



# RIVER SMART COMMUNITIES GUIDEBOOK

A COMPENDIUM FOR IMPLEMENTING  
INTEGRATED RIVER MANAGEMENT  
IN COLORADO



# PREFACE AND ACKNOWLEDGEMENTS



## About River Network

River Network works to strengthen organizations and leaders so that they can improve and protect their waterways, create climate-resilient communities, and ensure equitable access to safe, affordable drinking water. We accomplish this locally and nationally by responding to the capacity and training needs of organizations and communities, and by synthesizing, elevating, and activating proven and promising practices from the field.

## About River Network's Healthy, Resilient Rivers program

River Network's Colorado River Basin Healthy, Resilient Rivers program helps communities advance holistic river corridor management through proactive planning efforts. To break through siloed and patchwork policies and approaches to achieve resilient and accessible rivers, our Colorado team assists community-based organizations by strengthening local capacity, providing technical assistance, and supporting peer-to-peer knowledge sharing.

## About River Smart Communities & Integrated River Management (IRM)

A key component of the Healthy, Resilient Rivers program is River Network's River Smart Communities initiative that supports communities that want to implement Integrated River Management (IRM). In the Upper Colorado River Basin, we focus River Smart Communities on river and community resilience, including the following activities: 1) building local capacity to plan and implement holistic river corridor management projects; 2) providing technical assistance to communities to accelerate the pace, scale, and impact of integrated planning; and 3) supporting communities with education and outreach programs designed to foster mutual understanding and support of holistic river corridor management.

River Network's River Smart Communities program provides a structure and pathway for communities who wish to improve their coordination around river management. River Smart Communities set a collective vision for the river that forms the foundation of a holistic, iterative, community-driven approach that integrates planning, policies, and regulations. It puts IRM at the center of river management to create a complete, community-based picture of river health.

## Acknowledgements

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# THE GUIDEBOOK AT A GLANCE

Rivers in the Western United States are facing increasing pressure from climate change and implications of historic management practices. While there are many efforts underway to protect and restore rivers, the web of influences on river health is complex and often leads to limited coordination among river health stakeholders. Putting IRM at the heart of river management creates an opportunity for communities to build a coordinated and comprehensive approach to river management.

This Guidebook is one tool in the River Smart Communities program designed to help communities build a roadmap for IRM. Communities can use it to consider what plans, policies, regulations, programs, and projects affect their river health and therefore could be included in an IRM process. This guidebook focuses on four main sectors:



**LAND USE MANAGEMENT**

**HAZARD MITIGATION**

**WATER RESOURCES MANAGEMENT**

**RIVER HEALTH**

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*This Guidebook is for information purposes only and is not legally binding. The resources presented throughout this Guidebook were current at the time of writing, however federal and state resources change and evolve so we encourage communities to consider multiple resources as they pursue IRM.*



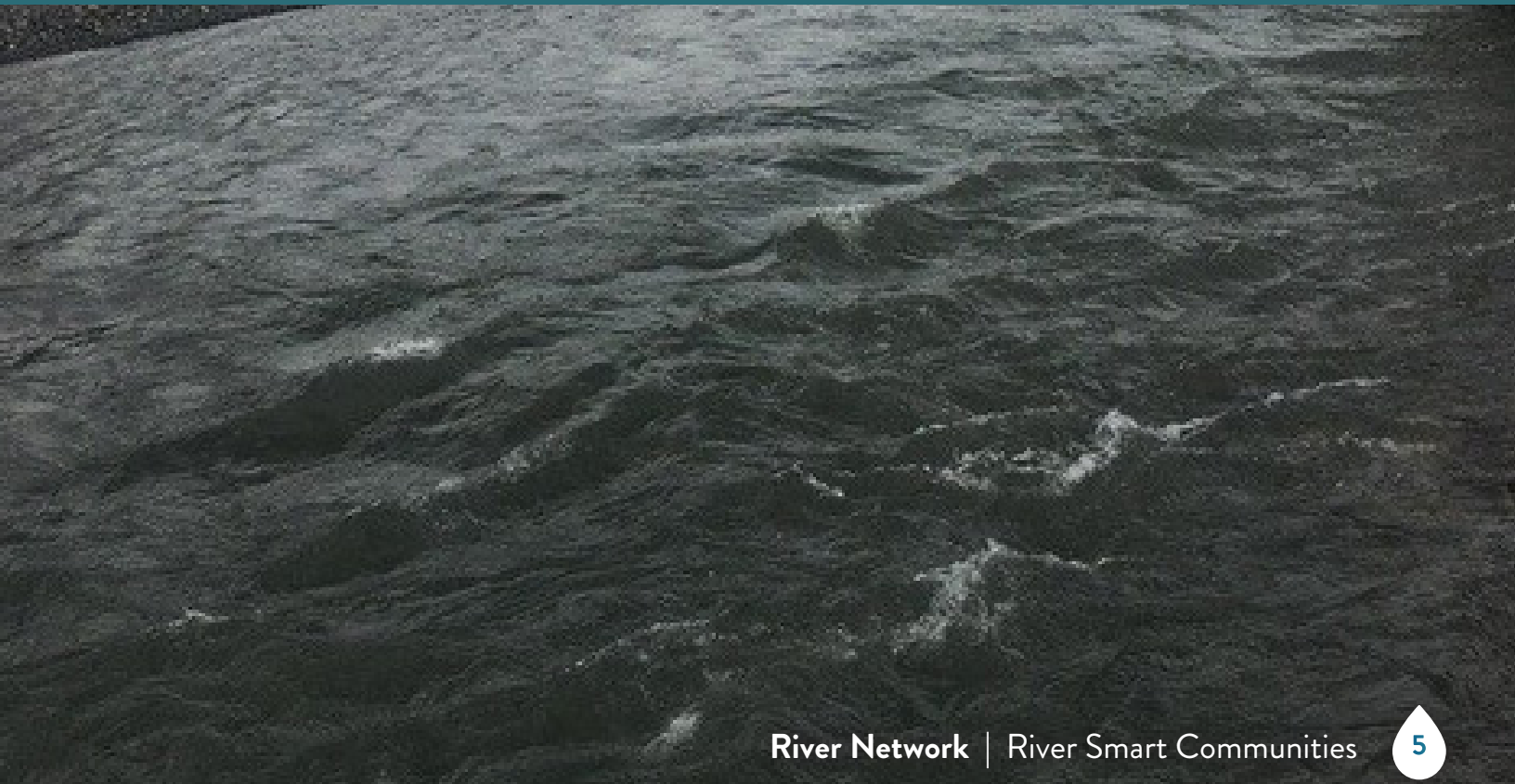
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# GUIDEBOOK INTRODUCTION





# CONTEXT

## THE PROBLEM: CLIMATE CHANGE AND SILOED RIVER MANAGEMENT

River corridors — rivers, floodplains, riparian areas, wetlands, and connected aquifers — within the Colorado River Basin are under unprecedented stress. Climate change, entrenched policies and practices, and inconsistent management approaches add to the damage already caused by destructive historic practices to strain river corridor health and limit their ability to provide all the ecosystem and community benefits they can.

The 2024 Climate Change in Colorado report details the impacts of rising temperatures on rivers (Bolinger, et al. 2024). From elevated stream temperatures to altered precipitation patterns, climate change is already affecting rivers, and its effects will increase over time. Heavy precipitation events are likely to increase in both frequency and intensity, resulting in periods of extreme river flows. Simultaneously, increased temperatures and prolonged periods without precipitation will result in more frequent periods of drought and increase the likelihood of wildfires. Wildfires directly affect river health by decreasing water quality. Indirectly, runoff and debris flow from heavy rainfall in post-wildfire burn scar areas both further diminish water quality and exacerbate flood risk. Climate change is also likely to result in earlier snowpack runoff and create conditions conducive to invasive species. The warmest years we experience today will be considered average by 2050, leaving rivers, their inhabitants, and the communities that depend on them limited time to adapt.

Historic river policies, land use practices, and natural resource management decisions that began as early as the 17th century also continue to affect

river health. For example, the establishment of the National Flood Insurance Program (NFIP) created floodplain regulations and insurance requirements intended to protect communities and individuals from the devastating impacts of flooding. However, the NFIP also created a management paradigm based on controlling a river's natural processes. From beaver trapping to controlling rivers with hard infrastructure like dams, levees, and berms, most river corridors today in the Western United States bear little resemblance to their original conditions. While these efforts did offer some benefits like water storage and local flood protection, they also had unintended consequences on communities and environmental health, including pushing flood risk downstream, destroying key habitats, disconnecting rivers from their historic floodplains, and blocking fish passage.<sup>1</sup>



<sup>1</sup> For more information, see Natural Resources Defense Council et al. (2024).



Siloed and patchwork policies and approaches to river management have further exacerbated river health, resulting in misaligned and inefficient programs and investments. River corridors are subject to a mosaic of regulations, projects, and interests at the federal, state, and local levels. Human-determined jurisdictional boundaries may have different regulations throughout a single river corridor, and these regulations often change, which can result in confusion and inconsistent enforcement. Well-intentioned stakeholders with varied interests can further complicate coordinated river management. Goals from one sector can interfere with those from another. Even when stakeholders have the same goals, strained budgets and competing demands on time can limit coordination and create redundancies or gaps in river protection and management. All of this plays out on top of complicated western water rights that have left many tributaries overallocated.

## THE GOAL: HEALTHY, RESILIENT RIVERS

Decisions that federal, state, and local governments make today will largely determine how resilient rivers will be in the future. By moving from reactive to proactive planning, communities can set goals for holistic river corridor health under an integrated planning paradigm. Doing so will foster healthy, resilient rivers that can better manage current stresses and withstand future changes, ensuring their rivers continue to provide natural benefits well into the future.

Healthy, resilient rivers exhibit four critical functions, summarized in Table 1.1 below:

- Natural streamflow and water balance,
- High-quality surface water and groundwater,
- Diverse biological communities, and
- Dynamic sediment process and quality soils.

Each function is measured by some or all of the example indicators listed in the table and provide the environmental and community benefits also summarized in the table. The table associates each key function with an icon. These icons appear throughout the guidebook to indicate functions that may be affected by a particular practice. Communities hoping to improve one of the functions listed below can focus on the associated icon throughout the Guidebook.

## KEY DEFINITIONS

**River Smart Community:** Practices an iterative, community-driven approach to river management that integrates planning, policies, and regulations to support a community-led river corridor vision, especially related to land use, hazard mitigation, river health, and water resources.









**Integrated River Management (IRM):** A collaborative, community-focused process that defines a common vision for the community's river corridor through integrated planning and then implements policies, practices, and solutions that drive holistic river corridor management.

**River corridor:** Rivers and their interconnected features, including the river channel, floodplains, riparian areas, wetlands, and connected aquifers.

**River health:** A river and its corridor that exhibit the key functions defined in Table 1: natural streamflow and water balance, high-quality surface water and groundwater, diverse biological community, and dynamic sediment processes and quality soils. River Smart Communities achieve healthy rivers through a community-focused integrated planning process.



TABLE 1.1. FUNCTIONS AND BENEFITS OF A HEALTHY, RESILIENT RIVER

	EXAMPLE INDICATORS	ENVIRONMENTAL BENEFITS	COMMUNITY BENEFITS
	<b>Natural streamflow and water balance</b>		
	Sustained surface runoff and shallow groundwater inflow	Retains runoff during high flow	Natural flood protection
	Sufficient surface water storage	Filters pollutants	Recreational opportunities
	Surface and subsurface water exchange	Allows river to move dynamically over time	Prevents systemic erosion
	Flood attenuation and overbank flooding	Maintains natural sediment deposition and transport	Reduces water quality impacts from urban runoff
	Intact wetland and riparian areas	Recharges the aquifer	Provides water for agriculture, municipal, and industrial supplies
	<b>High-quality surface water and groundwater</b>		
	Water chemistry	Cycles nutrients through photosynthesis	Protects clean water
	Biota present/absent	Creates aquatic habitat	Sustains fisheries
		Supports balanced plant, fish, and invertebrate communities	Recreational opportunities
	<b>Diverse biological community</b>		
	Diverse native plant and animal species	Bolsters riparian and upland habitat features	Sustains fisheries
	Diverse microorganisms and insects (invertebrates)	Maintains ecosystem integrity (complete food web)	Recreational opportunities
	Abundance of flood-tolerant vegetation	Supports robust riparian and wetland vegetation	
	<b>Dynamic sediment processes, quality bed sediment and floodplain soils</b>		
	Sediment transport continuity	Creates sustainable aquatic habitat	Offers food protection
	Intact substrate and structural processes	Supports robust riparian and wetland habitat	Produces carbon sinks
	Good quality and quantity of sediments and soil	Manages energy flow	Provides opportunities for food production
		Allows for natural patterns of sediment deposition and transport	Sustains fisheries
		Recharges aquifers	

Healthy rivers provide numerous environmental and social benefits. A river that moves dynamically and can flood regularly provides essential ecosystem functions including capturing snowmelt, slowing stormwater flows, recharging aquifers, and managing sediment flows. They provide critical aquatic and riparian habitat. A river with robust ecological health is also more resilient to climate change. For example, riparian areas with strong and diverse vegetation can lower water temperatures, provide habitat, and help protect riverbanks from erosion.

Communities also benefit from healthy rivers. Functions such as preserved riparian green spaces in urban areas reduce flood risk, control stormwater runoff, combat urban heat islands, offer recreational opportunities, add aesthetic value, and improve access to nature. Communities with access to healthy rivers and their surrounding green spaces have improved mental and physical health. When communities target river restoration projects in lower income areas, they can help address environmental inequities including reduced access to nature and higher flood risk. Beyond urban areas, healthy rivers offer recreational opportunities, supply water for irrigation, and help slow high flows. Controlled flows in source watersheds also keep sediment out of drinking water infrastructure and protects water quality for drinking water supplies.

## THE SOLUTION: INTEGRATED RIVER MANAGEMENT

River Network has developed a holistic approach to river management called Integrated River Management (IRM), intended to foster a new system of river management that prioritizes community values and coordinates river management among key sectors to protect river corridors. IRM is a collaborative, community-focused process that defines a common vision for the community's river corridor through integrated planning and then implements policies, practices, and solutions that drive holistic river corridor management.

A community that practices IRM brings diverse voices to the discussions around river management in a thoughtful, deliberate, and methodical way. Collectively, these voices create a vision for the community's river corridor and then identify community-led solutions to achieve that vision — building trust, fostering local support, and incorporating new perspectives and ideas. IRM offers an opportunity for stakeholders to discuss differing priorities and trade-offs and create a collective understanding around shared values. IRM builds on best practices in river science, such as nature-based solutions, watershed protection, “no adverse impact” floodplain management, and process-based restoration practices that restore and maintain natural river processes. IRM aligns efforts and groups around a common vision, creating efficiencies and streamlining funding opportunities all in support of the community's vision for a healthy river.





Communities in Colorado have considerable legal authority to implement many readily available tools to support healthy rivers. While the idea of implementing IRM may seem daunting, this Guidebook provides leaders committed to protecting river corridors — including local government staff, community-based organizations, recreation-focused stakeholders, agriculture producers, floodplain managers, watershed planners, and practitioners — with a roadmap of how to elevate uniformity among four main sectors that have a significant impact on river health:



Each of the following four chapters identifies sector-specific plans, policies, regulations, programs, and examples of projects that intersect with river health. In addition to the sector-specific discussion of the Colorado legislative context in each chapter, Title 37 of the Colorado Revised Statutes provides overarching state laws related to water resources in Colorado. Similarly, the Colorado Water Plan articulates broad goals for the state's water resources. These are discussed in the two boxes (*Title 37 and Colorado Water Plan*).

## TITLE 37: WATER AND IRRIGATION

Title 37 of the 2023 Colorado Revised Statutes (C.R.S. § 37-1-101 et seq.), Water and Irrigation, details the main governing provisions for water resources, conservation, and irrigation in Colorado, including provisions for water rights and allocation.

**Articles 1-8 Conservancy Law of Colorado:** establishes conservancy districts and focus on flood control

**Articles 20-33 Drainage and Drainage Districts:** establishes drainage districts

**Articles 40-50 Water Conservation and Irrigation Districts:** establishes water conservation and irrigation districts and details their responsibilities including issuing bonds and managing water rights.

**Articles 60-75 Water Conservation Board and Compacts:** establishes the Colorado Water Conservation Board and Basin Roundtables, and details their structure and responsibilities including water conservation, role in interstate water compacts, and administering water resources.

**Articles 80-93 Water Rights and Irrigation:** establishes the role of the State Engineer and covers water rights issues including adjudication, transfer, and irrigation regulation (water rights generally are covered in the Colorado Constitution in article XVI §§ 5 to 8).

**Article 95 Water Resources and Power Development:** focuses on hydropower, including constructing and operating reservoirs and dams.

**Articles 96-99 Water Conservation:** detail the importance of water conservation and efficiency practices. HB 74-1041: Areas and Activities of State Interest Act

This guide provides a menu of options to improve holistic river management because there is not a one-size-fits-all approach. Communities should consider which options, or combination of options, might work best for their context, and consider this information as a starting point they can customize to address their needs, concerns, and opportunities.

There is not a uniform approach to IRM, but it is rather a continual flow of information unique to each community's context. The resources presented in this Guidebook represent touchpoints connecting IRM in a community — specific places where communities can include river health goals as well as resources communities can draw upon to support their creation of IRM principles.

Table 1.2 provides a high-level summary of the information presented throughout the Guidebook. The first column identifies which healthy river functions each of the four sectors primarily addresses, the second column provides a high-level overview of how each sector overlaps with river management and how communities can integrate IRM into that sector, the third column provide highlights and in-practice examples from the chapter to illustrate how IRM may be practiced in that sector or key resources to support integration of that sector, and the resources column provides a summary of resources covered in each chapter.

# COLORADO WATER PLAN

Colorado's Water Plan articulates goals for the state's water resources through 2050 based on an evaluation of the state's water supplies and demands from agriculture, municipal and industrial, and environmental needs. The supply and demand forecasts include projections of future changes in population and climate. Water resource managers use the Water Plan to proactively prioritize projects in four main action areas — vibrant communities, thriving watersheds, robust agriculture, and resilient planning — that will address any gaps including water conservation, storage and infrastructure, and alternative supply strategies. The Water Plan was originally developed in 2015 and updated again in 2023. In addition to the state-wide Water Plan, each of the seven basins within the state has their own plan, known as a Basin Implementation Plan (BIP) developed by that Basin's Roundtable. The BIPs articulate each basin's goals and prioritize projects within their basin.






TABLE 1.2. INTEGRATING IRM IN FOUR SECTORS: A HIGH-LEVEL SUMMARY OF THE INFORMATION PRESENTED THROUGHOUT THE GUIDEBOOK


## LAND USE MANAGEMENT

ASSOCIATED FUNCTION(S)	ROLE IN IRM	RESOURCES
	<p>Decisions around land use can significantly affect river corridors. Integrating IRM practices and land use management provides communities an opportunity to incorporate their goals for healthy rivers with land use planning and regulations.</p>	<p><b>Planning</b></p> <p>Comprehensive plans Subject or area-specific plans (e.g., public health or special district)</p> <p><b>Regulations</b></p> <p>Land use regulations (e.g., zoning) Other regulations (e.g., codes, permits, overlays)</p> <p><b>Incentives &amp; funding</b></p> <p>Development incentives Density bonuses Land acquisitions Conservation easements</p>


## HAZARD MITIGATION

ASSOCIATED FUNCTION(S)	ROLE IN IRM	RESOURCES
	<p>Integrating IRM and local hazard mitigation provides the opportunity to leverage a river's natural ability to reduce hazard impacts and also help minimize the damage a river may experience from natural hazards.</p>	<p><b>Regulations</b></p> <p>Federal Emergency Management Agency (FEMA) Colorado floodplain regulations</p> <p><b>Planning</b></p> <p><i>Federal resources:</i> FEMA, Other federal agencies <i>Colorado resources:</i> Division of Homeland Security and Emergency Management (DHSEM), Colorado Water Conservation Board (CWCB), Colorado Resiliency Office (CRO)</p> <p><b>Actions</b></p> <p><i>Federal funding resources:</i> Building Resilient Infrastructure and Communities (BRIC), Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Colorado funding resources, Water Plan Grants, Healthy Rivers Fund</p>

# WATER RESOURCE MANAGEMENT

ASSOCIATED FUNCTION(S)	ROLE IN IRM	RESOURCES
	<p>Aligning water resource management with broader community goals for river health ensures that people and ecosystems have access to clean and sufficient water supplies, and use it efficiently for municipal needs, agriculture, environmental flows, flood control, transportation, and recreation.</p>	<p><b>Planning</b></p> <ul style="list-style-type: none"> <li>Water supply plans</li> <li>Water efficiency plans</li> <li>Water infrastructure master plans</li> <li>Stormwater plans</li> <li>Integrated Water Management Plans</li> <li>OneWater</li> </ul> <p><b>Infrastructure</b></p> <p><i>Supply:</i> Municipal, Agriculture</p> <p><i>Stormwater:</i> Gray stormwater infrastructure, Green stormwater infrastructure</p>

# RIVER HEALTH

ASSOCIATED FUNCTION(S)	ROLE IN IRM	RESOURCES
	<p>Aligning IRM and river health practices can help align stakeholders around a common vision and ensure proven stream health practices are implemented along a stretch of river, even if it crosses jurisdictional boundaries.</p>	<p><b>Planning</b></p> <p>Watershed management plans, Stream Management Plans, Wildfire Ready Action Plans, Habitat restoration plans, Environmental flow management plans, Water quality pollution control plans, Riparian buffer plans, River recreation plans</p> <p><b>Planning</b></p> <p><i>Federal programs:</i> Environmental Protection Agency (EPA) Healthy, Watersheds Program, Natural Resources Conservation Service (NRCS)</p> <p><i>State programs:</i> Colorado Department of Public Health and the Environment (CDPHE), CWCB, Colorado's Strategic Plan for Climate-Smart Natural and Working Lands</p> <p><b>Practices</b></p> <p>Assessments, Watershed protection, River/stream restoration, Riparian and aquatic habitat restoration, Environmental flow restoration, Recreation improvements, Public education</p>



# HOW TO USE THIS GUIDEBOOK

Community leaders can use this guidebook to consider a more holistic approach to river management, shifting their focus from reactive planning to proactively setting goals for holistic river corridor health and moving from siloed governance to an integrated planning paradigm.

**Chapters 2–5** provide in-depth overviews of how to integrate river management in each of the four sectors, opportunities for IRM best practices within each sector, and ideas of key partners. Within each sector chapter, “in practice” case studies profile examples where communities have implemented the concepts discussed. The sector chapters each conclude with a list of additional resources.

**Chapter 6** looks at how to integrate the concepts from the four sectors and create a collaborative approach to IRM, including offering an in-depth case study of IRM along the Yampa River.

There is not a one-size-fits-all approach to IRM so this guide provides a menu of options. Communities should consider which options, or combination of options, might work best for their context, and consider this information as a starting point they can customize to address their needs, concerns, and opportunities.



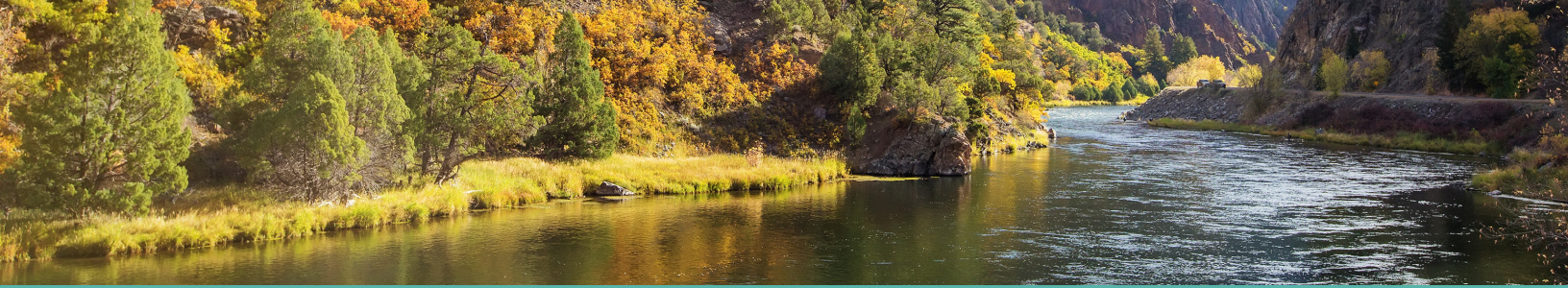




# LAND USE MANAGEMENT







# INTRODUCTION

How a community uses its land reflects its values. Decisions around land use significantly affect the quality of life within a community, including creating equitable access to amenities and transportation options, and protecting environmental quality. For many communities, a river corridor is central to those values. Because land use can affect river corridors, embedding Integrated River Management (IRM) in land use management is an opportunity for communities to articulate the value a river plays to their community.

Land use management dictates how people develop land and use resources within a geographic boundary. The Colorado Constitution gives communities a good deal of autonomy over their land use, which makes it a particularly powerful tool for communities to express their values and address locally-specific issues not covered by federal or state legislation.

Land use management is articulated in plans, implemented through regulations, and directed through incentives and funding. Plans articulate community-led visions for a community's future. Regulatory tools and non-regulatory incentives help implement the visions and goals described in plans. They often provide more specificity for how to translate planning visions into on-the-ground reality. Land use management creates a consistent and predictable regulatory context which helps developers and landowners by laying out specific expectations and ensuring consistent enforcement for violations. Regulations are also more likely to survive changes in local administrations, providing further consistency.

## REGULATORY CONTEXT

Colorado is a home rule state, which means the state constitution gives local governments with a home rule charter the authority to govern themselves if their laws do not conflict with state or federal laws. Both counties and municipalities in Colorado have the right to establish and enact zoning laws. Article XX in the Colorado State Constitution spells out this home rule provision, and further specifications are included in several places in the Colorado Revised Statutes (C.R.S.) and through House Bill 74-1041, commonly referred to as "1041."

### **Legislation governing local control in Colorado**

Article XX in the Colorado Constitution (Home Rule provision)

C.R.S. Title 30 (§ 30-11-101) outlines the powers granted to counties

C.R.S. Title 31 (§ 31-15-101) outlines the powers granted to municipalities

C.R.S. § 31-2-101 permits municipalities to adopt a home rule charter

HB 74-1041: Areas and Activities of State Interest Act

Because land use management is a powerful tool for communities, it is a critical element of IRM. This chapter delves into more specific details about types of land use management and how they can support IRM. Because each community has a different regulatory, political, and environmental context, there is no one-size fits all approach to using land use management in IRM. Communities can work with key partners to identify different land use tools that may help them accomplish different goals. This chapter includes general suggestions and “in-practice” highlights from communities to provide examples and spark ideas.

Developing plans can help communities articulate their visions and goals as well as detail approaches to achieving those goals. Plans help drive policies and legislation and can influence how resources are spent. Because they are meant to reflect community values, plans are often created with community input, reflecting the voices and priorities of a community. Because they drive action, plans provide a vital opportunity for a community to integrate IRM goals across different planning silos.

## KEY PARTNERS

Communities can most effectively implement IRM in land use management when key partners work together, such as:

### General land use partner categories

- Agricultural producers and agriculture organizations
- Community non-profits and community groups
- Neighborhood organizations
- Open space and parks and recreation departments
- Planning departments
- Private developers
- Stormwater, floodplain, and emergency management departments
- Transportation departments
- Utilities, especially water supply and wastewater

### Examples partners for Colorado communities

- Local branches of the American Planning Association
- Colorado Coalition of Land Trusts
- Colorado Department of Local Affairs (DOLA)
- Colorado Water Conservation Board (CWCB)
- Federal Emergency Management Agency (FEMA)
- Great Outdoors Colorado
- State Land Board
- State Parks
- United States Forest Service (USFS)



# TYPES OF PLANS

Every community has their own unique mosaic of plans but generally, there are three tiers from visionary to specific. Vision or strategic plans can outline broad community values and often include big-picture concepts and approaches. Comprehensive or master plans offer even more specificity than a strategic plan, including articulating more specific goals across a range of subject areas. Resource- or topic-specific plans dive further into detail about a particular subject or neighborhood.

Because every community's planning landscape differs, and communities may even use different terminology for similar types of plans, the information presented in this chapter is not meant to be universally applicable but rather illustrative. This chapter offers a high-level overview of the type of land use planning that may occur at a community level. For more information on subject-specific plans that may fall under an IRM umbrella, see Chapter 3, Hazard Mitigation; Chapter 4, Water Resource Management; and Chapter 5, River Health.

## Comprehensive Plans

Comprehensive Plans are one of the most common types of community plans. They are generally completed approximately every 10 years and spell out a community's long-term plan for its growth and development, often creating a vision for the community 20 to 50 years in the future. Comprehensive plans lay out a big picture vision for the community and direct future growth and development, balancing community needs with the environment. They can also reflect the community's goals around things such as community aesthetics, equity, or livability. According to C.R.S. § 30-28-106, all comprehensive plans in Colorado must include a discussion around recreation and tourism, but otherwise comprehensive plans have few guidelines. They can touch on multiple elements such as transportation, housing, the environment, cultural resources, economic growth, and hazard mitigation.

# IN PRACTICE

## COMPREHENSIVE PLAN OLATHE, CO



One goal of the Olathe Comprehensive Plan is to “develop a river park in conjunction with sound flood plain maintenance policies.”

### Take Home

IRM planning is not just for big communities. Small towns also have opportunities to integrate IRM values in their planning.

*Town of Olathe Comprehensive Plan. Undated. (Section B, Goal 1, Objective 5)*

Whatever elements a comprehensive plan includes, they tend to cover them at a high level. All comprehensive plans must gather community input throughout their development, and the final plan is voted on by the city council or a planning board. In Colorado, comprehensive plans are required for counties with more than 100,000 people and municipalities with more than 10,000 people. Smaller communities direct their community growth through housing needs assessments or housing action plans. Over 90% of Colorado communities have a comprehensive plan.

## Other Community Plans

Many communities supplement their comprehensive plans with more specific, detailed plans. These plans are often focused on a specific geographic area or subject. They tend to focus on land use, economic development, stormwater and natural resource management, environmental protection, public health, growth management, and infrastructure planning, or community values (such as historic preservation or design). Because Colorado communities have authority over local planning, there is not a standard set of these plans. Larger communities are likely to have several plans, whereas smaller communities may not have as many. These plans are often led by a particular

department, champion, or group of stakeholders, and have the potential to include more community input. Because they are updated more regularly, they can better capture new information, research, and circumstances. Ideally, these plans align with and support the comprehensive plan and other community plans.

Several of these plans can have implications for IRM, especially sustainability, resilience, or climate plans; hazard mitigation plans; transportation master plans; water quality; floodplain plans; water resources plans, such as stormwater master plans; or parks or open space plans. These plans are covered in more detail in the subsequent chapters or illustrated in the “in-practice” highlights throughout the Guidebook.

## IN PRACTICE

### COMPREHENSIVE PLAN

Glenwood Springs, CO



The Roaring Fork River flows into the Colorado River in the heart of Glenwood Springs. The city’s 2023 update of its Comprehensive Plan recognizes the importance of the rivers to the community in several ways:

One of the eleven community values that guides the Plan is: “Connection and preservation of nature (rivers and natural resources)” and several of the other eleven values also embody IRM principles, including, “Compact, walkable, and talkable neighborhoods,” “Sustainable tourism,” “Resilient and sustainable economy and environment,” and “Regionalism and partnerships.”

The Plan explicitly includes the rivers as part of the “community character and vitality.” (p. 51)

One of the four strategies in the natural resources section is “River Corridors,” which states: “A key concept of the Comprehensive Plan is to expand and improve the greenways along the rivers through town. Development that reduces the continuity of the habitat, the hydrologic function, or the visual quality of the river corridors should be discouraged. Any development adjacent to the river corridor should also be preserve public access to and along the river edge and assist in the restoration of damaged riparian areas.” (p. 89)

The Plan identifies five specific actions to achieve the goal to “preserve and enhance the river corridors,” including, “continue to obtain access easements as opportunities arise along the ... rivers for fishing access,” and “study the feasibility of a River Overlay District. Continue to assess land use and natural resources, and access to the ... rivers through completion of the river trail and through City-owned property adjacent to the river.” (p. 112)

#### Take Home

Glenwood Springs’ Comprehensive Plan exemplifies how to integrate IRM in a comprehensive plan, prioritizing river health at the highest level of city planning. By including IRM principles in its comprehensive plan, Glenwood Springs lays the foundation to implement IRM in its land use regulations, ensuring that IRM practices are implemented on the ground. Explicitly stating the importance of the rivers to the community in its Comprehensive Plan helps identify community-driven targets for river health and supports local leaders around a common vision for river health aligned around IRM.

*Glenwood Springs Comprehensive Plan Update. Adopted 3.16.2023.*

# EXAMPLES OF OTHER COMMUNITY PLANS

## Subject-specific

Capital improvement plans  
Sustainability, resilience, and climate plans\*  
Hazard mitigation\*  
Transportation\*  
Public health  
Housing and human services  
Water quality (“208 plans”)\*  
Water resources (e.g., stormwater, One Water)\*  
Watershed or stream management\*  
Parks, open space, and recreation\*

## Area-specific

Downtown  
Special district  
Development-specific plans  
Neighborhood  
Corridor

*\*See the case study examples through this section as well as other chapters in this Guidebook for further examples of how River Smart Communities use these types of plans in practice.*

## IN PRACTICE

### SUSTAINABILITY, CLIMATE ACTION, AND RESILIENCE PLAN

Boulder County, CO



Boulder County integrates IRM ideas throughout its Sustainability, Climate Action, and Resilience Plan in the climate, ecological health, local food and agriculture chapters. It spells out goals for river health including the need to “update the County Comprehensive Plan to establish and revise water-related goals and use updates in regulatory documents such as the Land Use Code to support implementation” and “Work with water rights holders to employ practices that increase soil capacity for water retention.” It also incorporates elements from other community plans, including the Comprehensive Plan, Cropland Policy, and Climate Change Preparedness Plans. The Plan also aligns with Boulder’s vision for compact land use development patterns.

#### Take Home

By including river health as a priority in its Sustainability, Climate Action, and Resilience Plan, Boulder County can begin to integrate IRM values and provide coordinated messages in other planning efforts, including the Comprehensive Plan. This Plan also helps create a roadmap for integrating IRM messaging in all County planning by identifying elements from other existing plans. This level of coordinated messaging will strengthen the consistent messaging that will create a strong foundation for IRM goals across all the county’s plans.

*Boulder County Sustainability, Climate Action, and Resilience Plan. 2023.*







## HOW TO USE PLANS AS A RIVER SMART COMMUNITY



The types of plans discussed above provide critical opportunities for communities to define a common vision for IRM and then embed it throughout multiple sectors and actions. Following a facilitated period of public engagement, a community can shape its IRM values in a comprehensive planning process by including it as a community priority. From there, other plans such as watershed, stream management, hazard mitigation, or transportation plans can detail specific IRM actions. This provides community employees and stakeholders with leverage to prioritize IRM work and help ensure that river management efforts are coordinated and consistent. Incorporating IRM in planning processes also provides avenues for community and stakeholder feedback at several levels. The Glenwood Springs Comprehensive Plan is an example of a Colorado community that integrated river management into its comprehensive plan (see “In Practice” example on pg. 19).

For some communities, existing plans may already include actions to achieve healthy river functions or approaches to more effectively integrate river management. Plans such as those focused on sustainability, climate, watershed, or stream management likely articulate community-specific river management issues that can be elevated or captured in a city-wide IRM vision. For example, a parks and open space plan may include goals to preserve land along river corridors, and stormwater management plans may outline approaches to minimize polluted runoff to rivers. Table 3 gives examples of plans that can help meet specific IRM goals for key functions of a healthy river.

TABLE 2.1. EXAMPLES OF SPECIFIC COMMUNITY PLANS THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	INCENTIVES AND RELEVANT PLANS
 <b>Natural streamflow and water balance</b>	Hazard mitigation, Parks and open space, Transportation, Integrated Water Management, Stream management
 <b>High-quality surface water and groundwater</b>	Water quality (“208 Plans”), Stormwater management, Public health, Stream management
 <b>Diverse biological community</b>	Parks and Open Space, Water quality, Stream management
 <b>Dynamic sediment processes and quality soils</b>	Water quality, Transportation, Stream management

Members of a community, key stakeholders, and local environmental non-profits can encourage the inclusion of IRM values in their own community plans through the public input phases of a planning process. They can offer key concepts or phrases for local planners to consider when developing plans, and they can help raise awareness about existing IRM values or practices that may already exist in other plans.

## IRM Plan

A River Smart Community can also create a specific IRM plan that addresses all the functions of a healthy river together. An IRM plan offers an opportunity for diverse stakeholders to come together and define a common value statement for river health in their community. The plan can also dive into more specificity and detail around the process for achieving river corridor health, breaking down silos, eliminating confusion, and aligning resources.

Typically, through the planning process, the IRM planning team gathers community input, identifies the top barriers to integrating river management across sectors, and takes stock of IRM-related components of other existing comprehensive or other community plans. Using this information, they can then articulate a roadmap for how to integrate IRM throughout other plans, policies, and regulations given their community context and priorities. An IRM plan helps communities identify and consolidate these messages under one common vision and ensure consistent messaging and management across all city plans. It also allows communities to engage stakeholders who might not be part of other planning processes and create a watershed or corridor-wide vision for river health. (see Chapter 6, Collaboration Across all Sectors, for further information and case studies about IRM planning).

## IN PRACTICE

### COMPREHENSIVE PLAN CRESTED BUTTE, CO



Crested Butte’s Area Plan identifies values that align with IRM including a community value of “changing our expectations for manicured landscapes (and) growth along our rivers” (p. 17) and a value of “seeking collaborative solutions that span jurisdictional boundaries” (p. 16).

#### Take Home

Crested Butte’s area plan calls on the entire community to rethink traditional expectations of land use along its river corridors. It also recognizes the importance of working at a larger geographic scale in natural resources planning.

*Crested Butte Community Compass. November 7, 2022.*

## IN PRACTICE

### COMPREHENSIVE PLAN GARFIELD COUNTY, CO



The Plan recognized the importance of “supporting projects ... that transcend political boundaries” and specify wildlife habitat, river, watershed protection, and water conservation as particular issues that fall under this policy.

#### Take Home

Garfield County’s comprehensive plan is notable because it recognizes that natural resources transcend political boundaries and so planning needs to follow suit.

*Garfield County Comprehensive Plan 2030: 2020 Update. February 26, 2020 (Policy 6).*

# PLANNING RESOURCES

The following list is a summary of key planning resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

Rugland, E. 2020. Incorporating Water into Comprehensive Planning: A Manual for Land Use Planners in the Colorado River Basin. Lincoln Institute of Land Policy.

Godschalk, D. and D. Rouse. 2015. Sustaining Places: Best Practices for Comprehensive Plans. American Planning Association PAS Report 578.

Rouse, D. and R. Piro. 2021. The Comprehensive Plan: sustainable, resilient, and equitable communities for the 21st century. American Planning Association Planning Essentials. Routledge. ISBN 9780367897750.

Planning for Hazards: Land Use Solutions for Colorado. Addressing Hazards in Plans and Policies.

Friends of the Verde River Land and Water Planning Toolbox

Tang, Z., et al. 2020. Integrating Wetland Conservation into Local Planning. University of Nebraska-Lincoln.

Federal Emergency Management Agency (FEMA). 2021. Integrating Hazard Mitigation into the Local Comprehensive Plan.

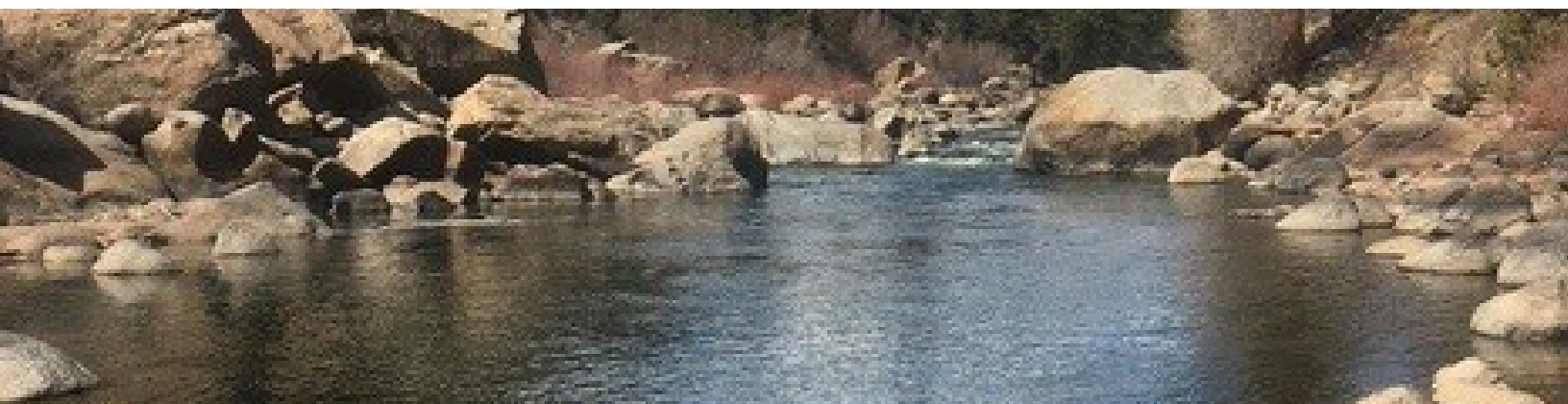
Glenwood Springs, Colorado. Comprehensive Plan Update. Adopted 3.16.2023.

Boulder County, Colorado. Sustainability, Climate Action, and Resilience Plan. 2023.

Town of Olathe, Colorado. Comprehensive Plan.

Garfield County, Colorado. Comprehensive Plan 2030: 2020 Update. February 26, 2020.

Town of Crested Butte, Colorado. Community Compass. November 7, 2022.







# REGULATIONS

Regulations are the legal directives in a community's code that can stem from the comprehensive plan goals and guide municipal development, standards, and practices. They are particularly helpful to cover gaps in state or federal regulations or address specific community priorities. Codes can include laws, ordinances, standards, and requirements on a wide range of topics including buildings, health and safety, subdivisions, annexation, impact fees, public hearing processes, and permitting. Putting something in municipal or county code, or "codifying" it — especially a larger or more complex change that may affect residents — can require an involved and lengthy process including conducting community outreach and collecting public input and passing it with a vote of the city council or county commissioners. Once a regulation has been codified, violating it comes with a range of legal ramifications including fines, a loss of license, or even civil or criminal charges. Because the process of changing regulations can be arduous, codes cannot be changed easily or without a good deal of community support.

## TYPES OF REGULATIONS

Land use regulations, especially zoning, serve as the primary "carrot and stick" in guiding community development and can significantly impact river health. In addition to land use regulations, other regulatory tools, such as permits and specific codes, also play a role in influencing river health. This section includes some examples of regulations that affect river health, but it is not an exhaustive list.

### Land Use Regulations

Land use regulations that direct a community's growth and development implement community values around public health and wellbeing, environmental protections, and safety by identifying what types of development can occur in different areas of a community, establishing guidelines around building standards, providing provisions to protect natural resources, and protecting areas that are critical to a community's culture.

## IN PRACTICE

### FLOODPLAIN OVERLAY DISTRICT

Jefferson County, CO



Jefferson County, Colorado has a floodplain overlay district determined by floodplain maps approved by the Board of County Commissioners. The overlay district adds additional building requirements and performance standards on development in the district, including requiring new or rehabilitated structures within the floodplain overlay district to be elevated to at least 2 feet above base flood elevation, which is more stringent than minimum requirements set by FEMA.

#### Take Home

To protect public safety and reduce the cost of flood events, Jefferson County approved special regulations within their floodplains that go above the minimal requirements set forward by FEMA. More information about district is discussed in Chapter 3, Hazard Mitigation.

*Jefferson County. 2022. Zoning Resolution. Section 37 – Floodplain Overlay District. Amended June 28, 2022.*

## Zoning

Zoning is a particular type of land use regulation focused on what types of development and land use can occur in which areas of the city. Zoning regulations most commonly designate areas for housing, commercial, industry, or mixed uses, and they also identify special use districts for things like schools, historic sites, or open space. Within each of those categories, zoning dictates acceptable types of land use and building specifications such as lot size, building height, and density. Zoning regulations can also include stipulations that have implications for floodplains and environmental health. Overlay districts, such as floodplain overlay zones, are a particular type of zoning that adds additional protections to a particular geographic area to help further guide development. They are often used to create additional environmental protection around sensitive areas, for example to restrict building on steep hillsides or alongside river corridors. Zoning regulations may also include restrictions around developments within a certain proximity to floodplains and environmentally sensitive areas, a type of regulation referred to as setbacks or buffers.

## Other Land Use Regulations

Some communities, especially larger towns and cities, have other land use regulations in addition to zoning. These types of regulations focus on a particular topic such as a specific area, buildings, public safety, historical or cultural preservation, or environmental protections. For example, while zoning might dictate what types of buildings can be built in different areas in the city, a building code might dictate construction standards. Land use regulations can include guidance around subdivisions, annexation, impact fees, public hearing processes, and permitting requirements. Floodplain management regulations, covered in Chapter 3, Hazard Mitigation, are especially critical for IRM. DOLA has resources for communities with further information about all types of land use regulations and codes, including template codes for counties and municipalities. Their Land Development Code Best Practices Guidebook, published in November of 2024, is an exceptionally helpful guide for Colorado communities.

# COMMON TYPES OF REGULATIONS

- Natural resource protection codes
- Subdivision controls
- Zoning use restrictions and overlays
- 1041 permits
- Impervious surface ratios
- Open space dedication
- Revegetation requirements
- Spill prevention and control
- Transferable development rights (TDR)
- Special use permits
- Building permits
- Lot size minimums or maximums
- Slope restrictions
- Erosion or sediment control
- Waterbody setbacks
- Floodplain and fluvial hazard zone protections
- Watershed protection (extraterritorial for municipalities)
- Incentives for watershed protection

*Modified from Jarvis Watershed Workshop PPT 2024. Some of these are covered in the incentives and funding section below.*



## Other Regulations

Beyond land use regulations, communities can enact other types of regulations that influence river health and watershed protection. Because communities in Colorado have autonomy in local legislation, these are not a standard or uniform set of rules, regulations, policies, or guidelines, but there are some common examples. Natural resource or wetland protection codes explicitly focus on protecting or restoring natural resources. They do this by requiring particular plantings or restricting activities such as filling or draining wetlands. Water quality and stormwater management codes protect water resources from pollution and control runoff that flows into rivers. They restrict chemical use, control erosion from construction projects, require green infrastructure, or encourage water conservation. For more information, see Chapter 4, Water Resources Management and Chapter 5, River Health.



## IN PRACTICE

### UNCOMPAHGRE RIVER BUFFER OVERLAY DISTRICT

Ridgway, CO



The Town of Ridgway's 2011 Land Use Plan Update recognized the value of the Uncompahgre River to the community, outlined a desire to reconnect the river, and included a goal to "preserve, restore, and re-engage the Uncompahgre River to strengthen the riparian corridor as an asset to the community." In response to the Plan, the town council updated its zoning code to create the Uncompahgre River Overlay District (UROD). The ordinance creating the district outlined the purpose of the UROD is to, "implement goals, policies, and action items in the Town of Ridgway's Land Use Plan; preserve, improve, and protect the river corridor as a Town amenity; regulate buildings and structures to maximize access to the Uncompahgre River and view corridors along the Uncompahgre River; utilize design and development techniques that avoid, minimize, and mitigate impacts to the natural environment; and ensure aesthetic and ecological qualities of the river corridor continue to be a community asset." (p. 4)

#### Take Home

Ridgway's ordinance demonstrates how recognizing the value of a river in a plan can translate into action on the ground. The town changed its zoning code to recognize the UROD so all future activity, development, and renovation are subject to its stipulations, providing strong protection for the river corridor.

*Town of Ridgway Ordinance 18-01. 2018.*



## HOW TO USE REGULATIONS AS A RIVER SMART COMMUNITY



Regulations, in particular zoning and environmental standards, can be critical tools for IRM. Different regulations can target each of the healthy river functions and, in many cases, they can address more than one (see Table 2 below).

Communities can use various regulations to help rivers maintain **natural streamflow and water balance**. Especially within more urban developed areas, regulations can help restrict development along river corridors and in flood-prone areas, leaving room for rivers to retain runoff during higher flows and move dynamically over time. While many communities use the FEMA flood maps to determine their flood-prone areas, there may be opportunities for communities to further reduce their flood risk and protect river health with additional protections (for more information on flood risk, see Chapter 3, Hazard Mitigation). Communities have several regulatory levers to steer development out of river

corridors that are not otherwise protected. Setbacks or buffer regulations are one of the most common tools, but communities can also use overlay districts, floodplain overlays, watershed protection ordinances, or annexations. Preserving riparian land from development also protects habitat and ecosystem health, stabilizes riverbanks, and minimizes erosion. Regulations can also designate key riparian areas for multiple uses such as open space or recreation which have added public health benefits.

Regulations such as water quality and stormwater management codes help communities maintain **high-quality surface water and groundwater**. They can regulate effluent pollution standards for wastewater or industrial outfalls. Standards that require or incentivize green infrastructure — an approach to water management that protects, restores, or mimics the natural water cycle — can help reduce pollutants in runoff while also controlling flows during periods of heavy precipitation.

Communities can use regulations such as overlay districts, natural resource protection codes, or sensitive area protection standards to help protect **diverse biological communities** focusing on creating healthy ecosystems by guiding plantings or setting guidelines for key species that support river health. These regulations will help protect **dynamic sediment processes and quality soils**, as will regulations that consider erosion and sediment flow, such as restrictions on building on steep slopes.

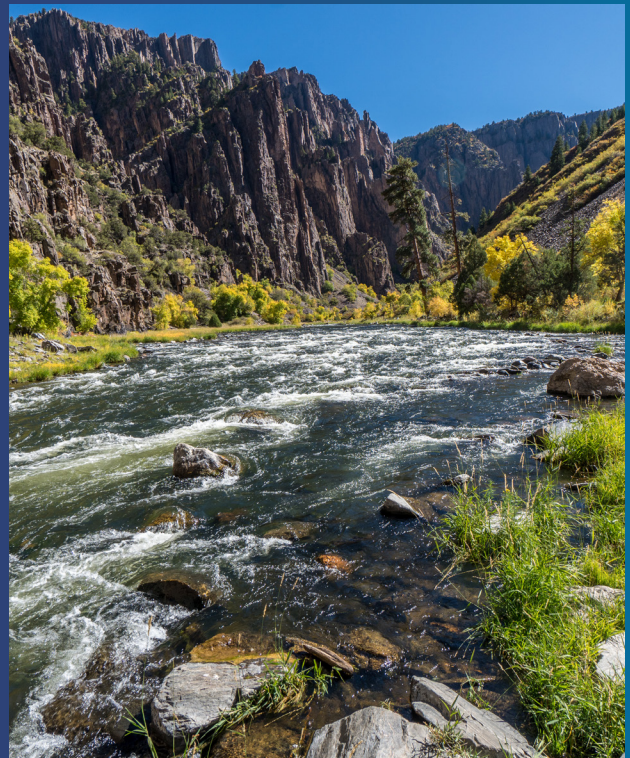






TABLE 2.2. EXAMPLES OF SPECIFIC COMMUNITY REGULATIONS THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF REGULATIONS
 <b>Natural streamflow and water balance</b>	Overlay districts, setbacks, slope restrictions, transfer of development rights, erosion or sediment control, floodplain or watershed ordinances, subdivisions, annexations, instream flows, National Flood Insurance Program
 <b>High-quality surface water and groundwater</b>	Water quality, stormwater management, green infrastructure and streets, maximum impervious surface ratios, spill prevention and control, slope restrictions
 <b>Diverse biological community</b>	Natural resource protection codes, open space dedication, revegetation requirements, watershed protection, sensitive area protection standards, landscaping and native planting codes, water conservation codes, instream flows, Restrictions on planting of invasive species
 <b>Dynamic sediment processes and quality soils</b>	Open space dedication, revegetation requirements, slope restrictions, erosion or sediment control

## IN PRACTICE

### WATERSHED PROTECTION ORDINANCE

Grand Junction, CO



In 2006, the City of Grand Junction passed a Watershed Protection Ordinance (No. 3961) that restricts actions that may compromise water quality in the city's main watersheds. It covers anything that may create a substantial risk of pollution or injury to the City's water supply or waterworks, including "the lands from under, or across, or through which the water flows or is gathered." The ordinance stipulates that, "no land use activity shall be permitted in any primary watershed which creates a substantial risk of pollution or injury to the City's water supply or waterworks except in compliance with the provisions of this ordinance." The ordinance includes a definition of the designated watersheds.

#### Take Home

Grand Junction has ensured additional water quality protection through a focused ordinance, clearly defining the scope and type of geographic areas included.

*City of Grand Junction Ordinance No. 3961.*



# REGULATIONS RESOURCES

The following list is a summary of key resources that provides further information on the regulatory information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

Jarvis, T. 2023. Approaches to local regulation for protecting stream corridors, riparian areas, wetlands, floodplains, and waterbody buffers. Memo to Brian Murphy, River Network, from Sullivan Green Seavy, LLC. June 19.

State of Colorado. Department of Local Affairs. Division of Local Government. Land Use Codes.

Planning for Hazards: Land Use Solutions for Colorado. Models and Commentary.

State of Colorado. Department of Natural Resources. Colorado Water Conservation Board. Fluvial Hazard Zone Overlay District Model Ordinance.

Legislative Council Staff. 2018. Colorado Local Government Handbook. Research Publication No. 719.

Jefferson County, Colorado. Zoning Resolution. Section 37 – Floodplain Overlay District. Amended June 28, 2022.

Grand Junction, Colorado. Watershed Protection Ordinance.

Town of Ridgway, Colorado. Ordinance 18-01. 2018.

Routt County, Colorado. Unified Development Code (UDC). Adopted June 11, 2024.

# IN PRACTICE

## SETBACKS

Routt County, CO



Routt County updated its Unified Development Code (UDC) in the beginning of 2024 and included a modification of its setback requirements (Section 3.31). The revised UDC created a new variable outer setback for parcels around particularly sensitive waterbodies, including the Yampa and Elk Rivers, and other named creeks. The variable outer setback is between 100 and 300 feet above the Ordinary High-Water Mark, depending on site-specific factors such as slope, bank conditions, soil type, and critical habitat areas. Site-specific setbacks requirements are determined using existing maps. The County arrived at the proposed setback changes after frequent public engagement and consultation with key river stakeholder groups including the Friends of the Yampa River, the Yampa Valley Sustainability Council, and River Network.

### Take Home

Routt County's variable setback code creates more room for rivers to flow during periods of high flow, meander naturally overtime, and protect infrastructure from inundation and debris flow, while accounting for parcel-specific conditions and the organic conditions along the river corridor.

*Routt County Unified Development Code (UDC).  
Adopted June 11, 2024.*



# INCENTIVES AND FUNDING

Non-regulatory levers are another land use management approach communities can take to meet healthy river goals. On their own, they will not result in a comprehensive approach to river corridor protection, but they are powerful tools when used as part of a broader IRM land use management strategy. They can be particularly useful to address specific issues, such as preserving a parcel of riparian land or establishing a conservation easement. They can also be easier to implement because they do not always require legislative action.

## TYPES OF INCENTIVES AND FUNDING

This section provides a few examples of specific non-regulatory tools that can help communities implement IRM, but it is not an exhaustive list of opportunities. Communities can consider this list

as inspiration of how to think outside planning and regulatory boxes to achieve IRM goals that best align with their circumstances.

### Development Incentives

Communities can offer incentives to developers in exchange for incorporating elements that support river health in their developments. Incentives can include cost-sharing, local code variances, density bonuses, water connection discounts, or TDR. In exchange, developers might engage in river health actions such as preserving riparian land along river corridors, not infilling wetlands, or incorporating green infrastructure.

### Density Bonuses

A density bonus is a particular type of development incentive that communities can offer which allows a zoning density exemption in lieu of something such as conserving or preserving open space.

## IN PRACTICE

### TRANSFERABLE DEVELOPMENT RIGHTS

Summit County, CO



This Summit County program allows developers with rights to sensitive rural land to voluntarily transfer those rights to more urban areas with the goal to “help protect the backcountry character, natural resources ... of the mountains surrounding the more urban areas from residential development.” The Joint Upper Blue TDR program started in 2000 and has been the most successful TDR program in the county, protecting 2,200 acres. High quality wetland areas even within urban areas can qualify as a TDR sending area. As of 2024, the program has protected 14 acres of wetlands.

#### Take Home

The TDR program in Summit County has preserved critical wetland areas from development while generating income for the County to purchase more open space.

*Summit County Government. TDR Program Background homepage.*



For example, a developer who owns a lot of land that is zoned to two-story single-family homes and includes a wetland might leave the wetland untouched in exchange for being able to build three-story homes or duplexes. Title 30 of the C.R.S. stipulates that local county land use codes should include development incentives that allow developers to comply with county goals to “preserve open space, protect wildlife habitat and critical areas, and enhance and maintain the rural character of lands with contiguity to agricultural lands suitable for long-range farming and ranching operations” (C.R.S. § 30-28-401).

## Land Acquisitions

Another tool communities can use to conserve or preserve sensitive areas of land is to acquire the land. Communities can purchase land using innovative funding or financing opportunities including federal or state grants, green or climate bonds, or by creating special tax districts. Communities can also partner with private organizations to purchase land. This can be done

through private financing, public-private partnerships, or creating special tax incentives. Another option is partnering with a private organization to purchase land which does not require a community to use public funds. Community Land Trusts are non-profits that focus on acquiring land for a particular purpose.

## Conservation Easements

Another way to preserve sensitive areas of land without an outright purchase is through conservation easements in which private landowners enter into a voluntary legal agreement to conserve land from certain types of development in perpetuity. The original landowner maintains possession of the land but often enters into the agreement in exchange for something, such as a zoning exemption, land exchange, or tax benefits. In some cases, conservation easements are used to encourage sustainable agriculture practices. Conservation easements are an innovative solution for communities to preserve sensitive areas of land without having to purchase them outright.

# IN PRACTICE

## CONSERVATION EASEMENT

Emma Open Space, Roaring Fork River, Pitkin County, CO



In 2000, a group of partners came together to purchase a conservation easement on 73 acres of land near Basalt, Colorado, known as the Emma Open Space. The Roaring Fork Conservancy acquired 58 of the acres in a conservation easement, and the Town of Basalt holds a conservation easement for 12.5 acres on the historic Emma townsite. Emma Open Space was created in a partnership that included Pitkin County Open Space and Trails, Great Outdoors Colorado, Eagle County, Colorado Parks and Wildlife, and the Town of Basalt. The easement protected 2,000 feet of riverfront along the Roaring Fork River and helped reestablish wildlife corridors on each side of the river. The land protects historical structures and natural habitats and is also used for agriculture and recreation.

### Take Home

The Emma Open Space conservation easement serves multiple purposes: it creates a riparian zone surrounding the Roaring Fork River, protects a wildlife corridor, establishes fields for agriculture, and preserves the historic Emma Townsite. The easement is an example of how multiple state, local, and non-profit organizations can come together to have a greater impact.

*Pitkin County, Colorado. Emma Open Space Webpage. Roaring Fork Conservancy. Conservation Easements Webpage.*





## HOW TO USE INCENTIVES AND FUNDING AS A RIVER SMART COMMUNITY



Communities can use non-regulatory levers in many of the same ways as regulatory levers to protect river health. These incentives are primarily used to conserve or restore land from development, especially environmentally sensitive areas such as wetlands, floodplains, and riparian areas. Conserving land helps rivers maintain **natural streamflow and water balance** because it creates more space for rivers to accommodate periods of higher flows and move dynamically over time. Conserving land also helps rivers maintain **high-quality surface water and groundwater** because it can naturally filter out pollutants and sediment before runoff reaches the river, as well as prevent uses that could result in chemical spills or nutrient loading. Non-regulatory incentives can also benefit a **diverse biological community** by preserving habitat and maintaining wildlife corridors. Finally, preserving riparian land and not filling in wetlands helps maintain natural **dynamic sediment processes and quality soils** by not interfering with sediment flow and helping preserve soil quality. This can be particularly true with conservation easements that support sustainable agriculture practices.

Incentives that encourage practices such as green infrastructure also help communities meet each healthy river function (Table 3). Green infrastructure can help regulate runoff during heavy precipitation events, which can help rivers maintain **natural streamflow and water balance**. Slowing runoff also helps to filter pollutants, which supports **high-quality surface water and groundwater**. Green infrastructure practices that include plantings can help create **diverse biological communities**, creating habitats for critical species. Green infrastructure can also promote **dynamic sediment processes and quality soils** by capturing sediment and helping to direct precipitation to recharge aquifers rather than running into a stormwater system.

TABLE 2.3. EXAMPLES OF INCENTIVES AND FUNDING THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF INCENTIVES AND FUNDING
 <b>Natural streamflow and water balance</b>	Development incentives, density bonuses, land acquisition, conservation easements
 <b>High-quality surface water and groundwater</b>	Development incentives, land acquisition, conservation easements
 <b>Diverse biological community</b>	Development incentives, density bonuses, land acquisition, conservation easements
 <b>Dynamic sediment processes and quality soils</b>	Development incentives, density bonuses, land acquisition, conservation easements



# INCENTIVES AND FUNDING RESOURCES

The following list is a summary of key incentives and funding resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

Jarvis, T. 2023. Approaches to local regulation for protecting stream corridors, riparian areas, wetlands, floodplains, and waterbody buffers. Memo to Brian Murphy, River Network, from Sullivan Green Seavy, LLC. June 19.

State of Colorado. Department of Local Affairs. Division of Local Government. Land Use.

Planning for Hazards: Land Use Solutions for Colorado. Models and Commentary.

Summit County, Colorado. Transferable Development Rights.

Garfield County, Colorado. Land Use and Development Code. July 15, 2013; amended June 19, 2023.

Pitkin County, Colorado. Emma Open Space.

Roaring Fork Conservancy. Conservation Easements.

## IN PRACTICE

### DENSITY BONUS

Conservation Subdivisions,  
Garfield County, CO

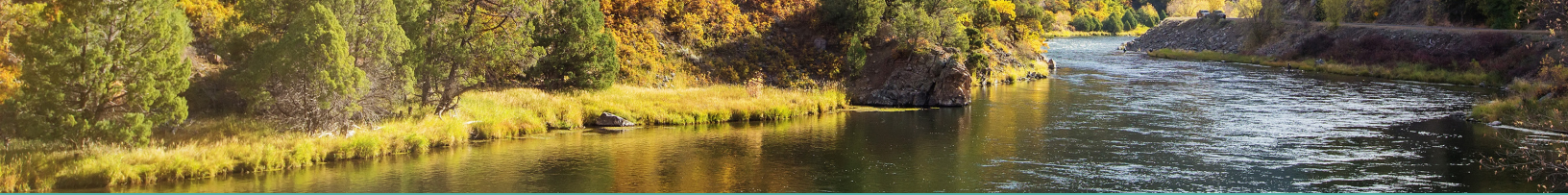


In accordance with C.R.S. 30-28-401, Garfield County's Land Use code includes design specifications for a Conservation Subdivision, which offers development incentives such as reduced lot size and density bonuses in exchange for leaving some of the land undeveloped as open space. The land use code specifies standards for open space that specify, among other preservation specifications, that the open space, "shall be designed to protect and not detract from existing wildlife habitat and natural features of the land, such as steep slopes, riparian areas" (Article 7-501). Other approved open space uses include recreation and agriculture.

### Take Home

Developers in Garfield County have incentives to create subdivisions that preserve open space, which can help communities achieve an IRM goal to preserve riparian land for natural streamflow.

*Garfield County, Colorado. Land Use and Development Code. July 15, 2013; amended June 19, 2023.*



# HOW RIVER SMART COMMUNITIES CAN USE LAND USE MANAGEMENT TO SUPPORT IRM

Land use management can achieve multiple IRM goals, from creating a common vision around river health to integrating river health practices in on-the-ground projects. Plans, especially an IRM plan, can articulate a community's common vision for a healthy river corridor and offer opportunities to involve key stakeholders and the public in that visioning process. Plans can also create an opportunity for ongoing community and stakeholder engagement by laying out a roadmap for how a community wants to implement its IRM vision. Plans lay the foundation for embedding IRM in a community. Communities can then use regulations and non-regulatory incentives to implement IRM visions and roadmaps articulated in land use plans. Regulations and non-regulatory incentives drive the on-the-ground projects that can benefit (or harm) river health. They are especially critical when thinking about how to conserve, preserve, or restore land or restrict harmful practices. By creating regulatory standards that integrate IRM, communities can ensure river health is considered in development decisions.

River Smart Communities in Colorado can choose from a variety of local land use management tools to achieve their IRM goals. Crafting a common vision for a healthy river and embedding it in existing plans like comprehensive plans is a good place to start. Communities can also go a step further and create a separate IRM plan that defines a collective and targeted approach to achieving their river smart goals. Incorporating practices that help a community meet their IRM goals in regulations will help ensure they are implemented consistently. River Smart regulations also create a consistent regulatory environment which can reduce confusion among landowners and developers and create long-lasting changes that can withstand administration turnovers. Incentives and funding opportunities allow communities to implement IRM goals in a more creative and flexible way, especially when targeting a specific critical location.

Table 2.4 Summarizes the different approaches covered in this chapter and how they can help a community achieve healthy river functions. Because not every community is the same, there is a toolbox of options that communities can use to become a River Smart Community.

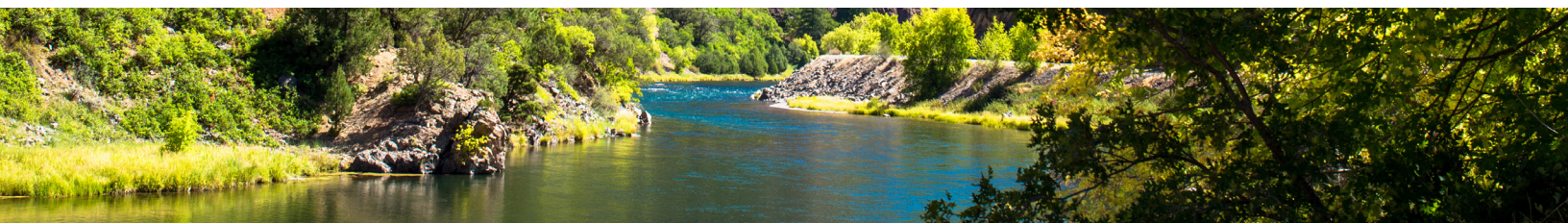






TABLE 2.4. SUMMARY OF SPECIFIC COMMUNITY PLANS, REGULATIONS, INCENTIVES, AND FUNDING THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

	EXAMPLES OF PLANS	EXAMPLES OF REGULATIONS	EXAMPLES OF INCENTIVES AND FUNDING
	<b>Natural streamflow and water balance</b>		
	Hazard mitigation Parks and Open Space Transportation Integrated Water Management Plan Stream management	Overlay districts Setbacks Slope restrictions Transfer of development rights Erosion or sediment control Floodplain or watershed ordinances Subdivisions Annexations Instream flows National Flood Insurance Program	Development incentives Density bonuses Land acquisition Conservation easements
	<b>High-quality surface water and groundwater</b>		
	Water quality ("208 Plans") Stormwater management Public health Stream management	Water quality Stormwater management Green infrastructure and streets Impervious surface ratios Spill prevention and control Slope restrictions	Development incentives Green infrastructure Land acquisition Conservation easements
	<b>Diverse biological community</b>		
	Parks and Open Space Water quality Stream management	Natural resource protection codes Open space dedication Revegetation requirements Watershed protection Sensitive area protection standards Landscaping and native planting codes Water conservation codes Instream flows	Development incentives Density bonuses Land acquisition Conservation easements
	<b>Dynamic sediment processes, quality bed sediment and floodplain soils</b>		
	Water quality Transportation Stream management	Open space dedication Revegetation requirements Slope restrictions Erosion or sediment control	Development incentives Density bonuses Land acquisition Conservation easements





# HAZARD MITIGATION







# INTRODUCTION

Local communities face a range of natural hazards that can destroy life, property, and the environment. Hazard mitigation<sup>1</sup> helps communities understand their potential risks to different hazards and identify ways to mitigate against potential impacts from those hazards if they occur. While communities cannot necessarily prevent natural hazards, such as heavy rain events, they can take actions to minimize their impacts. Hazard mitigation traditionally involves a formalized planning process that is closely linked to Emergency Services yet is typically separate from land use planning, river health considerations, or water resources improvements. Hazard mitigation and river corridor management are closely related but have historically offered distinct approaches to managing risks and promoting resilience in areas surrounding rivers. Integrated River Management (IRM) provides an opportunity for communities to align hazard mitigation and river management and capitalize on shared goals.

This chapter includes an overview of federal and state hazard mitigation resources to support communities who want to integrate river management in hazard mitigation planning and vice versa. There are also in-practice highlights from communities to provide examples and spark ideas.



<sup>1</sup> Traditional hazard mitigation planning includes hazards such as pandemic outbreaks or cyberattacks, but for the purposes of this chapter we are only focusing on natural hazard mitigation.



# NATURAL HAZARDS AND RIVER HEALTH

Natural hazards and river health are deeply intertwined, influencing each other in complex ways. Whereas floods, wildfires, severe storms, landslides, droughts, and extreme heat can damage river ecosystems, healthy rivers can act as natural buffers against these hazards. For example, a healthy floodplain can absorb floodwaters, reducing property damage and protecting downstream communities. A well-vegetated riparian corridor stabilizes streambanks which reduce the impacts of drought by minimizing erosion, protecting water quality, maintaining soil structure and health, and improving water retention. A well-vegetated riparian corridor also reduces extreme heat impacts by providing shade which stabilizes water temperatures, reducing impacts to water quality and river ecology.

On the other hand, many actions taken to mitigate against the impacts from natural hazards can inadvertently harm rivers. Channelizing streams to control floods can disconnect rivers from their floodplains, disrupting natural processes and harming aquatic life. Similarly, building dams for flood control can alter flow regimes and sediment transport, impacting downstream ecosystems.

Recognizing these interconnections is crucial for developing integrated strategies that promote both natural hazard resilience and river health. By understanding how these systems interact, communities can break down management silos, identify synergies, and leverage resources to achieve multiple benefits. For instance, restoring wetlands and reconnecting floodplains can not only enhance flood protection but also improve water quality, provide wildlife habitat, and create recreational opportunities.

## Flooding, Debris Flow, and Fluvial Hazards

When it comes to natural hazards and river health, flooding is likely the first hazard that comes to mind. Floods damage both built and natural environments. Periods of heavy rain can increase river flows and saturate soils, causing water to spread beyond the river channel and inundate surrounding low-lying areas. The heavy management of rivers over the last century, including confining rivers and armoring riverbanks, has disconnected channels from their floodplains and compromised their natural ability to attenuate floods.

Colorado's unique geography adds additional hazards to flood risk for many local communities. Streams and rivers in Colorado's mountains wind through narrow valleys with steep slopes on either side. Heavy rains on this type of landscape can translate to rapid flows that accelerate very quickly in these narrow rivers because the water does not have a lot of room to spread out. Additionally, heavy rains that fall on steep slopes can flush heavy loads of debris including sediment, rock, and trees into the river. This is especially true in the years following a wildfire when the burned soil is not able to absorb as much water and vegetation is not present to hold back hillside erosion. These fluvial hazards result in deposition and debris flow which can block the river channel and cause substantial erosion of channel beds or banks, undermining their stability and dramatically altering the path of the river. At times, these changes happen suddenly, with little warning. Further downstream, where riverbeds flatten out and floodwater slows down, the deposition of this debris can cause floodwater to spread well outside of traditional flood channels. These rapid changes to the river and riparian areas can cause flash flooding, one of the most dangerous



hazards to public safety, and result in major damage to ecosystems and built infrastructure in the path of the hazards. Much of the damage to Colorado's ecosystems and communities during major flooding events is caused by these dynamic fluvial processes. Both the legacy of traditional flood control practices and extensive development in floodplains have altered flood behavior and increased the risks to public safety and devastating economic impacts from flooding.

Rivers have evolved to absorb these disturbances and healthy river ecosystems can have a direct role in reducing hazards to humans. A river that functions with **natural streamflow and water balance** where riparian areas are protected from development is better able to accommodate high flows by distributing water over a larger area. Rivers that meander naturally through bends and curves slow the flow of water by increasing the distance water must flow and the friction it encounters as it does. Rivers that are not constrained to a particular channel can better absorb high flows and shift their channels to accommodate fluvial hazards, which in turn helps protect **dynamic sediment processes and quality soils**. Other River Smart Community practices such as promoting green infrastructure in built environments further reduces flood risk during heavy precipitation events.



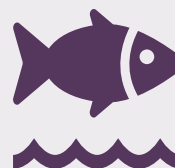
## Wildfire

Wildfires can affect river health directly and indirectly (see Figure 3.1). When wildfires burn across or near rivers, ash and burned materials containing chemicals, toxins, and nutrients (including nitrogen or phosphorus) are introduced to the river. Heat from wildfire can also increase water temperatures. These impacts degrade water quality and the river's ecosystem.

Indirectly, wildfires can exacerbate sediment

and debris flows into rivers, especially when rain falls on burned slopes where the soil is not capable of absorbing the water as a vegetated slope would. The result is dramatic increases in erosion, sediment, and runoff into waterways. This further degrades water quality which compromises ecosystem health and impacts municipal water treatment systems (for more on municipal treatment systems, see Chapter 4, Water Resources Management). Additionally, when riparian vegetation is burned, the river loses shade which helps regulate water temperature and key ecosystem elements that provide food and shelter for aquatic and riparian species.

Healthy rivers that have **high-quality surface and groundwater** will be better able to cope with stressors including wildfire-related sedimentation, nutrient, and chemical loads. Healthy rivers are also likely to recover more quickly following a wildfire. River ecosystems with **diverse biological communities** can also reduce impacts of wildfires on river health. For example, wetland areas can serve as natural fire breaks and help filter and disperse nutrients before they reach the main river channel.



## Droughts and Extreme Heat

River health can also be impacted by drought or extreme heat which can reduce water supplies, decrease flows, and increase water temperatures. Decreased water availability and increased water temperatures reduce water quality and strain ecosystems. For example, the oxygen content and nutrient load in rivers can increase with low flows. These hazards are slower to materialize and can result in more gradual impacts than specific hazard events like flooding or wildfires. As such, they often do not get the same attention or visibility as other

extreme events, but they can be just as destructive.

Healthy river corridors can help reduce some of these impacts from droughts and extreme heat. Rivers with **high-quality surface and groundwater** and **diverse biological communities** will be more resilient to extremes in water supplies. When rivers have stable baseline levels of oxygen and nutrients, they are more likely to absorb fluctuations from low flows and hotter temperatures. Healthy riparian habitats with trees shade the river and control water temperatures.

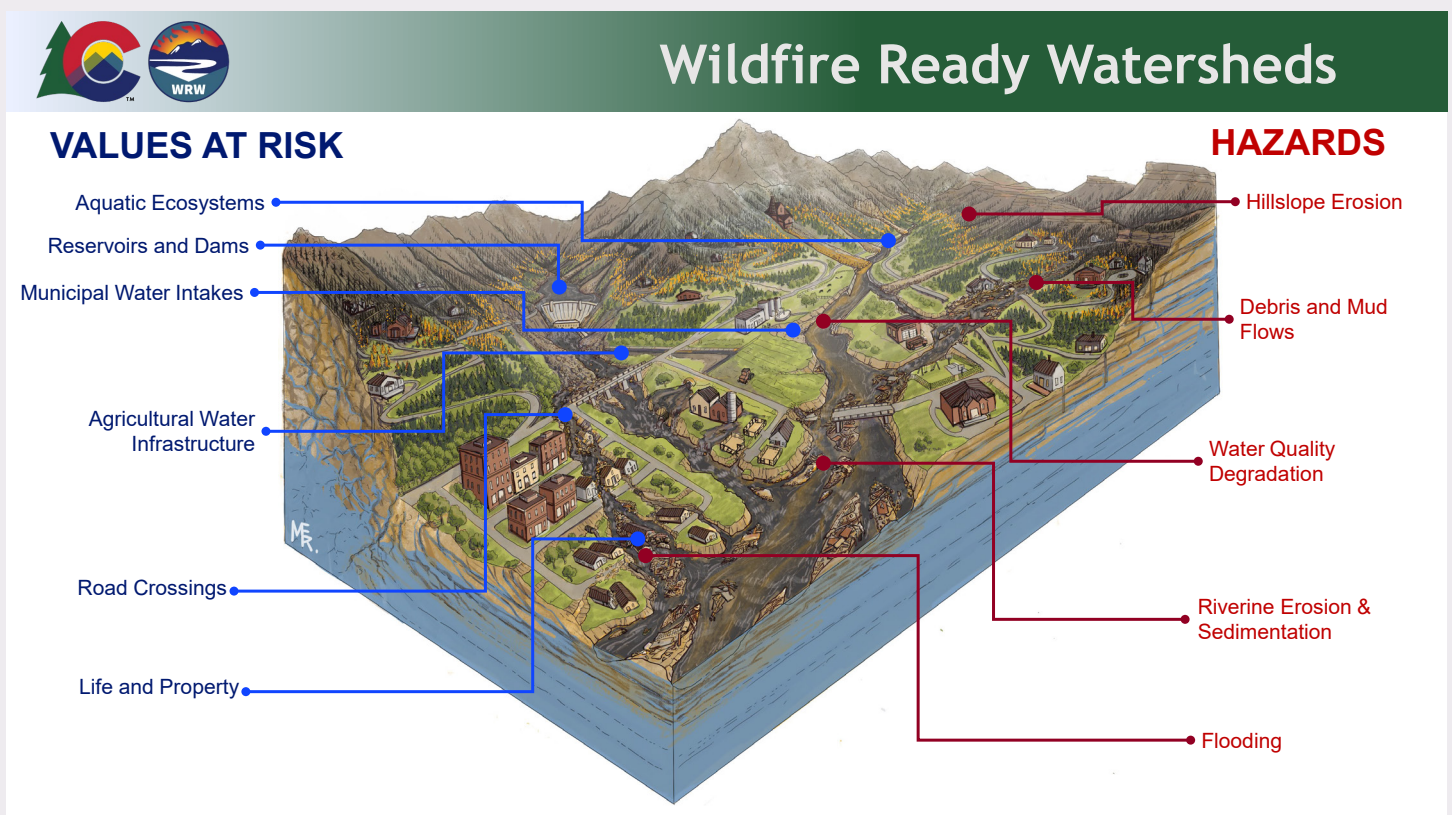


Figure 3.1. This figure, from CWCB's Wildfire Ready Watersheds program, illustrates the direct and indirect impacts wildfires can have on watersheds. The hazards illustrate specific examples of how a wildfire can compromise river health and the values at risk illustrate examples of consequences that can occur as a result of wildfires and post-wildfire hazards.

# COMMUNITIES AND HAZARD MITIGATION

Communities, including both counties and cities, often bear the brunt of natural hazards. Communities are responsible for producing their own local natural hazard mitigation plans. As part of the planning process, they assess specific risks and set mitigation priorities based on their unique hazard profiles, regulatory frameworks, economic assets, and critical lifelines affected and environmental conditions. When a disaster occurs, local responders are the first on the ground helping evacuate people, assessing damage, and beginning to identify recovery solutions. However, preparing

for and recovering from natural hazards can easily outstrip local budgets.

Fortunately, federal and state agencies offer several resources to help support communities. Federal agencies offer high-level resources and funding opportunities for hazard mitigation planning and post-disaster recovery. State agencies provide more localized information and resources, sometimes going beyond the federal guidance, and can act as an intermediary between federal and local governments. States also produce state-level hazard mitigation plans. Communities can use federal and state resources to produce their local natural hazard planning, including assessing their vulnerabilities and risks and identifying local mitigation priorities.

## KEY PARTNERS

Communities can most effectively integrate IRM in hazard mitigation when key partners work together, such as:

**General hazard mitigation partner categories**

- City and county emergency management or hazard mitigation agencies
- City and county land use officials
- Floodplain managers
- Open space and parks and recreation departments
- Planning departments
- Transportation departments
- Watershed groups

**Examples of hazard mitigation partners for Colorado communities**

- Association of State Floodplain Managers (ASFPM)
- Bureau of Land Management (BLM)
- Colorado Association of Stormwater and Floodplain Managers (CASFM)
- Colorado Department of Local Affairs (DOLA)
- Colorado Division of Homeland Security and Emergency Management (DHSEM)
- Colorado Water Conservation Board (CWCB)
- Federal Emergency Management Agency (FEMA) Region 8 (Colorado, Utah, & Wyoming) and 6 (New Mexico)
- HUD
- National Integrated Drought Information System (NIDIS)
- National Oceanic and Atmospheric Administration (NOAA)
- National Resources Conservation Service (NRCS)
- United States Army Corps of Engineers (USACE)
- United States Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)
- United States Housing and Urban Development Authority (HUD)



These resources can help communities strengthen the connection between hazard mitigation and river management by identifying common goals and opportunities to protect river corridors and reduce hazard impacts. This collaboration helps leverage shared resources, improve efficiency, and ensure that hazard mitigation actions do not unintentionally harm river health. These communities can also share engagement and feedback creating efficiencies and reducing engagement fatigue.

Because every community has a unique hazard, regulatory, and environmental context, not all aspects of integrating hazard mitigation planning and river management will work everywhere. Communities can work with their key partners to identify how to best integrate hazard mitigation into the other sectors, and what resources make the most sense for their context.

The following sections look at the regulatory context, planning resources, and funding opportunities available for communities looking to integrate river management and hazard mitigation. Each section covers federal and Colorado-specific resources. For purposes of organization and discussion these resources are separated, although in practice there is a good deal of overlap both between regulations, planning and funding, as well as between Federal and state resources.







# HAZARD MITIGATION REGULATIONS

Federal regulations, especially those provided by FEMA, set the legislative baseline for hazard mitigation planning, and Colorado supplements those regulations with additional requirements tailored to the state. In some cases, local governments set even higher floodplain management standards. In cases where the state or local government regulations go beyond what is required by federal agencies, as with Colorado's floodplain standards, Colorado communities must comply with the highest standard.

In Colorado, the CWCB is mandated in the state statutes to write and adopt the state floodplain regulations, assist in floodplain management,

drought planning, and water-related hazard mitigation, including supporting state-wide water-related risk mapping. Rivers in mountainous landscapes, such as Colorado, evolve as highly dynamic and active systems. Species associated with these systems are dependent on frequent disturbances (such as spring flooding) and migrating river channels. Therefore, many of the dynamic, natural river processes that have caused considerable damage during Colorado's historic flood events are not well-captured or anticipated by the hydrologic and hydraulic models (commonly referred to as "H&H models") that underpin FEMA's floodplain maps.

## REGULATORY CONTEXT

### Federal

Local Mitigation Planning Policy Guide (FP 206-21-0002), effective April 19, 2023. Office of Management and Budget Collection #1660-0062.

National Flood Insurance Program (NFIP) standards (44 Code of Federal Regulations [C.F.R.] § 60.3-60.5) sets forth the minimal standards for communities to participate in NFIP (note: Colorado communities much adhere to these plus the Rules and Regulations for Regulatory Floodplains in Colorado)

Disaster Mitigation Act of 2000 (44 C.F.R. Part 201) articulates that communities must comply with FEMA-approved hazard mitigation planning requirements to be eligible for certain types of federal disaster funding.

### Colorado

Colorado Disaster Emergency Act (Colorado Revised Statutes [C.R.S.] § 24-33.5-701) details the state regulations around emergency management, hazard mitigation, preparedness, response, and recovery.

Land Use Planning Act, including Floodplain Management Regulations (C.R.S. § 24-65.1) establishes floodplains and geologic hazard areas for which communities must adopt regulations and encourages communities to integrate hazard mitigation into local land use planning. This statute is tied to the state's participation in NFIP.

Rules and Regulations for Regulatory Floodplains in Colorado (2 Code of Colorado Regulations [C.C.R.] § 408-1) sets the state's floodplain standards and requires each community in Colorado to comply with the minimum floodplain criteria set forth in the FEMA regulation "Criteria for Land Management and Use," 44 C.F.R. § 60 C.R.S.

C.R.S. § 37-60-106 directs the Colorado Water Conservation Board to assist in water-related hazard mitigation.



# HAZARD MITIGATION PLANNING

Federal and state agencies offer programs, resources, and funding opportunities that help communities in all stages of the hazard mitigation planning process. This section broadly covers federal resources first and then dives into resources offered by the State of Colorado. While these resources are divided accordingly for discussion purposes here, many are linked, such as FEMA and the Colorado Office of Emergency Management in DHSEM. Communities in Colorado can begin with the Colorado planning resources, although it is important to understand the federal landscape of available resources as well, as some federal resources are offered directly to communities.

## FEDERAL PLANNING RESOURCES

Several federal agencies provide resources and tools to help with all elements of natural hazard planning. Understanding federal resources can help communities navigate and supplement state-level planning resources. Communities can also use them to leverage planning efficiencies when integrating hazard mitigation and river corridor management.

The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

## IN PRACTICE

### FLOODPLAIN MANAGEMENT STEERING COMMITTEE (FMSC) OF THE HMP UPDATE PROCESS

Larimer County, CO



As part of Larimer County’s 2021 HMP update process, the County formed an FMSC to focus specifically on floodplain related issues in the hazard mitigation planning process. The FMSC was a subgroup of the All-Hazards Planning Team so their work was closely aligned throughout the entire hazard mitigation planning process. The team included staff from multiple departments from communities within the County that participate in the CRS, other stakeholders, and members of the public.

#### Take Home

Having a dedicated, cross-departmental, floodplain-focused team as part of your hazard mitigation planning process can ensure your community integrates IRM principles into the HMP. This can help prioritize projects that are beneficial for river health and also reduce natural hazard impacts. These individuals can also help integrate aspects of the HMP into other planning and implementation efforts, helping build a robust River Smart Community.

*Larimer County Multi-Jurisdictional Hazard Mitigation Plan Update. FEMA Review. May 2021.*



## FEMA

FEMA provides the protocol for hazard mitigation planning and sets the baseline standards for flood regulations. To help communities meet or exceed these standards, FEMA offers several resources; some of the most common ones are profiled below. For more information on any of these programs, communities can consult FEMA's website, contact the FEMA Region 8 office, or Colorado's Division of Homeland Security and Emergency Management (see Colorado planning resources).

### Hazard Mitigation Plans (HMP)

Communities who wish to qualify for FEMA funding and incentive programs must complete a FEMA-approved Hazard Mitigation Plan (HMP) following FEMA's protocols. FEMA's hazard mitigation planning process includes four steps:

1. Organize the planning process and resources,
2. Assess risks and capabilities,
3. Develop a mitigation strategy, and
4. Adopt and implement the plan.

Throughout these four steps, communities determine the planning area, build a planning team, develop an outreach strategy, perform a risk assessment (identifying potential hazards, their likelihoods, and potential impacts), develop a mitigation strategy, adopt and monitor the plan, and update it every 5 years. HMPs then drive hazard mitigation programs and projects in a community. They are a critical and necessary step for accessing federal pre- and post-disaster grants (see the FEMA Hazard Mitigation Assistance [HMA] and Hazard Mitigation Grant Program [HMGP] resources in the Implementing Hazard Mitigation Actions section). The content FEMA requires in a HMP is highly prescriptive, but FEMA provides extensive guidance around creating HMPs and updating plans. Despite this type of planning, hazard mitigation is often reactive — centered on how to respond once a hazard occurs — but communities can also engage in proactive planning, identifying actions that can help mitigate impacts before hazards occur.

## National Flood Insurance Program

The NFIP is a voluntary program communities join in exchange for access to federally backed flood insurance and post-flood recovery funds. To participate in the NFIP, communities must adopt and enforce floodplain management regulations as defined in Chapter 44 of the C.F.R. The regulations must stipulate how a community will manage high-risk flood areas through mechanisms such as land use regulations and building codes. Land use regulations might include ordinances that restrict or prohibit development in high-risk areas, and building codes might require builders to elevate structures a certain number of feet above the base flood elevation (BFE) in high-risk zones. The NFIP also requires communities to keep development records in high-risk areas and assign a Floodplain Administrator. States may also have their own floodplain standards. If they are more stringent than FEMA's, then communities must also meet the state standards to qualify for NFIP.

To help communities navigate NFIP, every state has a NFIP coordinator that communities can use as their point of contact for guidance regarding NFIP compliance in their state. Many NFIP coordinators have model floodplain management ordinance language communities can use.



# FEMA FLOOD-RELATED KEY TERMS

For other key terms, see the supplemental information. Unless otherwise noted, these terms come from Colorado Department of Natural Resources Rules and Regulations for Regulatory Floodplains in Colorado (2 C.C.R. § 408-1).

## 100-year flood (also: Base Flood, 1-Percent-Annual-Chance-Flood, 1-Percent Annual Exceedance Probability [AEP] flood)

“A Flood having a recurrence interval that has a 1-percent-annual-chance of being equaled or exceeded during any given year (1-percent-annual-chance-Flood). For the purpose of these Rules, the terms “100-Year-Flood” “1-percent-annual-chance Flood,” and “base flood,” are synonymous. The term does not imply that the Flood will necessarily happen once every one hundred years.”

## 100-year floodplain (also: Regulatory Floodplain and SFHA)

“The area of land susceptible to being inundated as a result of the occurrence of a 100-Year-Flood. 100-Year-Floodplains are considered to be areas of high Flood hazard. For the purposes of these Rules, the terms “100-Year-Floodplain,” are synonymous.”

## Base Flood Elevation (BFE)

“The elevation shown on a FEMA FIRM for Zones AE, AH, A1-A30, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO, V1-V30, and VE that indicates the water surface elevation resulting from a Flood that has a 1-percent-annual-chance of equaling or exceeding that level in any given year.”

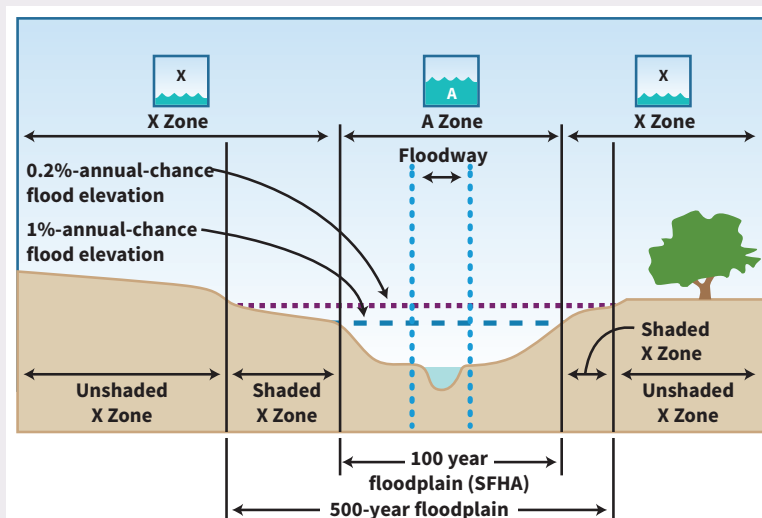


Figure 3.2. Cross-section illustration of FEMA flood-related terms<sup>3</sup>

## Federal Insurance Rate Maps<sup>1</sup>

FEMA primarily uses flood risk maps called Federal Insurance Rate Maps (FIRMs) to determine high-risk flood zones for communities<sup>2</sup> (see the FEMA Flood-related Key Terms box for definitions). High-risk areas are known as Special Flood Hazard Areas (SFHAs) and include zones:

- A – areas with a 1% AEP but no determined BFEs
- AE – areas with a 1% AEP and determined BFEs
- AH – areas with a 1% AEP of shallow flooding (usually 1 to 3 feet) and determined BFEs
- AO – areas with a 1% AEP of shallow flooding but no determined BFEs
- AR – areas that used to be protected by a levee but are no longer
- A99 – areas protected by a flood control project under construction

Lower-risk zones also determined by a FIRM include:

- X (shaded) – areas with a 0.2% AEP
- X (unshaded) – areas with minimal flood risk
- D – undetermined flood risk

FEMA houses FIRMs and other flood hazard data in its Map Service Center online portal.

<sup>1</sup> FEMA. 2023. *FEMA Acronyms, Abbreviations and Terms. A capability Assurance Job and Field Aid.* July.

<sup>2</sup> In some cases, FEMA may also use other resources such as the National Flood Hazard Layer or flood hazard data to determine floodplain boundaries.

<sup>3</sup> Bennett, J. and A. Reeder. 2024. *Building Designer's Guide to Calculating Flood Loads Using ASCE 7-22 Supplement 2.* 10.13140/RG.2.2.31105.47203.



## Floodplain Mapping

Communities can work with FEMA to revise their flood maps if they feel they do not accurately reflect their flood risk or if new technology, data, or information is available. In these cases, communities can request a map amendment or a map revision (called a Letter of Map Revision, or LOMR). FIRMs are created or updated through a process called Risk Mapping, Assessment, and Planning (Risk MAP). Risk MAP is a four-phase process that communities can undertake with FEMA to produce updated FIRMs. In addition to producing updated flood-risk maps, the Risk MAP process also includes other planning and outreach products. Communities participating in the NFIP that wish to partner more closely with FEMA to update flood hazard maps can also explore FEMA's Cooperating Technical Partners Program.

## Community Rating System (CRS)

Communities that provide flood risk reduction approaches and protection beyond the minimal NFIP standards can qualify for incentives through NFIP's CRS. CRS assigns communities a classification between 1 and 10, with 10 signifying a community not participating in the program and a class 1 community signifying a community with exemplary flood mitigation measures in place. Most communities enter the program with a CRS class 9 or 8 rating. Each CRS class receives a percentage discount on flood insurance premiums for property owners within the community from 5 to 45%, with higher discounts for communities they engage in additional mitigation activities. Classes align with a point scale and communities can accumulate points through different actions. Projects that qualify for CRS points include public engagement, preventing development in floodplains, reducing risk to existing developments, or improving flood warnings and emergency response. Any community that wants to participate in CRS or use more stringent boundaries must get approval from their FEMA Regional Office.

# IN PRACTICE

## WILDFIRE READY WATERSHED GRANT

North Fork Valley, Colorado  
(Hotchkiss, Paonia, Crawford, and Somerset)



The Western Slope Conservation Center (WSCC) led a successful bid to receive a CWCB grant to create a Wildfire Ready Action Plan (WRAP). The effort includes a stakeholder group of government representatives, private landowners, nonprofits, and other entities throughout the valley. The WRAP will evaluate the potential post-fire impacts across the valley and identify pre- and post-fire mitigation activities.

## Take Home

The WRAP brought together several neighboring communities to create a unified plan to help mitigate wildfire risk in their shared valley. By working together to create a plan, the WSCC ensured that the different communities in the valley share a common vision and approach to wildfire mitigation and watershed health.

*Hartter, J. Western Slope Conservation Center Receives Wildfire Ready Watersheds Grant. Undated. Western Slope Conservation Center blog.*



## National Risk Index

The National Risk Index is an interactive map and database that can help a community determine their risks to 18 natural hazards, including drought, extreme heat, landslides, riverine flooding, and wildfires. This map presents county-level results in terms of the expected annual loss, which is an economic estimate of the loss to buildings, people, and agriculture from each hazard. For example, according to the index, Larimer, Boulder, Jefferson, and Weld Counties have a “very high” Expected Annual Loss risk for riverine flooding. Communities can use the National Risk Index to help identify potential hazards in their hazard mitigation planning.

## Other Federal Programs

While FEMA provides the federal level regulations around hazard mitigation planning and floodplain management, several other federal agencies offer local resources that will help communities better prepare for and integrate natural hazard impacts and river health, including funding opportunities, technical guidance, and additional regulatory oversight.

## U.S. Army Corps of Engineers

The USACE provides environmentally sustainable engineering solutions for flood management. Several of their mission areas focus on river health including their environmental program, sustainability, and their flood emergency operation missions. These programs in particular can help support River Smart Communities:

*Floodplain Management Services Program:* provides technical assistance around local flood risk management and natural floodplain restoration

*Continuing Authorities Program:* can support small-scale water resources projects

*Engineering with Nature program:* catalyzes conversations, highlights projects, and provides technical resources to encourage projects that restore natural processes and integrate infrastructure into traditional flood control projects

Communities should coordinate with the USACE Colorado Regulatory Office for additional support.

# IN PRACTICE

## NFIP CRS CLASS 2 COMMUNITY

Mesa County, CO



Mesa County removed 100 structures from their regulatory floodplain in response to their hazard mitigation planning effort and integrated hazard mitigation planning goals in other plans. It has received CRS credit for incorporating the 10-step CRS planning process into its hazard mitigation planning process. As of October 2024, Mesa County has a Class 7 CRS rating, receiving a 15% discount.

### Take Home

Mesa County has engaged stakeholders throughout the county, including other jurisdictions within the county to engage in floodplain mitigation planning and increased the discount on flood insurance.

*Mesa County. Floodplain Management Program.*

*Colorado Resiliency Office. Planning for Hazards. Hazard Mitigation Plan.*

*FEMA. October 2024. CRS Eligible Communities.*



## National Oceanic and Atmospheric Administration (NOAA)

NOAA plays a critical federal role in providing ecosystem protection and supporting sustainable management practices. Communities can look to NOAA for technical resources and program support including:

*National Weather Service:* provides real-time river and weather data

*Advanced Hydrologic Prediction Service:* provides streamflow and drought conditions

*National Water Model:* provides simulated information of water availability, quality, and potential risks in river systems

# IN PRACTICE

## CHAMP, UPDATED FIRMS, AND FHZ

Boulder County, CO



Boulder County has experienced several catastrophic floods, most recently in 2013. Damage from these floods has not always aligned well with the County's mapped flood extents — almost half of flood insurance claims in Colorado since 1978 are from properties outside the FEMA designated 100-year floodplain — so the County worked with CWCB to remap its floodplains. As part of the CHAMP, CWCB and the County studied flood risk for several stream reaches throughout the County using updated topographic data, survey data, hydrology, hydraulics, and community input to create draft updated flood maps. After the revised maps were approved by the County Board of County Commissioners, the County and CWCB submitted the revised maps to FEMA for their review and approval in 2019. In October 2024, the maps were officially approved by FEMA and now serve as the FIRM for the County. In part because of these updated maps, Boulder County's CRS rating of 5 means Boulder County residents are eligible to receive a 25% discount on their flood insurance policies.

In addition to revising their FIRMs, Boulder County also participated in CWCB's pilot FHZ mapping protocol. Results from the FHZ are different from the regulatory floodplain, rather they highlight areas where rivers have flowed in the past and may do so again in the future. Properties within the FHZ are not included in the regulatory floodplain, but the FHZ map highlights opportunities for the County to prioritize mitigation actions and make sure residents are aware of their risk.

### Take Home

Spurred by a historic natural disaster, Boulder County has made significant progress in understanding its flood risk beyond FEMA's designated floodplains. The County and its residents learned through the recovery process that FEMA's floodplain and NFIP flood insurance did not always cover damage from debris flow so they embarked on their own mapping process with CWCB. By better understanding the County's risk to debris flow, residents can make more informed risk decisions.

*Boulder County. November 6, 2024. New Flood Insurance Rate Maps for Unincorporated Boulder County. Boulder County website news.*

*Boulder County. Boulder County Public Works. Floodplain Remapping Project website.*

*Boulder County. Fluvial Hazards in Boulder County. Floodplain Management Program. ArcGIS StoryMap.*

*Colorado Water Conservation Board. 2021. Water Plan Grant Application: Boulder County Fluvial Hazards Integration Study. May.*

For specific guidance and funding opportunities around habitat restoration:

*NOAA Fisheries Office of Habitat Conservation  
Community-Based Restoration Program  
Resilient Communities Grant Program*

Colorado is home to one of NOAA's 11 Regional Integrated Sciences and Assessments (RISA) offices called the Western Water Assessment (WWA) based in Boulder. Communities in Colorado can reach out to WWA for support navigating NOAA resources.

### **National Integrated Drought Information System (NIDIS)**

NIDIS is an inter-agency collaboration that provides data and technical guidance around droughts. NIDIS works with State Climatologists to create drought maps which identify the location and intensity of droughts in real-time. Communities in Colorado can reach out to the Regional Drought Coordinator for additional information.

### **U.S. Geological Survey (USGS)**

USGS provides real-time and historical water data, ecological health, and maps that communities can use to help manage their rivers.

*National Water Information System:* streamflow, water quality, sediment transport, and groundwater level data

*National Hydrography Dataset and Flood Inundation Mapping Program:* topographic and geospatial maps of floodplains, wetlands, and river corridors

Communities interested in USGS resources can contact the Colorado Water Science Center in Denver, Colorado's USGS local office.

### **Natural Resources Conservation Service (NRCS)**

The NRCS provides services aimed at supporting farmers, ranchers, and forest landowners. It is the conservation agency for private lands within the U.S. Department of Agriculture. The tools and resources available through NRCS can benefit communities

beyond agriculture producers. For examples, communities can look to:

*The National Water and Climate Center (NWCC)*, which provides historic, seasonal, and projected weather and water data. In Colorado, the NWCC produces several data-based products that measure snowpack, precipitation, soil moisture, and reservoir storage. The Colorado Snow Survey center also produces monthly Water Supply Outlook Reports for each watershed basin from January through June.

*The Emergency Watershed Protection program* offers post-disaster recovery to landowners for projects that address watershed impairments that pose a threat to life and property. A landowner must apply in collaboration with a project sponsor such as a community or conservation district.

NRCS also offers financial assistance for nature-based conservation practices through programs including:

*The Environmental Quality Incentives Program  
The Conservation Stewardship Program*

Communities in Colorado can contact the NRCS Colorado office in Denver for additional assistance.





## **Bureau of Land Management (BLM)**

BLM resources for river health are especially helpful for communities near public lands, with rivers that flow through public lands, or around rivers that have been designated as Wild and Scenic Rivers. BLM offers programs for water resource management and river restoration projects on public lands and watersheds it manages. Communities can participate with BLM projects through cooperative agreements, partnerships, or cost-share agreements. Sometimes the BLM designates rivers as an Area of Critical Environmental Concern and offers grants around them.

## **Department of Housing and Urban Development (HUD)**

HUD encourages communities who receive Community Planning and Development (CPD) funds, including Community Development Block Grant (CDBG) and Community Development Block Grant Disaster Recovery (CDBG-DR), to support resilience to natural hazards. The HUD Community Resilience Toolkit offers specific suggestions of resilience ideas and what CPD programs can help fund each action. The toolkit includes resilience ideas for inland flooding, wildfire, landslides, drought, and erosion, and a separate chapter on funding resilience.



## **Environmental Protection Agency (EPA)**

EPA provides communities with guidance and some funding opportunities around green infrastructure, watershed health, and offers a database of climate indicators (observed datasets around climate-related impacts). For example, through the Clean Water State Revolving Fund communities can apply for low-interest loans for river health projects. While EPA does provide some guidance that will help communities minimize the impacts from natural hazards but much of EPA's guidance focuses on water quality. (For information on EPA resources that can be synergistic with hazard mitigation, see Chapter 4, Water Resource Management).

# **COLORADO PLANNING RESOURCES**

In addition to the federal planning resources, Colorado offers several resources to help communities with hazard mitigation, focused on Colorado's regulatory circumstances and natural resources. This is a good place for Colorado communities to start when integrating hazard mitigation into river corridor management.

## **Division of Homeland Security and Emergency Management**

Colorado communities must work with DHSEM as part of their hazard mitigation planning process. DHSEM is Colorado's agency in charge of emergency management and hazard mitigation, including writing Colorado's HMP and coordinating with FEMA's Region 8 office. DHSEM's mitigation team provides local governments with technical assistance and financial resources for preparing for and recovering from hazards. They can support communities with hazard mitigation planning, complying with FEMA requirements, identifying risks, and applying for grants. Members of DHSEM's Mitigation team play a key role in determining state grant priorities and administering Hazard Mitigation

Assistance grants. They receive HMA grant sub applications then serve as the applicant for these proposals going to federal competition.

### **State of Colorado Enhanced State Hazard Mitigation Plan (E-SHMP)**

Colorado's 2023-2028 E-SHMP goes beyond FEMA's baseline requirements for a state HMP. It meets the "enhanced" status by complying with higher standards, providing more comprehensive data collection and analysis, demonstrating interagency cooperation, and focusing on proactive resilience measures. The E-SHMP qualifies Colorado for additional FEMA funding in the event of a disaster declaration within the state — 20% of estimated eligible assistance under the Stafford Act, versus 15% for states that do not have an enhanced plan.

## **Colorado Water Conservation Board (CWCB) in the Department of Natural Resources**

CWCB provides resources to help communities understand these processes and gain a better understanding of their natural hazard risks, especially through its Wildfire Ready Watersheds and Fluvial Hazard Zone programs. Within CWCB, the Watershed and Flood Protection Section supports watershed planning throughout the state. They offer specific programs that help communities' watershed restoration efforts, including funding opportunities, some of which are outlined below and others are covered in different sector chapters (for example, see Chapter 5, River Health, for information on Stream Management Plans (SMPs) and Chapter 4, Water Resources Management, for information on Integrated Water Management Plans ). The position of the State Floodplain Manager sits within this section.

Other sections within CWCB offer resources that may also be helpful to communities. The Water Supply and Planning section includes expertise on agriculture, drought planning, and water conservation programs. The Interstate, Federal, and Water Information Section includes expertise on

endangered species and stream health. The Stream and Lake Protection Section includes expertise on water resources management.

CWCB offers several hazard mitigation-related resources, covered below.

### **State Floodplain Standards**

The latest state floodplain standards were updated in 2022 and are published in the "Rules and Regulations for Regulatory Floodplains in Colorado" (2 C.C.R. § 408-1). The standards provide the legal definitions for regulatory floodplains, floodways, and floodplain management in Colorado. Every community in Colorado that participates in NFIP or has a regulatory floodplain designated by CWCB must adhere to these regulations. The 2022 update articulates new standards for defining floodplain boundaries based on the latest available science and modeling approaches, encourages flood mitigation with nature-based solutions, and provides stricter oversight on stream alteration activities. Colorado's standards mostly align with FEMA requirements except for freeboard requirements. Colorado requires at least 1 foot of freeboard above the BFE for structures in mapped floodplains. Colorado standards encourage communities to expand protections beyond those defined in federal standards, especially for critical facilities.

### **Wildfire Ready Action Plans (WRAP) and Wildfire Ready Watersheds (WRW)**

Colorado's Wildfire Ready Watersheds program aims to help communities address this unique combination of hazards by identifying the most at-risk areas and helping those communities prepare for and mitigate the risks. The program aims to partner with communities and support their efforts so that the process is community-driven and remains rooted in community values.

Communities can apply for a Watershed Restoration Grant through CWCB to create a wildfire ready action plan (WRAP) and implement identified restoration projects. WRAPs aim to help communities prepare for



and mitigate the impacts of wildfires on watersheds and critical infrastructure. Major elements of a WRAP are (1) visioning and establishment of goals and objectives, (2) stakeholder collaboration and outreach, (3) data collection, research, and gap analysis, (4) post-fire hazard analysis, (5) susceptibility analysis, and (6) pre-disaster planning and mitigation activities.

### **Fluvial Hazard Zone (FHZ) Program**

Communities in Colorado who wish to better capture risks from fluvial hazards in their risk profiles can use CWCB's FHZ program as a guide. According to the Colorado FHZ fact sheet, "Since 1978, approximately 49% of all NFIP claims in Colorado have come from policies written outside the high-risk area depicted on the FEMA FIRMs. FHZ provides communities with technical resources to identify their FHZ, planning guides to incorporate the FHZ in community planning and zoning, funding opportunities, and education and outreach to help raise awareness about the importance of accounting for FHZ. CWCB has conducted FHZ mapping for over 500 miles of streams throughout Colorado.

### **Colorado Hazard Mapping Program (CHAMP)**

Following the 2013 floods in Colorado, the State wanted to ensure that rebuilding efforts were directed away from high-risk areas, including those that may not be captured in the FEMA FIRMs. To accurately and relatively quickly update risk maps, the State funded the CHAMP program.

The CHAMP online dashboard gathers several resources communities can use in partnership with CWCB to update their flood risk maps, including updated topographic data, survey data, hydrology, and hydraulics. It includes a searchable library, maps, models, and training resources, and future projections of temperature and precipitation changes. These maps are a good starting point for communities who wish to update their FEMA FIRM maps or assess flood risk beyond the FEMA FIRM designated 1% AEP.

### **Colorado Resiliency Office (CRO) in the Department of Local Affairs**

CRO, which sits in DOLA, has several hazard mitigation and resilience resources to support local communities' efforts to reduce risks and recover from natural and economic disasters. Their Planning for Hazards site provides Colorado-specific resources for communities who wish to integrate hazard mitigation in their land use management. Their Community Readiness and Resiliency Toolkit provides resources following a 6-step approach for communities to create a resiliency plan or create a holistic approach to building resiliency. The toolkit provides the rationale, resource opportunities, tips, and case studies for each step. CRO offers regular workshops, webinars, and online resources for Colorado communities, creating networks of peer exchanges throughout the State.



# HAZARD MITIGATION PLANNING RESOURCES

The following list is a summary of key planning resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

## Federal Resources

FEMA. Hazard Mitigation Planning.

FEMA. National Flood Insurance Program.

FEMA. The National Risk Index.

FEMA Community Rating System: a local official's guide to saving lives, preventing property damage, and reducing the cost of flood insurance. March 2023. FEMA B 573/2023.

FEMA Cooperating Technical Partners Program

FEMA Guide to Expanding Mitigation: making the connection to the whole community. Risk MAP.

FEMA Local Mitigation Planning Handbook. May 2023.

FEMA Local Mitigation Planning Policy Guide. April 19, 2022. Updated April 19, 2023.

FEMA. National Flood Insurance Program. Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials. FEMA 480. February 2005.

U.S. Department of Housing and Urban Development (HUD). 2023. Community Resilience Toolkit.

## Colorado Resources

State of Colorado. DHSEM.

Colorado 2023-2028 Enhanced State Hazard Mitigation Plan

Colorado DHSEM Mitigation team

State of Colorado. CWCB.

Department of Natural Resources. Colorado Water Conservation Board. Rules and Regulations for Regulatory Floodplains in Colorado. 2 CCR 408-1

Colorado Water Conservation Board Wildfire Ready Watersheds

Colorado Water Conservation Board Fluvial Hazard Zone

Colorado Water Conservation Board. Colorado Hazard Mapping and Risk MAP Portal.

Colorado Resiliency Office. Planning for Hazards: Land Use Solutions for Colorado

Colorado Resiliency Office. Community Readiness and Resilience Toolkit





# IMPLEMENTING HAZARD MITIGATION ACTIONS

Communities can implement specific actions that can reduce the impacts from natural hazards, improve river health, and create resilient communities. Implementation can include creating action-specific plans, identifying a lead agency or champion, securing funding, and establishing a system for monitoring and evaluating the effectiveness of each action over time — especially during and after a natural hazard.

These actions may have been identified as part of the hazard mitigation planning process or may be independent of it. In many cases these actions go beyond traditional natural hazard planning requirements, but they nonetheless help reduce natural hazard risks and support river health. The

resources in this section can help communities plan and fund specific implementation actions (some of the resources listed in the Hazard Mitigation Planning section may help communities with project implementation, as well).

Communities can tap into federal and state resources to help support their implementation. In some cases, a community may be able to use multiple resources which may be particularly helpful for opportunities that require matched funding. Some of these resources may also be used to support proactive hazard mitigation planning and implementation. This is not an exhaustive list of funding opportunities available but provides a good starting point for Colorado communities. See

## IN PRACTICE

### SOUTH PLATTE RIVER RESTORATION

Denver, CO



Denver partnered with the USACE to improve habitat, reduce flood risk, improve water quality, and enhance recreational opportunities along the South Platte River in downtown Denver. The USACE conducted feasibility studies, designed flood mitigation measures, and provided funding. The City of Denver provided matching funds, project oversight, conducted community engagement, and ensured the project aligned with the City's planning goals. The project also partnered with the Mile High Flood District, the Greenway Foundation, and the CWCBC.

#### Take Home

Communities wanting to implement projects that will promote river health and reduce flood risk can seek innovative funding to help support river health projects.

*USACE. South Platte Ecosystem Restoration Project. Planning Project Summary. Landers, J. June 8, 2022. The US Army Corps of Engineers fully funds Denver restoration project. Civil Engineering Source. ASCE magazine.*

Chapter 6, Collaboration Across all Four Sectors, for further details.

The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

## FEDERAL FUNDING RESOURCES: FEMA HMA

Federal agencies offer some financial support for community-level natural hazard mitigation implementation. As with planning, communities might start with state agencies that have connections to different federal agencies. However, communities should also be aware of available federal resources so they can advocate for themselves and pursue individual opportunities that may work for their context. This section focuses on FEMA because it is the primary source for federal natural hazard funding.

FEMA offers several types of financial assistance under the umbrella of HMA for qualified communities taking a proactive approach to hazard mitigation. HMA grants offer information and financial resources for projects and programs that build community resilience. HMA prioritizes projects that focus on the whole community, address inequities, encourage coordinated regional and community planning, incorporate nature-based solutions, and consider changing climatic conditions.

To qualify for the HMA programs, as with many FEMA resources, communities must have a FEMA-approved HMP and participate in the NFIP program. Although HMA programs all support community resilience, each program has different requirements and priorities, and they are funded from diverse sources and have different cost share requirements. One program may be a better fit for a community depending on their local goals and context. For more information, communities can visit the “Summary of FEMA Hazard Mitigation Assistance (HMA) Programs” webpage, consult the

“Hazard Mitigation Assistance Program and Policy Guide (2024)”, or contact FEMA Region 8 or a member of the HMA Guide Team.

The three main HMA grant programs are Building Resilient Infrastructure and Communities (BRIC), Flood Mitigation Assistance (FMA), and the Hazard Mitigation Grant Program (HMGP).

### Building Resilient Infrastructure and Communities (BRIC)

FEMA’s annual competitive BRIC program focuses on funding proactive projects that will prevent damage from natural hazards, rather than providing recovery funding after a hazard occurs. It prioritizes funding projects that mitigate risk to public infrastructure and socially vulnerable communities, use nature-based solutions, improve a community’s resilience to climate change, and adopt and enforce updated building codes. BRIC also has a Management Cost category of assistance that will cover certain types of indirect, administrative, and capacity-building costs.

### Flood Mitigation Assistance (FMA)

FMA grants fund projects that will reduce damage to NFIP-insured buildings that are repeatedly flooded, known as repetitive loss properties. In 2023, the program prioritized local projects targeted in socially vulnerable areas, as defined by the Center for Disease Control and Prevention’s Social Vulnerability Index.

### Hazard Mitigation Grant Program (HMGP)

For communities that have experienced a natural disaster, the HMGP provides funding for resilient recovery to prevent future losses. Only governments that have received a Presidential Major Disaster Declaration are eligible for HMGP grants. Governments can request HMGP funding when they declare their disaster, and the amount of funding available is a percentage of the total federal assistance the federal government issues as part



of the disaster declaration. A small percentage of the award can be used for indirect costs including management and administration.

## COLORADO FUNDING RESOURCES

Colorado offers funding opportunities that will help support community actions that both improve river health and reduce natural hazard impacts.

### Colorado Water Plan Grants

CWCB offers many of the state-level funding opportunities that will help support healthy river corridor management. One of CWCB's main funding mechanisms is Water Plan Grants. These grants can help communities fund many IRM hazard mitigation projects including Wildfire Ready Watersheds and FHZ planning (discussed in the Hazard Mitigation Planning section). Water Plan Grant applications should focus on one or more of the project funding categories, including water storage and supply, conservation and land use, engagement and innovation activities, agricultural, and watershed

health and recreation. Grant applicants must offer matching funds — 25% for planning or study projects and 50% for construction projects. Interested applicants should contact their Regional Grant Manager and consider seeking a letter of support from their Basin Roundtable.

Occasionally the CWCB also offers more focused special releases of grants focused on particular issues. For example, in the fall of 2024, CWCB issued a special Watershed Restoration Grant cycle focused on applications under the Wildfire Ready Watersheds program. Communities can find regular funding opportunities on the Grant page of the CWCB website.

### Colorado Healthy Rivers Fund

The Colorado Watershed Assembly's Colorado Healthy Rivers Fund offers project or planning grants to watershed or community-based organizations to support collaborative approaches to restoring and protecting natural resources in Colorado's watersheds. These grants require stakeholder support and at least a 20% match.





# HAZARD MITIGATION ACTION RESOURCES

The following list is a summary of key planning resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

## Federal Resources

FEMA Hazard Mitigation Assistance Program and Policy Guide. Effective July 30, 2024.

FEMA Building Resilient Infrastructure and Communities

FEMA Flood Mitigation Assistance Grant Program

FEMA Hazard Mitigation Assistance Grants

## Colorado Resources

Colorado Water Conservation Board Water Plan Grants

Colorado Healthy Rivers Fund





# HOW RIVER SMART COMMUNITIES CAN USE HAZARD MITIGATION





Integrating natural hazard mitigation planning and river corridor management is essential for building resilient communities. Doing so provides multiple benefits, including:

- Breaking down hazard silos that often drive hazard mitigation planning
- Aligning priorities across sectors and other planning efforts
- Ensuring that broader community goals align with hazard mitigation plans
- Enhancing pre-disaster planning
- Providing additional avenues for community engagement
- Opening doors to secure additional funding and incentives

Creating solutions that have multiple benefits, such as integrating ecosystem restoration to reduce the risk of flooding to water treatment systems or providing green spaces alongside rivers that offer recreational benefit to communities and can absorb high flows with minimal damage

Federal and state resources can help communities plan and implement river smart hazard mitigation. The following sections identify how communities can use each set of resources to support their goals and Table 3.1 summarizes which resources communities can use to support each of the four healthy river functions or address a particular type of natural hazard.

TABLE 3.1. EXAMPLES OF HAZARD MITIGATION TOOLS THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	FEDERAL-LEVEL HAZARD MITIGATION TOOLS	COLORADO HAZARD MITIGATION TOOLS	NATURAL HAZARDS
 <b>Natural streamflow and water balance</b>	FEMA, USACE, NOAA, USGS, NRCS, BLM, HUD	DHSEM (E-SHMP), CWCB (State floodplain standards, CHAMP, FHZ, WRW), CRO	Floods, wildfires, severe storms
 <b>High-quality surface water and groundwater</b>	EPA	CDPHE, SMPs	Drought, extreme heat, wildfires
 <b>Diverse biological community</b>	FEMA, USACE, NOAA, USGS, NRCS, BLM, HUD	CWCB (WRW)	Floods, wildfires, severe storms, landslides, drought, extreme heat
 <b>Dynamic sediment processes and quality soils</b>	Dynamic sediment processes and quality soils	FEMA, USACE, NOAA, USGS, NRCS, BLM, HUD	Floods, wildfires, severe storms, landslides, drought

## HOW TO USE FEDERAL RESOURCES AS A RIVER SMART COMMUNITY

Federal resources can help River Smart Communities by offering information including best practices, research, and data that incorporates country-wide research and trends on river health concepts including implementing nature-based solutions, engaging key stakeholders, and coordinating with other plans. River Smart Communities can also seek funding from federal agencies to help them integrate river corridor management and hazard mitigation.

Federal resources can also help communities meet and exceed hazard mitigation planning standards set forth by FEMA. Within the context of prescribed hazard mitigation planning, communities often consider hazards, mitigation capabilities, and mitigation strategies in silos when undergoing an HMP process to meet FEMA's requirements. A River Smart Community can use federal resources to help them break down those silos by thinking comprehensively or holistically, identifying opportunities that will benefit multiple sectors and help mitigate against multiple hazards. For example, preserving riparian land for open space is one activity that can earn a community credit in the CRS and several federal agencies offer guidance and support on preserving riparian land. A River Smart Community can leverage federal resources to innovate a more holistic approach to river health and hazard mitigation.

## HOW TO USE COLORADO RESOURCES AS A RIVER SMART COMMUNITY

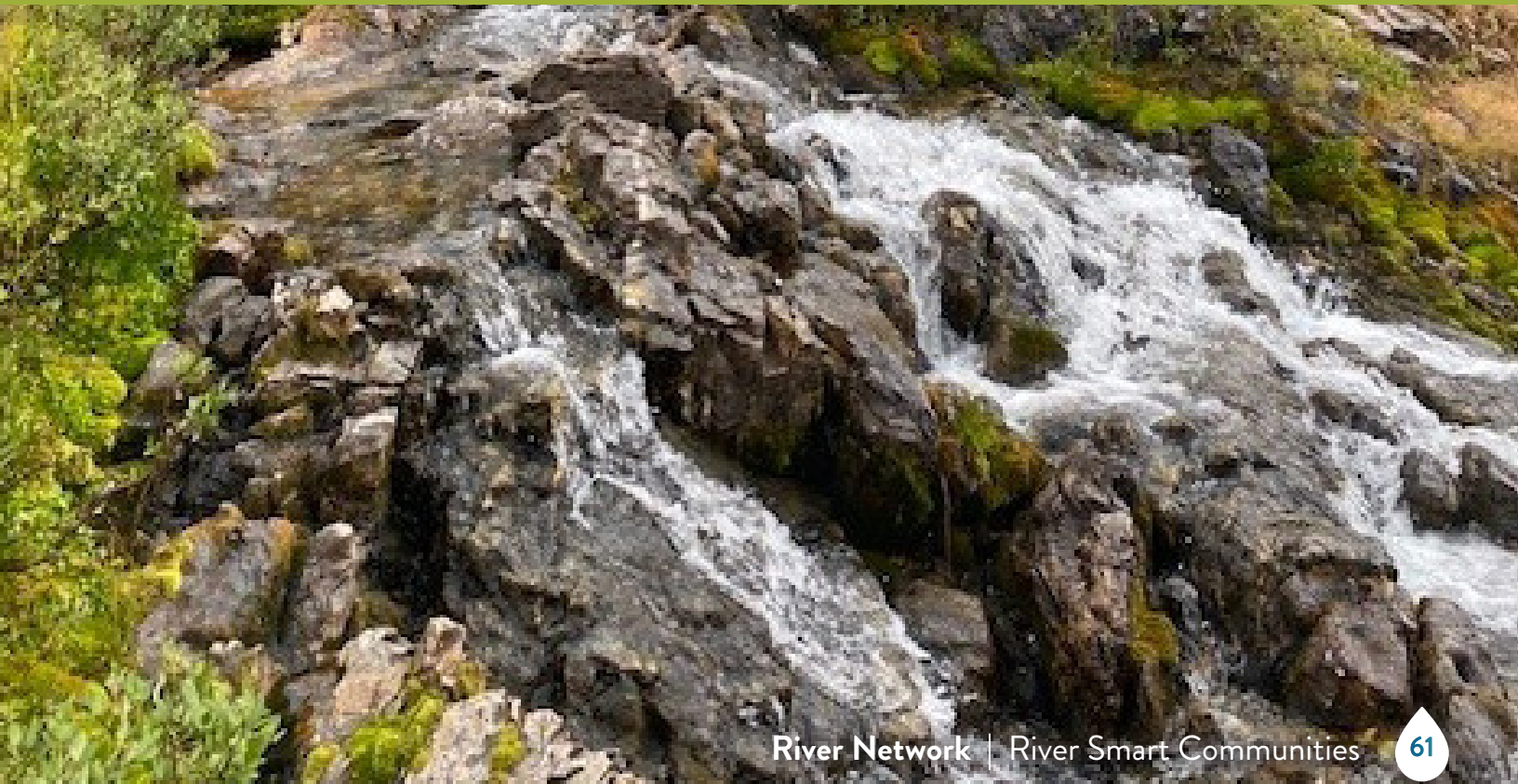
From informational support to funding opportunities, Colorado offers a variety of resources to help support communities as they integrate IRM practices and mitigate against their natural hazard risks.

River Smart Communities can use Colorado resources to go beyond baseline FEMA standards, especially when it comes to assessing risks unique to Colorado communities. This can be Mitigating against these risks can align well with River Smart Community goals and can open the door to additional funding opportunities. Several of the State's resources, including Wildfire Ready Watershed and the FHZ program share goals with those of a River Smart Community, including tailoring hazard mitigation plans to community values through community engagement and participation and preserving riparian land along river corridors that allow the river to flow dynamically.





# WATER RESOURCES MANAGEMENT





# INTRODUCTION

In the Western United States, there is a fragile balance between water supplies and human and environmental needs. Too much water can cause catastrophic flooding; too little can strain ecosystems and deplete municipal supplies. Water may be in short supply where it is needed, but abundant elsewhere. Managing water resources balances water supplies with demands, ensuring that people and ecosystems have access to clean and sufficient water and use it efficiently for municipalities, agriculture, flood control, transportation, and recreation.

Water resources management is a broad sector that includes professionals from chemists to engineers, planning scales from regions to communities, and infrastructure from small diversion gates to large reservoirs. It can include protecting the natural environment surrounding water bodies, ensuring adequate river flows, or treating water quality for municipal use.

Because of its comprehensive scope, water resources management is often planned or carried out in silos, creating inefficiencies and missed opportunities for holistic planning. There is even the potential for actions taken by one group of water resources managers to inadvertently cause harm to the efforts of others. Integrated River Management (IRM) offers an opportunity to improve collaboration within the sector while also aligning it with other related aspects of river management, including land use, hazard mitigation, and river health.





This chapter discusses various water resources management plans and different types of water resources infrastructure. Planning for water resources occurs at federal, state, and local levels stakeholders manage resources with plans that consider available water supplies and demands. Water resources managers implement these plans by balancing supply and demand, often

with infrastructure that stores, treats, and moves water. Understanding the various aspects of water resources management can highlight opportunities to integrate the sector with river health management under an IRM umbrella. Doing so will bolster the resiliency of water in an environment of increasing demands on limited supplies, offering an opportunity to increase efficiency and leverage resources.

## HAZARD MITIGATION ACTION RESOURCES

Communities can most effectively integrate IRM and water resources when key partners work together, such as:

### **General water resources partner categories**

- Agricultural producers and agriculture organizations
- State irrigation districts
- Ditch companies
- Ground water management districts
- Utilities, especially local water supply, wastewater, and stormwater agencies, companies, and organizations
- Transportation departments

### **Examples of water resource partners for Colorado communities**

- Bureau of Land Management (BLM)
- Colorado Department of Agriculture (CDA)
- Colorado Department of Transportation (CDOT)
- Colorado Department of Public Health and the Environment (CDPHE)
- Colorado Division of Water Resources (DWR)
- Colorado Water Conservation Board (CWCB)
- Colorado Water Congress
- Environmental Protection Agencies (EPA)
- Natural Resources Conservation Service (NRCS)
- United States Army Corps of Engineers (USACE)
- United States Bureau of Reclamation (USBR)



# REGULATORY CONTEXT

In Colorado, water resources management is guided by a complex framework of federal, interstate, and state water laws. Water rights in Colorado are allocated according to the Prior Appropriation Doctrine, or “first in time, first in right,” which distributes water rights based on when they were

first claimed. Those who first diverted water have more senior rights than those who came later. If water rights holders do not regularly use their allocated water, they can lose their right to that water under a principle known as “use it or lose it.”

## REGULATORY CONTEXT

Communities can most effectively integrate IRM and water resources when key partners work together, such as:

### **Federal and interstate**

Colorado River Compact of 1922: This compact allocates the distribution of water from the Colorado River between the seven U.S. states and the country of Mexico that the river flows through.

Upper Colorado River Compact of 1948: this companion to the 1922 compact dictates water allocations among the states in the upper Colorado river basin: Colorado, New Mexico, Utah, and Wyoming.

Clean Water Act of 1972 (33 United States Code [U.S.C.] § 1251 *et seq.*): regulates point and non-point pollution to improve water quality

Safe Drinking Water Act of 1974 (42 U.S.C. § 300 *et seq.*): protects drinking water quality in the U.S.

### **Colorado**

Colorado Water Right Act of 1969: streamlined, consolidated, and clarified Colorado’s regulatory context and legal framework for managing water rights in the state.

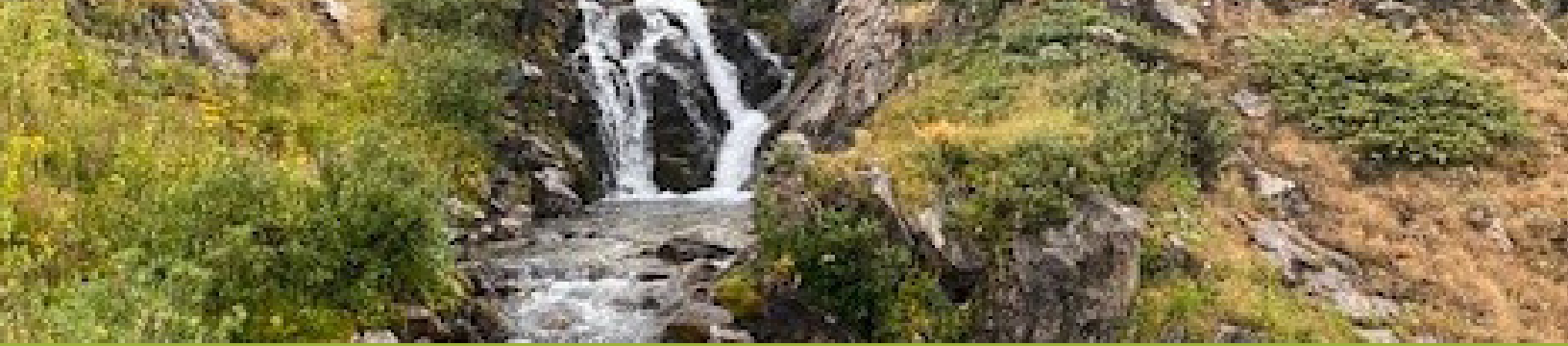
Water Right Determination and Administration Act of 1969 (Colorado Revised Statutes [C.R.S.] § 37-92-101 *et seq.*): focused on administrating and enforcing water rights, this act clarified the administrative process for determining water rights and managing water shortages.

Water Conservation Act of 2004 (Senate Bill 04-222): encourages municipal water conservation and reduction by requiring all retail water providers that sell at least 2,000 acre-feet of water per year to have a state-approved water efficiency plan.

Water Adequacy Statute (C.R.S. 29-20-304-3): provides basic criteria and guidance for water providers’ long-term water supply plans, including ensuring they have enough supplies available for future development.

Colorado Water Quality Control Act of 1973 (C.R.S. § 25-8-101 *et seq.*): this act sets the standards for water quality in the state’s water bodies, including regulating pollution and discharge limits.





# WATER RESOURCES PLANS

Water resources planning considers the current and projected balance of water supplies and demands. The Colorado Water Plan is the state-wide water resources plan (see the guidebook introduction for a description), but at the local level, water resources plans focus more on municipal supply, stormwater, and wastewater systems. Distinct types of water resources plans cover different management aspects, and every community may have a different collection of plans depending on their resources, needs, and local context. The planning discussions in Chapter 2, Land Use; Chapter 3, Hazard Mitigation; and Chapter 5, River Health, cover other types of plans that may overlap with or complement the water resources plans discussed here, especially watershed plans.

## TYPES OF PLANS

Water supply, efficiency, stormwater, wastewater, and water quality plans are some of the most common types of water resources plans a community might develop. These plans are led by municipal agencies including environmental protection, water resources, public works, or water providers. In some cases, communities may combine all these plans into one integrated plan, which can help consolidate resources and increase coordination. Integrated water management plans (IWMPs) and “One Water” are two examples of this approach and are discussed in more detail below.

## Water Supply Plans

Water supply planning broadly considers how to meet water needs. Plans consider how much water is needed now and into the future, what water may be available — considering water rights — to meet those needs, and how to meet the demand for water with the available supply. Water supply plans can tie in closely with growth projections and land use planning to ensure that future water supplies are sufficient for projected population growth and development.

Water supply plans are carried out at the municipal, county, or regional scale, where water providers conduct local water supply planning estimates. These plans may include opportunities to expand available water supply sources (such as reservoirs or diversions), identify opportunities to reduce demand (such as through incentivizing drought-tolerant landscaping), or outline infrastructure needs (such as expanding pipelines or treatment plants).

In conducting municipal-level planning, communities can consult Colorado’s state-level water supply planning documents including the Colorado Water Plan and its technical updates, led by the CWCB. Using a scenario planning model, the State’s water supply planning considers potential future demand scenarios based on population and climate change, and if the State’s water supplies are sufficient to meet those demands. In Colorado, water supply needs are broadly considered in three categories: agriculture, municipal and industrial, and environmental and recreational.

## Water Efficiency Plans

According to the Colorado Water Conservation Act of 2004, water providers that sell more than 2,000 acre-feet of water annually are required to have State-approved water efficiency plans. Water efficiency plans identify practices, techniques, and technologies that can help providers be more efficient with their water supplies. They include ideas for reducing water demand as well as reusing supplies. Water efficiency plans are linked to water supply reliability and drought plans. The State profiles a six-step water efficiency planning process in its Municipal Water Efficiency Plan Guidance Document.

## Water Infrastructure Master Plans

Water service providers and utilities undergo infrastructure master planning to track capital improvement projects for water supply, wastewater, and stormwater infrastructure. These plans inventory existing infrastructure, including identifying its location, condition, and maintenance needs. Infrastructure master plans can also conduct an infrastructure gap analysis, identifying gaps where new infrastructure might be necessary and projecting needs for future infrastructure development based on future growth. Communities

with land use plans use water infrastructure planning to ensure areas of planned growth have adequate water infrastructure to support development. Infrastructure plans at their most basic include timelines and budgets, and at their most complex include detailed engineering and environmental analyses.

## Stormwater Plans

When precipitation from storms falls in developed areas, it can cause flooding, especially in areas with extensive nonpermeable pavement. Replacement of precipitation-absorbing natural soil and vegetation with nonpermeable surfaces such as concrete and asphalt increases runoff, which can collect at low points, creating localized flooding or funneling polluted water back into rivers.

Municipalities may have stormwater plans that address these concerns by detailing how to manage drainage issues and stormwater flow. These plans can include everything from a high-level overview of local stormwater issues to design and engineering specifications for stormwater infrastructure. They may discuss a plan for controlling stormwater with a collection of gray and green infrastructure (discussed in further detail in the infrastructure

# IN PRACTICE

### INTEGRATED WATER MANAGEMENT PLAN

Middle Colorado Watershed Council



Community groups along the Middle Colorado River in Colorado came together to develop an IWMP to address growing concerns around water scarcity. Because several communities and various economic interests rely on the Colorado River and its tributaries in the area, the communities recognized the need to identify a shared mission to improve water security for all water users. Through a series of facilitated discussions, IWMP participants identified shared key concerns, articulated a mission statement, and prioritized 55 actions — projects, initiatives, and studies — to help meet the IWMP's mission.

### Take Home

Bringing together diverse stakeholders to articulate a shared mission statement and goals for a stretch of river that spans multiple jurisdictions and interests allows the Middle Colorado Watershed Council to build networks, leverage shared resources, and create a common platform for river health data.

*Middle Colorado Watershed Council. 2021. The Integrated Water Management Plan.*



section below). The Colorado Floodplain and Stormwater Criteria Manual published by CWCB provides guidance for local agencies to set standards for municipal drainage issues.

## Integrated Water Management Plans

Some communities are promoting the concept of Integrated Water Management, which brings together a diversity of stakeholders to encourage coordinated management and planning of water resources. IWMPs are focused on creating a common approach to various aspects of municipal water use — including water supply, stormwater, and wastewater — to maximize environmental, social, and economic benefits. IWMPs can engage stakeholders including municipal utilities and other water interests such as agricultural producers and riparian landowners. An IWMP might consider the implications of water management practices on river ecosystems and other water needs with the goal of building resilience in water supplies.

## One Water

Like IWMP, One Water is focused on holistic municipal planning, but it takes a water-cycle approach to managing water supplies. One Water encourages water stakeholders to come together and holistically approach planning from a water conservation perspective that considers water as a single, interconnected resource. As such, it focuses on maximizing all potential sources of water supply including reuse and resource recovery and reducing demand including minimizing waste and promoting sustainable use. The concept of One Water also improves water efficiency by holistically considering what type of water is best for each demand, for example using gray water to water lawns rather than tap water. The goal of a One Water approach is to improve long-term resilience and reliability of water supplies to meet community and ecosystem needs. A One Water Plan may include opportunities for water recycling, graywater reuse, and green infrastructure practices including rainwater harvesting.

# IN PRACTICE

## DENVER ONE WATER PLAN

Denver, CO



The City and County of Denver, the Colorado Water Conservation Board, Denver Water, Metro Wastewater Reclamation District, Mile High Flood District, and The Greenway Foundation/The Water Connection collectively developed Denver's One Water Plan in 2021. The plan articulates unified objectives for Denver's drinking water, wastewater, water reuse, stormwater, and flood management, all of which are overseen by different entities. The goal of the One Water Plan is to, "create a common framework for reliably managing water systems to meet public and environmental needs while reducing costs, improving resilience, and enhancing community livability." The One Water plan fulfills Goal 4# from Denver's Comprehensive Plan 2040 ("Denverright").

### Take Home

Denver's One Water plan offered an opportunity for partners working on overlapping water issues within the City and County of Denver to increase communication and collaboration and identify areas of shared interest.

*City and County of Denver. 2021. Denver One Water Plan – Final Report.*

## HOW TO USE WATER RESOURCES PLANS AS A RIVER SMART COMMUNITY



Planning gives communities an opportunity to articulate and create roadmaps to achieve collective goals. This is especially important in a sector as complex and dense as water resources.





Although these plans have traditionally been developed in silos, there are examples of planning efforts beginning to blur the boundaries of their silos. Municipal water providers increasingly understand the value of ecosystems to protect their supplies at their source and have added programs and departments focused on ecosystem preservation and restoration. IWMPs or One Water efforts align different elements of water resources planning. However, each of the plans discussed above has a different niche and role in a broader planning context and, even if their content may partially overlap, they can still leave out key aspects of IRM such as hazard mitigation or river health. A River Smart Community will ensure that each of these unique plans is not created in isolation and that plans align with broader aspects of river management.

IRM is especially important in urban environments where communities and researchers are still understanding the connection between urbanization — specifically impervious surfaces and stormwater systems — and healthy river functions. Recent studies show that groundwater pollution from urban sources can impact river quality, especially during periods of low flow (Pilone et al., 2021). However, sources of urban water that end up in local streams and rivers, such as grey water, treated effluent, and irrigation runoff, can significantly contribute to streamflow especially during critical low-flow summer months when household water is more likely used for outdoor purposes (Al Fatta et al., 2022). Another recent study found that urban areas with more impervious surface area can contribute to more frequent, higher-intensity flow events, although there are still questions about the impacts of urban runoff on river flow characteristics (Wilson et al., 2022). These complex relationships between municipal water resources and healthy river functions illustrate the importance of holistic conversations. A River Smart Community that plans holistically is better positioned to understand and prepare for the nuances between water resources and healthy river functions.

A River Smart Community brings together diverse stakeholders to align water-related planning goals at a broad level, integrating water resource planning alongside land use, hazard mitigation, and river health to align bigger picture goals to achieve corridor-wide healthy river functions. Aligning goals creates efficiencies for funding and capitalizes on shared resources, especially around water conservation and efficiency. It also reduces potential unintended consequences like ensuring that critical water infrastructure is constructed outside of fluvial hazard zones or that effluent outfalls are not placed in critical ecosystem zones. A River Smart Community that brings different water resource plans under an umbrella of IRM builds a stronger planning fabric by linking water resources planning with broader community goals and strengthening the integration between each water resources plan. Table 1 provides examples of water resources plans that can address different healthy river functions.



TABLE 4.1. EXAMPLES OF WATER RESOURCES PLANS THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF RELEVANT PLANS
 <b>Natural streamflow and water balance</b>	Water supply plans, Water efficiency plans, Stormwater plans
 <b>High-quality surface water and groundwater</b>	Stormwater plans
 <b>Diverse biological community</b>	IWMPs, One Water plans
 <b>Dynamic sediment processes and quality soils</b>	Stormwater plans

# IN PRACTICE

## NORTH FORK OF THE GUNNISON RIVER IRRIGATION MANAGEMENT PLAN

North Fork Water Conservancy District



The North Fork of the Gunnison River flows through agricultural lands in Western Colorado, and several agricultural producers in the North Fork Valley depend on water from the river for irrigation. Water is diverted from the North Fork at 12 points along the river, in accordance with the irrigator’s allocated water rights. In 2017, the North Fork Water Conservancy District contracted with an engineering firm to develop an assessment of infrastructure needs, educate agricultural producers in the North Fork about their water rights, and involve the agricultural community in stream management planning. The Conservancy District interviewed ditch board members and water users and assessed diversion and other irrigation infrastructure along the river. The process resulted in the Irrigation Management Plan that identifies and prioritizes potential improvement projects and provides rough project cost estimates with the goal of providing additional information for decision makers about the needs of agricultural producers in the North Fork.

### Take Home

This irrigation management plan is an example of how a River Smart Community can engage key stakeholders in river management discussions, identifying priority projects that the plan’s creators can then take to broader discussions about river health. Ideally the needs identified in this type of planning process align with other stakeholder needs in the valley and so projects can be combined for maximum efficiency and benefit.

*North Fork of the Gunnison River Irrigation Management Plan. 2017. North Fork Water Conservancy District. Prepared by J-U-B Engineers, Inc.*

# WATER RESOURCES PLANNING RESOURCES

The following list is a summary of key resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

Al Fatta, A. and A. Bhaskar. 2022. Water Contributors Identification to City Streams Using Multiyear Analysis of Water Stable Isotopes. ESS Open Archive. DOI: 10.1002/essoar.10511730.1.

American Rivers. 2016. The City Upstream and Down: How Integrated Water Management Can Help Cities Thrive. Great Lakes and St. Lawrence Cities Initiative, The Johnson Foundation at Wingspread, and Mayors Innovation Project.

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State of Colorado. Colorado Water Conservation Board. 2023. Colorado Water Plan.

State of Colorado. Colorado Water Conservation Board. 2012. Municipal Water Efficiency Plan Guidance Document.

State of Colorado. Colorado Water Conservation Board. Water Supply Planning website.

State of Colorado. Department of Local Affairs. Water and Land Use website.

Environmental Protection Agency. Addressing Water Quality Challenges Using a Watershed Approach website.

Environmental Protection Agency. 2024. Clean Water Programs and Partnerships for Land Protection. Webinar. December 16.

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U.S. Water Alliance.

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Wilson, S. et al. 2022. Urbanization of grasslands in the Denver area affects streamflow responses to rainfall events. Hydrological Processes. <https://doi.org/10.1002/hyp.14720>.



# WATER RESOURCES INFRASTRUCTURE

Water resources infrastructure stores, treats, moves, and controls water for municipal use, agriculture, flood control, transportation, and recreation. It is used for water supply, wastewater, stormwater systems, and hydropower; to control and manage river flows and prevent flooding; and to provide water for irrigation for agriculture. Water resources are managed by a wide range of infrastructure including pipes, culverts, tanks, reservoirs, rain gardens, retention ponds, or diversions.

Traditional water resource management focused on controlling water with “gray” infrastructure, or structures and systems built with processed materials including metals and concrete including pipes, culverts, and retaining walls. Gray infrastructure can be effective, but it also has limitations. Today, many pieces of gray infrastructure have not been properly maintained and are outdated and ineffective. Gray infrastructure

can also have unintended consequences, including degrading river ecosystems by reducing habitat, exacerbating erosion, contributing to poor water quality, and creating physically unstable rivers (Sholtes, 2017). It can cause downstream harm, reducing water quality and increasing flood risk. As infrastructure ages, maintaining it can be expensive, especially if it fails altogether.

While there is a place for gray infrastructure in water resources management, increasingly water managers recognize the benefits of using nature-based solutions — known as “green” infrastructure — instead of or alongside gray infrastructure to achieve water resources goals. Green infrastructure can reduce flood risk, preserve water quality, and protect riverine environments while also providing adequate water supplies for humans and the environment. Water resource managers are also recognizing the importance of more holistic

## IN PRACTICE

### STAGECOACH AND ELKHEAD RESERVOIR RELEASES

Yampa River, CO



Since 2012, stakeholders along the Yampa River have worked with the Colorado Water Trust to lease water for targeted releases from the Stagecoach and Elkhead Reservoirs during periods of low flows. The leased water helps mitigate adverse impacts from low flows including protecting aquatic habitat and maintaining flows for boaters and hydropower needs. The first release in 2012 was from Stagecoach Reservoir in response to the 2012 drought. In 2020, the Elkhead Reservoir released 250-acre feet of water to the Yampa River to support the Upper Colorado River Endangered Fish Recovery Program. In 2021, the Colorado Water Trust signed a 10-year contract that allows the opportunity for instream flow leases for 5 out of every 10 years.

#### Take Home

This innovative partnership is an example of how a River Smart Community can use water resources infrastructure to support healthy river functions at times of low flow.

*Colorado Water Trust. Projects. Upper Yampa River – Stagecoach Reservoir.*

*Colorado Water Trust. Projects. Lower Yampa River – Elkhead Reservoir.*

planning to protect water resources on a broader scale and ensure that actions taken in one place do not increase risk or cause harm in another.

## TYPES OF INFRASTRUCTURE

Some types of water resources infrastructure can impact healthy river functions, especially specific types of infrastructure that help with supply, stormwater, and flood control.

### Supply

Water infrastructure is used to transport water supplies from where they occur naturally to where they are needed for human or environmental uses. Although water supply infrastructure is most often associated with municipal water, it is also used in other contexts including industrial, agricultural, environmental, and recreational. Specific examples of water supply infrastructure include reservoirs, dams, weirs, canals, tunnels, and pipes.

#### Municipal

In Colorado, municipal water accounts for approximately 7% of water consumption in the state. Municipal water supply systems transport water to homes and businesses for indoor and outdoor use from thousands of miles away from where it is used. To do this, municipal providers use a series of storage and transportation infrastructure including reservoirs, tanks, tunnels, pumps, and pipes to move water from its source to treatment facilities. Water is treated as necessary to ensure it meets quality standards, and then it is distributed to homes and businesses via additional pipes.

#### Agriculture

Agriculture producers in Colorado use between 80 to 90% of consumptive water in the state to irrigate crops and provide water for livestock. Over 80% of

the water used to irrigate crops comes from surface water supplies. Moving water from its source to fields requires a network of infrastructure including storage, pumps, diversions, conveyance, and irrigation. Producers also construct levees and dikes to control the flow of water on their properties.

### Stormwater

Stormwater systems can affect healthy river functions such as local peak flows and water quality. Stormwater has traditionally been controlled with gray stormwater infrastructure, but increasingly municipalities are turning to green infrastructure to help them manage stormwater flows.

#### Gray Stormwater

Traditional stormwater infrastructure is designed to convey precipitation that falls on impervious surfaces to a wastewater treatment facility or into an open body of water using a connected network of gray infrastructure including culverts, drains, pipes, and retention basins. Precipitation that falls on impermeable surfaces flows to a low point where a drain collects it and funnels it into a pipe. Those pipes then either flow into a nearby waterway or are combined with wastewater systems and flow to a wastewater treatment facility. In systems that combine storm and wastewater, heavy precipitation events can exceed the capacity of wastewater treatment facilities causing the excess untreated water to discharge into a waterbody, causing an event known as a combined sewer overflow (CSO).

#### Green Stormwater

Green stormwater infrastructure is designed to capture precipitation before it enters a traditional stormwater system and increase absorption into the ground where it can be used for beneficial purposes. Green infrastructure includes rain gardens, permeable pavement, rain barrels, green roofs, and swales.

## Other Types of Urban Infrastructure

Water resources engineers use water infrastructure to control water for various other reasons. Water infrastructure such as retaining walls, culverts, or tunnels can help prevent flooding. Practices like grade control structures can help control erosion and influence river elevations. Channelizing rivers to control their flows — directing their flows by straightening, widening, or deepening them — is still prevalent although no longer as common as it once was. Water resources infrastructure is especially used to protect critical infrastructure and resources especially around roadways.



## IN PRACTICE

### MAYBELL DIVERSION MODERNIZATION PROJECT

Lower Yampa River, CO



Maybell is a small agricultural town in Northwestern Colorado. Since 1896, the Maybell Diversion has diverted water off the Yampa River. Today it provides water for 18 water users to irrigate approximately 2,000 acres of land. The headgate and diversion infrastructure that diverts water from the Yampa had been broken for decades which, combined with drought conditions, strained the available water supply.

In partnership with The Nature Conservancy, the Maybell Irrigation District received funding from state, regional, and federal sources to upgrade the headgate infrastructure. Completed in 2024, the upgraded Maybell Diversion infrastructure restored water supplies for agriculture producers and also improved fish passage and recreation opportunities. The head gate can be operated remotely so water users that draw from the Maybell Diversion can access their full water rights and time their water withdrawals to use the water more effectively.

#### Take Home

This project illustrates an example of unique stakeholder partnerships and diverse funding opportunities to accomplish a water resources project with multiple benefits.

*Colorado River Resilience. 2023. Featured Project: Maybell Diversion and Headgate Modernization Project.*

*The Nature Conservancy. 2024. Stories in Colorado: Maybell Project Restores Hope for Irrigators and Endangered Fish. May 28.*



# WATER INFRASTRUCTURE IMPACTS ON HEALTHY RIVER FUNCTIONS

Historical approaches to supply, stormwater, and urban water infrastructure can negatively and positively impact healthy river functions which illustrates the complexity of integrating river health and water resources.

Water infrastructure that removes or diverts water from its source or alters a river's **natural streamflow and water balance** disconnects river channels from their floodplains, which limits natural channel migration and interferes with **dynamic sediment processes and quality soils**. This includes culverts or pipes that straighten a river, retaining walls or channelized river, CSOs, dams, or diversions. When a river is straightened and disconnected from its natural floodplain, periods of heavy rain can concentrate and accelerate flows, increasing downstream flooding risk, exacerbating channelization, and causing erosion. These impacts may become more extreme as climate change increases the intensity or frequency of storm events. Even infrastructure that was intended to prevent flooding can result in flooding elsewhere. Water flowing at a high force can cause scour and degradation of the river channel. Poorly designed or maintained water infrastructure can result in erosion and degradation, undercutting banks and undermining structural support. This can be particularly harmful for transportation infrastructure. Water diverted from a river for municipal or agricultural use, even when it is returned to the same river, can disrupt natural flows, significantly alter river functions, and compromise river health.

Infrastructure can also compromise **high-quality surface water and groundwater** and negatively impact **diverse biological communities**, by



altering a river's natural flow. Removing water from a river can elevate water temperatures and strain groundwater sources. CSOs can deposit polluted water directly into waterbodies, especially when combined with wastewater. Elevated water temperatures, polluted water, and infrastructure that directly disturbs habitats can impact both aquatic and riparian ecosystems. Water infrastructure that is not maintained or fails can cause minor to major impacts. A leaky pipe may result in inefficiencies and deposit water where it should not be, which can compromise water quality and strain ecosystems. A major infrastructure failure, such as a dam breach, can result in catastrophe.





Water infrastructure can also have positive impacts on river functions. Reservoirs and other types of storage infrastructure can help maintain **natural streamflow and water balance** patterns which can help control flood risk during periods of high flows and encourage **diverse biological communities** including providing new aquatic habitat or offering opportunities to maintain minimal flows to support ecosystem health during dry periods. River water that is circulated through constructed wetlands can help restore or preserve **high-quality surface water and groundwater**. Other types of infrastructure can maintain river health, helping to restore rivers that have experienced severe erosion or restore unstable river channels.



Green infrastructure is particularly beneficial for river health. It protects water quality and ecosystems of nearby water bodies by reducing CSOs and filtering water naturally. Green infrastructure also reduces urban flooding and runoff, supports urban ecosystems, and recharges groundwater and aquifers.

Table 4.2 identifies examples of water resources infrastructure that can negatively or positively affect healthy river functions.

TABLE 4.2. EXAMPLES OF WATER RESOURCES INFRASTRUCTURE THAT CAN AFFECT HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF INFRASTRUCTURE
 <b>Natural streamflow and water balance</b>	Stormwater outfalls, diversion structures, levees
 <b>High-quality surface water and groundwater</b>	Stormwater and CSOs, surface runoff from nearby transportation infrastructure
 <b>Diverse biological community</b>	Diversion structures, stormwater outfalls, retention facilities
 <b>Dynamic sediment processes and quality soils</b>	Stormwater outfalls, floodplains/wetlands, retaining walls, buried infrastructure

## HOW TO USE INFRASTRUCTURE AS A RIVER SMART COMMUNITY



A River Smart Community that integrates water resources infrastructure and river management can capitalize on the benefits and reduce the negative impacts infrastructure can have on river health. For example, a community that includes transportation officials in IRM can help preserve healthy river functions and reduce the likelihood that a river may negatively affect transportation infrastructure. A community that incorporates its municipal water supplier in IRM can create efficiencies and leverage shared resources in source water protection and river health efforts.

A River Smart Community will also integrate water resources and river management across multiple levels of government. While some types of infrastructure are managed at a local level, others may fall under the jurisdiction of state or federal agencies. Water infrastructure — and its impacts — can also cross jurisdictional boundaries, so a River Smart Community integrates neighbors in their planning, as well.

# INFRASTRUCTURE RESOURCES

The following list is a summary of key resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

State of Colorado. Colorado Department of Transportation. 2018. Green Infrastructure Streets Guide.

State of Colorado. Colorado Department of Public Health and the Environment. Water quality reclaimed water (reuse) permits website.

State of Colorado. Colorado Water Conservation Board. Basin Implementation Plans.

Colorado WaterWise.

EPA. Climate Adaptation and Source Water Impacts website.

EPA. Green Infrastructure website.

EPA. Green Infrastructure in the Semi-Arid West website.

EPA. Green and Gray Infrastructure Research website.

EPA. Water Reuse and Recycling website.

Sholtes, J., et al. 2018. Managing Infrastructure in the Stream Environment. Journal of the American Water Resources Association. DOI:10.1111/1752-1688.12692.

WaterReuse Association.









# HOW RIVER SMART COMMUNITIES CAN USE WATER RESOURCES MANAGEMENT TO SUPPORT IRM

The water resources sector has traditionally focused on the beneficial use of water, ensuring water supplies are sufficient to meet human demands for water. While some approaches to water resources planning have begun to recognize the importance of including the natural environment, a River Smart Community seizes on the opportunity to widen the discussion and include river managers and environmental interests. In doing so, multiple stakeholders can work towards achieving common goals, leveraging resources, and creating efficiencies to protect river corridors while also supporting water resource needs. By integrating river management

and water resources, a River Smart Community can ensure water resources infrastructure is beneficial for its intended purpose and, where possible, also has an added benefit of supporting healthy river functions.

Table 4.3 provides specific examples from this chapter where water resources can affect healthy river functions, either positively or negatively. This list is illustrative and meant to encourage River Smart Communities to identify opportunities in their own communities for integrating water resources and IRM.

TABLE 4.3. EXAMPLES OF WATER RESOURCES PLANS AND INFRASTRUCTURE THAT CAN AFFECT HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF WATER RESOURCE PLANS	EXAMPLES OF WATER RESOURCE INFRASTRUCTURE
 <b>Natural streamflow and water balance</b>	Water supply plans, Water efficiency plans, Stormwater plans, IWMP	Reservoirs, Irrigation diversions, Green infrastructure
 <b>High-quality surface water and groundwater</b>	Stormwater plans	Wastewater treatment plants, Stormwater outfalls, Green infrastructure
 <b>Diverse biological community</b>	IWMP, One Water plans	Reservoirs, Irrigation diversions, Buried creeks, Green infrastructure
 <b>Dynamic sediment processes and quality soils</b>	Stormwater plans	Water storage infrastructure, Buried pipes, Green infrastructure



# RIVER HEALTH





# INTRODUCTION

Healthy rivers provide multiple environmental and community benefits, including reduced flood risk, increased recreational opportunities, and reduced need to treat water for agriculture and municipal uses. Healthy rivers are also essential to maximizing their benefits for land use, hazard mitigation, and water resources. Of course, rivers do not flow in isolation. Their health depends on the health of the interconnected network of aquatic resources that flow in and out of rivers, as well as their riparian vegetation that filters pollutants and provides critical habitat. Protecting the health of Colorado's rivers also means protecting aquatic and riparian ecosystems and creating holistic policies that consider the interdependence of these systems. See the Introduction for additional discussion about key functions and benefits of healthy rivers.

Planning for river health occurs at state and local levels — stakeholders manage watershed and rivers via plans that consider water quality, habitat, water flows, vegetation, and recreation. Watershed organizations and local governments implement those plans through programs that assess river health, preserve habitat, improve water quality, restore floodplains, and provide multi-purpose benefits. Understanding the various aspects of river health can highlight opportunities to integrate land use management, hazard mitigation, and water resources management under an Integrated River Management (IRM) paradigm. River health plans, therefore, provide a vital opportunity for a community to integrate their river health priorities

and priorities from different sectors to protect and improve their river corridors. Doing so will preserve, protect, and restore river corridors that are crucial to the lifeblood of Colorado communities.

Colorado takes a multifaceted approach to protecting and restoring the health of its valuable rivers — employing a combination of regulations, plans, programs, and actions to ensure their health and sustainability. This chapter discusses the various regulations, planning types, programs, and practices, delving into more specific details about types of river health plans and how they can support IRM. Because each community has a different regulatory, political, and environmental context, there is no one-size-fits-all approach to using river health in IRM. Communities can work with key partners to identify different plans, programs, and actions that may help them accomplish different goals. This chapter also includes general suggestions and “in practice” highlights from communities to provide examples and spark ideas.





# KEY PARTNERS

Communities can most effectively integrate IRM and river health when key partners work together, such as:

## General river health partner categories

Agricultural producers and agriculture organizations  
City and county public health agencies  
City and county environment agencies  
Ditch companies  
Ground water management districts  
Local recreation industry partners  
Local watershed and environmental groups  
Restoration practitioners  
Utilities, especially local water supply, wastewater, and stormwater agencies, companies, and organizations

## Examples of river health partners for Colorado communities

Bureau of Land Management (BLM)  
Bureau of Reclamation  
Colorado Association of Stormwater and Floodplain Managers  
Colorado Department of Agriculture (CDA)  
Colorado Department of Public Health and the Environment (CDPHE)  
Colorado Parks and Wildlife (CPW)  
Colorado Division of Water Resources  
Colorado Water Conservation Board (CWCB)  
Colorado Water Congress  
Colorado Watershed Assembly  
Environmental Protection Agencies (EPA)  
Natural Resources Conservation Service (NRCS)  
National Oceanic and Atmospheric Agency (NOAA)  
United States Army Corps of Engineers  
United States Department of Agriculture (USDA)  
United States Fish and Wildlife Agency  
United States Forest Service (USFS)  
National Parks Service (NPS)

## REGULATORY CONTEXT

Federal and state legislation protects river health in Colorado. At the federal level, the 1977 Clean Water Act (CWA) and its statutes seek to restore and maintain the chemical, physical, and biological integrity of the United States' waters and aquatic ecosystems. The CWA influences development activities around rivers and wetlands. The Environmental Protection Agency (EPA) sets national standards and guidelines under the CWA.

In Colorado, the CDPHE implements these standards

at the state level, regulating river health through a comprehensive set of water quality control regulations and programs and ensuring compliance with federal requirements. CDPHE also engages in monitoring and assessment activities to track water quality and identify areas needing improvement. They provide technical and financial assistance for water quality projects and collaborate with local governments, stakeholders, and the public to develop and implement effective water quality management plans. Through these efforts, CDPHE plays a crucial role in safeguarding the health of Colorado's rivers and streams.

# REGULATORY CONTEXT

## Federal

Clean Water Act (CWA) of 1977 (33 U.S.C. § 1251 et seq.) seeks to restore and maintain the chemical, physical, and biological integrity of the United States' waters and aquatic ecosystems.

Section 303(d) requires states to identify water bodies that do not meet water quality standards and create plans for restoring them

Section 404 of the CWA regulates the discharge of dredged or fill material into wetlands and streams

## Colorado

*Water and Irrigation:* Title 37 of the 2023 C.R.S. (C.R.S. § 37-1-101 et seq.) details the main governing provisions for water resources, conservation, and irrigation in Colorado.

Articles 1-8 Conservancy Law of Colorado: establishes conservancy districts and focus on flood control

Articles 20-33 Drainage and Drainage Districts: establishes drainage districts

Articles 40-50 Water Conservation and Irrigation Districts: establishes water conservation and irrigation districts and details their responsibilities including issuing bonds and managing water rights.

Articles 60-75 Water Conservation Board and Compacts: establishes the Colorado Water Conservation Board and Basin Roundtables, and details their structure and responsibilities including water conservation, role in interstate water compacts, and administering water resources.

Articles 80-93 Water Rights and Irrigation: establishes the role of the State Engineer and covers water rights issues including adjudication, transfer, and irrigation regulation (water rights generally are covered in the Colorado Constitution in article XVI §§ 5 to 8).

Article 95 Water Resources and Power Development: focuses on hydropower, including constructing and operating reservoirs and dams.

Articles 96-99 Water Conservation: detail the importance of water conservation and efficiency practices.

*Nonpoint Source Pollution Control:* Addresses pollution from diffuse sources like agriculture and urban runoff through best management practices and voluntary programs.

CDPHE Nonpoint Source Management Program (NPS Program): provides resources for nonpoint pollution control

*Discharge Permits:* Industries and municipalities that discharge wastewater into streams must obtain permits that limit pollutants and ensure compliance with water quality standards.

CDPHE Colorado Discharge Permit System (CDPS): enforces water quality standards for point source pollution. This system ensures that facilities like wastewater treatment plants and industrial

# REGULATORY CONTEXT (CONTINUED)

operations comply with effluent limitations to protect water quality. CDPS enforces pollutant discharge limits, water quality standards, stormwater discharge permits, and Total Maximum Daily Loads (TMDLs):

5 Code of Colorado Regulations (C.C.R.) § 1002-85 “Regulation 85” “Nutrient Management Control Regulation”: — sets limits on the concentration of various nutrients in point source wastewater discharges.

*Antidegradation Policy:* Aims to prevent the deterioration of existing high-quality waters.

*Water Quality Control Act:* Title 25 Article 8 of the C.R.S. (§ 25-8-101 et seq.) regulates water quality in the state and establishes the legal framework for water quality regulation. It sets specific limits for pollutants and other parameters (temperature, dissolved oxygen) to maintain designated uses (drinking water, aquatic life, recreation); grants authority to the CDPHE’s Water Quality Control Commission (WQCC), a regulatory body that establishes standards and classifications for surface and groundwater quality across the state; and requires the WQCC to establish standards for regulating dredge and fill activities in state waters, ensuring that construction near wetlands and streams does not harm water quality. It establishes a state regulatory program to permit dredge and fill activities impacting state waters not covered by the Clean Water Act. Specific regulations that fall under Title 25 include:

Regulation 31: outlines the basic standards and methodologies for surface water

Regulation 41: covers groundwater standards

Regulation 93: lists the Colorado waters that have been designated as “impaired”, or do not meet water quality standards. The list of impaired waters in Colorado is commonly referred to as the 303(d) list, in reference to the CWA Section 303(d).

*Instream flows:*

H.B. 24-1379: allows CWCB to acquire and protect instream flow rights.

C.R.S. § 37-92-102(3) Colorado Instream Flow Law (Water Right Law) of 1973: authorizes the CWCB to acquire and protect instream flow rights.



# PLANS

River health plans, like land use, hazard mitigation, and water resources plans, are a way for communities to assess, protect, restore, and adaptively manage locally important surface water resources and the environmental and social benefits they provide. In fact, best practice guidance for river health plans, such as EPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters" support practices that are synergistic with other sectors discussed in this guidebook. The plans discussed in the other sector chapters compliment, and often overlap, the types of river health plans presented here so make sure to review the planning sections of other sector chapters as well. As with other sectors, the river health planning process is iterative, holistic, geographically defined, integrated, and collaborative. Stakeholders lead the planning process and define goals, objectives, scope, and other planning elements.

## Types of plans

Herein, the term "river health planning" is intentionally broad. Plans typically include a focus on water quality, aquatic habitat, source water protection (e.g., watershed health), environmental flows, river restoration, or a combination of these issues. Although each plan type emphasizes different issues and reflects unique goals and management strategies, some common features are included in every planning process.

Each type of plan plays a crucial role in maintaining the overall health and sustainability of river corridors. Further information on each type of plan is provided below. Other planning types that overlap with river health planning, such as Wildfire Ready Watersheds, Fluvial Hazard Zone, Integrated Water Management Plan, and One Water, are described in the other sector chapters.

Community engagement is a key aspect of all these plans. It ensures that plans reflect the values and needs of the people who live, work, and recreate

along the river. By involving diverse stakeholders, including residents, businesses, environmental groups, and local governments, planning processes can benefit from a wider range of perspectives and expertise. This collaborative approach fosters a sense of ownership and responsibility for the river's health, increasing the likelihood of successful implementation and long-term sustainability of restoration and protection efforts.

Effective community engagement in river health planning involves a variety of strategies. These may include public meetings and workshops to gather input and share information, citizen science initiatives to monitor water quality and habitat conditions, and volunteer opportunities for river cleanups and restoration projects. Using online platforms and social media can further broaden participation and communication. Through these efforts, community members become active participants in shaping the future of their river, ensuring that it remains a healthy and valuable resource for generations to come.

## TYPES OF RIVER HEALTH PLANS

River health plans are designed to assess, maintain, and improve the ecological health of rivers. These common types of plans are each described in detail in this section.

Watershed Plans

Stream Management Plans (SMPs)

Wildfire Ready Action Plans (WRAPs)

Habitat Restoration Plans

Environmental Flow Management Plans

Water Quality Plans

Riparian Buffer Plans

River Recreation Plans

## Watershed plans

Watershed plans are developed to manage and protect environmental and water resources within a geographic region, typically a forested or open space area. The goal of a watershed plan is often to identify and prioritize comprehensive strategies that safeguard the landscape that run off to rivers and streams. By addressing all sources and causes of surface water and groundwater impairments and threats, watershed plans aim to restore and protect the long-term health of the watershed. These plans, therefore, involve a series of cooperative and iterative steps to characterize existing conditions, identify and prioritize problems, define management objectives, develop protection or restoration strategies, and implement and adapt selected actions.

A key aspect of watershed plans is their adaptability and iterative nature. The plans are designed to be dynamic, allowing for adjustments based on new information and changing conditions. This approach ensures continuous progress toward achieving goals. The plans also emphasize the importance of collaboration among various stakeholders, including local communities, environmental groups, and government agencies, so that management strategies are effective and widely supported.

Source water protection plans are an example of watershed plans that aim to protect the quality of drinking water sources for downstream communities. Public water systems and source water protection partners use watershed plans to inform development of assessments and actions to protect and enhance the landscape that provides the source water. It provides a roadmap for coordinating partner actions, such as public education, watershed conservation, application of best management practices, or land use restrictions, and may help leverage government and private investment to improve the resilience of the water supply.

Further information on water quality and pollution control watershed plans is provided in the Water Quality Plans sub-section below.

## Stream management plans

Colorado's stream management planning is a collaborative, data-driven process aimed at protecting and enhancing the health of the state's rivers and streams. SMPs may evaluate river health measures such as fisheries, a river's ability to transport sediment, bank stability, or the health of riparian corridors. Well-developed stream management plans are grounded in the complex interplay of biology, hydrology, channel morphology, alternative water uses, and management strategies. They also consider the flow and other structural or management conditions needed to support both recreational uses and ecosystem function. The Colorado Water Plan emphasizes the importance of SMPs, aiming for 80% of locally-prioritized streams to have an SMP by 2030.

SMPs are not regulatory, and participation is not required; therefore, community involvement and buy-in is necessary. An inclusive stakeholder approach expedites cooperative and integrated project planning, which leads to successful implementation of measures that will meet the goals identified in the SMP.

The development of SMPs involves several key steps, including gathering stakeholders, identifying objectives, and developing a stream health assessment (SHA) based on existing conditions. SHAs include biological, hydrological, and geomorphological metrics to analyze holistic river health and recreation goals. These plans prioritize ecological and recreational values, establish goals for flows and physical conditions, and select quantitative measures to track progress. SMPs also identify and prioritize management actions to maintain or improve stream conditions. By providing a framework for decision-making and project implementation, SMPs help communities achieve measurable progress in maintaining or enhancing river health and sustaining existing uses.

## Wildfire Ready Action Plans

Wildfire Ready Action Plans (WRAPs) are part of CWCB's Wildfire Ready Watersheds (WRW) Program. This plan aims to help communities prepare for and mitigate the impacts of wildfires on watersheds and critical infrastructure. WRAPs can help a community think more broadly about potential threats to river health and identify opportunities to address both fire risk and river health. See Chapter 3, Hazard Mitigation, for additional information.

## Habitat restoration plans

An (aquatic) habitat restoration plan typically involves a series of coordinated actions aimed at improving the health and functionality of aquatic ecosystems. These plans often include measures such as removing barriers to fish passage, restoring natural water flow patterns, and enhancing in-stream habitats. For example, the U.S. Fish and Wildlife Service's habitat restoration efforts focus on activities like planting native vegetation, controlling invasive species, and removing dams or culverts that impede fish movement. These actions help to reconnect fragmented habitats, allowing fish and other aquatic species to access critical spawning and feeding areas, ultimately supporting biodiversity and ecosystem resilience.

Additionally, community involvement and partnerships play a crucial role in the success of these restoration projects. Local stakeholders, including private landowners, conservation organizations, and government agencies, collaborate to provide technical assistance, funding, and long-term stewardship. Public meetings and educational programs are often held to engage the community and raise awareness about the importance of healthy aquatic habitats. By leveraging resources and expertise

## IN PRACTICE

### RIO GRANDE HEADWATERS RESTORATION PROJECT STREAM MANAGEMENT PLANS

Alamosa, CO



Capitalizing on the idea of SMPs presented in the 2015 Colorado Water Plan, The Rio Grande Basin Roundtable identified three stretches of rivers in their basin to develop SMPs for: one segment of the Rio Grande, one on the Conejos River, and one on Saguache Creek. Each SMP included stream condition assessments that included hydrologic modeling, geomorphology, riparian vegetation, fish populations, aquatic life, water quality, and infrastructure inventory. The Roundtable then used results from the assessments to gather feedback from the diverse stakeholders in the San Luis Valley, collectively identify values, and prioritize projects. At least ten projects have come out of the SMPs — four of which are complete, and six of which are still underway. Projects ranged from bank stabilization to increasing access to the river for recreation. One of those projects, the Rio Grande National Forest Wet Meadow Restoration Project, is highlighted in an in-practice example in the program and practices section below.

### Take Home

SMPs provide an opportunity to bring diverse stakeholders together to create a common vision around river health and identify priority actions. The Rio Grande Basin Roundtable created efficiency and consistency by conducting multiple SMPs simultaneously. For example, stakeholders throughout the basin can look to the SMP assessments and compare common metrics across different stream segments. The SMPs and projects updates are available on the clear and easily accessible Rio Grande Headwaters Restoration Project website.

*Rio Grande Headwaters Restoration Project. 2020.  
Rio Grande, Conejos River, and Saguache Creek SMPs. ArcGIS  
StoryMap.*



# IN PRACTICE

## COALITION FOR THE POUDBRE RIVER WATERSHED PLANS Cache La Poudre River, CO



The Coalition for the Poudre River in Northern Colorado is a non-profit started in the wake of two wildfires in the watershed in 2012. These wildfires resulted in erosion, high runoff, debris flow, and degraded water quality along the river. Since that time the Coalition has been working towards its mission to, “improve and maintain the ecological health of the Poudre River watershed through community collaboration.” Since its inception, the Coalition has initiated several planning projects for the river focused on watershed planning, river restoration, forest restoration, and post-fire restoration, including Upper and Lower Poudre Watershed Resilience Plans. Because this organization is involved in collaboration, planning, restoring, and monitoring throughout the river corridor, each individual plan has ties to other plans. For example, the project objective of the *State of the Upper Poudre River Watershed: A River Health Assessment* plan specifically states, “The study will also support the Coalition in meeting the goals articulated in its *Upper Poudre Watershed Resilience Plan* by providing the basic information to help track the outcomes...”

### Take Home

When one group, like the Coalition, is involved in several distinct aspects of watershed planning along a river corridor, it can help achieve IRM by ensuring consistent goal setting and using funding to create efficiencies, such as funding a common assessment.

*Coalition for the Poudre River Watershed. 2023. Strategic Plan 2023-2028.*

*Coalition for the Poudre River Watershed. 2020. Cache la Poudre River Watershed-Based Plan.*

from various partners, these restoration plans aim to create sustainable and thriving aquatic environments that benefit both wildlife and people.

In Colorado, habitat restoration plans are crucial for maintaining the state’s diverse ecosystems. One prominent initiative is the Restoration and Stewardship of Outdoor Resources and Environment (RESTORE) Colorado Program, which funds large-scale habitat restoration and stewardship projects across public and private lands. This program focuses on a variety of priority landscapes including river corridors, riparian areas, and wetlands. By pooling resources from various state, federal, and private partners, RESTORE Colorado supports projects that enhance the resiliency of wildlife, ecosystems, and communities.

Another significant effort is the Colorado Wetlands Program, which aims to protect and restore wetland habitats throughout the state. This program works to improve water quality, provide wildlife habitat, and support biodiversity. Projects often involve activities like replanting native vegetation, controlling invasive species, and restoring natural hydrology. These efforts are essential for maintaining the health of Colorado’s wetlands and the species that depend on them.

## Environmental flow management plans

Natural flow regimes in rivers are fundamental for maintaining healthy ecosystems. These regimes, characterized by the natural variation in water flow over time, are essential for supporting aquatic life, riparian habitats, and overall river health. Flow management plans are designed to regulate and optimize the flow of water in rivers and streams to support ecological health, water quality, and human needs. These plans often involve setting specific flow targets that mimic natural flow patterns, ensuring that aquatic habitats receive adequate water at critical times to balance water use for agriculture, industry, and municipalities

with the ecological requirements of rivers and streams.

The first step in defining environmental flow needs is a hydrological analysis — studying historical flow data to understand natural flow variability, including high flows, low flows, and seasonal variations. The second step is ecological assessments to determine

## IN PRACTICE

### LOWER SOUTH PLATTE WATERSHED PLAN

Northeastern Colorado



The CDA Colorado State Conservation Board developed the Lower South Platte Watershed Plan with support from a Core Committee and financing from CDPHE, CSCB, CWQCC, and the West Greeley Conservation District. The plan's goals are to raise awareness about water quality issues, increase the availability of data, and implement best management practices to improve water quality. The plan uniformly assesses water quality issues, contaminants, sources, and data gaps for the watershed, identifies existing management activities, and makes project recommendations. The plan was developed with extensive stakeholder input from agriculture producers, domestic users, natural resource managers, land use managers, energy interests, ground water users, and water management entities.

#### Take home

Using a collection of funding sources, a champion can lead a collaborative effort to engage multiple stakeholders in a watershed-wide plan. This assessment provides a common collection of data to help guide and prioritize projects and creates a common baseline from which stakeholders in the basin can monitor water quality over time.

*Cronquist, M. n.d. Lower South Platte Watershed Plan. Colorado State Conservation Board.*

the flow requirements of key species and ecosystem processes, such as fish spawning, riparian vegetation growth, and sediment transport. These are often done in collaboration with CWCB and CPW.

One key initiative is the Colorado Environmental Flow Tool, developed to help the state's 7 Basin Roundtables refine, categorize, and prioritize their environmental and recreational flow needs (see the Colorado Water Plan callout box in the introduction for more information on the Roundtables). This tool uses hydrologic data and flow-ecology relationships to provide flow statistics and recommendations, ensuring that water management actions support the ecological integrity of river systems. In addition to the Flow Tool, the Colorado Water Plan details additional opportunities for support to meet environmental flow needs (See Chapter 2 "Technical Analysis Overview" and Section 3.7 "Reducing barriers to participation in the Instream Flow Program" in the Thriving Watersheds section of the Colorado Water Plan).

## Water quality plans

Water quality plans are essential for maintaining and improving the health of water bodies by controlling various sources of pollution. These plans typically involve setting water quality standards, monitoring water bodies, and implementing measures to reduce pollutants. They also identify beneficial uses of water bodies, such as drinking water, recreation, and habitat for aquatic life, and establish objectives to protect these uses.

CDPHE maintains a list of impaired waterbodies in the state that do not meet CWA standards, known as the 303(d) list. Some of the stream segments on the 303(d) List require a Total Maximum Daily Load (TMDL), which is a calculation of the maximum amount of pollution a stream can receive per day and still maintain minimum water quality standards. Colorado Regulation 93 includes 303(d) List stream segments that require TMDL. In Colorado, CDPHE follows 5 steps to determine a TMDL:

1. Select the pollutant to consider.
2. Estimate the water body assimilative capacity.
3. Identify the contribution of that pollutant from all significant sources.
4. Analyze information to determine the total allowable pollutant load.
5. Allocate (with a margin of safety) the allowable pollution among the sources so water quality standards can be achieved.

A key component of these plans is the implementation of best management practices (BMPs) to control pollution from non-point sources, such as agricultural runoff, urban stormwater, and forestry activities. BMPs may include measures like buffer strips, sediment basins, and proper waste disposal techniques. Additionally, point source pollution, such as discharges from wastewater treatment plants and industrial facilities, is regulated through permits that set limits on the load of pollutants that can be released into water bodies. Regular monitoring and assessment are conducted to ensure compliance with these standards and to identify areas needing further attention.

A “319 Plan” is another example of a water quality plan. It refers to a watershed management plan developed under Section 319 of the Clean Water Act, which focuses on addressing nonpoint source pollution (NPS) like runoff from agriculture, urban areas, and construction sites. The EPA provides funding grant funding to states to support the development and execution of their 319 plans. EPA requires that nine minimum elements be included in Section 319-funded watershed plans for threatened or impaired waters.

Summary of the nine minimum elements to be included in section 319-funded watershed plans for threatened or impaired waters

1. Identify causes and sources of pollution
2. Estimate pollutant loading into the watershed and the expected load reductions
3. Describe management measures that will achieve load reductions and targeted critical areas

## IN PRACTICE

### FRASER RIVER SOURCE WATER PROTECTION PARTNERSHIP SOURCE WATER PROTECTION PLAN Grand County, CO



Following CDPHE’s efforts to create source water assessment and protection plans for counties and public water providers, the Fraser River Source Water Protection Partnership (FRSWPP) created their *Source Water Protection Plan* in 2017. The FRSWPP is a collaboration of eight public water systems that all draw water supplies from the Fraser River Valley. The Colorado Rural Water Association provided guidance and technical assistance to the FRSWPP as they developed their plan. Over a year, the FRSWPP held public meetings and conducted stakeholder engagement to gather feedback and input. The plan inventoried potential contamination sources and identified issues that may compromise the water quality of the Fraser River Valley. Some of the issues of concern the FRSWPP identified include the potential for wildfires to compromise water quality and sediment loads and the need to strengthen partnerships to help with emergency communication, education, and outreach.

#### Take Home

Although this source water protection plan is focused on protecting drinking water supplies, it recognizes the need to bring in a wide diversity of stakeholders to protect healthy river functions and is a good example of bringing together partners and conducting public outreach and stakeholder engagement around a common water goal.

*Fraser River Source Water Protection Partnership. 2017. Source Water Protection Plan.*



4. Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan
5. Develop an information/education component
6. Develop a project schedule
7. Describe the interim, measurable milestones
8. Identify indicators to measure progress
9. Develop a monitoring component.

These elements ensure that watershed plans are comprehensive, actionable, and capable of achieving significant improvements in water quality. Inclusion of these nine elements are required to pass EPA approval and apply for EPA 319 grants, but they can be used for other watershed plans as well.

## Riparian buffer plans

A riparian buffer plan involves creating and maintaining vegetated areas (buffers between the river and other land uses) along the banks of rivers, streams, and other water bodies. These buffers typically consist of native trees, shrubs, and

grasses that help stabilize the soil, reduce erosion, filter pollutants from runoff, and provide habitat for wildlife. The plan outlines specific actions for planting, managing, and protecting these vegetated areas to enhance water quality, support biodiversity, and improve the overall health of the aquatic ecosystem. By implementing a riparian buffer plan, communities can effectively mitigate the impacts of land use on water bodies and promote sustainable watershed management.

## River recreation plans

River recreation planning involves creating and managing access points, facilities, and programs to enhance recreational opportunities while preserving the natural and cultural values of river environments. The goal is to balance the needs of recreationists with the protection of river ecosystems. This planning process typically includes assessing current recreational use, identifying potential impacts on the environment, and developing strategies to mitigate these impacts. For example, the River Access Planning Guide provides a framework for enhancing river access, ensuring that facilities like boat launches and trails are designed to minimize environmental disturbance while maximizing user experience.

Recreational users often become advocates for river conservation, participating in cleanup efforts, monitoring programs, and supporting restoration initiatives, so a key component of river recreation planning is stakeholder engagement. This involves collaborating with local communities, government agencies, conservation organizations, and recreational users to gather input and build support for the plan. Additionally, river recreation planning often includes the development of educational programs and materials to promote responsible recreation. These initiatives aim to inform users about best practices for minimizing their impact on the environment, such as proper waste disposal, respecting wildlife, and adhering to safety guidelines.



## HOW TO USE RIVER HEALTH PLANS AS A RIVER SMART COMMUNITY







Using river health plans as community planning tools can help protect and enhance local water resources, improve ecosystem health, and increase community resilience. Each of the plans discussed above has its own role in supporting river health, but there is also room in many communities to better align the plans under a common IRM vision. An IRM plan provides a critical opportunity for communities to define a common, stakeholder-driven vision for their river corridors. For example, following a facilitated period of public engagement, a community can shape its river health goals by including it as a community priority in a SMP. From there, other plans such as a watershed, habitat restoration, or water quality plan can detail specific IRM actions. Similarly, a community with a SMP can use it to advocate to include SMP priorities in other relevant plans, especially land use, hazard mitigation, or water resources plans. Aligning river health plans under an IRM plan umbrella will provide local governments and stakeholders with leverage to prioritize IRM work across the community and ensure that river management efforts are consistent, identify opportunities for collaboration, create efficiencies, and leverage resources. A River Smart Community may even realize that some of their river health plans are redundant and look for opportunities to streamline them. Incorporating IRM in planning processes also provides avenues for community and stakeholder feedback throughout the planning process. See the case studies in in practice highlights below for examples of a Colorado community that integrated river management into its river health plan.

For some communities, existing plans may already include actions to achieve healthy river functions or approaches to more effectively integrate river management. Plans such as those focused on sustainability, land use, or hazard mitigation likely articulate community-specific river management issues that can be elevated or captured in a community-wide IRM vision and other river health plans. For example, a SMP may include goals to preserve land along river corridors, and a water quality plan may outline approaches to minimize polluted runoff to rivers. Some communities may already have a river recreation master plan that addresses access and recreational uses along the river corridor. Table 1 gives examples of river health plans that can help meet specific IRM goals.





TABLE 5.1. EXAMPLES OF RIVER HEALTH PLANS THAT CAN AFFECT HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF RIVER HEALTH PLANS
 <b>Natural streamflow and water balance</b>	Watershed management plans, Environmental flow management plans, River recreation plans
 <b>High-quality surface water and groundwater</b>	Watershed management plans, Water quality pollution control plans, Riparian buffer plans
 <b>Diverse biological community</b>	Habitat restoration plans, Stream management plans, Environmental flow management plans, Riparian buffer plans
 <b>Dynamic sediment processes and quality soils</b>	Habitat restoration plans, Stream management plans, Environmental flow management plans

# RIVER HEALTH PLAN RESOURCES

The following list is a summary of key planning resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

- EPA Healthy Watersheds Protection website
- CDPHE Watershed Planning and Planning Tools website
- Colorado’s Stream Management Plan Resource Library
- Colorado State University’s One Water Solutions Institute
- CWCB’s Environmental Flow Tool
- CWCB Colorado Water Plan







# PROGRAMS, ASSESSMENTS, AND ACTIONS

Federal and state agencies, universities, and other groups have developed several programs and actions to help communities put their river health plans into practice. Programs offer high level guidance, technical resources, and examples for communities looking to learn more. Communities can then take on-the-ground actions to achieve river health. The programs and actions listed here are focused on river health but many overlap or may be used alongside those discussed in the other sections of this guidebook. Many of these programs and actions may also include opportunities for funding.

## TYPES OF PROGRAMS

This section provides an overview of various federal and state programs that provide technical resources, guidelines for developing a river health program, and funding opportunities.



### Federal Programs

Several federal agencies, including EPA, USDA, NOAA, BLM, USFWS, USFS, and NPS, offer programs that preserve, protect, and improve river health. Each agency offers different resources and opportunities, but this section offers a summary of a selection of those programs.

#### EPA Healthy Watersheds Program (HWP)

The HWP, managed by the EPA, supports the protection of high-quality waters and provides technical, financial, and educational assistance. The program's vision is to, "protect and maintain the aquatic ecological integrity of watersheds and supporting habitat networks." Key aspects of the program include:

*Assistance:* The HWP offers various types of support, including technical assistance, financial aid, and educational outreach to states, tribes, and local communities.

*Assessment Tools:* The program provides tools like the Preliminary Healthy Watersheds Assessments and the Watershed Index Online to help identify and prioritize healthy watersheds.

*Partnerships:* The HWP collaborates with other federal agencies, states, and conservation organizations to share data, strategies, and successful practices.

By protecting healthy watersheds, the HWP helps communities build resilience against threats like water quality issues, habitat loss, and climate change impacts.

## **Natural Resources Conservation Service Incentive Programs**

NRCS offers several conservation incentives programs aimed at helping landowners and agricultural producers implement sustainable practices. Here are some key programs:

*Environmental Quality Incentives Program (EQIP):* provides technical and financial assistance to address natural resource concerns, such as improving water and air quality, conserving water, enhancing soil health, and creating wildlife habitats. EQIP provides funding or financing opportunities (e.g. compensation, cost-sharing, low-interest loans) for agricultural producers to create riparian buffers or implement other conservation practices on agricultural land.

*Conservation Stewardship Program (CSP):* helps landowners build on their existing conservation efforts by providing financial and technical support to enhance their operations

*Agricultural Conservation Easement Program (ACEP):* helps protect, restore, and enhance wetlands and working farms through conservation easements

*Conservation Innovation Grants:* support the development of new tools, approaches, and technologies for natural resource conservation on private lands.

*Emergency Watershed Protection (EWP) Program:* EWP assists communities in recovering from natural disasters by providing technical and financial support for emergency recovery work.

*Regional Conservation Partnership Program (RCPP):* is a partner-driven approach to

conservation that funds solutions to natural resource challenges on agricultural land.

NRCS has Colorado-specific watershed programs that follow state priorities, including state financial services programs for EQIP, CSP, ACEP, EWP, and RCPP.

## **State Programs**

Colorado has several stream and watershed health programs and policies aimed at protecting and restoring its water resources, including several programs developed by the Colorado Water Conservation Board (CWCB). These programs and policies work together to ensure the health and sustainability of Colorado's watersheds, providing benefits such as clean water, flood protection, and habitat preservation.

### **Colorado Department of Public Health and Environment Programs**

CDPHE oversees two programs that are relevant to planning for river health, which are discussed below.

CDPHE oversees the Impaired Waters Program, which aims to identify and restore water bodies that do not meet water quality standards. Under Section 303(d) of the CWA, CDPHE compiles a list of impaired waters every two years, known as the 303(d) List. This list includes water bodies that require TMDLs to limit pollutants and improve water quality. The program involves extensive monitoring, assessment, and public reporting to ensure transparency and effectiveness in addressing water quality issues.

A new state Dredge and Fill Program permits dredge and fill activities impacting state waters not covered by the CWA. This program is designed to maintain the health of Colorado's waterways by regulating activities that could impact them. It focuses on protecting ephemeral streams and isolated wetlands. The Water Quality Control Division is tasked with developing the program, while the WQCC will establish permitting and

mitigation rules by December 31, 2025. The Division will provide training on the Temporary Authorization process, including application requirements and compensatory mitigation.

### Colorado Water Conservation Board Programs

The CWCB provides several programs that are useful for planning for river health, which are discussed below.

The Wildfire Ready Watersheds (WRW) program provides guidance to help predict where and what post-fire impacts will be felt in local communities. In addition to identifying what parts of the state and the state's infrastructure are susceptible to post-fire hazards, the program provides a detailed work plan that community groups can use to incorporate local priorities and values. Importantly, it also provides guidance on actions that may be taken to reduce the impact of these post-fire hazards on infrastructure and natural resources — both before, and after, a wildfire occurs. The program supports pre-and post-wildfire planning and response efforts in local communities.

Following extensive flooding in 2013, CWCB developed a Fluvial Hazard Zone (FHZ) program to recognize and assess the hazards associated with erosion, sediment deposition, and other dynamic river processes. The program provides a technical protocol to help communities identify, map, and plan for these natural hazards. The program represents a significant and necessary step forward in adaptively managing stream corridors, preparing for and mitigating flood impacts, and making informed land use decisions based on an awareness of fluvial processes. See Chapter 3, Hazard Mitigation, for further information on the FHZ program.

The Instream Flow program is a state-led initiative to protect and improve the natural environment of streams and rivers by establishing instream flow water rights. These are non-consumptive rights that allow water to remain in the stream for the benefit of the environment. These rights help preserve or enhance flows needed for healthy aquatic

## IN PRACTICE

### PARK COUNTY WETLAND AND STREAM INVENTORY

Park County, CO



Following the CORHAF, the Park County Land and Water Trust Fund hired a contractor to conduct a baseline inventory of the health of several major streams and wetlands in the County. The inventory presents results on wetland land cover, and wetland and stream types, condition, and function, ultimately issuing each reach of stream and wetland assessment area a grade from A (negligible impairment) to F (profound impairment). The County is using results from the inventory to communicate with stakeholders, help prioritize restoration projects, and monitor stream and wetland health over time.

#### Take Home

A stream health assessment framework creates a common understanding of the health of rivers throughout the County. The County can use results from the inventory in its restoration efforts, creating consistency, efficiencies in resources, and understanding about which interventions have the biggest impact.

*Beardsley, M. 2016. Park County Wetland and Stream Inventory. EcoMetrics, LLC.*

*CWCB. Colorado Stream Health Assessment Framework. PPT developed by Brad Johnson and Mark Beardsley. Park County. Land & Water Trust Fund.*



ecosystems, recreation, and other environmental benefits. CWCB is the only entity in Colorado that can hold instream flow water rights. Therefore, CWCB works with various stakeholders, including state and federal agencies, local communities, and water users, to identify and prioritize streams for instream flow protection.

The Watershed Restoration Grant program: Supports projects designed to restore and protect watersheds, reduce flood hazards, stabilize stream channels, and enhance habitat. CWCB recently has approved a special release of the Colorado Watershed Restoration program focused on the development of Wildfire Ready Watershed action plans and implementation of projects designed to mitigate post wildfire impacts.

Colorado Water Plan grants support the implementation of the Colorado Water Plan by funding projects that address the state's water challenges. These grants aim to foster collaborative, multi-benefit projects that enhance Colorado's water resilience and sustainability. Funding for river health planning and implementation is supported by several grant categories including:

*Conservation & Land Use Planning:* Strategies for water efficiency, drought planning, and integrating water and land use,

*Engagement & Innovation:* Efforts in water education, outreach, and innovative solutions, and

*Watershed Health & Recreation:* Planning, design, and implementation of projects to enhance watershed health and recreational opportunities

Governmental entities, municipalities, districts, enterprises, counties, and state agencies can apply for these grants. Federal agencies are encouraged to collaborate with local entities. Applications are submitted through the CWCB Portal, with deadlines typically in December and July. Projects are assessed based on available funds and alignment with the Water Plan's goals.

## Colorado's Strategic Plan for Climate-Smart Natural and Working Lands

Recognizing the important role of natural lands in climate change, CDA, Department of Natural Resources, CWCB, the Colorado State Forest Service, and Colorado Natural Heritage Program developed "Colorado's Strategic Plan for Climate-Smart Natural and Working Lands" in 2023. The plan identifies the carbon sequestration and greenhouse gas (GHG) reduction opportunities that "working lands" can play in helping reach Colorado's GHG reduction targets. Working lands include croplands, rangelands, forests, grasslands and shrublands, wetlands and riparian areas, and urban green spaces. The plan recommends broad priority strategies, many of which align closely with river health actions including:

Map, inventory, protect, and restore wetlands and riparian areas

Restore degraded headwater wetland and riparian areas, especially those connected to large patches of intact wetlands

Monitor and evaluate wetland and riparian restoration efforts

The plan also calls for increasing funding and grant opportunities to restore and protect wetlands and riparian areas, with a focus on their benefits as carbon sinks and as a mechanism to reduce GHG emissions.



# TYPES OF ASSESSMENTS AND ACTIONS

River health actions include watershed and river assessments and monitoring, watershed and river/stream restoration, riparian and aquatic habitat restoration, flow management, recreation improvements, and public education. Chapter 2, Land Use Management; Chapter 3, Hazard Mitigation; and Chapter 4, Water Resource Management, also describe practices that preserve, protect, and restore river health.

## Assessments

Evaluating the conditions of each healthy river function is important to gain a baseline understanding of a river corridor's health. Identifying key metrics can help a community identify priority needs. Conducting the same, or similar, assessments of these metrics at regular intervals enables communities to monitor river health and track the impact of different projects. The types of assessments discussed below can be used to assess river health.

## IN PRACTICE

### RIO GRANDE NATIONAL FOREST WET MEADOW RESTORATION PROJECT

Rio Grande National Forest, CO



In 2020, the Rio Grande Headwaters Restoration Project led the development of three SMPs in its watershed: the Rio Grande SMP, the Conejos River SMP, and the Saguache Creek SMP. One of the projects that came from the SMP process was a wet meadow restoration project focused on high elevation meadows in the Rio Grande National Forest. These unique ecosystems play a vital role in maintaining streamflow and reducing flood risk by capturing snowmelt and slowly releasing it throughout the summer and fall, and they provide habitat for critical river species. Human and climate impacts have strained these fragile systems, so they have lost many of their ecosystem functions.

One of the most effective ways to restore wet meadow ecosystems is to reintroduce and support North American beaver populations because their dams encourage natural streamflow patterns, which reestablishes riparian vegetation and creates aquatic and riparian habitat. This project focused on characterizing the habitat to identify priority restoration areas; restoring habitat using “low-tech” restoration techniques installing restoration structures made of wood, rock, and sod that will slow the flow of the stream; reintroducing beavers; and monitoring the project's efforts. As of 2024, the project had installed 31 low-tech structures and relocated 12 beavers.

#### Take home

“Protecting and restoring floodplain connection and wet meadows...” was identified by stakeholders as a community value and general objective during the Conejos River SMP (the Conejos River is a tributary of the Rio Grande and wet meadow restoration was identified as an action item under the SMP's Goal C: Maintain and improve the function of floodplains, associated alluvial aquifers, and natural channel processes. This project illustrates an example of location-specific, on the ground project that is rooted in a basin-wide planning effort, demonstrating the important throughline between planning and practices.

*Rio Grande National Forest Wet Meadow Restoration Project. Rio Grande Headwaters Restoration Project. Conejos River SMP. 2020. Prepared by Rio Grande Headwaters Restoration Project.*



## Colorado River Health Assessment Framework (CORHAF)

A fundamental component of the stream management planning effort described in the Planning section above is the development of a stream health assessment to understand existing conditions in the watershed and the primary stressors that have played a part in influencing current conditions. Many SMPs across the state use an adaptation of the Functional Assessment of Colorado Streams (FACStream 1.0; Beardsley et al., 2015). This is a reach-scale assessment tool that rates stream health according to the degree of impairment of several ecological variables.

The Colorado River Health Assessment Framework (CORHAF) is a recent iteration of FACStream that can be customized to a particular stream or watershed and has been used as a river health assessment organizational framework for several SMPs. It provides a unified and consistent approach to collecting data and monitoring river health to guide restoration and management actions for an entire watershed. CORHAF also assists land managers, community members, policymakers, river advocates, scientists, and others concerned in understanding the state of a stream or river and the myriad of challenges the waterway faces.

These frameworks can be used to study core drivers of river health, represented by several variables (e.g., flow regime, floodplain connectivity, riparian condition, biotic community, and water quality), for each sub-reach within the project extent. Each reach, and each variable within each reach, is graded using an academic (“A” to “F”) scoring scale that indicates the degree of impairment from a desired condition. Possible stressors and likely causes of impairment are also explored. Together, the variables and stressors provide a holistic view of river health, and variable-specific metrics can be used for a detailed assessment of any specific aspect of river health over time.

The comprehensiveness of the data used to score each variable ranges from coarse-level information



designed to provide a general estimation of ecological integrity (e.g., windshield surveys, desktop assessments, anecdotal evidence) to fine-resolution data collection methods with intensive quantitative metrics (e.g., hydraulic modeling, R2Cross, riparian transects). Moderate resolution information includes rapid field assessments and detailed remote sensing analyses.

### Stream Visual Assessment Protocol (SVAP2)

The NRCS Stream Visual Assessment Protocol Version 2 (SVAP2) is a tool designed to help conservation planners, field office personnel, and private landowners evaluate the condition of aquatic ecosystems associated with wadeable streams. It provides a qualitative assessment of stream conditions, focusing on elements such as channel condition, hydrological alteration, riparian area conditions, and fish habitat complexity.

SVAP2 offers more detailed descriptions of scoring elements, making it suitable for tracking trends in stream conditions over time and identifying resource concerns. The assessment can be conducted with landowners or conservation planning teams, providing a snapshot of stream ecosystem conditions to assist in determining the quality of stream habitats.



## Water Quality Monitoring

CDPHE conducts extensive water quality monitoring to assess compliance with standards and identify impaired waters to ensure the protection and enhancement of the state's water resources.

*Surface Water Monitoring:* CDPHE conducts regular monitoring of rivers, streams, and lakes to assess water quality. This includes measuring parameters such as nutrient levels, temperature, and pollutants.

*Groundwater Monitoring:* The department also monitors groundwater quality to detect contamination and ensure safe drinking water supplies.

*Nutrient Monitoring:* Special focus is given to monitoring nutrient levels in water bodies to prevent issues like algal blooms, which can harm aquatic life and water quality.

*Data and Measurable Results Program:* This program collects and analyzes water quality data to track trends, identify problems, and evaluate the effectiveness of water quality improvement efforts

These programs collectively help maintain and improve the quality of Colorado's water resources, as well as identify impaired areas and the effectiveness of actions to improve conditions over time.

## IN PRACTICE

### ASSESSING INSTREAM FLOWS THAT SUPPORT WHITEWATER RECREATION IN THE SAN MIGUEL RIVER BASIN

San Miguel River Basin, CO



This technical assessment explores the impact of streamflow on whitewater recreation activities, which have a considerable economic impact in the San Miguel basin. The study wanted to evaluate potential impacts of changes to water projects proposed by Montrose County. Different levels of flow provide differing recreation opportunities so better understanding the connection between flow and recreation can help decision makers manage flow releases from dams, reservoirs, pipelines, and diversions. The study authors gathered data from boaters to define “low, acceptable, and optimal resource conditions” for boating, and evaluated them against the hydrological data record for points along the river to create a metric known as “Boatable Days”. The study found that the County’s applications for water rights would have “little to no effect on whitewater recreation opportunities”, at least under current flow conditions. The study authors also expressed the desire that their research could be used for additional research and decision making by stakeholders in the Southwest Basin Roundtable.

#### Take Home

This report presents a scientific framework to assess the impact of river health on a key economic sector like recreation. It is an example of one of many datasets that a community can gather to help improve their overall understanding of the nuances of river health and its benefits to the environment and society.

*Fey, N. and E. Stafford. 2016. Assessing Instream Flows that Support Whitewater Recreation in the San Miguel River Basin. American Whitewater. Prepared for Deere & Ault Consultants, Inc.*

## Bioassessment

Assessment of aquatic ecosystems often focuses on their physical, chemical, and biological integrity, typically to determine the effects of human influence or assess the degree of risk to the system resulting from management, restoration, or other projects. Aquatic organisms, like fish and macroinvertebrates (insects, snails, etc.), are constantly exposed to the water and its conditions. Their presence, absence, or health reflects the cumulative impacts of stressors over time, providing a more complete picture than a snapshot water sample.

There are diverse bioassessment measurements that quantify the physical and biological structure and ecosystem processes of waterways based on various regulatory and non-regulatory science-based assessment frameworks and methods. Common bioassessment methods include:

*Macroinvertebrate sampling:* Identifying and quantifying aquatic insects and other invertebrates, which are sensitive to pollution and habitat changes.

*Fish surveys:* Assessing the diversity, abundance, and health of fish populations, which are indicators of overall ecosystem health.

*Algae and diatom sampling:* Analyzing the types and abundance of algae and diatoms, which can reveal nutrient pollution and other water quality issues.

Unlike measuring individual water quality parameters, bioassessment provides a comprehensive picture of how physical, chemical, and biological factors interact to affect the river's health. By comparing the current biological community to reference conditions (what a healthy stream should look like), managers can set realistic goals for restoration and improvement and evaluate the effectiveness of actions to meet those goals.



## Actions

### Watershed protection

Watershed protection practices and strategies aim to safeguard the health and integrity of entire watersheds and emphasize source water protection. Watershed protection involves a range of actions, from sustainable land use management and erosion control to water quality preservation and upland and riparian habitat restoration. River health related watershed protection examples include forest management, streambank stabilization, wetland protection, and road and construction site management. Effective strategies prioritize responsible development, minimize pollution from various sources, and protect critical areas like wetlands and riparian buffers. Thus, watershed protection is about recognizing the interconnectedness of land, water, and ecosystems.

## River and stream restoration

Watershed and river/stream restoration are critical actions to improve the health and resilience of Colorado's waterways. Due to historical land use practices, many of Colorado's watersheds, rivers, and streams have become degraded, impacting water quality, wildlife habitat, and recreational opportunities. Restoration efforts aim to reverse these impacts and restore natural processes. Common restoration goals and objectives related to river health include:

*Improve water quality:* Reduce pollutants and excess sediment, enhance filtration, and restore natural temperature regimes.

*Enhance aquatic habitat:* Create diverse instream habitats, reconnect fragmented streams, and provide spawning grounds for fish.

*Stabilize streambanks:* Reduce erosion, protect infrastructure, and improve riparian vegetation.

*Reconnect floodplains:* Allow rivers to access their floodplains, enhancing floodwater storage and improving nutrient cycling.

*Restore wetlands:* Restoring or creating wetlands adjacent to rivers to filter pollutants, provide habitat, and regulate water flow.

*Enhance riparian areas:* Restore healthy vegetation along streambanks to provide shade, filter pollutants, and stabilize soils.

Watershed and river corridor restoration projects need a plan to develop a logical sequence of steps to satisfy their goals and objectives. When establishing restoration project goals, it can be helpful to first zoom out and consider the scale of the drivers and stressors at play within your reach and watershed. This can inform the appropriate importance of the stressors, potential strategies to address these, and the scale of a stream project. See the Assessments section above for further information on identifying stressors.

Restoration practices aim to revitalize degraded

ecosystems along rivers and streams, focusing on the interface between land and water. These actions address various issues, from pollution and erosion to habitat loss and invasive species. Restoring riparian zones, for example, improves the vegetated areas bordering rivers and streams that are critical for water quality, habitat, and bank stability. Riparian restoration efforts often involve:

*Revegetation:* Planting native trees, shrubs, and grasses to stabilize banks, provide shade, filter pollutants, and create wildlife habitat.

*Erosion control:* Implementing measures like bioengineering (using natural materials) or structural techniques to prevent soil erosion and maintain bank integrity.

*Invasive species removal:* Eliminating non-native plants that outcompete native species and disrupt ecosystem balance.

*Livestock management:* Restricting or managing livestock access to riparian areas to prevent overgrazing and trampling, which can lead to erosion and habitat degradation.

Instream habitat improvements emphasize restoring ecological processes in the channel and floodplain by adding structures like logs, rocks, and gravel to create diverse habitats for aquatic organisms, including riffles, pools, and spawning areas. Often, removing or modifying barriers like dams and culverts to allow fish to migrate freely, connecting fragmented habitats, is a key strategy to instream habitat improvements.

Note that effective restoration often requires an integrated approach, which requires land use and water resources sectors as well as community engagement and monitoring. During the design phases, a multi-disciplinary team should develop the project elements with supporting data and technical analyses to ensure that the project goals and objectives are being fully satisfied.

Specific information on restoration techniques and design solutions (e.g., low-tech process based



restoration structures, natural channel design) are available in the Resources section below.

### **Environmental flow restoration**

Restoring flow regimes to mimic natural flow patterns supports ecological processes and reduces flood risks. Environmental flow restoration actions and strategies focus on managing water resources to maintain or restore the natural flow patterns of rivers. These actions recognize that rivers need a certain amount of water flowing at the right times to support diverse plant and animal life, maintain water quality, and provide essential ecosystem services. Example actions and strategies include dam removal, diversion structure and culvert replacement, revising water rights and allocation policies, ditch lining, and purchasing water. The Colorado Water Trust, a Colorado not-for-profit organization, specializes in supporting environmental flow restoration projects.

### **Recreation improvements**

River recreation in Colorado generates economic benefits for local communities through tourism and related industries. Improving recreation along rivers and streams creates opportunities for fishing, kayaking, and other recreational activities, while enhancing river corridor access and aesthetics. When rivers are healthy, they naturally become more attractive for recreational activities, and increased recreational use can, in turn, drive further improvements in river health. Examples of river recreation improvements and their connection to river health include:

*Improved access points:* Building trails, boat ramps, and fishing piers makes rivers more accessible for recreation, while also encouraging responsible use and stewardship.

*Restored riparian areas:* Planting native vegetation along riverbanks stabilizes shorelines, provides shade, and filters pollutants, benefiting both river health and recreational experience.

*Fish passage improvements:* Removing or modifying barriers to fish migration allows fish to access spawning grounds, enhancing fish populations and recreational fishing opportunities.

Recreational improvements often include signage and educational information that raises public awareness about the importance of river health and the need for protection.

### **Public education**

Public education plays a crucial role in fostering a strong connection between communities and their rivers, which can lead to improved river health. Effective public education actions use a variety of methods to reach diverse audiences, such as:

*School programs:* Engaging students in hands-on learning experiences about river ecology, water conservation, and pollution prevention.

*Community workshops:* Offering workshops and presentations to educate adults about river health issues and actions they can take.

*Public events:* Organizing river festivals, cleanups, and other events to raise awareness and engage the community.

*Media outreach:* Using social media, websites, and traditional media to disseminate information and promote river stewardship.







## HOW TO USE RIVER HEALTH PROGRAMS AND ACTIONS AS A RIVER SMART COMMUNITY



River health is a foundational element of IRM. A River Smart Community can use the programs and actions discussed in this section to support and guide them in developing river health plans or achieving the river health goals set out in those plans. A high-level planning process such as the EPA's HWP can help communities create high-level watershed-wide plans, whereas a community can find guidance and funding opportunities for specific projects using programs such as CWCB's Water Plan Grants. Table 1 offers examples of which programs and actions discussed here can target each healthy river function. A priority for any River Smart Community is a river health assessment which will identify baseline conditions and help prioritize river health projects. A River Smart Community may even expand a river health assessment to include other IRM indicators such as the number of stakeholder engagement opportunities or the number of shared projects secured. By raising awareness and understanding about the importance of healthy rivers, these programs empower individuals to become stewards of their local watersheds, rivers, and streams.

TABLE 5.2. EXAMPLES OF SPECIFIC RIVER HEALTH PROGRAMS AND ACTIONS THAT CAN ADDRESS HEALTHY RIVER FUNCTIONS

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF RIVER HEALTH PROGRAMS AND ACTIONS
 <b>Natural streamflow and water balance</b>	HWP, In-stream flow program, CORHAF, watershed protection, environmental flow restoration
 <b>High-quality surface water and groundwater</b>	Impaired waters program, Water quality monitoring, CDPHE Dredge and Fill program, watershed restoration, riparian and aquatic habitat restoration
 <b>Diverse biological community</b>	HWP, Dredge & Fill program, CORHAF, SVAP2, Bioassessment, river restoration
 <b>Dynamic sediment processes and quality soils</b>	FHZ, CORHAF, SVAP2, river restoration, riparian and aquatic habitat restoration



# RIVER HEALTH PROGRAM, ASSESSMENTS, AND ACTIONS RESOURCES

The following list is a summary of key planning resources that provides further information on the information presented above. The information presented below was up to date at the time of writing, however federal and state resources can change so we encourage communities to consider multiple resources as they pursue IRM.

Colorado Stream Health Assessment Framework (Beardsley et al., 2015)

CDA Colorado's Strategic Plan for Climate-Smart Natural and Working Lands

CDPHE Impaired Waters

CDPHE State Dredge and Fill Program

CWCB Fluvial Hazard Zone Program

CWCB Instream Flow Program

CWCB Water Plan Grants

CWCB Watershed Restoration Grants

CWCB Wildfire Ready Watersheds

EPA Healthy Watersheds Program

FACStream

Low-tech process-based restoration manual (Wheaton et al., 2021)

Guidance for Stream Restoration (Yocom and Reynolds, 2020)

Stream Evolution Model (Cluer and Thorne, 2014)

USDA NRCS







# HOW RIVER SMART COMMUNITIES CAN USE RIVER HEALTH TO SUPPORT IRM

The river health sector seeks to restore and protect the **natural streamflow and water balance, healthy water chemistry and nutrient cycles, diverse biological communities, and dynamic sediment processes and quality soils** in and around rivers. Communities can adopt different types of river health plans or take advantage of multiple programs and actions to guide river restoration and preservation. Unfortunately, as with other sectors, river health work is often conducted in a vacuum.

A River Smart Community will use river health to support IRM by aligning:

- The various river health plans, programs, and actions in their community;
- River health work and IRM plans; and
- River health plans, programs, and actions with river-related work in other sectors.





River health plans each have an important, specific role to play for a community addressing river health, but when these plans are created in isolation, they have the potential to unintentionally harm river health goals, duplicate efforts, and create inefficiencies. A River Smart Community will ensure that there is a throughline between the plans by aligning them under a shared IRM vision, and ensuring each one is integrated with the others.

Depending on the context, a community may start with defining a vision for their river as part of an IRM planning process and then weave that vision into river health work. Or a community with existing river health plans may choose to pull that existing work up into an IRM planning process. Finally, a River Smart Community will not only ensure that their river health efforts are aligned but also embed river health goals throughout other sectors that affect river health, especially land use, hazard mitigation, and water resources.

Strengthening the coordination between all the sectors that impact river health in a community under the umbrella of IRM will help a River Smart Community capitalize on resources, embed consistency, and create efficiency. This approach is especially essential as communities face increasing pressure on river health and strained resources. By integrating river health in all aspects of river management, a River Smart Community can maximize the environmental and social benefits of river health efforts.

Table 5.3 summarizes the examples from this chapter where river health can support IRM. This list is illustrative and meant to encourage River Smart Communities to identify opportunities in their own communities for integrating river health and IRM.

TABLE 5.3. EXAMPLES OF RIVER HEALTH PLANS, PROGRAMS, AND ACTIONS THAT CAN AFFECT IRM

KEY FUNCTIONS OF A HEALTHY RIVER	EXAMPLES OF RIVER HEALTH PLANS	EXAMPLES OF RIVER HEALTH PROGRAMS AND ACTIONS
 <b>Natural streamflow and water balance</b>	Watershed management plans, Environmental flow management plans, River recreation plans	HWP, ISF program, CORHAF, watershed protection, WRW, FHZ
 <b>High-quality surface water and groundwater</b>	Watershed management plans, Water quality plans, Riparian buffer plans	Impaired waters program, Water quality monitoring, Dredge and fill program, watershed protection
 <b>Diverse biological community</b>	Habitat restoration plans, Stream management plans, Environmental flow management plans, Riparian buffer plans	HWP, Dredge and fill program, CORHAF, SVAP2, Bioassessment, River and stream restoration
 <b>Dynamic sediment processes and quality soils</b>	Habitat restoration plans, Stream management plans, Environmental flow management plans	WRW, FHZ, CORHAF, SVAP2, River restoration







# CONCLUSION







# PUTTING THE PIECES TOGETHER

Each sector in this guidebook — land use, hazard mitigation, water resources, and river health — influences river management in some capacity. But as Figure 1 illustrates, the web of influences on river management in a community is complex. This complexity too often leads to limited coordination between sectors, resulting in redundancies, inefficiencies, and even work that can inadvertently harm the river or the work of other sectors. Especially as competing demands rise for increasingly strained supplies, different interests can escalate conflicts around river management, further entrenching existing silos.

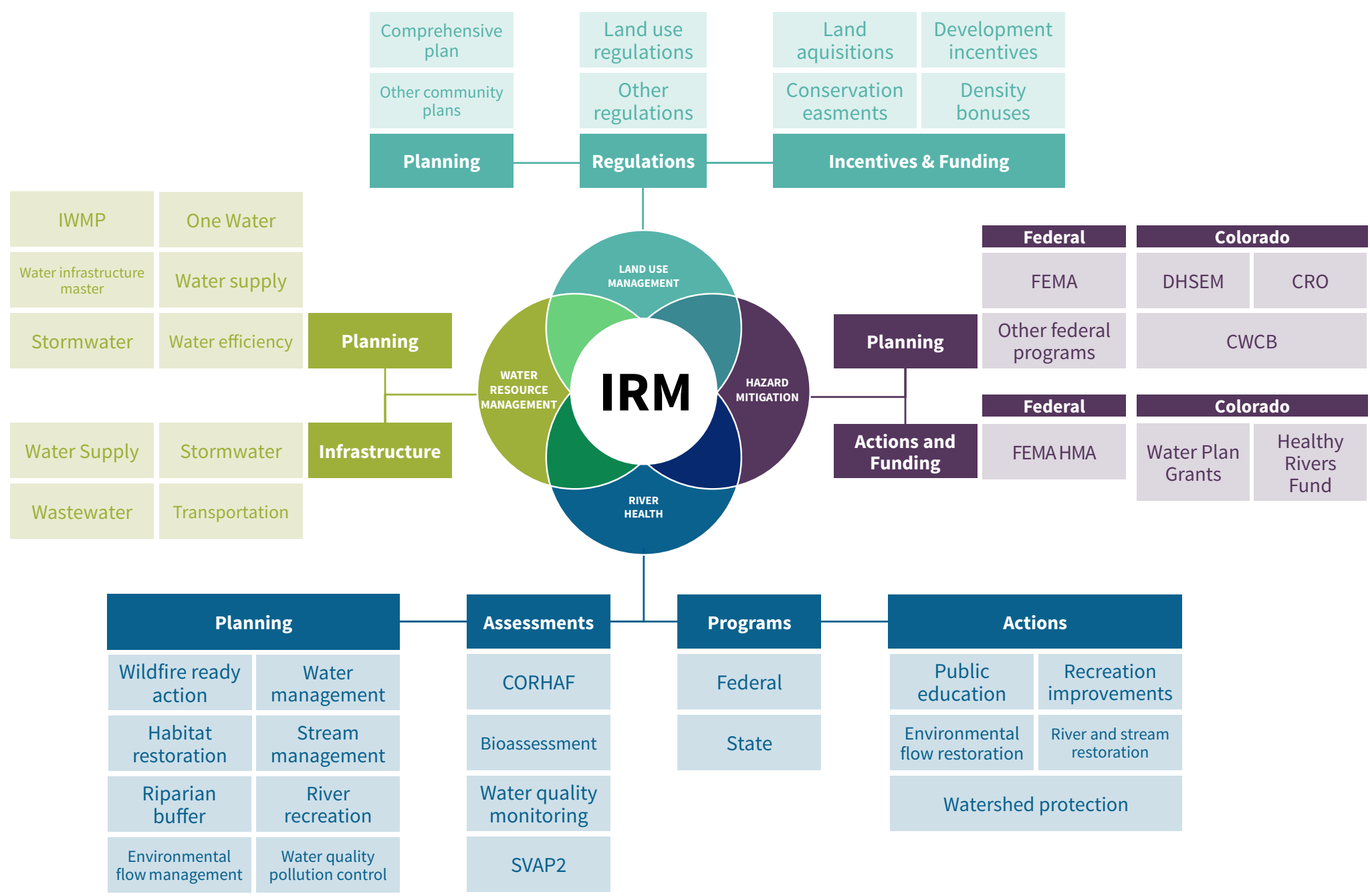
For many communities, this siloed and fraught approach is unintentional. Communities often face multiple obstacles to practicing integrated governance, including limited resources, weak structures or little reward for knowledge sharing

and collaboration across entities, lack of technical capacity, or no incentives for innovation. These factors stifle efforts to integrate sectors and can hamper the cultivation of champions to lead meaningful integrated river management.

River Network's River Smart Communities program provides a structure and pathway for communities who wish to improve their coordination around river management. River Smart Communities practice a holistic, iterative, community-driven approach that integrates planning, policies, and regulations to support a community-led river corridor vision. It puts Integrated River Management (IRM) at the center of river management, setting a collective vision for the river, and weaving that vision as a common thread throughout all sectors in a community to create a complete, community-based picture of river health.



Figure 6.1. IRM connects the complex web of river management by weaving a common thread through multiple sectors.





# RIVER SMART COMMUNITIES FRAMEWORK

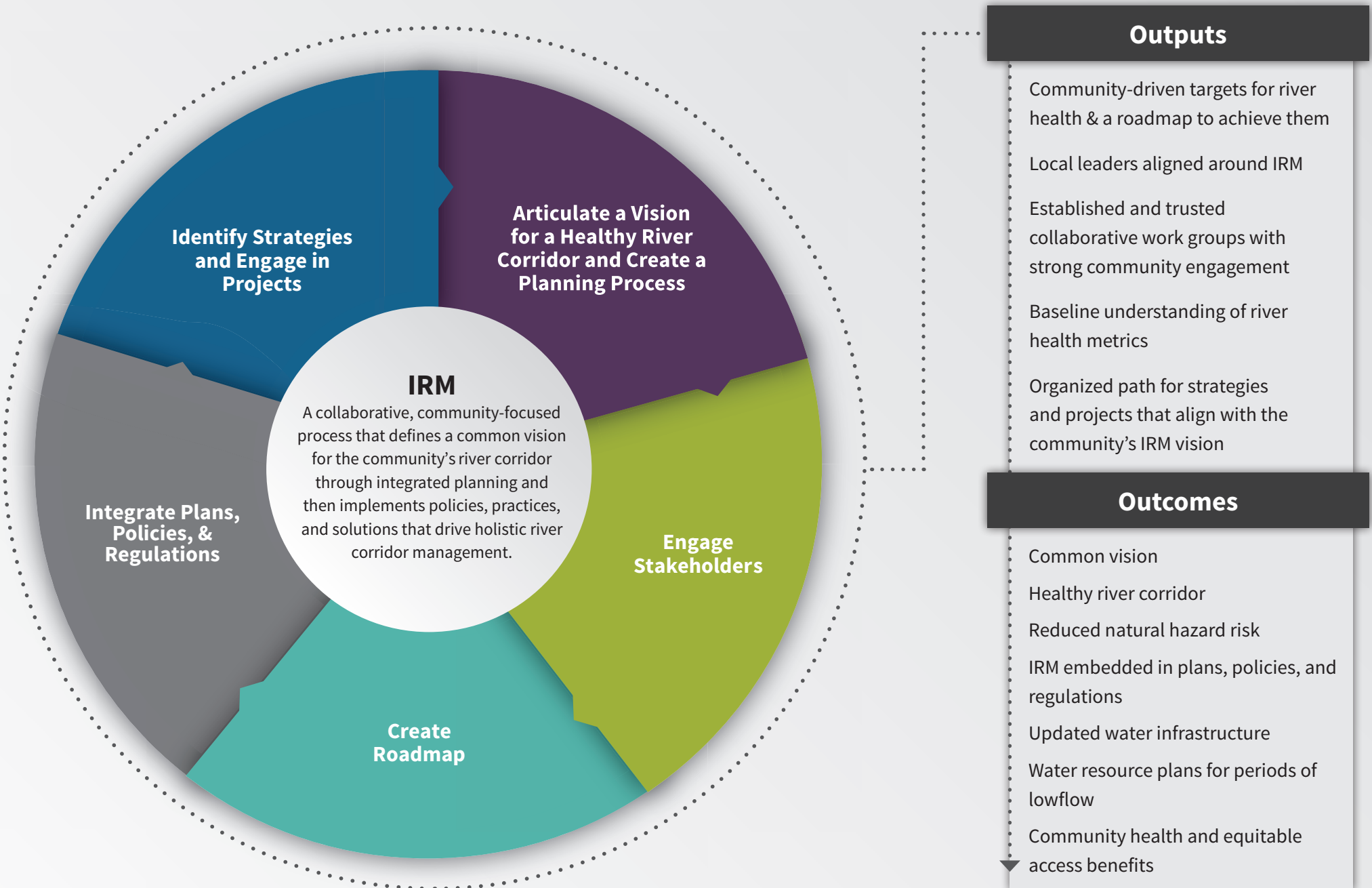
A River Smart Community adopts IRM by following the iterative framework presented in Figure 2. Because every community has a unique context, there is not a uniform approach to IRM, nor is IRM a linear, step-by-step process. Rather, the framework serves as a representation of a continual flow of information integral to IRM. A River Smart Community practices the following IRM principles, regardless of the order in which they occur:

1. Articulate common **visions** to align multiple stakeholders' priorities. Vision statements guide a collective IRM planning process or articulate community-driven river characteristics for a healthy river corridor. A common vision will provide clear and consistent guidance around river management across diverse interests. They strike a balance among competing interests for the river and create a collective understanding of river health.
2. Build a network of key **stakeholders** across diverse user groups to identify a vision for a healthy river corridor. Engage stakeholders thoughtfully, deliberately, and consistently. Ensuring multiple voices are included in developing a vision for the river will allow the community to balance priorities and discuss trade-offs, ultimately creating buy-in and ownership from all sectors. Creating a strong network of stakeholders improves partnership, opens new avenues for collaboration, builds trust, creates local support, and brings new perspectives and ideas to the discussion, elevating all voices.
3. Create a **roadmap** that will help stakeholders navigate a path to achieve their vision, including gathering existing information from scientific studies, community plans, and IRM best practices; conducting assessments of current conditions that establish baselines and fill in data gaps; and prioritizing recommended next steps. Creating a clear pathway for IRM will create resource efficiencies to maximize their impact.
4. Integrate holistic river elements in other **plans, policies, and regulations** — such as comprehensive, climate or sustainability, water-related, and hazard mitigation plans — and across different sectors including water resources, land use, stream health, and natural hazards to improve benefits for the environment and communities in an equitable manner.
5. Implement **strategies and projects** identified in the roadmap that will sustain or advance holistic conditions while not causing harm, and support stakeholders implementing those actions or projects.





Figure 6.2. River Smart Community Framework for IRM



# THE WAY FORWARD: HOW A RIVER SMART COMMUNITY CAN USE THIS GUIDEBOOK

Communities can reference this Guidebook to help them implement the River Smart Community Framework. It provides resources, case studies, and best practices to support communities as they build holistic river management and adopt the principles of IRM.



IRM PRINCIPLE	HOW A RIVER SMART COMMUNITY CAN USE THIS GUIDEBOOK
Visions	The Guidebook introduction identifies healthy river functions that communities can use to help them define their vision for a healthy river corridor.
Stakeholders	The agencies and organizations behind many of the resources mentioned throughout the sector chapters are potential stakeholders communities can include in IRM discussions.
Roadmap	The resources highlighted throughout the sector chapters can help communities create inventories of pre-existing and available resources germane to IRM as well as identify potential gaps.
Plans, policies, & regulations	The sector chapters list plans, policies, and regulations that are likely to influence river corridors. These are some of the resources communities can consider when implementing IRM.
Strategies & projects	Once a community lays a foundation of IRM, this guidebook can help identify and prioritize IRM strategies and projects (such as creating a sustainable system to monitor river health or implement floodplain restoration and hazard mitigation projects). The guidebook also offers ideas of where communities can codify healthy river practices, such as in land use codes.



# YAMPA CASE STUDY

The Yampa River basin offers an example of how local partners are implementing IRM to create a more resilient river system. This case study of the Yampa Integrated Water Management Plan (IWMP) illustrates how diverse stakeholders came together to implement the IRM principles.<sup>1</sup>

The Yampa River in Northern Colorado is critical to ranchers and agricultural producers, communities, recreators and fishers, and the ecology of Northwestern Colorado. Because of the diverse interests and structure of historic water rights along the Yampa, stakeholders are increasingly recognizing the importance of collaborating to manage the river.

Yampa's IWMP effort was born from the Yampa-White-Green River Basin Roundtable, which comprises approximately 30 stakeholders in the basin representing municipal, industrial, agricultural, recreational, and environmental interests. The Roundtable regularly creates and revises a Basin Implementation Plan (BIP) in which Roundtable members identify watershed goals that guide work within the basin. Following the release of the 2015 BIP, members of the Roundtable wanted to create a more streamlined pathway to meet the BIP goals. This pathway, built on stakeholder feedback and existing studies, became the Yampa IWMP.

## Vision

The IWMP created two distinct but related vision statements. The first aligned the IWMP process, providing clarity about the goals of the IWMP. The second, the “River in Balance,” defined a collaborative longer-term vision for what characteristics would bring the Yampa in balance, i.e., meeting the needs of all users while simultaneously protecting the river from degradation.

Both vision statements aligned diverse stakeholders around common goals and provided focus for the work. Every recommendation had to align with the “River in Balance” vision. The IWMP vision was fulfilled with the culmination of the IWMP, but the “River in Balance” statement continues to define a path for IRM work in the Yampa.

## Lessons learned

A River Smart Community can craft vision statements for a healthy river corridor. Sometimes this may mean creating multiple vision statements to guide different aspects of the work.

<sup>1</sup> Although this effort is referred to as an Integrated Water Management Plan, in practice it integrated sectors beyond water resources and therefore serves as a good example of Integrated River Management.



## Stakeholder engagement

Engaging diverse stakeholders at multiple levels was at the center of the Yampa IWMP. The IWMP leads gathered their input and integrated their feedback throughout the entire process, from surveys to multi-year volunteer commitments on committees. The IWMP published in-depth reports on their stakeholder surveys and interviews.

These diverse voices created buy-in, built trust, and ensured that the process represented as many perspectives as possible.

### Lessons learned

Engaging multiple key stakeholders early will help create buy-in and ownership, keep the work focused, and align multiple sectors from the beginning.

## Roadmap

To create a roadmap for their IWMP work, the IWMP team gathered existing information including work gathered through the Basin Roundtable Planning process. Then they conducted scientific and engineering assessments to establish an empirical understanding of river health, using standard and replicable protocols. One of the recommendations to come out of the IWMP was the idea of a scorecard to uniformly track different indicators across multiple reaches of the Yampa and present the results in a user-friendly and publicly accessible interface. That project — known as the Yampa River Scorecard — was completed following the release of the IWMP.

Assessments like those conducted as part of the IWMP create a starting point on an IRM roadmap. The assessments the IWMP team led in the Yampa created a holistic picture of baseline river health conditions that then allowed stakeholders to identify target areas where projects were likely to have the biggest impact.

### Lessons learned

A model River Smart Community would create a comprehensive inventory of existing plans, projects, and available data to create a foundation of information, identify gaps, and prioritize future projects and target areas. They would pull out the key findings from different assessments and present them in a user-friendly and uniform platform so that everyone can quickly access and compare the data. A River Smart Community would also ensure methods used to conduct assessments are replicable and schedule follow-up studies on a regular cadence so that key metrics can be tracked over time. Collecting information from other river basins about their planning effort would further ground IRM work.

## Planning

Using information gathered from stakeholder feedback and the assessments, the IWMP team created a process to identify 20 recommendations that would address key gaps and priority areas.

### Lessons learned

A model River Smart Community looks for opportunities to draw from existing local government planning efforts, focuses on IRM strategies that can be tied into other planning efforts, and seeks to weave IRM principles into other planning efforts. This cross-pollination strengthens IRM principles alongside other planning priorities.



## Strategies and projects

The recommendations and strategies that came out of the collaborative IWMP process created an implementation roadmap to help the Yampa River move towards holistic river health. Although several of the individual projects are site-specific, they are aligned at a corridor-wide scale because they are rooted in the “River in Balance” vision and emerged from a shared planning space.

### Lessons learned

To measure the river corridor-wide impact of the recommendations and projects, a model River Smart Community could create a system to monitor the status of these and how closely their outcomes align with the vision. Identifying opportunities for sustained funding or to codify practices would help bring the recommendations into fruition and sustain IRM work over a longer period.

## Outputs

The Yampa IWMP effort forged relationships along the Yampa River corridor, building trust by engaging diverse stakeholders in its IRM process. The IWMP process created a baseline understanding of conditions and current efforts along the river and then laid out a roadmap for future coordinated work

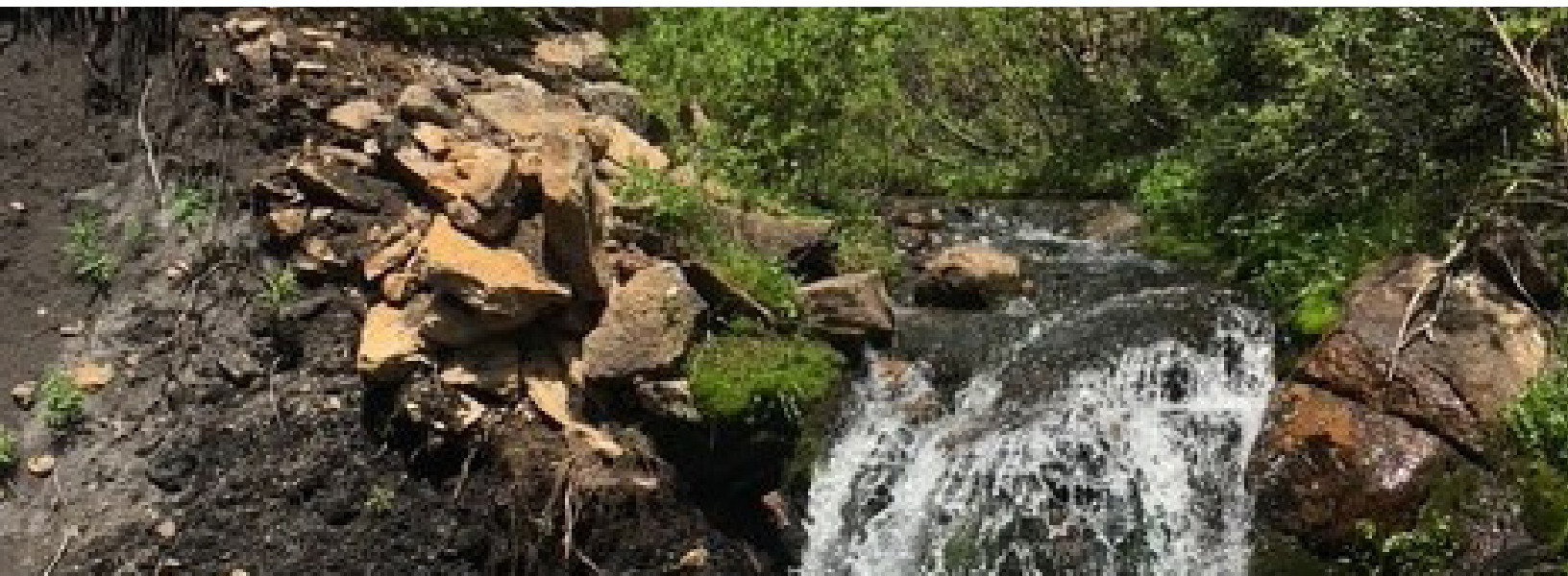
along the river. Key IWMP members formed the Yampa River Collaborative, a group of stakeholders working to advance the recommendations and maintain the momentum of collaborative and integrated river management along the Yampa.

## Outcomes

The Yampa stakeholders have started implementing recommendations, strategies, and projects identified in the Yampa IWMP. Examples include fluvial hazard zone mapping, the Yampa River Stewardship Program, environmental flows evaluations, the Yampa Valley beaver working group, and diversion replacement projects. Stakeholders are also working with Routt County and the City of Steamboat Springs to update their land use codes to include more protective waterbody and riparian corridor setback regulations.

### Lessons learned

A model River Smart Community uses the IRM process and resultant outputs to drive short- and long-term strategies and projects. These efforts, led by a collaboration of local stakeholders, identify multi-benefit opportunities that follow the vision and roadmap developed through a holistic planning approach.







## NEXT STEPS

River Network envisions that this Guidebook will just be one resource in its River Smart Community library to help support communities explore and implement IRM. Additional resources may include:

- A River Smart Communities “Getting Started” guide that includes the River Smart Communities templates, forms, checklists, and documents, referred to in this Guidebook.
- A River Smart Communities Framework manual that would provide more detail around each IRM principle and practical advice for communities about how to implement each step, drawing on examples from other communities.
- Workshops and training opportunities that would bring to life the information in the Getting Started guide, this Guidebook, and Framework manual in a facilitated, interactive series of in-person or virtual sessions.
- A Troubleshooting guide that would offer advice for communities about how to overcome barriers they encounter in the IRM process.
- A facilitated peer-to-peer network of communities embarking on a River Smart Community journey to offer one another support, advice, and a platform to share experiences.







# SUPPLEMENTAL INFORMATION

# KEY TERMS<sup>1</sup>

**100-year flood** (also: **Base Flood, 1 % Annual Chance Flood, 1% Annual Exceedance Probability (AEP) flood**): “A Flood having a recurrence interval that has a 1-percent-annual- chance of being equaled or exceeded during any given year (1 percent-annual-chance-Flood). For the purpose of these Rules [Rules and Regulations for Regulatory Floodplains in Colorado], the terms “100-Year-Flood” “1-percent -annual-chance Flood,” and “base flood,” are synonymous. The term does not imply that the Flood will necessarily happen once every one hundred years”

**100-year floodplain** (also: Regulatory Floodplain and Special Flood Hazard Area): “The area of land susceptible to being inundated as a result of the occurrence of a 100-Year-Flood. 100-Year-Floodplains are considered to be areas of high Flood hazard. For the purposes of these Rules, the terms “100-Year-Floodplain,” are synonymous.”

**Annual Exceedance Probability (AEP)**: The probability that a flood event of a certain size will occur in any given year, for example a 1% AEP flood is the flood that has a 1% chance of occurring in any year. This term is often synonymous with the “100-year-flood”. See 100-year flood definition above for further information.

**Base Flood Elevation (BFE)**: “The elevation shown on a Federal Emergency Management Agency (FEMA) Federal Insurance Rate Map (FIRM) for Zones AE, AH, A1-A30, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO, V1-V30, and VE that indicates the water surface elevation resulting from a Flood that has a 1-percent-annual-chance of equaling or exceeding that level in any given year.” See the FEMA Flood Zones definition for additional information.

**Basin Roundtables**: Each of Colorado’s seven major water basins — Arkansas, Colorado, North Platte, Rio Grande, Gunnison, Yampa-White-Green, South Platte, and Southwest — has a roundtable comprised of key water stakeholders in the basin that meet regularly to discuss water-related issues in the basin, distribute funding for projects. In line with the Colorado Water Plan, each roundtable is guided by a Basin Implementation Plan (BIP).

**Beneficial use**: The application of water necessary to accomplish the purpose of the appropriation, without waste. Some common types of beneficial use are agriculture, municipal, wildlife, recreation, and, mining.<sup>2</sup>

**Colorado Water Plan**: Colorado’s Water Plan articulates goals for the state’s water resources through 2050 based on an evaluation of the state’s water supplies and demands from agriculture, municipal and industrial, and environmental needs. See the Colorado Water Plan box in the introduction for further information.

**Consumptive use**: is 1) Any use of water that permanently removes water from the natural stream system; and 2) water that has been evaporated, transpired, incorporated into products, plant tissue, or animal tissue and is not available for immediate reuse.<sup>3</sup>

**Channel**: The physical confine of a stream or waterway consisting of a bed and stream banks, existing in a variety of geometries.

<sup>1</sup> Unless otherwise noted, these definitions are from Colorado Department of Natural Resources. Rules and Regulations for Regulatory Floodplains in Colorado (2 CCR 408-1)

<sup>2</sup> Colorado State University Extension. Glossary of Water Terminology. Fact Sheet No. 4.717. Crop Series, Irrigation.

<sup>3</sup> Colorado State University Extension. Glossary of Water Terminology. Fact Sheet No. 4.717. Crop Series, Irrigation.

**Channelization:** The artificial creation, enlargement, or realignment of a stream channel.

**Debris flow:** Movement of mud, water, and other materials downward over sloping terrain. The flow typically consists of a mixture of soil, rock, woody debris, and water that flows down steep terrain.

### **FEMA Flood Zones<sup>1</sup> –**

*Special Flood Hazard Areas:*

A – areas with a 1% AEP but no determined BFEs

AE – areas with a 1% AEP and determined BFEs

AH – areas with a 1% AEP of shallow flooding (usually 1 to 3 feet) and determined BFEs

AO – areas with a 1% AEP of shallow flooding but no determined BFEs

AR – areas that used to be protected by a levee but are no longer

A99 – areas protected by a flood control project under construction

*Lower-risk zones also determined by a FIRM include:*

X (shaded) – areas with a 0.2% AEP

X (unshaded) – areas with minimal flood risk

D – undetermined flood risk

**Freeboard:** The vertical distance in feet above a predicted water surface elevation intended to provide a margin of safety to compensate for unknown factors that could contribute to Flood heights greater than the height calculated for a selected size Flood such as debris blockage of bridge openings and the increased runoff due to urbanization of the watershed.

**Integrated River Management (IRM):** A collaborative, community-focused process that defines a common vision for the community's river corridor through integrated planning and then implements policies, practices, and solutions that drive holistic river corridor management.

**Return flows:** the amount of water that is not consumed and returns to the stream following a legal use of a given amount of water.<sup>2</sup>

**River corridor:** Rivers and their interconnected features, including the river channel, floodplains, riparian areas, wetlands, and connected aquifers.

**River health:** A river and its corridor that exhibit four key functions: natural streamflow and water balance, high-quality surface water and groundwater, diverse biological community, and dynamic sediment processes and quality soils. River Smart Communities achieve healthy rivers through a community-focused integrated planning process.

**River Smart Community:** Practices the iterative, community-driven approach that integrates planning outcomes from key plans, policies, and regulations that support their community-vision for their river corridor related to land use, hazard mitigation, river health, and water resources.

<sup>1</sup> FEMA. 2023. FEMA Acronyms, Abbreviations and Terms. Capability Assurance Job and Field Aid. July.

<sup>2</sup> Colorado Department of Natural Resources. Division of Water Resources. 2 CCR 402-12.



# ACRONYMS

AEP – Annual Exceedance Probability

APA – American Planning Association

ASFPM – Association of State Floodplain Managers

BFE – Base Flood Elevation

BIP – Basin Implementation Plan

BLM – Bureau of Land Management

BMPs – best management practices

BRIC – FEMA Building Resilience Infrastructure and Communities

CASFM – Colorado Association of Stormwater and Floodplain Managers

CBOs – Community Based Organizations

C.C.R. – Code of Colorado regulations

CDA – State of Colorado Department of Agriculture

CDBG – Community Development Block Grant

CDBG-DR – Community Development Block Grant Disaster Recovery

CDOT – State of Colorado Department of Transportation

CDPHE – State of Colorado Department of Public Health and the Environment

CDPS – Colorado Discharge Permit System

C.F.R. – Code of Federal Regulations

CHAMP – CWCB Colorado Hazard Mapping Program

CORHAF – Colorado River Health Assessment Framework

CPD – HUD Community Planning and Development

CPW – Colorado Parks and Wildlife

CRO – State of Colorado Resilience Office (DOLA)

C.R.S. – Colorado Revised Statutes

CRS – FEMA Community Rating System

CSO – Combined Sewer Overflow

CWA – Clean Water Act

CWCB – State of Colorado Water Conservation Board (DNR)

DHSEM – State of Colorado Division of Homeland Security and Emergency Management

DNR – State of Colorado Department of Natural Resources

DOLA – State of Colorado Department of Local Affairs

DWR – State of Colorado Division of Water Resources (DNR)

EPA – Environmental Protection Agency

EQIP – NRCS Environmental Quality Incentives Program

E-SHMP – State of Colorado’s Enhanced State Hazard Mitigation Plan

FACStream 1.0 – Functional Assessment of Colorado Streams

FEMA – Federal Emergency Management Agency

FHZ – CWCB Fluvial Hazard Zone

FIRM – FEMA Federal Insurance Rate Map

FMA – FEMA Flood Mitigation Assistance

GHG - greenhouse gas

HMA – FEMA Hazard Mitigation Assistance

HMGP – FEMA Hazard Mitigation Grant Program

HMP – FEMA Hazard Mitigation Plan

HUD – Department of Housing and Urban Development

HWP - Healthy Watersheds Program

IRM – Integrated River Management

IWMP – Integrated Water Management Plan

LOMR – FEMA Letter of Map Revision

NFIP – FEMA National Flood Insurance Program

NIDIS – National Integrated Drought Information System

NOAA – National Oceanic and Atmospheric Administration

NPS – National Parks Service

NRCS – USDA National Resources Conservation Service

NWCC – National Weather and Climate Center

RESTORE – Restoration and Stewardship of Outdoor Resources and Environment

RISA – NOAA Regional Integrated Sciences and Assessment

Risk MAP – FEMA Risk Mapping, Assessment, and Planning

SFHA – FEMA Special Flood Hazard Areas

SMP – Stream Management Plan

SVAP2 – Stream Visual Assessment Protocol Version 2

TMDL – Total Maximum Daily Load

TDR – Transferable development rights

UDC - Unified Development Code

USACE – United States Army Corps of Engineers

USBR - United States Bureau of Reclamation

U.S.C. – United States Code

USDA – United States Department of Agriculture

USEPA – United States Environmental Protection Agency

USFS – United States Forest Service

USGS – United States Geological Survey

US HUD - United States Housing and Urban Development Authority

WQCC - Water Quality Control Commission

WRAP – CWCB Wildfire Ready Action Plans

WRW – CWCB Wildfire Ready Watersheds

WWA – Western Water Assessment (Colorado’s Regional Integrated Sciences and Assessment (RISA) office)



# REFERENCES

*n.b. these are listed as parenthetical references throughout the text, whereas the “resources” listed in each chapter would provide the reader with additional information about that topic. The chapter the reference appears in is listed in parentheses behind the reference.*

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