Conejos River Stream Management Plan

Prepared for:
Rio Grande Basin Roundtable and the
Stream Management Plan Technical Advisory Team

With support from:
Colorado Water Conservation Board
San Luis Valley Conservation and Connection Initiative
Bureau of Reclamation WaterSMART Program
American Whitewater
San Luis Valley Water Conservancy District
Conejos Water Conservancy District

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Executive Summary

The purpose of the Rio Grande, Conejos River, and Saguache Creek Stream Management Plans (SMPs) is to assess stream conditions to enable local stakeholders to develop informed and data-driven management actions with the goal of preserving and enhancing water uses and community values. Following the release of the 2015 Colorado Water Plan, the Rio Grande Basin Roundtable (Roundtable) recognized the need for comprehensive assessments and management plans for locally prioritized streams in the Rio Grande Basin. Streams in the Rio Grande Basin were prioritized by a SMP Subcommittee of the Roundtable. The SMP Subcommittee prioritized the following stream segments: 1) The Rio Grande from Stony Pass to the Colorado state line, 2) Conejos River from Platoro Reservoir to the Rio Grande confluence, and 3) Saguache Creek from the South Fork Saguache Creek confluence to Braun Bridge. To support the project, a SMP Technical Advisory Team (TAT) was formed and composed of state and federal agency officials, local water managers, nonprofit organizations, private landowners, and interested stakeholders. The TAT was instrumental in guiding data collection and the overall direction of the SMPs.

The SMPs are built on and guided by stakeholder input and values. Stakeholder engagement, through public meetings, landowner outreach, surveys, and email and social media updates, was critically important throughout the planning process. The SMP goals and priority projects were developed with significant stakeholder input and are aligned with stakeholder values.

To characterize stream condition and function, a *conditions assessment* was conducted for each stream. Each stream was divided into reaches based on similarities in geomorphology and reach breaks influenced by infrastructure, such as diversion dams. Assessments of recreational and aquatic habitat streamflow needs, diversion infrastructure, geomorphology, riparian vegetation, water quality, and aquatic life were completed. Conditions assessment results are organized by reach and include a list of impacts, or stressors, affecting each reach as well as a discussion of the likely cause(s) of stressors. The SMPs define management goals as well as priority projects and actions stakeholders may take to further each goal. Rough cost estimates are included, where appropriate.

The Rio Grande, Conejos River, and Saguache Creek SMPs are intended to be used as science-based guides for stream management through collaborative and multi-benefit projects. They provide an implementation strategy to support healthy streams and protect the ecosystem services they provide for fish, wildlife, and communities that rely on them.

Acknowledgements

Technical Advisory Team

Representatives from the Following Agencies and Organizations:

American Whitewater
Bird Conservancy of the Rockies
Bureau of Land Management
Colorado Parks and Wildlife
Colorado Water Conservation Board
Conejos Water Conservancy District
Conejos Water Users Association
Headwaters Alliance
Natural Resources Conservation Service
Rio Grande Basin Roundtable
Rio Grande Headwaters Land Trust
Rio Grande Headwaters Restoration Project
Rio Grande Water Conservation District
Rio Grande Water Users Association
Saguache Creek Water Users Association
San Luis Valley Irrigation District
San Luis Valley Water Conservancy District
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Glossary

Alluvial aquifer – An aquifer comprising unconsolidated material deposited by water, typically occurring adjacent to rivers.

Armoring (bed or channel) – The application of resistant materials on a river bed or banks to reduce scour and erosion.

Augmentation (of flow) – The addition of water to a system. In the case of water rights, this typically refers to augmentation plans used to replace depletions to streams caused by well pumping.

Avulsion – The sudden change of river's location or path.

Base flow – The portion of streamflow occurring outside of runoff, typically lasting from mid- to late-summer through early spring.

Benthic macroinvertebrates – Aquatic insects and other invertebrate (lacking a backbone) organisms living on the stream channel bed, often within interstitial spaces of channel substrate anywhere from sand to large boulders. Although some aquatic invertebrates may be quite small, "macro" refers to their visibility without magnification.

Channelization – Mechanical alteration of a river or stream that confines flow within a single course. Often times these actions can be combined with straightening.

Channel migration – The natural process by which stream channels move laterally over time.

Compact – The interstate Rio Grande Compact signed in 1938 between the states of Colorado, New Mexico, and Texas.

C-value – A value ranging from 0 to 10 and representing an estimated probability that a plant is likely to occur in a landscape relatively unaltered from pre-European settlement conditions. Also known as a coefficient of conservatism.

Depletion (of flow) – Removal of water from a system.

Flow duration curve – A graph representing the percent of time a specified discharge is equaled or exceeded.

Geomorphic – Relating to the form of the land or topography. In the context of streams, geomorphic characteristics include the physical shapes of streams, their water and sediment transport processes, and the landforms they create.

Hyporheic zone – Delineates a volume of saturated sediment that surrounds a river, where mixing of surface water and shallow groundwater occurs, and constitutes a transitional area (ecotone) between the surface and groundwater hydrologic systems and between aquatic and terrestrial habitats in the riparian zone. Referred to in this document in the context of hyporheic exchange.

Peak flow – Highest streamflow of the year, typically during spring snowmelt runoff.

Reach – A stream segment along which similar hydrologic conditions exist, such as discharge, depth, area, and slope.

River miles – River miles represent the distance of a stream channel across a landscape. In this report, river miles were calculated using the Source Water Route Framework dataset, which is extracted from the National Hydrography Dataset. Note: river miles are synonymous with stream miles.

Roundtable – The Rio Grande Basin Roundtable

San Luis Valley Closed Basin – A basin in the northern San Luis Valley where surface water outflow is prevented by a hydrologic divide and therefore surface waters are not tributary to the Rio Grande.

Sediment transport – The ability of a stream or river to transport an equal amount of sediment out of a reach as the amount entering the reach.

Subdistrict – A groundwater management subdistrict of the Rio Grande Water Conservation District or the Trinchera Water Conservancy District.

Turbidity – The measure of relative clarity of a liquid.

Wet meadow – A type of wetland characterized by soils that are saturated for part or all of the growing season.

Acronyms

303(d)	The 303(d) list of impaired waters in Colorado (defined by the Colorado Department of Public Health and Environment)
AA	Targeted Assessment Area (see Riparian Vegetation Assessment)
AF	Acre-feet
AW	American Whitewater
Basin	Rio Grande Basin
BLM	Bureau of Land Management
BMI	Benthic Macroinvertebrates
CDPHE	Colorado Department of Public Health and Environment
CFS	Cubic feet per second
CNHP	Colorado Natural Heritage Program
CPW	Colorado Parks and Wildlife
CWCB	Colorado Water Conservation Board
DEM	Digital Elevation Model
EIA	Ecological Integrity Assessment
FQA	Floristic Quality Assessment
GIS	Geographic Information System
ISF	Instream Flow
M&E	Monitoring and Evaluation List
MMI	Multi-Metric Index (see Aquatic Life Assessment)
NRCS	Natural Resources Conservation Service
RGDSS	Rio Grande Decision Support System
RGHRP	Rio Grande Headwaters Restoration Project
SLV	San Luis Valley
SMP	Stream Management Plan
SWE	Snow Water Equivalent
SWRF	Source Water Route Framework
TAT	Technical Advisory Team
TMDL	Total maximum daily load
USFS	United States Forest Service
USGS	United States Geological Survey

Contents

1. Introduction

1.1 Purpose and Scope

The 2015 Colorado Water Plan set a goal that 80 percent of locally prioritized rivers be covered by stream management plans (SMPs) by 2030. Following publication of the Water Plan, the Rio Grande Basin Roundtable (Roundtable) recognized the need for comprehensive assessments and management plans for locally prioritized streams in the Rio Grande Basin. To help meet this need, a subcommittee of the Roundtable selected three priority stream segments for an initial round of SMPs. The SMP subcommittee prioritized the following stream segments: 1) The Rio Grande from Stony Pass to the Colorado state line (191.3 river miles), 2) Conejos River from Platoro Reservoir to the Rio Grande confluence (84.4 river miles), and 3) Saguache Creek from the South Fork Saguache Creek confluence to Braun Bridge (65.7 river miles). A map of the prioritized streams is shown in Figure 1.1.

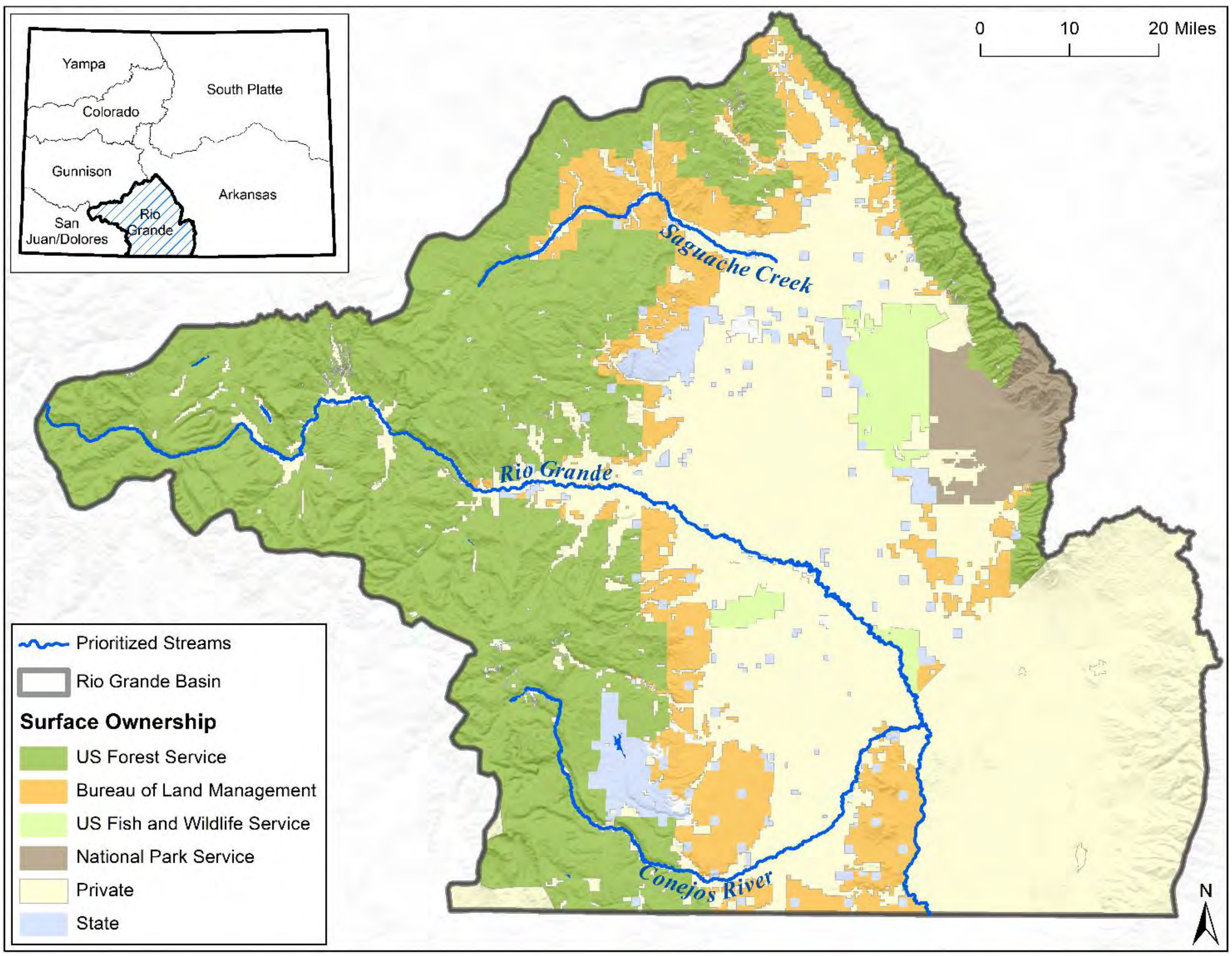


Figure 1.1: SMP prioritized streams with land ownership overlaid and delineation of Rio Grande Basin boundary.

To support the project, a SMP Technical Advisory Team (TAT) was formed and composed of state and federal agency officials, local water managers, nonprofit organizations, private landowners, and interested stakeholders. The TAT was instrumental in guiding data collection and the overall direction of the SMPs. The purpose of the Rio Grande, Conejos River, and Saguache Creek SMPs is to assess stream conditions to enable local stakeholders to develop informed and data-driven management actions with the goal of preserving and enhancing water uses and community values. The SMPs are intended to be used as guides for effective and multi-benefit restoration and stream management projects.

Although multiple studies have been conducted on the Rio Grande in Colorado, the Roundtable and TAT recognized a need to better understand the condition and function of streams in the Rio Grande Basin. Previous studies documenting the condition of the Rio Grande include the 2001 Rio Grande Headwater Restoration Project, the 2016 Rio Grande Natural Area River Condition Assessment, and the 2018 Upper Rio Grande Watershed Assessment (MWH, 2001; Riverbend Engineering, 2016; SGM & Lotic Hydrological, 2018). However, a study covering the entire Rio Grande in Colorado with consistent methodology had not been completed, and data for the Conejos River and Saguache Creek was particularly limited. The Roundtable recognized that a comprehensive study of these three prioritized streams was needed. The Rio Grande, Conejos River, and Saguache Creek SMPs address that need.

1.2 Project Objectives

The objectives of the Rio Grande, Conejos River, and Saguache Creek SMPs were to:

- Maintain and build on the coalition of community partners engaged in stream management planning through frequent and robust stakeholder engagement throughout the project.
- Summarize and obtain information regarding the biological, hydrological, and geomorphological condition of identified stream reaches in the Rio Grande watershed.
- Define and prioritize environmental, recreational, and community values.
- Develop goals to improve flows and physical conditions needed to support values.
- Outline actions to achieve measurable progress toward maintaining or improving goals.
- Identify opportunities and constraints for implementation of projects, and additional data needed to inform project development.

1.3 Why Are Stream Management Plans Important?

SMPs offer a valuable opportunity for communities to address issues related to stream functions in an effort to better support diverse groups of water users. They provide the opportunity to assess stream conditions and function, identify likely stressors adversely affecting these conditions, and develop multi-objective solutions to mitigate stressors and improve conditions. Because SMPs are stakeholder-driven, diverse community values are represented in decision making and the development of goals and priority actions. Strong stakeholder interest and support provided the impetus for the Rio Grande, Conejos River, and Saguache Creek SMPs and contributed significantly to the success of each SMP.

1.4 Stakeholder Engagement

A diverse group of stakeholders utilize and are intimately connected to the Rio Grande, Conejos River, and Saguache Creek. Irrigated agriculture has a rich history on the basin, having utilized surface water from the Rio Grande for over 150 years. Agricultural producers depend on surface water to irrigate crops during the growing season, and many farms and ranches are now operated by the fourth and fifth generation producers. Anglers have access to exceptional Rio Grande, Conejos River, and Saguache Creek sport fisheries. Recreational boating opportunities are also plentiful, with commercial and private boaters floating the Rio Grande and Conejos River. Not least, San Luis Valley residents enjoy and take pride in the aesthetic value of the streams and rivers flowing through the region.

To engage stakeholders and gather input, significant outreach was conducted throughout the SMP process. Regular email updates were sent to a SMP stakeholder listserv, individual and group meetings were held, and the SMP Project Coordinator presented regularly to the Roundtable and several other stakeholder groups. A summary of stakeholder engagement activities is detailed below:

- Provided regular project updates via the SMP email listserv.
- Held six TAT meetings to discuss stream conditions assessment methodology, assessment results, and project goals/priority projects. Resources from TAT and public meetings including minutes, handouts, and presentations were published on the Rio Grande Headwaters Restoration Project website.
- Held five public community meetings in summer 2019. Each meeting was specific to one of the three SMPs. Public meetings were advertised in the Valley Courier, Saguache Crescent, Conejos County Citizen, Del Norte Prospector, Monte Vista Journal, and through the SMP listserv and several Facebook groups. Meetings were also advertised on KSLV and KRZA radio stations.
- Provided regular updates for the following groups: Rio Grande Basin Roundtable, Rio Grande Water Users Association, Conejos Water Users Association, Saguache Creek Water Users Association, San Luis Valley Wetland Focus Area Committee, and the boards of the Rio Grande Headwaters Restoration Project, San Luis Valley Water Conservancy District, Rio Grande Water Conservation District, and the Conejos Water Conservancy District.
- Presented to several other interested groups including the Colorado Agricultural Water Alliance and the San Luis Valley Cattlemen's Association.
- Published an online ArcGIS "Story Map" outlining the Stream Management Plans.
- Distributed three public SMP stakeholder surveys, one for each SMP.
- Coordinated with American Whitewater to distribute a "boatable days" survey, which informed the recreational use assessment study on the Rio Grande and Conejos River.
- Completed significant outreach to and held meetings with many individual landowners.
- Held meetings with water commissioners for each SMP.

- Held special meetings with state and federal agencies including Colorado Parks and Wildlife (CPW), U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and U.S. Forest Service (USFS).

Individual responses and themes resulting from the surveys, as well as feedback and input from formal and informal meetings, were incorporated into the planning process. The community values and general objectives identified during this process include:

- Diversion infrastructure improvements to increase efficiency, reduce maintenance, and promote stream health.
- Maintaining and enhancing riparian areas.
- Maintaining adequate streamflows for aquatic habitat, overall stream health, agriculture, and recreation. This includes coordinated reservoir releases and consistent flows for fishing and on the Conejos River to support recreation and the local economy.
- Increased storage to augment flows and increase flexibility during dry years (e.g., reservoirs).
- Removal or mitigation of recreational hazards (fencing, diversions, bridges, etc.).
- Improved infrastructure for sustainable recreational access to the river, especially fishing access.
- Riparian and aquatic habitat connectivity and agriculture viability through conservation easements and other strategies.
- Protecting and restoring floodplain connection and wet meadows and other wetlands for increased alluvial aquifer storage.
- Improving overall stream health for imperiled species, including fish and riparian habitat restoration.
- Additional monitoring data on water quality, irrigation infrastructure, and streamflows.
- Mitigating effects of flooding and debris flows (i.e., addressing severe bank erosion, particularly near key infrastructure).

1.5 Physiographic and Geologic Setting

Regional geologic and climatic history play important roles in fluvial geomorphology, which largely shapes the streams and rivers we see today. For the purposes of the SMPs, the physiographic context of a study area is defined by the dominant geologic and climatic conditions that define the modern landscape, which influence the study streams' form and associated physical processes.

The Upper Rio Grande Basin (Basin) in south-central Colorado covers 7,630 square miles and is bordered to the south by New Mexico. Within the Basin lies the San Luis Valley (SLV), a high elevation intermountain valley situated between two major mountain ranges. The SLV is a large rift valley in the Southern Rocky Mountains Province (Figure 1.2) and is part of the larger Rio Grande rift which extends from north of the SLV near Leadville, Colorado to southern Mexico (Bachman & Mehnert, 1978).

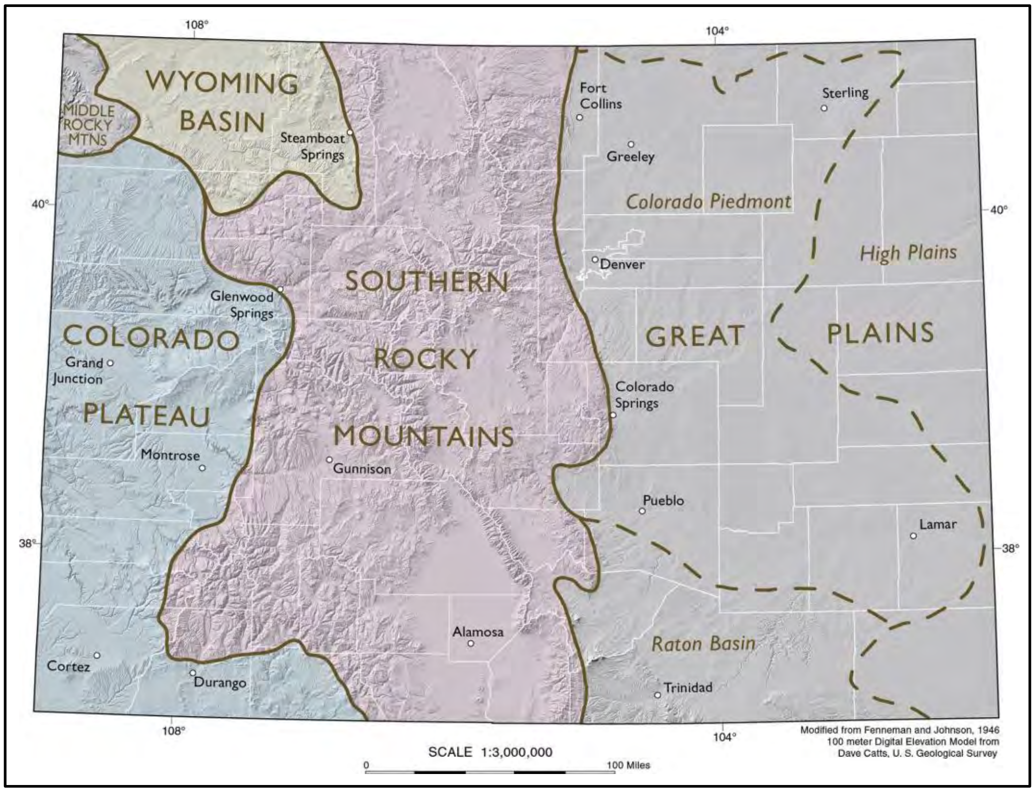


Figure 1.2: Physio-geographic regions of Colorado (source: Colorado Geological Survey website).

The geology of the Southern Rocky Mountains Province is dominated by Precambrian igneous and metamorphic rocks uplifted and exposed during mountain building events. The last major event, the Laramide orogeny, ended approximately 70 million years ago and was largely responsible for building the San Juan Mountains. The Sangre de Cristo Mountains bound the SLV on the east, while the eastern San Juan Mountains form the western edge of the valley. The La Garita Range, which lies on the northwest edge of the valley and on the north end of the San Juan Mountains, was formed from volcanism and tectonics. The La Garita Range forms the headwaters of Saguache Creek, which also drains the Cochetopa Hills to the north. The La Garitas and eastern San Juans contribute to the Upper Rio Grande Watershed while the south-eastern San Juans make up the headwaters of Conejos River. Much of this area was influenced during the Paleocene (approximately 60 million years ago) by the La Garita super-caldera eruption, one of the largest known volcanic eruptions in Earth's history.

Generally speaking, the La Garitas are less steep than the San Juans and drain lower elevations. Significant glaciation was not noted to have occurred in the headwaters of Saguache Creek. The valley in which Saguache Creek lies is bound by lava and ash deposits. Near the town of Saguache, the Creek escapes onto the broad Alamosa Basin, an alluvial basin which makes up the north end of the Rio Grande Rift Valley (Figure 1.3). Alternating layers of sand, gravel and clay compromise the Alamosa alluvial basin. This material was transported and deposited by fluvial processes that fan material out onto the valley floor as well as by shallow water bodies where clay layers would have formed.

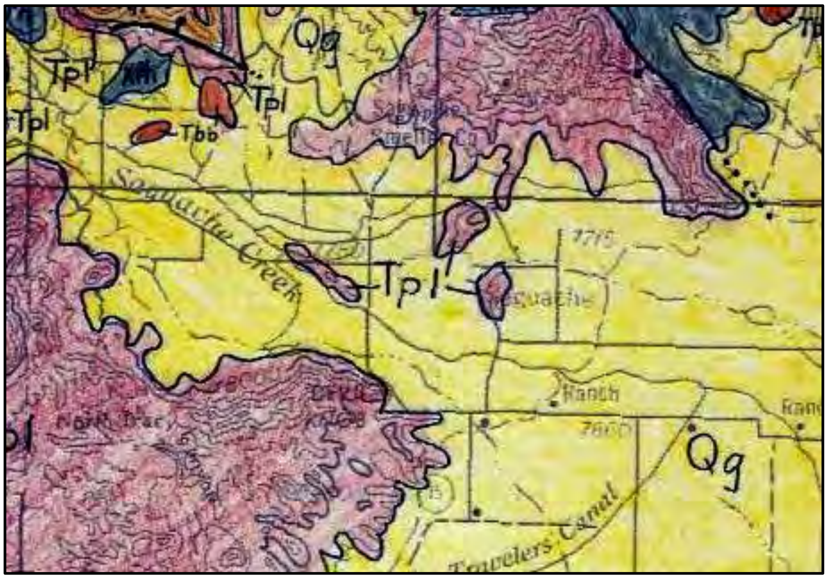
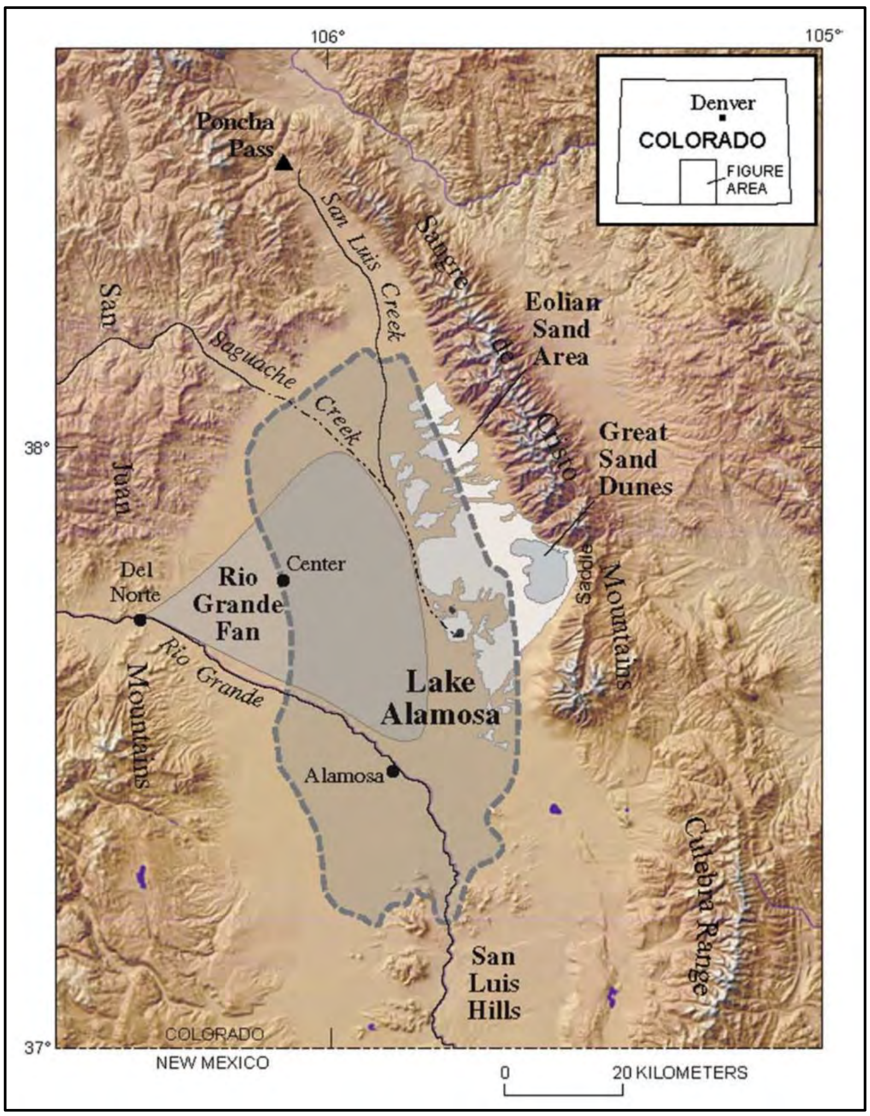


Figure 1.3: Simplified geologic map of the lower portion of the Saguache Creek study area. Qg (yellow) indicates alluvium; Tpl (light purple) indicates pre-ash flow andesitic lavas and breccias (volcanic origin).



Conversely, both the Rio Grande and Conejos River headwaters were heavily glaciated. Sediment excavated and deposited by glacial movement and melt as recently as 10,000 years ago still exists throughout the canyons and within the floodplains of the Rio Grande and Conejos River. Sediment and runoff contributions from glacial meltwater contributed to large alluvial fan formations where the streams break free from the San Juan foothills and spill onto the Rio Grande rift valley floor (Figure 1.4).

Figure 1.4: Map showing the generalized location of the Rio Grande Fan which covered over the ancient lakebed sediments of Lake Alamosa (Madole et al., 2008).

The Rio Grande, Conejos River, and Saguache Creek drain east out of the mountains and into the SLV. On the northern end of the SLV, Saguache Creek and other streams drain into a high altitude subbasin known as the San Luis Valley Closed Basin (Closed Basin), also referred to as the Alamosa Basin (Upson, 1939). The Closed Basin is endorheic, meaning its surface waters do not flow outside its boundaries and therefore are not tributary to the Rio Grande. Within the Closed Basin, streams draining the La Garita and Sangre de Cristo Ranges on the west and east sides of the valley, respectively, terminate in low points, or sump areas, forming numerous Inter-Mountain Basin Playas. The lowest elevation playa complex in the Closed Basin is San Luis Lakes, located just west of the Great Sand Dunes. The southern boundary of the San Luis Valley Closed Basin is thought to be formed by a low hydrologic divide resulting from the Rio Grande alluvial fan on the west and alluvial material from the Sangre de Cristo Mountain on the east (Alstine & Simon, 1982). The Closed Basin covers approximately 2,940 mi^2, making up about 39% of the Rio Grande Basin, shown in Figure 1.5.

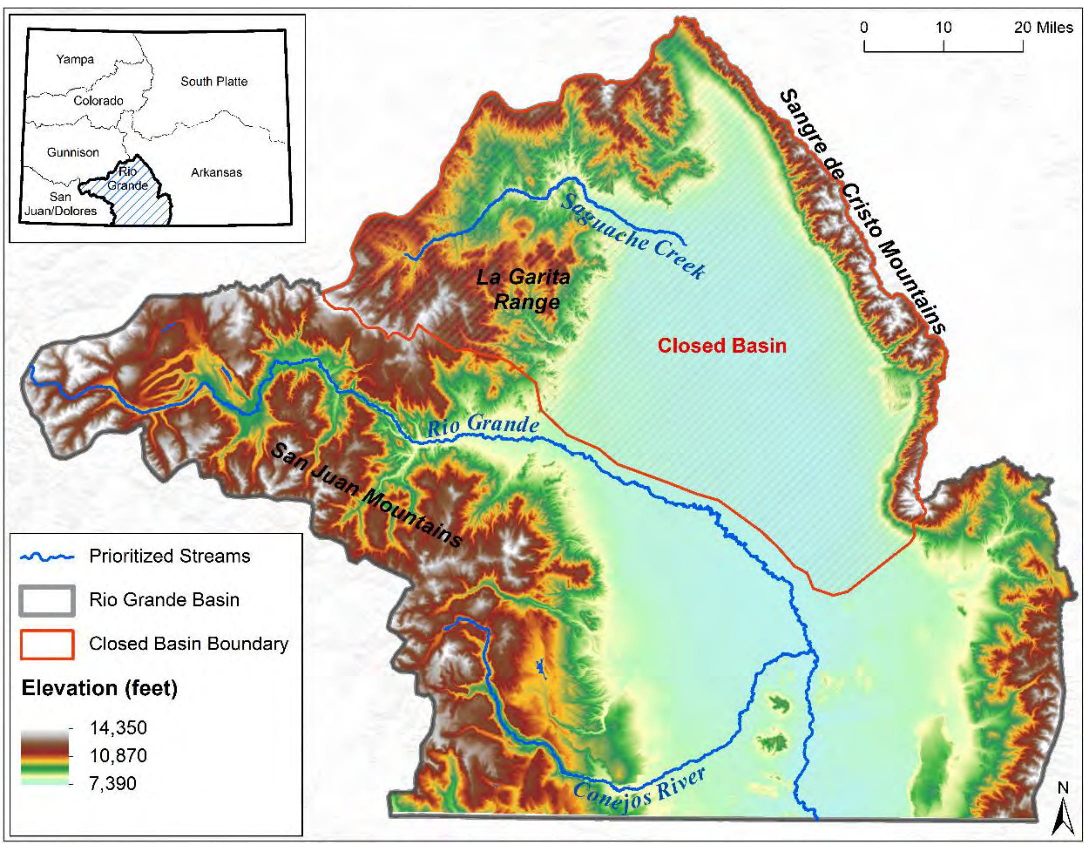


Figure 1.5. Prioritized streams in the Rio Grande Basin with elevation, major mountain ranges, and delineation of the Closed Basin boundary.

The headwaters of the Rio Grande are located on the Continental Divide near Stony Pass. From Stony Pass, the river flows east through the San Juan Mountains toward the SLV. At the Town of Del Norte, the river spreads out onto a broad alluvial fan, meandering east through the SLV. At the City of Alamosa, the river turns south and eventually crosses the Colorado - New Mexico state line.

The Conejos River is situated in the southern San Luis Valley, draining a portion of the eastern San Juan Mountains. The Conejos is a diverse river, beginning in once glaciated valleys, running down through narrow canyons, and spilling out onto the broad San Luis Valley where it becomes a low gradient meandering channel. The prioritized portion of the Conejos River is from the outlet of Platoro Reservoir (37°21'7.43"N, 106°32'40.07"W) downstream to the confluence with the Rio Grande (37°18'12.38"N, 105°44'9.00"W), a stretch of 84.4 miles.

The Conejos River's high alpine headwaters are located near the Continental Divide at Lake Ann (approximately 11,925 ft). The river flows northeast, joining several tributaries, including the North Fork and Adams Fork, before reaching Platoro Reservoir at approximately 10,000 ft. From Platoro Reservoir, it flows southeast through narrow alluvial valleys, bounded by the volcanic rock of the San Juan Mountains. It passes through foothills and eventually meets the broad alluvial plain of the SLV near the Town of Mogote. From Mogote, it becomes a low gradient, meandering river flowing northeast through the SLV. Just east of Manassa, the southern-bounding San Luis Hills turn the river north before its confluence with the Rio Grande near Lasauses, CO. The total watershed area of the Conejos River at the downstream end of the study area is 767 mi^2.

Saguache Creek begins at a series of small lakes in the La Garita Wilderness. The Creek flows northeast before reaching a wide alluvial fan upstream of the Town of Saguache, where it turns southeast. The Creek then flows past Saguache and into the non-tributary Closed Basin on the northern end of the SLV, where it terminates in wetlands and playa lakes.

1.6 Hydrologic Context

Hydrology plays a fundamental role in channel form, riparian areas, water quality, and aquatic life. The timing and magnitude of streamflow is a driver of geomorphic "work" in stream channels (i.e., more water in the system means more work being done to mobilize and transport sediment in the system, affecting stream channel and floodplain morphology). These hydrologic processes also affect the establishment and maintenance of riparian vegetation, water quality parameters, and the type and abundance of aquatic life. Surface hydrology in Colorado's Rio Grande Basin is characterized by high flows during spring runoff lasting into early summer, and significantly lower (base) flows in late summer, early fall, and winter. The SMP study streams are snowmelt-driven, with the vast majority of water production occurring in the form of snow. These characteristics are illustrated by the hydrograph in Figure 1.6, showing average daily flows at the Rio Grande Near Del Norte gage from 1890 to 2017.

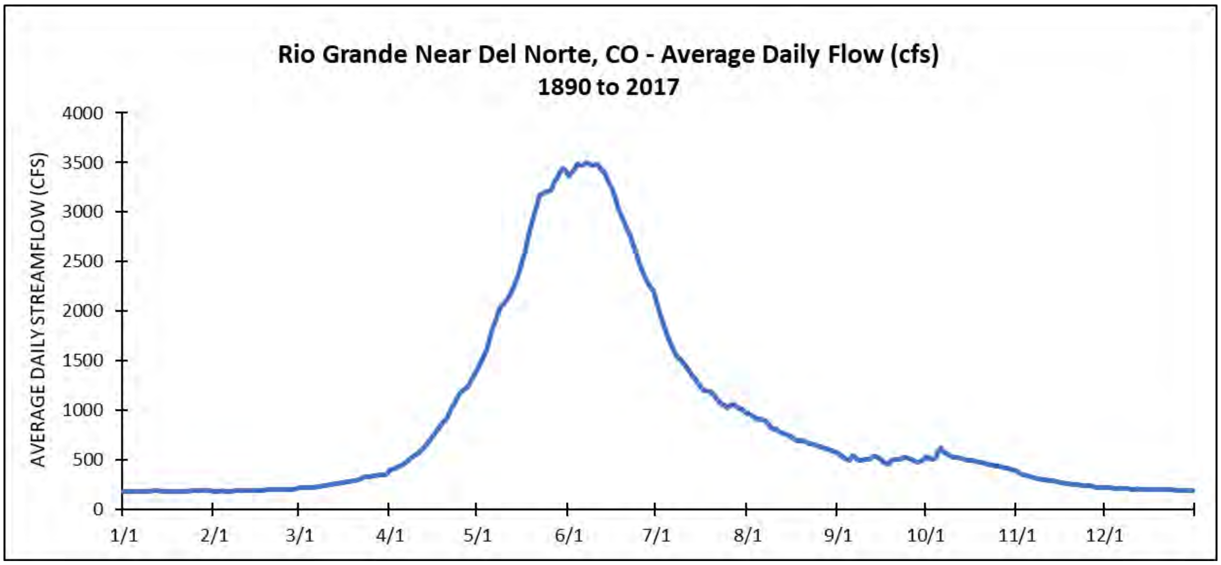


Figure 1.6: Average daily streamflow at the Rio Grande Near Del Norte, CO (RIODELCO) gage – 1890 to 2017.

Monsoon season typically results in sufficient precipitation to increase flows again in mid- to late-summer. Flooding from both snowmelt runoff and small-scale convective rainfall events during the monsoon are common mechanisms for high water events in the SMP study streams (Figure 1.7). Though rare in the period of record, extreme events have been observed to occur on streams draining into the SLV from the San Juan Mountains. Localized flash floods are likely to occur on tributary streams, which may cause the mainstems to swell, but more likely influence the streams by bringing fresh sediment down to the valley bottom and supplying the channels with material (Figure 1.7).

Saguache Creek does not have considerable upstream water storage facilities (dams and reservoirs) or flow regulation, so flows are more likely to fluctuate depending on available runoff in the watershed. The Rio Grande and Conejos River both have water storage reservoirs in their headwaters, which have reduced peak flows and thus the frequency with which geomorphically significant flows pass through the channels and floodplains. In all the study streams, numerous diversion structures influence flows by withdrawing water, but not typically enough to significantly alter the geomorphic condition or trajectory of the study reaches. However, these diversions change the frequency in which floodplains are inundated and bed sediments are mobilized.

Figure 1.7: Left: Snowmelt runoff doing geomorphic work on the Rio Grande floodplain, June 2019. Right: Sediment washed down from a small watershed that feeds a tributary to Saguache Creek (Photo: Round River Design, LLC).

In the “plains” reaches of the San Luis Valley, relatively impermeable clay layers connect the contributing streams to the relatively shallow aquifer that sits on top of these clay layers. Until as recent as the 1970s, the Alamosa Basin in the northern part of the San Luis Valley was naturally endorheic with water only escaping through evapo-transpiration of which the endpoint was a playa adjacent to the Great Sand Dunes. Modern water engineering projects have created some transfer of water out of the basin and into the Rio Grande watershed. In any event, the shallow depth to clay creates a situation where flooding can occur from water percolating up from below when the shallow aquifer is saturated (as opposed to flooding only occurring from over-topping of streambanks). The shallow depth to water in portions of the study area creates naturally abundant wetlands (Figure 1.8).

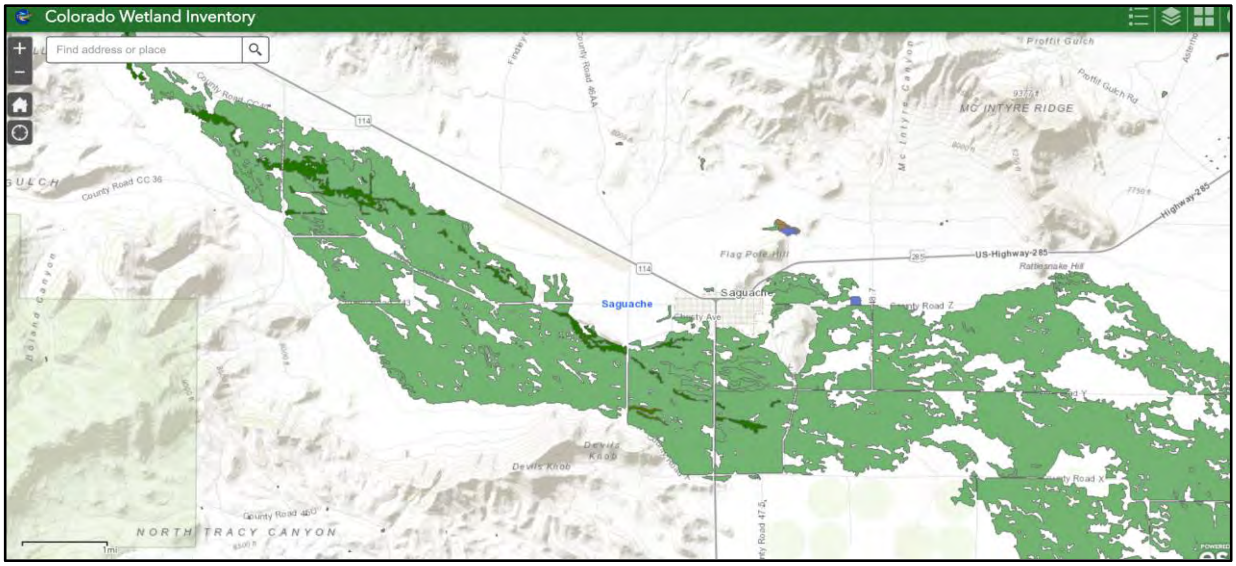


Figure 1.8: Wetlands map showing that much of the valley floor of Saguache Creek is sub-irrigated Source: Colorado Wetland Inventory Mapping Tool (CNHP, 2019).

Temporal Trends in Rio Grande Hydrology

Generally speaking, average annual streamflow of the SMP study streams has been in decline since the 1930s (Figure 1.9) and winter and spring season temperatures have increased in the Rio Grande Basin (Chavarria & Gutzler, 2018). Recent climate modeling suggests this trend of decreasing annual precipitation and streamflow in the Rio Grande Basin will continue in the future (Lukas et al., 2014).

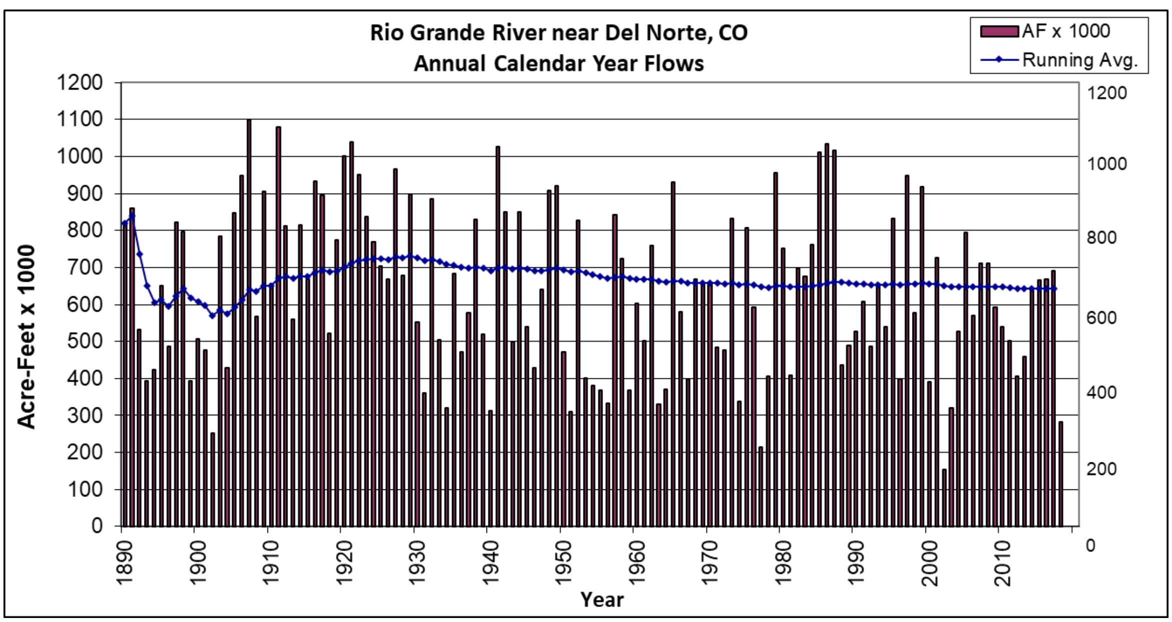


Figure 1.9: Annual flows (acre-feet x 1000) at the Rio Grande Near Del Norte, CO gage, illustrating downward trend in average annual flow (Source: Colorado Division of Water Resources).

In addition, compared to historic hydrology (viewed here as 1950 to 1997), the timing and peak of spring snowmelt and runoff has shifted in the last 20 years. Conejos River peak runoff has, on average, decreased 11.8% and shifted five days earlier, from May 31st to May 26th. To help illustrate this shift, Figure 1.10 compares average daily streamflow at the Conejos River Near Mogote gage from 1950 to 1997 to the average daily flow from 1998 to 2017.

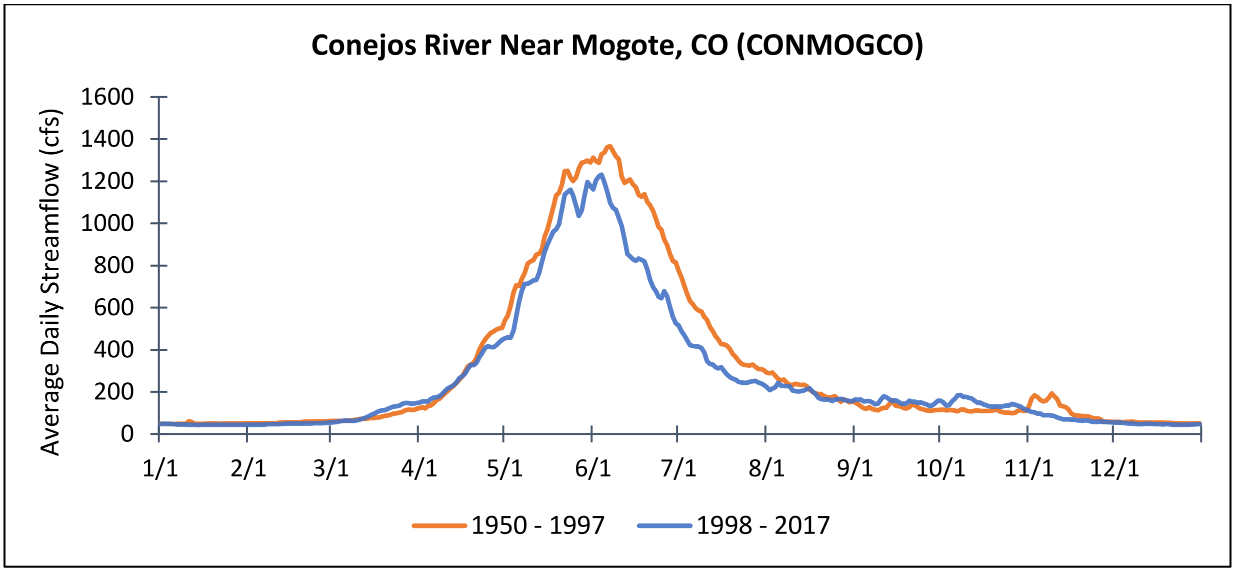


Figure 1.10: Comparison of average daily flows at the CONMOGCO stream gage.

Studies suggest these changes in peak runoff can be attributed to a combination of lower Snow Water Equivalent (SWE), a warming trend in spring temperature, and increased solar absorption caused by dust-on-snow events (Clow, 2010; Stewart et al., 2004; Lukas et al., 2014). Research by Chavarria and Gutzler (2018) showed April 1 SWE decreased approximately 25% across the Rio Grande Basin between 1958 and 2015. Although average peak runoff has decreased, recent increases in dust-on-snow events can result in significantly earlier and *higher* peak runoff. Figure 1.11 illustrates this phenomenon at the Rio Grande Near Del Norte gage following a 2009 dust-on-snow event in the San Juan Mountains.

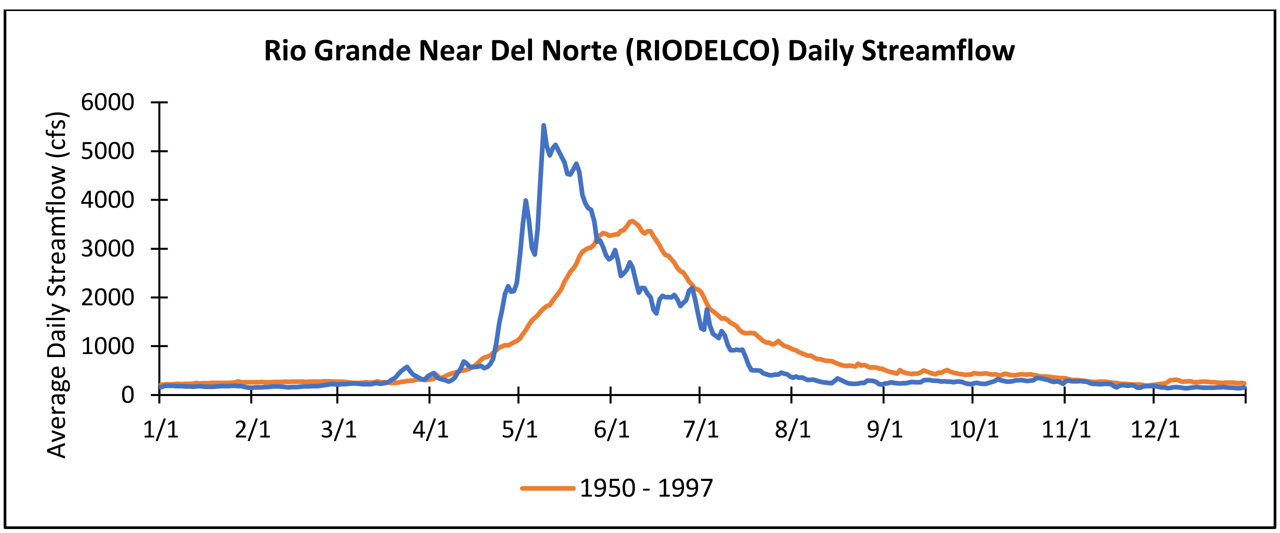


Figure 1.11: 2009 average daily flow at the RIODELCO gage following a dust-on-snow event plotted with 1950 to 1997 average daily flow.

As peak runoff continues to occur earlier in the spring, late summer flows are also predicted to decrease, as seen in the Figure 1.11. Furthermore, climate projections indicate that more precipitation will likely shift from snow to rain. One study showed the extent of snow-dominated land area within the upper Rio Grande Basin could decrease from 65% to 36% by the mid-21st century (Klos et al., 2017). Because the Basin's hydrology is primarily snowmelt-driven, this shift from snow to rain will have significant impacts on natural flow regimes. For example, increased precipitation in the form of rain paired with higher air temperature will increase the rate of evapotranspiration, resulting in less water reaching streams and contributing to streamflow. Studies also suggest this shift will cause less predictable, "flashier" streamflow and a reduction in the natural snowpack reservoir will accelerate the trends of decreasing annual streamflow, earlier peak flow, and lower late summer flow. Additionally, wildfires, tree mortality due to insects, and other forest health impacts will exacerbate these impacts. For example, vegetation loss decreases snowpack shading and increases snowmelt rates, creating a positive feedback loop (Lukas et al., 2020).

These projected changes in precipitation and hydrology may have a variety of impacts for water managers, water users, and aquatic life. Changes in the timing and amount of available water will affect agriculture, boating, fishing, and aquatic species. With less predictable flows, water managers, including reservoir operators, will be challenged to store and deliver water effectively using current infrastructure and may need to invest in additional or altered infrastructure. Farmers and ranchers are likely to have significantly less surface water available for agricultural use and groundwater recharge may decline. Aquatic species, including insects and fish, may be stressed by lower and warmer streamflow as well as a lack of adequate flows to maintain aquatic habitat. In turn, anglers and boaters are likely to have fewer recreational opportunities when flows are ideal. Many aspects of stream function, and the ecosystem services provided by those functions, may also be affected. For example, the geomorphic work performed by historic hydrology will be altered, riparian areas and flood-dependent species such as cottonwoods may no longer receive overbank flows at the same time or frequency, and water quality will almost certainly be affected. Adaptation to these effects and creative solutions to water management are critical to maintaining adequate surface water for water users and the environment.

1.7 Groundwater–Surface Water Interactions and Aquifer Storage

Groundwater-surface water interactions have been well documented across the western U.S., including in Colorado (Arnold et al., 2016; Hatch et al., 2006; Winter et al., 1998). In Colorado's Rio Grande Basin, groundwater-surface water dynamics have been extensively studied, especially as part of the Rio Grande Decision Support System (RGDSS) Groundwater Model. Although aquifer dynamics and groundwater-surface water interactions are not fully understood, RGDSS utilizes the best available data to model these dynamics, including calculations of streamflow depletions due to groundwater pumping. This section discusses the history of groundwater development in the Basin, the modeled impact of groundwater pumping on streamflows, and the conservation efforts underway to reduce groundwater withdrawals, replace injurious streamflow depletions resulting from pumping, and ultimately reach sustainable aquifer conditions.

There are two aquifers in the Basin: the confined and unconfined aquifers. The shallow, expansive unconfined aquifer is made up of sands and gravels and occupies the entire Alamosa Basin. The relatively deep confined aquifer lies beneath the unconfined and the two aquifer systems are separated by a series of blue clay layers.

The Rio Grande, Conejos River, and Saguache Creek are located within the jurisdiction of Colorado Department of Natural Resources – Division of Water Resources, Division 3 which manages all water well permits for the Rio Grande Basin. Well permit appropriations within the Rio Grande Basin withdraw unconfined and confined aquifer groundwater. Well withdrawals cause depletions to streams from which surface water right holders obtain their water supplies; the depletions to surface water rights result from the consumptive use of water withdrawn from the wells. Well development in the Basin began in the 1920s with scattered development across the Basin. Figure 1.12 shows Division 3 wells in 1930.

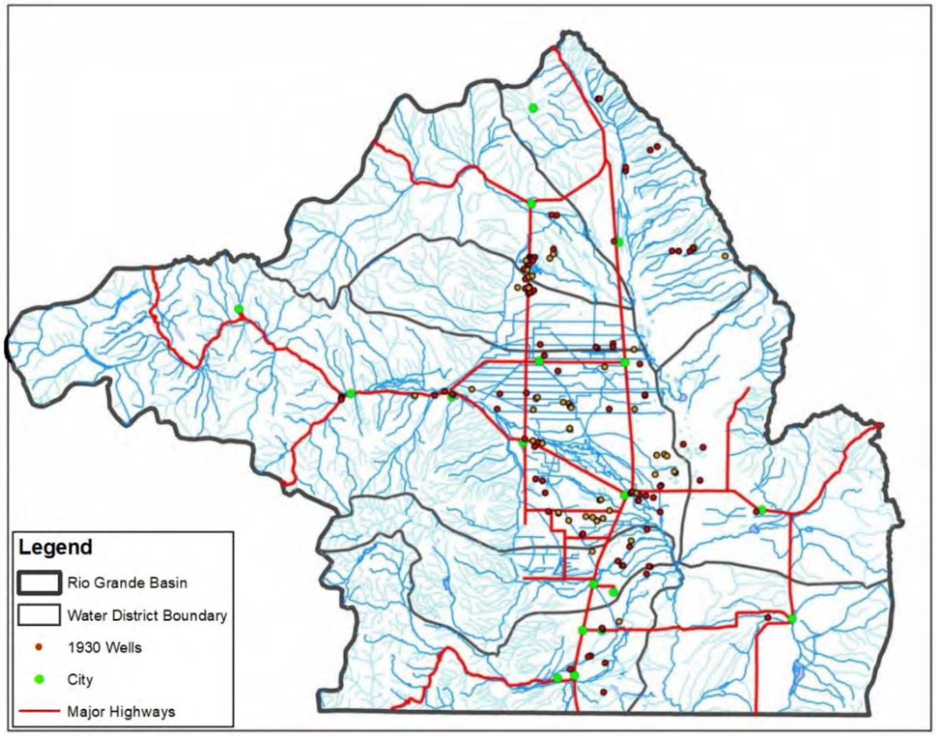


Figure 1.12: Division 3 well locations in 1930.

In the late 1930s, new well development increased significantly and by 1952 there were 1,300 wells in the Basin. By 1980, there were more than 2,300 wells. There are currently over 6,000 irrigation, commercial, and municipal wells in Division 3. Figure 1.13 shows current Division 3 wells.

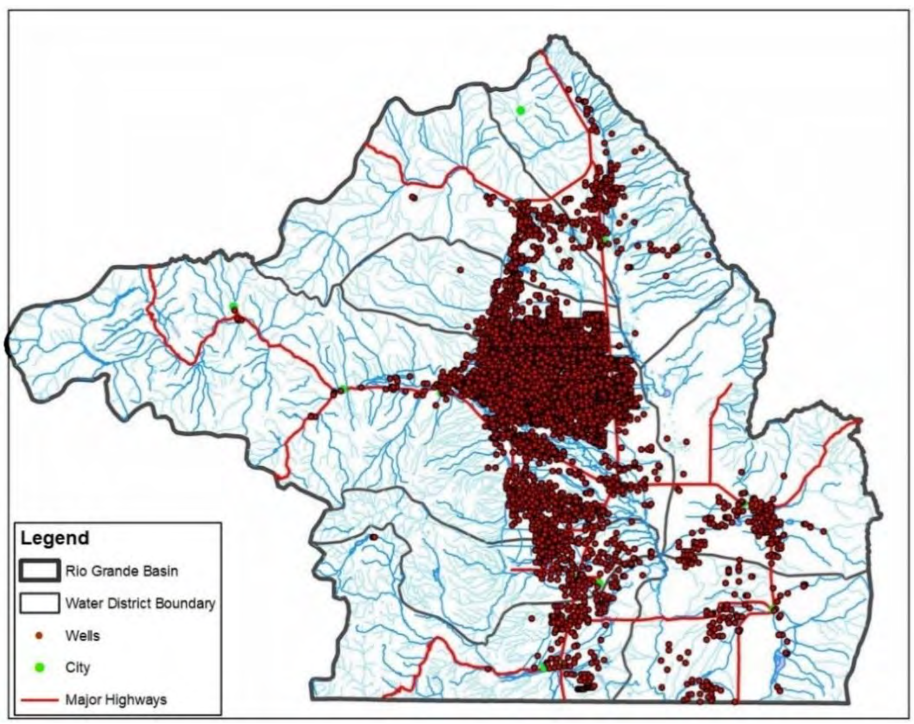


Figure 1.13: Current Division 3 well locations.

Groundwater development led to extensive groundwater use and over appropriation, eventually resulting in the need for groundwater withdrawal rules and regulations. To help inform and develop the rules, the RGDSS Groundwater Model (Model) was developed. The Model calculates flows through the confined and unconfined aquifer systems and can be used to predict stream gains/losses as a result of pumping stresses.

Surface Water Depletions

The Model shows that groundwater withdrawal can cause surface water (stream) depletions. To quantify depletions for a given stream reach, the San Luis Valley floor was divided into geographic subdivisions called Response Areas (RAs) which share broad hydrologic commonalities. The Model was then used to generate Response Functions (RFs), which describe the relationships between groundwater withdrawals and stream depletions, within each RA. RFs can be used within the Model to evaluate current and/or hypothetical changes in groundwater withdrawals such as switching off select wells. Using these spatial and temporal inputs, stream depletions caused by groundwater withdrawals can be calculated under varying conditions. Each stream with modeled depletions resulting from groundwater withdrawals in a given RA was divided into administrative reaches, shown in Table 1.1.

Table 1.1: Administrative stream reaches RGDSS Groundwater Model Response Area stream reaches.

Stream	Stream Reaches
Rio Grande	1. Rio Grande Del Norte to Excelsior Ditch 2. Excelsior Ditch to Chicago Ditch 3. Chicago Ditch to the State Line
Conejos River	1. Conejos Above Seledonia/Garcia Ditches 2. Conejos Below Seledonia/Garcia Ditches
Saguache Creek	1. Malone Ditch to Braun Bros Ditch

Modeled stream depletions from the groundwater withdrawals extend well into the future. A portion of the depletions in most RAs extend ±20 years past the current year's groundwater withdrawals. Over time, gradual refinements have been applied to the Model, typically when one or more of the modeled stresses are changed or new data is available and Model calibration refinement is applied.

Division 3 Well Rules

In 2015, the State Engineer submitted new Well Rules through the Division 3 water court system (DWR, 2015) to mitigate stream depletions, which injure senior surface water rights, and to attain sustainable groundwater levels within each RA. The Well Rules were approved by water court decree on March 15, 2019 and require all non-exempt wells to replace their calculated depletions to Rio Grande Basin streams through following a formal water augmentation plan or joining a groundwater management subdistrict (Subdistrict). Under a water augmentation plan, a water district or other entity mitigates a well's injury to senior water rights by physically replacing depletions in time, place, and quantity.

Beginning in 2006, the Rio Grande Water Conservation District (RGWCD) began forming Subdistricts, whose boundaries are based on geologic and hydrologic characteristics of the Basin. Subdistricts are responsible for replacing the injurious stream depletions caused by groundwater withdrawal by well owners within a given Subdistrict. Each Subdistrict operates under an annual replacement plans (ARP) to replace their injurious stream depletions. They also strive to reduce well pumping in an effort to regain sustainable aquifer levels. Wells not in compliance with the Well Rules after March 15, 2021 will be curtailed by the State Engineer.

For planning purposes, the Model was run using the RFs for Subdistricts located on the Rio Grande, Conejos River, and Saguache Creek. This example was completed to estimate the amount of water that will be replaced on these streams when all Subdistricts are operating. The example included streamflow and groundwater withdrawal data from 2017 and results are shown in Table 1.2.

Table 1.2: Total depletions on each stream system in 2017.

Stream	Total Depletions - May through April (acre-feet)
Rio Grande	10,316
Conejos River	6,923
Saguache Creek	912

The 2017 example illustrates the measurable effect of well pumping on streamflows in the Rio Grande Basin. Within each Subdistrict, participating well owners are making considerable efforts to reduce overall well pumping. Through these efforts, Subdistricts are working toward aquifer sustainability and reductions in surface water depletions resulting from well pumping. As a result of groundwater users replacing depletions to streams and rivers throughout the Rio Grande Basin, streamflows are expected to increase and result in healthier, more resilient systems.

There is also potential to mitigate streamflow depletions and the associated water quality impacts through conservation and restoration activities throughout the watershed. For example, streams with active and connected floodplains support groundwater-surface water exchange within hyporheic zones, thereby buffering water temperature. Additionally, alluvial aquifer and wet meadow restoration efforts have been shown to attenuate flood flows and enhance late summer streamflow in the arid West (Hammersmark et al., 2008 & Loheide et al., 2009). These restoration techniques mitigate the risk of flooding and the damage it may cause by enabling high flows, most commonly experienced during spring runoff, to spread out onto floodplains and soak into alluvial systems. This water, stored in wet meadows and alluvial systems, is slowly released throughout the summer irrigation season, augmenting late summer and fall base flow in streams. Finally, conserving existing surface water use and protecting wet meadows, wetlands, and riparian areas also has the potential to mitigate stream depletions and aide in groundwater recharge and aquifer sustainability.

1.8 Major Reservoirs on the Rio Grande and Conejos River Systems

Reservoirs provide water storage on both the Rio Grande and Conejos River. Major reservoirs affecting the Rio Grande are "pre-Compact," which, under the terms of the Compact, means they were built before 1929, while the two reservoirs on the Conejos River are "post-Compact." Operations of post-Compact reservoirs are limited by Article VII of the Compact. Under Article VII, post-Compact reservoirs are not permitted to store water when total Rio Grande Project (downstream Compact reservoirs) storage is less than 400,000 acre-feet (Compact, 1938). This significantly limits post-Compact reservoir operations in the Basin.

Rio Grande Reservoirs

Four major reservoirs provide storage for the Rio Grande: Rio Grande Reservoir, Santa Maria Reservoir, Continental Reservoir, and Beaver Creek Reservoir. Figure 1.14 shows the locations of these reservoirs.

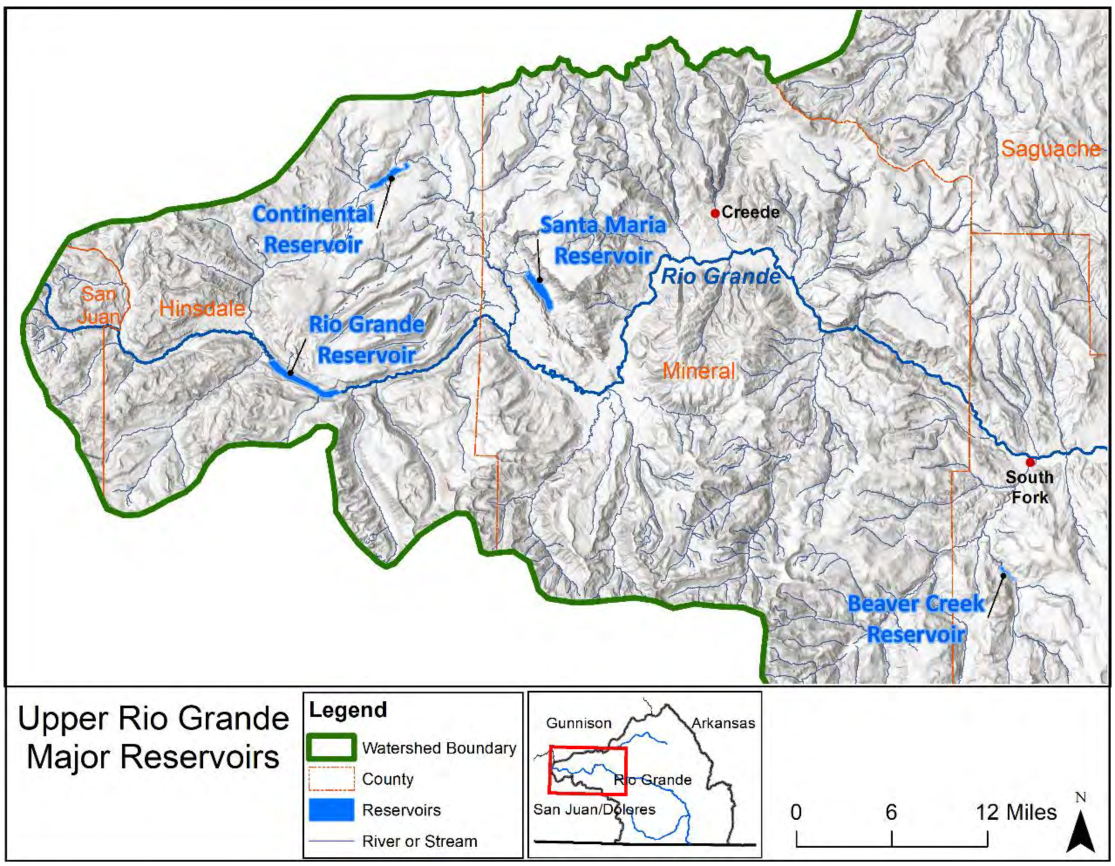


Figure 1.14: Major reservoirs in the Rio Grande watershed upstream of South Fork.

Rio Grande Reservoir is an on-channel reservoir on the Rio Grande just upstream of the Rio Grande Box Canyon. It was built in 1912 to provide water storage for farmers in the San Luis Valley Irrigation District and has a capacity of 51,113 AF. It is owned and operated by the San Luis Valley Irrigation District. Between 2012 and 2020, significant improvements were made to the dam and its outlet works to address seepage and dam safety concerns. Improvements included resurfacing the dam to prevent seepage as well as updating the outlet tunnel and adding new valves to the outlet works, which will allow the reservoir to pass high flows and eliminate leakage from the outlet. The improvements were made as part of the Rio Grande Cooperative Project and the Rio Grande Reservoir Rehabilitation Project, completed in 2020.

Continental Reservoir is an on-channel reservoir on North Clear Creek. It was built in 1928 and has a capacity of 26,716 AF. Santa Maria Reservoir is an off-channel reservoir built in 1911 with a capacity of 43,826 AF. Santa Maria Reservoir flows are released into Boulder Creek, a tributary to Clear Creek downstream of Continental Reservoir. Clear Creek joins the Rio Grande approximately 2.1 miles downstream of the Rio Grande Box Canyon. Santa Maria Reservoir and Continental Reservoir are owned and operated by the Santa Maria Reservoir Company.

Beaver Creek Reservoir is an on-channel reservoir on Beaver Creek. It was built in 1914 and has a capacity of 4,758 AF. It is owned and managed by CPW. Along with Rio Grande Reservoir, improvements were also made to Beaver Creek Reservoir as part of the Rio Grande Cooperative Project. The reservoir's spillway was rebuilt, a new abutment was constructed, and the outlet tunnel was improved to enhance outlet control and downstream flow management. Additionally, seepage issues on the dam were addressed.

All four major Rio Grande reservoirs are pre-Compact, allowing them to store during the non-irrigation season and operate with more flexibility than post-Compact reservoirs. Rio Grande, Santa Maria, and Continental reservoirs store water primarily for irrigation, Rio Grande Compact deliveries, augmentation plans, and instream replacements for Subdistricts. Beaver Creek Reservoir is primarily managed for wildlife and recreation.

Conejos River Reservoirs

Platoro Reservoir and Trujillo Meadows Reservoir, both of which are post-Compact reservoirs, provide the only significant storage in the Conejos River watershed. The Platoro dam was completed in 1951 by the Bureau of Reclamation (BOR), making it a post-Compact reservoir. The dam is an earthfill structure consisting of a main embankment and a dike section, separated by a rock knoll in which the spillway is excavated. The reservoir formed by the dam has a capacity of 59,570 AF, 6,060 AF of which are for flood control and 53,510 AF for joint use. While BOR retains ownership of the dam, operations are managed by the Conejos Water Conservancy District (CWCD). The dam is situated at 10,000 ft, relatively high in the watershed.

Upper portion of Platoro Reservoir during winter (Photo: Christi Bode).

Trujillo Meadows Reservoir is located on the mainstem Rio De Los Pinos, a tributary to the Rio San Antonio, and was completed in 1957. It has a capacity of 913 AF and is managed by CPW for recreation.

1.9 Inter-State Legal Context and Surface Water Rights

History of Surface Water Rights

Development of surface water irrigation in the Rio Grande Basin began in the 1850s. By the late 1800s, surface water rights from the Conejos River (Water District 22) were fully appropriated. The three most senior water rights served by Conejos River are decreed to the Guadalupe Main, Manassa No. 3, and Romero ditches. All three of these water rights were appropriated in 1855. Figure 1.15 shows the relationship between cumulative absolute surface water rights versus dry, average, and wet streamflow hydrographs, as measured at the Conejos River Near Mogote, CO (CONMOGCO) stream gage. Average daily flow from the year 1920 is also shown on the graph below to illustrate an exceptionally wet year in which all water rights were in priority.

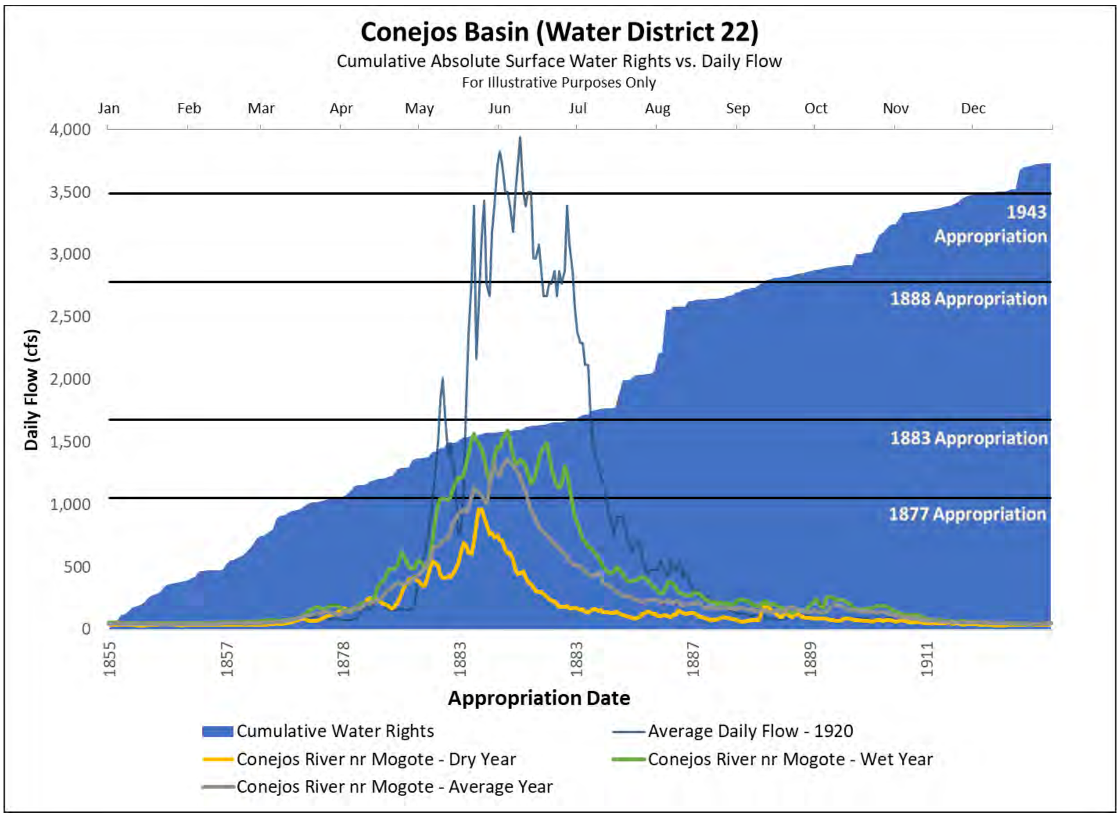


Figure 1.15: Water District 22 cumulative absolute surface water rights versus dry, average, and wet streamflow hydrographs measured at the Conejos River Near Mogote, CO (CONMOGCO) stream gage.

Rio Grande Compact

The equitable distribution of Rio Grande waters between the United States and Mexico was established in the 1906 Convention between the two countries (Convention, 1906). In 1938, the states of Colorado, New Mexico, and Texas entered into the Rio Grande Compact (Compact). The Compact equitably apportions the waters of the Rio Grande in the U.S. and defines Colorado's delivery requirement to New Mexico along with many other aspects of management of the river. To determine baseline water supply and use, inflows at upstream gaging stations (index stations) were compared to outflows at downstream gaging stations during a study period from 1928 to 1937. Under the Compact, Colorado agreed to deliver a predetermined amount of water to New Mexico based on flows at index stream gage stations (Compact, 1938). On the Rio Grande, index flows are determined by measurements at the Rio Grande Near Del Norte, CO (RIODELCO) stream gage. On the Conejos River, index supply is measured as the sum of the Conejos River Near Mogote, CO (CONMOGCO) stream gage during the calendar year, plus the measured flows of Rio San Antonio and Rio de Los Pinos (SANORTCO and LOSORTCO, respectively) during the months of April to October. Conejos River Compact deliveries to the Rio Grande are measured as the sum of two gages, the North Channel Conejos River Near La Sauces (NORLASCO) and South Channel Conejos River Near La Sauces (SOULASCO). Saguache Creek does not have a delivery requirement under the Rio Grande Compact because it drains into the Closed Basin and therefore is not considered a tributary to the Rio Grande.

The combined flows of the Rio Grande and Conejos River are measured at the Rio Grande Near Lobatos, CO (RIOLOBCO) stream gage to determine total deliveries to New Mexico (Compact, 1938). Figure 1.16 shows locations of stream gages used to measure Rio Grande Compact index and delivery flows in Colorado, while figure 1.15 shows the larger spatial extent of the international Compact.

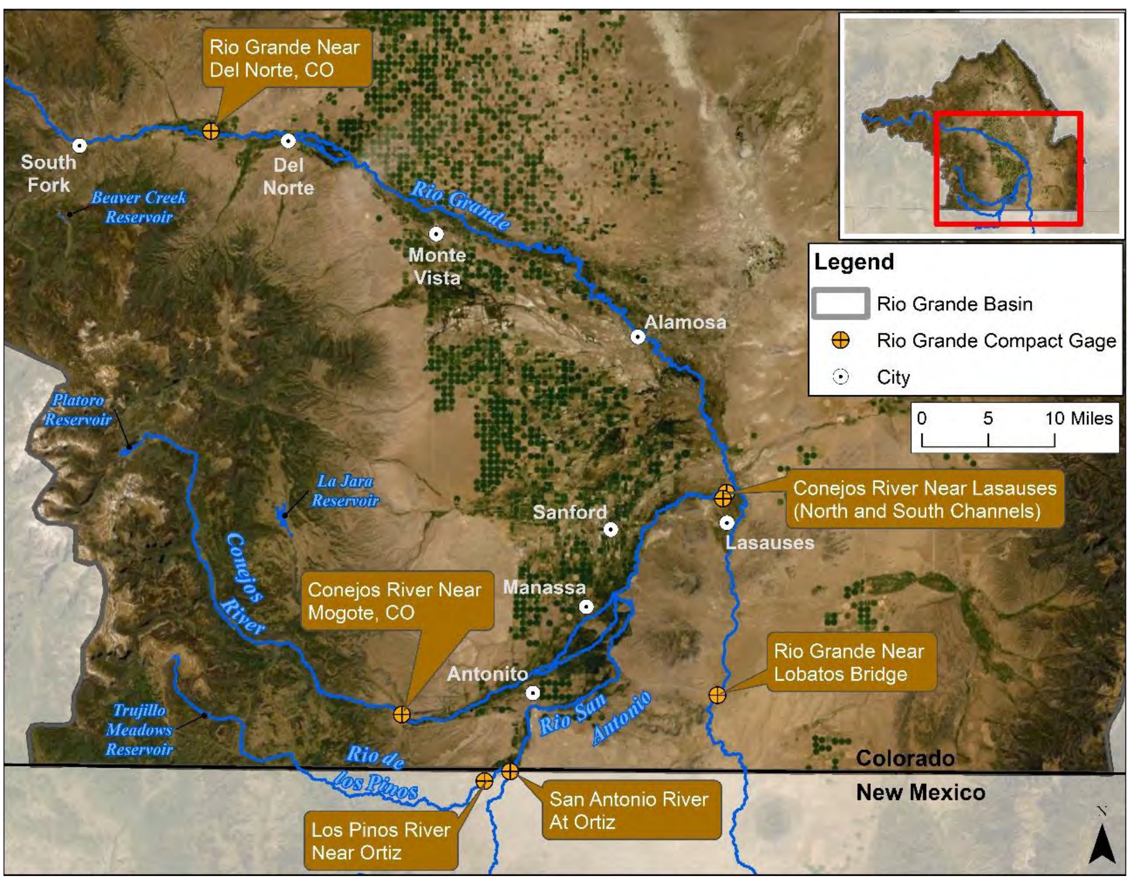


Figure 1.16: Stream gage locations used to measure Rio Grande Compact index and delivery flows.

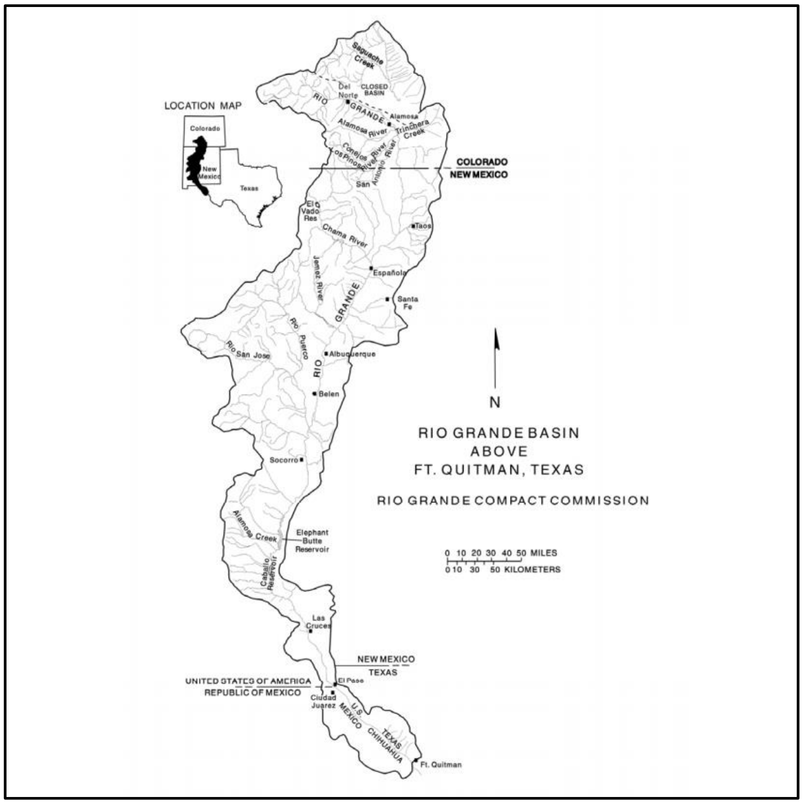


Figure 1.17: Spatial extent of the Rio Grande Compact (Source: Rio Grande Compact Commission, 2015).

Figure 1.18 shows Rio Grande and Conejos River delivery obligations as a function of each river's annual measured index flows.

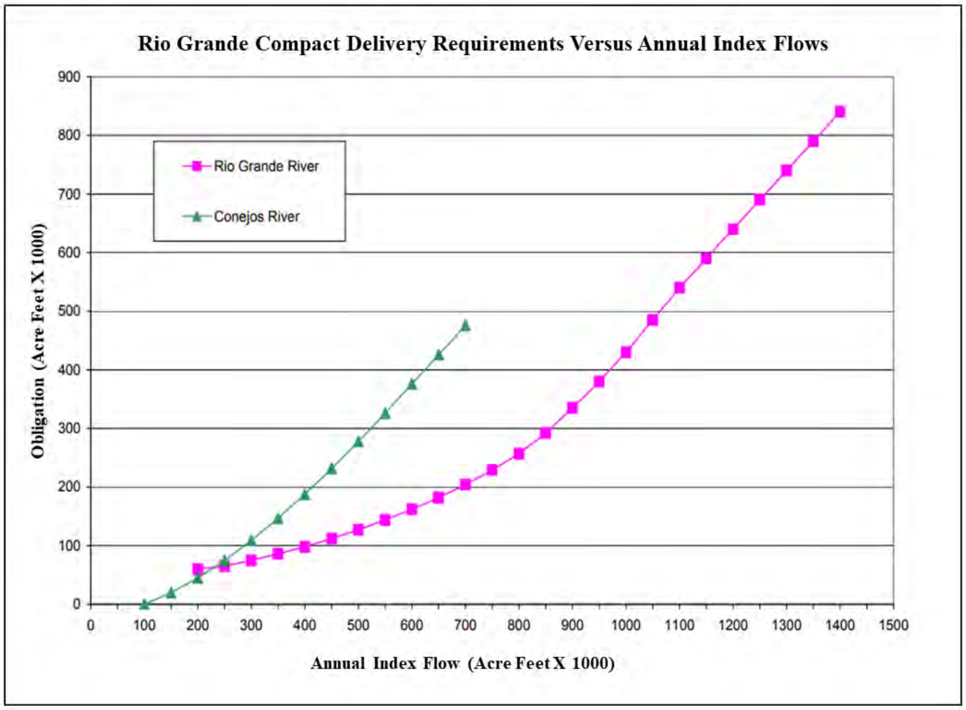


Figure 1.18: Rio Grande and Conejos River delivery obligations as a function of annual index flows under the Rio Grande Compact.

Water Rights Curtailment

Because water rights in Division 3 are over-appropriated, the Division 3 Engineer is required to curtail surface water diversions on the Rio Grande and Conejos River during the irrigation season (typically April 1 to October 31) in order to meet Compact delivery obligations (DWR, 2015). During the irrigation season, the Division Engineer estimates annual flow at the index gages using snowpack measurements, weather forecasts, and streamflow models. The Division Engineer uses the flow estimates and models to calculate total anticipated annual streamflow and flow within the winter months and the irrigation season. Because all winter flows are delivered to the state line, the Division Engineer subtracts these flows from the total anticipated delivery requirement. The remaining obligation must be met with flows produced in the irrigation season and therefore, is curtailed from irrigators. The curtailment is applied to surface water rights on a daily basis, which results in some water rights not being served. Annual index flow estimates and curtailment are updated every 10 days to reflect the most recent data. As noted above, Saguache Creek does not have a delivery requirement under the Compact. Saguache Creek water rights are administered based on prior appropriation.

2. Conditions Assessment Methods

The Rio Grande, Conejos River, and Saguache Creek SMPs utilized a reach-scale conditions assessment to assess current stream condition and function. The conditions assessment considered seven indicators of stream health and function: diversion infrastructure, recreational flow needs, aquatic habitat flow needs, geomorphology, riparian vegetation, aquatic life, and water quality. With the exception of recreational and aquatic habitat flow needs, each indicator was rated by reach using an academic rating scale. Recreational and aquatic habitat flow needs were quantified by reach but were not rated. Each indicator was assessed using two or more metrics, or subvariables, to determine an overall rating. The conditions assessment focused on identifying stressors affecting stream condition as well as opportunities to improve those conditions for environmental, recreational, agricultural, and other stakeholder uses. The assessment provides benchmark data that can be used for management decisions and can be incorporated into long-term monitoring programs. In addition, assessment findings provide an opportunity to approach restoration, conservation, and stream management planning using an interdisciplinary and multi-benefit approach.

Where appropriate, a modified version of the Functional Assessment of Colorado Streams (FACStream) 1.0 framework was utilized to rate stream health indicators by reach (Beardsley et al., 2015). FACStream is an organizational framework that uses an academic grading scale (A-F) to assess a stream condition and its degree of functional impairment as compared to reference condition. Table 2.1 shows the FACStream grading system. Each grade represents a condition class defined by the degree of functional impairment. Pristine streams having no impact score 100 (A+). A score of 50 (F-) indicates the lowest level of functioning for a reach that is profoundly impaired, but still recognizable as a feature that conveys water.

The water quality and aquatic life assessments utilized modified FACStream while other stream condition variables included in the assessment utilized slightly different methodology. Methodology for each variable is described in sections 2.3 through 2.10.

Table 2.1: FACStream functional condition rating criteria.

(blue)	A	**Reference standard**
(green)	B	**Highly functional**
(yellow)	C	**Functional**
(pink)	D	**Functionally impaired**
(red)	F	**Nonfunctional**

2.1 Reach Delineation

Each prioritized stream was divided into relatively homogenous reaches with start/end points based on significant changes in geomorphology, land use, tributary streams, and major diversion structures. The intention of reach delineation is to provide discrete spatial units for analysis. Due to the large geographic extent of the study area, some reaches include subtle changes in geomorphology that are not captured. Conditions assessment results are organized by reach within each SMP for ease of use. Reach descriptions, overview maps, photos, associated river miles, and assessment results are provided in each SMP.

River miles for each reach were calculated using the Colorado Decision Support System (CDSS) Source Water Route Framework (SWRF). The SWRF is a GIS dataset extracted from the National Hydrography Dataset and specifically developed for Colorado. The SWRF dataset contains measured route data for all named streams and rivers in Colorado. Measurements on each stream begin at its most downstream location and progress upstream to the headwaters of the stream. River mile 0 may be located at the Colorado state line (e.g., Rio Grande), at a confluence with a larger river (e.g., Conejos River), or at a stream's terminus (e.g., Saguache Creek). For example, river mile 0 on the Conejos River is defined as its confluence with the Rio Grande and the outlet of Platoro Reservoir is located at river mile 84.4. River miles represent the distance of a stream channel across a landscape. This is important to note because river miles are based on a stream or river's centerline, and therefore the calculated lengths over-represent the distance geographically of the valleys from start to endpoint.

2.2 Review of Relevant Existing Information

Existing reports, studies, datasets, and other information on stream condition were compiled for each SMP. A significant amount of existing information was gathered, particularly related to the Rio Grande, including the Upper Rio Grande Watershed Assessment, the Rio Grande Headwaters Restoration Project, and the Rio Grande Natural Area River Condition Assessment (MWH, 2001; Riverbend Engineering, 2016; SGM & Lotic Hydrological, 2018). Table 2.2 lists existing information used in the condition assessment as well as the primary information types.

Table 2.2: Summary of existing information.

Summary of Existing Information		Applicable SMP Assessments					
Report or Data Source	**Description**	**Diversion Infrastructure**	**Hydrology and Flow Needs**	**Geomorphology**	**Riparian Vegetation**	**Water Quality**	**Aquatic Life**
Rio Grande Headwaters Restoration Project (2001)	Planning document for mainstem Rio Grande	X		X	X		
Rio Grande Basin Implementation Plan (2015)	Planning document supporting Colorado Water Plan and Rio Grande Basin needs		X				
Rio Grande Natural Area River Condition Assessment (2016)	Assessment of stream conditions within Rio Grande Natural Area			X	X	X	X
Upper Rio Grande Watershed Assessment (2018)	Physical and biological stream assessment driven by stakeholders and technical advisory team			X	X	X	X
Feasibility Study: River Corridor Improvements Rio Grande in Alamosa, CO (2017)	Planning document for Rio Grande in Alamosa						
Colorado Water Conservation Board Diversion Infrastructure Inventory (2006)	Inventory and maps of diversion structures, including condition	X					
Rio Grande Decision Support System (RGDSS)	Irrigation statistics for all decreed water rights	X	X				
Measurable Results Program and Phase II Monitoring (2015)	SVAP, macroinvertebrates, water quality, bank stability						X
Bureau of Land Management Aquatic Assessment, Inventory, and Monitoring (AIM) program (2017)	Detailed reach-level assessment of stream condition					X	X
Integrated Water Quality Monitoring and Assessment Report, Colorado Department of Public Health and Environment (CDPHE) (2018)	Water quality parameters (e.g. pH, conductivity, dissolved oxygen) National Water Quality Assessment Program, United States Geological Survey, and EPA					X	X
Wildfire Impacts on Water Quality, Macroinvertebrate, and Trout Populations in the Upper Rio Grande (Rust, 2019)	Study of post-wildfire impacts on water quality and aquatic life.					X	X
Colorado Parks and Wildlife (Nehring and Anderson, 1993)	PHABSIM surveys and IFIM		X				
CPW Fish Survey and Stocking Data (2006 - 2018)	Fish population surveys and stocking data	X	X				X
CPW Rio Grande Fisheries Management Plan (2016)	An overview for collaborative efforts in river restoration efforts	X	X				X
Colorado State Wildlife Action Plan (2015)	Planning document						X
Instream Flows (ISF) Water Rights - Held by the Colorado Water Conservation Board (CWCB)	Decreed instream flows		X				
Division of Water Resources Division 3 Streamflow Monitoring Network	Stream gage data		X				
Rio Grande Basin LiDAR survey (2012)	SLV-wide LiDAR dataset (bare earth)	X		X			
Colorado Natural Heritage Program (CNHP) Vegetation Surveys	Vegetation surveys, including wetlands				X		
Rio Grande National Forest Vegetation Mapping	GIS data containing vegetation communities				X		

2.3 Diversion Infrastructure Inventory and Assessment

The Rio Grande Headwaters Restoration Project (RGHRP) completed an inventory and functional assessment of instream diversion infrastructure. Diversion structures located on the mainstems of each prioritized SMP stream were included in the inventory. The inventories include assessments of diversion structure headgates, diversion dams, measurement devices, and nearby channel conditions affecting each structure. Each structure's impact on stream function was also included.

Figure 2.1: Del Puerticito Ditch diversion on the Conejos River.

Each structure's condition was rated using the A-F scale defined by FACStream. Two ratings were determined for each structure. One rating was assigned to the structure's headgate and a separate rating was assigned to the cumulative condition of the structure's diversion dam, measurement structure, and nearby channel conditions. Ratings were based on the structure's ability to effectively divert water as well as its impact on channel conditions, stream function, fish passage, and recreational boating. Grades were averaged for an overall rating. The overall rating scale is described in Table 2.3.

Table 2.3: Rating scale used for diversion infrastructure assessment.

Rating Scale	Impairment	Description
A ≥ 90	Negligible	The structure functions very well and no stream health impacts were detected. Improvements are not currently needed.
B ≥ 80	Mild	The structure functions well, however minor repair needs were noted and/or stream health impacts were detected. Minor improvements are recommended.
C ≥ 70	Significant	The structure functions, however significant repair needs were noted and/or significant stream impacts were detected. Improvements are recommended.
D ≥ 60	Severe	The structure functions poorly and/or severely impacts stream health. Extensive repairs or replacement of structural elements is recommended.
F ≥ 50	Profound	The structure is nonfunctional and/or profoundly impacts stream health. Full structure replacement is recommended.
N/A	N/A	The structure does not exist or was not rated.

To determine diversion structure condition and function, three kickoff meetings were held with the water commissioners for Water Districts 20 (Rio Grande), 22 (Conejos River), and 26 (Saguache Creek). During meetings, concerns, needed improvements, and other functional considerations were noted. Following kickoff meetings, each structure was visited and photographed to document its condition and to highlight repairs and/or improvements needed. Individual landowners and ditch companies were also consulted and field visits were arranged.

Channel Migration Analysis

Channel margins along the Rio Grande and the Conejos River were delineated using available aerial photography for the years 1960, 1975, 1998 and 2017. These delineations identify an approximated, but not exact, location of the channel margin at the time the image was taken (further information regarding their accuracy and known error is described in **Appendix B**). These delineations (example in Figure 2.2) were used to investigate significant channel migration since 1960 at the reach level in order to identify potential threats to a given structure. For example, although channel avulsion is a naturally occurring process, it can cause the river to bypass diversion structures.

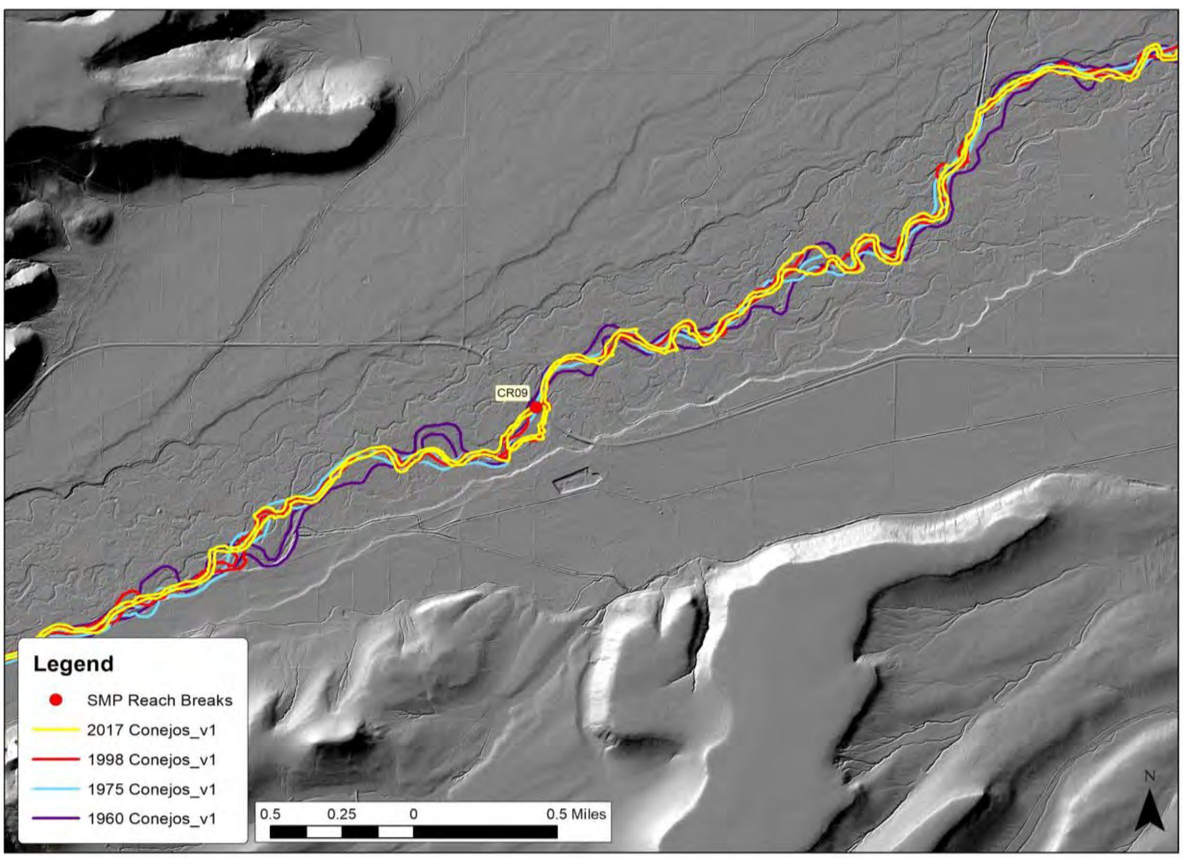


Figure 2.2: Example of bankline identification to delineate the very recent historic location of the Conejos River in the vicinity of the Mogote Bridge utilizing aerial photography from 1960, 1975, 1998 and 2017.

Using the information described above, a “report card” containing descriptive statistics, photographs, location, and channel migration maps, and recommended improvements was created for each structure. An example report card for the North Eastern Ditch is shown in Figures 2.3 and 2.4.

Each structure’s report card was saved as a PDF. Links to each structure’s report card, as well as a map showing diversion structure locations, are available on Rio Grande Headwaters Restoration Project’s “Stream Management Plans” webpage at the following url: https://riograndeheadwaters.org/stream-management-plans. The report cards are intended to be used by water commissioners, landowners, ditch companies, and other water users to monitor structure conditions over time. A summary of each structure, including recommended improvements, can be found in section 3.2.

Example Report Card

CONEJOS RIVER
DIVERSION INFRASTRUCTURE INVENTORY

Structure Name: NORTH EASTERN D

Reported By: Daniel Boyes

Date: April 14, 2019

Headgate Location:	**Latitude** 37.068313	**Longitude** -106.092378

Headgate Type: Manually operated 8' wide radial gate

Headgate Condition:	**Diversion and Other Conditions:**	**River Miles From Rio Grande Confluence (Point Of Diversion):**	**Structure Submerged:**
A ☐ B ☐ C ☐ D ☒ F ☐	A ☐ B ☐ C ☐ D ☒ F ☐	37.88 mi	Yes ☐ No ☒

Repair(s) or Improvement(s) Completed Since 2006: None

Repair(s) or Improvement(s) Currently Needed: The river headgate at the point of diversion is tilted and does not function well. It should be repaired or replaced in conjunction with a new structure to prevent high flows from flooding the carrier channel. The main headgate and diversion dam on the feeder channel are spalling and do not function well. The banks surrounding the diversion and headgate on the feeder channel need to be built up and reinforced regularly to prevent flows from bypassing the structure. Additionally, debris accumulation is an issue at the main headgate. The main headgate and diversion dam need to be replaced and a sluice gate should be installed. Headgate automation should be considered when the headgate is replaced. Existing fish and boat passage should be maintained as part of any future repairs or improvements to the diversion. Riparian and aquatic habitat restoration should also be considered.

Structure Description: Water is diverted off the Conejos River by a boulder diversion dam to a river headgate and carrier channel. Adjacent to the river headgate is a repurposed molasses tank that is intended to prevent high flows from entering the feeder channel. The carrier channel then transports water ~1.7 miles to the main headgate, which also services Bernardo Romero Ditch. A checkboard diversion structure on the feeder channel diverts water to the headgate. An unused water returns to the river via an ~0.75-mile return flow channel, which reaches the river just upstream of La Del Rio Ditch. In this area, the Conejos River channel has migrated in the past, especially upstream of the diversion. During a high flow event, the river could migrate to its historic channel, beginning at the Antonito Ditch point of diversion (see maps below), thereby bypassing the point of diversion. Additionally, during high flows, the river can breach the river headgate and adjacent molasses tank, flooding the carrier channel.

Comments: This structure services two ditches – the priority 35 Bernardo Romero Ditch and the priority 66 North Eastern Ditch.

Notes:

Estimated Range of Cost: High

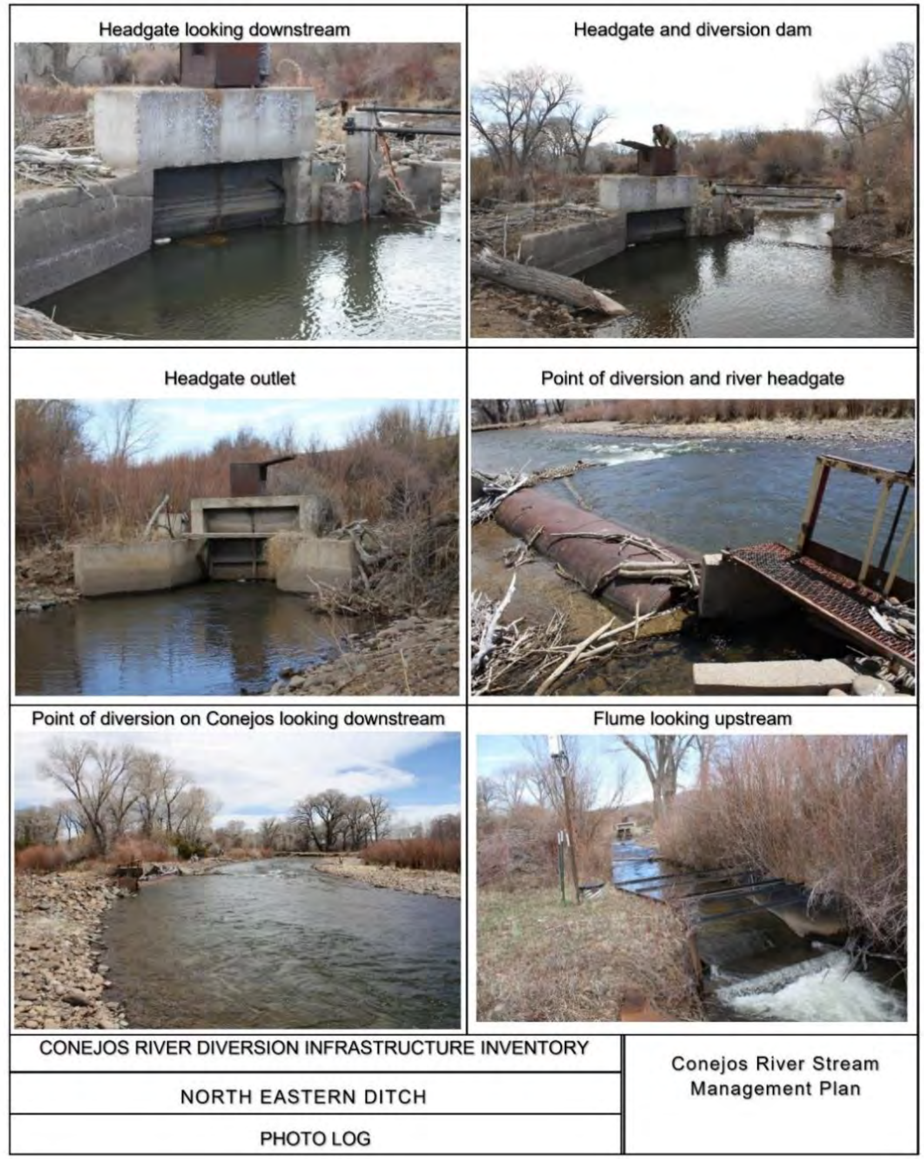
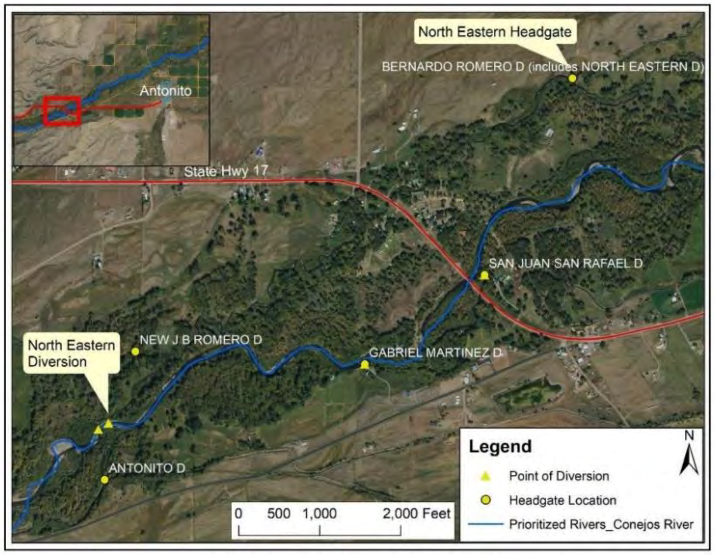
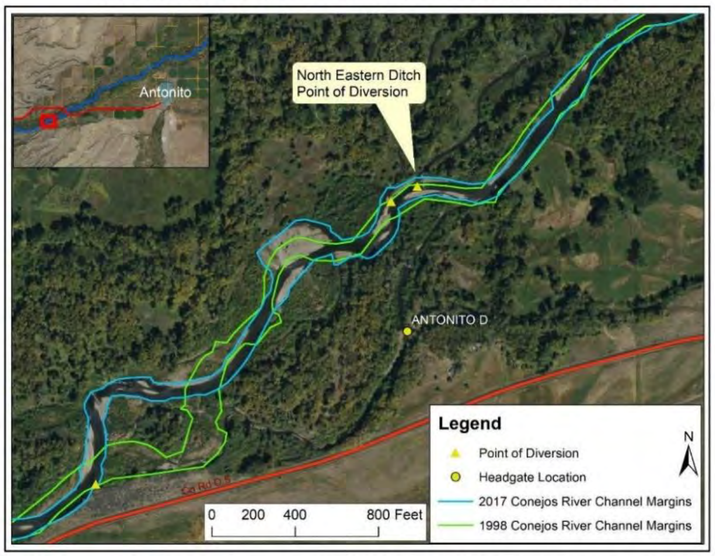


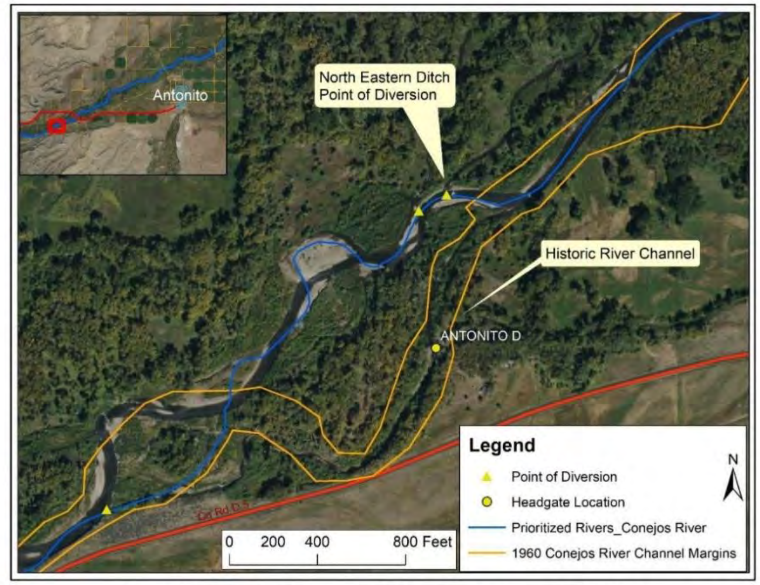
Figure 2.3: Example report card developed for diversion infrastructure inventory (pages 1-2).



North Eastern Ditch point of diversion and headgate locations



North Eastern Ditch point of diversion with 1998 and 2017 channel margins overlaid



Map of historic river channel (1960), showing potential for river to migrate and bypass the point of diversion in the future

River channel upstream of diversion (looking upstream).

Figure 2.4: Example report card developed for diversion infrastructure inventory (pages 3-4).

2.4 Hydrology Assessment

The hydrology assessment characterized flow regimes and assessed flow targets for the Rio Grande, Conejos River, and Saguache Creek SMPs. Daily point flow models (PFMs) were developed by Wilson Water Group, LLC, for each stream using a combination of gaged streamflow data, diversion records, stream gains/losses, USGS Stream Stats, and local knowledge from water commissioners and hydrographers. Within each PFM, daily streamflows were generated for both gaged and ungaged locations of interest (i.e., hydrology nodes). Locations of hydrologic interest within each SMP were selected with input from the TAT. At ungaged locations, the tools described above were used to simulate daily historical streamflow conditions.

The Conejos River and Rio Grande PFMs were calibrated by comparing simulated streamflow to recorded values and anecdotal information from the Water Commissioner and water users. The Saguache Creek PFM was calibrated assuming no flow after the last diversion on the Creek, per discussions with the Water Commissioner. A study period of 1998 to 2017 was used for all point flow models and reflects current administration over variable hydrology including the critically dry period during 2002. Gains and losses were distributed along the river based on irrigated acreage, tributary inflows, and on-the-ground observations by the Water Commissioners. Flows were estimated at all ungaged hydrology nodes, using the closest gages, diversions, and gains and losses. It should be noted that the level of calibration at each node varied depending on several external factors including frozen streams, irrigation return flows, ungaged tributaries, springs and seeps, etc.

The results from each PFM were summarized both graphically and tabularly and used in the recreational flow needs assessment as well as the aquatic habitat flow needs assessment. Using the PFM, wet, dry, and average daily hydrographs for the 1998 to 2017 period of record were calculated based on average annual streamflow. Wet years were classified as the 75th percentile and above, average was the 25th to the 75th percentile, and dry was the 25th percentile and below. Figure 2.5 illustrates a typical hydrograph resulting from the PFM.

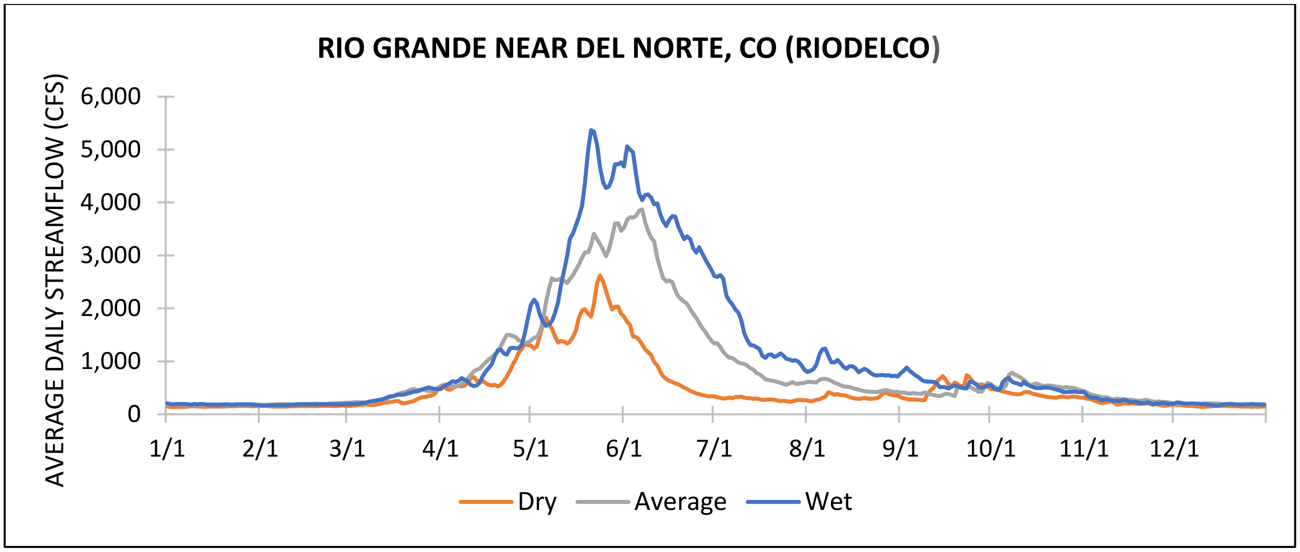


Figure 2.5: Typical hydrograph developed as part of the hydrology assessment.

Application of Hydrology Data and Point Flow Models

In addition to characterizing general hydrology and flow regimes, the hydrology data described above was used in the geomorphology, the recreational use and streamflow needs, and aquatic habitat needs assessments. Specifically, flow duration curves for each hydrology node were utilized in the geomorphology assessment to calculate bed mobility thresholds and frequency of overbanking events. Additionally, daily PFMs were utilized to calculate boatable days as part of the Recreational Use and Streamflow Needs assessment and to determine frequency of flow target attainment as part of the Aquatic Habitat Streamflow Needs assessment. Each of these assessments is described in detail below.

2.5 Recreational Use and Streamflow Needs Assessment

With input from the TAT, local stakeholders, and the RGHRP, American Whitewater (AW) completed a recreational use and streamflow needs assessment on the Rio Grande and Conejos River. Eight Rio Grande reaches and three Conejos River reaches were identified as priorities for recreational use and were included in the assessment.

To determine flow preferences for each reach, an online recreational use survey was distributed. Four types of questions were presented to survey respondents, three of which quantified flow preferences by reach, collectively, while another was directly related to water management and stream management planning. SMP-related questions allowed for comments on recreation constraints caused by infrastructure, navigational hazards, and opportunities to improve streamflow and overall recreational opportunities. Responses to SMP-related questions were incorporated into Rio Grande and Conejos River SMP stakeholder values.

Survey results were analyzed to determine streamflow preferences as well as acceptable and optimal flow thresholds for each reach. Having identified flow preferences and thresholds, AW's Boatable Days tool was run using daily streamflow data for dry, average, and wet year types (described above) to capture flow variations over the period of record. The tool applied flow preferences as inputs to calculate the number of boatable days by flow year type and reach. The Boatable Days tool has been employed in previous recreational use assessments, including the Colorado and San Miguel rivers, and is an accepted methodology for assessing and defining recreational flow needs (Stafford et al., 2016). Assessment results defined the range of flows supporting recreational use and illustrated how flows affect recreational opportunities for each reach.

This assessment played a critical role in the SMP process by quantifying baseline recreational use on the Rio Grande and Conejos River. Although some information existed previously, this assessment provided quantitative information needed to develop goals to maintain and enhance streamflows for recreational use on these two rivers. The TAT and local stakeholders used this information to develop a variety of action items to maintain and enhance recreational streamflows on the Rio Grande and Conejos River. The assessment will be available to inform water management operations in the future. Additionally, the TAT used the results to identify additional river access needs and infrastructure hazards currently limiting recreational use. Priority projects and action items resulting from this assessment are described in Section 4.0, *Rio Grande and Conejos River SMP Implementation Strategy*.

Detailed assessment methodology, results by assessment reach, and a copy of the survey questions, are available in the full report, *Assessment of Streamflow Needs for Supporting Recreational Water Uses on the Rio Grande and Conejos River* (**Appendix A**).

2.6 Aquatic Habitat Streamflow Needs Assessment

The RGHRP used a combination of data and models to determine aquatic habitat flow needs for each SMP assessment reach. The R2-Cross protocol was used to determine minimum flow targets for aquatic species habitat (CWCB, 1996). This protocol includes detailed site-level data collection, including a cross section, discharge measurement, and pebble count. This field data is run using the R2Cross model and results in two minimum flow recommendations: a winter recommendation and a summer recommendation. For the purposes of aquatic habitat flow targets, *winter* is defined as October 1 through April 30 while *summer* is defined as May 1 through September 30 (see Figure 2.6). This is the time period used for existing decreed instream flows (ISFs). Summer and winter flows are applied as recommended minimum flows for each reach.

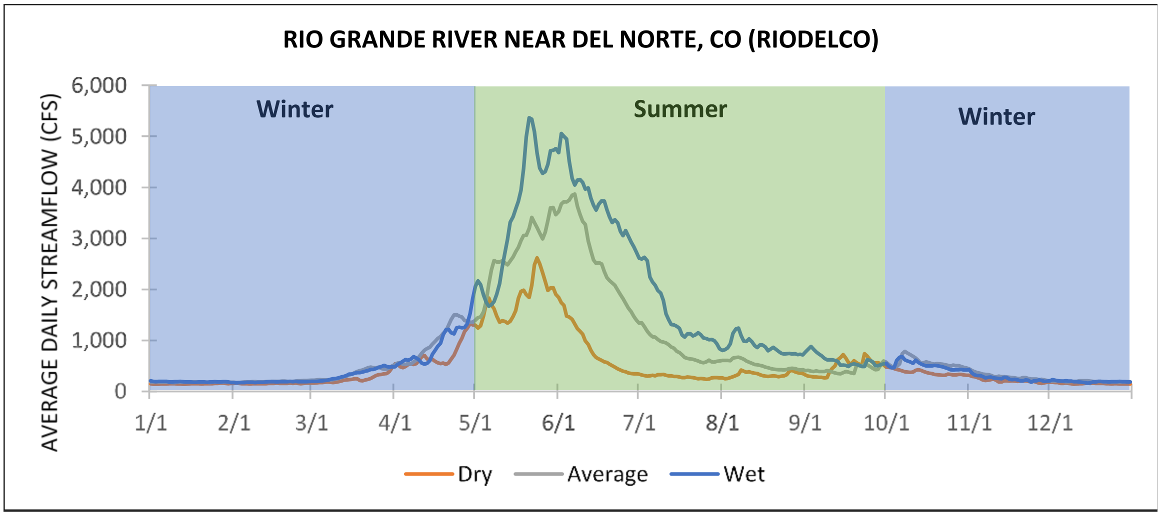


Figure 2.6: Winter versus summer time periods used in aquatic habitat flow needs assessment.

Final minimum flow determinations from R2Cross were also compared to existing aquatic habitat assessments completed on the Conejos River. Specifically, results from Physical Habitat Simulation Model (PHABSIM) and Instream Flow Incremental Methodology (IFIM) assessments previously conducted on the Conejos River were used to verify the accuracy of R2Cross results within reaches CR01 through CR04. R2Cross site locations for each reach were selected based on two primary criteria, which are standard for R2Cross: 1) Located within the lower third of the reach, and 2) located at a critical, habitat-limiting riffle.

Similar to the recreational needs assessment, results from the aquatic habitat flow needs assessment were paired with hydrographs created as part of the hydrology assessment. As described above in section 2.5, hydrographs for low, average, and high flows were applied to each priority reach. By overlaying these three hydrographs with aquatic habitat flow targets, the frequency of flow target attainment was determined. This information will be available to inform existing and potential voluntary programs and opportunities aimed at better meeting aquatic habitat flow recommendations.

Important Caveats Regarding Aquatic Habitat Flow Targets

It is important to note the following caveats regarding aquatic habitat flow recommendations:

- R2Cross was developed using habitat criteria for lower order streams and cold-water fisheries, with a focus on supporting salmonid species. Some sites within the SMP study area occurred outside these typical parameters, including in reaches classified as warm-water fisheries.
- The time period defined for winter and summer flow recommendations does not align with the Rio Grande Basin irrigation season, which to a large degree dictates reservoir releases and surface water diversions. Specifically, the summer period, as defined for aquatic habitat, begins May 1 and ends September 30 while the irrigation season is two months longer, beginning April 1 and ending October 31. The seasonal periods used in the aquatic habitat needs assessment

are intended to best protect critical life stages of salmonid species and were determined using the best available data.

- It is likely that flow targets for some reaches would not have been met even under unaltered hydrologic conditions. For example, natural, unaltered inflows to Platoro Reservoir rarely meet the calculated winter flow targets below Platoro Reservoir (reaches CR01 and CR02). There may be external factors contributing to the relatively high flow targets calculated for those reaches.
- The effects of climate change on the timing and amount of precipitation and snowmelt runoff have exacerbated existing challenges with regard to water storage and delivery.
- The timing and/or amount of legal water delivery requirements, including decreed water rights as well as those required under the Rio Grande Compact, can result in very limited flexibility in reservoir releases. In some cases, often due to below-average snowpack or other hydrologic factors, existing legal delivery requirements may prohibit reservoirs from shifting releases in an effort to meet flow targets.
- Some reservoirs affecting the Rio Grande and Conejos River are privately owned and are operated at the discretion of the reservoir company.

2.7 Geomorphology Assessment

The geomorphology assessment, conducted by Round River Design, Inc and Watershed Science and Design, LLC, utilized GIS and field data to assess the reach-scale geomorphic condition for each SMP study stream. Geomorphic characterization begins with identifying the fundamental processes of river change. Eventually, additional factors, both natural and human-caused, may create circumstances that increase the uncertainty of how a channel will react when energized.

In order to individually and collectively tell the story of a stream's geomorphic condition and attempt to decipher its expected future trajectory, both the examination of existing data and development of new remote-sensed data layers were completed. The assessment focused on documenting the geomorphic characteristics and constraints of each reach using GIS data. Additionally, site-level data was used, and, where vehicle access exists, field observations were conducted. An overall assessment of existing geomorphic condition in relation to an assumed natural reference condition was completed. Using assessment results, a qualitative rating was assigned to each reach. Table 2.4 defines the rating scale used for geomorphic condition.

Table 2.4: Rating scale used for geomorphology assessment.

Rating Scale	Impairment	Description
A	Very Low	Reach geomorphology is at or near reference condition with very little or no impact due to stressors. Few stressors may exist, however their impact on the geomorphology is minimal.
B	Low	Geomorphic condition is mildly impaired, with mild impacts resulting from a few stressors.
C	Moderate	Geomorphic condition is significantly impaired, with measurable impacts exist resulting from several stressors.
D	High	Geomorphic condition is severely impaired, with impacts resulting from numerous stressors. The reach is considered geomorphically impaired.
F	Very High	Geomorphic condition is profoundly impaired, with extreme impacts resulting from numerous stressors. The reach is considered nonfunctional in terms of geomorphic processes.

Several subvariables were included in the geomorphology assessment and are described in Tables 2.5 and 2.6. Among other subvariables, assessments of floodplain connectivity, sediment transport, and flow regime in terms of bankfull flow were included.

Table 2.5: Geomorphic reach information sheets explanation.

Reach	Determined by the RGHRP
Confinement	A reach averaged ratio comparing the average channel width over the average valley width.
D50	Median bed surface grain size (as determined through a pebble count conducted by RGHRP staff).
Bed composition	Descriptive categorization of the D50 grain (e.g., sand, fine gravel, large gravel, cobble).
Stream form	Generalized qualitative categorization of the existing and reference morphology of the stream bed based on categories developed by Montgomery and Buffington (1997). See **Appendix D**.
SEM stage	A qualitative assessment of existing and idealized/undisturbed stream evolution stage based on guidance developed by Cluer and Thorne (2014). See **Appendix D**.
Sediment regime	A qualitative assessment of current and idealized sediment regime based on guidance developed by Vermont's River Management Program (see **Appendix D**).
Valley slope	A measurement of the change in elevation between the top of the reach and the bottom of the reach divided by the length of the valley within which the stream has the opportunity to pass through (note this is not always a straight line as large terraces or bedrock outcrops might force "bends" into the valley length measurement.
Stream Power △	Qualitative assessment of change in stream power based on changes in valley slope and confinement.
Mobility Threshold Flows	A calculation of the flow or range of flows as described below in **Section 2.7.1**.
Frequency of Occurrence	How often the mobility threshold flow is exceeded as described below in **Section 2.7.1**.
Overbank Flow Estimate	The flow that is estimated to overtop the channel and initiates floodplain activation based on HEC-RAS modeling using surveyed cross-sections.
Overbank Flow Frequency	How often the overbank flow estimate is exceeded as described below in **Section 2.7.1**.
Watershed setting	"Landscape units" broadly defined by their position within a watershed and the prevailing sediment transport processes of net erosion, transfer, or accumulation as described by Fryirs et al. (2005).
River Style	River styles were identified in the 2018 Upper Rio Grande Watershed Assessment (Lotic, 2018). In the interest of continuity, this assessment has largely kept those same River Style names and descriptions while adding a few new ones for the reaches that were not described in that report (Table 2.6).
Stressors	A qualitative summary of the stressors to the geomorphic condition of the reach. These may include anthropomorphic-induced changes to the watershed or stream corridor including alterations to the hydrologic, biotic and/or geomorphic controls that determine the quality of the geomorphic condition of the reach and lend to an evaluation of its departure from an unadulterated assumed reference condition (i.e., degree of geomorphic impairment).
Degree of Geomorphic Impairment	Overall assessment of existing geomorphic condition in relation to an assumed natural reference condition.

Table 2.6: River Styles (adapted from the Upper Rio Grande Watershed Assessment, 2018).

Watershed Setting	Watershed Setting	Modifiers	River Style
Headwaters	Source	Valley Slope Floodplain Presence or Absence Planform (Existing and Potential) Floodplain Geomorphology Channel Geomorphology Bed/Bank Material Structural Elements	Alpine Headwaters
Canyon (Confined and Partially Confined)	Transport		Step Cascade
			Confined Valley
			Confined Valley Occasional Floodplain Pockets
Mountain Valley (Partially Confined and Unconfined Reaches)	Response		Elongated Discontinuous Floodplain, Bedrock and/or terrace confined
			Low-Moderate Sinuosity Planform-Controlled Discontinuous Floodplain
			Meandering Planform Controlled Discontinuous Floodplain
Alluvial Fans, Plains and San Luis Valley Floor (Unconfined)	Accumulation		Low-Moderate Sinuosity Unconfined
			Meandering Coarse Grain Bed
			Meandering Fine Grain Bed
Altered	Altered		Altered

2.7.1 Geomorphic Condition – Floodplain Activation and Bed Mobility

Geomorphic condition was assessed through the lens of a traditional bankfull flow. This bankfull flow has two components to its definition: 1) it is the flow at which water begins to spill out of the channel and onto the adjacent floodplain and 2) it is the flow that transports the greatest amount of sediment over time. Both components of this definition were assessed by calculating the flow at which the adjacent floodplain is activated and by calculating the flow that can mobilize the channel bed. Generally speaking, the floodplain activation flow and the bed mobility flow should be similar at any given location in an alluvial stream system.

The bankfull flow in an unimpaired system has a recurrence interval of approximately 1.5 years, on average. This means that in any given year there is a 67% chance that the river will rise to or overtop the channel banks and activate the floodplain. There is a small amount of variability in the frequency of bankfull flows but typically they are always smaller than the 2 to 3-year peak flow if there is not a prevalence of biotic factors in the stream system, which is the case for all three streams in this study.

Floodplain Activation Flows

A channel is said to be at bankfull stage when it is just about to flood the active floodplain. Thus, the active floodplain defines the limits of the bankfull channel. The active floodplain is the flat portion of the valley adjacent to the channel that is constructed by the present river in the present climate. The phrase “present river in the present climate” is especially important because if the river degrades or incises, what was formerly the floodplain is abandoned and becomes a terrace or abandoned floodplain. It is therefore important to distinguish the active floodplain from abandoned terraces.

HEC-RAS, a tool developed by the U.S. Army Corps of Engineers, was used to perform cross-sectional hydraulic calculations for floodplain activation flow (i.e., the flow that fills the channel and begins to spill onto the floodplain immediately adjacent to the channel). This analysis is only applicable to alluvial channels; reaches in confined bedrock canyons or whose shape is defined by geologic factors were not assessed through this method. Additionally, the analysis was limited to the surveyed channel and not tied to any floodplain modeling. To assess hydrologic geomorphic impairment, the calculated floodplain activation flow for each reach was compared to streamflow data from the hydrology assessment. For a given reach, the calculated floodplain activation flow should be roughly equal to the peak flow from the hydrology assessment’s average year hydrograph and should be greater than the 2-year peak flow. If this standard was not met, the reach was considered impaired. The degree of impairment is linked to the deviation in the frequency of floodplain inundation.

Function and Benefits of Floodplain Connectivity

Floodplain connectivity refers to a stream’s ability to spread out on its floodplain during overbanking events. The floodplain activation analysis described above is important because functional, well-connected floodplains play a critical role in overall stream function, providing a multitude of benefits to stream health as well as water users. Floodplain inundation recharges alluvial aquifer systems, a process sometimes referred to as "wetting the sponge." Alluvial water storage results in sustained streamflow during baseflow periods in late summer and fall. These sustained flows not only benefit aquatic species but also surface irrigators, who receive more consistent late season flows. For this reason, alluvial aquifers are often referred to as "natural reservoirs."

Figure 2.7: Floodplain activation and resulting alluvial aquifer recharge, June 2019 (Photo: Christi Bode).

Floodplain activation and overbanking events are also critical to cottonwood and other riparian vegetation establishment. In some cases, an elevated groundwater table may be supporting riparian vegetation. Elevated groundwater tables are naturally common throughout the SLV with flood irrigation contributing. Conversely, poor floodplain connectivity reduces groundwater-surface water exchange in the hyporheic zone, can negatively impact stream temperature and dissolved oxygen levels, and reduces alluvial aquifer storage potential.

Figure 2.8: Overbanking event on the Conejos River upstream of Mogote.

Function and Benefits of Wet Meadows

Functional floodplains also exist as both natural and managed wetlands. Many wetland types are found in the Basin and one type of particular importance is wet meadows. Natural wet meadows are common at higher elevations and headwaters of the Rio Grande Basin, including tributaries to mainstem streams and rivers. Managed, or “working,” wet meadows are abundant on the floor of the SLV in the form of irrigated lands. Wet meadows provide valuable ecosystem services including attenuation of flood flows, augmentation of baseflow, mitigation of post-wildfire sediment production, streambank stability, buffering of surface water temperature, nutrient filtering, and wildlife habitat (Findlay, 1995). Wet meadows are typically seasonally saturated. During high flows resulting from spring runoff or monsoon rains, wet meadows become saturated and act as a sponge in alluvial aquifer systems. In late summer, water stored in these sponges is slowly released, resulting in baseflow augmentation. Additionally, wet meadows have been shown to increase streambank stability and resiliency. One study indicated that streambanks colonized by wet meadow vegetation were, on average, five times stronger than banks with xeric vegetation (Micheli & Kirchner, 2002). This suggests that instability caused by loss of riparian vegetation can be mitigated by meadow vegetation.

Figure 2.9: Wet meadow near the Conejos River.

In the event of high severity wildfires and other disturbance events, wet meadows, particularly those at high- to mid-elevations, play an important role in mitigating potential downstream fluvial hazards. Post-wildfire precipitation can lead to significant soil erosion and an increased risk of flooding, debris flows, and other flow-related impacts. For example, following the 2013 West Fork Complex Fire, the upper Rio Grande watershed exhibited resiliency to wildfire impacts. Elevated turbidity and total suspended solids concentrations was observed and a fish kill of brown and rainbow trout on Trout Creek was attributed to sediment loading resulting from wildfire impacts (Rust et al., 2019). However, outside of these short-term impacts, the watershed as a whole was shown to be very resilient to wildfire. This resiliency is likely due in part to intact wet meadows and other wetland types. In functional wetlands and wet meadows, flood flows spread out, dissipate their energy, and allow for sediment deposition. In this way, wet meadows can act as sediment banks, thereby significantly mitigating downstream flooding and sedimentation caused by wildfire and other impacts. Although the SMPs focus on the Rio Grande, Conejos River, and Saguache Creek mainstems, maintaining the condition and resiliency of wet meadows on tributary streams, in alpine and subalpine basins, and in adjacent uplands is crucial to protecting water quality and mitigating the risk of fluvial hazards downstream and in the mainstems.

In addition to the benefits listed above, working wet meadows maintained by annual flood irrigation have been shown to be important habitat for migratory bird species. Among other species, iconic sandhill cranes, which migrate through the SLV twice a year, rely upon working wet meadows (Wetland Dynamics LLC, 2019).

Bed Mobility Flows

Long-term bed load and flow measurements have shown that the bankfull flow transports the greatest amount of material over time. While larger flow events transport greater quantities per event and smaller flow events occur more frequently, the bankfull flow is effective and sufficiently frequent to perform the greatest amount of work in establishing and maintaining channel shape.

Bankfull flows should mobilize the bed material in alluvial channels, though this assessment can become more complex in areas where the streams are working through glacial outwash alluvium rather than contemporary alluvium. Similar to the floodplain activation flows, the bed mobility flows should occur during the peak flows in the *average year* hydrographs and if peak flow data is available, the floodplain activating flow should be greater than the 2-year peak flow. If this standard was not met, the reach was considered impaired. Again, the degree of impairment is linked to the deviation in the frequency of floodplain inundation. Bed mobility flows were calculated using Critical Shear Stress and Shields Analysis, which are further described in **Appendix C**, and were reported as a range.

Function and Benefits of Bed Mobilization

At larger scales, the mobilization and deposition of bed sediments creates and maintains bedform features that provide in-channel habitat such as riffles and pools to support aquatic species at various stages of their life-cycle. At smaller scales, flows that flush fine particles such as sand and silt from the interstitial spaces between more coarse material are important for food web building blocks such as algae, zooplankton, phytoplankton, and macroinvertebrates. Flows that evacuate fine sediment from pools and deposit coarse sediment on bars are important to maintain the quality and quantity of habitat used for many species of cold-water fish to spawn and rear their young. Conversely, a lack of flows that trigger bed mobility will tend to cause either long-term scour or aggradation (site specific) of the channel bed and tend to simplify the channel, reduce bedform variability, and homogenize aquatic and riparian habitat. On the floodplain, riparian vegetation establishment and succession is often dependent upon the mobilization and deposition of sediment (and seed) within the stream corridor. Mobilizing sediments may also result in the erosion of banks (and therefore the recruitment of wood) and the deposition of new bars (and therefore places for early successional species to colonize).

2.8 Riparian Vegetation Assessment

Riparian vegetation was assessed using site-level surveys as well as larger scale remote sensing methods. A site-level botany survey, conducted by McBride BioTracking, LLC, assessed the current ecological integrity of selected assessment areas (AAs) along the Rio Grande, Conejos River, and Saguache Creek riparian areas. Additionally, the RGHRP used a GIS tool to characterize riparian condition at a reach scale. Each assessment yielded a rating and the two ratings were averaged for an overall reach rating. The overall riparian vegetation rating scale is outlined in Table 2.7.

Table 2.7: Rating scale used for riparian vegetation assessment.

Rating Scale		Impairment	Description
A	≥ 90	Negligible	Riparian area is unaltered, at or near reference condition, and supports stream health. Native vegetation diversity is self-sustaining and there is no evidence of exotic or noxious species.
B	≥ 80	Mild	Riparian area is in good condition with only minor alterations. Native species predominate and if nonnative species are present, their impact on diversity and native species cover is insignificant. The riparian area's ability to support stream health may be slightly reduced.
C	≥ 70	Significant	Riparian area exhibits decreased plant diversity, loss of structural complexity, and may be hydrologically disconnected from the river. Nonnative species may be widespread and small populations of noxious species may be present. Riparian area degradation is a significant stream health stressor.
D	≥ 60	Severe	Riparian area has severely decreased species diversity, loss of structural complexity, hydrologic alteration, and is disconnected from the river. Lack of riparian function is a main stream health stressor. Noxious species are prevalent or dominant, leading to very low native species cover. Bare ground may be a substantial proportion of land cover.
F	≥ 50	Profound	Riparian area is dominated by noxious species and/or has been converted to bare ground or other impervious surfaces. Riparian habitat is essentially nonfunctional and poor riparian condition is a primary stream health stressor.

2.8.1 Site-Level Assessment (Ecological Integrity Assessment)

A site-level riparian vegetation assessment was completed for most, but not all, SMP reaches. The sampling methodology was based on the Ecological Integrity Assessment (EIA) for Colorado Wetlands, Version 2.1 (Lemly et al., 2016). This protocol has itself been adapted from the U.S. Environmental Protection Agency's (EPA) National Wetlands Condition Assessment (NWCA) flexible-plot method (U.S. EPA, 2011). The EIA framework was designed by the EPA and NatureServe in response to the need to assess the effectiveness of biological and functional indicators of wetlands nationwide. In its entirety, this method collects data to evaluate the following range of Major Ecological Factors for each assessment area (AA), or site: 1) Landscape, 2) Buffer, 3) Vegetation, 4) Hydrology, 5) Physiochemistry, and 6) Size (Table 2.8). Because the focus of the assessment was riparian vegetation, field data collection only included Major Ecological Factors 1 – 3.

Table 2.8: Hierarchical structure of the Colorado EIA method (Lemly et al., 2016).

Rank Factor	*Major Ecological Factor*	*Metrics*[1]	*Metric Variants*
Landscape Context	Landscape	L1. Contiguous Natural Land Cover L2. Land Use Index	
	Buffer	B1. Perimeter with Natural Buffer B2. Width of Natural Buffer B3. Condition of Natural Buffer	
Condition	Vegetation	V1. Native Plant Species Cover V2. Invasive Nonnative Plant Species Cover V3. Native Plant Species Composition V4. Vegetation Structure V5. Regeneration of Native Woody Species **[opt.]** V6. Coarse and Fine Woody Debris **[opt.]**	V3 and V4 vary by wetland type. V5 and V6 are for woody systems.
	Hydrology	H1. Water Source H2. Hydroperiod H3. Hydrologic Connectivity	H1, H2, and H3 vary by wetland type.
	Physiochemistry	S1. Soil Condition S2. Surface Water Turbidity / Pollutants **[opt.]** S3. Algal Growth **[opt.]**	S2 and S3 are for sites with surface water.
Size	Size	Z1. Comparative Size **[opt.]** Z2. Change in Size **[opt.]**	Z1 and Z2 are for assessments of entire wetlands.

[1] Optional metrics noted as **[opt.]** can be used depending on study design and wetland type.

A modified version of the CNHP (2015) Colorado EIA Scorecard was used to determine individual metric and overall ratings for each AA. The modified scorecard includes the following rating weights:

<u>Modified EIA Scorecard</u>

- Rank Factor: Landscape Context (overall rating weight of 0.3)
    1) Landscape metrics (rating sub-weight 0.33)
    2) Buffer metrics (rating sub-weight 0.67)
- Rank Factor: Condition (overall rating weight of 0.7)
    3) Vegetation metrics (rating sub-weight 1)

Each metric is rated according to deviation from its natural state, or the best current understanding of how the particular ecological system is expected to look and function under reference conditions (Lemly & Rocchio, 2009). The further a metric moves away from its natural range of structure and function, the lower the rating it receives. The ratings for each category are collectively applied to produce an overall Ecological Integrity Score (EIS) for each site. General EIS score definitions are shown in Table 2.9.

Table 2.9: Definition of Ecological Integrity Assessment ratings (Lemly et al., 2016).

Rank Value	Description
A	**Reference Condition (No or Minimal Human Impact):** Wetland functions within the bounds of natural disturbance regimes. The surrounding landscape contains natural habitats that are essentially unfragmented with little to no stressors; vegetation structure and composition are within the natural range of variation, nonnative species are essentially absent, and a comprehensive set of key species are present; soil properties and hydrological functions are intact. Management should focus on preservation and protection.
B	**Slight Deviation from Reference:** Wetland predominantly functions within the bounds of natural disturbance regimes. The surrounding landscape contains largely natural habitats that are minimally fragmented with few stressors; vegetation structure and composition deviate slightly from the natural range of variation, nonnative species and noxious weeds are present in minor amounts, and most key species are present; soils properties and hydrology are only slightly altered. Management should focus on the prevention of further alteration.
C	**Moderate Deviation from Reference:** Wetland has a number of unfavorable characteristics. The surrounding landscape is moderately fragmented with several stressors; the vegetation structure and composition is somewhat outside the natural range of variation, nonnative species and noxious weeds may have a sizeable presence or moderately negative impacts, and many key species are absent; soil properties and hydrology are altered. Management would be needed to maintain or restore certain ecological attributes.
D	**Significant Deviation from Reference:** Wetland has severely altered characteristics. The surrounding landscape contains little natural habitat and is very fragmented; the vegetation structure and composition are well beyond their natural range of variation, nonnative species and noxious weeds exert a strong negative impact, and most key species are absent; soil properties and hydrology are severely altered. There may be little long term conservation value without restoration, and such restoration may be difficult or uncertain.

According to Lemly and Rocchio (2009), there are two important thresholds which indicate degradation to the point where action is needed within the assigned ranks:

- The B-C threshold (i.e. transition from a rating of B to a rating of C) indicates the level below which conditions are not considered acceptable for sustaining ecological integrity.
- The C-D threshold indicates a level below which system integrity has been drastically compromised and is unlikely to be restorable.

EIA metrics and associated ratings are specific to the particular ecological system being sampled. The Ecological System definitions and descriptions are components of the International Vegetation Classification System and have been developed by NatureServe and the Natural Heritage Network (Lemly et al., 2016). The EIA for an assessment area helps clarify the minimum performance standards for a wetland system, identifies the current ecological integrity of a system, and specifies the particular ecological components that must be repaired in order to restore a wetland to a desired level of ecological integrity (Lemly & Rocchio, 2009).

NatureServe has begun development of descriptions for specific wetland and riparian ecological systems found in the Southern Rocky Mountain Ecoregion (Lemly & Rocchio, 2009):

- Subalpine-Montane Riparian Shrublands
- Subalpine-Montane Riparian Woodlands
- Lower Montane Riparian Woodlands and Shrublands
- Subalpine-Montane Fen
- Alpine-Montane Wet Meadow
- North American Arid Freshwater Marsh
- Intermountain Basin Playas

As part of the EIA assessment, CNHP's Floristic Quality Assessment (FQA) tool was also used to assess native riparian vegetation (Lemly et al., 2016). The FQA method uses "coefficients of conservatism" (C-values), which are assigned to all native species in Colorado. C-values range from 0 to 10 and represent an estimated probability that a species is likely to occur in unaltered, pre-European settlement conditions. Species which are intolerant of habitat degradation and are obligate to reference condition landscapes have high C-values while those more tolerant of habitat degradation have low C-values. Most nonnative species have C-values of 0. For the SMP, the basic FQA index called mean C (i.e. average C-value for a given site) was calculated at each SMP site.

See **Appendix E** for a detailed description of the site-level EIA survey methods.

2.8.2 GIS Remote Sensing Vegetation Assessment

To assess riparian vegetation condition at a larger scale, the RGHRP employed a set of GIS tools. The tools are collectively known as the Riparian Condition Assessment Tool (RCAT), which includes the Valley Bottom Extraction Tool (VBET), Riparian Vegetation Departure (RVD) tool, and the Riparian Condition Assessment (RCA) tool (Macfarlane et al., 2018). These GIS tools consist of ArcPython scripts that use nationally available digital elevation models (DEMs) and 30-meter LANDFIRE imagery to assess the current condition of riparian vegetation. Because the RCAT tools and analysis are based upon watershed boundaries, the analysis was completed for all perennial streams within the Rio Grande Basin. First, VBET was used to delineate the maximum possible extent of riparian vegetation along each study stream using a DEM and average slope and valley width thresholds. Note: the riparian extent does not include wetlands that are not associated with the perennial stream network. Where available, a 2-meter DEM, derived from LiDAR data, was used. For the remainder of the Basin, the nationally available 10-meter DEM was used.

The RVD assessment tool divides each stream into discrete 500-meter assessment units. Within each assessment unit, the tools overlay the VBET output and LANDFIRE imagery. To compare current and reference vegetation, two LANDFIRE datasets are used. Current riparian vegetation cover is modeled using the Existing Vegetation Type (EVT) layer, while historic (pre-European settlement) vegetation is modeled using the LANDFIRE Bio-physical Setting (BpS) layer. Imagery falling within the VBET boundary is included in each assessment. RVD calculates the degree to which each unit has "departed" or been converted from pre-European, or "reference," condition. This is expressed as a percentage. Additionally, the tool analyzes the LANDFIRE imagery to determine what primary type of land conversion, if any, has occurred within each unit.

The more comprehensive RCA tool assesses riparian area condition using three inputs: riparian vegetation departure (modeled by the RVD tool), land use intensity, and floodplain connectivity. Each assessment unit is attributed with values on continuous scales for each of the three inputs. To determine floodplain connectivity, roads, railroads, development, and other types of land conversion were used to assess overall riparian conditions for each spatial unit. The overall RCA score is calculated using all three inputs and is expressed as a value between 0 and 1. An example of the RCA output is shown in Figure 2.10.

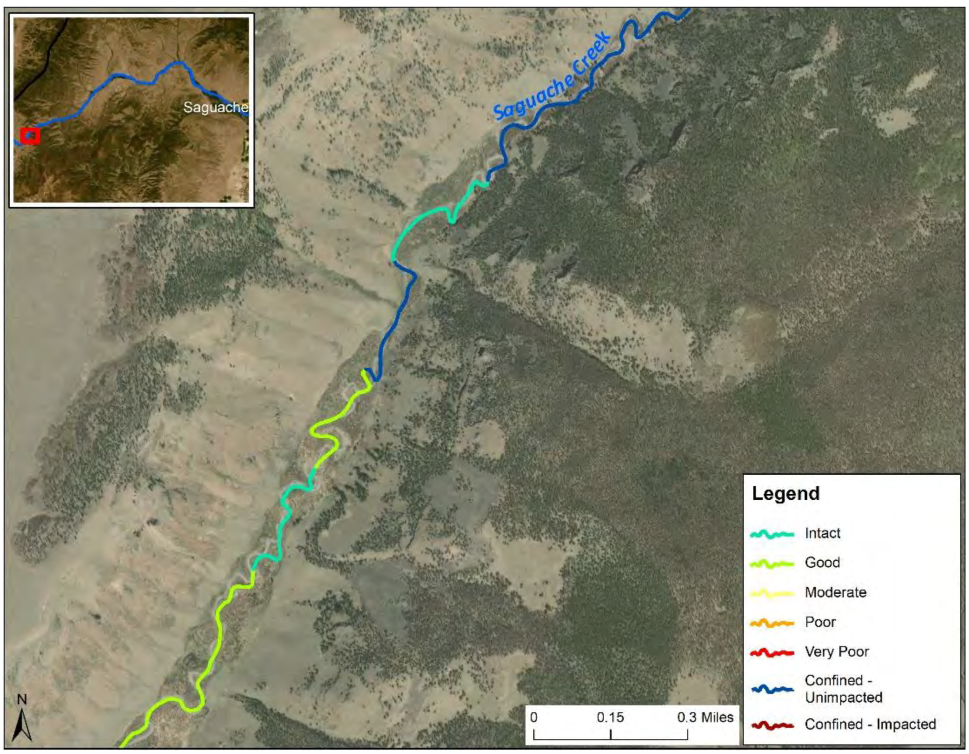


Figure 2.10: Example of GIS riparian vegetation assessment results.

The RCA rating scale, including RCA score thresholds, is shown in Table 2.10.

Table 2.10: Rating scale used GIS remote sensing vegetation assessment

Rating Scale	Impairment	RCA Score	Description
A ≥ 90	Negligible	≥ 0.9	Riparian vegetation is considered to be in reference condition. Few, if any, nonnative species are present, land use intensity is negligible, and floodplain connectivity is intact.
B ≥ 80	Mild	0.6 - 0.89	Riparian vegetation is in good condition with few nonnative species present. Land use intensity is low and river-floodplain connectivity is mostly intact.
C ≥ 70	Significant	0.3 - 0.59	Riparian vegetation is in moderate condition and small populations of noxious species may be present. Land use intensity is moderate and there is some loss of river-floodplain connectivity.
D ≥ 60	Severe	0.1 - .29	Riparian vegetation is in poor condition. Noxious plant species are prevalent. Land use intensity is high and, in many areas, the river lacks floodplain access.
F ≥ 50	Profound	< 0.1	Riparian vegetation is in very poor condition. Noxious plant species are dominant. Land use intensity is extreme and the majority of the reach lacks floodplain access.

The RCAT tools were developed by a team of researchers at Utah State University. Additional information and documentation of these tools is available at this url: http://rcat.riverscapes.xyz/. As noted above, both the site-level and GIS assessments were used in assessing overall riparian vegetation condition. The EIA rating and RCA ratings were averaged to calculate a final grade for each SMP reach.

2.9 Water Quality Assessment

A modified version of the FACStream framework was used for the water quality assessment. The assessment primarily utilized existing data collected by the Colorado Water Quality Control Division (CWQCD), CPW's River Watch program, and the U.S. Geological Survey's National Water Quality Assessment (NAWQA) program. Recent data (i.e. post-2010) was prioritized to best capture current water quality conditions. Existing data was supplemented with targeted water quality data collection during summer 2018 and spring 2019. Three water quality parameters (subvariables) were assessed: 1) temperature, 2) nutrients, and 3) chemical conditions (including pH and metal concentrations). Each of these parameters is an important indicator of water quality and, collectively, provide a detailed assessment of overall water quality. Where available, sediment data was also analyzed but was not included in the overall water quality reach ratings. Subvariables were rated according to the rating scales in Tables 2.11 to 2.13.

Table 2.11: Rating scale used for water temperature subvariable

Rating Scale		Impairment	Description
A	≥ 90	Negligible	The temperature regime is natural and appropriate for a pristine, high-functioning river in reference condition.
B	≥ 80	Mild	The temperature regime is within the range of natural variability and standards are not exceeded. However, natural aquatic biota may be minimally impaired.
C	≥ 70	Significant	The temperature regime is altered to a degree that could potentially limit natural aquatic biota and/or regulatory standards are occasionally exceeded. This rating applies to **303(d) Monitoring and Evaluation (M&E)** reaches.
D	≥ 60	Severe	The temperature regime is altered to a degree that is known to be lethal or limiting to natural aquatic biota and/or regulatory standards are *frequently* exceeded. This rating applies to **303(d) listed** reaches.
F	≥ 50	Profound	The temperature regime is severely altered. Natural biota may be severely impaired and/or regulatory standards are *chronically* exceeded. This rating also applies to **303(d) listed** reaches.

Table 2.12: Rating scale used for nutrients subvariable

Rating Scale		Impairment	Description
A	≥ 90	Negligible	Nutrient levels are natural and appropriate for a pristine, high-functioning river in reference condition.
B	≥ 80	Mild	Nutrient levels are within the range of natural variability and standards are not exceeded. However, natural aquatic biota may be minimally impaired.
C	≥ 70	Significant	Nutrient levels are altered to a degree that could potentially limit natural aquatic biota and/or regulatory standards are occasionally exceeded. This rating applies to **303(d) Monitoring and Evaluation (M&E)** reaches.
D	≥ 60	Severe	Nutrient levels are altered to a degree that is known to be lethal or limiting to natural aquatic biota and/or regulatory standards are *frequently* exceeded. This rating applies to **303(d) listed** reaches.
F	≥ 50	Profound	Nutrient levels are severely altered. Natural biota may be severely impaired and/or regulatory standards are *chronically* exceeded. This rating also applies to **303(d) listed** reaches.

Table 2.13: Rating scale used for chemical conditions subvariable

Rating Scale		Impairment	Description
A	≥ 90	Negligible	Chemical conditions are natural and appropriate for a pristine, high-functioning river in reference condition.
B	≥ 80	Mild	Chemical conditions are within the range of natural variability and standards are not exceeded. However, natural aquatic biota may be minimally impaired.
C	≥ 70	Significant	Chemical conditions are altered to a degree that could potentially limit natural aquatic biota and/or regulatory standards are occasionally exceeded. This rating applies to **303(d) Monitoring and Evaluation (M&E)** reaches.
D	≥ 60	Severe	Chemical conditions are altered to a degree that is known to be lethal or limiting to natural aquatic biota and/or regulatory standards are *frequently* exceeded. This rating applies to **303(d) listed** reaches.
F	≥ 50	Profound	Chemical conditions are severely altered. Natural biota may be severely impaired and/or regulatory standards are *chronically* exceeded. This rating also applies to **303(d) listed** reaches.

The overall water quality score was calculated as the mean of the subvariable scores. In some reaches, there was insufficient data to assess one or more subvariables. Any subvariables lacking sufficient data for a given reach were not included in the calculation of that reach's overall water quality score. An exception to the chemical conditions subvariable (Table 2.13) was made for reaches having only a chronic total arsenic impairment. Many SMP reaches as well as pristine headwater streams exceed the chronic water supply standard for total arsenic of 0.02. The impairments do not appear to affect aquatic life. Because the impact is negligible and because it is likely that these exceedances are likely attributable to naturally occurring arsenic, any such reaches were assigned a chemical condition rating of B. A summary of water quality data and impairments is included in **Appendix F**.

2.10 Aquatic Life Assessment

The aquatic life assessment included an assessment of benthic macroinvertebrates and trout species' abundance and health. These two subvariables were rated using a modified version of the FACStream framework, described in Tables 2.14 through 2.16. The overall aquatic life rating was calculated as the mean of the subvariable scores. In some reaches, there was insufficient data to assess one or more subvariables. Any subvariables lacking sufficient data for a given reach were not included in the calculation of that reach's overall water quality score. Table 2.14 describes the aquatic life rating scale. The two subvariables are described below.

Table 2.14: Rating scale used for aquatic life assessment

Rating Scale	Impairment	Description
A ≥ 90	Negligible	Aquatic biota indicate a high-functioning reach that is representative of an unaltered, reference condition reach.
B ≥ 80	Mild	Aquatic biota are mildly impaired, indicating a functioning reach near reference condition. Macroinvertebrate and/or fish species presence or abundance may be slightly altered.
C ≥ 70	Significant	Aquatic biota are altered. Exotic species may be common, diversity lacking, and/or species distributions skewed. Important functional groups are appropriately represented even when nonnative species are present.
D ≥ 60	Severe	Aquatic biota are severely altered and may include abundant exotic species, major loss of diversity, or lacking keystone species. One or more important functional groups is unfilled or poorly represented.
F ≥ 50	Profound	Aquatic biota are fundamentally altered. Examples include communities dominated by exotic species and communities with multiple important functional groups that are vacant or severely diminished.

Benthic Macroinvertebrates

Benthic macroinvertebrates (BMI) are excellent indicators of water quality, aquatic habitat, and overall river health. BMI assemblages are sensitive to many stressors including altered habitat, changes in sediment input, hydrologic regimes, and water quality. Different macroinvertebrates groups respond differently to these stressors. For example, species of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), often referred to as EPT, are intolerant of pollution and poor water quality while other aquatic invertebrate groups are relatively tolerant. Macroinvertebrates are also a significant food source for fish and play a critical role in the transfer of energy to higher trophic levels. Changes in BMI communities can result in changes to fish communities.

Figure 2.11: Stoneflies, an indicator of good water quality.

BMI data was obtained from previously collected samples and was supplemented with targeted sampling during the summer of 2018. BMI samples were assessed using multi-metric index (MMI) scores. The MMI uses multiple equally weighted metrics to score the macroinvertebrate population diversity and density on a scale from 0-100 (CDPHE, 2020). The MMI is calibrated to one of three “biotypes,” where biotypes are defined as regions that would have similar macroinvertebrate assemblages based on the elevation, slope, and ecoregion. The biotypes group macroinvertebrate assemblages into mountain streams, plains streams, and the transition streams in between the mountains and plains. The sampling locations within the SMP study area include Biotype 1 (transition) and Biotype 2 (mountain) sites. The state of Colorado sets different MMI attainment and impairment thresholds for each Biotype, which are described in Table 2.15.

Table 2.15: Thresholds for Biotype 1 and Biotype 2.

MMI	Biotype 1	Biotype 2
Attainment	45.2	47.5
Impairment	33.7	39.8

If a site’s MMI score is between the impairment and attainment threshold, further investigation is warranted and other metrics are considered. To determine impairment, two additional indices, the Shannon-Wiener Diversity Index (SDI) and Hilsenhoff Biotic Index (HBI), are considered. The SDI is a measure of relative species abundance, on a scale from zero to five, with higher values indicating higher species diversity (MacArthur, 1965). HBI is a measure of the relative abundance of pollution-tolerant species and ranges from zero to ten, where a higher value indicates more pollution tolerant species are present (Hilsenhoff, 1987).

The rating scale for the benthic macroinvertebrates subvariable is described in Table 2.16.

Table 2.16: Rating scale used for MMI aquatic life subvariable

Rating Scale	Impairment	Description
A	Negligible	The reach sustains and supports reference conditions for macroinvertebrate communities and aquatic life use. No management is needed other than protection of existing conditions. MMI score is 80–100.
B	Mild	Some detectable stressors are likely with minor alterations to macroinvertebrate communities. The ecological system retains essential qualities and supports a high level of function. Some management may be required to sustain or improve this condition. MMI score is 65 – <80.
C	Significant	The reach supports and maintains essential components of macroinvertebrate communities, but exhibits measurable signs of degradation and less than optimal community parameters. The reach meets the attainment threshold, with an MMI score >45.2 (Biotype 1) or >47.5 (Biotype 2) and <65.
D	Severe	There are detectable alterations or degradation of aquatic life use, but the system still supports a fundamental community structure and function. Active management is recommended to maintain and improve characteristic functional support. MMI score is >33.8 – 45.2 (Biotype 1) or 39.9 – 47.5 (Biotype 2).
F	Profound	There is clear impairment to macroinvertebrate communities and aquatic life. This level of alteration generally results in an inability to support characteristic benthic organisms, or makes the stream segment biologically unsuitable. The reach has a "below impairment" threshold. MMI score of <33.7 (Biotype 1) or <39.8 (Biotype 2).

Trout

Trout biomass was also included as a subvariable in the aquatic life assessment. Because trout species depend on abundant food sources and high-quality habitat, their presence is an indicator of good water quality and aquatic habitat. Within the SMP study area, several native fishes are present, however due to limited data on native fish habitat requirements and abundance, native species were not assessed in this subavariable. The subvariable was measured as total pounds of trout species per acre, as shown in Table 2.17.

Table 2.17: Rating scale used for trout aquatic life metric

Rating Scale	Impairment	Description
A ≥ 90	Negligible	High total biomass (≥60 lbs/acre-gold medal standard); overall average relative weight is average or higher than average; viable recreational fishery.
B ≥ 80	Mild	Medium total biomass (40-59 lbs/acre); overall average relative weight is average; mediocre fishery with moderate numbers of adult fish.
C ≥ 70	Significant	Low total biomass (20-39 lbs/acre); overall average relative weight is below average; inconsistent recreational fishery with low numbers of adult fish.
D ≥ 60	Severe	Very low total biomass (0-19 lbs/acre); overall average relative weight is substantially below average; minimal recreational fishery potential with very low numbers of adult fish.
F ≥ 50	Profound	No trout present; no natural reproduction; no biomass; no recreational fishery.

A summary of macroinvertebrate and trout data is included in **Appendix F**.

2.11 Stream Condition Stressors

For the purposes of the SMP, stream condition stressors are considered to be past or present anthropogenic impacts affecting stream conditions. To understand the likely causes of impairment for each condition assessment, stream condition stressors were investigated for each SMP study reach. Stressors are often manifested and can be observed through their impact on stream condition. For example, degraded water quality may be the measurable result of a historic mining stressor. This section lists the most common stressors affecting the SMP study streams, many of which are interrelated and affect multiple stream health variables.

Crossings and Diversions

Structures such as bridges, culverts, diversion dams, and weirs may exacerbate channel migration or erosion. These structures can direct and concentrate flows into a streambank or embankment resulting in damage to infrastructure. Structures that are undersized, located near tight bends, or located where slopes change are more likely to have trouble passing sediment and debris being transported by a stream (Figure 2.12). This can result in upstream deposition of this material and subsequent channel movement while on the downstream side the sediment-deprived water becomes erosive. It is important to understand that this is often a structure problem, not a sediment or debris problem. As such, negative impacts can often be ameliorated through improved design or structure retrofits. Sediment and debris transport disruption is common at diversion structures within the SMP study area.

Prediction of geomorphic instability as a result of crossing structures or the most likely location of new channels should a crossing become blocked or fail is beyond the scope of this SMP. It is recommended, however, that road crossing designs allow for appropriate sediment transport at low, medium, and high flows (including the overflow areas), as well as the capability to pass debris. Crossings or crossing approaches might even be designed to fail (e.g., break-away designs) should they become plugged during a flood so as to encourage flood waters to stay in the channel. Similarly, diversion dams may create instability in a system partially due to their attempt to lock a laterally dynamic channel into a fixed location.

Disruption of natural sediment and/or debris transport regimes also degrades aquatic habitat. Sediment accumulation upstream of structures decreases fish as well as aquatic insect habitat complexity by eliminating interstitial spaces. Sediment and/or woody debris deprivation downstream of structures also decreases habitat complexity and limits nutrient inputs. Additionally, in-channel structures such as diversion dams can create barriers to fish passage, thereby fragmenting aquatic habitats. Habitat fragmentation can negatively affect fish populations and communities in a variety of ways including preventing fish from reaching spawning areas, isolating breeding populations and decreasing genetic diversity, and increasing the risk of disease.

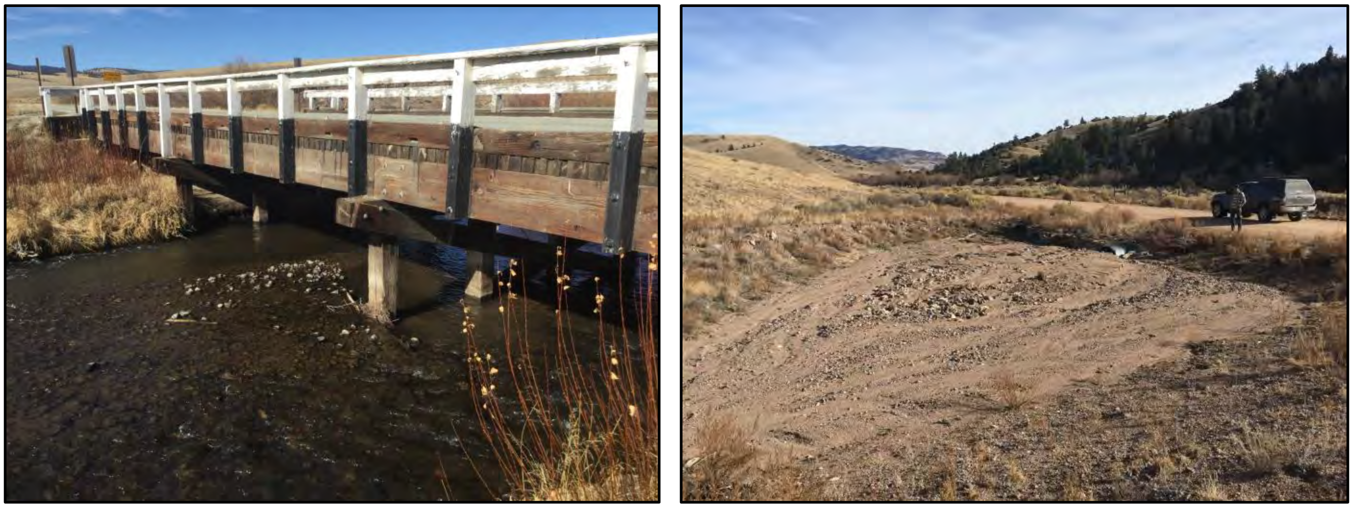


Figure 2.12: (Left) Bridge over Saguache Creek with a pier in the middle of the bridge that may collect debris during a flood. (Right) Undersized culverts failing to transport sediment in a dry wash in Saguache County.

Roads and Railways

Roads oriented so they constrict the active river corridor can increase flow depths, shear stresses, and sediment transport capacities of streams. These constrictions can affect reaches upstream and downstream. Road and railroad bed encroachment does not appear to be significantly affecting the geomorphic stability of any of the streams in the SMP study area (Figure 2.13).

Figure 2.13: Railroad lines and bridges crossing the Rio Grande near flood stage, June 2019.

Channelization, Armoring, and Disconnection of Floodplains

Channelization (i.e., straightening of channel meanders; removal of large wood and/or beavers; filling of side channels to force a stream into a single-thread) and stream bank armoring (i.e., placement of rock riprap, concrete barriers, or other materials to prevent channel migration or widening) has occurred on the SMP study streams and adversely affects natural channel processes and stream health. Figure 2.14 shows a channelized portion of the Rio Grande.

Figure 2.14: Channelization of the Rio Grande at the Soldiers Home Road (County Road 3E).

These features can cause river-floodplain disconnection (i.e., the river is unable to access its floodplain at high flows where it otherwise would have). Stream response to floodplain disconnection and/or bank armoring typically results in the transfer of erosive energy to the opposite bank, a downstream reach, or toward the channel bed.

Figure 2.15: River-floodplain disconnection on the Rio Grande upstream of Alamosa.

Generally speaking, these changes lead to a fluvial response (i.e., instability seen as increased erosion, sedimentation, and/or channel movement). Disconnecting features such as berms or levees are not uncommon in the SMP study area, typically as a result of land conversion or road and railroad construction that now occupies former river floodplain.

Fill and Floodplain/Riparian Area Conversion

Land conversion can alter or eliminate floodplain complexity, side channels, wetlands, riparian vegetation, overflow relief channels, and other important geomorphic and ecological components of streams. Riparian vegetation and wetlands along some SMP reaches are impacted by fill and/or floodplain/riparian area conversion resulting from development, overgrazing, and nonnative species dominance. Riparian vegetation throughout the floodplain and river corridor, not just along the main channel, is critical to energy dissipation, stream shading, bank stability, wildlife habitat, and many other natural stream processes. Overgrazing and/or development fill brought into the corridor erases the evidence of past channel migration, possibly creating a false sense of protection from fluvial erosion to those that occupy the land. Furthermore, development creates the expectation (e.g., stable banks) that these rivers will remain in their current location indefinitely and therefore current and future generations will be willing and able to invest in the costs (both monetary and ecological) that will be required to resist natural channel processes (e.g., bank erosion and channel migration) (Figure 2.16).

Figure 2.16: Development in the active river corridor of the Rio Grande in the Town of Del Norte.

Flow Alteration: Impoundments

While Saguache Creek is a free-flowing stream, large dams affect both the Rio Grande and Conejos River. Dams affect these rivers both by reducing sediment transport, by trapping sediment behind them (Figure 2.17), as well as by reducing the peak flows that might otherwise provide channel-forming flows to flush fines, mobilize sediments, and do other geomorphic work. The Rio Grande is controlled by the earthen dam of the Rio Grande Reservoir which sits approximately 20 miles west of Creede. To a lesser degree, flows are also affected by Continental and Santa Maria reservoirs, which flow into Clear Creek. The Platoro dam on Conejos River is located roughly 1 mile above the town of Platoro, Colorado. Because these reservoirs are required to pass inflows during spring runoff, peak runoff is only altered when reservoir inflows surpass reservoir outlet capacity.

Figure 2.17: Sediment trapped behind the Rio Grande Reservoir (seen during dam repairs which had the reservoir drained during the fall of 2018).

Flow Alteration: Diversions

Diversion structures can affect stream health in two main ways: they act as small dams, trapping sediment behind them and they can act as barriers to aquatic habitat connectivity. The disruption of sediment transport can create localized channel and bank instability. As water is diverted out of the stream system, it can create conditions where channel flow is below optimal to perform geomorphic work. Without channel-maintaining flows, channels may narrow as vegetation creeps into the channel where scouring flows once kept the channel open. This process is particularly evident in Rio Grande SMP reach RG14, within the Alamosa levee system. Diversions can act as fish barriers, thereby reducing aquatic habitat connectivity and limiting species movement. Although very little is known regarding the habitat requirements of native species inhabiting the SMP study streams, fish species thrive when they are able to move between a variety of habitat types.

Hillslope/Channel Erosion

Streams receive sediment of varying sizes from naturally-occurring hillslope and channel erosion processes. However, unusually high or low sediment inputs can adversely affect stream health. Among other impacts, unusually high sediment loads decrease fish and macroinvertebrate habitat complexity by eliminating interstitial spaces, while low sediment loads can also decrease habitat complexity and limit key nutrient inputs. High sediment input often occurs as a result of hillslope, bank, and channel instability. Instability often results from a loss of riparian vegetation that would otherwise stabilize banks and can be exacerbated by floodplain disconnection. In areas lacking floodplain connectivity, high flows cannot dissipate energy by spreading out, leading to accelerated bank erosion and downstream sedimentation. Low sediment supply can also be caused by bank stabilization efforts which have resulted in less erosion than would have occurred under natural conditions.

Abandoned Mine Lands

Historic mining operations, or Abandoned Mine Lands (AML) continue to affect water quality in the SMP study area. For example, historic mining near Creede is known to be the primary source of elevated heavy metal concentrations in Willow Creek, which has led to elevated concentrations in the Rio Grande downstream of Willow Creek. State water quality standard exceedances of both cadmium and zinc resulted in a 303(d) listing and subsequent Total Maximum Daily Load (TMDL) requirement for these metals from the Willow Creek confluence to the Rio Grande/Alamosa County line. Mild AML water quality impacts were noted in the Conejos River but were not noted in Saguache Creek. Elevated metal concentrations can have toxic effects on aquatic life.

Exotic/Naturalized Plant Species

It is worth briefly exploring the difference between nonnative invasive (including noxious) plant species and nonnative naturalized species. Native plant species occurred in the U.S. before European settlement, while a nonnative species is thought to have been introduced as a result of European settlement. An invasive plant is nonnative, able to establish itself at a variety of sites, grows quickly, and spreads to the point of disrupting the local plant community and associated ecosystem. A naturalized plant species is also nonnative, but doesn't take over the existing native plant community or associated ecosystem dynamics (USDA NRCS, 2019).

Dense stands of invasive species can negatively affect hydrologic processes and ecological function of an area, particularly in riparian zones (Gebauer, 2013). A key trait of invasive plant species is their potential to outcompete the native plant community, sometimes resulting in a monoculture of vegetation. The presence of naturalized species, however, may have minimal impacts on the native biological integrity, species or functional group diversity, or productivity of a given site (Spyreas et al., 2010).

Buffer width is one important factor in riparian health. A buffer of sufficient size and quality improves water quality by trapping sediments and filtering pollutants before they reach the river or stream. When the buffer includes a variety of canopy layers, it also provides stream shading and helps control water temperature. Finally, the presence of woody debris helps shape the riparian channel and provides habitat for a variety of species (Gebauer, 2013). These pivotal ecosystem services provided by a diverse and structurally complex plant community are often diminished when invasive species spread through and area. Naturalized species however, have been observed to exist within a community without having strong adverse impacts to these ecological functions. Therefore, while the presence of naturalized plant species may not be as desirable as that of native plants, naturalized species should not be managed in the same aggressive manner used to control populations of invasive species.

For the purpose of the SMPs, the following plant species encountered during surveys were considered to be naturalized rather than invasive: *Dactylis gomerata* (Orchardgrass), *Phleum pratense* (Timothy grass), *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (Dandelion), *Trifolium pratense* (Red clover), and *Trifolium repens* (White clover). It is important to note that these species may be considered to be invasive in some locations and under certain ecological conditions. However, during SMP surveys, these species were neither observed to establish monocultures, nor to have obvious harmful impacts on the biological integrity of any given assessment area.

Additionally, all noxious plants encountered in addition to the species, *Phalaris arundinaea* (Reed canarygrass), were considered to be invasive. Noxious plants were identified using the state of Colorado's Noxious Weed List (CDA, 2018). While not classified as a noxious species, *P. arundinacea* is thought to have both native and nonnative types within the U.S. It has been promoted and intentionally spread in the past as a forage grass for livestock. For the purpose of the Colorado EIA Scorecard, this species is considered to be an increaser species with a '0' rating for its C-value. Spyreas et al. (2008) suggested that when *P. arundinacea* becomes invasive, it decreases community level diversity and biological integrity of sampled sites across Illinois. This species has also been implicated in contributing to low streamflow during the growing season in semi-arid riparian zones in eastern Washington. The recommendation for assessment areas with a presence by noxious plant species is to actively control these populations to minimize spread and prevent further disruption to the site's ecological integrity.

Exotic Aquatic Species

Nonnative aquatic species such as common carp and northern pike, both of which are present in the SMP study streams, may indicate degraded stream health. Exotic species are more likely to survive in areas where water quality or habitat degradation has led to unsuitable conditions for native species.

Removal or Lack of Woody Material

Large and small woody material, both alive and dead, is an important driver of river function and the creation and maintenance of aquatic species habitat. Woody material within the main channel, secondary channels, and floodplain influences the transport of water, sediment, and debris as well as the geomorphic form and stability of streams. It also creates valuable aquatic habitat including pools, which provide refuge for fish and other aquatic species during high and low flows and buffer water temperature. Lack of woody material in some SMP study reaches has resulted in reduced floodplain connectivity, less diverse aquatic habitat, and lower overall system resiliency.

Unknown Stressors

In some cases, causes of impairment are unknown. Most often, unknown stressors are related to water chemistry impairment. For example, elevated arsenic concentrations measured in the headwaters of the Rio Grande, Conejos River, and Saguache Creek have no readily apparent source. Likely, the impairment can be attributed to high concentrations of naturally occurring arsenic in geologic formations. However, the point source is unknown and warrants further research.

3. Conejos River SMP Conditions Assessment Results

3.1 Summary of Conejos River SMP Conditions Assessment Findings

This section provides a summary of the conditions assessment results for all Conejos River reaches. Table 3.1 and the corresponding map in Figure 3.1 outline the Conejos River Stream Management Plan assessment reaches, including each reach's length in river miles.

Table 3.1: Description of Conejos River SMP assessment reaches.

Reach ID	Reach Description	Length (River Miles)*
CR01	Platoro Reservoir to Rio Grande National Forest Boundary	2.3
CR02	Rio Grande National Forest Boundary to End of "The Meadows"	3.0
CR03	End of "The Meadows" to Lake Fork Confluence	3.5
CR04	Lake Fork Confluence to South Fork Conejos River Confluence	6.0
CR05	South Fork Conejos River Confluence to Horca	10.3
CR06	Horca to Aspen Glade Campground	9.9
CR07	Aspen Glade Campground to Carpe and Reekers Canon Ditch	4.4
CR08	Carpe and Reekers Canon Ditch to Highway 17 Bridge in Mogote	8.2
CR09	Highway 17 Bridge in Mogote to the Bifurcation at the Manassa Core Diversion	6.4
CR10	South Branch Conejos River	11.8
CR11	Rio San Antonio Confluence to Rio Grande Confluence	18.6
	Total River Miles	**84.4**

*River miles were calculated using SWRF (see section 2.1).

Diversion structures were also assessed on the North Branch Conejos River, a 12.9-mile reach. Other stream conditions were not assessed for the North Branch Conejos River.

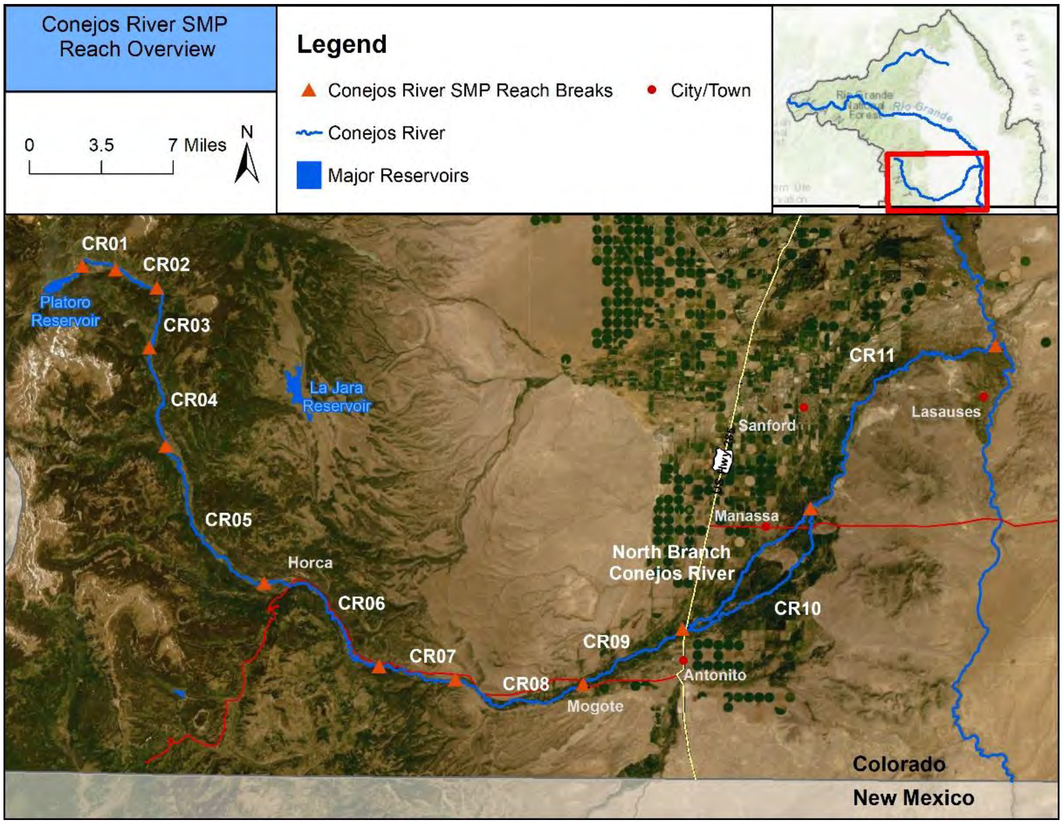


Figure 3.1: Conejos River SMP reach overview.

The transition from Reach CR10 to CR11, at the confluence of the Conejos River and Rio San Antonio, marks the river's transition from a classification of *aquatic life cold 1* to *aquatic life warm 1*. Classifications refer to the stream segment's *aquatic life use* and are designated by the Colorado Department of Public Health and Environment (CDPHE). Water temperature standards, designated by CDPHE, are as follows: Reaches CR01 through CR05 have a *cold stream tier I (CS-I)* standard; reaches CR06 through CR10 have a *cold stream tier II (CS-II)* standard; reach CR11 has a *warm stream tier II (WS-II)* standard (CDPHE, 2018b).

Figure 3.2 displays reach condition by assessment as well as the overall reach condition. Overall reach condition was calculated as the mean assessment rating for each reach.

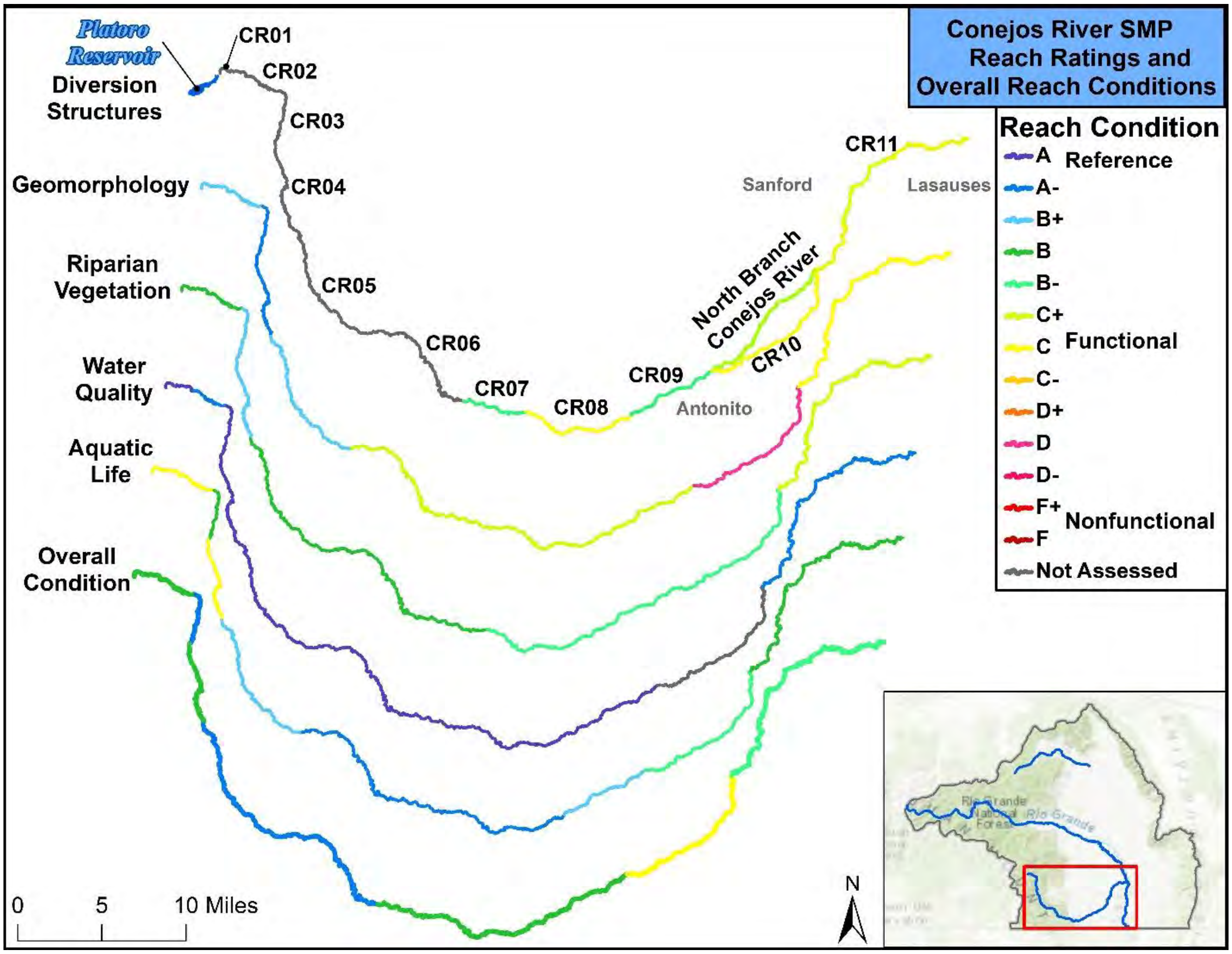


Figure 3.2: Conejos River Reach Ratings and Overall Reach Condition.

3.1.1 Conejos River Diversion Infrastructure Inventory

All diversion structures located on the mainstem Conejos River were included in this assessment.

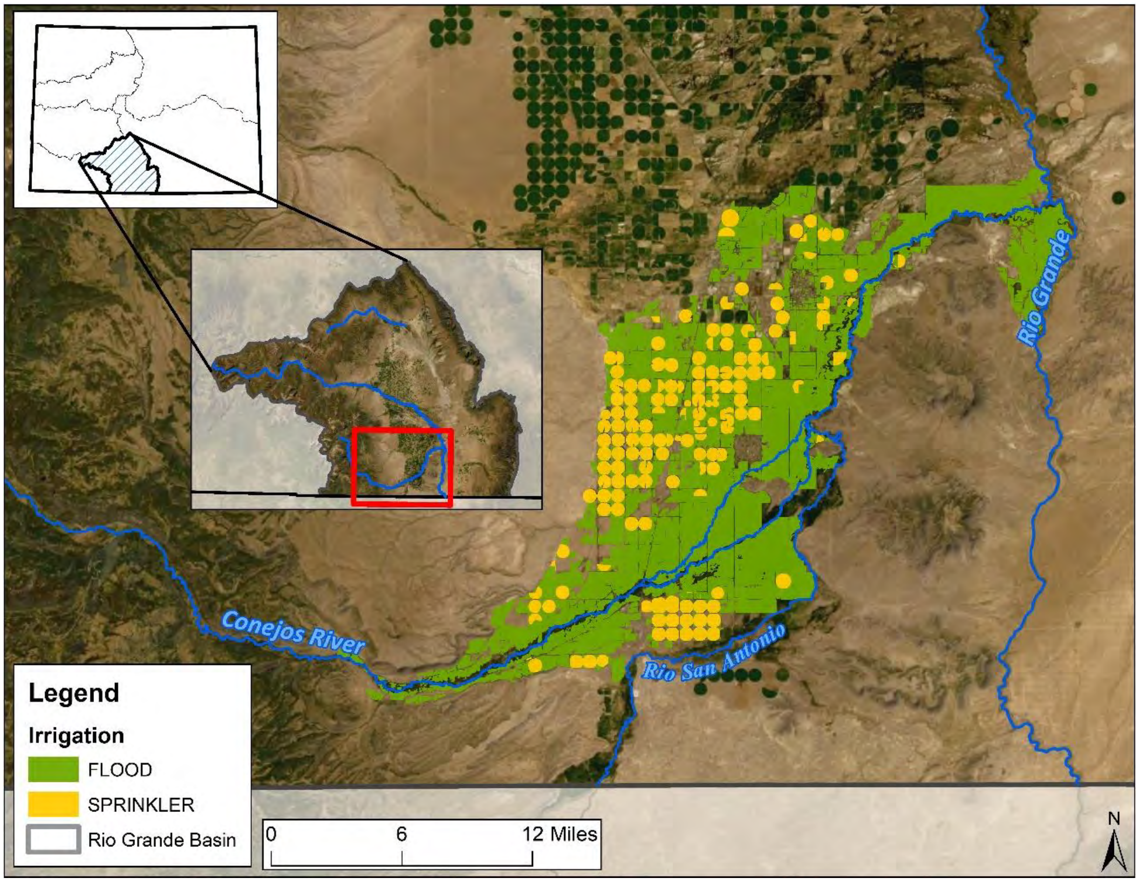


Figure 3.3: Land irrigated partially or entirely by Conejos River surface water rights.

The diversion infrastructure inventory revealed several issues affecting the function of diversion infrastructure (e.g., headworks, diversion dams, measurement devices, and other diversion infrastructure) as well as adjacent riparian and stream conditions. Issues identified included aging and inefficient infrastructure requiring significant maintenance, bank and hillslope erosion resulting in increased sediment accumulation at diversions, headgates, and in ditch systems, sediment transport disruption at diversion dams, which exacerbates erosion, channel migration, and/or incision, and barriers to fish passage at some diversions. Technical Advisory Team (TAT) recommendations for diversion infrastructure improvements include: 1) Diversion dam improvements for enhanced sediment transport and fish passage, 2) Floodplain reconnection and channel stabilization through reshaping and riparian revegetation, and 3) Repair or replacement of structural components including headgates, headwalls, and measurement devices. Additionally, the TAT recommends consolidating the points of diversion for several structures to improve ditch efficiencies and reduce maintenance and sediment transport impacts. Consolidation of the following structures is recommended: Vega Ditch and Canon Irrigating Ditch, North Eastern Ditch and New JB Romero Ditch, San Rafael Conejos Ditch and

Home Ditch, Guadalupe Main and Romero ditches, Heads Mill Ditch and JF Chacon Ditch 3, Manassa Westfield Ditch and Jacks Irrigating Ditch, and the Ephraim Ditch, Richfield Ditch, and Sanford Ditch. It should be noted that consolidation of some structures may not be possible due to legal or water rights-related obstacles.

With the exception of one potential fish barrier on the lower Conejos River, the TAT recommends maintaining existing or creating new fish passage at diversions within the entire SMP study area to maintain and improve aquatic habitat connectivity. Installation of a barrier is recommended in the vicinity east of the Town of Sanford (reach CR11), to prevent upstream movement of nonnative fish and potential predation on native small-bodied fish and/or competition with trout fisheries. With landowner approval, a barrier may be installed at an existing diversion structure. This would likely be the least impactful option.

Table 3.2 summarizes several attributes of each diversion structure, including its location and current condition. Additionally, each structure’s annual irrigated acres and amount diverted are listed based on data from 2017 diversion records. A diversion inventory and assessment funded by the Colorado Water Conservation Board (CWCB) was completed in 2006 and included diversions on the mainstem Conejos River. Structure condition from the 2006 inventory is also shown in Table 3.2 below.

Table 3.2: Diversion infrastructure statistics and condition listed by structure.

SMP Assessment Reach	Structure Name	Priority	Total Decreed Rate (cfs)	Water District ID (WDID)	2006 Rating	Current Structure Rating	Headgate Automation (Y/N)	Measure-ment Telemetry (Y/N)	River Miles From Rio Grande Confluence	Acres Irrigated (acres)	Amount Diverted (acre-feet)	Flood, Sprinkler, Both	% Flood/ % Sprinkler	Notes
CR07	Le Duc Ditch	78	6	2200579	Good	B	N	N	45.3	98.91	333.20	Flood	100/0	
CR07	Carpe & Reekers Canon Ditch	130	20.75	2200525	Good	B	N	N	45.1	43.15	875.72	Flood	100/0	
CR08	Bagwell Ditch	99	7	2200508	Good	B	N	N	43.6	70.79	583.15	Flood	100/0	
CR08	McCarroll Ditch	47	13.72	2200600	Good	B	N	Y	43.1	171.51	1315.06	Flood	100/0	
CR08	Angustura Ditch	65	26	2200503	N/A	C-	N	Y	42.7	60.82	2445.66	Flood	100/0	
CR08	Vega Ditch	76	11.13	2200646	Good	B	N	Y	41.7	165.81	940.18	Flood	100/0	
CR08	Canon Irrigating Ditch	22	42.68	2200626	Good	C	N	Y	41.5	1193.21	6874.81	Flood & Sprinkler	47/53	
CR08	Mecitos Ditch	26	38.99	2200524	Good	D-	N	N	41.0	1459.10	7204.27	Flood & Sprinkler	72/28	
CR08	Sanches Ditch	37	26.26	2200604	Good	C	N	Y	41.0	292.07	3081.17	Flood	100/0	
CR08	Antonito Ditch	113	139	2200504	N/A	B	N	Y	38.4	2821.17	6513.62	Flood & Sprinkler	31/69	
CR08	New JB Romero Ditch	170	17.82	2200608	N/A	F	N	Y	37.9	62.97	N/A	Flood	100/0	Amt diverted in 2016: 157.49; 2017 data N/A
CR08	North Eastern Ditch	66	92.8	2200609	Fair	D	N	Y	37.9	N/A	4056.26	Flood	100/0	Irrigated acreage N/A – water diverted at alternate (*Romero D*, ID #619). This structure services priority 35 *Bernardo Romero Ditch* (ID #513), which irrigates ~350 acres.

SMP Assessment Reach	Structure Name	Priority	Total Decreed Rate (cfs)	Water District ID (WDID)	2006 Rating	Current Structure Rating	Headgate Automation (Y/N)	Measure-ment Telemetry (Y/N)	River Miles From Rio Grande Confluence	Acres Irrigated (acres)	Amount Diverted (acre-feet)	Flood, Sprinkler, Both	% Flood/ % Sprinkler	Notes
CR08	Gabriel Martinez Ditch	15	3.71	2200548	N/A	B-	N	Y	37.2	100.69	786.66	Flood & Sprinkler	93/7	
CR09	San Juan San Rafael Ditch	27	51.76	2200624	Good	B	N	Y	36.8	1734.43	8769.65	Flood & Sprinkler	71/29	
CR09	La Del Rio Ditch	23	20.01	2200576	Good	B	N	Y	35.8	835.38	4661.23	Flood & Sprinkler	85/15	
CR09	San Rafael Conejos Ditch	13	63.21	2200625	N/A	B-	N	Y	35.2	891.31	4620.76	Flood	100/0	
CR09	Home Ditch	79	4.5	2200555	N/A	B	N	Y	35.0	288.50	414.55	Flood	100/0	
CR09	Mogote Ditch	115	342.4	2200591	Fair	B	N	Y	34.5	9911.46	12597.2 1	Flood & Sprinkler	44/56	
CR09	Town of Antonito	N/A	0.6	2200643	N/A	B	N	N	34.2	N/A	361.99	N/A	N/A	For municipal water use.
CR09	Chacon Ditch No 1	31	18.31	2200526	N/A	C-	N	Y	33.9	285.54	2479.57	Flood	100/0	
CR09	Guadalupe Main	1	13.46	2200553	Poor	C-	N	Y	33.2	1567.29	5213.43	Flood	100/0	This structure services the priority 139 Brazo Del Norte Ditch (ID #519).
CR09	Romero Ditch	1	165	2200619	Poor	A	Y	Y	32.6	8305.30	20201.9 9	Flood & Sprinkler	39/61	
CR09	Heads Mill & Irrigation Ditch	2	61.08	2200554	Fair	A	Y	Y	32.6	2755.88	7716.81	Flood & Sprinkler	23/77	This structure services the priority 37 AD Archuleta Ditch (ID #500). Irrigation data for #500 is included here.

SMP Assessment Reach	Structure Name	Priority	Total Decreed Rate (cfs)	Water District ID (WDID)	2006 Rating	Current Structure Rating	Headgate Automation (Y/N)	Measure-ment Telemetry (Y/N)	River Miles From Rio Grande Confluence	Acres Irrigated (acres)	Amount Diverted (acre-feet)	Flood, Sprinkler, Both	% Flood/ % Sprinkler	Notes
CR09	JF Chacon Ditch No 3	38	18.31	2200562	N/A	B-	N	Y	31.0	578.04	1479.89	Flood & Sprinkler	6/94	Services priority 42 An Con Irrigation Ditch (ID #502), which irrigates approximately 907 acres, 73% of which are flood-irrigated.
CR09	Manassa Core	N/A	N/A	N/A	Fair/ Poor	A	Y	Y	30.4	N/A	N/A	N/A	N/A	This structure delivers water to the North Branch Conejos River
North Branch	Manassa Ditch No 3	1	169.64	2200593	Good/ Fair	B	Y	Y	12.6	16188.3 0	29449.2 0	Flood & Sprinkler	66/34	
North Branch	Servietta Ditch	5	31.57	2200631	Good	B	N	Y	12.6	1802.71	7195.54	Flood & Sprinkler	92/7	
North Branch	Garcia Ditch	17	6.09	2200692	Good	B	N	Y	10.7	259.10	1555.06	Flood	100/0	
North Branch	Garcia R Ditch	4.5	6.23	2200552	Good	B	N	Y	10.7	258.20	1501.51	Flood	100/0	
North Branch	Santiago Ditch	16	41.69	2200629	Fair/ Poor	C	N	Y	10.2	397.52	5760.08	Flood	100/0	
North Branch	Cordova Ditch	53	6.54	2200531	Fair	C+	N	Y	7.9	326.21	650.59	Flood	100/0	
North Branch	Lopez Ditch	51	2.88	2200583	Good/ Fair	A-	N	Y	7.3	122.09	315.77	Flood	100/0	
North Branch	Martinez Ditch	51	12.96	2200598	Fair	B	N	Y	6.9	550.52	1495.56	Flood	100/0	
North Branch	JM Espinosa Ditch	52	26	2200563	N/A	B-	N	Y	6.1	253.22	944.15	Flood	100/0	
North Branch	Manassa Westfield Ditch	98	139	2200596	N/A	B-	N	Y	5.8	Included in Manassa D No. 3	1874.41	Flood	100/0	Decree is diverted via Manassa D No 3 (ID# 593)

SMP Assessment Reach	Structure Name	Priority	Total Decreed Rate (cfs)	Water District ID (WDID)	2006 Rating	Current Structure Rating	Headgate Automation (Y/N)	Measure-ment Telemetry (Y/N)	River Miles From Rio Grande Confluence	Acres Irrigated (acres)	Amount Diverted (acre-feet)	Flood, Sprinkler, Both	% Flood/ % Sprinkler	Notes
North Branch	Jacks Irrigating Ditch	55	8.12	2200564	N/A	D	N	Y	5.6	66.26	876.71	Flood	100/0	
North Branch	Stover Ditch	131	4.5	2200636	N/A	B+	N	Y	4.5	533.16	809.27	Flood	100/0	
North Branch	Manassa Ditch	48	38.6	2200595	N/A	B	N	Y	4.2	Included under Manassa D No. 3	3369.17	Flood	100/0	Decree is diverted via Manassa D No 3 (ID# 593)
North Branch	Branch Ditch	120	10.4	2200518	N/A	B	N	Y	3.0	71.84	1378.93	Flood	100/0	
North Branch	William Jackson Ditch	120	1.6	2200659	N/A	B-	N	Y	1.8	198.94	119.80	Flood	100/0	
North Branch	Ephraim Ditch	56	47	2200541	Fair	A	N	Y	0.4	3682.68	4011.03	Flood & Sprinkler	78/22	
North Branch	Richfield Canal	59	168.74	2200616	Fair	C	N	Y	0.3	3883.02	9272.27	Flood & Sprinkler	84/16	
North Branch	Sanford Ditch	104	146.3	2200627	Fair	C-	Y	Y	0.1	3016.78	6527.50	Flood & Sprinkler	74/26	
CR10	Sabine School Section Ditch	39	11.95	2200620	N/A	D	N	Y	29.9	165.09	944.15	Flood	100/0	
CR10	Seledonia Valdez Irrigation and Mill Ditch	6	31.77	2200630	Good	C-	Y	Y	29.0	4240.37	13586.7 8	Flood & Sprinkler	93/6	Services the following: San Jose (ID 623, priority 10), Vega Grande (ID 647, priority 41), and William Sabine Ditch No 1 (ID 648, priority 50). Irrigation statistics include these ditches.

SMP Assessment Reach	Structure Name	Priority	Total Decreed Rate (cfs)	Water District ID (WDID)	2006 Rating	Current Structure Rating	Headgate Automation (Y/N)	Measure-ment Telemetry (Y/N)	River Miles From Rio Grande Confluence	Acres Irrigated (acres)	Amount Diverted (acre-feet)	Flood, Sprinkler, Both	% Flood/ % Sprinkler	Notes
CR10	Overflow Ditch	20	11.79	2200611	Good	B	N	Y	28.0	229.97	2768.37	Flood	100/0	Services the Vega Grande and Sabine Ditch (ID 650, priority 41), and includes irrigation statistics from #650.
CR10	Fuerticitos Ditch	25	31.47	2200547	N/A	C	N	Y	26.4	401.06	3630.50	Flood	100/0	
CR10	Archuleta Trogillio No 1	18	12.58	2200505	N/A	B	N	Y	25.1	641.99	2204.07	Flood	100/0	
CR10	Del Puerticito Ditch	12	8.76	2200534	N/A	A	Y	Y	24.2	701.82	3146.62	Flood	100/0	Services the Becroft Irrigation Ditch (ID 511, priority 61) and Salazar Ditch (ID 621, priority 8) and includes irrigation statistics from #511 and #621.
CR10	Mill Ditch	9	12.67	2200605	N/A	D	N	Y	23.6	282.24	1174.23	Flood	100/0	
CR10	El Serrito Ditch	14	16.19	2200539	N/A	B-	N	Y	22.2	392.17	1326.76	Flood	100/0	
CR10	Trogillio Ditch	21	53.48	2200644	N/A	C	N	Y	21.3	253.90	5314.79	Flood	100/0	
CR10	Elledges Ditch	64	7.52	2200540	N/A	C	N	Y	20.4	150.76	645.23	Flood & Sprinkler	78/22	

SMP Assessment Reach	Structure Name	Priority	Total Decreed Rate (cfs)	Water District ID (WDID)	2006 Rating	Current Structure Rating	Headgate Automation (Y/N)	Measure-ment Telemetry (Y/N)	River Miles From Rio Grande Confluence	Acres Irrigated (acres)	Amount Diverted (acre-feet)	Flood, Sprinkler, Both	% Flood/ % Sprinkler	Notes
CR11	Cottonwood Ditch	95	28.5	2200532	N/A	D	N	N	18.3	542.45	2762.02	Flood	100/0	
CR11	Christensen Ditch	190	12.25	2200528	N/A	D	N	N	16.0	227.47	0.00	Flood & Sprinkler	47/53	
CR11	Smith Bros Ditch	89	8	2200634	N/A	B	N	Y	14.5	188.53	839.02	Flood & Sprinkler	78/22	
CR11	East Bend Ditch	88	37.4	2200535	N/A	C	Y	Y	14.2	264.66	2230.84	Flood	100/0	
CR11	East Bend No 2 Ditch	88	8	2200536	N/A	D	N	N	12.1	175.64	280.67	Flood	100/0	
CR11	Los Ojos Ditch No 1	63	40.08	2200584	N/A	A-	N	Y	11.7	1213.62	2584.30	Flood	100/0	
CR11	Los Ojos Ditch No 2	58	8.53	2200585	Good	B	N	Y	10.1	336.89	355.05	Flood & Sprinkler	64/36	
CR11	Alamo Ditch	58	53.5	2200501	N/A	A-	N	Y	8.3	1471.97	4829.23	Flood	100/0	
CR11	William Stewart Co Irrigation Ditch	43	11.4	2200651	Fair	C-	N	Y	5.7	981.03	2285.59	Flood	100/0	
CR11	Los Sauces Ditch	32	88.43	2200587	Good	B-	N	Y	3.4	2245.15	10841.22	Flood	100/0	
CR11	Ball Bros Overflow No 1	80	22	2200509	N/A	B	N	Y	2.1	719.88	3897.58	Flood	100/0	

*Note: Acres irrigated, amount diverted, and percent flood/sprinkler are based on 2017 records. River miles for all structures located on North Branch Conejos River (North Branch) are from the confluence of the North Branch and the mainstem Conejos River. Amounts are rounded to the nearest tenth.

3.1.2 Aquatic Habitat Flow Needs Assessment Summary

***For a description of R2Cross methodology and caveats, refer to section 2.6**

Fourteen R2Cross sites were completed between Platoro Reservoir and the confluence with the Rio Grande. The hydrology nodes used in the aquatic habitat flow needs assessment, summer/winter flow targets, and corresponding instream flow water rights for each reach are included in Table 3.3.

Table 3.3: Hydrology nodes, summer and winter flow targets, and corresponding instream flows by reach.

SMP Reach(es)	Gage/Location Name	Gaged/ Ungaged	Summer Flow Target (cfs)	Winter Flow Target (cfs)	Latitude	Longitude	Corresponding Instream Flow Case No. and Flow Rates (summer/winter) in cfs
CR01, CR02	Conejos River Below Platoro Reservoir (CONPLACO)	Gaged	64	41	37.354923	-106.544233	3-84CW138 (40/10)
CR03	Conejos River Upstream of Lake Fork	Ungaged	48	25	37.293388	-106.483831	3-84CW138 (40/10)
CR04	Conejos River Upstream of South Fork	Ungaged	48	25	37.222596	-106.466539	3-82CW237 (45/15)
CR05	Conejos River Upstream of Elk Creek	Ungaged	109	31	37.130347	-106.362348	3-82CW214 (75/25)
CR06, CR07, CR08	Conejos River Near Mogote (CONMOGCO)	Gaged	139	46	37.053954	-106.187145	3-82CW216 (90/45)
CR09	Conejos 6 - CONCONCO gauge, Hwy 285	Ungaged	102.5	32	37.10106	-106.010257	N/A
CR10	End of South Branch Conejos River	Ungaged	63	30	37.186944	-105.898885	N/A
CR11	North Channel Conejos River Near Lasauses (NORLASCO)	Gaged	91	63	37.300208	-105.746881	N/A

The summer minimum flow recommendation (three of three Habitat Criteria met and based on the mean of two sites), referenced at the Platoro gage, is 64 cfs. The winter minimum is 41 cfs. Notably, minimum flow recommendations increased from CR03 through CR08, decreased from CR08 to CR10, and increased again at CR11. It is assumed that the decrease from CR08 to CR10 is due to diversions from the river, which, over the last 150 years, have reduced channel capacity and resulted in other geomorphic changes.

In an attempt to estimate flows between gages, a regression analysis was performed at downstream gages (Mogote and Lasauses) relative to measured flow at the Platoro gage. Although a reasonable correlation and precision to the Mogote gage was achieved, particularly at higher flows, a poor relationship was found further downstream to the Lasauses gage.

For the purposes of the SMP, it is assumed that if the recommended minimum instream flow is delivered at the Platoro gage (64 cfs summer and 41 cfs winter), then habitat values for trout would be protected elsewhere on the stream. Instream Flow Incremental Methodology (IFIM) and Physical Habitat Simulation (PHABSIM) studies were conducted by the US Bureau of Reclamation (BOR) in the late 1980’s. These studies were conducted within one-half mile below Platoro reservoir. A winter flow of 10 cfs was recommend, however it is inadequate to protect all life stages of brown trout, particularly adult fish. A 10 cfs flow may prevent egg desiccation during the winter incubation period but provides little fall spawning or winter adult holding habitat. A flow of 40 cfs adequately protects all life stages of brown trout through the winter and is supported by the winter R2Cross minimum flow recommendation (41 cfs).

Fish species life history information is important when considering opportunities to operate reservoirs to maximize aquatic habitat. Conejos River brown trout (the dominant resident salmonid) life history was assumed to be similar to that of Rio Grande populations. Using findings from Nehring & Anderson (1993) for the Rio Grande populations, critical life history is as follows: Adult Spawning 10/15-11/15; Egg Incubation 10/15-5/1; Egg Hatching 4/1-6/1; Fry Emergence 5/15-6/15. Based on this information, the following actions are recommended, when possible:

- When possible, keep flows consistent during the winter period (October 1 through April 30). When possible, a flow of 41 cfs at the Platoro gage should be maintained for brown trout spawning, egg incubation, and hatching. Fish are sensitive to flow changes during the spawn. Even subtle changes can affect spawning behavior with possible effects on egg deposition, hatching, and subsequent fry production. Spawning flows should be maintained through the winter to protect incubating eggs. Flows can increase early in the incubation period but care should be taken not to scour eggs from the gravel. Newly emerged fry are very vulnerable to “blowout” from elevated flow. It is critical to not artificially increase the winter flow prior to runoff whenever possible.
- Natural runoff aside, it is recommended that flows be gradually ramped (see ramping recommendations below) to the summer minimum criteria (64 cfs May 1 through September 30) to protect further hatching and fry emergence. Allow river flow to return to base flow prior to October 1, if possible.
- An abrupt and large change in flow can be very detrimental to aquatic biota and their habitat. If possible, ramping should be conducted in a manner that allows water managers to meet downstream obligations while protecting aquatic life and their habitat. To this end, it is recommended that flow changes not exceed 25% per day. This pertains to any anthropogenic flow change, either up or down, throughout the year.

3.1.3 Lower Conejos River Dry-up and Re-wetting Analysis

Reach CR10 accounts for the entire length of the South Branch Conejos River (South Branch). Just upstream of Highway 285, the river bifurcates into two branches (North and South Branches). The North Branch delivers water to the Manassa No. 3 Ditch, among many others, which serves as one of three senior calling rights on the river. After running parallel for over 10 miles, the branches meet to form one channel downstream of the Town of Manassa. Before converging, the Rio San Antonio meets the South Branch. In most years, the South Branch dries up as the North Branch diverts the available water to meet the Manassa No. 3 ditch irrigation demands. Figure 3.6 shows the North and South Branches, Rio San Antonio, and stream gages.

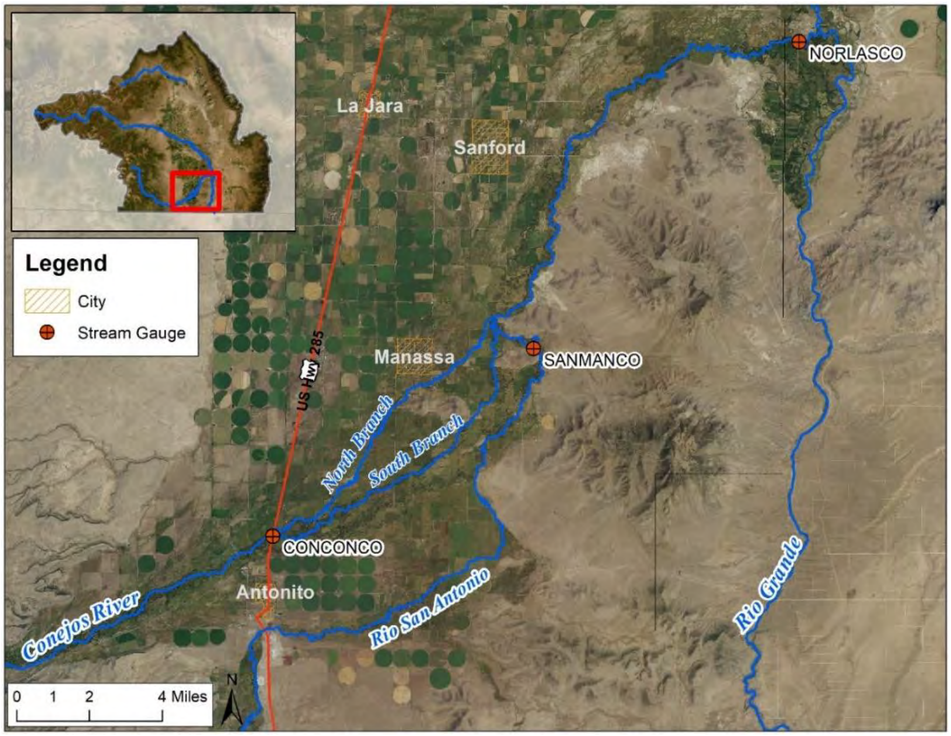


Figure 3.6: South Branch Conejos River Overview

The dry reach normally extends the entire length of the South Branch, from the Conejos River near Conejos (CONCONCO) stream gage, located at the top of the South Branch, downstream to the Rio San Antonio and North Branch Conejos River confluences. The reach from this point to the confluence with the Rio Grande (CR11) can also run dry. However, between flows from Rio San Antonio and a series of seeps and springs, including Sego Springs and McIntire Springs, the reach maintains hydrologic connectivity in some years. At the conclusion of the irrigation season (typically October 31st), the Manassa Core gate on the North Branch is closed in an effort to re-wet the South Branch.

The Conejos River's delivery requirements under the Rio Grande Compact vary substantially from year to year based on snowpack and hydrologic conditions in the basin. To effectively administer water rights and the Compact, it is important to understand and monitor dry-up on the Lower Conejos River. This investigation and continued monitoring is also important because dry-up impacts aquatic habitat, riparian vegetation, and overall stream health.

An analysis was completed to quantify dry-up and to estimate the number of days required to re-wet the lower Conejos River (reaches CR10 and CR11) as well as just the South Branch (CR10). Flow data from the CONCONCO and NORLASCO gages between 2000 and 2017 was used to estimate the number of days to re-wet the lower Conejos River. The number of days to re-wet the South Branch was then estimated by pro-rating results from the Lower Conejos River analysis.

Lower Conejos River (CR10 and CR11)

The number of days to re-wet the Lower Conejos River was defined as the total number of days it took for streamflow to be recorded at the NORLASCO gage after sustained flow was recorded at the CONCONCO gage. As an example, Figure 3.6 shows the daily stream gage data for October through December of 2003 and the period used to determine the number of days to re-wet the Lower Conejos River.

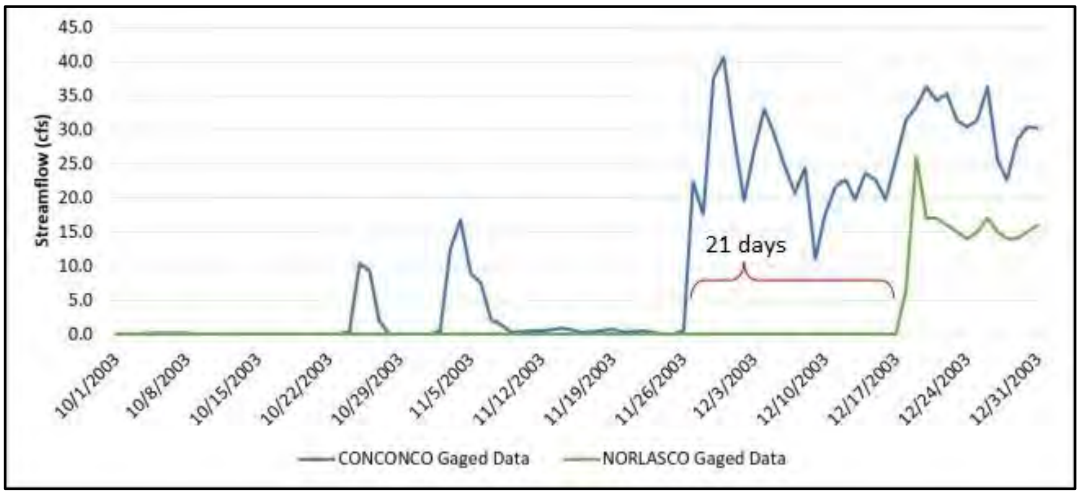


Figure 3.6: Number of Days to Re-wet the Lower Conejos River (2003).

Figure 3.7 reflects the number of days to re-wet the Lower Conejos River for those years during which the reach was dry. The number of days varies substantially in the study period, ranging from 1 to 25 days with an average of 12 days. The number of days tended to be lower during years with average or above-average streamflow (i.e., wetter hydrological conditions), indicating increased diversions and subsequent return flows had a larger role in re- wetting the Lower Conejos River.

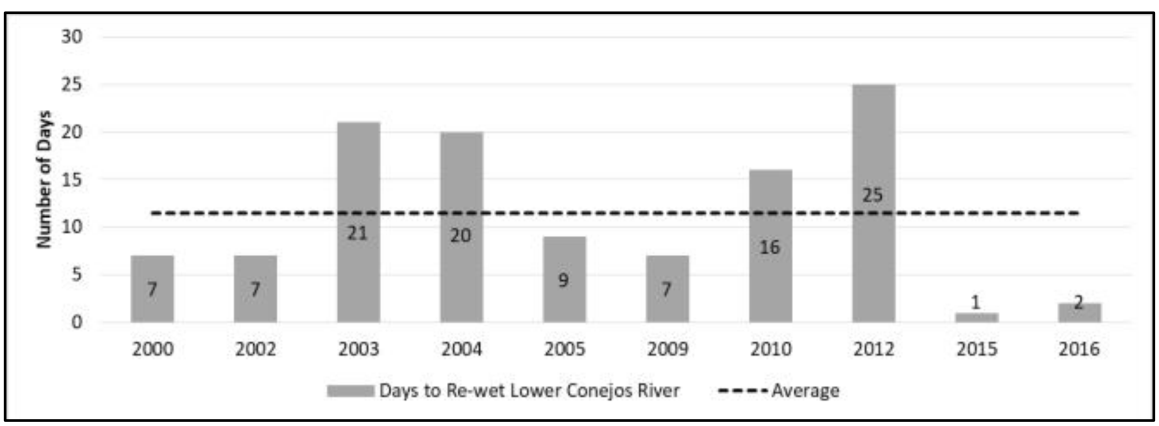


Figure 3.7: Number of Days to Re-wet the Lower Conejos River

It should be noted that numerous factors impact streamflow in the Lower Conejos River, including diversions, return flows, pumping depletions, temperature, precipitation events, and aquifer/channel bank storage conditions. In this analysis, the combined impact of all these factors could not be fully captured in the number of days needed to re-wet.

South Branch Conejos River (CR10)

To determine the time required to re-wet just the South Branch, the combined length of CR10 and CR11 was compared to that of just CR10. Assuming a constant rate of flow, the difference in length was used to determine the number of miles per day water travels during re-wetting. This rate was used to estimate the number of days to re-wet the South Branch. As illustrated in Figure 3.11, the number of days to re-wet the South Branch ranges between zero and 9 days, averaging nearly four days.

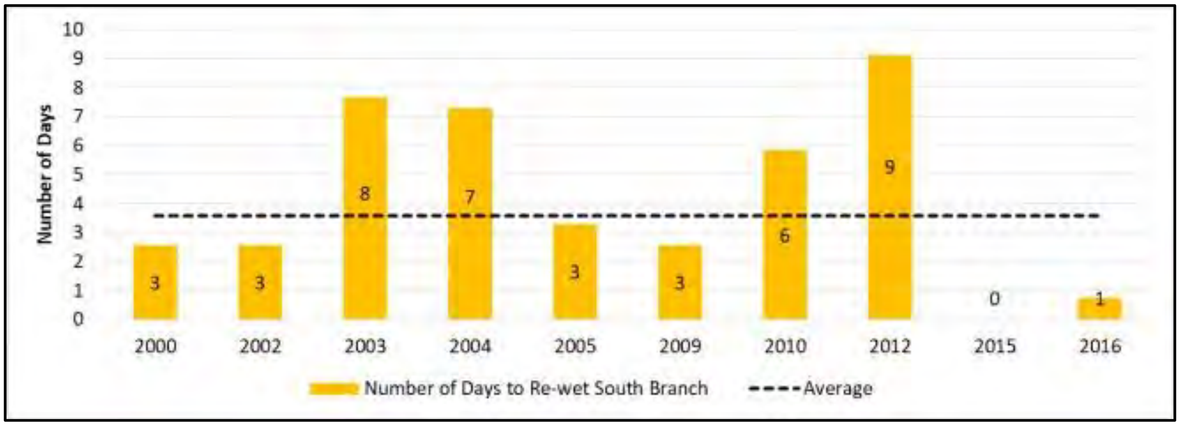


Figure 3.11: Number of Days to Re-wet The South Branch

Water Commissioners confirmed that it can take anywhere between two days to two weeks to re-wet the South Branch. Water managers seek to efficiently administer water rights and Rio Grande Compact delivery requirements while minimizing the amount of time dry-up occurs. This information on dry-up and re-wetting may help inform flexible water administration strategies to mitigate channel dry-up. A new stream gage installed on the South Branch near Manassa (CONMANCO) will also help inform management. Additionally, projects such as the Winter Flow Program and diversion infrastructure efficiency improvements described in section 4 will have multiple benefits of increasing efficiency and water administration flexibility while also reducing dry-up periods.

3.1.4 Conejos River Riparian Vegetation Summary

Figure 3.4: Conejos River immediately downstream of the confluence with the South Fork Conejos River. Photograph from Volume IV of the Wheeler railroad surveys, which were conducted during the 1870s (top) and Conejos River in 2020 (bottom [Wheeler, 1878]).

Figure 3.4 shows current and historic (1870s) photographs of the Conejos River mainstem immediately downstream of its confluence with the South Fork Conejos River. These images confirm and illustrate the findings from the riparian vegetation assessment, which found large portions of Conejos River's riparian zones have remained largely unaltered from natural, or "reference" condition (Wheeler, 1878).

There were a total of 11 AAs along the Conejos river, which all occurred within Conejos County (Figure 3.5). The highest elevation site was CRVeg01 at 2,982 meters (9,639 ft) while the lowest elevation location was CRVeg11b at 2,306 meters (7,565 ft). Seven sites were located on federally managed lands (BLM or U.S. Forest Service), two occurred on CPW state managed parcels, and two were located on privately owned properties.

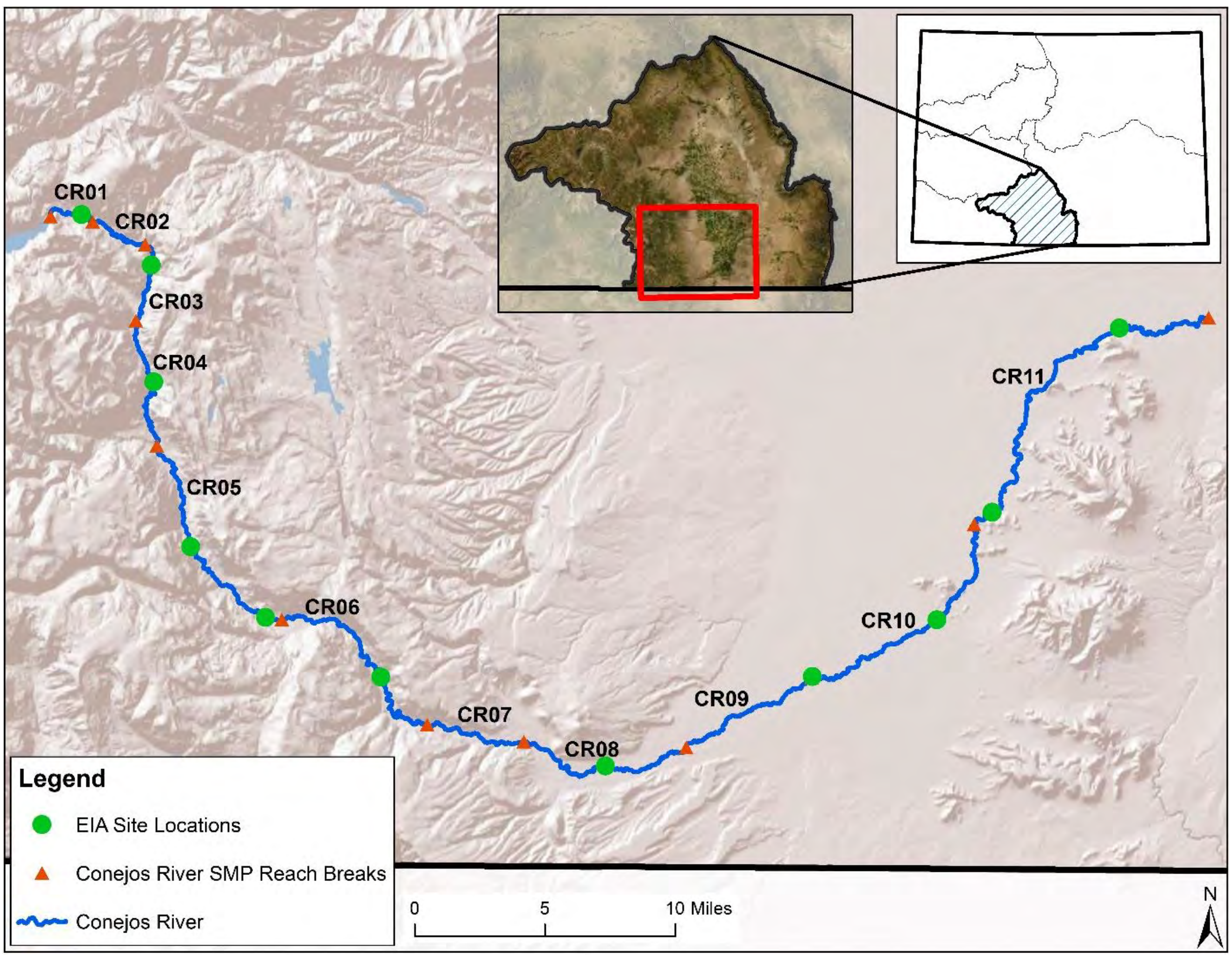


Figure 3.5: Conejos River SMP EIA AA locations

Ten of the 11 total sites sampled along the Conejos River received a B rating for their overall Ecological Integrity Assessment score. Conejos sites CRVeg03, CRVeg04, CRVeg05a, and CRVeg05b received the highest rating of B+. This score suggests that these sites have slight deviation from reference conditions. These wetlands predominantly function within the bounds of natural disturbance regimes. According to Lemly et al. (2016), management should focus on preventing further alteration (Table 2.8). Sites 01, 06, 08, 09, 10, and 11a all received an overall score of B-. While these sites are still considered to be in good condition, their score suggests that they are near the threshold of potentially degrading to an ecological condition requiring more intensive management if further alteration from natural conditions occurs. Site 11b, the lowest elevation surveyed, received the lowest rating with a score of C+. Recommendations for sites with this score are to focus management on the most impacted ecological attributes, which can be identified by the individual metric ratings for the site (Tables 3.4 and 3.5).

Table 3.4: Overall EIA scores for all Conejos River AAs.

Assessment Area	Calc Points	Calc Rating
CRVeg01	2.99	B-
CRVeg03	3.32	B+
CRVeg04	3.33	B+
CRVeg05a	3.34	B+
CRVeg05b	3.27	B+
CRVeg06	2.73	B-
CRVeg08	2.7	B-
CRVeg09	2.59	B-
CRVeg10	2.68	B-
CRVeg11a	2.69	B-
CRVeg11b	2.47	C+

Table 3.5: Individual EIA metric scores for all AAs.

	CRVeg01	CRVeg03	CRVeg04	CRVeg05a	CRVeg05b	CRVeg06	CRVeg08	CRVeg09	CRVeg10	CRVeg11a	CRVeg11b
Overall Ecological Integrity Points	2.99	3.32	3.33	3.34	3.27	2.73	2.70	2.59	2.68	2.69	2.47
Overall Ecological Integrity Rank	B-	B+	B+	B+	B+	B-	B-	B-	B-	B-	C+
LANDSCAPE METRICS											
L1. Contiguous Natural Land Cover	C	B	A	B	B	B	B	B	B	B	B
L2. Land Use Index	B	B	B	B	B	B	C	C	B	C	C
BUFFER METRICS											
B1. Perimeter with Natural Buffer	A	A	A	A	A	A	A	A	A	A	A
B2. Width of Natural Buffer	C	C	B	B	A	A	B	C	A	A	B
B3.1. Condition of Natural Buffer - Veg	C	B	C	C	C	C	B	C	C	B	B
B3.2. Condition of Natural Buffer - Soils	A	A	B	A	A	C	B	B	B	B	C
VEGETATION METRICS											
V1. Native Plant Species Cover	C-	C-	C-	C-	C-	D	C-	C-	C-	C	C
V2. Invasive Nonnative Plant Species Cover	A	A	A	A	A	A	B	C	C-	C	C
V3. Native Plant Species Composition	B	B	B	B	B	B	B	B	B	B	B
V4. Vegetation Structure	B	A	A	A	A	C	B	A	B	C	C
V5. Regen. of Native Woody Species **(opt.)**	B	A	A	A	B	C	C	B	B	B	B
V65. Coarse and Fine Woody Debris **(opt.)**	A	A	A	A	A	A	B	C	B	B	C

A total of 190 plant taxa were encountered, including 175 unique species. The total number of plant taxa encountered at an individual site ranged from 25 to 58, with an average of 44 plant taxa per site. CRVeg04 had the highest diversity with 58 taxa, while CRVeg09 had the lowest diversity with 25 total taxa encountered. There was no obvious trend observed in species diversity and elevation along Conejos sample sites (Table 3.6).

Table 3.6: Total taxa encountered by AA.

Assessment Area	# Taxa Observed
CRVeg01	42
CRVeg03	56
CRVeg04	58
CRVeg05a	55
CRVeg05b	43
CRVeg06	35
CRVeg08	49
CRVeg09	25
CRVeg10	35
CRVeg11a	51
CRVeg11b	42
Average	**45**

Average relative cover of native species ranged from 45% at CRVeg06 to 90% at CRVeg11a. Noxious species were present in the following locations: CRVeg08 (1.8% average cover), CRVeg09 (7.1% average cover), CRVeg10 (26.1% average cover), CRVeg11a (5.1% average cover), and CRVeg11b (5.2% average cover). Average mean C-values for native species ranged from 4.6 (CRVeg11b) to 5.5 (CRVeg04). Average cover weighted mean C-values for native species ranged from 4.4 (CRVeg11b) to 5.7 (CRVeg10) (Table 3.7).

Table 3.7: Floristic Quality Assessment (FQA) indices by AA.

FQA Indices	CRVeg01	CRVeg03	CRVeg04	CRVeg05a	CRVeg05b	CRVeg06	CRVeg08	CRVeg09	CRVeg10	CRVeg11a	CRVeg11b
Mean C-Value (All species)	4.3	4.6	4.8	4.5	4.5	4.1	4.3	3.8	3.7	3.7	3.5
Mean C-Value (Native species)	5.3	5.1	5.4	5.2	5.3	5.5	5.0	5.0	5.3	4.9	4.6
Cover-weighted Mean C-Value (All species)	3.2	4.1	4.0	3.4	3.2	2.5	4.4	3.7	3.9	4.2	3.8
Cover-weighted Mean C-Value (Native species)	5.3	5.1	5.5	5.1	4.9	5.5	5.3	5.0	5.7	4.8	4.4
FQI (All species)	18.8	25.4	23.7	22.9	22.2	19.7	19.0	15.0	15.2	15.6	14.3
FQI (Native species)	20.8	26.8	25.3	24.7	24.2	22.5	20.7	17.3	18.1	18.2	16.4
Cover Weighted FQI (All species)	14.1	22.5	19.6	17.6	16.1	11.9	19.7	14.6	15.9	18.0	15.7
Cover Weighted FQI (Native species)	21.0	26.7	25.3	24.2	22.5	22.6	21.7	17.3	19.3	17.6	16.3
Adjusted FQI	48.1	48.8	50.9	48.2	48.8	47.5	46.2	43.6	44.3	42.5	40.0
Adjusted Cover Weighted FQI	48.3	48.5	51.1	47.2	45.3	47.6	48.4	43.6	47.0	41.2	38.3

The highest elevation site (CRVeg01) was identified as Rocky Mountain Subalpine-Montane Riparian Shrubland Ecological System. Sites CRVeg03 through CRVeg06 were identified as Rocky Mountain Subalpine-Montane Riparian Woodland Ecological System. The lower elevation Sites (CRVeg08, CRVeg09, CRVeg10, CRVeg11a, and CRVeg11b) were identified as Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland Ecological System. The following Physiognomic Groups represented all sites surveyed along the Conejos River: Deciduous Dominated Forest/Woodland (54.5% of plots), Tall Willow Shrubland (34.1% of plots), Evergreen Riparian Forest (4.5% of plots), Herbaceous vegetation (4.5% of plots), and Non-Willow Shrubland (2.3% of plots).

Reach-level RCA scores derived from the GIS remote sensing vegetation assessment closely matched and helped validate overall EIA scores. For more detailed findings from the GIS assessment, see **Appendix E**.

3.1.5 Conejos River Water Quality Summary

Generally speaking, the Conejos River exhibits very good water quality with several tributary streams listed as "outstanding waters" (CDPHE, 2018c). Only minor water quality impacts were observed in the SMP study reaches (CDPHE, 2018a; CDPHE, 2018d). Arsenic exceeds the chronic state water quality standard in reaches CR02 and CR11 however the impairment does not appear to significantly affect aquatic biota. Robust water temperature datasets are lacking within the SMP study area and determinations on temperature conditions was not possible. Reaches CR10 and CR11 experience seasonal dry-up, however an assessment of water quality impacts from low flow and dry-up was not possible due to a lack of temperature data at the time of assessment. Recently installed water temperature instruments at the Platoro and Mogote stream gages will help fill this data gap.

3.1.6 Conejos River Aquatic Life Summary

Overall, the diverse aquatic habitats within the SMP study area support healthy aquatic life. Many macroinvertebrate samples had diverse species assemblages including sensitive taxa. Fish surveys indicate healthy trout fisheries in multiple SMP study reaches. However, sampling data showed mild impairment to macroinvertebrate communities in reaches CR10 through CR04 as well as CR11. In addition, native cold- and warm-water fish populations have declined within the SMP study area and nonnative fish species are impacting reaches CR10 and CR11.

From Platoro Reservoir to the river's bifurcation at Highway 285 (SMP reaches CR01 – CR10), the river is a cold-water stream inhabited by trout, suckers and dace. Native Rio Grande cutthroat trout have been replaced in the mainstem by brown, rainbow, and brook trout as well as nonnative cutthroat trout. Native cutthroat trout are still present in some tributaries. White sucker has replaced native Rio Grande sucker. Downstream of the bifurcation to the confluence with the Rio Grande (CR10 – CR11), the river transitions from a cold-water to a warm-water stream. Limited fisheries data is available within this section, but it appears to be dominated by brown trout, northern pike, common carp, and white sucker. Brook stickleback, fathead minnow, longnose dace, red shiner, and green sunfish have also been documented in this section. Rio Grande sucker and Rio Grande chub have been documented at McIntire Springs however both species have largely been replaced by nonnative species elsewhere.

Native Species Distribution

In general, the distribution and abundance of native fish species has declined significantly, with most species retreating from their historic ranges into more isolated and small populations. Species of particular interest within the SMP study area include Rio Grande sucker, chub, and cutthroat trout. The current basin-wide distribution of these species is described below.

The Rio Grande sucker is a small herbivorous fish considered State Endangered in Colorado. The sucker is endemic to the Rio Grande watershed in Colorado and New Mexico. In Colorado, it was historically found in the Rio Grande, Conejos River, Hot Creek, and at McIntire Springs. It now only exists in a few small populations, including where it has been reintroduced to lower-elevation streams on the Rio Grande National Forest. Rio Grande sucker have been stocked in tributaries to the Conejos River as well as the mainstem of Saguache Creek near the Town of Saguache.

The Rio Grande chub, a Tier 1 Species of Concern in Colorado, is a small insectivore species endemic to the Rio Grande Basin in Colorado and New Mexico, including the SLV Closed Basin. Historically, the species is known to have been present in the Rio Grande, Conejos River, Saguache Creek, and San Luis Creek. Currently, three known aboriginal populations exist – in Baca National Wildlife Refuge, Hot Creek State Wildlife Area, and the Rio Grande between the Rio Grande Canal and the Prairie Ditch diversion. A 2003 study showed Rio Grande chub to be declining and limited to select streams in the Rio Grande Basin (Bestgen et al., 2003). The only large and relatively stable populations at that time were in Hot Creek and Saguache Creek. More recent surveys, however, revealed that a small population of Rio Grande chub are present in the mainstem of the Rio Grande (CPW, 2018). CPW also stocks chub in the mainstem Rio Grande downstream of Monte Vista.

The Rio Grande cutthroat trout is a native salmonid species listed as a Tier 1 Species of Concern in Colorado. Numerous populations exist in the Rio Grande Basin, mostly in lower order, high elevation streams on the Rio Grande National Forest. The historic range of Rio Grande cutthroat trout (RGCT) has dramatically decreased (RGCT, 2013). Significant efforts are underway to maintain and enhance RGCT populations. The Rio Grande Cutthroat Conservation Team, made up of regional aquatic ecologists from state and federal agencies, has conducted and supported population surveys, genetic analyses, fish stocking efforts, and habitat improvements to promote the long-term protection of RGCT. Similar efforts are focused on Rio Grande chub and sucker conservation.

3.2 Conditions Assessment Results by Reach

3.2.1 CR01 – Platoro Reservoir to Rio Grande National Forest Boundary

From the outlet at the base of Platoro Reservoir downstream to the change in valley slope just east of the Town of Platoro. This reach break coincides with the Rio Grande National Forest boundary.

Representative Reach Photo

CR01 Conditions Assessment Overview

Reach: CR01		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	B+	X	X		X	X	X					X		
Riparian Vegetation	B		X			X								
Water Quality	A													
Aquatic Life	C						X					X		
Diversion Structures	N/A													

A	B	C	D	F	Not Assessed

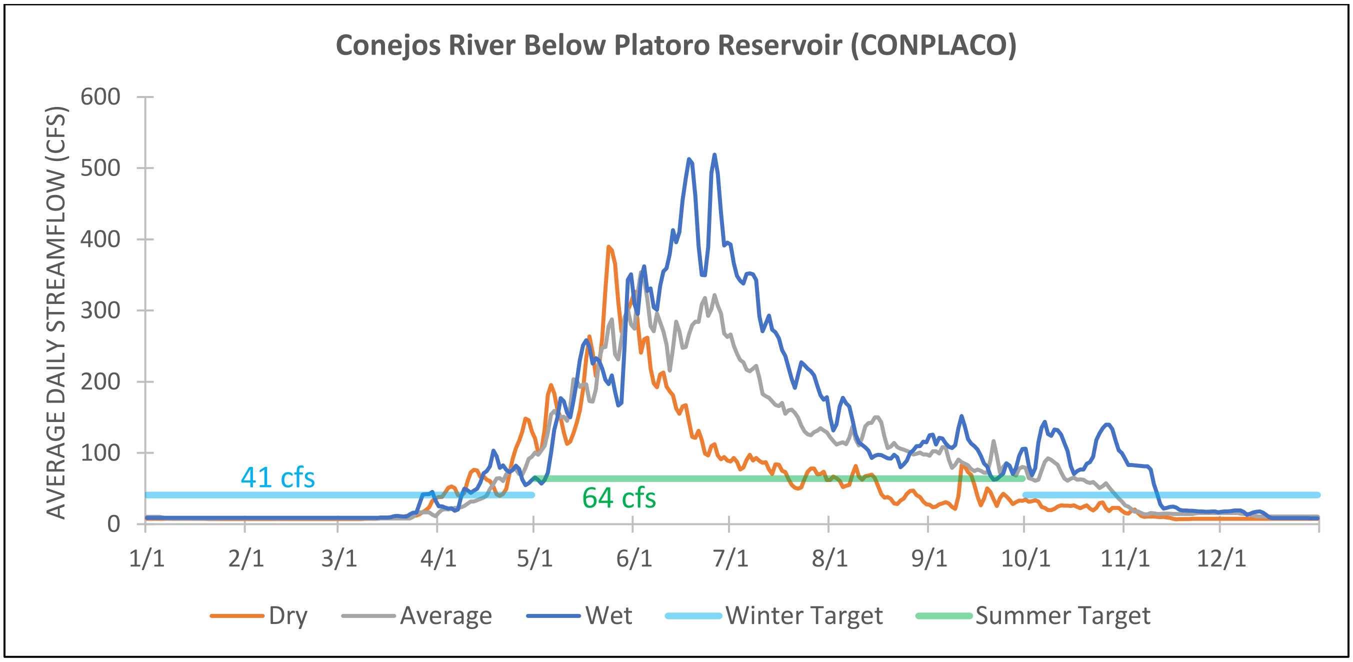
*For an explanation of reach ratings, see Section 2.

CR01 Geomorphology

<table>
<tr><td>Reach</td><td colspan="8">Location Description</td></tr>
<tr><td>CR01</td><td colspan="8">Platoro Reservoir to Rio Grande National Forest Boundary</td></tr>
<tr><td>Confine-ment</td><td>D50</td><td>Bed Comp.</td><td>Existing Stream Form</td><td>Reference Stream Form</td><td>SEM Stage Existing</td><td>SEM Stage Ref.</td><td>Existing Sediment Regime</td><td>Reference Sediment Regime</td></tr>
<tr><td>Partially-confined</td><td>No Data</td><td>No Data</td><td>Plane bed</td><td>Plane bed</td><td>4</td><td>1</td><td>Transport</td><td>Transport</td></tr>
<tr><td>Valley Slope</td><td>Stream Power △</td><td>Bed Mobility Threshold Flows</td><td>Bed Mobility Frequency</td><td colspan="2">Overbank Flow Estimate</td><td colspan="3">Overbank Flow Frequency</td></tr>
<tr><td>1.15%</td><td>↔</td><td>No Data</td><td>No Data</td><td colspan="2">No Data</td><td colspan="3">No Data</td></tr>
<tr><td colspan="2">Watershed setting</td><td>River Style</td><td colspan="4">Characteristics</td><td colspan="2">Representative Photo</td></tr>
<tr><td colspan="2">Transport</td><td>Confined valley occasional floodplain pockets</td><td colspan="4">Small and discontinuous floodplain pockets, controlled largely by margin structures. Riffles, runs and rapids with occasional larger wood-generated or step pools. Occasional but irregular instream bar formations.</td><td colspan="2"></td></tr>
<tr><td colspan="9">Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity</td></tr>
<tr><td colspan="9">This Conejos River study reach predominantly sits in a partially-confined valley (the geomorphic reach break ends where the valley becomes unconfined, however the SMP located the reach break further downstream where channel and valley conditions differ significantly from the beginning of this reach). The valley size and shape are the result of glacial excavation. Channel location, however, has been manipulated through the Platoro settlement (as evidenced by straight sections and abrupt 90 degree turns) There are several small fan deposits along the valley margins coming from tributary drainages to the north. Generally speaking, these fans are not dramatically impacting the river’s location or sediment loads. Within the study reach, the primary sediment source is colluvium brought down from the adjoining hillslopes. Sediment from up higher in the watershed is trapped in Platoro Reservoir. The base level of the river is likely controlled by underlying bedrock. The channel is generally a SEM stage 1 – departure from its reference condition. The sensitivity of this reach is low (although the lower third of the reach is high due to the stream’s ability to meander in an unconfined valley).</td></tr>
<tr><td colspan="7">Stressors</td><td colspan="2">Degree of Geomorphic Impairment</td></tr>
<tr><td colspan="7">Other than the influence of Platoro Reservoir on the hydrology, sediment supply, and woody material, there are limited stressors affecting this reach. Very minor floodplain conversion and bank arming exists. Two small bridges exist, but their geomorphic influence is not significant.</td><td colspan="2">B+</td></tr>
</table>

CR01 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR01	DRY	AVERAGE	WET
Winter	12%	20%	32%
Summer	64%	100%	97%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

CR01 Riparian Vegetation

Overall, this site (CRVeg01) appears to be in good condition with an overall EIA rating of B- (2.99). The lowest individual metric ratings it received were for Contiguous Natural Land Cover (C), Width of Natural Buffer (C), Condition of Natural Buffer – Vegetation (C), and Native Plant Species Cover (C-) (Table 3.7).

Table 3.7: EIA Scorecard – CRVeg01.

CRVeg01 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**2.99**	**B-**
Rank Factor: LANDSCAPE CONTEXT	0.30			**2.78**	**B-**
LANDSCAPE METRICS	0.33			**2.50**	**B-**
L1. Contiguous Natural Land Cover	1	C	2		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			**2.91**	**B-**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	C	2		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	A	4		
Rank Factor: CONDITION	0.70			**3.08**	**B+**
VEGETATION METRICS	1			**3.08**	**B+**
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	A	4		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	B	3		
V5. Regen. of Native Woody Species **(opt.)**	1	B	3		
V65. Coarse and Fine Woody Debris **(opt.)**	1	A	4		

Both Contiguous Natural Land Cover and Width of Natural Buffer were disrupted by Forest Service Road 250 that runs generally parallel to the river to the north. Without re-routing this road, these metric scores cannot be easily improved as they are currently assessed.

The Condition of the Natural Buffer – Vegetation and Native Plant Species cover were both impacted by an average relative native plant cover of only 60%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (37.5%, 62.5%, 7.5%, and 17.5%), and *Bromus inermis* (17.5%, 1.5%, 0%, and 0%), *Taraxacum officinale* (7.5%, 1.5%, 17.5%, and 0%), and *Trifolium repens* (7.5%, 0.5%, 17.5%, and 0%). While it is desirable to have higher cover by native species, the most common nonnative species at this site are essentially naturalized in this region. Further, these nonnatives did not result in monocultures and there were no noxious species observed at this site.

The average mean C-value for native species was 5.3, while the average cover-weighted mean C-value was only 5.3 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas. Current land uses observed and their approximate cover within the 500 m buffer include light grazing on rangeland (92%), moderate recreation (5%), unpaved roads (2%), and domestic and commercial buildings (1%).

This site likely experiences moderate to occasionally high recreational use due to its proximity to the town of Platoro, which lies only 0.3 miles to the west.

Results from the reach-scale RCA assessment also indicated heathy riparian areas with a rating of B. Mild stressors were identified including roads and development within the town of Platoro. The average of the EIA and RCA ratings is B.

CR01 Water Quality and Aquatic Life

Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	A	A
Overall Rating		**A**

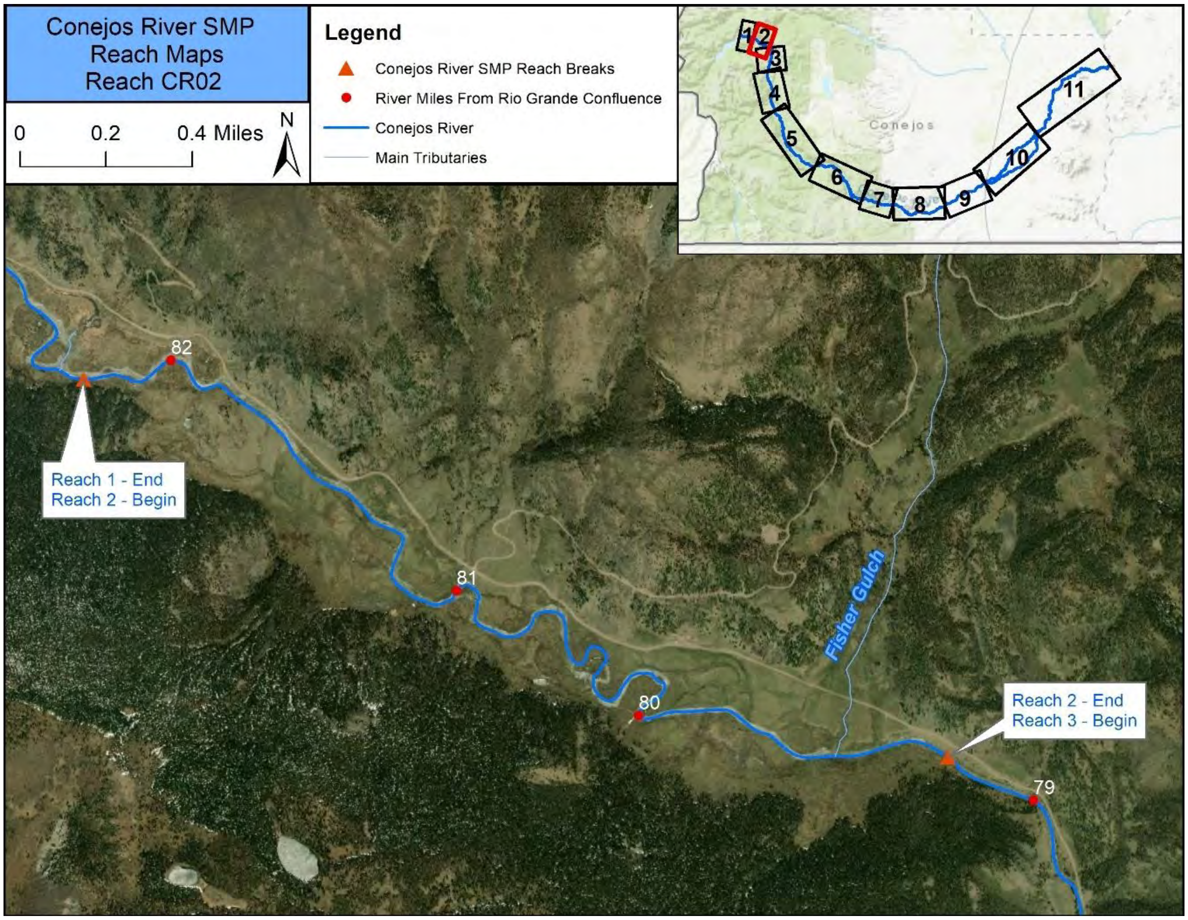
Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
40.5	D-	59.22	B+
Overall Rating			**C**

Overall, water quality in this reach appears to be excellent with no state water quality exceedances. In summer 2019, a water temperature instrument was installed at the Conejos River Below Platoro Reservoir, CO (CONPLACO) gage. The new instrument was integrated into the existing Division of Water Resources stream gage data logger, which is remotely uploaded to the DWR's surface water website, along with streamflow and any other data collected at a given gage. This data will be useful for future water temperature monitoring.

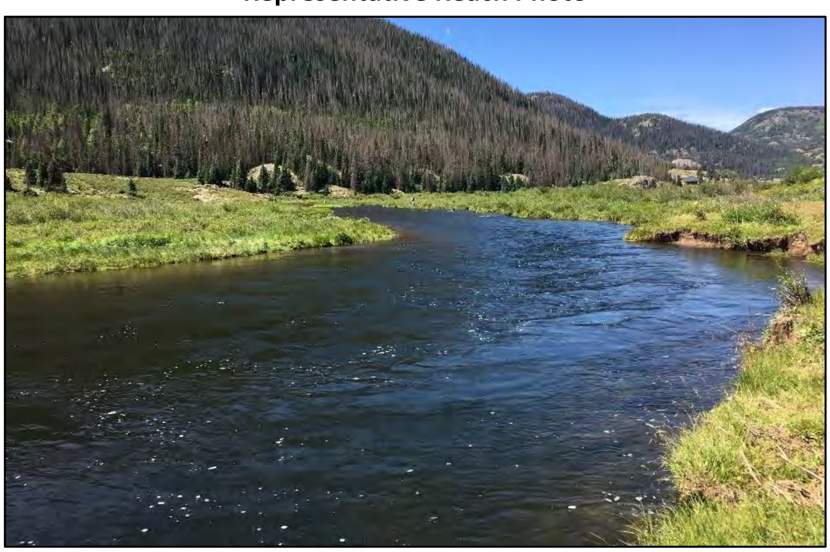
Trout data from CR02 is assumed to apply to this reach given their proximity and similarity. An average MMI score of 40.5 indicates significant impairment to the macroinvertebrate community. This impairment is likely due in part to flow and sediment regime impacts resulting from Platoro reservoir immediately upstream. Trout biomass data, extrapolated from CR02, suggests a relatively healthy fishery.

3.2.2 CR02 – Rio Grande National Forest Boundary to End of "The Meadows"

From the Rio Grande National Forest boundary east of the Town of Platoro downstream to where the confinement and valley slope changes. This reach is commonly referred to as "the meadows" due to the sinuous channel and wet meadows that form the river's broad floodplain. The upstream end of this reach marks the beginning of a wild and scenic eligible reach, which extends to the end of reach CR04.



Representative Reach Photo



CR02 Conditions Assessment Overview

Reach: CR02		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	B+		X				X					X		
Riparian Vegetation	B		X											
Water Quality	A-								X					
Aquatic Life	C						X					X		
Diversion Structures	N/A													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

CR02 Geomorphology

Reach	Location Description
CR02	Rio Grande National Forest Boundary to End of "The Meadows"

Confine-ment	D50 (mm)	Bed Comp.	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Partially-confined	47-66	Coarse Gravel	Riffle-pool	Riffle-pool	1	0	Coarse Equilibrium & Fine Deposition	Coarse Equilibrium & Fine Deposition

Valley Slope	Stream Power △	Bed Mobility Threshold Flows	Bed Mobility Frequency	Overbank Flow Estimate	Overbank Flow Frequency
0.56%	↓	Extreme Events Only	Extreme Events Only	1000 cfs	Extreme Events Only

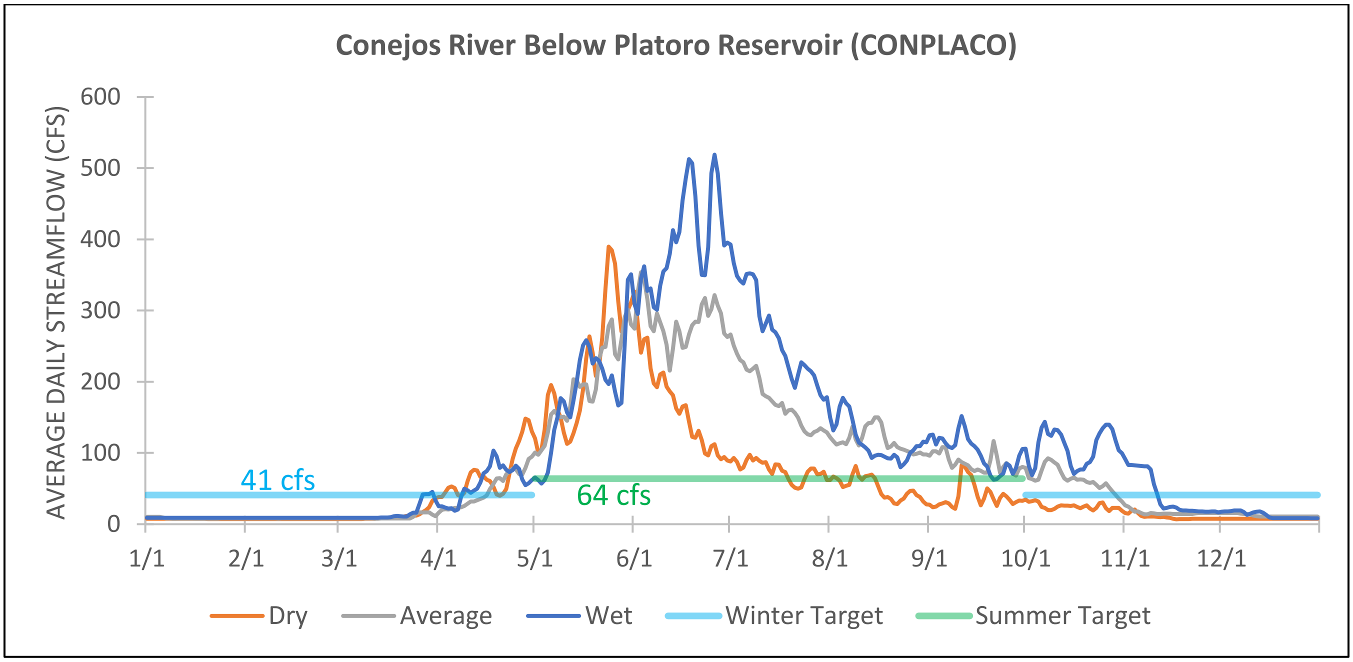
Watershed setting	River Style	Characteristics	Representative Photo
Response	Low-Moderate Sinuosity Planform-Controlled Discontinuous Floodplain	Similar to elongated discontinuous floodplain but with slightly increased sinuosity and tendency to exhibit active meandering activity and channel features in planform. Channel still abuts confining valley margins frequently. Increased presence of meander-related geomorphic floodplain and channel features including paleo channels, meander cutoffs, cutbanks; multiple instream bar types.	

Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity
This Conejos River study reach sits in a partially-confined alluvial valley. The valley size and shape are most likely the result of glacial excavation. Bedrock outcroppings (which have been worked over by glacial movement) protrude from the valley floor which the modern stream works around. There are several small fan deposits along the valley margins coming from tributary drainages on the north and south valley margins. Generally speaking, these fans are not dramatically impacting the river's location or sediment loads. Within the study reach, the primary sediment source is colluvium brought down from the adjoining hillslopes and/or material gathered from eroding banks. Bedload and suspended sediment contributed from the upper watershed is trapped in Platoro Reservoir and so this reach is likely sediment starved. The base level of the river is controlled by bedrock at the downstream end of the reach where the valley narrows at a bedrock knickpoint. The channel is generally a SEM stage 1 (a departure from its reference condition, stage 0). The sensitivity of this reach is moderate due to the sediment imbalance.

Stressors	Degree of Geomorphic Impairment
Stressors of this reach include Platoro Reservoir, which has affected the hydrology, sediment supply, and woody material recruitment. Additionally, beavers, a biotic driver, would likely have occupied the river corridor but presently do not appear active in this reach.	B+

CR02 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR02	DRY	AVERAGE	WET
Winter	12%	20%	32%
Summer	64%	100%	97%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

CR02 Riparian Vegetation

An EIA site was not completed in this reach. Results from the reach-scale RCA assessment indicated heathy riparian areas with a rating of B. Mild stressors were identified including roads and grazing within the riparian zone. The reach received an overall rating of B.

CR02 Water Quality and Aquatic Life

Water Quality		
Temperature	Chemical Conditions	Nutrients
N/A	B	A
Overall Rating		A-

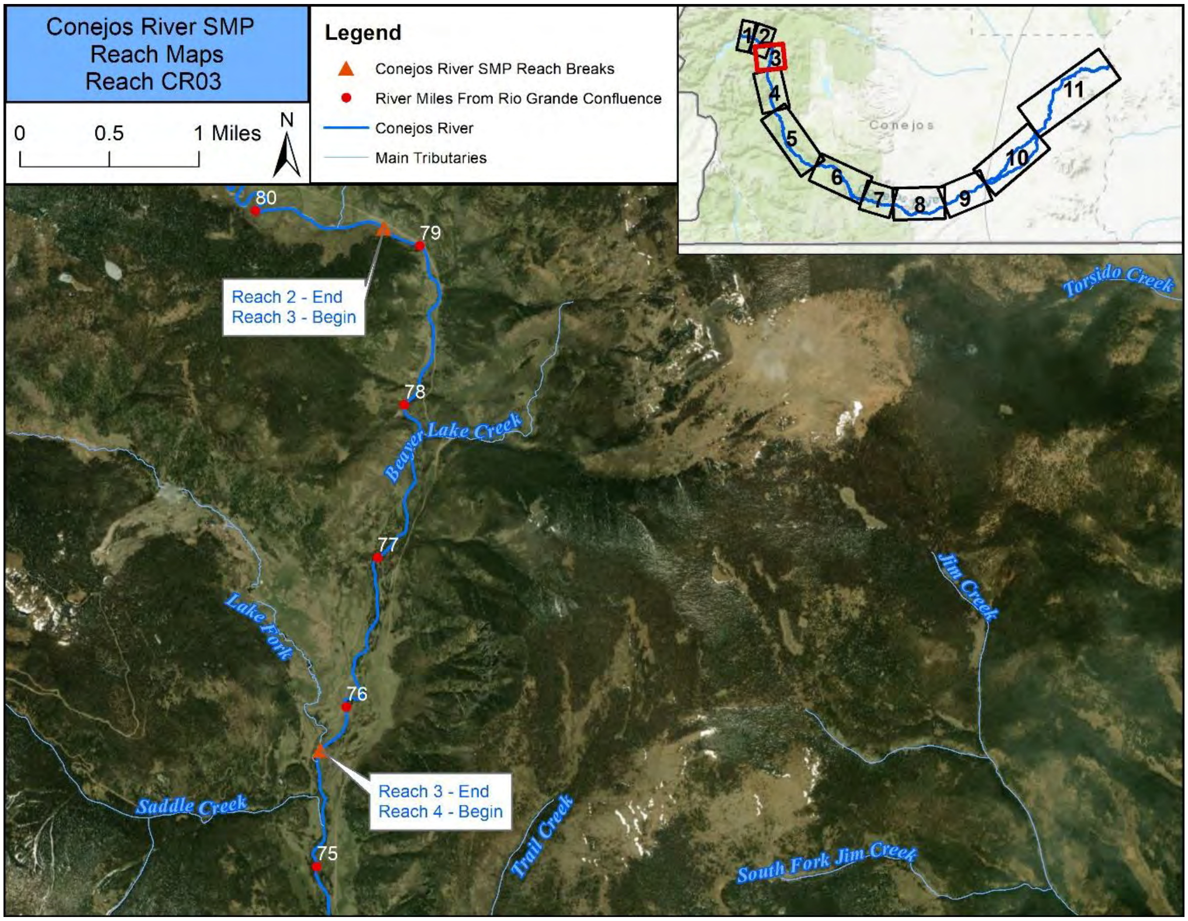
Aquatic Life			
Average MMI Score	Overall MMI Rating	Trout (lbs/acre)	Trout Rating
40.5	D-	59.22	B+
Overall Rating			C

Overall, water quality is very good in this reach. However, recent water samples collected both upstream and downstream of the Glacier/Chilkat mine show that total arsenic exceeds the state water quality standard. The standard was only exceeded downstream of the mine, suggesting elevated arsenic can be attributed to mine effluent. Otherwise, this reach exhibits good water quality, as evidenced by healthy trout populations in this area.

The MMI score from CR01 is assumed to apply to this reach given their close proximity and similarities. An average MMI score of 40.5 indicates significant impairment to the macroinvertebrate community. This impairment is likely due in part to flow and sediment regime impacts resulting from Platoro reservoir immediately upstream. Trout biomass data, however, suggests a relatively healthy fishery.

3.2.3 CR03 – End of "The Meadows" to Lake Fork Confluence

Where the confinement and valley slope changes at the end of The Meadows downstream to the confluence with the Lake Fork. This reach's gradient is significantly steeper than that of CR02.



Representative Reach Photo

CR03 Conditions Assessment Overview

Reach: CR03		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	A-		X				X							
Riparian Vegetation	B+		X											
Water Quality	A													
Aquatic Life	B						X							
Diversion Structures	N/A													

A	B	C	D	F	Not Assessed

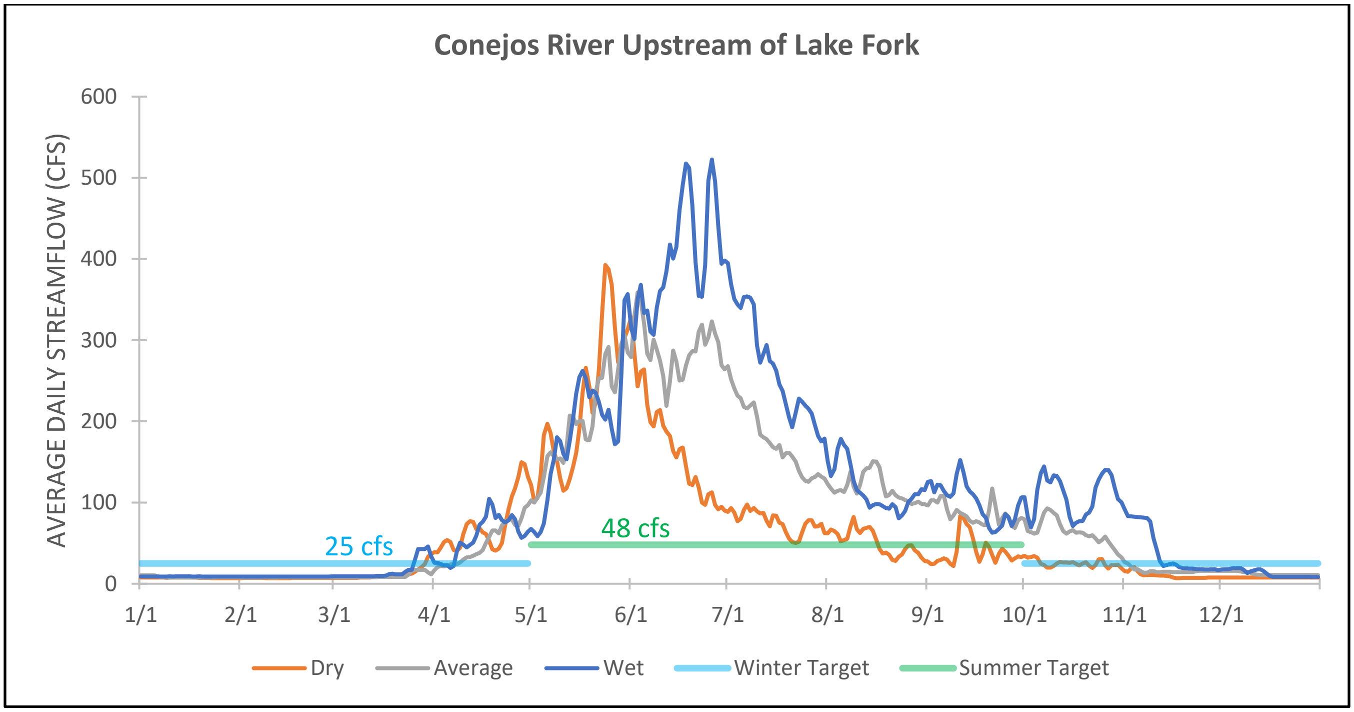
*For an explanation of reach ratings, see Section 2.

CR03 Geomorphology

<table>
<tr><td>Reach</td><td colspan="8">Location Description</td></tr>
<tr><td>CR03</td><td colspan="8">End of The Meadows to Lake Fork confluence</td></tr>
<tr><td>Confine-ment</td><td>D50</td><td>Bed Comp.</td><td>Existing Stream Form</td><td>Reference Stream Form</td><td>SEM Stage Existing</td><td>SEM Stage Ref.</td><td>Existing Sediment Regime</td><td>Reference Sediment Regime</td></tr>
<tr><td>Confined</td><td>No Data</td><td>No Data</td><td>Plane bed</td><td>Plane bed</td><td>1</td><td>1</td><td>Transport</td><td>Transport</td></tr>
<tr><td>Valley Slope</td><td>Stream Power △</td><td>Bed Mobility Threshold Flows</td><td>Bed Mobility Frequency</td><td colspan="2">Overbank Flow Estimate</td><td colspan="3">Overbank Flow Frequency</td></tr>
<tr><td>2.0%</td><td>↑</td><td>No Data</td><td>No Data</td><td colspan="2">No Data</td><td colspan="3">No Data</td></tr>
<tr><td colspan="2">Watershed setting</td><td>River Style</td><td colspan="4">Characteristics</td><td colspan="2">Representative Photo</td></tr>
<tr><td colspan="2">Transport</td><td>Confined valley occasional floodplain pockets</td><td colspan="4">Small and discontinuous floodplain pockets, controlled largely by margin structures. Riffles, runs and rapids with occasional larger wood-generated or step pools. Occasional but irregular instream bar formations.</td><td colspan="2"></td></tr>
<tr><td colspan="9">Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity</td></tr>
<tr><td colspan="9">This Conejos River study reach sits in a narrow, confined valley. The valley size and shape are the result of water downcutting through bedrock in combination with bedrock faulting (as opposed to glacial scour as dominates the valleys above this reach). Sediments are dominated by cobble and small boulders. Within the study reach, the primary sediment source is colluvium brought down from the adjoining hillslopes and alluvium brought down from several small fans. Most sediment contributed from up higher in the watershed is either trapped in Platoro Reservoir or largely settled out in the alluvial pocket in the reach upstream. The base level of the river is controlled by bedrock. The channel is generally a SEM stage 1 – its reference condition. The sinuosity of this reach is a result of bedrock outcroppings, the channel meandering into softer pockets of hillslope colluvium and/or being pushed into hillslopes by alluvial fans coming from side drainages. The sensitivity of this reach is low.</td></tr>
<tr><td colspan="7">Stressors</td><td colspan="2">Degree of Geomorphic Impairment</td></tr>
<tr><td colspan="7">Other than the influence of Platoro Reservoir on the hydrology and sediment supply, there are limited stressors affecting this reach.</td><td colspan="2">A-</td></tr>
</table>

CR03 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR03	DRY	AVERAGE	WET
Winter	21%	26%	35%
Summer	75%	100%	100%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

CR03 Riparian Vegetation

Overall, this site (CRVeg03) appears to be in very good condition with an overall EIA rating of B+ (3.32). The lowest individual metric ratings it received were for Width of Natural Buffer (C), and Native Plant Species Cover (C-) (Table 3.8).

Table 3.8: EIA Scorecard – CRVeg03.

CRVeg03 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**3.32**	**B+**
Rank Factor: LANDSCAPE CONTEXT	0.30			**3.10**	**B+**
LANDSCAPE METRICS	0.33			**3.00**	**B+**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			**3.15**	**B+**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	C	2		
B3.1. Condition of Natural Buffer - Veg	n/a	B	3		
B3.2. Condition of Natural Buffer - Soils	n/a	A	4		
Rank Factor: CONDITION	0.70			**3.42**	**B+**
VEGETATION METRICS	1			**3.42**	**B+**
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	A	4		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	A	4		
V5. Regen. of Native Woody Species **(opt.)**	1	A	4		
V65. Coarse and Fine Woody Debris **(opt.)**	1	A	4		

The Width of the Natural Buffer was impacted by the proximity of Forest Service Road 250 to the east. This road roughly parallels the river and occurs within the 100 m buffer zone of the AA.
The average relative cover of native species for this site was 79%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (0%, 7.5%, 37.5%, and 37.5%), and *Taraxacum officinale* (0.5%, 0.5%, 7.5%, and 7.5%). While it is desirable to have higher cover by native species, the most common nonnative species at this site are essentially naturalized in this region. Further, these nonnatives did not result in monocultures and there were no noxious species observed at this site.

The average mean C-value for native species was 5.1, while the average cover-weighted mean C-value was only 5.1. This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas (Table 3.7). Current land uses observed and their approximate cover within the 500 m buffer include management for native vegetation (63%), moderate grazing on rangeland (30%), light recreation (5%), and unpaved roads (2%).

Results from the reach-scale RCA assessment also indicated heathy riparian areas with a rating of B+. The only mild identified stressor was roads. The average of the EIA and RCA ratings is B+.

CR03 Water Quality and Aquatic Life

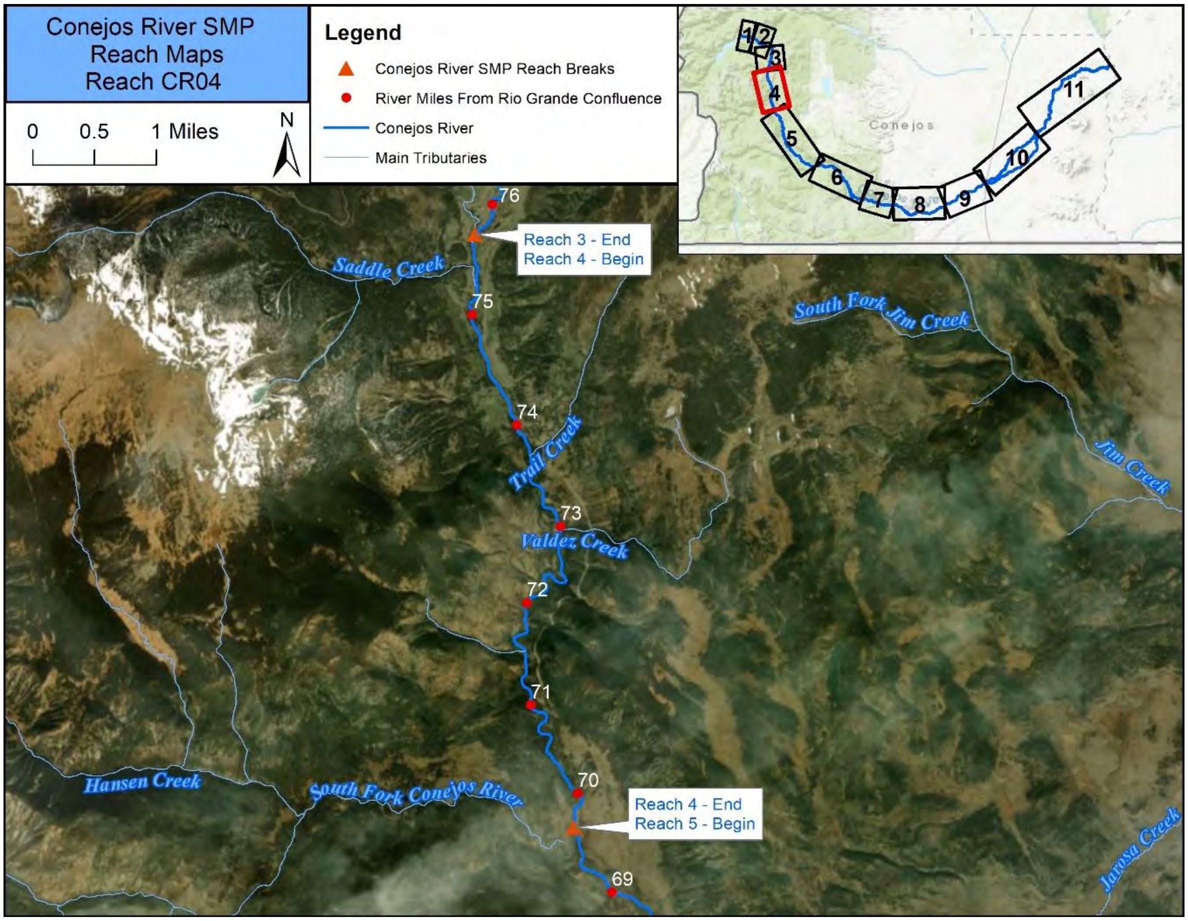
Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
72.2	B	N/A	N/A
Overall Rating			**B**

No water quality impairments were identified in this reach. The macroinvertebrate community is mildly impaired with an average MMI score of 72.2. Trout data was not available.

3.2.4 CR04 – Lake Fork Confluence to South Fork Conejos River Confluence

From the Lake Fork confluence downstream to the confluence of the South Fork Conejos River. This reach break marks the end of the wild and scenic eligible reach.



Representative Reach Photo

CR04 Conditions Assessment Overview

Reach: CR04		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	A-						X							
Riparian Vegetation	B+													
Water Quality	A													
Aquatic Life	C						X							X
Diversion Structures	N/A													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

CR04 Geomorphology

Reach	Location Description
CR04	Lake Fork Confluence to South Fork Conejos River Confluence

Confine-ment	D50 (mm)	Bed Comp.	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Confined	110	Cobble	Plane bed	Plane bed	0	0	Transport	Transport

Valley Slope	Stream Power △	Bed Mobility Threshold Flows	Bed Mobility Frequency	Overbank Flow Estimate	Overbank Flow Frequency
1.4	↔	2600 cfs	Extreme Events	Canyon/Confined Reach; no large floodplains.	N/A; variable depending on floodplain pocket.

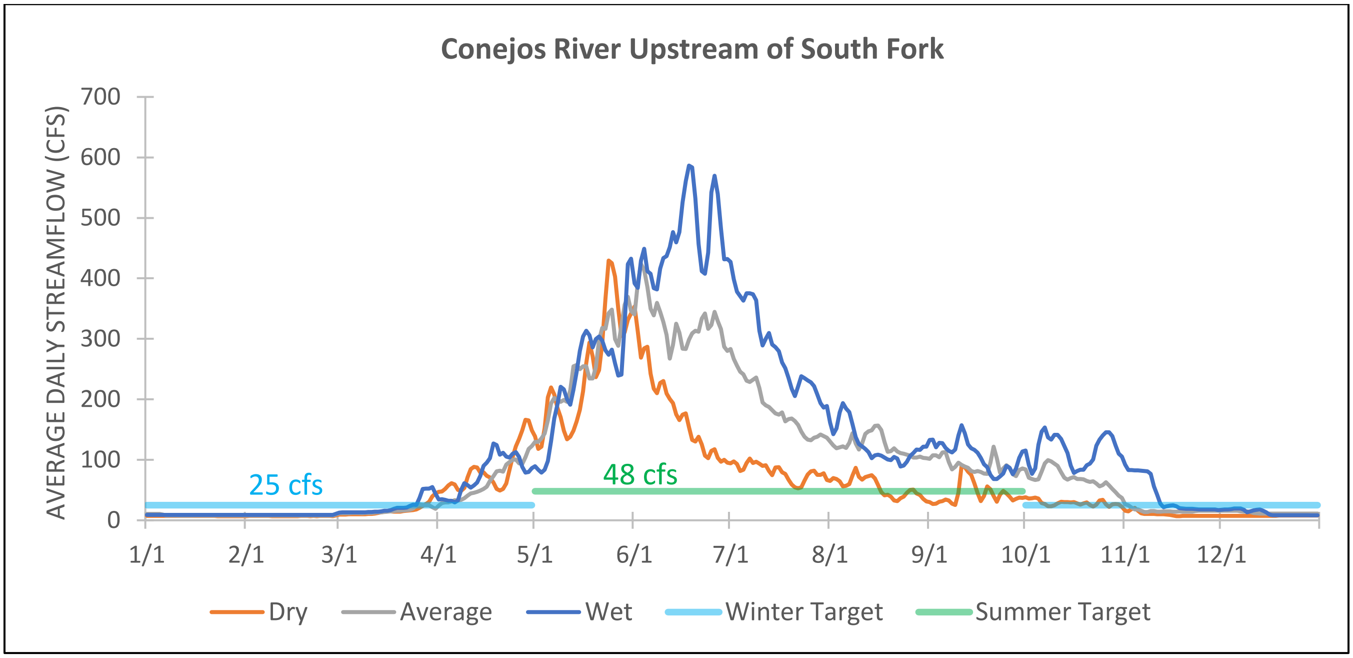
Watershed setting	River Style	Characteristics	Representative Photo
Transport	Confined valley occasional floodplain pockets	Small and discontinuous floodplain pockets, controlled largely by margin structures. Riffles, runs and rapids with occasional larger wood-generated or step pools. Occasional but irregular instream bar formations.	

Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity
This Conejos River study reach sits in a narrow, confined valley. The valley size and shape are the result of water downcutting through bedrock in combination with bedrock faulting (as opposed to glacial scour as dominates the valleys above this reach). Sediments are dominated by cobble and small boulders. Within the study reach, the primary sediment source is colluvium brought down from the adjoining hillslopes and alluvium brought down from several small fans. Most sediment contributed from up higher in the watershed is either trapped in Platoro Reservoir or largely settled out in the alluvial pocket in the reach upstream. The base level of the river is controlled by bedrock. The channel is generally a SEM stage 1 - its reference condition. The sinuosity of this reach is a result of bedrock outcroppings, the channel meandering into softer pockets of hillslope colluvium and/or being pushed into hillslopes by alluvial fans coming from side drainages. The sensitivity of this reach is low.

Stressors	Degree of Geomorphic Impairment
Other than the influence of Platoro Reservoir on the hydrology and sediment supply, there are limited stressors affecting this reach.	A-

CR04 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR04	DRY	AVERAGE	WET
Winter	28%	30%	38%
Summer	77%	100%	100%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

CR04 Riparian Vegetation

Overall, this site (CRVeg04) appears to be in very good condition, receiving an overall EIA rating of B+ (3.33). The lowest individual metric rating was for Condition of Natural Buffer – Vegetation and Native Plant Species Cover (C-) (Table 3.9).

Table 3.9: EIA Scorecard – CRVeg04.

CRVeg04 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**3.33**	**B+**
Rank Factor: LANDSCAPE CONTEXT	0.30			**3.13**	**B+**
LANDSCAPE METRICS	0.33			**3.50**	**A-**
L1. Contiguous Natural Land Cover	1	A	4		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			**2.94**	**B-**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	B	3		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	B	3		
Rank Factor: CONDITION	0.70			**3.42**	**B+**
VEGETATION METRICS	1			**3.42**	**B+**
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	A	4		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	A	4		
V5. Regen. of Native Woody Species **(opt.)**	1	A	4		
V65. Coarse and Fine Woody Debris **(opt.)**	1	A	4		

The scores of both Condition of Natural Buffer – Vegetation and Native Plant Species Cover metrics were impacted by the average relative cover of native species for this site, which was 74%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (37.5%, 3.5%, 0%, and 37.5%), *Taraxacum officinale* (7.5%, 1.5%, 3.5%, and 7.5%), *Phleum pretense* (0%, 0%, 17.5%, and 7.5%), and *Trifolium repens* (0%, 0%, 3.5%, and 7.5%). These nonnatives did not result in monocultures and overall plant species diversity was relatively high compared to the other Conejos River AAs. Further, no noxious species were observed at this site.

The average mean C-value for native species was 5.4, while the average cover-weighted mean C-value was only 5.5 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Current land uses observed and their approximate cover within the 500 m buffer include light grazing on rangeland (68%), management for native vegetation (15%), moderate grazing on rangeland (10%), moderate recreation (5%), and unpaved roads (2%). Dispersed campsites occur within 200 m of the river to the east and several anglers were encountered during fieldwork. It is likely this area experiences moderate to high recreational activity (especially across the dispersed campsite areas) throughout the summer.

Results from the reach-scale RCA assessment also indicated heathy riparian vegetation with a B+ rating. The only mild identified stressor was roads. The average of the EIA and RCA ratings is B+.

CR04 Water Quality and Aquatic Life

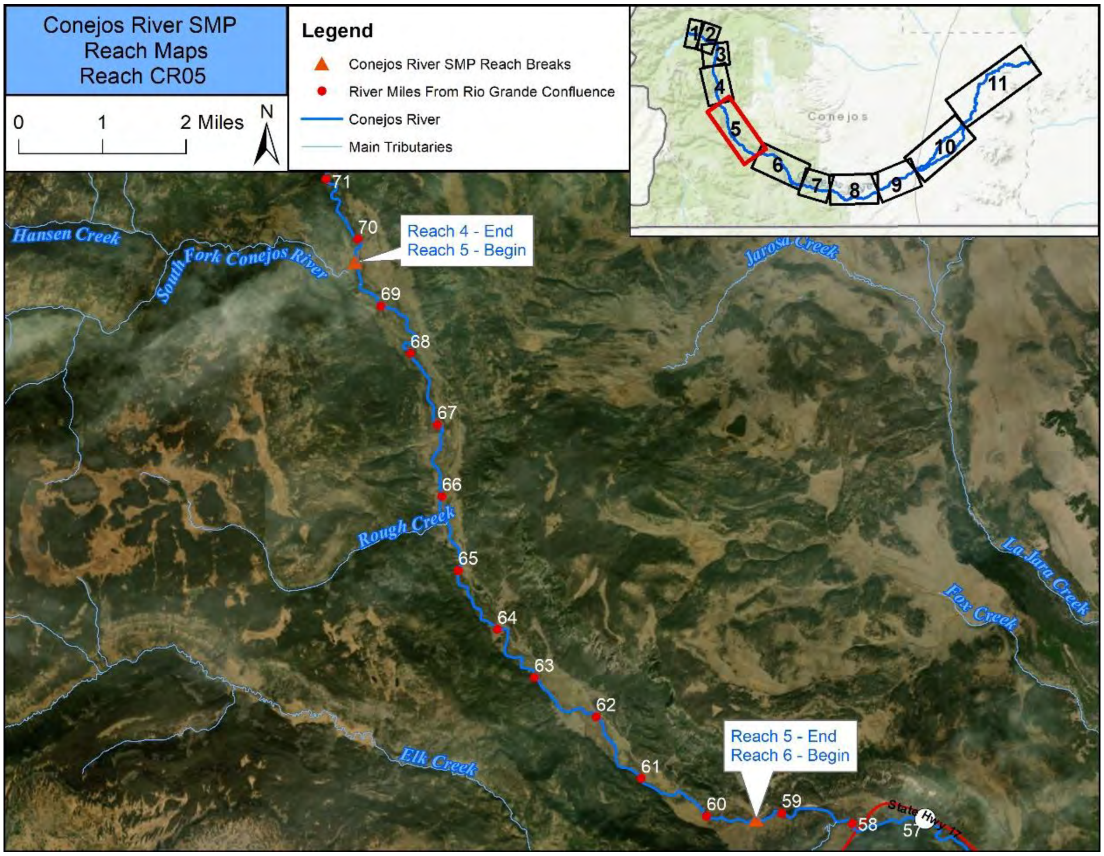
Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
55.8	C	N/A	N/A
Overall Rating			**C**

Water quality in this reach is excellent with no state water quality standards exceedances. An average MMI score of 55.8 indicates significant impairment to macroinvertebrate communities, however key functional groups remain intact. The source of macroinvertebrate impairment is unknown. Trout data was not available.

3.2.5 CR05 – South Fork Conejos River Confluence to Horca

From the South Fork Conejos River confluence with the main stem to a point just upstream of the Elk Creek confluence, the town of Horca, and the Highway 17 bridge.



Representative Reach Photo

CR05 Conditions Assessment Overview

Reach: CR05		Major Stream Condition Stressors												
Parameter	**Condition Rating**	**Crossings and diversions**	**Roads and railways**	**Floodplain disconnection**	**Channelization and armoring**	**Fill and floodplain conversion**	**Flow alteration: impoundments**	**Flow alteration: diversions**	**Abandoned mine lands**	**Exotic/naturalized plant species**	**Exotic aquatic species**	**Lack of woody material**	**Hillslope/channel erosion**	**Unknown source**
Geomorphology	B+	X				X	X							
Riparian Vegetation	B		X			X								
Water Quality	A													
Aquatic Life	B+													
Diversion Structures	N/A													

A	**B**	**C**	**D**	**F**	**Not Assessed**

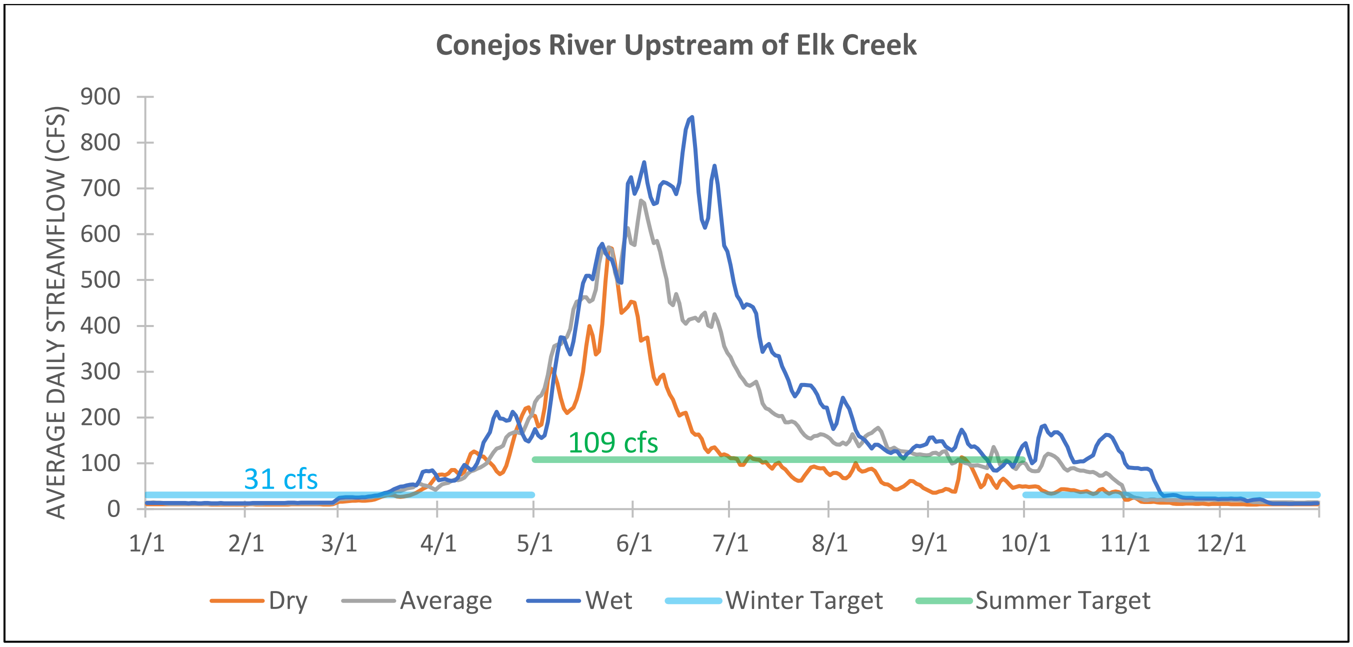
*For an explanation of reach ratings, see Section 2.

CR05 Geomorphology

Reach	Location Description							
CR05	South Fork Conejos River Confluence to Horca							
Confine-ment	D50 (mm)	Bed Comp.	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Partially-confined	46-66	Coarse Gravel	Riffle-pool	Riffle-pool	1	0	Coarse Equilibrium & Fine Deposition	Coarse Equilibrium & Fine Deposition
Valley Slope	Stream Power △	Bed Mobility Threshold Flows	Bed Mobility Frequency	Overbank Flow Estimate		Overbank Flow Frequency		
0.25%	↓	1600-1800 cfs	Extreme Events Only	Extreme Events Only		Extreme Events Only		
Watershed setting		River Style	Characteristics				Representative Photo	
Response		Low-Moderate Sinuosity Planform-Controlled Discontinuous Floodplain	Similar to elongated discontinuous floodplain but with slightly increased sinuosity and tendency to exhibit active meandering activity and channel features in planform. Channel still abuts confining valley margins frequently. Increased presence of meander-related geomorphic floodplain and channel features including paleo channels, meander cutoffs, cutbanks; multiple instream bar types.					
Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity								
This Conejos River study reach sits in a partially-confined valley comprised of glacial outwash deposits and modern alluvium. Fan deposits and outwash terraces along the valley margins along with bedrock landforms influence the channel's location on the valley bottom. Sediment is contributed from tributaries and hillslope colluvium. The channel is generally a SEM stage 1 (a departure from Stage 0) due to the absence of connecting/maintaining overbank flows. The sensitivity of this reach is moderate.								
Stressors							Degree of Geomorphic Impairment	
Platoro Reservoir influence on the hydrology and sediment supply becomes less as the river picks up major tributaries such as the South Fork near the top of this reach. Stressors include development, undersized crossings, and riparian area impacts.							B+	

CR05 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR05	DRY	AVERAGE	WET
Winter	33%	38%	43%
Summer	44%	72%	93%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

CR05 Riparian Vegetation

Two riparian vegetation sites were assessed within this reach: CRVeg05a and CRVeg05b.

CRVeg05a: Overall, this site appears to be in very good condition with an overall EIA rating of B+ (3.34). The lowest individual metric ratings it received were for Condition of Natural Buffer – Vegetation (C), and Native Plant Species Cover (C-) (Table 3.10).

Table 3.10: EIA Scorecard – CRVeg05a.

CRVeg05a Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**3.34**	**B+**
Rank Factor: LANDSCAPE CONTEXT	0.30			**3.15**	**B+**
LANDSCAPE METRICS	0.33			**3.00**	**B+**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			**3.22**	**B+**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	B	3		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	A	4		
Rank Factor: CONDITION	0.70			**3.42**	**B+**
VEGETATION METRICS	1			**3.42**	**B+**
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	A	4		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	A	4		
V5. Regen. of Native Woody Species **(opt.)**	1	A	4		
V65. Coarse and Fine Woody Debris **(opt.)**	1	A	4		

The average relative cover of native species for this site (70%) impacted both of the low scoring individual metrics above. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (3.5%, 7.5%, 37.5%, and 37.5%), *Taraxacum officinale* (7.5%, 7.5%, 17.5%, and 7.5%), *Phleum pratense* (0%, 0%, 37.5%, and 17.5%), and *Trifolium repens* (7.5%, 7.5%, 0%, and 17.5%). The nonnative species at this site are essentially naturalized in this region. Further, these nonnatives did not result in monocultures and there were no noxious species observed at this site.

The average mean C-value for native species was 5.2, while the average cover-weighted mean C-value was only 5.1 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Current land uses observed and approximate cover within the 500 m buffer include light grazing on rangeland (53%), management for native vegetation (30%), moderate grazing on rangeland (10%), moderate recreation (5%), and unpaved roads (2%). The Conejos Campground is located immediately adjacent to this AA. Recreational activity via camping, fishing, and hiking access appeared to be at moderate levels during fieldwork. Livestock (cows) were also observed actively grazing nearby, with access to the AA. The overall ecological integrity of this site can likely be maintained by limiting the amount of access livestock have to this section of the riparian corridor, or ensuring sufficient grazing area so that cattle can disperse themselves across a large area while grazing this allotment.

CRVeg05b: Overall, this site appears to be in very good condition, receiving an overall EIA rating of B+ (3.27). The lowest individual metric ratings it received were for Condition of Natural Buffer – Vegetation (C), and Native Plant Species Cover (C-) (Table 3.11).

Table 3.11: EIA Scorecard – CRVeg05b.

CRVeg05b Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				3.27	B+
Rank Factor: LANDSCAPE CONTEXT	0.30			3.31	B+
LANDSCAPE METRICS	0.33			3.00	B+
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			3.46	B+
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	A	4		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	A	4		
Rank Factor: CONDITION	0.70			3.25	B+
VEGETATION METRICS	1			3.25	B+
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	A	4		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	A	4		
V5. Regen. of Native Woody Species (opt.)	1	B	3		
V65. Coarse and Fine Woody Debris (opt.)	1	A	4		

The average relative cover of native species for this site (65%) impacted both of the low scoring individual metrics above. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (7.5%, 37.5%, 37.5%, and 62.5%), *Taraxacum officinale* (7.5%, 0.5%, 3.5%, and 1.5%), and *Phleum pretense* (3.5%, 0%, 7.5%, and 0%). The nonnative species at this site are essentially naturalized in this region. Further, these nonnatives did not result in monocultures and there were no noxious species observed at this site.

The average mean C-value for native species was 5.3, while the average cover-weighted mean C-value was only 4.9 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Current land uses observed and approximate cover within the 500 m buffer include light grazing (68%), moderate grazing along riparian corridor (20%), light recreation (fishing access) (10%), and unpaved roads (2%). There is a private property located just south and east of this site, which occurs within the 500 m buffer of the AA. There are no domestic structures located within the buffer, but there appears to be livestock grazing activity of unknown intensity (based on aerial imagery). It also appears that grazing access on the private property may connect to the national forest access that includes the AA. General observations of plots 1-3 were that the majority of willows observed were seedlings, with more mature individuals lacking. This may be the result of moderate to occasionally heavy grazing and browsing pressure.

Results from the reach-scale RCA assessment also indicated heathy riparian vegetation with a B- rating. Mild stressors identified include roads and minor development. The average of the EIA and RCA ratings is B.

CR05 Water Quality and Aquatic Life

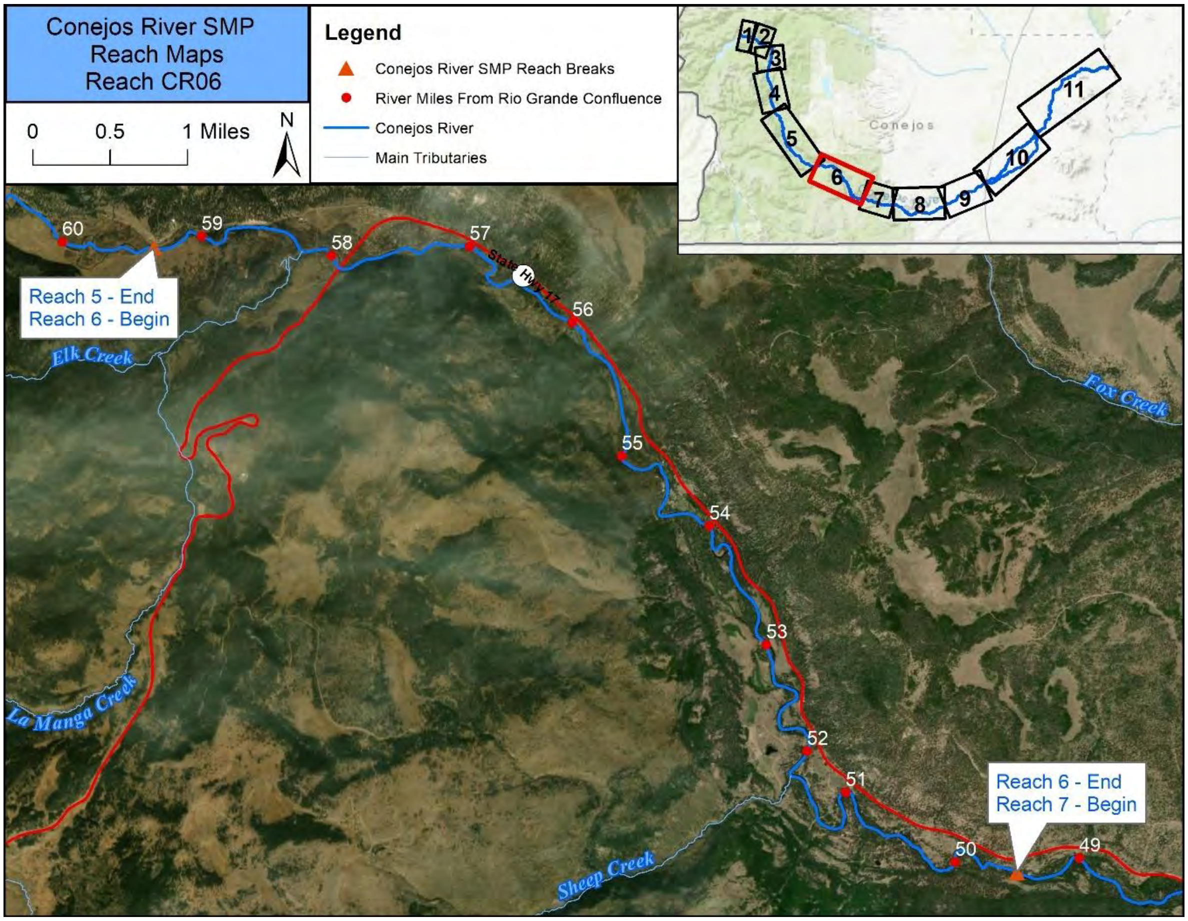
Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
82.8	A-	42.8	B+
Overall Rating			**B+**

Water quality in this reach is excellent with no state water quality standards exceedances. This reach supports a very healthy benthic macroinvertebrate community near reference condition with an average MMI score of 82.8. Fish surveys also indicate healthy trout fisheries.

3.2.6 CR06 – Horca to Aspen Glade Campground

From a point just upstream of the Elk Creek confluence to the upstream boundary of Aspen Glade campground. The lower half of this reach, from Menkhaven Resort to Aspen Glade campground, is known as the "fly water," a special fishing regulation reach allowing only artificial flies.



Representative Reach Photo

CR06 Conditions Assessment Overview

Reach: CR06		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	C+	X	X	X		X	X							
Riparian Vegetation	B					X								
Water Quality	A													
Aquatic Life	A-													
Diversion Structures	N/A													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

CR06 Geomorphology

Reach	Location Description
CR06	Horca to Aspen Glade Campground

Confine-ment	D50*	Bed Comp.*	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Partially-confined	No Data	No Data	Riffle-pool	Riffle-pool	7	8	Coarse Equilibrium & Fine Deposition	Coarse Equilibrium & Fine Deposition

Valley Slope	Stream Power △	Bed Mobility Threshold Flows*	Bed Mobility Frequency*	Overbank Flow Estimate*	Overbank Flow Frequency*
0.45%	↔	No Data	No Data	No Data	No Data

Watershed setting	River Style	Characteristics	Representative Photo
Response	Elongated discontinuous floodplain, bedrock and/or terrace confined	Low to moderate sinuosity reaches in partially confined valleys; channel bed in predominantly alluvial materials; various bar types, run and pool complexes, well developed floodplain typically on one side of the river; lateral channel movements occur but are largely confined by valley margins for a majority but not all of linear channel distance. Confining margins variously include bedrock, terraces, alluvial fans, and extensive colluvium stretches.	

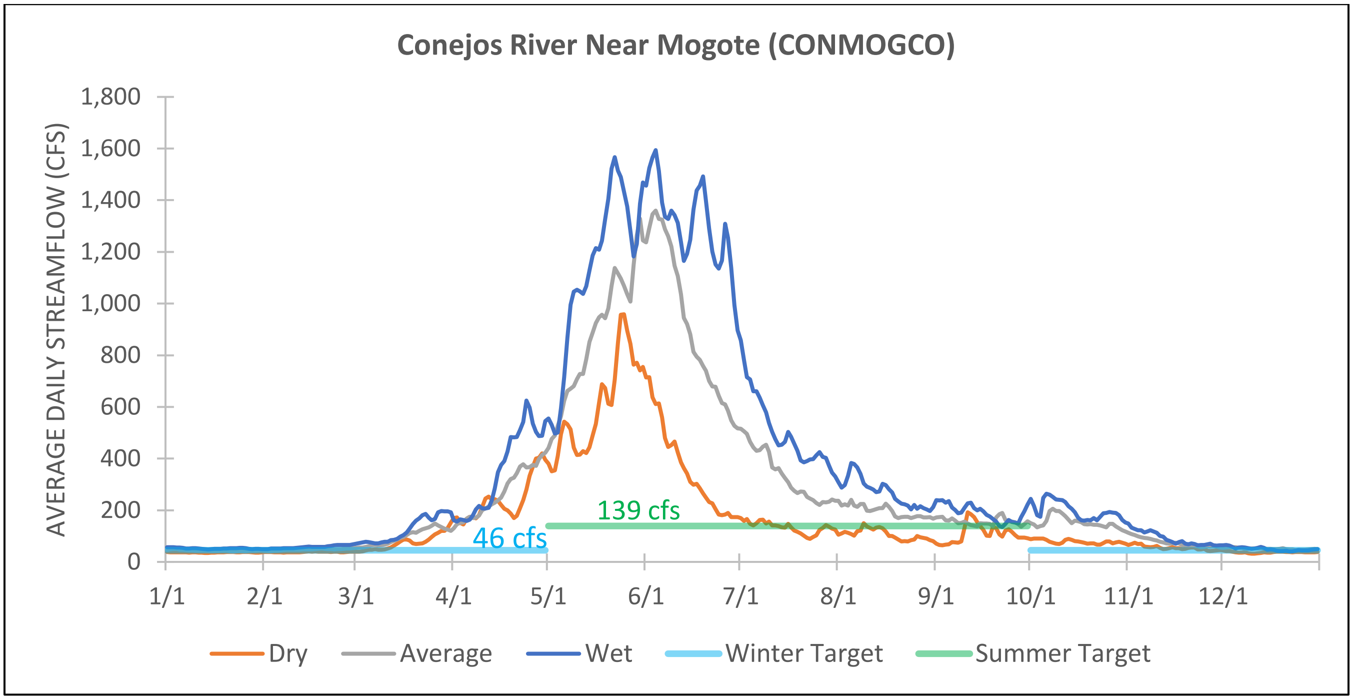
Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity
This Conejos River study reach sits in a partially-confined alluvial valley. The modern channel is set within glacial outwash terraces. Fan deposits along the valley margins push the channel's location and contribute sediment to the system. Sediment is also contributed from tributaries and hillslope colluvium. The channel is generally a SEM stage 1 (a departure from its reference condition stage 0). The sensitivity of this reach is moderate.

Stressors	Degree of Geomorphic Impairment
Floodplain disconnecting roads, undersized crossings, development, riparian impacts.	C+

*The cross sections collected in this reach are in the lowest part of CR06. However, they were located in the confined segment of the reach which is more reflective of the conditions in CR07 and as such, the results are reported there.

CR06 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR06	DRY	AVERAGE	WET
Winter	54%	86%	96%
Summer	52%	98%	100%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats. *Note: the aquatic habitat flow targets and hydrograph above are applied to reaches CR06 through CR08.*

CR06 Riparian Vegetation

Overall, this site (CRVeg06) appears to be in good condition with an overall EIA rating of B- (2.73). The lowest individual metric ratings it received were for Condition of Natural Buffer – Soils (C) and Condition of Natural Buffer - Vegetation (C), Native Plant Species Cover (D), Vegetation Structure (C), and Regeneration of Native Woody Species (C) (Table 3.12).

Table 3.12: EIA Scorecard – CRVeg06.

CRVeg06 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**2.73**	**B-**
Rank Factor: LANDSCAPE CONTEXT	0.30			**2.89**	**B-**
LANDSCAPE METRICS	0.33			**3.00**	**B+**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			**2.83**	**B-**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	A	4		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	C	2		
Rank Factor: CONDITION	0.70			**2.67**	**B-**
VEGETATION METRICS	1			**2.67**	**B-**
V1. Native Plant Species Cover	1	D	1		
V2. Invasive Nonnative Plant Species Cover	1	A	4		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	C	2		
V5. Regen. of Native Woody Species **(opt.)**	1	C	2		
V65. Coarse and Fine Woody Debris **(opt.)**	1	A	4		

The Condition of Natural Buffer – Vegetation and Native Plant Species Cover were most impacted by an average relative native plant cover of only 45%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (37.5%, 62.5%, 62.5%, and 62.5%), *Trifolium repens* (37.5%, 3.5%, 3.5%, 37.5%), *Agrostis stolonifera* (7.5%, 17.5%, 17.5%, and 17.5%), and *Taraxacum officinale* (0%, 7.5%, 7.5%, and 7.5). No noxious species were observed.

The average mean C-value for native species was 5.5, while the average cover-weighted mean C-value was only 5.5 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Condition of Natural Buffer – Soils, Regeneration of Native Woody Species, and Vegetation Structure were most impacted by moderate to heavy livestock grazing and trampling at this site. Active grazing was occurring during field sampling, and significant "mowing" of willows (*Salix* spp.), alder (*Alnus incana*), and narrowleaf cottonwood (*Populus angustifolia*) was observed throughout the site. The height of these native woody species had been browsed to make them appear uniformly dwarfed. Both mature and seedling age groups of native woody species were lacking in addition to a lack of litter cover, suggesting that this site may not have sufficient recovery time between grazing periods.

Current land uses observed and approximate cover within the 500 m buffer include light grazing (73%), moderate grazing adjacent to the riparian corridor (20%), moderate recreation (fishing access and associated trails) (5%), and paved roads (2%). Overall, this site appears to be more heavily impacted by grazing and recreation than Conejos sample sites upstream of this location that are also grazed.

Results from the reach-scale RCA assessment also indicated heathy riparian vegetation with a B+ rating. The only mild identified stressor was roads. The average of the EIA and RCA ratings is B.

CR06 Water Quality and Aquatic Life

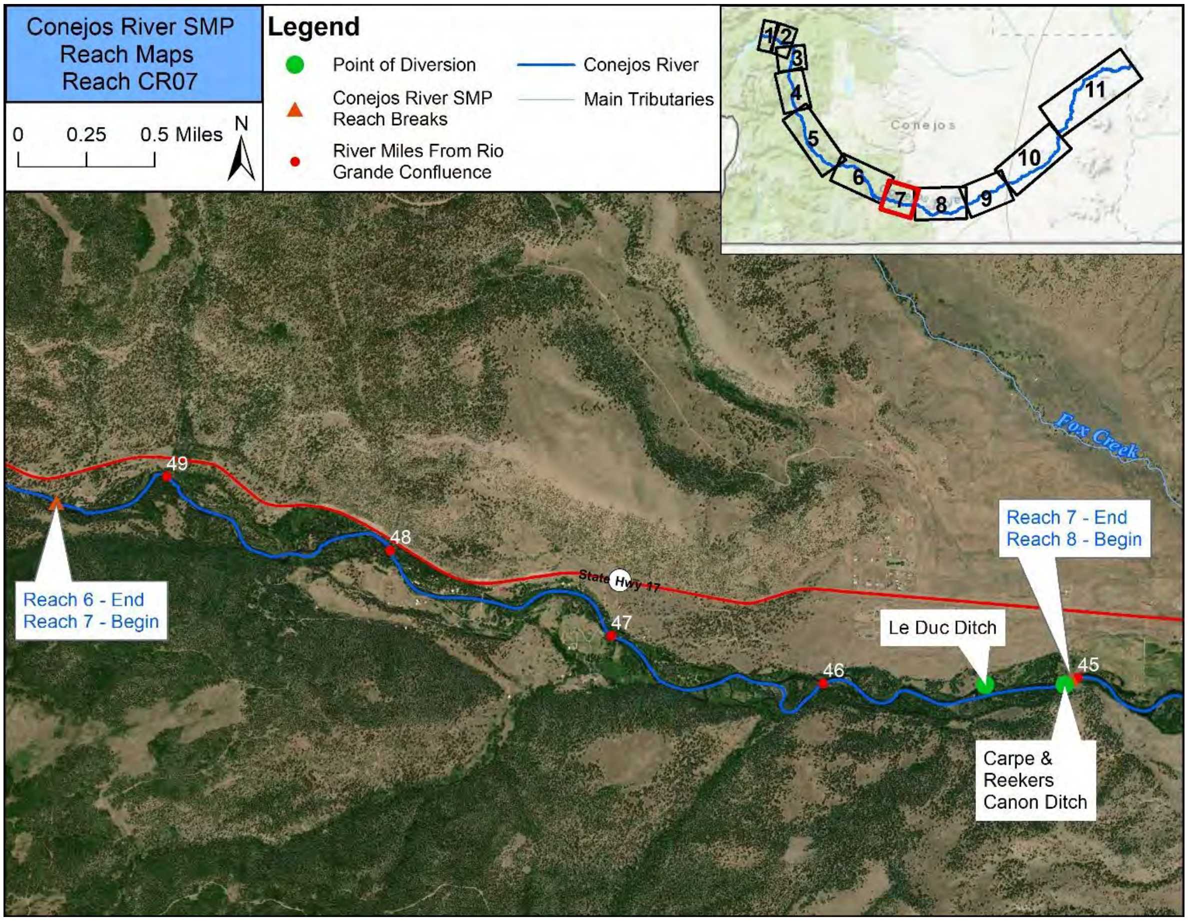
Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
69	B-	>60	A
Overall Rating			**A-**

No water quality impairments were identified. This reach supports a healthy BMI community with an average MMI score of 69. Fish surveys indicate very healthy trout fisheries with gold medal–eligible waters.

3.2.7 CR07 – Aspen Glade Campground to Carpe and Reekers Canon Ditch

This reach extends from the upstream boundary of Aspen Glade campground downstream to where the valley confinement changes just downstream of Carpe and Reekers Canon Ditch.



Representative Reach Photo

CR07 Conditions Assessment Overview

Reach: CR07		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	C+		X		X	X	X							
Riparian Vegetation	B			X		X								
Water Quality	A													
Aquatic Life	A-													
Diversion Structures	B													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

CR07 Geomorphology

Reach	Location Description
CR07	Aspen Glade Campground to Carpe and Reekers Canon Ditch

Confine-ment	D50 (mm)*	Bed Composition*	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Partially-confined	101-120	Cobble	Riffle-pool	Riffle-pool	7	8	Coarse Equilibrium & Fine Deposition	Coarse Equilibrium & Fine Deposition

Valley Slope	Stream Power △	Bed Mobility Threshold Flows*	Bed Mobility Frequency*	Overbank Flow Estimate*	Overbank Flow Frequency*
0.65%	↔	Extreme Events Only	Extreme Events Only	Confined Reach, not calculated	Confined Reach, not calculated

Watershed setting	River Style	Characteristics	Representative Photo
Response	Elongated discontinuous floodplain, bedrock and/or terrace confined	Low to moderate sinuosity reaches in confined and partially confined valleys; channel bed in predominantly alluvial materials; various bar types, run and pool complexes, well developed floodplain typically on one side of the river; lateral channel movements occur but are largely confined by valley margins for a majority, but not all, of the linear channel distance. Confining margins variously include bedrock, terraces, alluvial fans, and extensive colluvium stretches.	

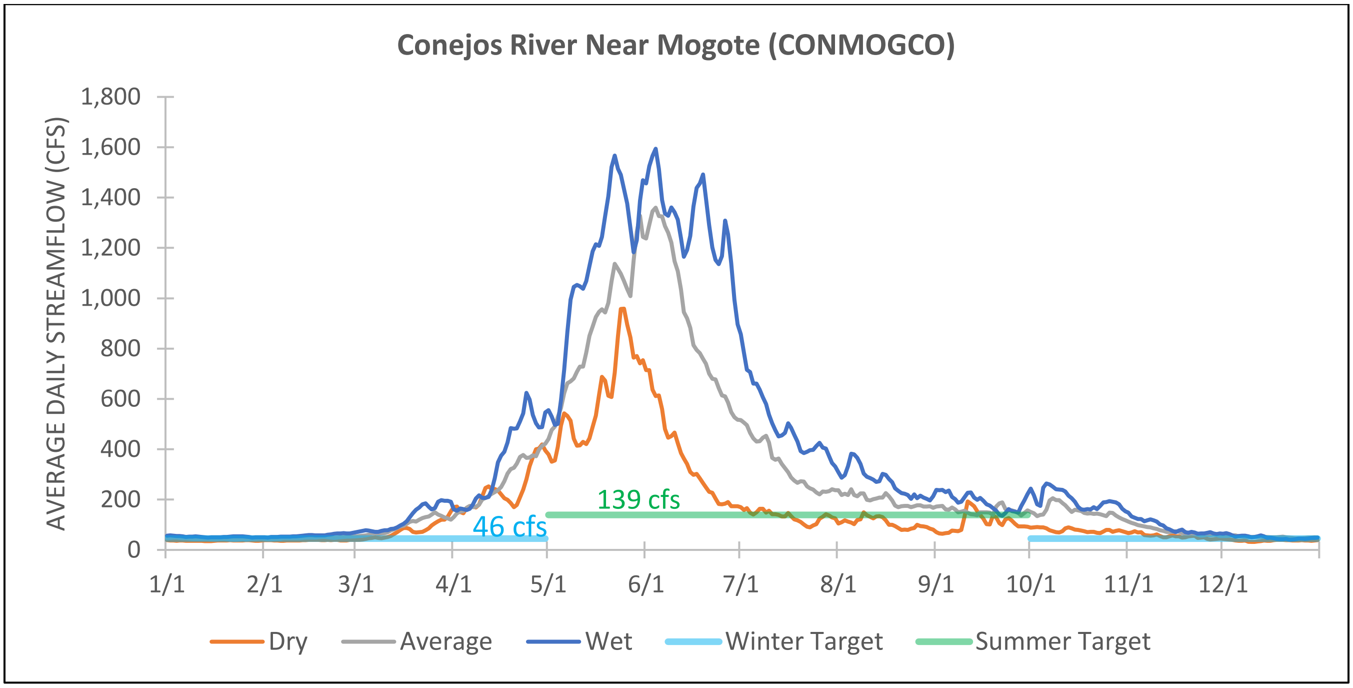
Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity
This Conejos River study reach sits in a partially-confined alluvial valley. The modern channel is set within glacial outwash terraces and occasional bedrock outcrops. Fan deposits along the valley margins influence the channel's location and contribute sediment to the system. Sediment is contributed from tributaries and hillslope colluvium. The channel is generally a SEM stage 1. The sensitivity of this reach is moderate.

Stressors	Degree of Geomorphic Impairment
Two headgates are located at the downstream end of the reach. Limited development exists.	C+

*The cross sections used for bed mobility and floodplain activation flows were located in the lowest part of CR06. However, they were located in the confined segment of the reach which is more reflective of the conditions in CR07 and as such, the results are reported here.

CR07 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR07	DRY	AVERAGE	WET
Winter	54%	86%	96%
Summer	52%	98%	100%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats. *Note: the aquatic habitat flow targets and hydrograph above are applied to reaches CR06 through CR08.*

CR07 Riparian Vegetation

An EIA site was not completed in this reach. Results from the reach-scale RCA assessment indicated overall heathy riparian areas. Mild stressors were identified including roads and development. The reach received an overall rating of B.

CR07 Water Quality and Aquatic Life

Water Quality		
Temperature	Chemical Conditions	Nutrients
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	Overall MMI Rating	Trout (lbs/acre)	Trout Rating
69	B-	>60	A
Overall Rating			**A-**

No water quality impairments were identified. The average MMI score and trout biomass data from CR06 is assumed to apply to this reach given the close proximity and similarities of the two reaches.

CR07 Diversion Infrastructure

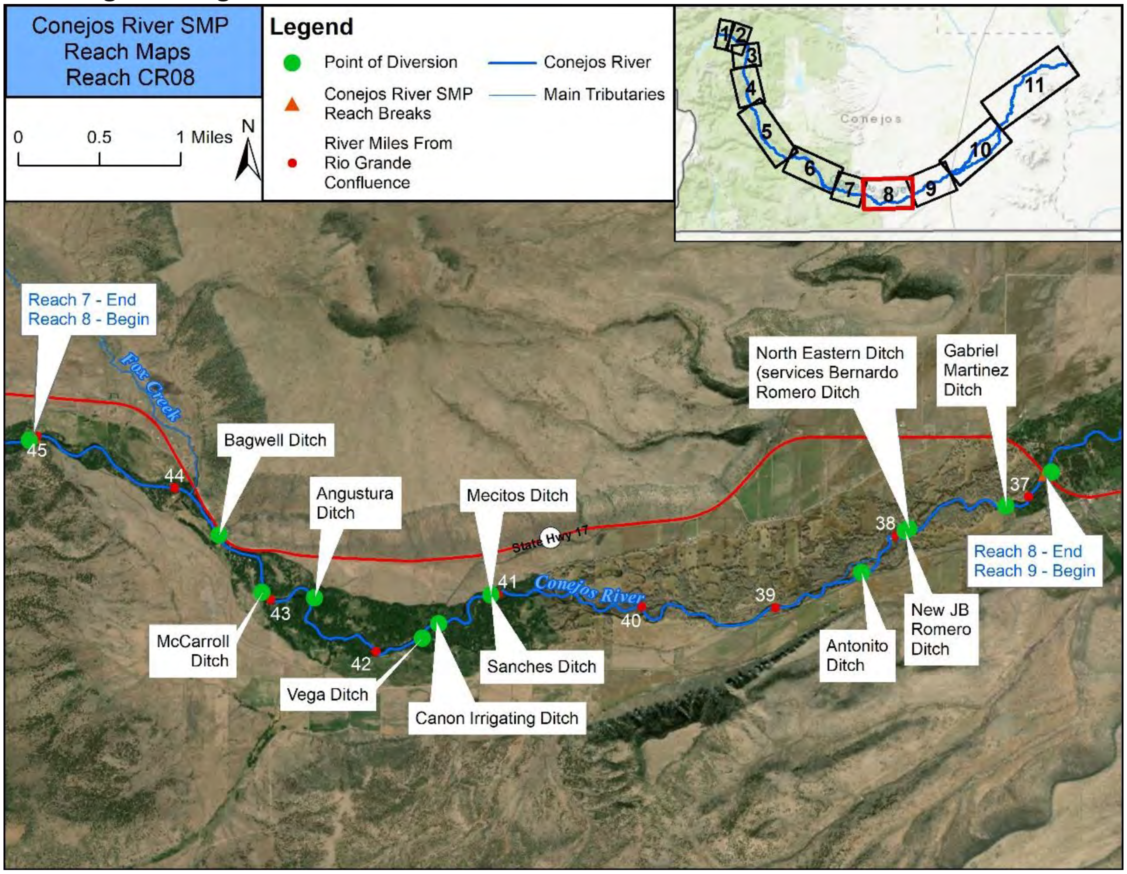
***Refer to reach overview map above for diversion structure locations.**

Le Duc Ditch: This structure's river headgate is located on the north bank of the Conejos River. It leads to an approximately 720 ft long feeder channel which leads to the main headgate. No formal diversion dam exists, but the elevation of the river headgate is sufficient to deliver water when the ditch is in priority. Debris accumulates at the river headgate, but does not pose a significant maintenance issue for the structure. There is minor erosion occurring downstream of the river headgate, but it does not appear to be adversely affecting the structure. The TAT recommends improving or replacing the main headgate and resetting the flume. Headgate and flume improvements would improve accuracy and reduce maintenance.

Carpe & Reekers Canon Ditch: A U-shaped rock weir diversion dam directs water toward the headgate, which sits along the south bank of the river. The headgate is located on the outside of a small bend in the stream, which has not migrated significantly in the recent past. Woody debris accumulates at the headgate and overflow gate and the ditch has difficulty diverting during extremely low flow conditions. The Parshall flume is approximately 0.5 mile down the ditch. The ditch downstream of the headgate experiences substantial conveyance losses due to its geologic characteristics. The TAT recommends installing a trash rack and considering modifications to the diversion to divert water at all flow levels. Additionally, the ditch could be lined to reduce conveyance loss, however the gate can be adjusted to compensate and lost water through seepage recharges the adjacent river.

3.2.8 CR08 – Carpe and Reekers Canon Ditch to Highway 17 Bridge in Mogote

This reach extends from just downstream of the Carpe and Reekers Canon Ditch downstream to the Highway 17 bridge in Mogote.



Representative Reach Photo

CR08 Conditions Assessment Overview

Reach: CR08		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	C+	X	X	X	X	X		X						
Riparian Vegetation	B-			X		X								
Water Quality	A													
Aquatic Life	A-	X												
Diversion Structures	C													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

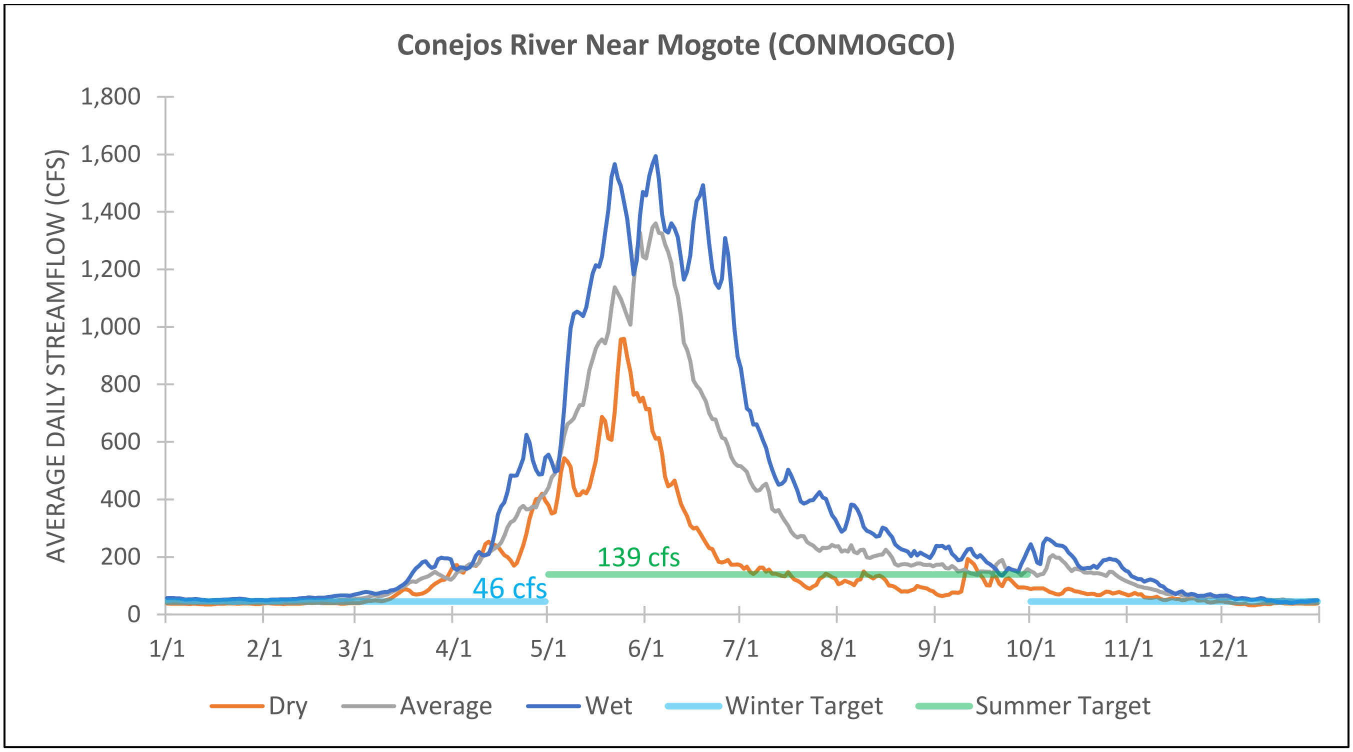
CR08 Geomorphology

Reach	Location Description							
CR08	Carpe and Reekers Canon Ditch to Highway 17 Bridge in Mogote							
Confine-ment	D50 (mm)*	Bed Composition*	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Unconfin ed	108	Cobble	Riffle-pool	Riffle-pool	8	8	Deposition	Deposition
Valley Slope	Stream Power △	Bed Mobility Threshold Flows*	Bed Mobility Frequency*	Overbank Flow Estimate*		Overbank Flow Frequency*		
0.7%	↔	3000 cfs	Extreme events only	Confined		Not Calculated		
Watershed setting		River Style	Characteristics				Representative Photo	
Accumulation		Meandering Coarse Grain Bed	Unconfined channel with moderate to high sinuosity, well developed meandering and associated channel and floodplain geomorphic forms. Range of bar types, floodplain features and floodplain textures; substrate variability depends on habitat-scale geomorphic features such as location in bend, pool, or riffle.					
Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity								
This Conejos River study reach sits in a valley bounded by hillslopes of volcanic origin. At the toe of these hillslopes are glacial outwash terraces which bound the modern river valley bottom. The active river corridor now sits within an alluvial band where channel and floodplain interactions appear common. Within the study reach, the primary sediment source is material eroded from the outwash terraces as well as from shifting channel banks. The channel is generally a SEM stage 8 except in locations where the river has been channelized. The river is sinuous through this reach and expected to be dynamic with lateral and down valley movement of meanders as well as activated cut-offs and secondary channels during high water. That said the system should exhibit an overall meta-stability, meaning that the processes and stressors that drive the rivers dynamism are in a state of relative equilibrium, under the existing conditions of water and sediment delivery from the watershed (Note: changes in these inputs could lead to instability). The sensitivity of the river is high and efforts should be made to avoid further encroachment of it or its active geomorphic floodplain.								
Stressors							Degree of Geomorphic Impairment	
The predominant stressors of the Conejos River in this reach are channelization/straightening, floodplain development, the establishment and maintenance of a single threaded channel on the valley floor, the removal of biotic drivers such as wood and beavers, the change of the valley floor vegetation due to grazing, and altered hydrology and sediment transport due to diversions.							C+	

*Calculations completed in a naturally confined subreach of reach CR08 and many not apply to the unconfined and partially-confined segments of this reach.

CR08 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR08	DRY	AVERAGE	WET
Winter	54%	86%	96%
Summer	52%	98%	100%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats. *Note: the aquatic habitat flow targets and hydrograph above are applied to reaches CR06 through CR08.*

CR08 Riparian Vegetation

Overall, this site (CRVeg08) appears to be in good condition, receiving an overall EIA rating of B- (2.70). The lowest individual metric ratings were for Land Use Index (C), Native Plant Species Cover (C-), and Regeneration of Native Woody Species (C) (Table 3.13).

Table 3.13: EIA Scorecard – CRVeg08.

CRVeg08 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**2.70**	**B-**
Rank Factor: LANDSCAPE CONTEXT	0.30			**2.98**	**B-**
LANDSCAPE METRICS	0.33			**2.50**	**B-**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	C	2		
BUFFER METRICS	0.67			**3.22**	**B+**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	B	3		
B3.1. Condition of Natural Buffer - Veg	n/a	B	3		
B3.2. Condition of Natural Buffer - Soils	n/a	B	3		
Rank Factor: CONDITION	0.70			**2.58**	**B-**
VEGETATION METRICS	1			**2.58**	**B-**
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	B	3		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	B	3		
V5. Regen. of Native Woody Species **(opt.)**	1	C	2		
V65. Coarse and Fine Woody Debris **(opt.)**	1	B	3		

Regarding Native Plant Species Cover, the average relative native species cover was 83%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (37.5%, 37.5%, 0%, and 0%), and *Phleum pratense* (3.5%, 17.5%, 0%, and 0%). The noxious species *Cirsium arvense* and *Verbascum thapsus* were present with average covers of 1.5% and 2%, respectively.

The average mean C-value for native species was 5.0, while the average cover-weighted mean C-value was only 5.3 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Regeneration of Native Woody Species was impacted by dense stands of *Populus angustifolia* saplings which appear to be choking out other vegetation. This may be the result of a change in the course of the channel over time. The river splits into multiple braiding channels along this stretch, and the plant cover suggests a high water table in between the channels at this location. The AA may be located where the channels have shifted in recent years. Flood events likely helped the *P. angustifolia* seedlings establish. Since this event, the soil appears to have built up, enabling an early seral plant community to develop. If soil stability persists, this early seral community will have an opportunity to develop into a mature stand of native woody species dominated by *P. angustifolia.*

Old beaver sign was observed near plot 4, approximately 30 meters north of the main river corridor. Gnawed stumps of old trees were observed, however no signs of recent activity were noted.

Current land uses observed and approximate cover within the 500 m buffer include moderate livestock grazing (60%), non-tilled hayfields (22.5%), light grazing (15%), unpaved roads (2%), and paved roads (0.5%).

Results from the reach-scale RCA assessment indicated significant riparian vegetation impairment with a C+ rating. Stressors identified include roads, minor development, and floodplain conversion. The average of the EIA and RCA ratings is B-.

CR08 Water Quality and Aquatic Life

Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
84.8	A-	N/A	N/A
Overall Rating			**A-**

No water quality impairments were identified. In summer 2019, a water temperature instrument was installed at the Conejos River Near Mogote, CO (CONMOGCO) gage. The new instrument was integrated into the existing Division of Water Resources stream gage data logger, which is remotely uploaded to the DWR's surface water website, along with streamflow and any other data collected at a given gage. This data will be very useful for future water temperature monitoring.

This reach supports a healthy, near-reference benthic macroinvertebrate community with an average MMI score of 84.8. Trout data was not available however it should be noted that diversion structures form multiple barriers to fish passage in this reach and reduce aquatic habitat connectivity.

CR08 Diversion Infrastructure

***Refer to reach overview map above for diversion structure locations.**

Bagwell Ditch: This structure is just upstream of the Mogote stream gage. The diversion dam is minimal but functions well when the ditch is in priority. A sluice gate sits adjacent to the headgate. The ditch runs through a culvert under County Rd D.5. No repair needs were noted at this structure.

McCarroll Ditch: A stacked rock diversion dam directs flow to the river headgate located on the south bank of the mainstem Conejos River. A short feeder channel delivers water from the river to the main headgate. A manually operated 4 ft wide steel slide gate and wood plank weir, at the head of the return flow channel and adjacent to the structure, acts as a diversion and directs water to the headgate. The river is relatively stable both upstream and downstream of the structure, although the river has slowly migrated west since 1998 and a meander was cut off downstream of the diversion sometime between 1975 and 1998. The migration trajectory at this location is not expected to affect this structure. No repair needs were noted at this structure.

Angustura Ditch: There is no diversion dam for this structure. The headgate is located on the north bank of the river. The bank upstream of the headgate is eroding, causing flows to bypass the headgate and enter the ditch, especially at high flows. The headgate also leaks, causing additional flows to enter the ditch. The headgate needs to be repaired or replaced. Bank stabilization is also recommended to ensure the headgate does not experience catastrophic failure during high flows. Although the channel near this structure has migrated historically (pre-1970s), it has not experienced significant lateral migration since 1998 or earlier. The channel upstream of headgate is widening and flows could bypass the headgate, especially at high flows. Given the stressors affecting this structure, the TAT recommends bank stabilization upstream of the diversion as well as riparian revegetation and aquatic habitat restoration. The TAT also recommends maintaining fish passage for aquatic habitat connectivity in this reach. Bank stabilization structures and riparian revegetation would help prevent flows from bypassing the headgate. Alternatively, the headgate and point of diversion could be relocated upstream as a long-term solution to localized erosion at the headgate. Aquatic habitat enhancement, especially the creation of a low-flow channel near the diversion, would improve the fisheries.

Vega Ditch: There is a short feeder channel, located on the south bank of the Conejos River, that leads to the headgate. A rock boulder diversion, at the head of the return flow channel and adjacent to the structure, directs water to the headgate. Water can seep through this diversion. No immediate repair needs were noted at this structure. However, to minimize maintenance and reduce impacts to the river, this diversion could be combined with that of the Canon Irrigating Ditch.

Canon Irrigating Ditch: This ditch's point of diversion is just downstream of the Vega Ditch diversion. There is a feeder channel off the south bank of Conejos River, approximately 600 ft long, that leads to the river headgate. Any water not diverted at the river headgate returns to the river via an approximately 0.25-mile secondary channel. The feeder channel then carries water approximately 1 mile to the Canon Ditch headgate. The headgate sits across the feeder channel adjacent to a return flow channel that directs unused water back to the river. During spring 2019 runoff, the diversion dam partially washed out. Although the river channel in this area has migrated very little in the last 20 years, aerial imagery shows lateral migration prior to 1998. Debris accumulation is an issue at the headgate and return flow structure (see report card). The TAT recommends installing a trash rack above the headgate and considering the addition of telemetry to this structure's Parshall flume. A trash rack would minimize debris accumulation and telemetry would increase efficiency. The TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach.

Mecitos Ditch: The river channel has undergone significant migration, including meander cutoffs, at the point of diversion and especially downstream of the diversion. A U-shaped rock weir diversion dam directs flow to the feeder channel, located on the north bank of the Conejos River. The feeder channel is approximately 820 meters long and delivers water to the Mecitos Ditch headgate. Adjacent to the headgate, a return flow structure with check boards directs unused water back to the river. This ditch has difficulty accessing its full decree during low flow conditions. During 2019 spring runoff, flood flows caused the banks adjacent to the headgate and return flow structure to fail, resulting in flows bypassing the structure completely (see photos in report card). Given the issues identified at this structure, the TAT recommends improving or replacing the diversion dam, stabilizing the banks surrounding the main headgate and diversion dam, adjustment capabilities for the feeder channel, and headgate automation. An improved diversion dam would allow the ditch to access water at all flows and adjustment capabilities for the feeder channel could be improved to better administer the structure's water rights and to minimize the impact of high flow events at the headgate. Bank stabilization would mitigate erosion and reduce sediment accumulation in the feeder channel. Headgate automation would improve efficiency and reduce operating needs. Improved adjustment capabilities may include relocating the point of diversion downstream and/or installing a headgate or other control structure on the feeder channel upstream of the headgate. If the diversion is relocated, the current river channel trajectory should be considered. If it is not relocated, the TAT recommends improving it with a stacked rock or similar structure. The TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach.

Sanches Ditch: For a description of the diversion structure, see Mecitos Ditch, as this structure shares a diversion dam and feeder channel with the Mecitos Ditch. Approximately 1400 ft down the feeder channel, a small diversion dam directs flow north to the Sanches Ditch. A return flow structure with check boards sits adjacent to the Sanches Ditch headgate and directs unused water back to the Mecitos Ditch feeder channel. Debris accumulation is an issue at the headgate and return flow structure (see report card). The TAT recommends installing a trash rack above the headgate to minimize debris accumulation. As noted above, the TAT recommends an improved diversion dam that allows the ditch to divert water at all flows. For a description of recommended improvements to the diversion and feeder channel, see the Mecitos Ditch. Additionally, the TAT recommends repairing or resetting the Parshall flume.

Antonito Ditch: This structure has no formal diversion dam off the Conejos River. Water is delivered to the headgate via a 0.4 mile feeder channel. A small stacked rock diversion dam on the feeder channel directs water to the headgate. Lateral migration is occurring at the point of diversion, and the river has experienced significant avulsion since 1998. Channel migration analysis suggests that in 1960, the river channel followed this structure's feeder channel. This channel may be recaptured in the future. Aside from monitoring channel migration, no repair needs were noted.

New JB Romero Ditch: This structure is located approximately 150 ft upstream of the North Eastern Ditch diversion. Water is diverted off Conejos River into an approximately 0.25 mile feeder channel that delivers water to the main headgate. There is no formal diversion dam on Conejos River, but a small side channel on the river, formed by a gravel bar, diverts water to the feeder channel. Flow in the feeder channel is controlled by stacked boulders located approximately 80 ft off the river. Any water not diverted by this ditch returns to the North Eastern/Bernardo Romero carrier channel. The river channel has migrated in the past, especially upstream of the diversion. During a high flow event, the river could migrate to its historic channel, beginning at the Antonito Ditch point of diversion (see maps in report card), thereby bypassing the point of diversion. Even a small shift in the river channel could result in flows to the feeder channel being cut off. The main headgate is washed out and the measurement structure could not be located at the time of inspection. Given the issues identified at this structure, the TAT recommends resetting the main headgate, installing a flume, improving adjustment capabilities for the feeder channel, improving the conveyance capacity of the feeder channel, and improving upstream channel conditions on Conejos River. Additionally, the TAT recommends installing a river headgate at the point of diversion to reduce maintenance and a small stacked rock diversion dam to more effectively divert water. As an alternate solution, the point of diversion and feeder channel could be combined with that of the North Eastern/Bernardo Romero Ditch to reduce maintenance and impacts to the river. The TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach.

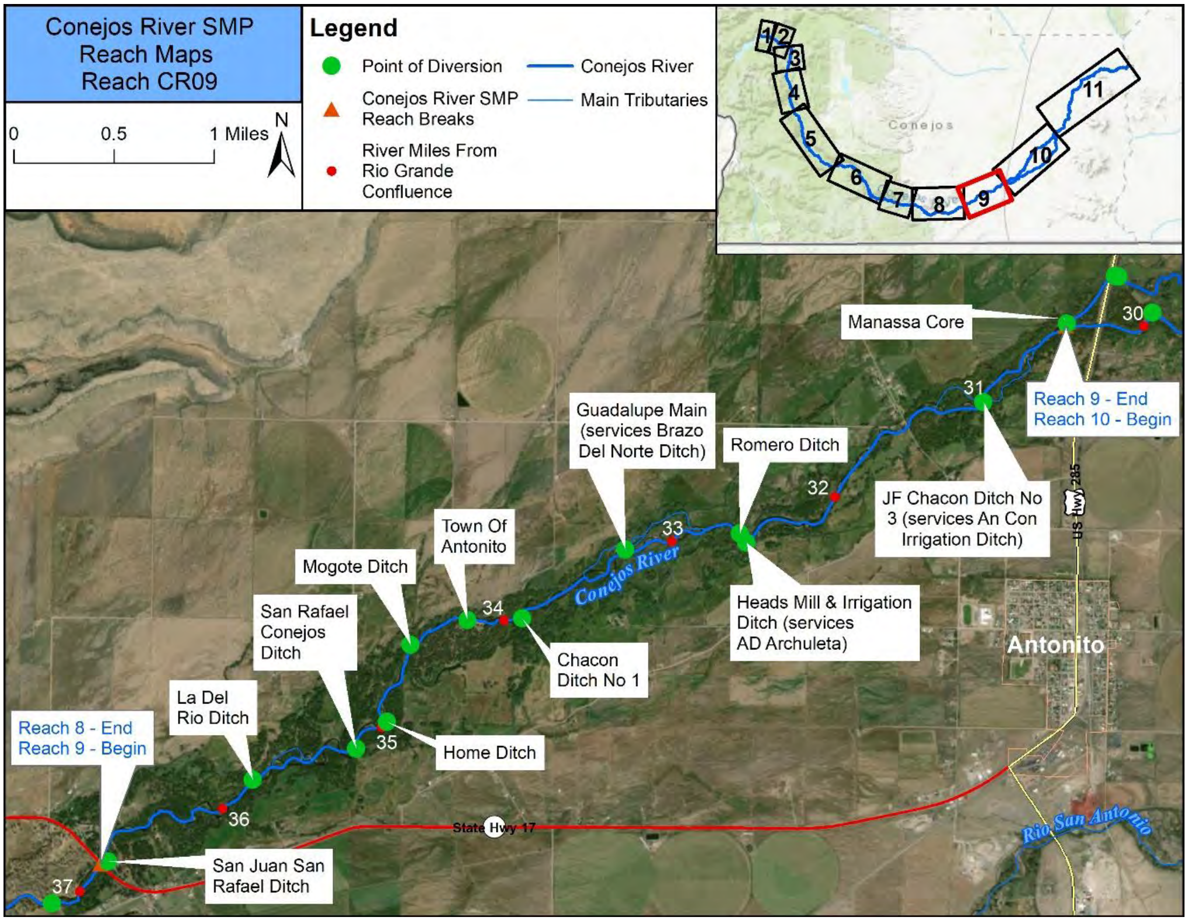
North Eastern Ditch: This structure's diversion is approximately 150 ft downstream of the New JB Romero diversion. Water is diverted off the Conejos River by a boulder diversion dam to a river headgate and carrier channel. Adjacent to the river headgate is a repurposed molasses tank that is intended to prevent high flows from entering the feeder channel. The carrier channel then transports water approximately 1.7 miles to the main headgate, which also services the priority 35 Bernardo Romero Ditch. A check board diversion structure on the feeder channel diverts water to the main headgate, which is often obstructed by debris and sediment. Any unused water returns to the river via an approximately 0.75 mile return flow channel, which reaches the river just upstream of the La Del Rio Ditch. In this area, the river has migrated in the past, as described under the New JB Romero description, and channel avulsion could cause the river to bypass the point of diversion. The river headgate at the point of diversion is tilted and does not function well. The concrete stabilizing the main headgate and diversion dam on the feeder channel are spalling and in poor condition. The banks surrounding the diversion and headgate on the feeder channel need to be built up and reinforced regularly to prevent flows from bypassing the structure. Given the issues identified at this structure, the TAT recommends replacing the river headgate and diversion dam as well as the main diversion and headgate on the feeder channel. The TAT further recommends headgate automation for the main headgate. New diversions and automated headgates would allow this structure to divert water at all flows and would increase efficiency and reduce maintenance. During high flows, the ditch's feeder channel acts as a secondary river channel, thereby dispersing flood flows and reducing downstream risk. The TAT recommends maintaining the feeder channel's overflow capability to mitigate flood risk.

Additionally, the TAT recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach. As noted under the New JB Romero description, an alternate solution to these issues is to combine the point of diversion and feeder channel with that of the New JB Romero Ditch to reduce maintenance and impacts to the river.

Gabriel Martinez Ditch: A U-shaped rock weir diversion dam directs water to the headgate, which is located on the south bank of Conejos River. A sluice gate is adjacent to the headgate. Downstream of the structure, a series of several U-shaped rock structures were installed. Meanders upstream of the structure are growing and channel avulsion has occurred in the past. A series of j-hooks were installed upstream of the structure on the south bank of the river. However, significant bank erosion has continued upstream of the j-hooks. The TAT recommends bank stabilization and riparian revegetation upstream of the structure to reduce erosion and increase channel and bank stability.

3.2.9 CR09 – Highway 17 Bridge in Mogote to the Bifurcation at the Manassa Core Diversion

From the Highway 17 bridge in Mogote downstream to the river's bifurcation into the North Branch and South Branch Conejos River (just upstream of the Highway 285 bridge north of Antonito). This reach marks the river's transition from the San Juan Mountains to the San Luis Valley plains reaches.



Representative Reach Photo

CR09 Conditions Assessment Overview

Reach: CR09		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	C+	X	X	X	X	X		X				X	X	
Riparian Vegetation	B-			X		X				X				
Water Quality	A													
Aquatic Life	B+	X						X			X	X		
Diversion Structures	B													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

CR09 Geomorphology

Reach	Location Description
CR09	Highway 17 Bridge in Mogote to the Bifurcation at the Manassa Core Diversion

Confine-ment	D50 (mm)	Bed Comp.	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Unconfined	36	Coarse Gravel	Riffle-pool	Riffle-pool	0	0	Deposition	Deposition

Valley Slope	Stream Power △	Bed Mobility Threshold Flows	Bed Mobility Frequency	Overbank Flow Estimate	Overbank Flow Frequency
0.7%	↔	1200-1400 cfs	Wet years, for short durations	1200 cfs	Wet years, for short durations

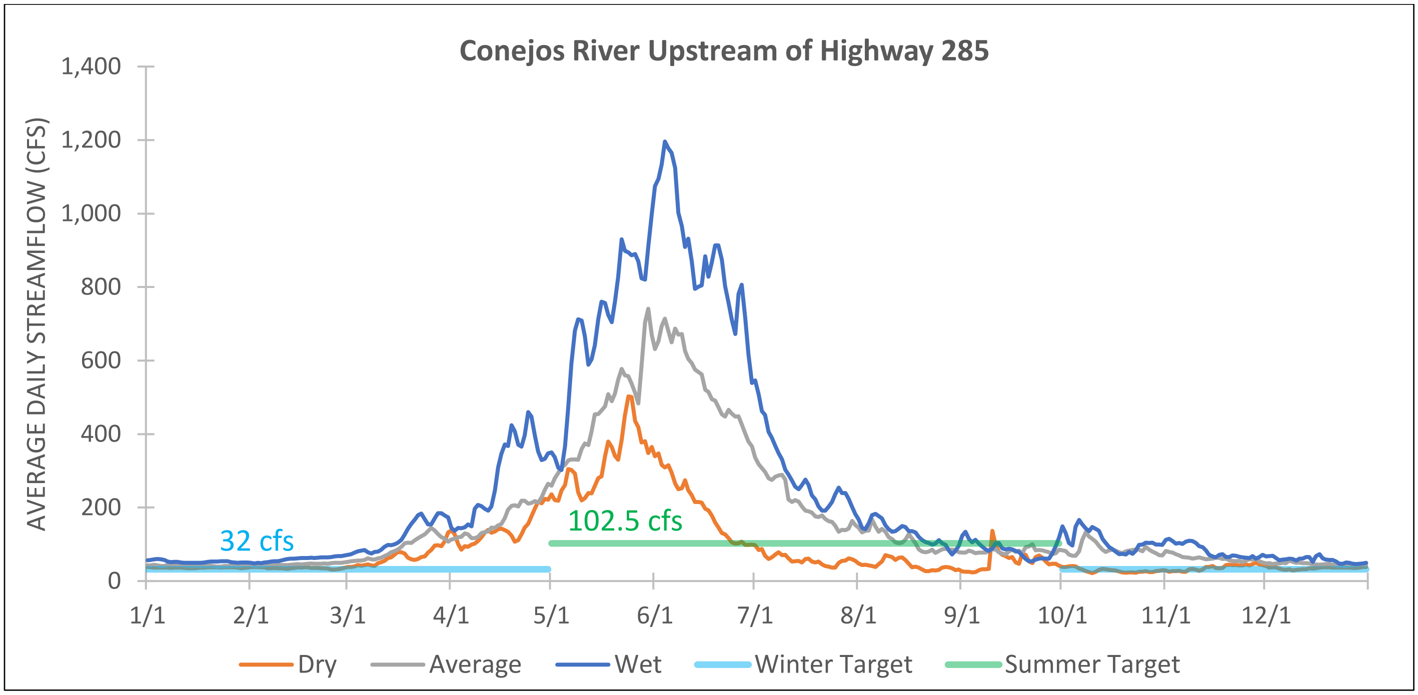
Watershed setting	River Style	Characteristics	Representative Photo
Accumulation	Meandering Coarse Grain Bed	Unconfined channel with moderate to high sinuosity, well developed meandering and associated channel and floodplain geomorphic forms. Range of bar types, floodplain features and floodplain textures; substrate sizes tending toward cobble and large gravel; substrate variability depends on habitat-scale geomorphic features such as location in bend, pool, or riffle.	

Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity
This Conejos River study reach marks the transition from the San Juan Mountains out onto the San Luis Valley plain and the start of the historic distributary system. The reach is located on an ancient outwash fan and features an unconfined meandering channel across a broad flat valley. Within the study reach, the primary sediment source is material brought down to the reach from the upper watershed. The channel is generally a SEM stage 0 except in locations where the river has been channelized. The river is sinuous through this reach and expected to be dynamic with lateral and down valley movement of meanders as well as activated cut-offs and secondary channels during high water. The sensitivity of the river is high and efforts should be made to avoid further encroachment of it or its active geomorphic floodplain.

Stressors	Degree of Geomorphic Impairment
The predominant stressors of the Conejos River in this reach are channelization/straightening, floodplain development, the establishment and maintenance of a single threaded channel on the valley floor, the removal of biotic drivers such as wood and beavers, the change of the valley floor vegetation due to grazing, and altered hydrology and sediment transport due to diversions.	C+

CR09 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR09	DRY	AVERAGE	WET
Winter	80%	100%	100%
Summer	38%	72%	81%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

CR09 Riparian Vegetation

Overall, this site (CRVeg09) appears to be in good condition, receiving an overall EIA rating of B- (2.59). The lowest individual metric ratings include Land Use Index (C), Width of Natural Buffer (C), Condition of Natural Buffer – Vegetation (C), Native Plant Species Cover (C-), Invasive Nonnative Plant Species Cover (C), and Coarse and Fine Woody Debris (C) (Table 3.14).

Table 3.14: EIA Scorecard – CRVeg09.

CRVeg09 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**2.59**	**B-**
Rank Factor: LANDSCAPE CONTEXT	0.30			**2.61**	**B-**
LANDSCAPE METRICS	0.33			**2.50**	**B-**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	C	2		
BUFFER METRICS	0.67			**2.66**	**B-**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	C	2		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	B	3		
Rank Factor: CONDITION	0.70			**2.58**	**B-**
VEGETATION METRICS	1			**2.58**	**B-**
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	C	2		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	A	4		
V5. Regen. of Native Woody Species **(opt.)**	1	B	3		
V65. Coarse and Fine Woody Debris **(opt.)**	1	C	2		

The Land Use Index was mainly impacted by signs of light to moderate grazing and an active access road leading from Highway 285 to a diversion dam located adjacent to the AA. The Width of the Natural Buffer was interrupted by the access road, which runs roughly parallel to the southern boundary of the AA and within approximately 15 meters of the boundary.

Both Condition of Natural Buffer – Vegetation and Native Plant Species Cover were affected by the presence of nonnative species. The average relative cover of native species for this site was 73%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Poa pratensis* (7.5%, 37.5%, 7.5%, and 37.5%), *Agrostis stolonifera* (0%, 17.5%, 17.5%, and 7.5%), *Cirsium arvense* (0%, 3.5%, 7.5%, and 17.5%), and *Bromus inermis* (0%, 0%, 0%, and 17.5%). This site had one of the highest covers for noxious weed species. Although *C. arvense* was the only noxious species encountered within the plots, *Verbascum thapsus* was seen scattered throughout the AA with an estimated overall cover of 2%.

The average mean C-value for native species was 5.0, while the average cover-weighted mean C-value was only 5.0. This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Woody debris appeared to be somewhat excessive at this site leading to a low score for Coarse and Fine Woody debris. Concurrently, there were minimal *Salix* seedlings and saplings encountered across this site. While mature *Salix* species and *Populus angustifolia* were observed throughout the site, the younger age classes occurred infrequently. This could be the result of competition from dense patches of nonnative herbaceous species (see previous paragraph). Current land uses observed and approximate cover within the 500 m buffer include non-tilled hayfields (40%), moderate grazing (30%), light grazing (25%), unpaved roads (2%), paved roads (2%), and diversion dam site (1%).

Results from the reach-scale RCA assessment indicated significant riparian vegetation impairment with a C+ rating. Stressors identified include roads, floodplain conversion, and nonnative plant species. The average of the EIA and RCA ratings is B-.

CR09 Water Quality and Aquatic Life

Water Quality		
Temperature	Chemical Conditions	Nutrients
N/A	A	A
Overall Rating		**A**

Aquatic Life			
Average MMI Score	Overall MMI Rating	Trout (lbs/acre)	Trout Rating
76.5	B+	N/A	N/A
Overall Rating			**B+**

No water quality impairments were identified. This reach supports a healthy benthic macroinvertebrate community with an average MMI score of 76.5. Trout data was not available however it should be noted that diversion structures form multiple barriers to fish passage in this reach and reduce aquatic habitat connectivity.

CR09 Diversion Infrastructure

***Refer to reach overview map above for diversion structure locations.**

San Juan San Rafael Ditch: A feeder channel off the south bank of the Conejos River, approximately 1,500 ft long, directs water to the San Juan San Rafael headgate. The diversion dam is a boulder structure. The headgate sits across the feeder channel on the east bank. A return flow channel with a headgate directs unused water back to the river. The headgate does not seal completely. The TAT recommends headgate repair by installing a rubber mat or otherwise stopping the leak. Upstream of the diversion, the channel has migrated laterally but is not expected to affect the structure.

La Del Rio Ditch: The ditch's diversion dam is made up of a recycled molasses tank and concrete blocks which divert water to headgate, which is located on the north bank of the river. Steel wing walls extend approximately 20 ft both upstream and downstream of the ditch. J-hooks were installed upstream of the structure just prior to 2006. This structure is located downstream of the return flow channel from the Bernardo Romero Ditch. The river in this location is relatively stable. The headgate leaks and the steel wing walls that make up its headwall are aging. The TAT recommends headgate repair (e.g., rubber mat) or replacement. Additionally, if any future improvements are made to the diversion, the TAT recommends aquatic habitat enhancement to create a low flow channel and also recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach.

San Rafael Conejos Ditch: The river is unstable both upstream and downstream of this structure. Large riprap and vehicles are used to stabilize bank upstream of headgate. The diversion dam is made up of a molasses tank and large boulders that diverts water from the mainstem Conejos River to the headgate, which is located on the east bank of the river. The diversion functions moderately well, however water users have difficulty diverting at low flows. Although the channel has migrated significantly in the past, more recent channel migration analysis shows the channel is relatively stable in this area (see report card). Given the issues identified at this structure, the TAT recommends making some adjustments and improvements to the diversion dam and replacing existing bank stabilization materials with improved bank stabilization structures. Diversion improvements and bank stabilization would improve river function and allow water users to divert water more effectively.

Home Ditch: The river is relatively stable in this reach, although channel migration has occurred prior to 1998 (see maps in report card). There is no diversion dam for this ditch. Water is diverted from the mainstem Conejos River to the headgate, which is located on the east bank. Significant bank erosion is occurring near the headgate. The TAT recommends implementing bank stabilization and riparian revegetation to prevent further erosion.

Mogote Ditch: The diversion dam is constructed of repurposed molasses tanks and concrete blocks, which direct water to the headgate, located along the north bank of the Conejos River. The headgate does not completely seal when closed and its headwall is spalling. The channel is relatively stable in this reach, although prior to 1998, the channel did experience some migration (see maps in report card). A small aggregate berm has been pushed up below the headgate outlet in an attempt to prevent water from flowing down the ditch. The diversion dam can accumulate woody debris and requires maintenance. However, it is not a significant issue for water users. The diversion is currently a barrier to fish passage, especially at low flows. Given the issues identified at this structure, the TAT recommends repairing the headgate and its headwall. A new or repaired headgate would increase efficiency and water control, and reduce maintenance. If any improvements are made to the diversion, the TAT also recommends creating fish passage to increase aquatic habitat connectivity.

Town of Antonito Ditch: This structure serves the Town of Antonito municipal water system. The point of diversion is a constant head galley (metal grate) on grade with the river. It enters a pipeline and is transported to the town's municipal water system, also connecting with town well ID #5041. The river channel in this area has migrated very little in the last 45 years and is not expected to shift significantly in the future. This structure is essentially always in priority to provide municipal water to the town. The town maintains this structure and no repair needs were noted.

Chacon Ditch No 1: A U-shaped rock weir diversion dam made up of boulders and debris directs water to the headgate, which is located on the east bank of the river. Concrete walls reinforce the headgate. Concrete blocks are used as bank stabilization upstream of the diversion, where the river appears to have limited floodplain access on its southern bank. At least one j-hook is upstream of the diversion. The river in this area, especially downstream of the point of diversion, is prone to avulsion and migration. During spring 2019 runoff, several large boulders making up the diversion dam were dislodged and transported downstream. The diversion now functions poorly, particularly during low flow conditions. Given the issues identified at this structure, the TAT recommends replacing the diversion and headgate and replacing existing streambank stabilization with improved bank stabilization and riparian revegetation. An improved diversion and headgate would allow water users to divert water at all flow levels and would afford increased water control and reduced maintenance needs. New bank stabilization structures and riparian revegetation would improve bank stability as well as floodplain access and would reduce erosion. If improvements are made to the diversion, the TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity.

Guadalupe Main: A U-shaped rock weir diversion dam directs flow from the river to a feeder channel, located on the north bank of the river. The feeder channel is approximately 600 ft long and delivers water to the headgate. A second smaller rock weir diversion directs flow from the feeder channel to the headgate, which is located on the north side of the channel. The concrete headwall is spalling very badly and exposing reinforcing steel. A return flow channel directs unused water back to the river to the southeast. Debris and sediment accumulation is an issue in the return flow carrier. The river channel has migrated historically in this area, which may cause issues at the diversion dam in the future. The meander upstream of the diversion is growing and accelerated erosion will cause the feeder channel to be bypassed if bank erosion continues. Additionally, the river had been historically dredged leaving high berms (now failing) that prevent the river from accessing the rivers natural floodplain. Given the issues identified at this structure, the TAT recommends bank stabilization upstream of the diversion, including riparian revegetation and floodplain reconnection, improving the return flow channel, and replacing the headgate. Bank stabilization and floodplain reconnection will help reduce future bank erosion on the bend and create low flow fish habitat. Return flow channel improvements will allow the channel to effectively convey return flows and headgate replacement will improve efficiency and reduce maintenance. If improvements are made to the diversion, the TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity.

Romero Ditch: A stacked rock diversion dam delivers water to a 12 ft automated headgate on the north bank of the Conejos River. Adjacent to the headgate is a 4 ft wide sluice gate. These structures were recently installed. The diversion dam also services Heads Mill & Irrigation Ditch, which is located on the south bank of Conejos River. The channel has migrated significantly in this area, especially upstream of the diversion dam. J-hooks were installed upstream to stabilize banks. If future channel migration occurs, other solutions may need to be considered, however no immediate repair needs were noted.

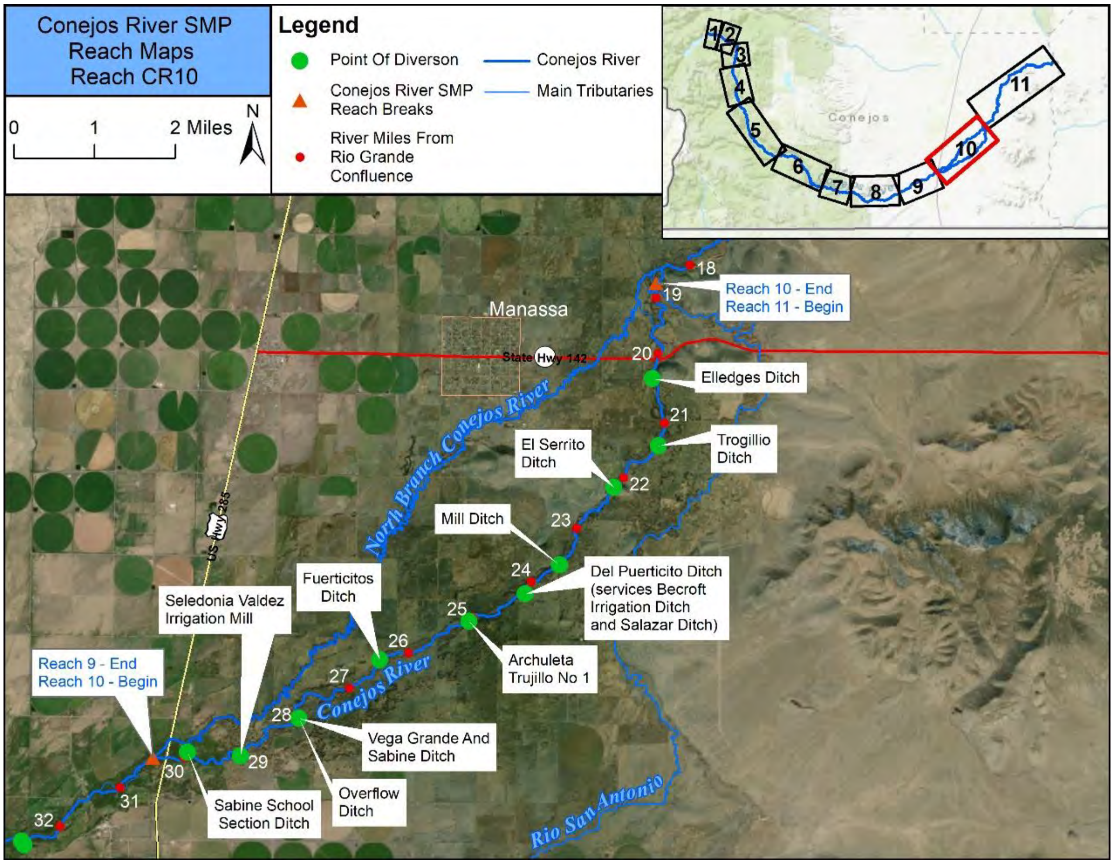
Heads Mill & Irrigation Ditch: A feeder channel off the south bank of the Conejos River, approximately 280 ft long, directs water towards the headgate. There is then a submerged pipe diversion dam downstream that directs water to the headgate, which sits along the south bank of the feeder channel. Any water not diverted to the headgate returns to the Conejos River approximately 100 ft downstream of the diversion. This ditch is just downstream of the Romero Ditch and also services the AD Archuleta Ditch. The channel has migrated significantly in this area, especially upstream of the diversion dam. J-hooks were installed upstream to stabilize banks. If future channel migration occurs, other solutions may need to be considered. No immediate repair needs were noted at the time of inspection.

JF Chacon Ditch No 3: A long feeder channel (approximately 0.3 miles long) comes off the east bank of the river. A sheet metal diversion dam on the feeder channel directs water to the headgate. There is no formal diversion dam for the feeder channel. Steel wing walls are used to stabilize the bank upstream and downstream of the diversion but are failing. This ditch also services the An Con Irrigation Ditch, which includes priorities 42 and 100 for a total decreed amount of 18.8 cfs. Both upstream and downstream of the structure, meanders are tightening and lateral migration is occurring. Additionally, the meander on which the diversion is located is growing and could be cut off during high flows. Given the issues identified at this structure, the TAT recommends improving the diversion off the mainstem Conejos River, replacing the steel wing walls used for bank stabilization upstream of the diversion, and performing regular maintenance on the feeder channel's diversion dam to prevent debris accumulation. If the diversion dam and bank stabilization structures are improved, the TAT also recommends riparian revegetation and maintaining fish passage to preserve aquatic habitat connectivity in this reach. Diversion and streambank stabilization improvements will increase efficiency, reduce maintenance, mitigate erosion, and improve aquatic and riparian habitat.

Manassa Core: This structure controls flows and is critically important for the administration of water rights the North and South Branches of the Conejos River. A large concrete diversion dam spans the river on the South Branch side of the split and a set of five headgates control flow to the North Branch of the river. Two of the five headgates are automated and include remote monitoring capabilities. Some lateral channel migration has occurred upstream of the structure, but is not expected to affect this structure. The stilling well at the gage downstream of this structure could use maintenance, which the TAT recommends in the near future. No additional repairs are needed.

3.2.10 CR10 – South Branch Conejos River

This reach extends from the bifurcation into the North and South Branch Conejos River, located at the Manassa Core Diversion, downstream to the confluence with the Rio San Antonio. This reach spans the entire extent of the South Branch Conejos River.



Representative Reach Photo

CR10 Conditions Assessment Overview

Reach: CR10		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	D	X	X	X	X	X		X				X	X	
Riparian Vegetation	B-			X	X	X		X		X				
Water Quality	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aquatic Life	B-	X						X			X	X	X	X
Diversion Structures	C													

A	B	C	D	F	Not Assessed

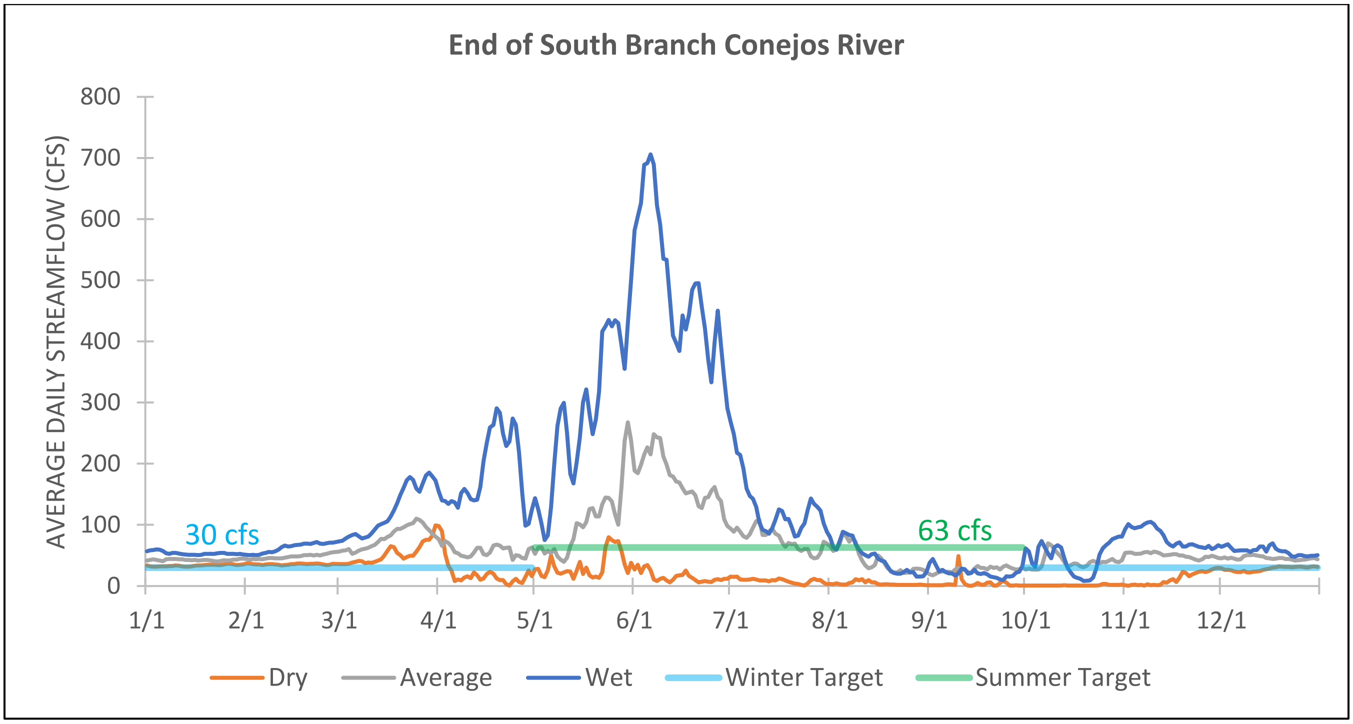
*For an explanation of reach ratings, see Section 2.

CR10 Geomorphology

<table>
<tr><td>Reach</td><td colspan="8">Location Description</td></tr>
<tr><td>CR10</td><td colspan="8">South Branch Conejos River</td></tr>
<tr><td>Confine-ment</td><td>D50</td><td>Bed Comp.</td><td>Existing Stream Form</td><td>Reference Stream Form</td><td>SEM Stage Existing</td><td>SEM Stage Ref.</td><td>Existing Sediment Regime</td><td>Reference Sediment Regime</td></tr>
<tr><td>Unconfined</td><td>No Data</td><td>No Data</td><td>Riffle-pool</td><td>Riffle-pool</td><td>1</td><td>0</td><td>Deposition</td><td>Deposition</td></tr>
<tr><td>Valley Slope</td><td>Stream Power △</td><td>Bed Mobility Threshold Flows</td><td>Bed Mobility Frequency</td><td colspan="2">Overbank Flow Estimate</td><td colspan="3">Overbank Flow Frequency</td></tr>
<tr><td>0.45%</td><td>↓</td><td>No Data</td><td>No Data</td><td colspan="2">No Data</td><td colspan="3">No Data</td></tr>
<tr><td colspan="2">Watershed setting</td><td>River Style</td><td colspan="4">Characteristics</td><td colspan="2">Representative Photo</td></tr>
<tr><td colspan="2">Accumulation</td><td>Meandering Coarse Grain Bed</td><td colspan="4">Unconfined channel with moderate to high sinuosity, well developed meandering and associated channel and floodplain geomorphic forms. Range of bar types, floodplain features and floodplain textures; substrate sizes tending toward cobble and large gravel; substrate variability depends on habitat-scale geomorphic features such as location in bend, pool, or riffle.</td><td colspan="2"></td></tr>
<tr><td colspan="9">Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity</td></tr>
<tr><td colspan="9">This Conejos River study reach is located on an ancient outwash fan and features an unconfined meandering channel across a broad flat valley. Within the study reach, the primary sediment source is material brought down to the reach from the upper watershed. The channel is generally a SEM stage 0 except in locations where the river has been channelized. The river is sinuous through this reach and expected to be dynamic with lateral and down valley movement of meanders as well as activated cut-offs and secondary channels during high water. The sensitivity of the river is high and efforts should be made to avoid further encroachment of it or its active geomorphic floodplain.</td></tr>
<tr><td colspan="7">Stressors</td><td colspan="2"></td></tr>
<tr><td colspan="7">The predominant stressors of the Conejos River in this reach are channelization/straightening, floodplain development, the establishment and maintenance of a single threaded channel on the valley floor, the removal of biotic drivers such as wood and beavers, the change of the valley floor vegetation due to grazing, and altered hydrology and sediment transport due to diversions.</td><td colspan="2">D</td></tr>
</table>

CR10 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR10	DRY	AVERAGE	WET
Winter	51%	98%	96%
Summer	3%	53%	65%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

This reach often experiences channel dry-up (i.e., no flow) in late summer/early fall. Dry-up normally only occurs during year types categorized as "dry." During the 2000 to 2017 period, channel dry-up duration ranged from less than 30 to over 100 days per year.

CR10 Riparian Vegetation

Overall, this site (CRVeg10) appears to be in good condition, receiving an overall EIA rating of B- (2.68). The lowest individual metric ratings were for Condition of Natural Buffer – Vegetation (C), Native Plant Species Cover (C-), and Invasive Nonnative Plant Species Cover (C-) (Table 3.15).

Table 3.15: EIA Scorecard – CRVeg10.

CRVeg10 Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				2.68	B-
Rank Factor: LANDSCAPE CONTEXT	0.30			3.11	B+
LANDSCAPE METRICS	0.33			3.00	B+
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			3.16	B+
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	A	4		
B3.1. Condition of Natural Buffer - Veg	n/a	C	2		
B3.2. Condition of Natural Buffer - Soils	n/a	B	3		
Rank Factor: CONDITION	0.70			2.50	B-
VEGETATION METRICS	1			2.50	B-
V1. Native Plant Species Cover	1	C-	1.5		
V2. Invasive Nonnative Plant Species Cover	1	C-	1.5		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	B	3		
V5. Regen. of Native Woody Species **(opt.)**	1	B	3		
V65. Coarse and Fine Woody Debris **(opt.)**	1	B	3		

Both Condition of Natural Buffer – Vegetation, Native Plant Species Cover, and Invasive Nonnative Plant Species Cover were affected by the presence of nonnative species. The average relative cover of native species for this site was 66%. The nonnative species with the highest absolute cover include the following species with cover values for plots 1, 2, 3, and 4, respectively: *Elymus repens* (37.5%, 37.5%, 0%, 7.5%), *Poa pratensis* (37.5%, 17.5%, 17.5%, and 17.5%), and *Cirsium arvense* (3.5%, 3.5%, 7.5%, and 7.5%). Average cover of the noxious species *C. arvense* across all plots was 5.5%, while the average cover of *E. repens* was 20.6%.

The average mean C-value for native species was 5.3, while the average cover-weighted mean C-value was only 5.7 (Table 3.7). This suggests that most native species at this site are equally likely to be found in natural and non-natural areas. However, they are not typical of high disturbance areas.

Current land uses observed and approximate cover within the 500 m buffer include non-tilled hayfields (80%), management for natural vegetation (18%), and unpaved roads (2%). Old beaver sign from gnaw marks on felled *P. angustifolia* were observed near the AA, but no recent sign was seen.

Results from the reach-scale RCA assessment indicated significant riparian vegetation impairment with a C+ rating. Stressors identified include roads, floodplain conversion, and nonnative plant species. The average of the EIA and RCA ratings is B-.

CR10 Water Quality and Aquatic Life

Water Quality		
Temperature	Chemical Conditions	Nutrients
N/A	N/A	N/A
Overall Rating		**N/A**

Aquatic Life			
Average MMI Score	Overall MMI Rating	Trout (lbs/acre)	Trout Rating
72.9	B	N/A	N/A
Overall Rating			**B-**

Water quality data is limited in this reach and a determination of overall condition was not made. Because of this reach's similarities to CR11, the average MMI score of 72.9 from CR11 is assumed to apply to this reach as well. The reach experiences seasonal dry-up, which likely severely impacts water quality and aquatic life. Additionally, diversion structures form multiple barriers to fish passage in this reach and reduce aquatic habitat connectivity. Aquatic life received a B- rating due to these impacts and the presence of nonnative species.

CR10 Diversion Infrastructure
***Refer to reach overview map above for diversion structure locations.**

Sabine School Section Ditch: The structure is located on the South Branch of the Conejos River at the apex of a meander. A repurposed molasses tank serves as the diversion dam and directs flow to the headgate, which is located on the north bank of the river. Some lateral migration of the meanders has occurred in this area, especially downstream of this structure. The streambank surrounding the headgate and diversion dam experiences erosion on an annual basis. If this erosion continues, it may wash out the headgate. The diversion dam is in disrepair. A segment of the tank forming the diversion dam has washed downstream and the channel surrounding the remaining dam has been scoured and may fail at high flows. Water users have difficulty diverting water at low flows. The diversion also appears to be a partial barrier to fish passage, especially at low flows. Given the issues identified at this structure, the TAT recommends replacing and/or potentially relocating the diversion and headgate, and implementing streambank stabilization and riparian revegetation upstream and downstream of the structure. A new diversion and headgate would create fish passage and connectivity, increase ditch efficiency and allow water users to divert water at all water levels, and reduce maintenance. Streambank stabilization would reduce erosion and help protect key diversion infrastructure.

Seledonia Valdez Irrigation Mill: A diversion dam, constructed of boulders, directs water to the headgate, which sits along the south bank of the river. A steel grate trash rack protects the headgate. Boulders and concrete chunks have been placed on the west bank upstream of structure to prevent erosion, however the bank upstream of the diversion continues to erode. The river channel in this location is unstable. The meander on which the headgate is situated is tightening and could be cut off during high flows. The TAT recommends improved bank stabilization and riparian revegetation upstream of the headgate and also recommends filling in the ditch downstream of the flume. Bank stabilization and riparian revegetation would help prevent a potential meander cutoff and reduce erosion. Fill near the flume would improve its measurement accuracy. If any modifications are made to the diversion in the future, the TAT also recommends maintaining fish passage to maintain aquatic habitat connectivity in this reach.

Overflow Ditch: This structure's diversion dam is made up of a small stacked rock structure and a fence just downstream that collects debris and acts as a makeshift diversion. A short feeder channel delivers water to the headgate, which is on the east side of the river. Woody debris accumulates in front of the headgate. The headwall is constructed of rock and appears to be in fair condition overall. Given the issues identified at this structure, the TAT recommends installing a new diversion dam and trash rack to effectively divert water at all flows and to reduce maintenance. If any modifications are made to the diversion in the future, the TAT also recommends maintaining fish passage to maintain aquatic habitat connectivity in this reach.

Fuerticitos Ditch: A large metal beam spans the channel, functioning as the diversion dam. This diversion is currently a barrier to fish passage. A significant amount of the river's flow travels underneath the diversion. The headgate is located on the north bank of the river on the outside of a meander. Debris accumulation is a significant issue at this structure, both on the diversion dam and at the headgate. Upstream of the diversion, the river is wide and two gravel bars have formed. Both upstream and downstream of the diversion, meanders have been tightening over time, which is not currently adversely affecting the structure, but may lead to future channel avulsion. The TAT recommends replacing the diversion dam and headgate, implementing bank stabilization, and resetting the Parshall flume. The TAT also recommends fish passage in this reach and ensuring adequate sediment transport at this structure. An improved diversion would improve the sediment transport regime and create new fish passage and habitat in this reach. A new headgate would increase efficiency and reduce maintenance. Targeted bank stabilization would help prevent potential channel avulsion and ensure water is delivered to this structure. Additionally, resetting the Parshall flume would improve its measurement accuracy.

Archuleta Trogillio No 1: The channel surrounding this structure has migrated significantly, with meander cutoffs and channel avulsion common and likely to occur in the future. The diversion dam is a U-shaped rock weir structure with concrete and woody debris. On the south bank of the river, upstream of the headgate, large boulders have been placed on the bank to prevent erosion. A gravel bar has been built up to prevent the river from flowing into a channel on the north side if the river, opposite the headgate. Sediment and debris accumulation is an issue at this structure. Given the issues identified at this structure, the TAT recommends installing a new diversion dam, bank stabilization near the headgate, and riparian revegetation. The TAT also recommends fish passage in this reach and ensuring adequate sediment transport at this structure. An improved diversion dam would reduce maintenance, improve sediment transport capacity, and create fish passage. Bank stabilization and riparian revegetation would protect the headgate and improve bank stability and river health.

Del Puerticito Ditch: The river is unstable in this reach and is prone to avulsion and significant migration during high flows. In 2019, the headgate and diversion dam were replaced. The banks upstream and downstream of the structure were also reinforced with boulders. The new structure features a grouted rock diversion dam that directs water to the headgate, which is located on the south bank of the river. The ditch runs parallel to the river for approximately 250 ft before turning east and away from the river. Prior to the 2019 improvements, the portion of the ditch running parallel to the river experienced significant erosion and could fail in the future. The TAT recommends reinforcing the ditch to avoid potential failure.

Mill Ditch: This structure has a minimal stacked rock diversion dam which directs water into an approximately 620 ft long feeder channel which ends at the headgate. The feeder channel's capacity is limited due to sediment accumulation. The channel is migrating south at the point of diversion, and the main channel has captured an old oxbow, leaving the north channel dry at low flows. The diversion dam is not easily controlled and the ditch has difficulty accessing its full decree at low flows. A sluice gate and overflow channel at the headgate returns unused water to the river. The sluice gate functions poorly and the overflow channel's capacity is limited due to sediment accumulation. The Parshall flume is located approximately 1 mile down the ditch, just downstream of County Rd 19. Given the issues identified at this structure, the TAT recommends improving or relocating the point of diversion, installing a new river headgate, and cleaning both the feeder and return channels. A new diversion and headgate would increase ditch efficiency and allow water users to divert water at all water levels.

Feeder and return channel cleaning would increase capacity and ditch efficiency. If any modifications are made to the diversion in the future, the TAT also recommends maintaining fish passage to maintain aquatic habitat connectivity in this reach.

El Serrito Ditch: This structure is located just downstream of County Rd M. A stacked rock diversion dam directs water to the headgate, which is located on the north bank of the channel. The diversion dam accumulates woody debris, which is a significant maintenance issue. It is also a barrier to fish passage, especially at low flow. The river is stable in this area. The County Road M bridge located approximately 110 ft upstream of this structure may negatively affect this structure, particularly during a high flow event. Large gravel piles have accumulated on the banks of the river, leading to increased velocity and scour downstream of the bridge. This scour may cause sedimentation at the diversion dam and headgate if it is not addressed. In addition, a fence crossing the river just upstream of the bridge collects woody debris. If the fence washes out, the debris flow could damage this structure. The TAT recommends installing a new diversion dam and creating fish passage at this location. A new diversion could be designed to divert water at all flows, mitigate debris accumulation, and allow for fish passage.

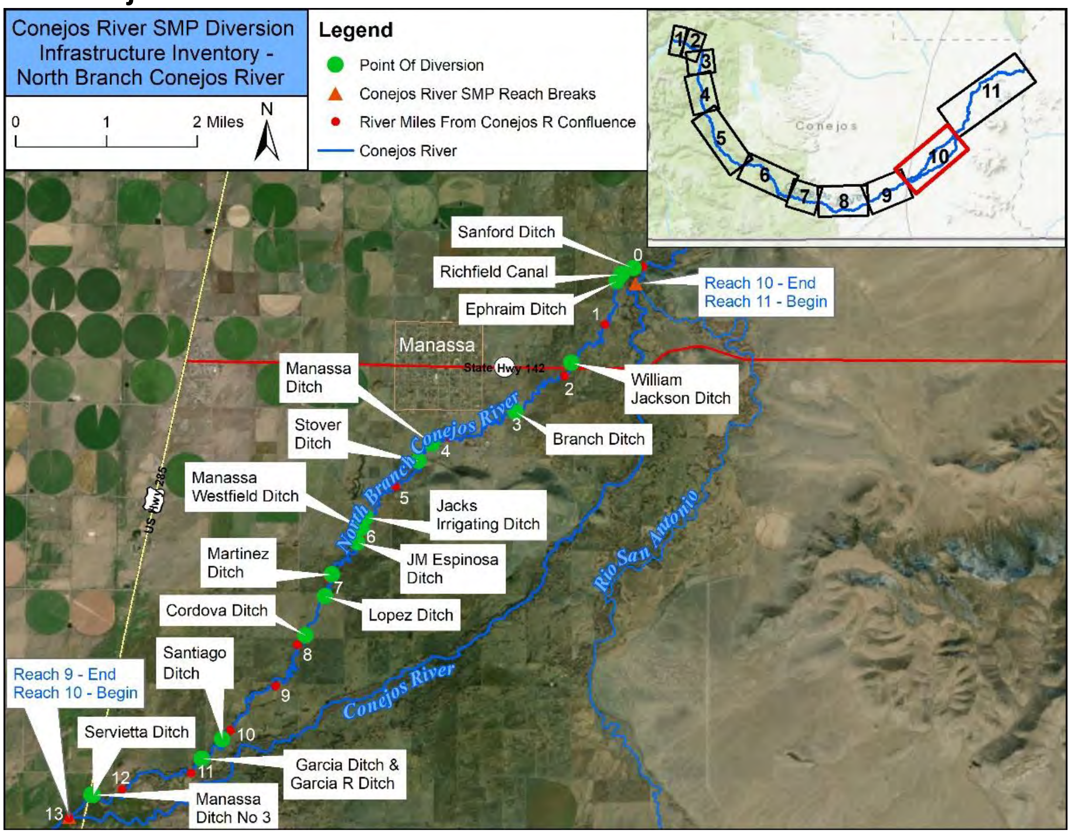
Trogillio Ditch: The river is relatively stable upstream and at the diversion, however significant lateral migration has occurred in the last 20 years downstream of the diversion. Additionally, channel avulsion could occur during a high flow event. A diversion dam made of large boulders, debris, and a repurposed molasses tank directs water to the headgate, which is located on the east bank of the river. The diversion can form a barrier to fish passage at some flow levels. Sediment and debris accumulate at the diversion and headgate. Given the issues identified at this structure, the TAT recommends installing a new diversion dam and adjacent sluice gate and implementing bank stabilization and riparian revegetation. The TAT also recommends creating fish passage at the diversion. A new diversion and sluice gate would create fish passage, allow for sediment and debris transport, and reduce maintenance. Bank stabilization and riparian revegetation would reduce erosion and improve river health and function.

Elledges Ditch: The river is relatively stable in this location due to bedrock controls on the east side of the river. The stacked rock diversion dam, which directs water to the headgate on the east bank of the channel, forms a barrier to fish passage. Woody debris accumulates on the diversion dam and at the headgate. The ditch runs parallel to an access road for approximately 0.5 mile. Downstream of the headgate, the ditch is very close to the river in two locations. During past high flow events, the river bank has failed and washed the ditch out in these locations, which are approximately 450 and approximately 950 ft downstream of the headgate, respectively. At the closer location, a j-hook spans the river but does not appear to be mitigating erosion that is threatening the ditch. Given these issues, the TAT recommends installing a new diversion, installing a trash rack, and implementing streambank stabilization at the two vulnerable locations, including replacement of the existing j-hook. A new diversion and trash rack would allow for fish passage and reduce debris accumulation and maintenance. Bank stabilization would reduce erosion and help prevent the ditch from washing out.

CR10 Bridge Infrastructure

County Road M Bridge: This bridge is located approximately 110 ft upstream of El Serrito Ditch (downstream of Mill Ditch) may negatively affect the El Serrito, particularly during a high flow event. Large gravel piles have accumulated on the banks of the river, leading to increased velocity and scour downstream of the bridge. This scour may cause sedimentation at the diversion dam and headgate for El Serrito if it is not addressed. In addition, a fence crossing the river just upstream of the bridge collects woody debris. If the fence washes out, the debris flow could damage El Serrito Ditch.

North Branch Conejos River Diversion Infrastructure



Manassa Ditch No 3: This structure is located on the North Branch of the Conejos River. A concrete diversion dam directs water to the headgate, which sits along the north bank of the channel, just downstream of the railroad bridge. The diversion dam is shared with the Servietta Ditch, which is located downstream of Manassa Ditch No 3. Since the 2006 inventory, the headgate was replaced and is now an automated radial gate. No immediate repairs or improvements were noted at this structure.

Servietta Ditch: See the Manassa Ditch No. 3 diversion description, as the diversion point is the same for both ditches. The headgate is directly adjacent to and just downstream of the Manassa Ditch No 3 headgate and shares the same diversion dam. No immediate repairs or improvements were noted at this structure.

Garcia Ditch: A check board diversion with a combination of steel and wood wingwalls directs water to a short feeder channel and to the headgate, which is located on the north bank of the river. Opposite this headgate is the Garcia R Ditch headgate, located on the south bank. Flow is measured by a Cutthroat flume. Localized erosion is occurring downstream of the diversion, which requires significant maintenance. The TAT recommends erosion mitigation and riparian revegetation as well as improving the diversion. A new or improved diversion would improve efficiency and reduce maintenance.

Garcia R Ditch: For a description of this structure's diversion, see Garcia Ditch, as the two structures share a diversion. The same recommendations related to erosion mitigation and riparian revegetation listed under Garcia Ditch also apply to this structure.

Santiago Ditch: A check board diversion with steel wingwalls directs water to the headgate, which is located on the south bank of the river. There is a log trash boom in front of the headgate. The diversion is difficult to maintain and sediment deposition is a significant issue at this structure. Given these issues, the TAT recommends repairing or replacing the diversion. A new diversion would control flows more effectively, allow for sediment transport, and reduce maintenance.

Cordova Ditch: The headgate sits along the east bank of the river. There is a trash rack consisting of a log boom, t-posts, and check boards upstream of the headgate, which is tilted. The structure has a minimal stacked rock diversion dam which accumulates woody debris and sediment. Given these issues, the TAT recommends improving or replacing the diversion, channel shaping or rock structures to direct debris away from the diversion, and riparian revegetation. An improved diversion would reduce maintenance and riparian revegetation would reduce erosion and improve river function.

Lopez Ditch: A U-shaped rock weir diversion dam diverts river flow to the headgate, which sits along the east bank of the river. There is a manually operated 3 ft wide steel slide gate sluice/return flow gate adjacent to the headgate. Woody debris and sediment accumulate at this structure, although it is not a significant maintenance issue. The TAT recommends regular debris clearing to ensure the diversion dam is functioning properly and implementing riparian revegetation to reduce erosion.

Martinez Ditch: A stacked rock diversion directs water from the North Branch to the headgate, which is located on the east bank of the river. Recent headgate repairs were completed, however it still leaks. The river channel was also recently improved in this area. The TAT recommends regular debris clearing to ensure the diversion dam is functioning properly. The TAT also recommends implementing riparian revegetation to reduce erosion and improve river health.

JM Espinosa Ditch: A rock diversion dam directs water to the headgate, which is located on the east bank of the channel. The headgate is located near the downstream end of a bend in the river. The sluice gate was recently replaced. The flume is aging and the headgate is tilted. The TAT recommends resetting the headgate and replacing the flume to increase efficiency and reduce maintenance.

Manassa Westfield Ditch: A steel check board diversion directs flow to the headgate, which is located on the west bank of the channel. Check boards can be added or removed from the diversion dam to control flows however the diversion functions poorly and requires regular maintenance. Bank erosion upstream of this structure is causing sedimentation at the diversion and headgate. Given the issues identified at this structure, the TAT recommends repairing or replacing the diversion and implementing bank stabilization and riparian revegetation. An improved or new diversion would increase efficiency and bank stabilization would prevent accelerated erosion upstream of the structure.

Jacks Irrigating Ditch: A diversion dam made up of concrete blocks, boulders, and debris diverts water to a short feeder channel, about 130 ft long, located on the west bank of the channel. Debris accumulation and sedimentation is an issue at this structure, particularly for the diversion dam. The headgate is protected from livestock by two metal fences but functions poorly. Significant erosion downstream of the flume and around the wing walls may cause it to fail and/or not measure accurately. Given these issues, the TAT recommends replacing the headgate, maintaining the flume, and implementing riparian revegetation. A new headgate would increase efficiency and reduce maintenance, and ditch maintenance at the flume would ensure long-term function. Riparian revegetation would reduce erosion and structure maintenance.

Stover Ditch: This structure is located just upstream of County Rd 17.5. The channel in this area is relatively stable, partially due to bedrock controls. A U-shaped rock weir diversion dam directs water to the headgate, located on the east bank of the river. A new Parshall flume was installed approximately 5 years ago. No immediate repair needs were noted, however annual maintenance is recommended to clear sediment and debris from the headgate and ditch.

Manassa Ditch: The channel is relatively stable in this location. A steel diversion structure with a 5 ft manually operated slide gate directs water to the headgate, which is adjacent. A 3 ft culvert adjacent to the diversion dam serves as the overflow/return channel. The headgate is slightly crooked and there are plans to straighten and repair it.

Branch Ditch: The channel is unstable in this location and prone to migration and avulsion. A check board diversion dam supported on either side by tires creates head pressure and directs water to the headgate. The headgate is difficult to operate. The soil supporting the headgate wing walls is eroding. The flume's wing walls are also eroding. Given the issues identified at this structure, the TAT recommends replacing the diversion dam and implementing bank stabilization and riparian revegetation. The diversion dam could be improved with a more easily adjustable structure and bank stabilization and riparian revegetation would address erosion at the diversion and flume.

William Jackson Ditch: This structure is located just downstream of Highway 142. The channel gradient here is very low and sediment accumulation is an issue. The channel is unstable and prone to erosion. A low stacked rock diversion dam directs water to the headgate, located on the north bank of the river. The headgate functions poorly. The TAT recommends installing a new headgate, which would increase efficiency and reduce maintenance.

Ephraim Ditch: The channel gradient here is very low and sediment accumulation is a maintenance issue. A long feeder channel comes off the North Branch's main channel and runs approximately 0.7

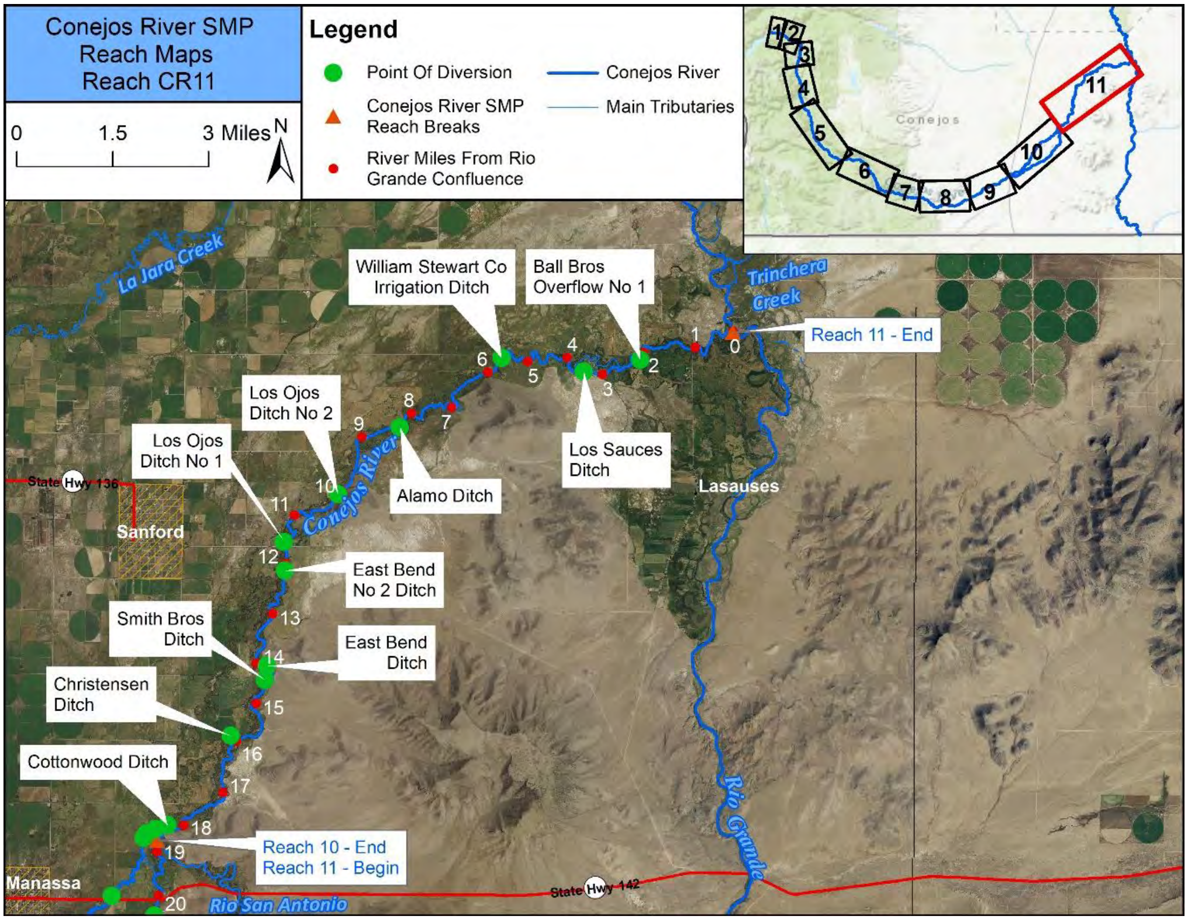
miles to this structure's recently installed diversion. The concrete diversion dam directs flow to the headgate, which sits along the west bank of the channel. There is a sluice gate adjacent to the headgate. This ditch is just upstream of the Richfield Canal and Sanford Ditch. Given these issues, the TAT recommends implementing bank stabilization. Bank stabilization and riparian revegetation would reduce erosion and improve river health and function.

Richfield Canal: This structure is near the confluence of the South Branch Conejos River and Rio San Antonio. The headgate sits along the west bank of the channel. This ditch can receive water from the North and South Branches of the Conejos River as well as the Rio San Antonio. Approximately 1.25 miles upstream, a feeder channel comes off the South Branch and directs river flow to the North Branch, which services the Ephraim Ditch. Any unused water at the Ephraim Ditch is available at the Richfield Canal via the North Branch Conejos. In addition, a diversion dam located at the confluence of the South Branch Conejos River and Rio San Antonio diverts flow to an approximately 1,000 ft feeder channel that also serves this headgate. Any water not diverted by the Richfield Canal from either of these feeder channels is then available at the Sanford Ditch via the North Branch Conejos River. At the time of inspection, repairs were in progress, including carrier repairs and the installation of a new core, and headgate. No repair needs are anticipated after completion of these repairs.

Sanford Ditch: A large concrete diversion dam delivers water to an approximately 600 ft feeder channel that then directs river flow to the headgate. The diversion dam includes a 12 ft wide radial sluice gate on the west bank of the river. This ditch can also receive water not used upstream by the Richfield Canal and Ephraim Ditch via the North Branch Conejos River. A return flow culvert returns any unused water to the mainstem Conejos River, just downstream of the confluence with the Rio San Antonio. During 2019 spring runoff, the recently installed overflow culvert washed out, along with the bank north of the headgate, causing flood flows to bypasss the headgate and overflow structure. Temporary bank stabilization was completed to prevent flows from bypassing the headgate and the overflow culvert was replaced with a small rock diversion dam. Given the challenges the ditch company faces, the TAT recommends stabilizing the headgate and repairing the return flow structure and flume. Bank stabilization would prevent flood flows from damaging this structure in the future, a repaired return flow structure would be capable of passing flood flows, and a repaired flume improve measurement accuracy.

3.2.11 CR11 – Rio San Antonio Confluence to Rio Grande Confluence

From the Rio San Antonio confluence (end of the South Branch Conejos River) downstream to the confluence with the Rio Grande. The North Branch Conejos River confluence is located just downstream of the Rio San Antonio confluence.



Representative Reach Photo

CR11 Conditions Assessment Overview

Reach: CR11		Major Stream Condition Stressors												
Parameter	Condition Rating	Crossings and diversions	Roads and railways	Floodplain disconnection	Channelization and armoring	Fill and floodplain conversion	Flow alteration: impoundments	Flow alteration: diversions	Abandoned mine lands	Exotic/naturalized plant species	Exotic aquatic species	Lack of woody material	Hillslope/channel erosion	Unknown source
Geomorphology	C	X	X	X	X	X		X				X	X	
Riparian Vegetation	C+			X		X				X				
Water Quality	A-							X					X	
Aquatic Life	B	X						X			X	X	X	X
Diversion Structures	C+													

A	B	C	D	F	Not Assessed

*For an explanation of reach ratings, see Section 2.

CR11 Geomorphology

Reach	Location Description
CR11	Rio San Antonio Confluence to Rio Grande Confluence

Confine-ment	D50 (mm)	Bed Comp.	Existing Stream Form	Reference Stream Form	SEM Stage Existing	SEM Stage Ref.	Existing Sediment Regime	Reference Sediment Regime
Unconfin ed	36	Gravel	Riffle-pool	Riffle-pool	1	0	Deposition	Deposition

Valley Slope	Stream Power △	Bed Mobility Threshold Flows	Bed Mobility Frequency	Overbank Flow Estimate	Overbank Flow Frequency
0.2%	↓	Extreme Events Only	Extreme Events Only	400-700 cfs	Wet years for approximately 30-60 days

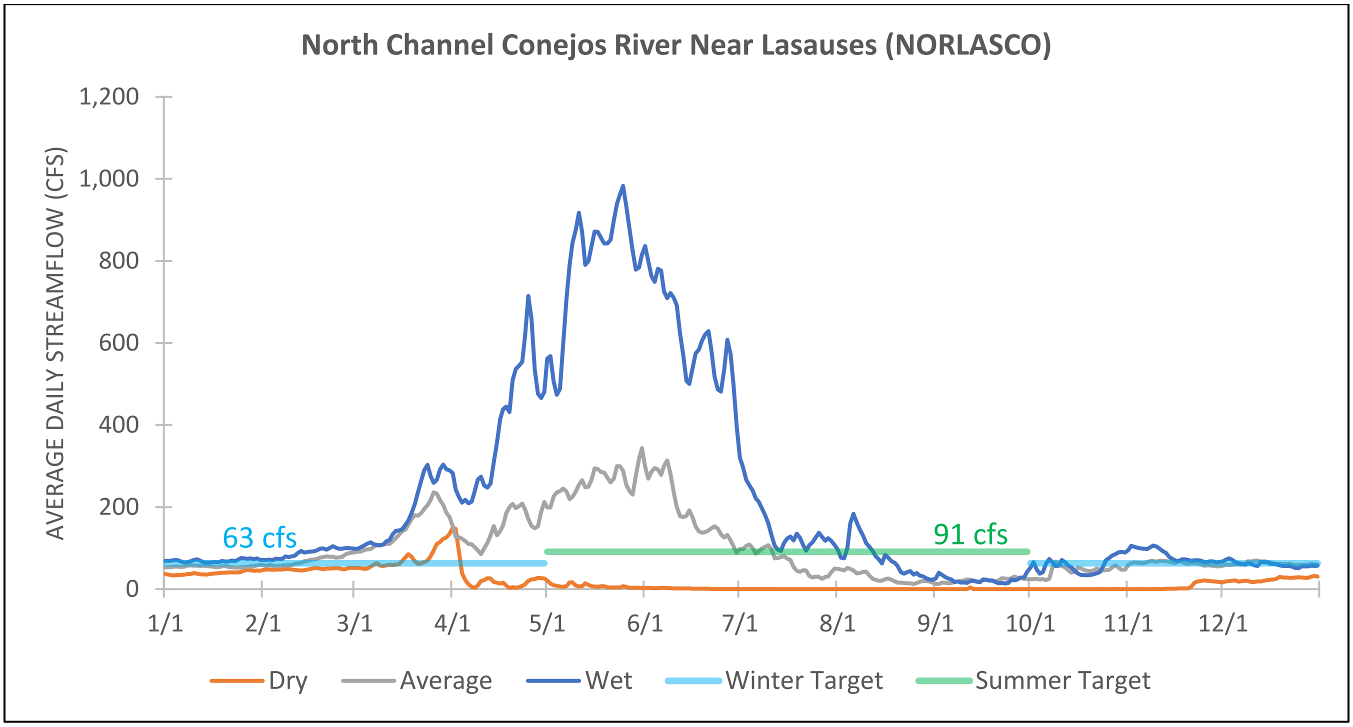
Watershed setting	River Style	Characteristics	Representative Photo
Accumulation	Meandering Coarse Grain Bed	Unconfined channel with moderate to high sinuosity, well developed meandering and associated channel and floodplain geomorphic forms. Range of bar types, floodplain features and floodplain textures; substrate sizes tending toward cobble and large gravel; substrate variability depends on habitat-scale geomorphic features such as location in bend, pool, or riffle.	

Setting, Morphology, Channel Evolution, Trajectory, and Sensitivity
This Conejos River study reach is located on an ancient outwash fan and features an unconfined meandering channel across a broad flat valley. Within the study reach, the primary sediment source is material brought down to the reach from the upper watershed. The channel is generally a SEM stage 1. The river is sinuous through this reach and expected to be dynamic (assuming channel forming flows) with lateral and down valley movement of meanders as well as activated cut-offs and secondary channels during high water. The sensitivity of the river is high and efforts should be made to avoid further encroachment of it or its active stream corridor.

Stressors	Degree of Geomorphic Impairment
The predominant stressors of the Conejos River in this reach are channelization/straightening, floodplain development, the establishment and maintenance of a single threaded channel on the valley floor, the removal of biotic drivers such as wood and beavers, and the change of the valley floor vegetation due to grazing and altered hydrology.	C

CR11 Aquatic Habitat Flow Targets

The graph below shows summer and winter flow targets with dry, average, and wet hydrographs.



The table below shows percent of days the reach's summer and winter flow targets are met in each year type:

CR11	DRY	AVERAGE	WET
Winter	8%	49%	80%
Summer	0%	46%	67%

*See section 2.6 for detailed explanation of aquatic habitat methodology and caveats.

This reach often experiences channel dry-up (i.e., no flow) in summer and fall. Dry-up normally only occurs during year types categorized as "dry" but can occur in "average" years as well. During the 2000 to 2017 period, channel dry-up duration ranged from less than 30 to over 100 days per year.

CR11 Riparian Vegetation

Two riparian vegetation sites were assessed within this reach: CRVeg11a and CRVeg11b.

CRVeg11a: Overall, this site appears to be in good condition, receiving an overall EIA rating of B- (2.69). The lowest individual metric ratings it received were for Native Plant Species Cover (C), Invasive Nonnative Plant Species Cover (C), and Vegetation Structure (C) (Table 3.16).

Table 3.16: EIA Scorecard – CRVeg11a.

CRVeg11a Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**2.69**	**B-**
Rank Factor: LANDSCAPE CONTEXT	0.30			**3.14**	**B+**
LANDSCAPE METRICS	0.33			**2.50**	**B-**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	C	2		
BUFFER METRICS	0.67			**3.46**	**B+**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	A	4		
B3.1. Condition of Natural Buffer - Veg	n/a	B	3		
B3.2. Condition of Natural Buffer - Soils	n/a	B	3		
Rank Factor: CONDITION	0.70		NULL	**2.50**	**B-**
VEGETATION METRICS	1			**2.50**	**B-**
V1. Native Plant Species Cover	1	C	2		
V2. Invasive Nonnative Plant Species Cover	1	C	2		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	C	2		
V5. Regen. of Native Woody Species **(opt.)**	1	B	3		
V65. Coarse and Fine Woody Debris **(opt.)**	1	B	3		

The average relative cover of native species for this site was 90%. The nonnative species with the highest absolute cover was *Poa pratensis* with cover values for plots 1, 2, 3, and 4 of 3.5%, 17.5%, 3.5%, and 0%, respectively. Total average cover for noxious species was 5.1%. Cover values across each plot for the noxious species encountered were: *Cirsium arvense* (3.5%, 7.5%, 7.5%, and 7.5%) and *Verbascum thapsus* (0.5%, 0%, 1.5%, and 0%).

Regarding Native Plant Species Composition, the average mean C-value for native species at this site was 4.9, and the average cover-weighted mean C-value for native species was 4.8 (Table 3.7). This suggests that the native plant species composition reflects moderately disturbed conditions with significant cover by species that are indicative of anthropogenic disturbance.

Vegetation Structure was affected by dense stands of *Salix* and *P. angustifolia* where it is difficult to impossible to travel through without mechanical assistance. While livestock grazing occurs in the AA, the cattle are largely restricted to grazing along scattered trampled paths through these woody stands.

Current land uses observed and approximate cover within the 500 m buffer non-tilled hayfields (30%), light grazing (27%), moderate grazing (25%), moderate recreation (10%), light recreation (5%), and unpaved roads (3%). Old beaver sign from gnaw marks on felled woody shrubs and trees were observed within the AA, but no recent sign was seen.

CRVeg11a: Overall, this site appears to be in fair condition, receiving an overall EIA rating of C+ (2.47). The lowest individual metric ratings it received were for Land Use Index (C), Condition of Natural Buffer – Soils (C), Native Plant Species Cover (C), Invasive Nonnative Plant Species Cover (C), Native Plant Species Composition (C), Vegetation Structure (C), and Coarse and Fine Woody Debris (C) (Table 3.17).

Table 3.17: EIA Scorecard – CRVeg11b.

CRVeg11b Observer: W. McBride	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				**2.47**	**C+**
Rank Factor: LANDSCAPE CONTEXT	0.30			**2.80**	**B-**
LANDSCAPE METRICS	0.33			**2.50**	**B-**
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	C	2		
BUFFER METRICS	0.67			**2.94**	**B-**
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	B	3		
B3.1. Condition of Natural Buffer - Veg	n/a	B	3		
B3.2. Condition of Natural Buffer - Soils	n/a	C	2		
Rank Factor: CONDITION	0.70			**2.33**	**C+**
VEGETATION METRICS	1			**2.33**	**C+**
V1. Native Plant Species Cover	1	C	2		
V2. Invasive Nonnative Plant Species Cover	1	C	2		
V3. Native Plant Species Composition	1	B	3		
V4. Vegetation Structure	1	C	2		
V5. Regen. of Native Woody Species **(opt.)**	1	B	3		
V65. Coarse and Fine Woody Debris **(opt.)**	1	C	2		

Livestock grazing of moderate intensity across a large portion of this site impacted Land Use Index and Condition of Natural Buffer – Soils scores. The plant community reflected exposure to disturbance over an extended time period. Signs of livestock grazing at a moderate intensity were observed across the site. Additionally, there was erosion and floodplain disconnection on the north bank of the main river channel.

Regarding Native Plant Species Cover and Invasive Nonnative Plant Species Cover, the average relative native species cover was 88%. *Poa pratensis* was the nonnative species with the highest absolute cover with cover values of 3.5%, 17.5%, 3.5%, and 0% for plots 1, 2, 3, and 4, respectively. Noxious species had an average total cover of 5.2%. *Cirsium arvense* had cover values of 3.5%, 7.5%, 7.5%, and 0%, while *Verbascum thapsus* had cover values of 0.5%, 0%, 1.5%, and 0%. Although *Cardaria draba* was not encountered within the individual sample plots, it commonly occurred within the AA and within the 500 meter buffer. *Cirsium arvense* and *Cardaria draba* formed near monocultures in scattered patches across the site, particularly adjacent to the dry river channel to the north and the access road running parallel to it. Regarding Native Plant Species Composition, the average mean C-value for native species at this site was 4.6, and the average cover-weighted mean C-value for native species was 4.4 (Table 3.7). This suggests that the native plant species composition reflects moderately disturbed conditions with significant cover by species that are indicative of anthropogenic disturbance.

Vegetation Structure and Coarse and Fine Woody Debris received low marks as a result of dense stands of *Salix exigua*. These stands were difficult to impossible to navigate through without the aid of a mechanical device or cutting tool. Further the amount of fine woody debris on the ground appeared to be lacking given the high shrub cover across the vegetation plots. Current land uses observed and approximate cover within the 500 m buffer include heavy to moderate grazing (60%), light grazing (38%), and unpaved roads (2%).

Results from the reach-scale RCA assessment indicated significant riparian vegetation impairment with a C+ rating. Stressors identified include roads, floodplain conversion, and nonnative plant species. The average of the EIA and RCA ratings is C+.

CR11 Water Quality and Aquatic Life

Water Quality		
Temperature	**Chemical Conditions**	**Nutrients**
N/A	B	A
Overall Rating		**A-**

Aquatic Life			
Average MMI Score	**Overall MMI Rating**	**Trout (lbs/acre)**	**Trout Rating**
72.9	B	N/A	N/A
Overall Rating			**B**

Water quality appears to be acceptable in this reach, with only arsenic exceeding state water quality standards (CDPHE, 2018a). Sufficient water temperature data was not available to make a determination on temperature condition. The reach experiences channel dry-up which likely impacts water quality, especially temperature, as well as aquatic life. Despite seasonal dry-up, this reach supports a healthy benthic macroinvertebrate community with an average MMI score of 72.9. Trout data was not available however it should be noted that diversion structures form multiple barriers to fish passage in this reach and reduce aquatic habitat connectivity.

CR11 Diversion Infrastructure

***Refer to reach overview map above for diversion structure locations.**

Cottonwood Ditch: This structure is located just downstream of the North Branch Conejos and Rio San Antonio confluence. The river is relatively stable in this area, however localized erosion is occurring at the diversion. A repurposed tank serves as the diversion dam, directing water to the headgate on the north bank of the river. The diversion functions but is a partial barrier to fish passage. The headwall is made of concrete and has significant spalling. A portion of the upstream side of the headwall has broken off and the river is eroding the bank around the headgate. The headgate is a wood screw gate and does not function well. The TAT recommends replacing the diversion, headgate and headwall, and flume. A new diversion and headgate would create fish passage and increase efficiency. A new Parshall flume would improve the measurement accuracy.

Christensen Ditch: The structure is located in a slough and there is no diversion dam. The headgate is aging and functions poorly. The flume could not be located at the time of visit. The ditch requires general maintenance, including clearing accumulated sediment. The TAT recommends replacing the headgate to improve efficiency and reduce maintenance.

Smith Bros Ditch: Channel avulsion has occurred upstream of this structure's diversion, but the river migrated very little in the last 20 years. Cutbanks and accelerated bank erosion is an issue near the diversion, however. There is no diversion dam at this structure. The headgate is located on the outside of a meander that is stabilized with concrete blocks. Despite stabilization, the headgate is tilted. The flume is also tilted. The TAT recommends resetting the headgate and flume and implementing riparian revegetation. Headgate and flume improvements would improve efficiency and long-term accuracy. Riparian revegetation would reduce erosion and improve river and ditch function.

East Bend Ditch: A concrete diversion dam spans the river and directs water to the headgate. The automated headgate is located on the north bank of Conejos River and does not have a feeder channel. An adjustable sluice gate sits adjacent to the headgate. Despite repairs completed in 2019, the structure still functions poorly. The headgate collects debris and shows signs of potentially washing out at high flows. The diversion dam is also experiencing erosion on the south bank (see photos in report card). The meanders downstream of the diversion have been growing over the last 20 years. There is a lack of riparian vegetation, particularly downstream of the diversion, that likely exacerbates localized bank erosion. Approximately 550 ft downstream of the flume, the river can wash the ditch out during high flows. Given the issues identified at this structure, the TAT recommends reinforcing the headgate, sluice gate, flume, and diversion, installing a trash rack, and implementing riparian revegetation. Reinforcing the headgate, sluice gate, and diversion would prevent bank failure at high flows. A trash rack would address debris accumulation at the headgate. Riparian revegetation would aid in bank stability and resiliency. If the diversion and/or headworks are improved, the TAT also recommends incorporating fish passage to improve aquatic habitat connectivity in this reach.

East Bend No 2 Ditch: The meanders upstream of the diversion have tightened over the last 45 years and channel avulsion may occur at high flows. A minimal stacked rock diversion dam directs water to the headgate, which is located on the east bank of the river. The head wall is made up of a combination of boards, concrete and grouted rock. The headgate has plywood covering the opening to reduce leakage. Given the issues identified at this structure, the TAT recommends replacing the diversion, headgate and Parshall flume. A new diversion would require less maintenance and improves sediment transport and river function. A new headgate and flume would increase efficiency. The TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach.

Los Ojos Ditch No 1: This structure is located just downstream of County Road V. A concrete diversion dam spans the river and directs flow to a short feeder channel on the west bank of the river. Just upstream of the headgate, a trash rack made up a fence and a 4 inch welded wire panel crosses the feeder channel. This structure creates a barrier to fish passage, especially at low flows. However, a barrier is needed within this reach to prevent nonnative carp from traveling upstream and this structure could serve that role. Downstream of the diversion, the channel is experiencing significant lateral migration and accelerated erosion. Immediately below the diversion, the west bank of the river is eroding and the river is widening. Given these issues, the TAT recommends erosion mitigation and riparian revegetation. Channel shaping and/or riparian revegetation would address bank erosion.

Los Ojos Ditch No 2: The river is unstable upstream and downstream of this structure. However, bedrock on the east side of the river has kept the channel stable in this location. A diversion dam made of stacked boulders diverts water to the headgate, which is located on the east bank of the river. A sluice gate on the east bank is integrated into the diversion dam. A second sluice gate sits adjacent to the headgate. Woody debris accumulation is an issue at this structure. The TAT recommends installing a trash rack to prevent debris accumulation in front of the headgate. If any improvements are made to the diversion and/or headworks in the future, the TAT also recommends incorporating fish passage to improve aquatic habitat connectivity in this reach.

Alamo Ditch: A U-shaped rock weir diversion dam directs water to the headgate, which is located on the north bank of Conejos River. The headgate is located on the inside of a meander. A sluice gate sits adjacent to the main headgate. Upstream of the diversion, meanders have been developing over the last 45 years and meander cutoffs are likely in the future. The headgate and diversion dam require regular maintenance due to the sand/small gravel-dominated substrate but otherwise function well. Debris accumulates in the ditch downstream of the headgate and in the flume. This woody debris needs to be regularly removed, especially from the Parshall flume. The south bank of the river immediately downstream of the headgate is experiencing significant erosion and lacks floodplain connection. The TAT recommends bank restoration by installing rock structures to reduce erosion and reconnecting this part of the river with its floodplain. The TAT also recommends maintaining fish passage to preserve aquatic habitat connectivity in this reach.

William Stewart Co Irrigation Ditch: The diversion for this structure is located between two wide meanders and is made of river sediment (sand and small gravel-dominated). It directs water to a feeder channel on the north side of the river. The feeder channel is approximately 0.46 miles long and delivers water to the headgate. On the feeder channel, a diversion made of stacked rock and debris directs water to the headgate, located on the north side of the feeder channel. This structure is located on a very flat part of the river. Significant sedimentation is occurring in the main channel of Conejos

River and in the feeder channel. The main channel is modified on an annual basis in order to deliver water to the feeder channel. Significant bank erosion is occurring just upstream of the diversion dam (see photo in report card). Additionally, the main channel has migrated significantly in the past, and future lateral migration and meander cutoffs are likely. The TAT recommends an improved diversion dam and headgate, a sluice gate, and riparian revegetation. A new diversion would deliver water at various flows, reduce annual maintenance, and improve river function by enhancing sediment transport and aquatic habitat. A sluice gate adjacent to the headgate would reduce sedimentation and maintenance. The TAT also recommends incorporating fish passage into any diversion improvements to maintain aquatic habitat connectivity. Riparian revegetation would reduce erosion and improve river health. A useful reference and potential model is the Alamo Ditch, the next structure upstream.

Los Sauces Ditch: A concrete diversion dam with a sluice gate diverts water to the headgate, located on the east bank of the river. Lateral channel migration and meander cutoffs have occurred upstream of the structure, especially prior to 1998 (see report card). Upstream of the diversion, a secondary channel is partially cut off, but still receives water at high flows. If this secondary channel is captured by the river, this structure would be cut off. Additionally, there is an island just upstream of the structure that formed when the river partially cut off a meander. The meander may eventually be completely cut off. If this occurs, the bank on either side of the headgate will be exposed to high flows which may cause erosion issues at the structure. Three j-hooks upstream of the structure help to stabilize the bank. Sediment and woody debris accumulation is a significant issue at this structure. Debris accumulates on the diversion dam and poses a maintenance challenge, particularly when it accumulates near the sluice gate and headgate. The measurement structure is in poor condition. Given these issues, the TAT recommends a long-term solution to prevent debris accumulation and replacing the measurement device. Additional bank stabilization and riparian restoration upstream of the structure would improve river function by reducing erosion and sedimentation at the diversion dam and headgate as well as enhancing aquatic habitat. The TAT also recommends incorporating fish passage into any diversion improvements to increase aquatic habitat connectivity.

Ball Bros Overflow No 1: This structure is located approximately 1.2 miles upstream of County Rd 28 and is the last structure on the Conejos River before its confluence with the Rio Grande. It is located approximately 0.4 miles downstream of a secondary channel which receives water during high flows. If the secondary channel is captured by the river, this structure would likely be affected. Some lateral channel migration has occurred upstream of the diversion, which is located on the outside of a meander in the river, near its apex. A stacked boulder diversion dam with soil fill directs water to a short feeder channel on the south side of the channel. The diversion dam forms a barrier to fish passage, especially at low flows. It also accumulates woody debris and requires regular maintenance. The TAT recommends improving or replacing the diversion. A new diversion would function better for water users, allow sediment and debris to pass through this point in the river, and be less vulnerable to failure during high flows. The TAT also recommends incorporating fish passage into any diversion improvements to increase aquatic habitat connectivity.

CR11 Bridge Infrastructure

County Road V Bridge: This bridge is located between East Bend No 2 Ditch and Los Ojos No 1 Ditch. Some of the bridge pilings are rotting and need to be replaced.

4. Conejos River SMP Implementation Strategy

4.1 Conejos River SMP Goals and Priority Action Items

The vision for implementation of the Conejos River Stream Management Plan is *to balance diverse ecological, agricultural, cultural, and recreational needs to support a healthy watershed and its sustainable use*. The goals and associated action items and projects listed below are based on community values identified during stakeholder engagement activities and stream condition assessment results. Action items and projects are organized under the primary goal which they will help meet. This implementation strategy was developed with input and support from the Technical Advisory Team (TAT). The TAT recognizes that the projects list below is dynamic. As conditions change, project details may also change and new projects will be identified in the future.

*Note: Refer to Table 4.1 for relative costs of priority projects. For action items that may include multiple projects and sites, cost estimates are per site.

Table 4.1: Range of project costs.

Relative Cost	Range
Low	<$10,000
Medium	$10,000 – $100,000
Medium-High	$100,000 – $250,000
High	$250,000 – $1,000,000
Very High	>$1,000,000

Goal A. Improve function and reduce maintenance of irrigation infrastructure, both for water users and river health.	
Target – Fully functioning, low maintenance diversion structures with little or no impairment to river function. Riparian restoration and fish habitat improvements should be considered as part of any improvements.	**Performance Indicators –** Continued monitoring and documentation of infrastructure function.
Justification – The diversion infrastructure assessment identified significant need for infrastructure improvements. Some structures do not function well for water users, and in some cases negatively affect stream health and function.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Partnership Project - Phase 1	CRPP - Phase 1 will rehabilitate five irrigation structures, enhance aquatic habitat, and restore riparian and wetland habitats. The irrigation structures include the North Eastern Ditch, New JB Romero Ditch, Sabine School Section Ditch, Fuerticitos Ditch, and Elledges Ditch. The project will be integrated with existing and future restoration projects with the goal of maintaining aquatic habitat connectivity and enhancing aquatic and riparian condition.	Reaches 8 through 10	B, C, D, F, and G	Bank stabilization; enhanced aquatic habitat; improved natural channel processes, riparian vegetation condition, and water quality.	High
Angustura Ditch Improvement Project	Replacement of the Angustura Ditch headgate, streambank stabilization, and riparian revegetation upstream of the diversion.	Reach 8	B, C, D, and F	Bank stabilization; improved natural channel processes, riparian vegetation condition, and water quality.	Medium
Mecitos and Sanches Ditch Improvement Project	Replacement of the Mecitos Ditch headgate and diversion dam as well as carrier channel dredging. These improvements will benefit both the Mecitos and Sanches ditches.	Reach 8	B, C, D, F, and G	Bank stabilization; enhanced aquatic habitat; improved natural channel processes, riparian vegetation condition, and water quality.	High
Chacon Ditch No. 1 Improvement Project	Streambank stabilization, riparian revegetation, and headgate replacement at the Chacon Ditch No. 1.	Reach 9	B, C, D, and F	Bank stabilization; improved natural channel processes, riparian vegetation condition, and water quality.	Medium

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Trogillio Ditch Improvement Project	Replacement of the Trogillio Ditch diversion to reduce maintenance and create fish passage. Replacement of headgate, streambank stabilization, and riparian revegetation both upstream and downstream of the diversion.	Reach 10	B, C, D, F, and G	Bank stabilization; enhanced aquatic habitat; improved natural channel processes, riparian vegetation condition, and water quality.	Medium-High
Sanford Ditch Improvement Project	Streambank stabilization and the construction of a hardened road crossing on the Sanford Ditch return channel.	North Branch Conejos River	B, C, D, and F	Bank stabilization; improved natural channel processes, riparian vegetation condition, and water quality.	Low
Cottonwood Ditch Improvement Project	Headgate replacement and diversion improvements, including bank stabilization and riparian revegetation.	Reach 11	B, C, D, F, and G	Bank stabilization; enhanced aquatic habitat; improved natural channel processes, riparian vegetation condition, and water quality.	Medium-High
East Bend Ditch Improvement Project	Bank stabilization and riparian revegetation surrounding the diversion dam. The project will also include the installation of a trash rack and adjustments to the headgate and adjacent sluice gate.	Reach 11	B, C, D, F, and G	Bank stabilization; enhanced aquatic habitat; improved natural channel processes, riparian vegetation condition, and water quality.	Medium
William Stewart Co Irrigation Ditch Improvement Project	Improvements to point of diversion, including bank stabilization, aquatic habitat enhancement, and revegetation. The project will also include headgate repair or replacement.	Reach 11	B, C, D, F, and G	Bank stabilization; enhanced aquatic habitat; improved natural channel processes, riparian vegetation condition, and water quality.	High

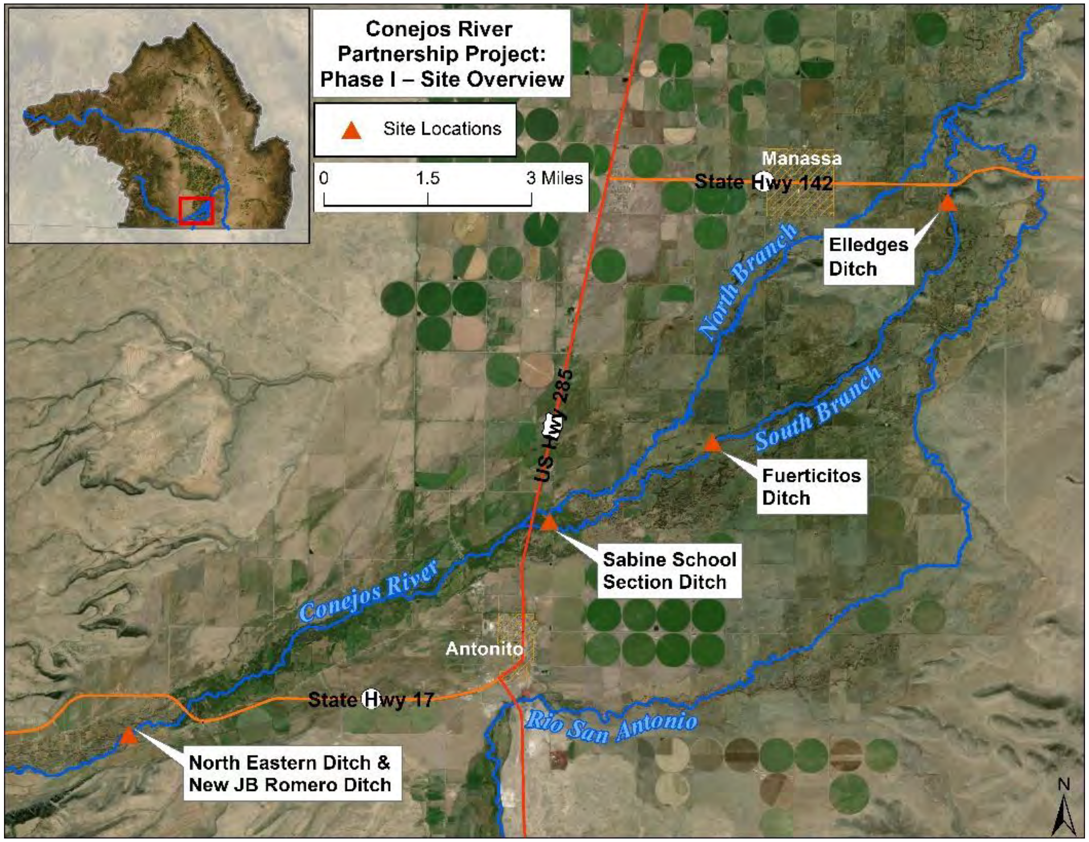


Figure 4.1: Proposed diversion structure locations included in the Conejos River Partnership Project (CRPP) – Phase 1.

Although diversion structures are listed individually, infrastructure improvement projects may be grouped and completed in phases. Irrigation infrastructure projects listed here are top priorities, however improvement needs exist on other structures as well. For a detailed assessment of each diversion structure and its condition, visit this webpage: https://riograndeheadwaters.org/stream-management-plans.

Goal B. Maintain or improve bank and channel stability, especially near important wildlife habitat and critical infrastructure such as homes, diversion structures, roads, and bridges.	
Target – Improved stream function through localized bank stabilization, riparian vegetation reestablishment, sediment transport, and floodplain connection.	**Performance Indicators** – Monitoring of geomorphic condition indicators, including channel morphology, bank stability, and sediment balance.
Justification – Results from the conditions assessment and historic imagery analysis show accelerated erosion and channel instability with impacts on critical infrastructure.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Streambank Stabilization and Riparian Restoration at Guadalupe	Improve floodplain connection, natural channel processes, riparian vegetation condition, and water quality through streambank stabilization and riparian revegetation on the Conejos River near Guadalupe.	Reach 9	C, D, and F	Improved floodplain connectivity, natural channel processes, riparian vegetation condition, and water quality.	Medium-High
Improved River Crossing Near Fuerticitos Ditch	Improve an existing river crossing through channel hardening and bank stabilization as well as channel and riparian revegetation near the Fuerticitos Ditch.	Reach 10	D and F	Improved riparian vegetation condition and water quality.	Low
Improved River Crossing on Double X Ranch	Improve an existing river crossing on Double X Ranch through channel hardening and bank stabilization as well as channel and riparian revegetation.	Reach 10	D and F	Improved riparian vegetation condition and water quality.	Low
Bank Stabilization Near County Road 28	Implementation of bank stabilization and riparian revegetation on the lower Conejos River immediately upstream of County Road 28. The proposed restoration area is approximately 1,000 linear feet.	Reach 11	A, C, D, and F	Improved function of infrastructure; increased floodplain connectivity, natural channel processes, riparian vegetation condition, and water quality.	Medium
Lower Conejos River Bank Stabilization and Fish Habitat Enhancements	Implement bank stabilization, riparian revegetation, and aquatic habitat enhancements on the lower Conejos River between County Road V and the confluence with the Rio Grande. Bank shaping and floodplain reconnection may also be implemented.	Reach 11	A, C, D, F, and G	Improved function of infrastructure; increased floodplain connectivity, natural channel processes, riparian vegetation condition, and water quality; enhanced aquatic habitat.	High

Goal C. Maintain and improve the function of floodplains, associated alluvial aquifers, and natural channel processes.	
Target – Improved floodplain connection where appropriate. Allow for channel migration where possible.	**Performance Indicators** – Floodplain function allowing for mitigation of flood flows and augmentation of baseflows. Improved riparian areas and geomorphic condition indicators.
Justification – Functional floodplains maintain connection between uplands and river corridors and contribute to alluvial aquifer storage.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Floodplain Reconnection	Implementation of floodplain reconnection and channel restoration projects between Elk Creek and the Rio Grande confluence. These projects will be integrated with diversion infrastructure improvements when possible.	Reaches 7 through 11	A, B, D, E, and F	Irrigation infrastructure improvements; bank stabilization; floodplain connectivity and increased alluvial aquifer storage; improved riparian vegetation condition and water quality.	Medium
Conejos River Corridor Conservation Easements	Further existing efforts to acquire conservation easements on private lands within the active river corridor.	All	C, D, and J	Easements can help preserve the ecological integrity of working lands which provide valuable ecosystem services and support stream health. As new easements are secured, river corridor protection is expanded, providing substantial natural resources and river health benefits. Benefits may include increased streambank and channel stability, improved riparian vegetation condition, and enhanced alluvial aquifer storage, thereby mitigating impacts of groundwater withdrawal on streamflow depletion.	Variable

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Wet Meadow Restoration	Implementation of targeted wet meadow restoration using temporary wood grade structures (TWGS) and other restoration techniques on tributaries to the Conejos River.	Tributary streams to the Conejos River.	D, E, and F	Floodplain connectivity; improved riparian vegetation condition and water quality.	Medium

Figure 4.2: Floodplain disconnection on the mainstem Conejos River near Mogote

Goal D. Maintain and improve the extent and condition of riparian areas.	
Target – Riparian areas with diverse species and age classes that contribute to overall stream health and wildlife habitat, including imperiled species.	**Performance Indicators** – Colorado Natural Heritage Program Ecological Integrity Assessment (EIA) score; SLV HCP, riparian area function, in conjunction with floodplain and river channel function.
Justification – Healthy and highly functioning riparian areas are critical to overall stream health. Importantly, intact riparian vegetation provides stream shading and provides a buffer against changes in water temperature. Maintaining and improving riparian vegetation will support overall stream health and complements other objectives.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Riparian Revegetation Near Horca	Targeted riparian revegetation between Elk Creek and Sheep Creek. Opportunities exist on both private and public lands.	Reach 7	B, C, and F	Improved bank stability and water quality; floodplain connectivity.	Medium
Lower Conejos River Riparian Revegetation	Targeted riparian revegetation on the lower Conejos River, downstream of Manassa. Significant opportunities exist on private, federal, and state lands in this area.	Reaches 10 and 11	B, C, and F	Improved bank stability and water quality; floodplain connectivity.	Medium
Conejos River Riparian Fencing	Installation of fencing to protect riparian vegetation, where possible. Where possible, off-channel water developments (e.g., stock tanks) are recommended to protect riparian areas while maintaining adequate water for livestock. Opportunities exist in many locations on the Conejos River.	All	B, C, and F	Improved bank stability and water quality; floodplain connectivity.	Low

Figure 4.3: Conejos River riparian vegetation in the "fly water" (reach CR06).

Goal E. Work toward aquifer sustainability and mitigate impact of groundwater withdrawal on streamflow depletion.	
Target – Improvements in aquifer sustainability and implementation of projects to minimize impacts of groundwater withdrawal on streamflow.	**Performance Indicators** – Aquifer level monitoring, as required by Division 3 groundwater rules and regulations.
Justification – Groundwater withdrawal has a modeled impact on streamflow, as shown by the Rio Grande Decision Support System model.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Groundwater Management Subdistrict Number 3	Continue to prioritize and support groundwater conservation efforts underway through groundwater management Subdistricts. For the purposes of the Conejos River SMP, the focus is Subdistrict 3.	Reaches 8 through 11	C, D, F, G, and J	Improved bank stability and water quality; floodplain connectivity; improved flows for aquatic habitat and fisheries.	N/A
Groundwater Conservation Strategies	Investigate additional groundwater conservation strategies, including groundwater conservation easements.	All	C, D, F, G, and J	Improved bank stability and water quality; floodplain connectivity; improved flows for aquatic habitat and fisheries.	Variable

Goal F. Maintain or improve water quality, with a focus on mine reclamation projects and compliance with State water quality standards.	
Target – Improve water quality, particularly reducing heavy metal concentrations and temperature exceedances, where feasible.	**Performance Indicators** – Heavy metal concentrations, water temperature, and other standard water quality parameters.
Justification – Excellent water quality is crucial to the health of the Conejos River. Although there are few water quality concerns, it is recognized that maintaining excellent water quality is critically important for supporting aquatic and overall river health for all water users.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Glacier/Chilkat Reclamation Project	The Glacier/Chilkat tailings pile is ~280 feet from the Conejos River and a small surface water channel makes contact with the pile before reaching the river. This project includes reclamation through construction of a defined flow path via a 100 ft lined channel and removal/relocation of up to 400 cubic yards of mine waste. Revegetation of both the mine wastes and repository area would need to take place for long-term stabilization and environmental improvement.	Reach 2	G	Mitigation of hazardous materials and improvement of soil/water quality for aquatic life, including recreational fisheries.	Medium
Lower Fisher Gulch Reclamation Project	Reclamation of the Lower Fisher Gulch Mines tailings piles. Depending on volume of waste rock, contamination present, and discharging water, recommended actions would include direct revegetation or capping and covering of mine wastes. Revegetation would consist of incorporation of amendments such as lime, limestone, compost, fertilizer, and seed to create a native vegetation component. This type of work has been successfully implemented at several USFS sites in Colorado.	Reach 2	G	Mitigation of hazardous materials and improvement of soil/water quality for aquatic life, including recreational fisheries.	Medium
Big Lake Reclamation Project	A large mine waste pile abuts the edge of Big Lake, which drains into the Lake Fork Conejos River, providing perpetual contamination into the lake. Specific reclamation activities are still being determined, but may involve removal/relocation of the tailings.	Reach 3	G	Mitigation of hazardous materials and improvement of soil/water quality for aquatic life, including recreational fisheries.	Medium

Goal G. Maintain or improve long-term sustainability of Conejos River fisheries and associated aquatic habitat.	
Target – Protect and build upon Conejos River fisheries by continuing current management and prioritizing projects that enhance both cold- and warm-water fisheries, including imperiled species.	**Performance Indicators** – Colorado Parks and Wildlife fish surveys, macroinvertebrate MMI scores, water quality monitoring.
Justification – The Conejos River supports remarkable recreational fisheries, which supports local anglers and outfitters, and bolsters the local economy.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Fall Fish Surveys	Conduct fry shocking in fall to better understand species life stage information.	Reaches 1 through 7	J	Improved understanding of Conejos Rive fish species life history; potential for improved aquatic habitat flows.	Low (annually)
Conejos River Fish Passage Improvements	Maintain and improve fish passage, particularly at diversion structures, with the exception of a potential fish barrier near the Town of Sanford.	Reaches 7 through 11	A and J	Improved irrigation infrastructure; potential for improved aquatic habitat flows.	Very High
Lower Conejos River Nonnative Fish Barrier	Installation of a fish barrier using existing diversion structure on lower Conejos River. The barrier will be installed near the Town of Sanford to prevent upstream movement of nonnative species. This will help protect the existing sport fishery as well as native fish species.	Reach 11	A and J	Improved irrigation infrastructure; potential for improved aquatic habitat flows.	High

Goal H. Improve infrastructure to support recreational access and use on the Conejos River.	
Target – Improve current access locations and construct new infrastructure, where appropriate, to enhance recreational opportunities, with a focus on sustainable infrastructure.	**Performance Indicators** – Number of new or improved river access locations; number of people utilizing the river for recreation.
Justification – Recreational access and safety improvements were identified as high priorities for community stakeholders. Opportunities exist to better support recreational activities on the Conejos River, including fishing access improvements, signage, and removal of navigational hazards.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Recreational Hazards Rectification	Rectification of hazardous fencing and installation of recreation-friendly fencing. Several opportunities exist between Platoro Reservoir and Mogote.	Reaches 1 through 7	N/A	Improved signage will increase recreational use and safety of the Rio Grande, helping to support the local economy and improve recreational opportunities in general.	Medium
Conejos River Recreational Signage Improvement Project	Install signage to indicate river access locations and river hazards. If possible, local organizations and state and federal agencies should coordinate to ensure consistency in signage formatting.	Reaches 1 through 7	N/A	Hazard rectification will improve river recreation safety.	Low
The Conejos River "Flowcast" Initiative	Development of a consistent communication pathway between reservoir operators, Division of Water Resources, and water users, including anglers, during the irrigation season. This may involve a daily email during the irrigation season containing streamflow information.	All	J	Improved recreational fishing opportunities and enhanced aquatic habitat flows.	Low (annually)

Figure 4.4: Example of recreation-friendly fencing in reach CR06. In this example, the fence could be raised to provide optimal passage.

Goal I. Collect additional streamflow data and continue snowpack monitoring to better characterize Conejos River hydrology and improve streamflow forecasting.	
Target – Strategically install instrumentation and collect additional data to improve available streamflow and snowpack information.	**Performance Indicators** – Additional high-quality streamflow and snowpack data.
Justification – A lack of streamflow data, particularly on tributaries to the Conejos River, was identified. Additional streamflow data will aid in understanding current hydrology and water management.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Streamflow Data Collection	Install temporary and/or permanent stream gages on select tributaries, including, but not limited to, Lake Fork, South Fork Conejos River, and Elk Creek.	Reaches 3 through 7	F, G, and J	Additional streamflow data to potentially enhance water quality, aquatic habitat flows and fishery health.	Medium
Conejos River Streamflow Forecasting Improvement Project	Build upon snowpack and climate measurement tools to improve streamflow forecasting. While forecasting capabilities have greatly improved in recent years, opportunities for improvement remain. In particular, consistent Airborne Snow Observatory snowpack data collection and assimilation into models such as WRF-Hydro will continue to enhance forecasting accuracy. Identification and planning for potential climate impacts such as dust-on-snow events is also recommended.	All	F, G, and J	Improved streamflow forecasting to potentially enhance water quality, aquatic habitat flows and fishery health. Improved forecasting will also aid in Rio Grande Compact administration.	Medium (annually)

Figure 4.5: Conejos River Near Mogote, CO (CONMOGCO) stream gage.

Goal J. Consider flow targets identified in the Aquatic Habitat Needs Assessment in the context of reservoir operations.	
Target – Utilize partnerships and flexible, voluntary agreements among water managers to meet aquatic habitat flow targets, when possible, to improve aquatic habitat.	**Performance Indicators** – Stream gage data to track progress toward aquatic habitat flow targets.
Justification – Meeting aquatic habitat flow targets, where possible, will improve aquatic species habitat while also supporting the local economy.	

Action Item/Project	Description	Applicable Reach(es)	Additional Goals Met	Associated Benefits	Relative Cost
Conejos River Winter Flow Program	Maintain and enhance the Conejos Winter Flow Program. This program is a partnership between Trout Unlimited and the Conejos Water Conservancy District.	Reaches 1 through 3	C, G, and J	Improved floodplain connectivity; improved flows for aquatic habitat and fisheries.	Medium (annually)
Conejos Meadows Resilient Habitat Project	Enhance habitat on 9,200 linear feet of the Conejos River below Platoro Reservoir to improve connectivity and habitat complexity during low flow time periods such as winter months (non-irrigation season Nov. 1- March 31) and during droughts. The project involves fish habitat enhancements and the creation of a low-flow channel in "The Meadows," and is led by Trout Unlimited.	Reach 2	B, C, G, and J	Improved floodplain connectivity; improved flows for aquatic habitat and fisheries.	Medium-High

5. Potential Funding Sources for SMP Implementation

A list of potential funding sources was developed to support implementation of the Conejos River SMP. This list is intended to be used as a reference and starting point for funding priority projects. It should be noted that there are likely numerous other applicable sources of funding. Table 5.1 lists funding sources and the types of projects expected to be eligible under each source.

Table 5.1: Potential funding sources for priority SMP projects and action items.

Funder	Description of Grant Program(s)	Eligible SMP-Related Projects/Action Items
Bureau of Reclamation (BOR)	BOR administers the WaterSMART program, which houses several grant programs including planning, research, and water efficiency projects.	This program primarily funds infrastructure-related projects to improve water efficiency. Other programs support baseline data collection, basin studies, and watershed planning.
Colorado Department of Public Health and Environment (CDPHE)	CDPHE administers grant funds to address water quality issues, especially projects that address water quality impairments on the 303(d) list.	Restoration or mitigation projects related to water quality. In the event of a Compliance on Consent (COC) order, funds are available for Supplemental Environmental Projects (SEP) that mitigate water quality issues, especially those associated with the COC order.
Colorado Healthy Rivers Fund	This grant program is administered through Colorado Water Conservation Board in association with the Water Quality Control Division and the Colorado Watershed Assembly.	On-the-ground projects "that contribute to cleaner water, healthier wildlife habitat, and improved recreation," including river restoration and riparian re-vegetation.
Colorado Parks and Wildlife (CPW)	CPW's Wetlands and Wildlife Program	Wetlands restoration, including streambank restoration and floodplain reconnection projects. Infrastructure projects that support wetland and/or wildlife habitat.
Colorado Water Conservation Board (CWCB)	There are numerous grant and loan programs administered by the CWCB. Among others, these include the Watershed Restoration, Colorado Water Plan (CWP) grants, and the Water Supply Reserve Fund (WSRF) program.	CWCB grant programs cover a wide range of potential projects, from stream restoration to water infrastructure. Loans are also available for entities such as ditch companies.
Great Outdoors Colorado (GOCO)	GOCO grants fund habitat restoration, land conservation, recreation and outdoor planning, and stewardship.	Boat ramps and other recreation infrastructure. River and wetland restoration and conservation activities, including conservation easements.
National Fish and Wildlife Foundation (NFWF)	NFWF primarily funds wildlife-related projects. The Foundation also has a significant restoration focus.	Stream corridor restoration, especially wildlife-related projects.
Natural Resource Conservation Service (NRCS)	NRCS has several funding programs including the Environmental Quality Incentive Program (EQIP), Targeted Conservation Plan (TCP), National Water Quality Initiative (NWQI), and Regional Conservation Partnership Program (RCPP).	Bank stabilization, diversion and ditch infrastructure improvements, and wildlife habitat enhancement.
RESTORE Colorado Program (Restoration and Stewardship of Outdoor Resources and the Environment)	RESTORE Colorado is a strategic funding partnership between GOCO, NFWF, CWCB, CPW, Gates Family Foundation, and Colorado Department of Natural Resources.	Enhancement and restoration of hydrology and connectivity for native species including aquatic habitat restoration and fish barrier installation/removal. Enhancement and restoration of riparian and wetland habitats, including managing grazing in riparian areas, invasive species removal, and wet meadow restoration.

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7. List of Appendices

The following is a list of SMP appendices. The appendices, which include the recreational use and flow needs assessment conducted by American Whitewater and other background reports used to develop the SMP are available as PDFs at: https://riograndeheadwaters.org/stream-management-plans. The full riparian vegetation and geomorphology reports are also available at this site.

A. **Assessment of Streamflow Needs for Supporting Recreational Water Uses on the Rio Grande and Conejos River**
B. **Channel Migration Analysis**
C. **SMP Tracer Gravel Study**
D. **Stream Classification System Summaries**
E. **Botany Survey and Analysis**
F. **Water Quality and Aquatic Life Data**