant decreases in chlorophyll a and total phosphorus, though clarity remains unchanged and TSI scores vary. Milton Reservoir shows improvements in all parameters, with decreasing total phosphorus, better clarity, and more TSI scores in the eutrophic range [Barr Lake & Milton Reservoir Watershed Association, 2017].

3.2 BIG DRY CREEK WATERSHED

The mission of the Big Dry Creek Watershed Association is to develop a solid scientific understanding of water quality, flow, aquatic life, and habitat conditions in the Big Dry Creek Watershed. This knowledge aims to support environmentally responsible decision-making regarding land and stream uses and identify measures to improve and protect stream conditions. The goals of the Watershed Association fall into three main categories: public education and involvement; monitoring and study; and protecting, preserving, and restoring water quality, aquatic life, and habitat. The watershed association is currently in the process of updating the original plan, completed in 2002 [Wright Water Engineers, 2002].

3.3 BIG THOMPSON RIVER ENVISIONING PROJECT PLAN

The *Big Thompson River Envisioning Project Plan*, completed in 2022, is a stream management planning initiative focused on the future of the watershed and the Big Thompson River system through Loveland. The project's goal was to create a shared vision for enhancing the Big Thompson River by identifying strategies and action plans that respect property and water rights, address water user needs, and improve environmental conditions and recreational opportunities. An advisory committee consisting of stakeholders, water users, and community members was involved in the project. The committee evaluated the Big Thompson River from the canyon mouth to Interstate-25, covering a 15-mile stretch [Otak, 2022].

3.4 BIG THOMPSON RIVER RESTORATION MASTER PLAN

The *Big Thompson River Restoration Master Plan* [Ayres Associates, 2015], offers high-level guidance for long-term flood recovery and watershed restoration. It evaluated the Big Thompson River from just below Olympus Dam to its confluence with the South Platte River, covering approximately 80 miles, and included main tributaries like the North Fork and Glen Haven area. This plan has been instrumental in securing more than $10 million for implementation projects.

3.5 BIG THOMPSON RIVER CORRIDOR MASTER PLAN

The City of Loveland expanded the original *Big Thompson River Restoration Master Plan* [Ayres Associates, 2015] in 2017 by adding more details on the areas of expansion within the city. This project developed a long-term vision for the Big Thompson River corridor and outlined plans for phased enhancements over time. The project aims to increase the benefits provided to the community by the river, including more open space, recreational opportunities, and natural habitats. The project also focuses on adding flood protection and improving resiliency [BTWC, 2017].

3.6 BIG THOMPSON WILDFIRE READY ACTION PLAN

The Wildfire Ready Watersheds Program offers guidance to help predict where and what post-fire impacts will affect local communities. The program provides detailed work plans, which can be customized with local priorities and values as needed. The program also offers advice on actions to reduce the impact of post-fire hazards on infrastructure and natural resources, both before and after a wildfire occurs. Currently, a Big Thompson Wildfire Ready Action Plan is being prepared and will be completed by 2025. This plan will be available on the Peaks to People Water Fund's website.

3.7 BOULDER CREEK RESTORATION MASTER PLAN

The *Boulder Creek Restoration Master Plan* aims to guide efforts to enhance resiliency along Boulder Creek, stretching from Four Mile Creek to St. Vrain Creek. The plan offers general guidance on stream restoration, addressing ecological needs and benefits, floodplain management strategies, transportation improvements at stream crossings, and planning for recreation and open space access. The plan also includes prioritization and cost estimates for these initiatives [ICON Engineering, Inc., 2015].

3.8 CACHE LA POUDRE RIVER WATERSHED-BASED PLAN

The *Cache la Poudre River Watershed-Based Plan* [CPRW, 2020] focuses on creating a framework to prioritize and implement restoration projects in two pilot sub-drainages: North Fork Lone Pine Creek (COSPCP08) in the headwaters and Sheep Draw (COSPCP13a) in the lower basin. This plan is designed to be flexible, scalable, and adaptable to other areas and concerns within the watershed as new priorities arise. The planning effort also included the development of several interactive watershed planning support tools for future planning, analysis, and implementation activities across the watershed.

Similar to the current plan, priority parameters were chosen based on impairment and stakeholder concerns, including sediment, nutrients, heavy metals, temperature, and *E. coli*. The older version of Pollutant Load Estimation Tool (PLET), Spreadsheet Tool for Estimating Pollutant Loads (STEPL), was used to quantify sources and associated loads of nutrients and sediments from cropland, pastureland, urban areas, forests, and feedlots. Additionally, GRAIP_Lite was used to evaluate sediments from roads. Because the areas represented were different, the final load and expected reductions are not comparable [CPRW, 2020].

3.9 COLORADO 10-YEAR WATER QUALITY ROADMAP

Nutrients can harm water quality and negatively impact fish and other aquatic life. The Water Quality Roadmap is a plan to keep our streams and lakes clean and healthy. It aims to reduce nutrient pollution from both direct and indirect sources. This plan will gather data and provide recommendations to support new water quality regulations. Its integrated approach ensures coordination across all aspects of the Clean Water Program, including monitoring, standards, NPS management, permits, and engineering [CDPHE, 2024a].

3.10 COLORADO WATER PLAN

The Colorado Water Plan, adopted in January 2023, aims to foster statewide collaboration in water planning, guide future decisions, and support local efforts to tackle water challenges with a balanced and solution-focused approach that builds resilience. The plan focuses on four main areas that work together to strengthen the state: Vibrant Communities, Robust Agriculture, Thriving Watersheds, and Resilient Planning. The Colorado Water Conservation Board (CWCB) developed and oversees the Colorado Water Plan framework, offering funding and technical resources to help the state's water community implement programs and projects. This initiative relies on the Colorado water community to identify and carry out basin-specific or statewide water projects that benefit the state's water users [Colorado Water Conservation Board, 2023].

3.11 HIGH PARK POST-FIRE PRIORITIZATION PLAN

After the 2012 High Park Fire in Larimer County, various agencies and groups worked on numerous projects to reduce the fire's negative impacts. However, because of differing goals and limited funding, a need for more post-fire restoration efforts might still exist. The High Park Post-Fire Prioritization Plan outlined remaining projects that were identified and prioritized them for funding and implementation [JW Associates Inc., 2017].

3.12 LEFT HAND CREEK WATERSHED MASTER PLAN

The *Left Hand Creek Watershed Master Plan* [AMEC et al., 2014] focuses on recovery efforts following the 2013 flood, aiming to restore and enhance the Left Hand Creek Watershed. The plan seeks to bolster resilience against future flooding and improve the ecological health of the area, and does the following:

- Provides detailed information on the watershed's geography, hydrology, and ecological characteristics and identifies critical areas impacted by the flood that need restoration
- Suggests various restoration methods, such as stabilizing the banks, improving habitats, and reconnecting the floodplain
- Advocates for using natural and sustainable techniques to restore the watershed
- Highlights the importance of community involvement and collaboration with local stakeholders
- Encourages public participation in restoration projects and ongoing watershed management
- Outlines a phased approach to carrying out restoration projects
- Includes detailed timelines, identifies funding sources, and specifies the responsible parties for each phase
- Outlines how to monitor the success of restoration efforts and provides guidelines for ongoing maintenance to ensure long-term effectiveness

Restoring the watershed is essential to prevent future flood damage and improve ecological health. Natural restoration methods are favored rather than engineered solutions. Community involvement is crucial for achieving sustainable watershed management. The plan concludes that a collaborative, phased approach is crucial for successful watershed restoration. Continuous monitoring and adaptive management are necessary to respond to changing conditions and ensure the longevity of restoration efforts [AMEC et al., 2014].

3.13 LOWER POUDRE WATERSHED RESILIENCE PLAN

Catastrophic flooding occurred in 2013 along Colorado's Front Range from Colorado Springs north to Fort Collins. The flooding caused extensive damage and flooding throughout Larimer and Weld Counties. In Weld County, hundreds of residents were displaced, leading the Weld County Commissioners to declare a disaster emergency. Governor Hickenlooper also declared a disaster emergency. The costly and devastating aftermath of the flood highlighted the urgent need to reduce risks along the river corridor by building a more resilient community. In the Lower Poudre River, a key part of boosting resilience involves understanding how sediment transport impacts the area. The goal of this project was to create a master plan for the river corridor and a sediment transport model following the flood. The *Lower Poudre River Flood Recovery and Resilience Plan* helps identify and prioritize future work on the lower Poudre River [Lynker Technologies, et al., 2017].

3.14 SOUTH PLATTE BASIN IMPLEMENTATION PLAN

The *South Platte Basin Implementation Plan* (BIP) [Metro Roundtable and South Platte Basin Roundtable, 2022] was created through a collaborative effort by basin stakeholders. It focuses on addressing the current and future water needs in the South Platte and Republican River Basins. The plan outlines a vision for how individuals and organizations can meet these future needs and sets goals and projects that pave the way to success. The initial South Platte BIP was completed in 2015, and this is the first update to that plan. The update includes South Platte Basin's current and future water resources. It highlights the goals, projects, and strategic vision needed to meet future water demands. The update also includes a detailed overview of the South Platte Basin's achievements, challenges, goals, and strategic vision for addressing future water needs; and legacy information, technical analyses, project data, and case studies [Metro Roundtable and South Platte Basin Roundtable, 2022].

3.15 ST. VRAIN AND LEFT HAND STREAM MANAGEMENT PLAN

The *Phase I Stream Management Plan* [St. Vrain and Left Hand Water Conservancy District, 2022] brought together stakeholders to identify projects and strategies for both St. Vrain and Left Hand Creeks. The goal was to shift the focus from flood recovery to enhancing stream health, improving environmental conditions in the river, and meeting the current and future needs of water users. The Phase I Stream Management Plan aligned with private property rights, public land and resource management plans, and the prior appropriation system. The Phase II Stream Management Plan aims to put these projects and strategies into action.

The September 2013 flood sparked a new era of collaboration and brought in hundreds of millions of dollars for stream restoration. This collaborative flood recovery effort built a stronger sense of trust and partnership among water users. Now, many are eager to shift the conversation to water management activities that can maximize the benefits of post-flood projects for environmental, recreational, agricultural, and domestic uses. The Stream Management Plan was designed to facilitate this transition. With a wide range of uses and a focused study, the Stream Management Plan balanced river health with water users' needs, identifying goals and projects to support flow management, habitat management, water quality management, and overall water management.

The St. Vrain and Left Hand Water Conservancy District is leading the Stream Management Plan effort. The District relied on various technical consultants who agreed on a two-phase approach. Phase I,

completed in 2020, aimed to better understand environmental conditions and community values. The final deliverable for Phase I recommended 10 projects, including water storage, riparian revegetation, and setting environmental flow targets.

Phase II builds on the groundwork laid in Phase I by refining the potential topics and targets, selecting appropriate strategies, initiating planning actions and pilot projects, and supporting a data-driven stream management program. The objectives for Phase II include feasibility analyses of alternatives, identifying data gaps, planning logistics for implementation, and developing adaptive management plans. Six strategies are recommended to complete the Stream Management Plan and support long-term policies, financial planning, technology, and management improvements [St. Vrain and Left Hand Water Conservancy District, 2022].

3.16 ST. VRAIN WATERSHED MASTER PLAN

The St. Vrain Creek Watershed is a key natural feature in Colorado's Northern Front Range. In September 2013, a devastating flood hit the watershed, damaging infrastructure and impacting communities along the St. Vrain Creek and its tributaries. The Watershed Master Plan was developed to address the flooding and to create a science-based, community-focused stream master plan. Supported by the CWCB, the project took a holistic approach, considering the river's morphology, the importance of habitat for the ecosystem, and the needs of communities and private landowners. This included land use, flood and debris risk, and various types of in-stream recreation.

The master plan involved assessments of geomorphology, Federal Emergency Management Agency (FEMA) risk, habitat needs, and other scientific data. This information was combined with community and public input, considering land use before and after the flood. The resulting study prioritized projects that promote a resilient and healthy stream corridor, a thriving riparian zone, a vital ecosystem, and a robust economy along the riverbanks, all centered around healthy, active outdoor living [S2O, 2024].

3.17 UPPER POUDRE WATERSHED RESILIENCE PLAN

The *Upper Poudre Watershed Resilience Plan* [JW Associates Inc., 2024] examines the conditions in the Upper Poudre Watershed and suggests ways to boost its long-term resilience. By analyzing the current state of the watershed, specific areas that need attention were located and actions were prioritized to strengthen the watershed's resilience over time.

The project area for the plan covers the watersheds above the mouth of the canyon, located west of Fort Collins. This area is part of the larger Cache la Poudre Watershed (HUC 10190007), which eventually drains into the South Platte River. The Upper Poudre Watershed includes 37 smaller watersheds, spanning a total of 688,678 acres. The stakeholder group also requested including a few additional watersheds outside the Upper Poudre Watershed, whose runoff is diverted into its waters [JW Associates Inc., 2024].

4.0 REGIONAL SUMMARY OF NONPOINT SOURCE POLLUTION ISSUES AND CONCERNS

Essential to developing this Regional NPS Watershed 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 Section 4.8, Regional Stakeholder/Public Outreach and Education.

- 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 the stakeholders' concerns, issues, resources, and 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 4-1 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.

Table 4-1. Stakeholder Survey Distribution (Page 1 of 3)

Organization	Took Survey #1 (2022)	Took Survey #2 (2024)
BTWC		
Boxelder Sanitation District	X	
Brink Corp		
Carestream		
CDPHE		
City & County of Broomfield	X	
City of Evans	X	X
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
CPRW		
CAWA		
Colorado Livestock Association		
Colorado Parks & Wildlife		
Colorado Rural Water Association	X	
CSU	X	
Colorado Watershed Assembly		X
Colorado Wheat Administrative Committee		X
Davies Mobile Home Park		X
Drala Mountain Center	X	
Ducks Unlimited		
Estes Park Sanitation District	X	
Estes Valley Watershed Coalition	X	X
Fox Acres Community Services	X	
FPAC-NRCS, CO		
Fresh Water Trust	X	

Table 4-1. Stakeholder Survey Distribution (Page 2 of 3)

Organization	Took Survey #1 (2022)	Took Survey #2 (2024)
Galeton Water & Sanitation District	X	
JBS Greeley Beef Plant		X
Larimer County		X
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		
Resource Colorado Water & Sanitation Metro District		
RNC Consulting LLC		X
South Fort Collins Sanitation District	X	X
South Platte Basin Roundtable		
St. Vrain Creek & Boulder Creek Watershed		
St. Vrain Sanitation District	X	
Thompson School District		X
Town of Ault	X	
Town of Berthoud	X	X
Town of Brighton		
Town of Eaton		
Town of Erie	X	
Town of Estes Park		
Town of Firestone		
Town of Frederick		
Town of Hudson	X	
Town of Johnston	X	
Town of Keenesburg		
Town of LaSalle		

Table 4-1. Stakeholder Survey Distribution (Page 3 of 3)

Organization	Took Survey #1 (2022)	Took Survey #2 (2024)
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		
Weld County Department of Public Health and Environment	X	
Weld County	X	
Wright Water Engineers/Cherry Creek Basin Water Quality Authority		X
Xcel Energy		X

4.1 POLLUTANTS OF CONCERN

Pollutants of concern were identified using the stakeholder surveys along with the 2024 303(d) list [CDPHE, 2024b] of impairments. Pollutants of concern are listed in Table 4-2. Per- and polyfluoroalkyl substances (PFAS) and emerging contaminants are stakeholder concerns but are not included in this document. 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. 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, 2024].

Table 4-2. Pollutants of Concern and Source

Parameter Type	Parameter	Stakeholder Concern	Big and Little Thompson River 303(d) List	Cache la Poudre River 303(d) List	St. Vrain Creek 303(d) List	Middle South Platte River 303(d) List
Nutrient/Sediment-Related	Ammonia (TMDL)	Y			Y	
Nutrient/Sediment-Related	Nitrate	Y	Y			Y
Nutrient/Sediment-Related	Nitrogen (T)	Y				
Nutrient/Sediment-Related	Phosphorus (T)	Y				
Nutrient/Sediment-Related	Dissolved Oxygen		Y			
Nutrient/Sediment-Related	Sediment (TMDL)	Y		Y		
Other	*E. coli*	Y	Y	Y	Y	Y
Other	Macroinvertebrates		Y	Y	Y	
Other	pH		Y		Y	Y
Other	Temperature	Y	Y	Y	Y	
Other	Sulfate					Y
Heavy Metals	Arsenic (T)	Y	Y	Y	Y	Y
Heavy Metals	Cadmium (D)	Y				Y
Heavy Metals	Copper (D)	Y	Y			
Heavy Metals	Fish Mercury	Y	Y			
Heavy Metals	Iron (T)	Y	Y	Y		
Heavy Metals	Manganese (D)	Y	Y	Y	Y	
Heavy Metals	Mercury (T)	Y	Y			
Heavy Metals	Selenium (D)	Y	Y	Y	Y	
Heavy Metals	Silver (D)	Y		Y		
Heavy Metals	Uranium (T)	Y				Y
Heavy Metals	Zinc (D)	Y	Y		Y	

D = dissolved

T = total

4.2 SOURCES ASSESSMENT

Only NPS pollutants are addressed for this project. Point sources and areas with MS4s are addressed in the *208 Areawide Water Quality Management Plan – 208 AWQMP Update (Region 2)* [NFRWQPA, 2022]. Outside of MS4 permitted areas, NPSs of nutrients are generally related to runoff from cropland, pastureland, developed land, and other lands. 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. In general, areas with higher agricultural (cropland, pastures, and feedlots) and developed land have higher loads. The land use throughout the project is shown in Figure 4-1, and primary land uses in each project area are included in Table 4-3.

Each Watershed Implementation Plan summarizes sources of pollutants of concern. For nutrients and sediment, EPA's PLET was used to estimate source loads by HUC10. For *E. coli*, a GIS assessment was used to estimate source loads by HUC10. Finally, for heavy metals, literature was used to link the most likely sources to each pollutant. These include runoff from Pierre Shale from flood irrigation, abandoned mine lands (AMLs), use of herbicides, and manufacturing.

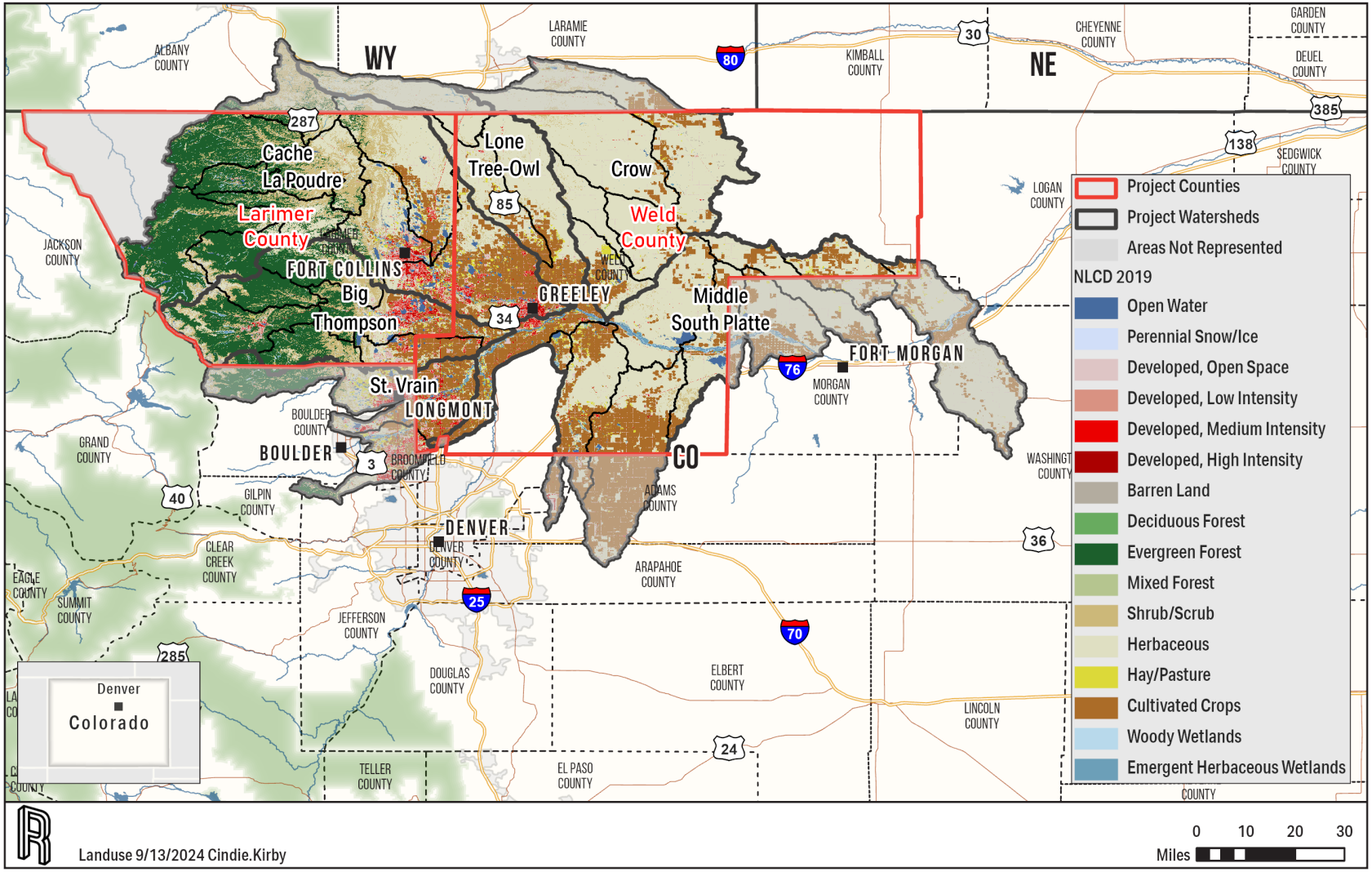

Figure 4-1. Land Use.

Table 4-3. Land Use for Each Project Area

Project	Urban Non-MS4 (mi^2)	Cropland (mi^2)	Pastureland (mi^2)	Forest (mi^2)	Feedlots (mi^2)	Other (mi^2)
Big and Little Thompson River	44	90	9	499	<1	108
Cache la Poudre River	59	195	24	886	<1	452
Middle South Platte River	64	554	45	38	<1	1,649
St. Vrain Creek	24	76	5	14	<1	18

4.2.1 NUTRIENTS AND SEDIMENT

Sources of nutrients and sediment are summarized in more detail (at the HUC10 level) in the Watershed Implementation Plans included in Appendices A through D. In general, an increased presence of agricultural and developed lands leads to higher nutrient and sediment loads per acre. NPSs of sediment consist of sediment contributions through wash off, as well as bed and bank erosion during high flows. Similarly, NPSs of nutrients are generally from wash off. To show the impacts on a regional scale, loads were summarized per acre by each project area. By project area, the St. Vrain Creek Watershed had the highest per acre loads of nitrogen, phosphorus, and sediment. This is likely because as a whole, cropland is the dominant land use. Big and Little Thompson River Watershed is second for per-acre nitrogen loads but third for phosphorus and sediment loads, and Middle South Platte River Watershed is second for phosphorus and sediment loads and third for nitrogen. The Cache la Poudre River Watershed has the lowest overall per-acre loads of nitrogen, phosphorus, and sediment. Nutrient and sediment loads per acre by project area are shown in Table 4-4.

Table 4-4. Nutrient and Sediment Rank by Project Area Loads per Acre From PLET

Major Watershed	Area (mi^2)	% Agricultural	% Non-MS4 Developed	Nitrogen (lb/acre)	Phosphorus (lb/acre)	Sediment (lb/acre)	Nitrogen Source Rank	Phosphorus Source Rank	Sediment Source Rank
Big and Little Thompson River	750	13	6	0.44	0.11	0.02	2	3	3
Cache la Poudre River	1,615	14	4	0.33	0.09	0.02	4	4	4
Middle South Platte River	2,350	26	3	0.38	0.15	0.12	3	2	2
St. Vrain Creek	137	59	17	2.24	0.69	0.42	1	1	1

lb/acre = pounds per acre

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. Wildfires in each project area are shown in Table 4-5. No significant fires occurred in the St. Vrain Creek project area during the years reported in Table 4-5.

The U.S. Geological Survey (USGS) has SPAtially Referenced Regression on Watershed Attributes (SPARROW) models that were developed by HUC8 for phosphorus, sediment, and nitrogen. Results are

shown in Table 4-6 and, in general, show that phosphorus is primarily from natural sources and cropland, nitrogen is primarily from wastewater and natural sources, and sediment is generally from cropland and channels. Although SPARROW models are older, they do include wastewater so they provide a useful comparison of point versus NPS loads. More information about SPARROW models is available on the USGS SPARROW modeling webpage.

Table 4-5. Wildfires Acres by Project Area

Year	Big and Little Thompson River	Cache la Poudre River	Middle South Platte River
2000	16.9	0.1	0.0
2001	0.0	0.0	2.1
2002	7.1	1.1	0.0
2003	0.1	0.0	0.0
2004	0.2	14.2	0.0
2005	0.1	0.1	0.0
2006	0.4	0.0	0.0
2008	1.0	0.0	0.0
2009	0.1	0.1	1.1
2010	3.8	0.0	1.1
2011	4.6	0.0	1.6
2012	24.6	88.4	0.7
2013	0.0	0.0	0.1
2014	0.0	0.0	0.0
2015	0.0	0.0	1.6
2016	0.6	0.5	2.8
2017	0.0	0.0	1.6
2018	0.0	0.4	0.2
2019	0.0	0.2	1.7
2020	109.6	215.3	0.8
2021	0.2	0.1	0.1
Total	169.4	320.4	15.4

Table 4-6. SPARROW Sources of Nutrients and Sediment [USGS, 2012]

Parameter	SPARROW Sources	St. Vrain Creek	Big and Little Thompson River	Cache la Poudre River	Middle South Platte River
Phosphorus	Wastewater	9%	14%	5%	17%
Phosphorus	Urban	12%	7%	7%	12%
Phosphorus	Cropland	18%	18%	25%	40%
Phosphorus	Natural	61%	61%	63%	31%
Nitrogen	Wastewater	63%	41%	54%	76%
Nitrogen	Urban	2%	2%	1%	1%
Nitrogen	Crops	7%	14%	12%	12%
Nitrogen	Atmospheric Deposition	28%	44%	33%	11%
Sediment	Urban	12%	7%	12%	15%
Sediment	Cropland	18%	25%	24%	45%
Sediment	Natural	5%	3%	4%	17%
Sediment	Other Geology	4%	10%	11%	0%
Sediment	Channel	62%	56%	49%	23%

4.2.2 E. COLI

Production of *E. coli* is summarized in more detail (at the HUC10 level) in the Watershed Implementation Plans included in Appendices A through D. Agricultural lands include crops, pastures, and feedlots. Flood irrigation on agricultural lands can increase nutrient loads. Nutrients and sediment also can increase significantly in areas where wildfires occur because of diminished root systems to hold soils in place.

In general, *E. coli* is higher when *E. coli* production is higher. Some other factors impact how much of the produced *E. coli* gets to a waterway. Some of these factors include ground cover, stream buffers, and water retention. Flood irrigation gives an additional mechanism to move *E. coli* to waterways, especially when manure is used as the primary nutrient on a field. To show contributions by a regional scale, loads were summarized per acre by each project area. By project area, the Middle South Platte River has the highest *E. coli* production per acre, followed by St. Vrain Creek, then Cache la Poudre River, then Big and Little Thompson River. *E. coli* loads/acre by project area are shown in Table 4-7.

Table 4-7. *E. coli* Rank by Project Area Loads per Acre

Major Watershed	Area (mi^2)	% Agricultural	% Non-MS4 Developed	*E. coli* (billion organisms/acre)	*E. coli* Source Rank
Big and Little Thompson River	750	13	6	1.7	4
Cache la Poudre River	1,615	14	4	2.2	3
Middle South Platte River	2,350	26	3	4.8	1
St. Vrain Creek	137	59	17	3.7	2

4.2.3 HEAVY METALS

Primary sources of heavy metals include AMLs, industrial practices, and flood irrigation on soils where metals are naturally occurring. On AMLs, precipitation exposure to rocks containing sulfide minerals becomes acidic, and acidic waters are more capable of carrying heavy metals. Table 4-8 shows the density of AMLs in each project area within Larimer and Weld Counties (outside of MS4s), and Table 4-9 shows the acres of flood and sprinkler irrigation within Larimer and Weld Counties (outside of MS4s). Both of these items contribute to NPSs of heavy metals.

Table 4-8. Abandoned Mine Land Density by Project Area

Major Watershed	AML Density (#/mi^2)	AML Density Rank
Big and Little Thompson River	0.02	3
Cache la Poudre River	0.07	2
Middle South Platte River	0.002	4
St. Vrain Creek	18.5	1

Table 4-9. Flood Irrigation Acres by HUC8

Major Watershed	Area (mi^2)	Flood Irrigation (mi^2)	% Area With Flood Irrigation	Sprinkler Irrigation (mi^2)	% Area With Sprinkler Irrigation
Big and Little Thompson River	750	41.1	5.5	26.2	3.5
Cache la Poudre River	1,615	74.0	4.6	75.1	4.7
Middle South Platte River	2,350	73.4	3.1	165.6	7.0
St. Vrain Creek	137	31.2	22.8	11.7	8.5

4.3 REGIONAL WATER QUALITY GOALS

The primary goal for water quality throughout the project area is to meet the standards set forth by the CDPHE. Standards are set based on beneficial uses of each waterbody. For 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). Another water quality goal is to avoid degradation beyond the current status. BMPs outlined in this Regional NPS Watershed Plan will help make progress toward meeting these water quality goals.

4.4 REGIONAL ACTION STRATEGIES

This section outlines the best action strategies for different land use types on a regional basis. Overall, the westerly watersheds transitioned from forested areas in the west to agricultural and developed areas in the east, and the Middle South Platte has more agricultural and other land.

4.4.1 FAST GROWTH/FUTURE MS4 AREAS

Two towns were designated as expected new MS4 areas for this project: Johnstown (7.5 mi^2) and the Firestone/Frederick Area (10.1 mi^2). Johnstown is mainly in the Big and Little Thompson River project area with a small sliver in the Middle South Platte River project area, and Firestone/Frederick is mainly in the St. Vrain Creek project area with a small area in the Middle South Platte River project area. To determine which areas were the most likely to be MS4 permitted, the current population and growth rate were examined. In 2020, Johnstown had a population of 14,329 with a growth rate of 3.9 percent per year, Firestone had a population of 16,372 with a growth rate of 4.2 percent per year, and Frederick had a population of 14,530 with a growth rate of 6.7 per year [U.S. Census Bureau, 2020]. In general, to be MS4 permitted in Colorado, a city needs to be classified as an urban area with a population of 50,000 or more (exceptions do exist) [EPA, 2023].

Existing MS4s are not discussed in the Watershed Implementation Plans; however, the areas expected to become MS4s should be proactive by using development practices that will minimally impact water quality to ease the burden when they reach the MS4 requirements. If the areas expected to become MS4s plan accordingly and more implementation is completed up front, less effort will be needed to retrofit BMPs after the area becomes a designated MS4. 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 and 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

4.4.2 DEVELOPED

Although all developed areas are not expected to become permitted MS4 areas, implementing LID and MIDS as development occurs anywhere is a good practice. This will minimize water quality impacts as these areas expand. MS4 areas are not represented in the project models. BMPs recommended for MS4 and non-MS4 developed areas are like those outlined for the fast growth/future MS4 areas. 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.

4.4.3 AGRICULTURAL (CROPLAND, PASTURELAND, FEEDLOTS)

For nutrients and sediment, 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 Natural Resources Conservation Service (NRCS) Conservation Practice Physical Effects (CPPE) for reducing *E. coli*. For *E. coli*, these include vegetated treatment areas, constructed wetlands, filter strips, nutrient management, and waste treatment lagoons. For heavy metals, these include secondary containment facilities, constructed wetlands, irrigation and drainage tailwater recovery, and land reclamation. 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.

4.4.4 FORESTED AREAS

Forested areas typically have a low negative impact on water quality because of the natural cover; however, wildfires and anthropogenic activities such as mining, grazing, and recreation can increase the chance of negative impacts on water quality. Though 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 should include those listed in the NRCS CPPE that exclude forest-grazing livestock from accessing streams and septic assessments. Forest practices should also focus on pre- and post-fire activities. One watershed in the project area—the Big and Little Thompson River—is in the process of developing the Big Thompson Wildfire Ready Action Plan, which will be completed in 2025 and will be available on the Peaks to People Water Fund's website. Practices from this plan can be implemented in other watersheds in at-risk areas for wildfire.

Additionally, AMLs tend to be more heavily located in forest lands. Most AMLs in the watershed have not yet been identified because 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 the environment. To improve water quality, identifying AMLs should become a higher priority. AML BMPs are not prioritized because of the variable nature of AML lands; however, each site should be assessed and practices that target specific issues related to each site should be chosen. For heavy metals, priority practices should focus on AMLs. AML practices should include those listed in the NRCS Conservation Practice Standard [NRCS, 2024c] including erosion and sediment control practices, site preparation, storage of soil materials, highwall treatment, shafts and adits, placement of surface material, restoration of borrow material, establishment of vegetation, control of toxic aqueous discharge, and working with contaminated soil materials.

4.4.5 REMAINING AREAS

Some lands in the project area were classified as "Other." In general, the other lands include those land types that generally are natural in nature and have a smaller relative impact on water quality. These include wetlands and grasslands. This plan does not list practices for these remaining "Other" areas.

4.5 REGIONAL LOAD REDUCTION ESTIMATES BASED ON ACTION STRATEGIES

In general, land managers are more likely to implement practices that have been proven to work in the area and those that give them the highest chance of impact. In the state of Colorado, BMPs on pastureland have been the most implemented, with prescribed grazing, upland wildlife habitat management, watering facilities, livestock pipeline, fence, and access control leading the way. According to the United States Department of Agriculture (USDA), the most implemented cropland BMPs in Colorado are conservation crop rotation, pest management conservation systems, conservation cover, and nutrient management [USDA, 2024].

According to Survey #2, practices that have been implemented on cropland and pasture include filter strips, vegetation planting, vegetated buffer strips, streambank stabilization, wetland protection, wetland construction, fencing/livestock exclusion, conservation tillage, no-till practices, and crop rotation. Similarly, Survey #2 identified that in developed areas, regional stormwater detention and water quality facilities, extended detention basins, bioretention practices, hydrodynamic separators, inlet filters, sand filters, grass swales, constructed wetlands, rain gardens, manufactured treatment devices, bioswales, bank stabilization, riparian vegetation restoration, native plant installation, pollution prevention programs, spill response, and public education.

The stakeholder survey combined with expected reductions from PLET were combined to determine what the priority BMPs should be. The PLET model was used to estimate load reductions from priority BMPs for sediment and nutrients. The scenarios were run individually for each HUC10 by land use on 25 percent of each specific land use. Table 4-10 shows the overall reductions by project area to give a more regional view. Cropland BMPs had the highest overall reductions for each project area. HUC10 results are included in the Watershed Implementation Plans in Appendices A through D.

Table 4-10. PLET Best Management Practice Reductions by Land Use, Practice, and Project Area for Nitrogen, Phosphorus, and Suspended Sediment (Page 1 of 2)

Land Use	Practice	Project Area	% Nitrogen Reduction	% Phosphorus Reduction	% Sediment Reduction
Cropland	Streambank Stabilization and Fencing	Big and Little Thompson River	9.5	9.1	14.6
Cropland	Streambank Stabilization and Fencing	Cache la Poudre River	8.3	7.7	14.4
Cropland	Streambank Stabilization and Fencing	St. Vrain Creek	14.9	16.2	17.9
Cropland	Streambank Stabilization and Fencing	Middle South Platte River	17.6	17.6	17.7
Cropland	35-ft Buffers	Big and Little Thompson River	4.9	5.7	10.4
Cropland	35-ft Buffers	Cache la Poudre River	4.4	4.9	10.2
Cropland	35-ft Buffers	St. Vrain Creek	9.5	11.2	12.6
Cropland	35-ft Buffers	Middle South Platte River	12.4	12.4	12.5
Pasture	Streambank Stabilization and Fencing	Big and Little Thompson River	0.6	0.2	0.3
Pasture	Streambank Stabilization and Fencing	Cache la Poudre River	0.8	0.3	0.4
Pasture	Streambank Stabilization and Fencing	St. Vrain Creek	0.5	0.4	0.4
Pasture	Streambank Stabilization and Fencing	Middle South Platte River	0.3	0.3	0.3
Pasture	35-ft Buffers	Big and Little Thompson River	3.6	2.0	2.5
Pasture	35-ft Buffers	Cache la Poudre River	0.9	0.3	0.3
Pasture	35-ft Buffers	St. Vrain Creek	0.5	0.4	0.4
Pasture	35-ft Buffers	Middle South Platte River	0.2	0.2	0.2
Pasture	Livestock Exclusion	Big and Little Thompson River	0.2	0.2	0.2
Pasture	Livestock Exclusion	Cache la Poudre River	0.2	0.2	0.3
Pasture	Livestock Exclusion	St. Vrain Creek	0.3	0.3	0.4
Pasture	Livestock Exclusion	Middle South Platte River	0.2	0.2	0.2
Feedlot	Waste Management System	Big and Little Thompson River	1.4	1.3	0.0
Feedlot	Waste Management System	Cache la Poudre River	3.1	2.6	0.0
Feedlot	Waste Management System	St. Vrain Creek	0.7	0.5	0.0
Feedlot	Waste Management System	Middle South Platte River	0.0	0.0	0.0

Table 4-10. PLET Best Management Practice Reductions by Land Use, Practice, and Project Area for Nitrogen, Phosphorus, and Suspended Sediment (Page 2 of 2)

Land Use	Practice	Project Area	% Nitrogen Reduction	% Phosphorus Reduction	% Sediment Reduction
Forest	Site Preparation/Straw/Crimp/Net	Big and Little Thompson River	0.2	0.3	1.2
Forest	Site Preparation/Straw/Crimp/Net	Cache la Poudre River	0.2	0.3	1.2
Forest	Site Preparation/Straw/Crimp/Net	St. Vrain Creek	0.1	0.1	0.1
Forest	Site Preparation/Straw/Crimp/Net	Middle South Platte River	0.0	0.0	0.0
Forest	Site Preparation/Straw/Crimp Seed/ Fertilizer/Transplant	Big and Little Thompson River	0.2	0.3	1.2
Forest	Site Preparation/Straw/Crimp Seed/ Fertilizer/Transplant	Cache la Poudre River	0.2	0.3	1.2
Forest	Site Preparation/Straw/Crimp Seed/ Fertilizer/Transplant	St. Vrain Creek	0.1	0.1	0.1
Forest	Site Preparation/Straw/Crimp Seed/ Fertilizer/Transplant	Middle South Platte River	0.0	0.0	0.0
Urban	Extended Wet Detention	Big and Little Thompson River	1.7	1.3	2.1
Urban	Extended Wet Detention	Cache la Poudre River	1.2	0.8	1.4
Urban	Extended Wet Detention	St. Vrain Creek	0.6	0.3	0.2
Urban	Extended Wet Detention	Middle South Platte	0.0	0.0	0.0
Urban	Infiltration Basin	Big and Little Thompson River	1.9	1.2	1.9
Urban	Infiltration Basin	Cache la Poudre River	1.3	0.8	1.2
Urban	Infiltration Basin	St. Vrain Creek	0.6	0.3	0.2
Urban	Infiltration Basin	Middle South Platte River	0.0	0.0	0.0
Urban	Concrete Grid Pavement	Big and Little Thompson River	2.8	1.7	2.2
Urban	Concrete Grid Pavement	Cache la Poudre River	1.3	0.8	1.2
Urban	Concrete Grid Pavement	St. Vrain Creek	0.9	0.4	0.2
Urban	Concrete Grid Pavement	Middle South Platte River	0.0	0.0	0.0

4.6 REGIONAL MANAGEMENT MEASURES

Each Watershed Implementation Plan includes a final list of the most effective practices for the applicable land uses. Table 4-11 lists the priority practices for sediment and nutrients, *E. coli*, and heavy metals in each HUC8 area. These priority practices were based on the top two dominant land uses, sediment sources, nitrogen sources, and phosphorus sources by HUC10 and, therefore, most show up as priorities for all project areas because of the variation within each HUC8. More information about these priority practices is available in the Watershed Implementation Plans in Appendices A through D.

Table 4-11. Priority Management Measures for Project Areas

Parameter Group	Land Use	Practice	Big and Little Thompson River	Cache la Poudre River	St. Vrain Creek	Middle South Platte River
Sediment and Nutrients	Forest	Site Preparation/ Straw/Crimp Seed/Net	Y	Y	Y	Y
Sediment and Nutrients	Forest	Site Preparation/ Straw/Crimp Seed/ Fertilizer/Transplants	Y	Y	Y	Y
Sediment and Nutrients	Urban	Extended Wet Detention	Y	Y	Y	Y
Sediment and Nutrients	Urban	Infiltration Basin	Y	Y	Y	Y
Sediment and Nutrients	Agricultural	Streambank Stabilization and Fencing	Y	Y	Y	Y
Sediment and Nutrients	Agricultural	Buffer-Grass (35 feet wide)	Y	Y	Y	Y
Sediment and Nutrients	Agricultural	Waste Management System		Y		
E. coli	Urban	Septic Upgrades	Y	Y	Y	Y
E. coli	Urban	Wastewater Treatment Facility Connections	Y	Y	Y	Y
E. coli	Urban	Wetland Basin	Y	Y	Y	Y
E. coli	Urban	Retention Pond	Y	Y	Y	Y
E. coli	Agricultural	Vegetated Treatment Area	Y	Y	Y	Y
E. coli	Agricultural	Constructed Wetlands	Y	Y	Y	Y
Heavy Metals	Urban	Discontinue Use	Y	Y		Y
Heavy Metals	Agricultural	Irrigation Water Management	Y	Y	Y	Y
Heavy Metals	Abandoned Mine Lands	Abandoned Mine Land BMPs	Y	Y	Y	Y

4.7 REGIONAL FINANCIAL/TECHNICAL PLAN IMPLEMENTATION STRATEGY

The Watershed Implementation Plans list opportunities that can be used to plan and fund water quality improvement projects. Numerous private companies and organizations as well as local, state, and federal agencies provide technical assistance to address NPS pollution. Some of these organizations and agencies also provide financial assistance. Tables 4-12 through 4-14 list the local, state, federal, and private 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 Colorado NPS Program and its annual grants, the South Platte Basin Roundtable 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.

4.7.1 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. The following programs are relatively easy for users to take advantage of, and the money for them is generally allocated annually.

4.7.1.1 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.

4.7.1.2 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.

4.7.1.3 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.

4.7.1.4 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.

4.7.2 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.

4.7.2.1 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.

4.7.2.2 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 NFRWQPA 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 Chatfield State Park to assist with protecting water quality.

4.7.2.3 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 Colorado Department of Natural Resources' (DNR) 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 Roundtable. CDPHE has a state revolving fund that includes a Water Pollution Control revolving fund that completes many Onsite Wastewater Treatment System (OWTS) to sewer projects.

Under the Colorado DNR, 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 DNR 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.

4.7.2.4 FEDERAL

Federal agencies can provide funding and technical assistance for projects and monitoring. These agencies include the U.S. Fish and Wildlife Service (USFWS), USGS, NRCS, Farm Service Agency, EPA, and others. The USGS is more likely to provide support for data acquisition and monitoring programs, and the USFWS 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.

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

Additional EPA 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. The funds are generally for municipal wastewater facility construction, control of NPS pollution, decentralized wastewater treatment systems, green infrastructure projects, project estuaries, and other water quality projects.

4.7.2.4.2 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.

4.7.2.5 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 Northern Colorado Water Conservancy District mentioned that it has an extensive, long-term water quality monitoring program in the Big and Little Thompson River HUC8. Los Rios Farm, a local farm in the watershed, stated a need for financial assistance for projects if landowners were willing and has been successful in receiving funding from FEMA, NRCS, and CWCB. Technical resources that would be helpful include education on project benefits and how resulting projects impact the adjacent communities. Los Rios Farm has received technical assistance from the CSU Watershed Group and is aware of technical assistance available from the NRCS but has not used it. The 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 its 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 4-12. Local Sources of Technical and Financial Assistance (Page 1 of 2)

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
City of Broomfield	www.broomfield.org	Financial, Technical	X					X	X
City of Boulder	bouldercolorado.gov	Financial, Technical	X					X	X
City of Fort Collins	www.fcgov.com	Financial, Technical	X					X	X
City of Lafayette	www.lafayetteco.gov	Financial, Technical	X					X	X
City of Longmont	www.longmontcolorado.gov	Financial, Technical	X					X	X
City of Louisville	www.louisvilleco.gov	Financial, Technical	X					X	X
City of Loveland	www.lovgov.org	Financial, Technical	X					X	X
City of Johnstown	www.johnstown.colorado.gov	Financial, Technical	X					X	X
Town of Erie	erieco.gov	Financial, Technical	X					X	X
Town of Estes Park	estespark.colorado.gov	Financial, Technical	X					X	X
Town of Firestone	www.firestoneco.gov	Financial, Technical	X					X	X
Town of Frederick	frederickco.gov	Financial, Technical	X					X	X
Town of Superior	www.superiorcolorado.gov	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
BTWC	bigthompson.co	Technical	X	X	X	X	X	X	X
CPRW	www.poudrewatershed.org	Technical	X	X	X	X	X	X	X

Table 4-12. Local Sources of Technical and Financial Assistance (Page 2 of 2)

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
Keep it Clean Partnership	www.keepitcleanpartnership.org	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
Longmont and Boulder Valley Conservation District	https://bouldervalley-longmontcd.colorado.gov/	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
Poudre Heritage Alliance	poudreheritage.org	Technical	X	X	X	X	X	X	X
South Platte Basin Roundtable	www.southplattebasin.com	Technical	X	X	X	X	X	X	X
West Greeley Conservation District	www.wgcd.org	Financial, Technical		X	X	X	X	X	X
Southeast Weld Conservation District	seweldcd-co.org	Financial, Technical		X	X	X	X	X	X

Table 4-13. State Sources of Technical and Financial Assistance

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
CSU Extension	extension.colostate.edu	Technical	X	X	X	X	X	X	X
CSU	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
CDPHE	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 DNR	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 4-14. Federal and Private Sources of Technical and Financial Assistance

Agency or Organization	Website	Assistance	BMP Category						
			Developed Non-MS4	Cropland	Pasture	Feedlot	Forest	Stream	Outreach
FEDERAL									
U.S. 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 of Land Management	www.blm.gov	Financial, Technical					X	X	X
U.S. Department of Interior–Bureau of Reclamation	www.usbr.gov	Financial, Technical	X	X			X	X	X
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
USFWS	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

4.8 REGIONAL STAKEHOLDER/PUBLIC OUTREACH AND EDUCATION

Current communication, education, and outreach efforts established in regional project area 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 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 to Survey #2 were used to rank a list of information, education, and outreach options. 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 Metro Water Recovery, Northern Colorado Water Conservancy District, City of Greeley, City of Fort Collins, City of Evans, Los Rios Farm, Colorado Watershed Assembly, Colorado Wheat Administrative Committee, and Estes Valley Watershed Coalition. 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.

4.9 IMPLEMENTATION SCHEDULES, INTERIM MILESTONES, AND PROGRAM EFFECTIVENESS EVALUATION

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. Each Watershed Implementation Plan shows practices that could be implemented to make progress and count as measurable milestones. Because goals for these plans are very broad (the plan is not being written as a part of a specific 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. 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. Each specific plan (included in Appendices A through D) has detailed tables of recommended practices.

4.10 REGIONAL MONITORING PLAN AND REQUIREMENTS

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 on EPA's Nonpoint Source Monitoring: TechNOTES webpage. Existing water quality monitoring occurring for the NFRWQPA's 208 Areawide Water Quality Management Plan is available on its 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 mainstem waterbodies 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 Northern Colorado Water Conservancy District, City of Evans, and City of Longmont would be interested in quarterly sampling as well as the installation, maintenance, and operation of a monitoring station. The Town of Frederick, City of Greeley, and Colorado Wheat

Administrative Committee would be interested in quarterly sampling to be analyzed by a local laboratory. The City of Fort Collins and Colorado Watershed Assembly would be interested in the installation, maintenance, and operation of a monitoring station.

5.0 REGIONAL APPLICATION OF WATER QUALITY TOOLS FROM EXISTING WATERSHED PLANS

The primary water quality tool that was used for this project is the EPA's PLET. 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 [EPA, 2022]. PLET is a newer version of the EPA's STEPL, which was used for the *Cache la Poudre Watershed-Based Plan* [CPRW, 2020].

PLET offers an easy-to-use web interface for creating customized watershed models. It calculates watershed surface runoff, nutrient loads, and sediment delivery based on different land uses and management practices. PLET can be used to evaluate loading and load reductions at various scales. The size and characteristics of each area being evaluated are defined based on the total acreage of each land use entered into PLET. For each watershed, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water, influenced by factors like land use distribution and management practices.

The annual sediment load is calculated using the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The reductions in sediment and pollutant loads resulting from the implementation of BMPs are computed using known BMP efficiencies. PLET features an integrated combined BMP calculator that determines the overall BMP efficiency of multiple BMP combinations, which can then be applied in the model. This calculator can represent BMPs both in series and parallel, and it also allows users to save their BMP configurations.

6.0 CONCLUSIONS

As stated in Chapter 1.0, one focus of this plan was to identify areas that would likely become MS4 permitted within the next 5 to 15 years and provide them with methods to prepare for being permitted. Communities identified were the Town of Johnstown and the Towns of Firestone and Frederick. Decision-makers in these communities should be proactive because they grow by using development practices that will minimally impact water quality. If more implementation is completed up front, less effort will be needed to retrofit BMPs after the area becomes a designated MS4. 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. MIDS is a new concept being used in Minnesota that 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 NFRWQPA 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

Overall, water quality issues occur throughout watersheds addressed in this planning effort. Many practices are available for reducing the pollutants of concern, and those are summarized in the Watershed Implementation Plan for each specific area. Funding and technical assistance are available from many sources, and these plans will make funds easier to obtain. Further, these plans open up CWA Section 319(h) funds for implementation, which are provided only for areas with approved NPS management programs. Practices implemented should focus on the primary sources of pollutants of concern in each project area and should be the practices that provide the greatest load reductions. To avoid limiting what practices can or should be funded, a large variety of practices are listed in the Watershed Implementation Plans. Similarly, the lists of practices provided in the plans should not be all inclusive, but instead should be a starting point for the determination of the most effective options and the best general locations for each.

For nutrients, the USGS SPARROW modeling [USGS, 2012] shows that phosphorus and sediment are generally from NPSs, such as runoff from agricultural and developed lands, and not from wastewater treatment plants. Nitrogen is the exception to this and comes more from wastewater treatment plants and atmospheric deposition. *E. coli* is often from runoff from agricultural lands and developed lands because wastewater facilities have regulations for *E. coli* concentrations in their effluent and generally disinfect to kill bacteria sources. Finally, heavy metals are generally coming from AMLs and flood irrigation practices on cropland where high natural concentrations exist. Therefore, implementation of NPS practices will significantly reduce pressure on wastewater facilities to decrease concentrations of phosphorus, sediment, *E. coli*, and heavy metals. Point source permittees should be mindful that water

quality trading options may be available to use money available for upstream NPS implementation to improve water quality for a lower potential cost. Water quality trading options need to be further evaluated and quantified.

7.0 REFERENCES

AMEC, CDR Associates, and Walsh, 2014. *Left Hand Creek Watershed Master Plan*, prepared by AMEC, CDR Associates, and Walsh, available online at *https://watershed.center/wp-content/uploads/2017/05/final-left-hand-creek-watershed-master-plan2.pdf*

Ayres Associates, 2015. *Big Thompson River Restoration Master Plan*, prepared by Ayres Associates, Fort Collins, CO, for the Big Thompson River Coalition, Loveland, CO, available online at *https://bigthompson.co/wp-content/uploads/2019/03/BTWC_Master_Plan.pdf*

Big Dry Creek Watershed Association, 2024. "Big Dry Creek Watershed Association Reports," accessed September 18, 2024, from *https://www.bigdrycreek.org/reports*

Big Thompson Watershed Coalition, 2017. *Big Thompson River Corridor Master Plan*, prepared by Big Thompson Watershed Coalition, Loveland, CO, available online at *https://bigthompson.co/project/river-corridor-master-plan/*

Barr Lake & Milton Reservoir Watershed Association, 2008. *Barr Lake and Milton Reservoir Watershed Plan*, prepared by the Watershed Plan Writing Committee of the Barr Lake & Milton Reservoir Association, Broomfield, CO, available online at *https://barr-milton.org/wp-content/uploads/2019/07/bmw_wp_draft_text_102008.pdf*

Barr Lake & Milton Reservoir Watershed Association, 2013. *BMW Adaptive Implementation Plan for pH TMDL*, prepared by the Barr Lake & Milton Reservoir Association, Broomfield, CO, available online at *https://barr-milton.org/wp-content/uploads/2020/09/Implementation-Plan-from-State-website-9-20.pdf*

Barr Lake & Milton Reservoir Watershed Association, 2017. *Barr Lake and Milton Reservoir Watershed Plan Update*, prepared by the Barr Lake & Milton Reservoir Association, Broomfield, CO, available online at *https://barr-milton.org/wp-content/uploads/2019/07/sept_watershedplan_update_ew09202017.pdf*

Bremser, P., 2023. Personal communication between P. Bremser, St. Vrain Sanitation District, Longmont, CO, and Cindie Kirby, RESPEC, Rapid City, SD, October 2.

Catena Analytics, 2024. "eRAMS Online," accessed August 13, 2024, from *https://erams.com/catena/*

Coalition for the Poudre River Watershed, 2020. *Cache la Poudre River Watershed-Based Plan*, prepared by the Coalition for the Poudre River Watershed, Fort Collins, CO, available online at *https://static1.squarespace.com/static/5af07ab53917ee099d13c874/t/5eb1e67095ae0505f397957a/1588717186644/Final+CPRW+Watershed+Plan+-+April+2020.pdf*

Colorado Data Sharing Network, 2024. "CDSN 'AWQMS' Data Management System," accessed January 11, 2024, from *http://www.coloradowaterdata.org/awqmscdsn.html*

Colorado Department of Public Health and Environment, 2022. *Colorado's Nonpoint Source Management Plan: 2022,* prepared by Colorado Department of Public Health and Environment Water Quality Control Division, Glendale, CO, available online at *https://drive.google.com/file/d/1nrZ1D4yp2LGHUxrNsyjwGbu3w1ZCs9wz/view*

Colorado Department of Public Health and Environment, 2024a. "Water Quality Roadmap," accessed September 17, 2024, from *https://cdphe.colorado.gov/water-quality-10-year-roadmap*

Colorado Department of Public Health and Environment, 2024b. *Regulation #93 – Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List*, 5 Code of Colorado Regulations 1002-93.

Colorado Water Conservation Board, 2023. *Colorado Water Plan*, prepared by the Colorado Water Conservation Board, Denver, CO, available online at *https://cwcb.colorado.gov/colorado-water-plan*

Colorado Water Conservation Board and Colorado Division of Water Resources, 2023. "Colorado's Decision Support Systems, Division 1 – South Platte," accessed July 17, 2023, from *https://cdss.colorado.gov/gis-data/division-1-south-platte*

Fayram, A., 2023. Personal communication between A. Fayram, Loveland Water and Power, Loveland, CO, and Cindie Kirby, RESPEC, Rapid City, SD, September 29.

Fischer, J., 2023. *OTWS.zip,* attachment from personal communication between J. Fischer, InVision GIS, CO, and C. Kirby, RESPEC, Rapid City, SD, December 13.

Graves, J., 2024. Personal communication between J. Graves, Colorado Division of Reclamation, Mining, and Safety, Denver, CO, and N. Acosta, RESPEC, Colorado Springs, CO, March 8.

Hathaway, B., 2023. Personal communication between B. Hathaway, City of Greeley, Greeley, CO, and Cindie Kirby, RESPEC, Rapid City, SD, September 25.

Horsley and Witten, Inc., 1996. *Identification and Evaluation of Nutrient and Bacterial Loadings to Maquoit Bay, New Brunswick, and Freeport, Maine*, prepared by Horsley & Witten, Inc., Barnstable, MA, for Casco Bay Estuary Project, Portland, ME.

Horton, J. D., C. A. San Juan, and D. B. Stoeser, 2017. "The State Geologic Map Compilation (SGMC) Geodatabase of the Conterminous United States," *US Geological Survey Data Series 1052,* Ver. 1.1, August 2017, p. 46.

ICON Engineering, Inc., 2015. *Boulder Creek Restoration Master Plan*, prepared by ICON Engineering, Centennial, CO, for the Urban Drainage and Flood Control District, Denver, CO, available online at *https://assets.bouldercounty.gov/wp-content/uploads/2018/04/Boulder-Creek-Restoration-Master-Plan-2015a.pdf*

International Stormwater Best Management Practices Database, 2023. "International Stormwater BMP Database," accessed August 14, 2024, from *https://bmpdatabase.org/*

JW Associates, Inc., 2017. *High Park Fire Identification of Post-fire Remaining Priorities*, prepared by JW Associates, Breckenridge, CO, for the Coalition for the Poudre River Watershed, Fort Collins, CO, available online at *https://static1.squarespace.com/static/5af07ab53917ee099d13c874/t/5b5752741ae6cf3b02412eeb/1532449435620/Post-fire+Targeting+Report+Final+compressed.pdf*

JW Associates Inc., 2024. *Upper Poudre Watershed Resilience Plan*, prepared by JW Associates Inc., Breckenridge, CO, for the Coalition for the Poudre River Watershed, Fort Collins, CO, available online at *https://static1.squarespace.com/static/5af07ab53917ee099d13c874/t/662bbd100a7b9519c2453695/1714142520419/UPRP+2024+Final_smaller.pdf*

Larimer County, 2023. "Larimer County GIS Digital Data," accessed month day, 2024, from *https://www.larimer.gov/it/gis/digital-data*

Lynker Technologies, Otak, AlpineEco, LVBrown Studio, LLC, 2017. *Lower Poudre River Flood Recovery and Resilience Master Plan*, prepared by Lynker Technologies, Otak, AlpineEco, LVBrown Studio, LLC, for the Coalition for the Poudre River Watershed, Fort Collins, CO, available online at *https://static1.squarespace.com/static/5af07ab53917ee099d13c874/t/5b58bebe1ae6cfc82b9e7f6d/1532542666812/Lower+Poudre+Master+Plan+FINAL+compressed.pdf*

Metcalf and Eddy, Inc., 1991. *Wastewater Engineering: Treatment, Disposal and Reuse*, 3rd Edition, McGraw-Hill, New York, NY.

Metro Roundtable and South Platte Basin Roundtable, 2022. *South Platte Basin Implementation Plan, Volume 1*, prepared by the Metro Roundtable and South Platte Basin Roundtable, Denver, CO, available online at *https://static1.squarespace.com/static/62102d32cbc97713f25c3099/t/62bdfe9537168629ce77a68d/1656618673204/99756bdcf884440d177fbeef0743f94b_SouthPlatte-Metro_BIP_Volume1_2022.pdf*

Minnesota Pollution Control Agency, 2024. "Minnesota Stormwater Manual Overview of Minimal Impact Design Standards (MIDS)," accessed May 6, 2024, from *https://stormwater.pca.state.mn.us/index.php/Overview_of_Minimal_Impact_Design_Standards_(MIDS)*

Multi-Resolution Land Characteristics Consortium, 2019. "National Land Cover Database 2019 - Landcover & Imperviousness (NLCD2019)," accessed August 14, 2024, from *https://www.mrlc.gov/data?f%5B0%5D=category%3ALand%20Cover&f%5B1%5D=year%3A2019*

National Interagency Fire Center, 2024. "InterAgencyFirePerimeterHistory All Years View," accessed August 14, 2024, from *https://data-nifc.opendata.arcgis.com/datasets/e02b85c0ea784ce7bd8add7ae3d293d0_0/explore?location=39.994103%2C-103.924962%2C8.89*

National Water Quality Monitoring Council, 2023. "Water Quality Portal," accessed October 19, 2023, from *https://www.waterqualitydata.us/*

Natural Resources Conservation Service, 2024a. "Soil Survey Geographic Database (SSURGO)," accessed August 13, 2024, from *https://www.nrcs.usda.gov/resources/data-and-reports/soil-survey-geographic-database-ssurgo*

Natural Resources Conservation Service, 2024c. "Conservation Practice Standard Land Reclamation, Abandoned Mined Land Code 543," accessed May 30, 2024, from *https://www.nrcs.usda.gov/sites/default/files/2022-09/Land_Reclamation_Abandoned_Mined_Land_543_NHCP_CPS.pdf*

North Front Range Water Quality Planning Association, 2022. *208 Areawide Water Quality Management Plan 2022 – 208 AWQMP Update (Region 2)*, prepared by the North Front Range Water Quality Planning Association, Johnstown, CO.

Northern Water, 2024. "Environmental Monitoring," accessed February 16, 2024, from *https://www.northernwater.org/what-we-do/protect-the-environment/environmental-monitoring*

Otak, 2022. *Big Thompson River Envisioning Project Plan*, prepared by Otak, Denver, CO, for the Big Thompson River Watershed Coalition, Loveland, CO, available online at *https://bigthompson.co/wp-content/uploads/2022/11/BigT_EnvisioningReport_PDF_with-Appendices_final.pdf*

PRISM Climate Group, 2024. "Average Monthly and Average Annual Precipitation 1961-1990, 1971-2000 and 1981-2010 by State," accessed May 14, 2024, from *https://gdg.sc.egov.usda.gov/Catalog/ProductDescription/PRCIP.html*

S2O, 2024. "St. Vrain River Creek Watershed Master Plan," accessed July 9, 2024, from *https://s2odesign.com/projects/saint-vrain-river-master-plan/*

Smith, E., 2024. *2023 Zoning Boundary.zip,* attachment from personal communication between E. Smith, Town of Timnath, CO, and C. Kirby, RESPEC, Rapid City, SD, January 29.

South Fort Collins Sanitation District, 2023. "Fossil Creek Water Quality Data," accessed October 6, 2023, from *https://lookerstudio.google.com/u/0/reporting/f37fd02a-76b9-4e7f-ab68-29860d999627/page/p_6jx0trsz6c/edit*

St. Vrain and Left Hand Water Conservancy District, 2022. "St. Vrain and Left Hand Stream Management Plan," accessed September 17, 2024, from *https://coloradosmp.org/wp-content/uploads/2019/02/SVLH_Summary_web.pdf*

U.S. Census Bureau, 2010. "Explore Census Data," accessed August 1, 2024, from *https://data.census.gov/*

U.S. Census Bureau, 2020. "QuickFacts," accessed July 29, 2024, from *https://www.census.gov/quickfacts/*

U.S. Department of Agriculture, 2024. "Farmers.gov," accessed May 30, 2024, from *www.farmers.gov*

U.S. Environmental Protection Agency, 2022. "User's Guide Pollutant Load Estimation Tool (PLET) Version 1.0," accessed August 1, 2024, from *https://www.epa.gov/system/files/documents/2022-04/user-guide-final-04-18-22_508.pdf*

U.S. Environmental Protection Agency, 2023. "Stormwater Phase II Rule, Factsheet 2.1," prepared by the U.S. Environmental Protection Agency Office of Water.

U.S. Environmental Protection Agency, 2024. "Per- and Polyfluoroalkyl Substances (PFAS) Final PFAS National Primary Drinking Water Regulation," accessed August 14, 2024, from *https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas*

U.S. Geological Survey, 2023. "National Water Information System, USGS Surface-Water Daily Data for Colorado," accessed October 20, 2023 from *https://waterdata.usgs.gov/co/nwis/dv/?referred_module=sw*

U.S. Geological Survey, 2024. "2012 SPARROW Models for the Midwest: Total Phosphorus, Total Nitrogen, Suspended Sediment, and Streamflow," accessed September 18, 2024, from *https://sparrow.wim.usgs.gov/sparrow-midwest-2012/*

Wright Water Engineers, Inc., 2002. *Big Dry Creek Watershed Management Plan*, prepared by Wright Water Engineers, for the Big Dry Creek Watershed Association, Denver, CO.

Zeckoski, R. W., B. L. Benham, S. B. Shah, and C. D. Heatwole, 2005. "BSLC: A Tool for Bacteria Source Characterization for Watershed Management," *Applied Engineering in Agriculture*, Vol. 21, No. 5, pp. 879–889.

APPENDIX A

BIG AND LITTLE THOMPSON RIVER WATERSHED IMPLEMENTATION PLAN

APPENDIX B

CACHE LA POUDRE RIVER WATERSHED IMPLEMENTATION PLAN

APPENDIX C

ST. VRAIN CREEK WATERSHED IMPLEMENTATION PLAN

APPENDIX D

MIDDLE SOUTH PLATTE RIVER WATERSHED IMPLEMENTATION PLAN