RIO GRANDE NATURAL AREA
RIVER CONDITION ASSESSMENT
APRIL 2016 REPORT

Colorado Rio Grande Restoration Foundation
Rio Grande Headwaters Restoration Project

RIVERBEND ENGINEERING

San Luis Valley Water Conservancy District

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

COLORADO WATER CONSERVATION BOARD STATE OF COLORADO 1876 1937

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Executive Summary

This report summarizes a study effort of the Rio Grande within the Rio Grande Natural Area (RGNA), which encompasses approximately 8,800 acres, of which 5,900 acres (67%) is private lands and 2,900 acres (34%) is federal lands managed by the Bureau of Land Management, San Luis Valley Field Office (BLM). This 35-mile stretch of the Rio Grande River, is also the boundary line between Conejos County to the west and Costilla County to the east.

The Rio Grande Headwaters Restoration Project, in cooperation with the BLM San Luis Valley Field Office, Colorado office, is actively promoting restoration efforts on the Rio Grande throughout the San Luis Valley, and beyond. This report is intended to inform The Rio Grande Headwaters Restoration Project and the BLM as a planning document for future restoration efforts, identifying priority restoration areas and specific restoration techniques.

This study and report follows a similar effort in 2001 that documented existing conditions in the Rio Grande between South Fork and Alamosa, and identified priority areas in need of restoration work. Other reports which evaluate this study area include the 2015 Draft of the RGNA Management Plan (Pitts); Costilla County, CO Trails, Recreation and Open Space (TROS) Master Plan; and the 2013 Sangre de Cristo National Heritage Area Management Plan (Gallegos).

This assessment includes map level assessments of land use, land ownership, riparian vegetation extents, and critical habitat designations for certain threatened and endangered species. It also includes field level measurements of river cross sections, sediment sizes, geomorphic condition, bank stability, water flow rates, water temperature, turbidity measurements, pH, and conductivity measurements. Qualitative observations of fish habitat were made, and quantitative data on macro-invertebrate species was collected. Of concern in this study area, but left for future research, is the presence & impact of both noxious weeds and trespass livestock.

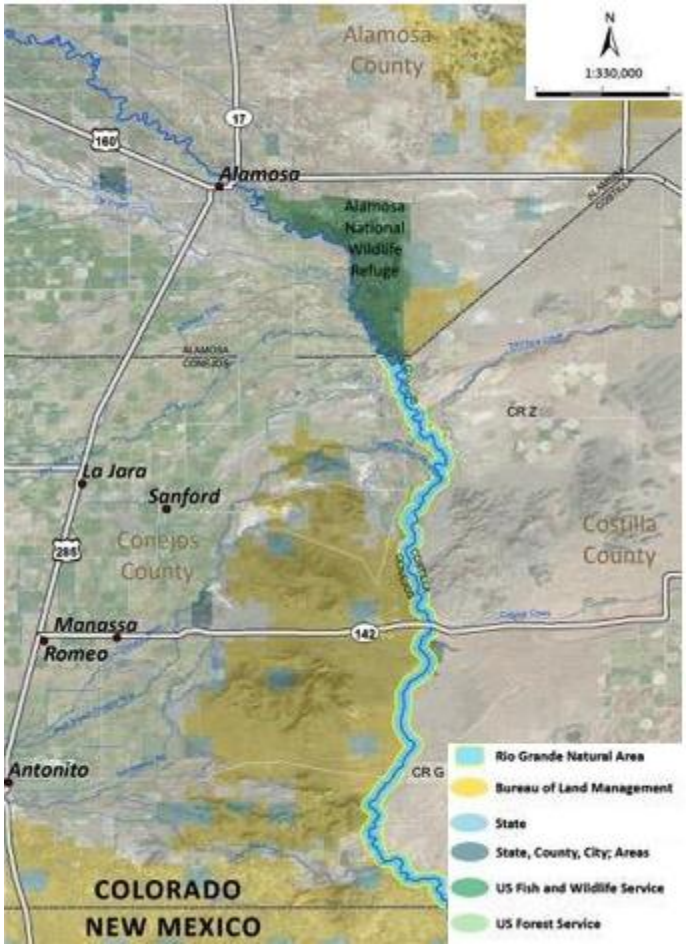
For each of the five reaches within the Study Area/ RGNA, this report ranks the condition of the river in several areas of functionality. The upper two reaches have the highest priority for potential future projects because of their poor current conditions and geographic accessibility. Suggested projects include wetland restoration, channel shaping & bank stabilization, fencing, education, access points & education/ informational signs.

Another approach to improving the river's health would be to restore periodic high flow events in the river. A short duration (days) "pulse flow" would create natural conditions of shallow overbank flooding and movement of bed sediments, conditions that have not been seen in this part of the river for decades. This would require future study and significant stakeholder engagement, but has the potential to create many collateral benefits for the river.

The report was prepared by Riverbend Engineering, LLC under contract RGHRP in collaboration with BLM San Luis Valley Field Office.

INTRODUCTION

This study has been led by the Rio Grande Headwaters Restoration Project (RGHRP), with cooperation and partial funding by the BLM (Colorado office), with additional funding provided by a grant from Colorado Healthy Rivers Fund. The Rio Grande Natural Area (RGNA) is located in the southern portion of the San Luis Valley (SLV) in south central Colorado and was established in 2006 by the U.S. Congress through Public Law 109-337, the Rio Grande Natural Area Act[1]. The RGNA includes the Rio Grande river corridor from the southern boundary of the Alamosa National Wildlife Refuge (ANWR) to the Colorado/New Mexico State line, extending ¼ mile on either side of the bank of the river (approximately 35 miles)—see map. The RGNA encompasses approximately 8,800 acres, of which 5,900 acres (67%) is private lands and 2,900 acres (34%) is federal lands managed by the Bureau of Land Management (BLM), San Luis Valley Field Office. The Rio Grande Natural Area Act also established a 9-member Commission to advise the Secretary of the Interior with respect to the Natural Area and to develop a management plan (Draft July 2015[2]) for the non-Federal land within the Natural Area. The RGNA Commission is a BLM Resource Advisory Council (RAC). Other reports which evaluate this study area include BLM; Costilla County, CO Trails, Recreation and Open Space (TROS) Master Plan[3]; and the 2013 Sangre de Cristo National Heritage Area Management Plan[4].



On the Costilla County[5] side, the land is mostly privately owned except for a parcel of county owned land near State Highway 142, whereas the Conejos County[6] side is primarily owned by the BLM (75%) with the remaining portion (25%) being privately owned. This 35-mile reach of the Rio Grande is home to spectacular wildlife and historical/cultural resources, and remains relatively undeveloped—see Map.

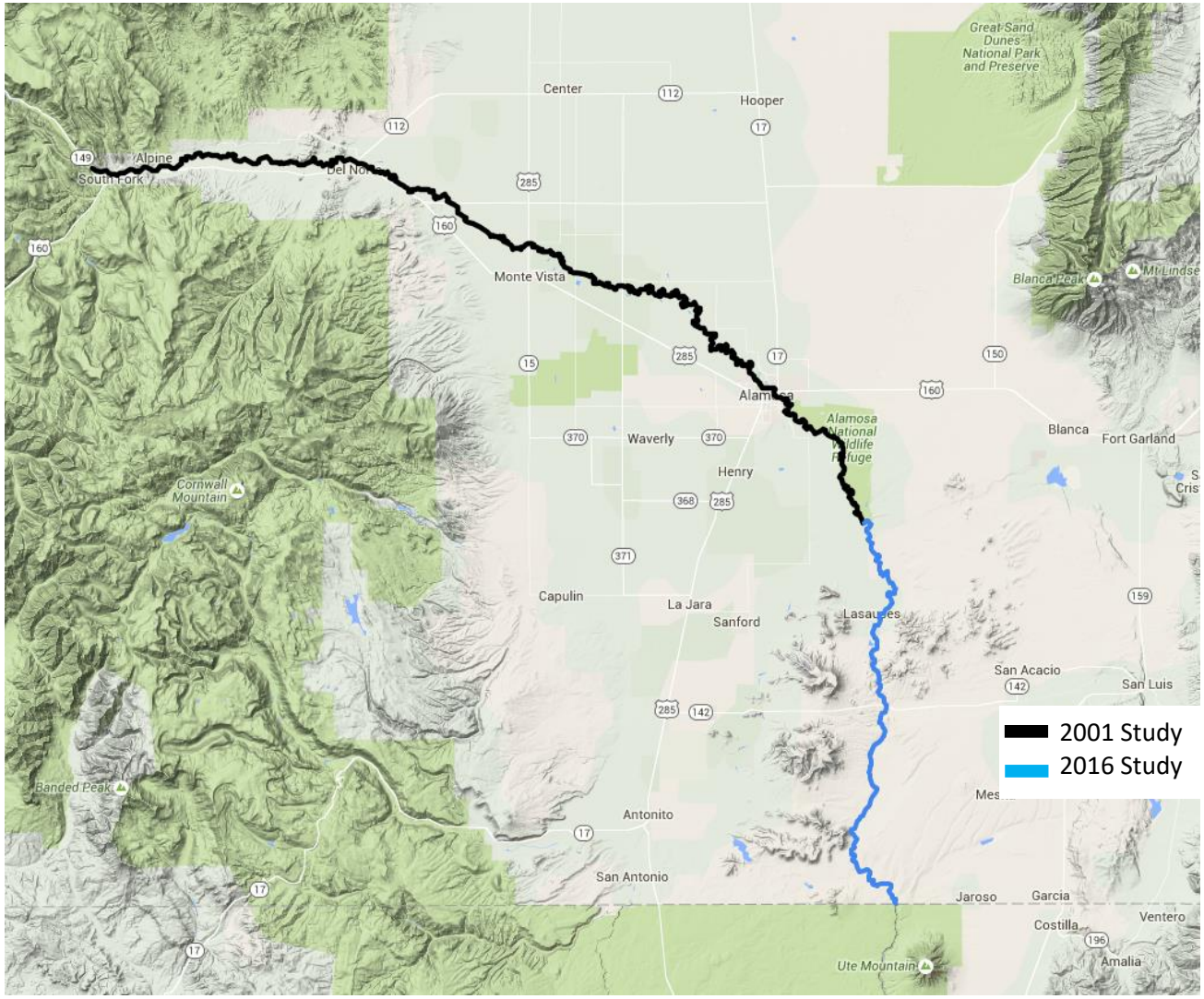
In 2001, the RGHRP authorized a study of the Rio Grande between South Fork and Alamosa. The purpose of the 2001 study was to assess current conditions in the river, and to identify and prioritize locations where restoration efforts are needed. This report has a similar purpose, but within the RGNA section of the river. The study area for this report is much shorter than the 2001 report, and the land use/ ownership is also very different.

As with any effort like this, all stakeholders are advised that any potential projects will go through the proper cultural & environmental clearance/ permitting process and that projects on private land would require the proper easements from willing landowners.

Study Area Overview

2001 & 2015

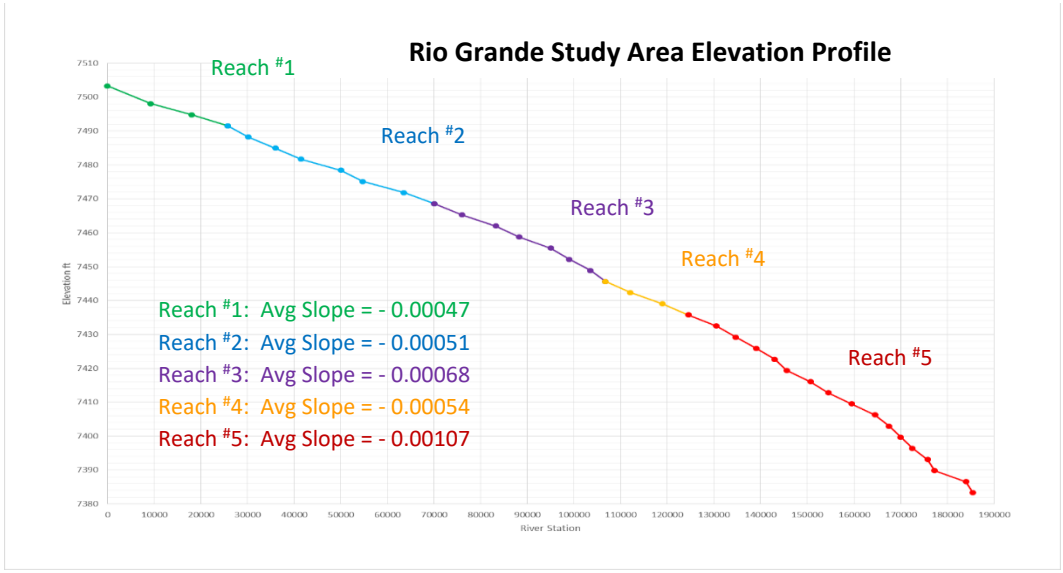
The 2001 RGHRP study covered approximately 91 river miles of the Rio Grande, from the town of South Fork, CO to the Alamosa/ Conejos County Line. This section of the Rio Grande has been managed extensively with many (~48) water diversion dams, large water extractions for agriculture and ranching, some levees and other flood control structures. Conversely, the lands within this 2015 study reach have no diversion structures and almost no flood control structures. Within the RGNA there is only one area where farming & ranching activities adjoin the river, and this is near where the Conejos River joins the Rio Grande. Irrigation water for this area comes from the Conejos River. Topographically speaking, there is very little arable land adjacent to the Rio Grande that is low enough to be reached by a surface water diversion. Within the RGNA, the Rio Grande forms the boundary between Conejos County (West) and Costilla County (East). Approximately 22 miles of the west side of the river is BLM (public land) and virtually all of the east side of the river is private land. See Appendix 1—Maps of Potential Projects for more detail.

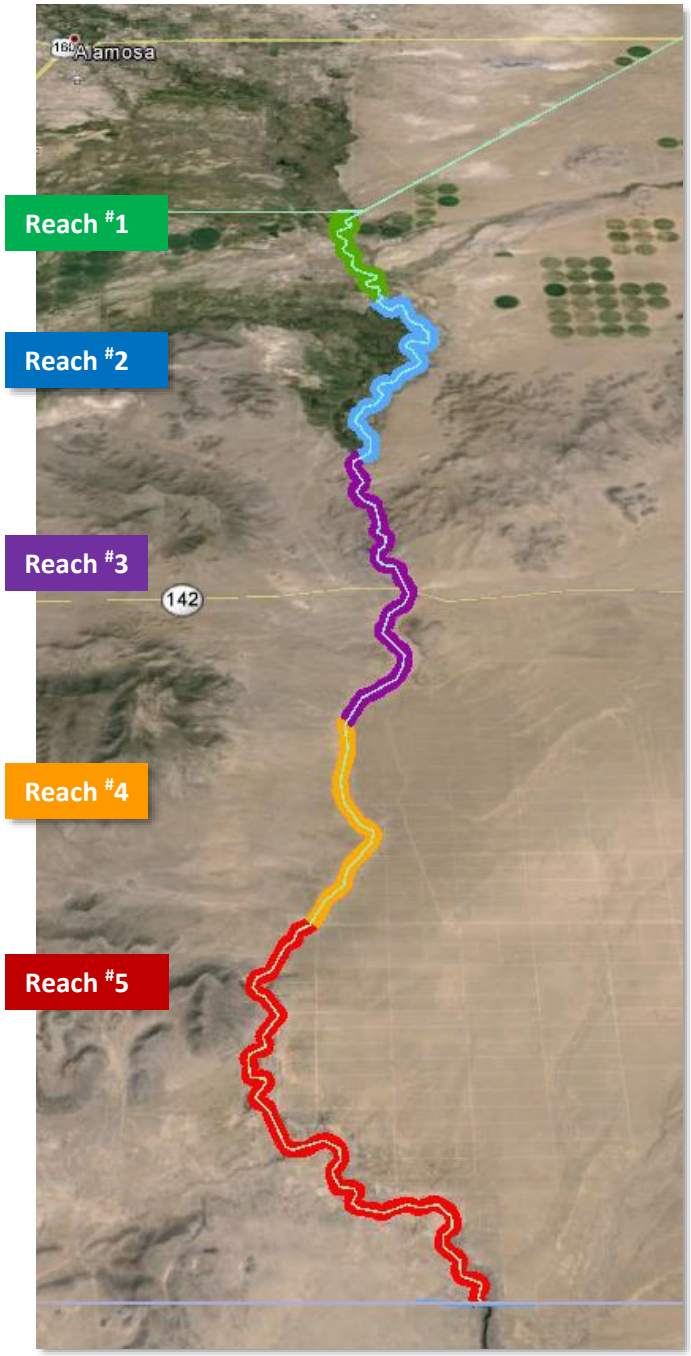


Five (5) Reaches Defined

The 35 mile study area was divided into 5 reaches. Reach locations were determined for a variety of reasons including changes in landform, land use, geomorphic characteristics, accessibility, and others. Each of the five (5) reaches defined will be discussed in more detail in the sections that follow.

	Beginning	Ending
Reach #1	Top of study area, end of Alamosa Wildlife Refuge	Confluence with the Rio Conejos
Reach #2	Confluence with the Rio Conejos	End of Private Property on River Right
Reach #3	Beginning of Public BLM Property on River Right	La Jara Jeep Trail Crossing
Reach #4	La Jara Jeep Trail Crossing	G Road/ Lobatos Bridge
Reach #5	G Road/ Lobatos Bridge	Bottom of study area CO/ NM state line

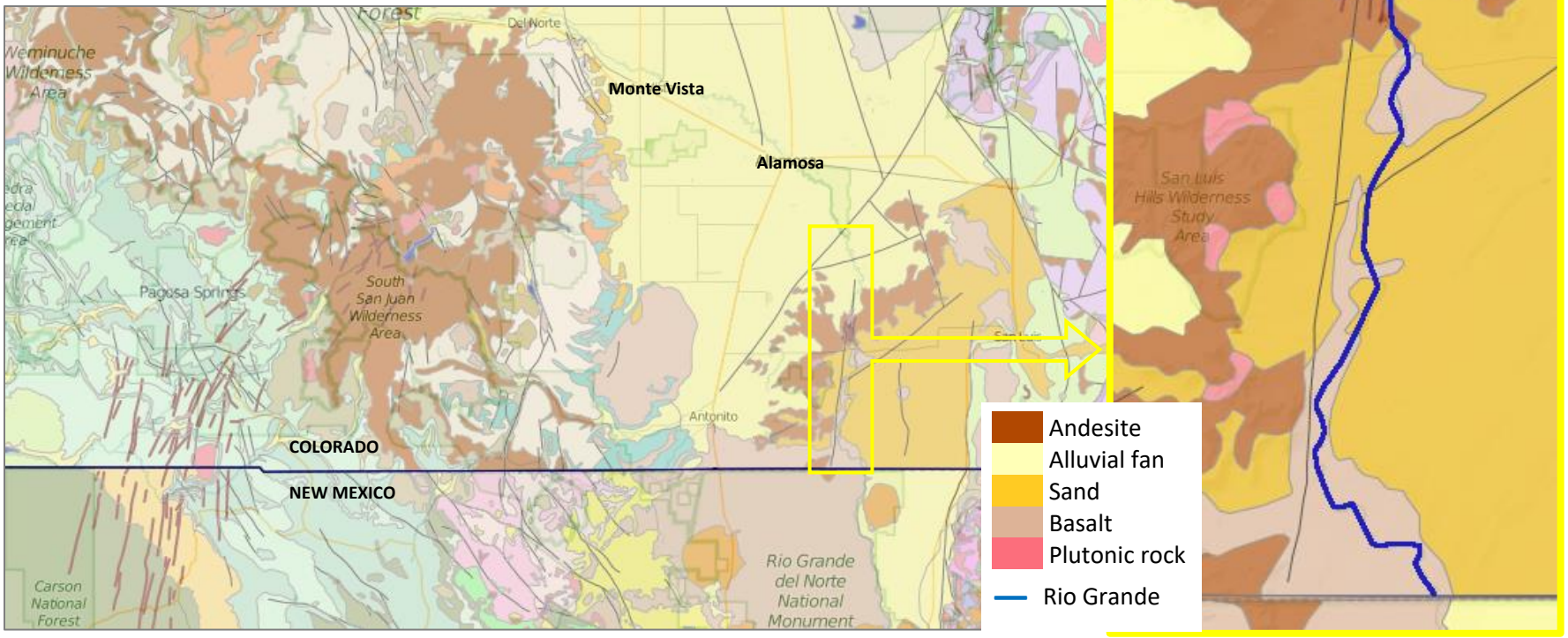




Geology/ Soil Information

During the Miocene & Pliocene time (~3-25 million years ago), the whole state of Colorado, and adjacent states, rose into a broad irregular dome about 5,000 feet higher than before uplift, with considerable squeezing and deforming, bending and breaking. Five-thousand foot mountains became 10,000 feet, plains only a thousand feet above sea level lifted to 6,000 feet, and summits over 9,000 feet high became Fourteeners. Only one slender slice of pie remained low—a long, narrow, crooked sliver represented today by the Rio Grande Valley.

The steep western face and high jagged crests of the Sangre de Cristo Range marks the line of a large fault zone bordering the east side of the San Luis Valley. Though movement on this fault zone began during the Laramide Orogeny 25-65 million years ago, some—perhaps most—of it took place in the Miocene-Pliocene time, when the Rio Grande Rift did not rise during regional uplift. There is evidence in the triangular facets at the bases of the mountains showing sporadic movement is still occurring, but peak elevations over time suggest erosion is happening at roughly the same pace.[7] See USGS Maps[8] and Appendix 5—Geology Data.



Project Methods

All 35 miles of the Rio Grande Natural Area were evaluated by float trips in the spring and summer of 2014.

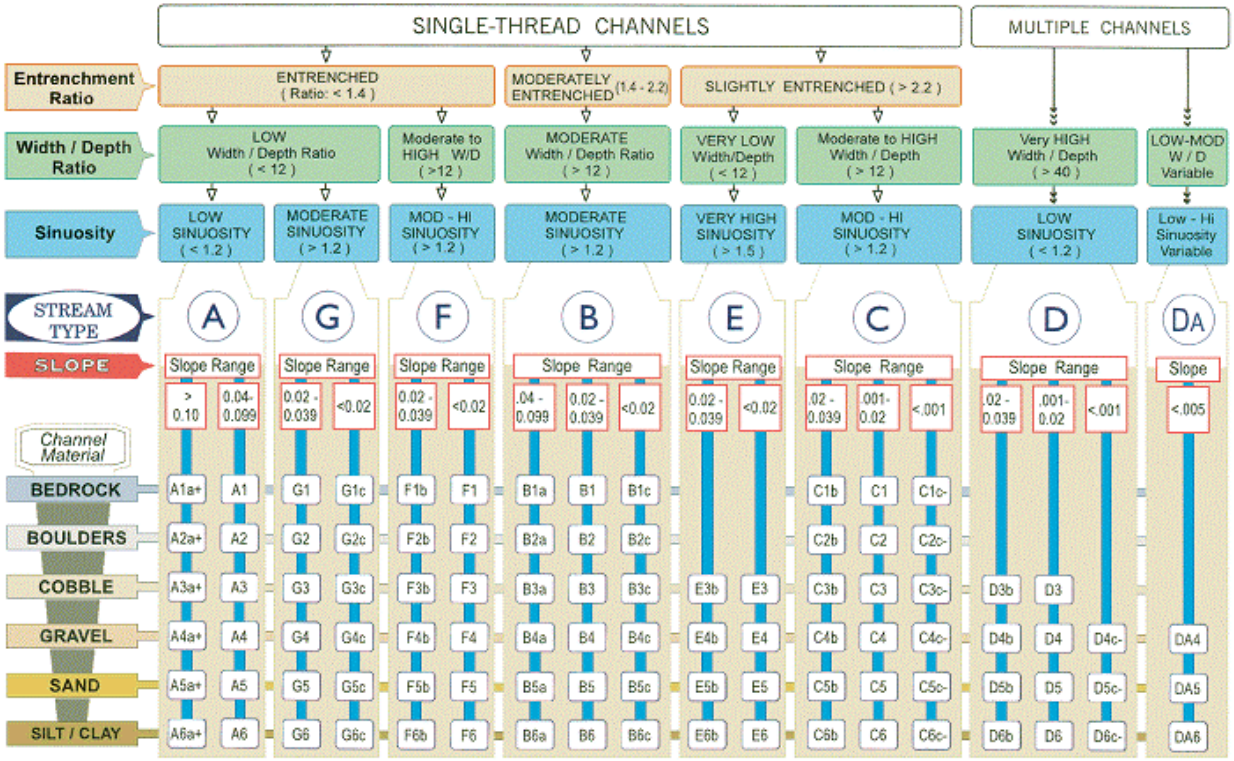
Stream Visual Assessment Protocol (SVAP) was utilized at representative locations (p. 11).

GPS cross sections[9] were done at 6 locations.

Water quality sampling, temperature, pH, and Wolman Pebble counts were done at the 2 locations (p. 10 & 14).

Benthic Macroinvertebrate sampling was done at 4 locations (p. 12).

Locations were classified with the Rosgen Classification system (adjacent figure). This system considers whether or not the river is single or multiple channel, its entrenchment ratio, width/ depth ratio and sinuosity—as well as the slope and predominant channel material[10].



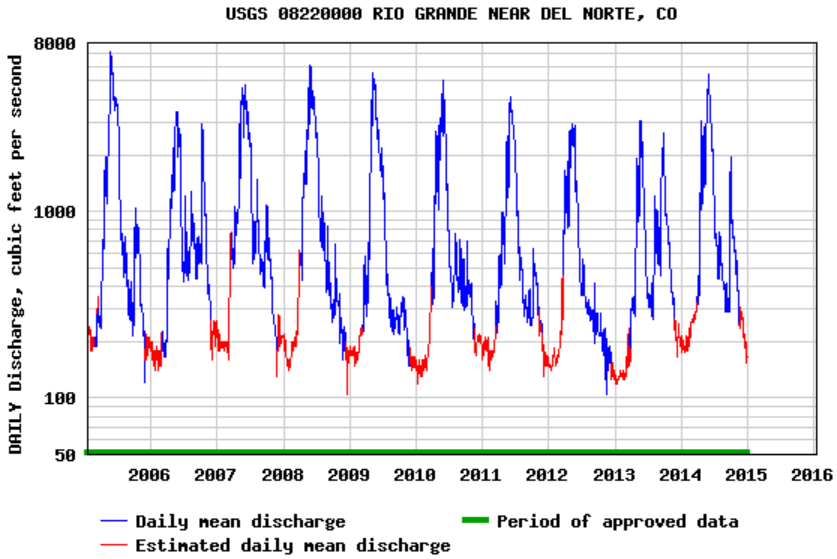
KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

A total of 71 photo points were established and pictures were taken Appendix 2—Photo Points.

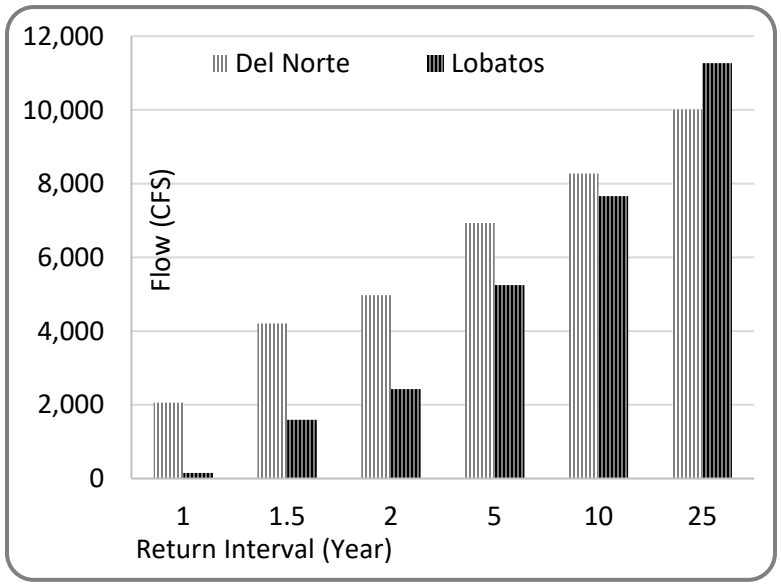
In March 2014 & December 2015 & March 2016 Riverbend Engineering convened RGHP and stakeholders from the BLM to discuss the observed conditions found and make recommendations for the future, based on potential benefits both to the health of the river and to the people who use it. The results of this discussion are covered reach by reach in the "Recommendations for the Future" tables (pages 20, 25, 30, 34, and 38) and are summarized in Appendix 1—Maps of Potential Projects.

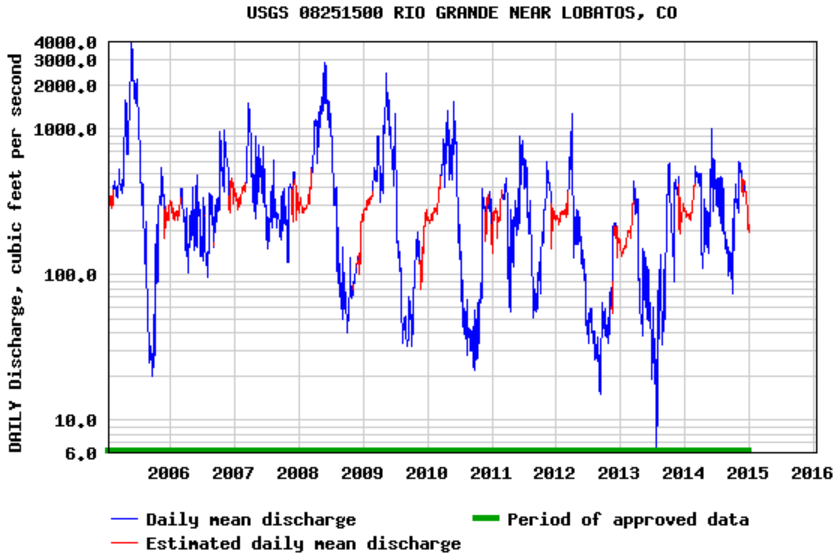
Gauge Data—Flow

A gauge data comparison of the Del Norte Gauge of the Rio Grande (USGS 08220000) and the Lobatos gauge (USGS 08251500) shown here quantifies the changes in expected flow frequency events for each location. An annual peak flow frequency analysis was also conducted[11]. The Del Norte and Lobatos gauge analysis utilized 121 and 111 years of peak flow data respectively (Appendix 3—Gauge Data Analysis). The Lobatos site has a watershed area nearly 6 times as large as the Del Norte site, yet the predicted 1.5 year return interval flow amounts, otherwise known as the bankfull flow event, for the Lobatos site is less than 40% of the same return interval flow at the Del Norte site. 10-year graphs shown here simplify the story[12].



Sustained historical water diversions for irrigation and potential flood control[13] are the evident causes for the drastic depletion of annual channel forming flows in the Lower Rio Grande.

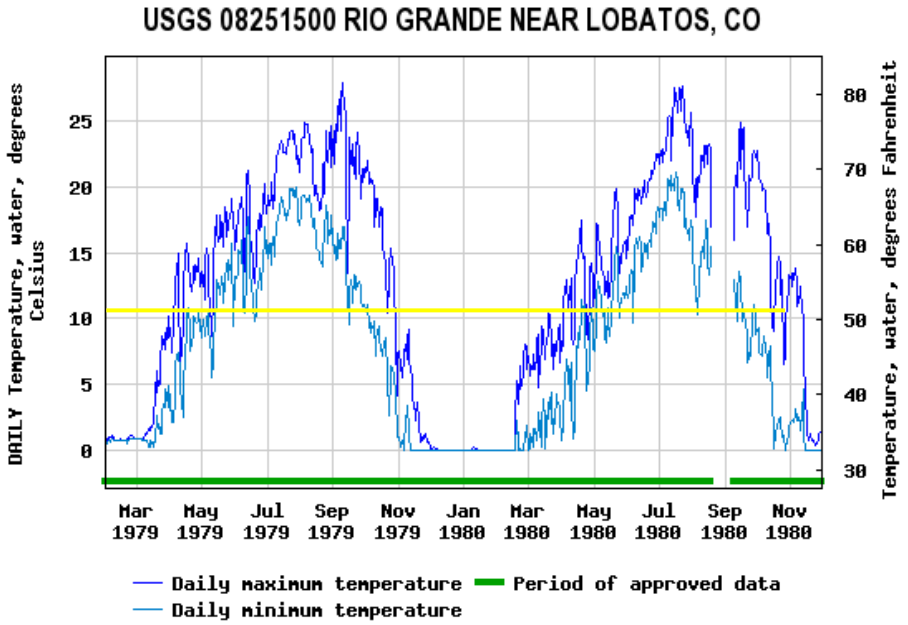




Gauge Data—Water Quality

The scope of this study did not allow for robust water quality analysis, so a single collection was made at only two locations--in Reach #3 at the cross section location below the HWY 142 Bridge; and in Reach #5 also at the cross section below the G Road Bridge, both on 9 May 2014[14]. It appears the data collected is consistent with historical temperatures in early May. The data collected seems to be consistent with available USGS Gauge data[15] here.

The Colorado Coldwater Fish Stream Habitat Technical Note from NRCS[16] defines 'Coldwater streams' as streams that maintain temperatures of 70°F or less for most of the year, and a pH of 6.5-9.0. The 1979-1988 USGS temperature information included here, has an added yellow line approximating 70°F, highlighting that for most of the summer temperatures exceed that threshold, at the Lobatos gauge. The average pH levels taken from the same gauge location in spotty intervals from 1947-2016 is ~8.2, at the upper end of the NRCS recommended alkalinity. Dissolved Oxygen (DO), a critical parameter for fisheries, was not evaluated. Turbidity recorded between 1977-1993 averaged ~9.8. Point samples taken May 2014 remain consistent with that data. These low turbidity levels are not a concern for fish health.



HWY 142 Bridge May 2014

pH = 8.48

Temperature = 49.3°F

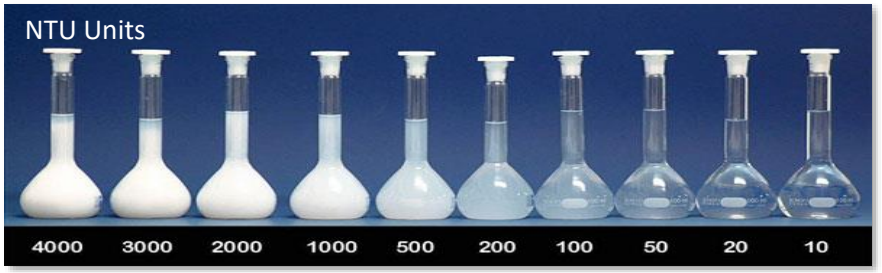
Turbidity = 9.2 NTU

Road G Bridge May 2014

pH = 8.4

Temperature = 54.3°F

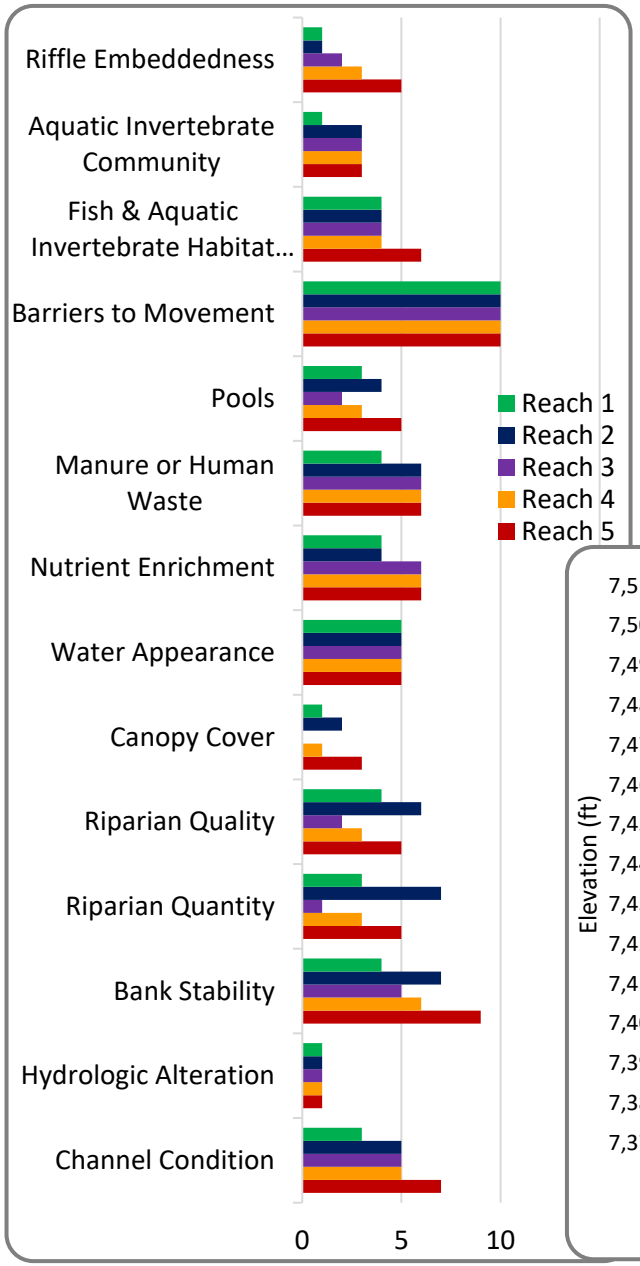
Turbidity = 10.9 NTU



This data not preclude this reach from holding coldwater species such as rainbow and brown trout, and may suggest that projects that improve temperature and pH would increase the likelihood of suitable fishery habitat—especially in the lower reaches where the canyon walls provide shade and the geology provides a larger substrate and a more typical pool-glide-riffle-run pattern in the system.

Further study is warranted, especially to explore the potential for improving fish habitat.

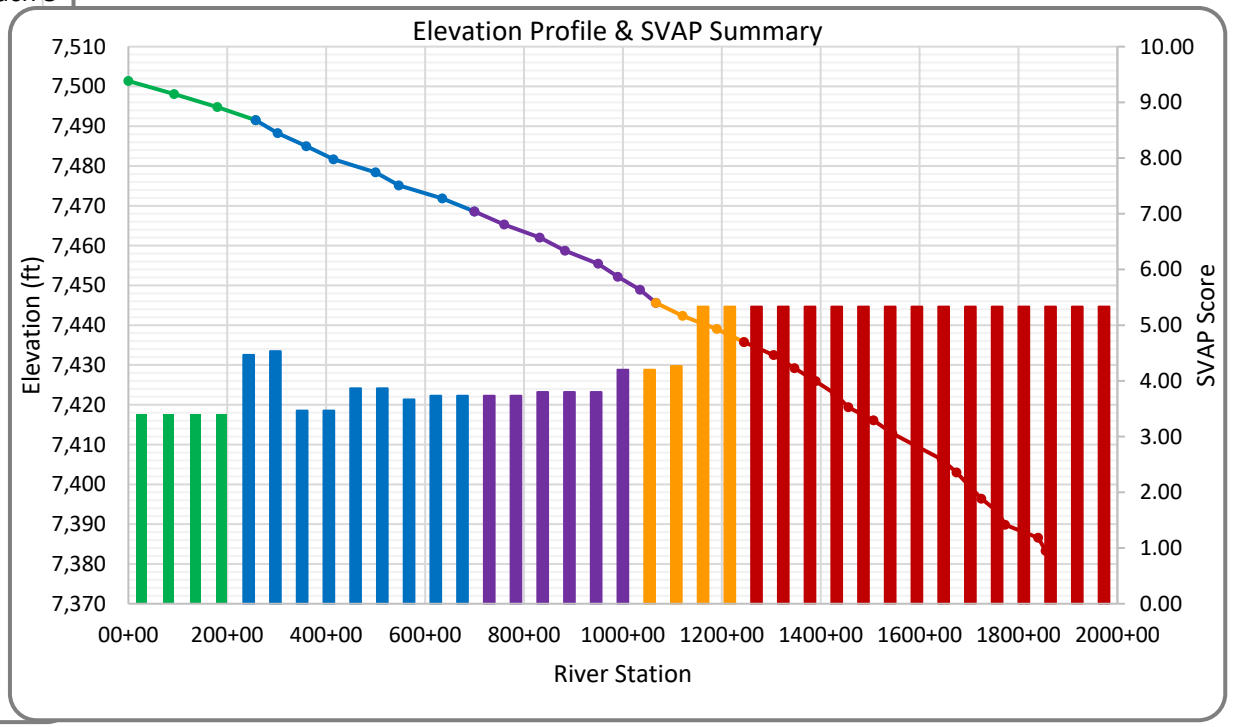
Stream Visual Assessment



The Colorado NRCS Stream Visual Assessment Protocol (SVAP)[17] is a qualitative multidisciplinary stream assessment method used to perform rapid visual assessment of several elements of overall stream corridor conditions. Typically this assessment method is used to evaluate conditions at the property level. For this study, the SVAP protocol was used as a guide with the intention of informing the planning process from a broad perspective. The results of this SVAP assessment are listed in the graph on the left.

Colorado NRCS considers a score of 5 or less to indicate poor or severely degraded conditions. For this study SVAP scores were not utilized to determine priority project areas, but do provide a broad view of the health of the river.

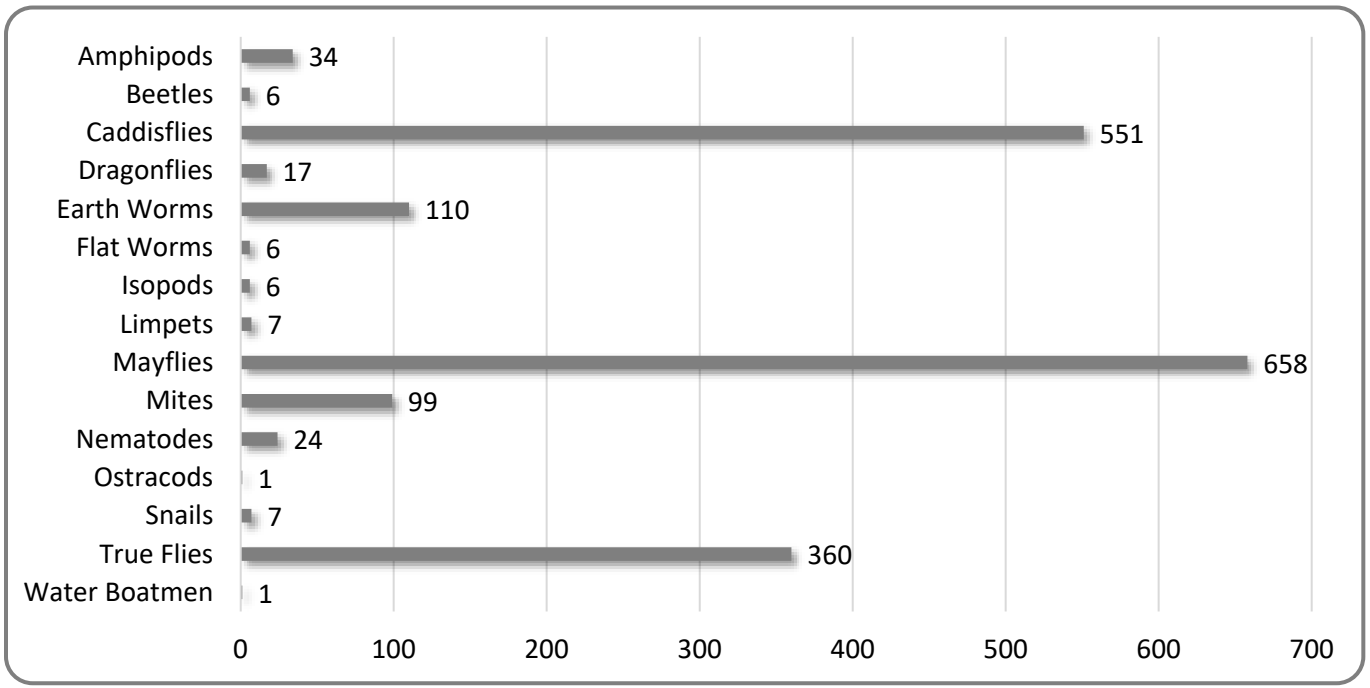
These scores show two trends that are worthy of noting: (1) The upper reaches had consistently lower scores than the lower reaches, and (2) many reaches of the river show poor habitat conditions such as a lack of canopy cover, riffles, and pools.



Benthic Macroinvertebrates

Benthic Macroinvertebrate collections were done at four (4) locations (see adjacent map) using a Hess Type Benthic Macroinvertebrate Sampler. Specimens were preserved in 90% Isopropyl Alcohol and sent to a professional taxonomy lab (EcoAnalysts in Moscow, ID) for taxonomic identifications. Full results are in Appendix 4—Macroinvertebrate Data. This study only represents a one-time limited assessment, and further investigation is needed to draw conclusive results regarding the overall health of the benthic ecosystem. With the significant hydrologic alterations (lower flows), this study only investigates a snapshot of the existence of benthic macroinvertebrates in the system to provide a general assessment of the presence of a significant benthic population. SVAP as a guide:

> "*the presence of a diversity of intolerant macroinvertebrate species (pollution sensitive) indicates healthy, resilient stream conditions. Macroinvertebrates such as stoneflies, mayflies, and caddisflies are sensitive to pollution and do not tolerate polluted water. These intolerant orders of insects comprise Group I. Group II macroinvertebrates are facultative, meaning they can tolerate limited pollution. This group includes damselflies, aquatic sowbugs, and crayfish. The dominant presence of Group III macroinvertebrates, including midges, craneflies and leeches without the presence of Group I, suggests the water is significantly polluted. The presence and abundance of only one or two species from Group I species in a reach community does not generally indicate diversity is good.*"



Benthic Macroinvertebrates	SITE:	#1	#2	#3	#4
Nematodes *Nematoda*		○	○	X	X
Earth Worms *Oligochaeta*		●	◌	○	○
Leeches *Helobdella stagnalis*		X	○	X	X
Flatworms *Turbellaria*		○	X	○	X
Air Breathing Limpets *Ferrissia sp.*		○	○	X	○
Pond Snails *Lymnaeidae*		○	○	X	X
Left Handed Air Breathing Snail *Physa sp.*		X	○	○	X
Amphipod *Hyella*		X	○	○	●
Isopod *Caecidotea sp.*		X	○	○	○
Ostracod (Tiny Clam) *Ostracoda*		X	X	○	X
Water Mites *Eylais sp.*		○	X	X	X
Hygrobates sp.		○	○	X	X
Lebertia sp.		X	○	X	X
Sperchon sp.		○	X	○	X
Water Boatmen *Corixidae*		X	○	X	X
Silver Water Beetles *Hydrophilidae*		○	X	X	X
Predaceous Diving Beetles *Laccophilus sp.*		X	○	X	X
Non Biting Midges *Chironomidae*		●	○	○	○
Black Flies *Simulium sp.*		○	○	●	○
Moth Flies *Pericoma/Telmatoscopus sp.*		X	X	○	X
Shore Fly *Ephydridae*		X	○	X	X

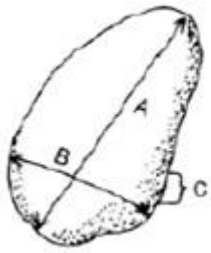
	SITE:	#1	#2	#3	#4
Mayflies (Small Minnow) *Baetidae Acentrella insignificans*		○	○	○	◌
Baetidae Camelobaetidius warreni		○	○	○	●
Baetidae Heterocloeon sp.		X	○	○	X
Baetidae Paracloeodes minutus		○	○	X	○
Baetidae Baetis tricaudatus *(Blue Winged Olive)*		X	○	○	X
Baetidae Fallceon sp. *(Blue Winged Olive)*		X	○	○	○
Mayflies (Small Squaregill) *Brachycercus sp*		○	X	X	X
Mayflies (Pronggilled) *Choroterpes sp.*		X	○	○	X
Mayflies (Little Stout Crawler) *Tricorythodes sp.*		◌	●	○	○
Caddisflies (Netspinning) *Hydropsychidae Cheumatopsyche sp.*		○	◌	◌	○
Hydropsychidae Hydropsyche sp.		○	○	●	○
Caddisflies (Micro) *Hydroptilidae Hydroptila sp.*		○	○	○	X
Hydroptilidae Ochrotricia		X	X	○	X
Caddisflies (Long Horned/ White Miller) *Leptoceridae Nectopsyche sp.*		○	X	○	X
Caddisflies (Small Case) *Helicopsychidae Helicopsyche sp.*			○	X	X
Caddisflies (Tortise/ Little Black) *Glossosomatidae Culoptila sp.*		X	X	○	X
Caddisflies (Tube Making) *Psychomyia sp.*		X	X	○	X
Clubtails/ Dragonflies *Ophiogomphus*		○	○	X	X
Narrow Wing Damselflies/ Pond Damsels *Psychomyiidae Coenagrionidae*		X	○	X	X

● Dominant Taxa ◌ 2nd Dominant ◌ 3rd Dominant ○ Species Present X Not Found

Pebble Counts

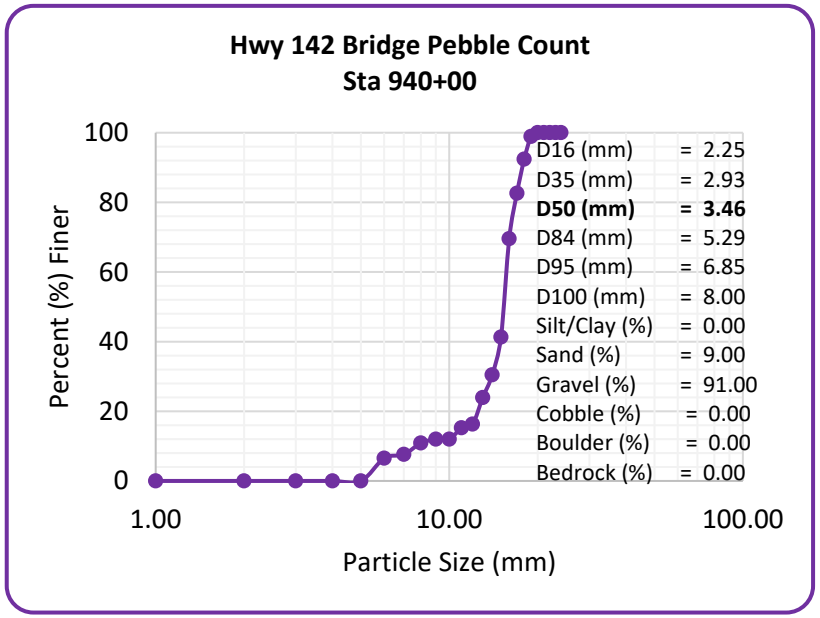
Pebble Counts were taken at the same locations as water quality sampling, to characterize the channel and bed material present and classify the stream type morphologically. The "Wolman" Pebble Count Method[18] was used and the results are shown here. Results show the upper reaches have much finer sediment. Not only is the slope in Reaches #1-4 is lower than Reach #5, but also agriculture upstream of and in the study area for this report has allowed for upland topsoil erosion. With current management practices, the river is unable to naturally flood at a level which will mobilize the substrate to flush the finer materials downstream.

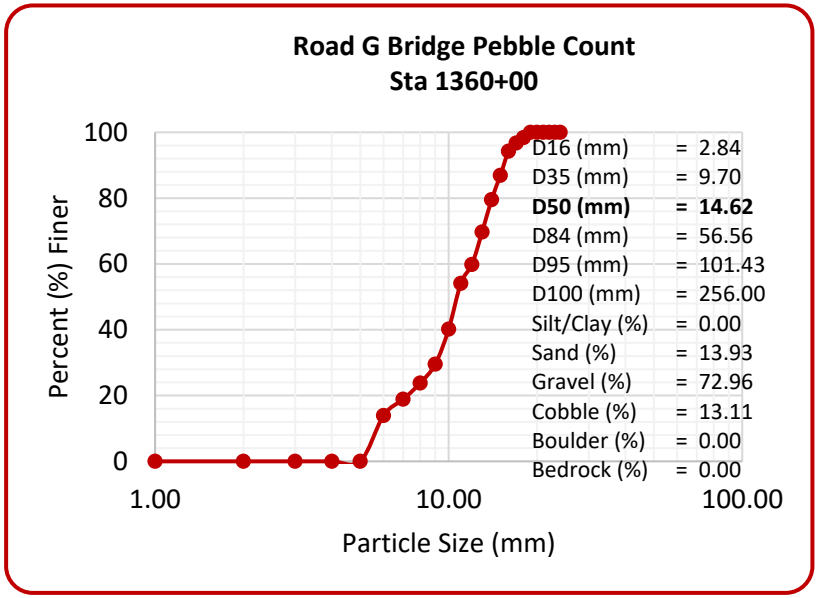
The HWY 142 Bridge is in Reach #3 and the average sediment size (intermediate axis, see below) was ~3.46 mm; and at the G Road Bridge in Reach #5 it was ~14.62 mm. Reach #5 has a higher slope, supporting larger cobble and is not aggrading like the upper reaches where finer sediments were found. While informative, this data does not draw any definitive conclusions except to contribute to the stream-type calculations derived for each reach.



Axis of a pebble

(A) – Long axis
(B) – Intermediate axis
(C) – Short axis



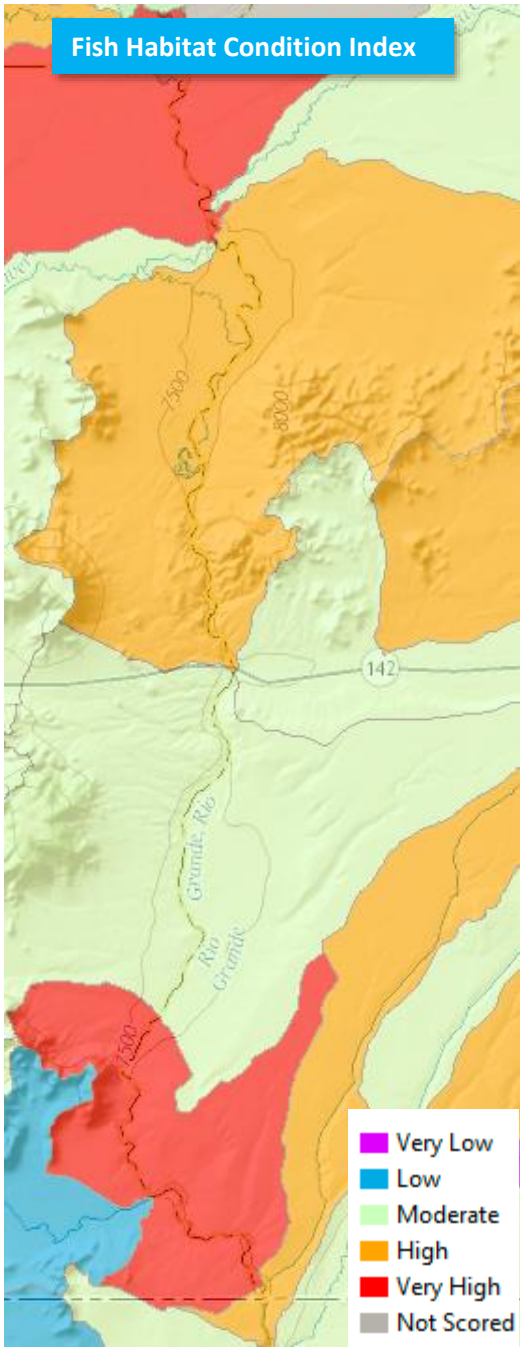


Other Observations/ Data Collected

The following data were qualitatively observed or collected from outside sources.

Fishery Potential

As discussed in the Water Quality section (p. 10), Carp and minnows were observed in all reaches, and it seems the likelihood for coldwater fish habitat (i.e. rainbow or brown trout) is higher in lower reaches where colluvial rocks provide pool-glide-riffle-run habitat and the steep cliffs provide shade. The map shown here is from the USGS National Fish Habitat Partnership[19]. The Habitat Condition Index (HCI) estimates the expected condition of habitats based on the intensity of human disturbance to the landscape affecting the river reach—and this study area is very high, high, and moderate. This aligns with the historic altered hydrology/ low flows and agricultural influences in the watershed. Further study is warranted to determine the coldwater fishery potential.



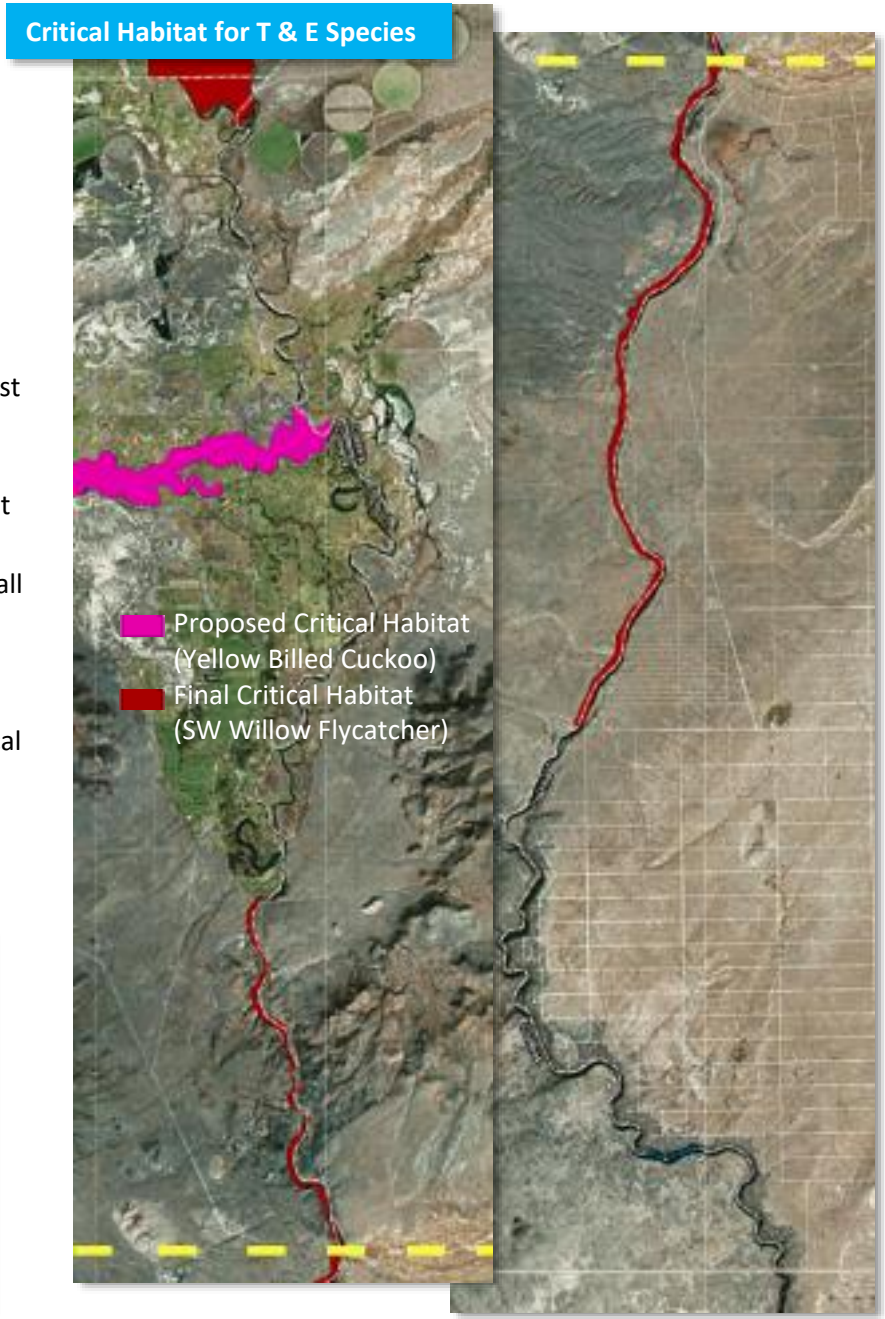
Vegetation

According to the USFWS[20] riparian habitat in the San Luis Valley generally consists of a mosaic of woody trees and shrubs, wetlands, grasslands, and open water. The woody canopy includes stands of coyote willow, peachleaf willow, crack willow, and broad-leafed and narrow-leaf cottonwood. In some areas, riparian vegetation is dominated by monotypic stands of either willow or cottonwood, while other areas support mixed stands of trees and shrubs. In addition to woody trees and shrubs, the general riparian corridors are typically include wetlands and open water associated with irrigation and old oxbows, as well as wet meadows and grasslands that are often supported by irrigation and used for pasture. These ancillary habitat areas are generally found within the 100-year floodplain of major streams and rivers.

A Biological Inventory which included Conejos County (but not Costilla County), completed by Colorado State University Colorado Natural Heritage Program in 2000[21] identified a Potential Conservation Area (PCA) was identified near Lasauses in Conejos County. PCAs are wetlands and riparian areas that contain rare or imperiled plant and animal species, and significant plant communities. This PCA was identified because it "supports a good example of the globally imperiled slender spiderflower," giving it a very high significance biodiversity rank. The site also supports a fair example of a submergent giant bur-reed wetland community, which is also imperiled. The site occurs along the western side of the Rio Grande approximately 1 mile south of the town of Lasauses, within a broad floodplain where numerous large oxbow lakes occur.[22] Again, the PCA report did not cover river right, Costilla County. Further evaluation for noxious weeds may be warranted.

"Critical Habitat"/ Threatened & Endangered Species

The Threatened Southwestern Willow Flycatcher (SWF), in left photo, and the Endangered Yellow-Billed Cuckoo (YBC), on the right, have been identified as having critical habitat in and near the RGNA. The USFWS Critical Habitat Map[23] shown here shows final critical habitat in dark red designated for SWF, and proposed in pink for YBC (primarily on the Rio Conejos). The USFWS Information for Planning and Conservation (IPaC) report[24] data is much broader than the Critical Habitat information above, and extends over all ecosystems in the upland and montane region, not just thousands of acres of riparian/ wetland habitat within the RGNA. It is important to remember how important the Rio Grande and its riparian buffer serves as a perennial water source and migratory habitat for at least 29 migratory birds. Almost all migratory birds are threatened somewhere along their ranges, and only 9% of all species are protected year-round in all of their habitats[25]. Also in the region are the listed threatened Gunnison Sage-grouse and Mexican Spotted Owl, Black-footed Ferret, Canada Lynx, and New Mexico Meadow Jumping Mouse are all found somewhere near the study area listed in this USFWS IPaC Report. The presence of the critical habitat for these species will require special planning, permitting, and clearances. Monitoring the future modifications and additions to these maps will also be necessary to ensure future listings are not overlooked after the publication of this report.



Reach #1

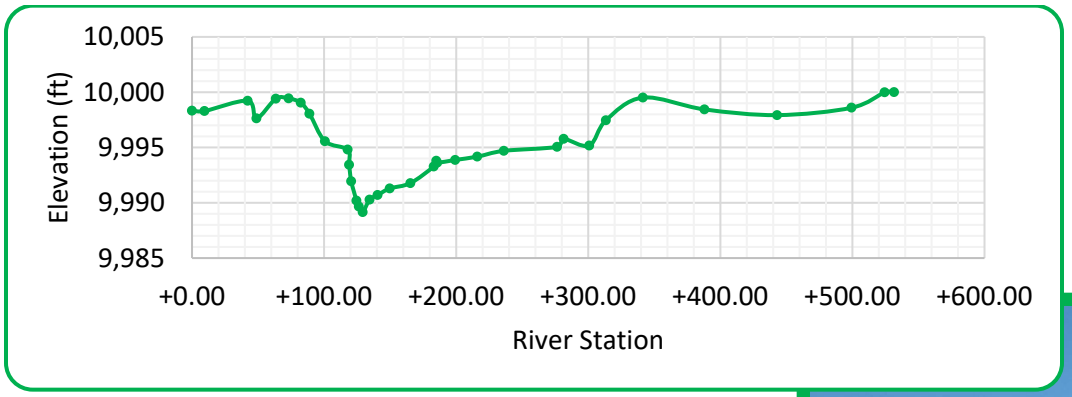
Location Description

The first reach runs ~5.2 miles from the top of the study area the southern edge of the Alamosa Wildlife Refuge (ANWR) to the confluence of the Rio Coñejos from the west, just downstream of the confluence of Trinchera Creek and the Z Road Bridge.

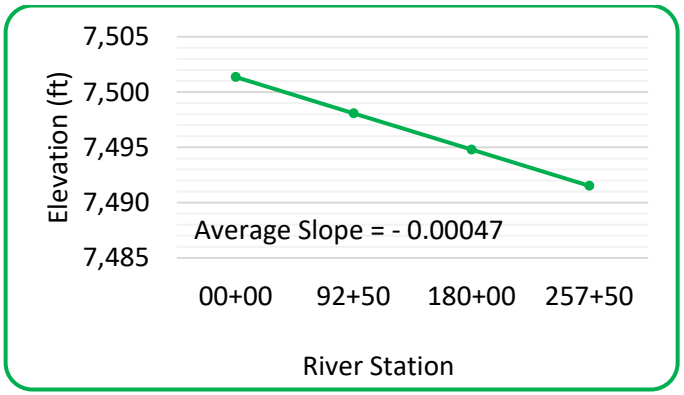
As can be seen in Appendix 2—Photo Points, this reach has pressures from heaving grazing of domestic livestock, some severe active bank erosion, and a lack of strong woody riparian vegetation. Abandoned oxbows and side channels provide potential for wetland restoration.

This map shows an approximation of the Alamosa National Wildlife Refuge (ANWR) southern boundary, the small patches of BLM and land within this reach, with the majority of land owned privately. The cross section for this reach is at the top. Current access points include from within the ANWR, and the BLM polygon on the bottom both up and downstream of the Z Road Bridge.

Cross Section



Elevation Profile



Geomorphic Classification

Floodplain Width	=	453 ft
Entrenchment Ratio	=	2.87
Sinuosity	=	1.78
Width/ Depth Ratio	=	28.7
Channel Material	=	sand
Rosgen Classification	=	**C5c**

Summary of Observed Conditions with Notes on Priority

Mileage (Bottom Station)	Condition Notes	High Priority/ Easy Access 5 4 3 2 1 Low Priority
REACH #1 BEGINS AT THE BOTTOM OF THE ALAMOSA NATIONAL WILDLIFE REFUGE PROPERTY ~ 00+00		
MILE 0-1 (52+80)	River right some rip rap and river left has steep (20-30') cut banks and in general lacks large woody riparian vegetation i.e. cottonwoods, willows	3 The Alamosa National Wildlife Refuge is adjacent to much of the first mile on river left, enabling access for river improvement projects. The river would benefit from channel shaping, bank stabilization, riparian rehabilitation, and land-owner education.
MILE 1-2 (105+60)	Most of this mile has cut banks (1-4') and lacks woody riparian vegetation, especially on river left. Eroded/ trampled banks due to livestock private and/ or trespass.	2 This reach is entirely within private land and the unstable banks (both cut and trampled) are due to land management practices and maybe trespass livestock. The river would benefit from channel shaping, bank stabilization, riparian rehabilitation, and riparian fencing.
MILE 2-3 (158+40)	Little to no riparian vegetation and some cut banks, especially river left. River right appears overgrazed and trampled and some pole plants were observed.	5 BLM polygon of land in miles 2-3 is mostly on river left and enables access for improvement projects. The river would benefit from channel shaping, bank stabilization, riparian rehabilitation, and riparian fencing.
MILE 3-4 (211+00)	Some cut banks (2-3'), especially river left.	2 This section contains private property on both sides of the river with limited access. The river would benefit from channel shaping, bank stabilization, riparian rehabilitation, and riparian fencing.
MILE 4-5 (264+00)	Some channel bars; some cut banks (5-6') on river left near confluence with Trinchera Creek; man-made deposits on river right just above the Z Road Bridge. Access to river for recreation is poor.	5 BLM polygon of land above and below the bridge enables access for improvement projects, however the cut banks in this mile are on private property, upstream. High potential to improve the river's health (with channel shaping, bank stabilization, riparian rehabilitation) and, with interest, projects could also include informational signage, wildlife viewing opportunities, parking lot, trail(s)/ river access improvements, etc.
REACH #1 ENDS AT Z ROAD BRIDGE ~260+00		

Recommendations for the Future

River Condition	% of Reach Affected	Severity	River Health Benefits	Public & Private Benefits
Actively eroding vertical cut banks	4	5	5	4
Unstable river banks	4	4	5	3
Lack of riparian shrubs & trees	3	5	3	3
Lack of riparian herbaceous cover	3	5	3	3
Inadequate sediment transport	5	4	4	4
Lack of fishery habitat	4	3	3	3
Lack of benthic macroinvertebrates	3	3	4	3
Lack of Recreational Access	2	5	1	5
Upland Conditions*				
Trespass Livestock	2	3	4	4
Noxious Weeds	3	3	4	3

* Upland Conditions were scored primarily by the BLM.

% of Reach Affected		Severity		River Health Benefit		Human Benefit	
5	~81-100%	5	Extreme	5	Very High	5	Very High
4	~61-80%	4	Very Severe	4	High	4	High
3	~41-60%	3	Severe	3	Moderate	3	Moderate
2	~21-40%	2	Moderate	2	Low	2	Low
1	~1-20%	1	Mild	1	Very Low	1	Very Low
0	None	0	Not a problem	0	No Benefit	0	No Benefit

The majority of Reach #1 is affected by extreme actively eroding vertical cut banks. By addressing bank stability as a priority, the compromised aquatic and riparian habitat, impaired water quality, and very limited sediment transport will also be improved. The majority of the surrounding property in this reach is private, much of which is being managed allowing livestock unlimited access to the river corridor.

Potential projects include:

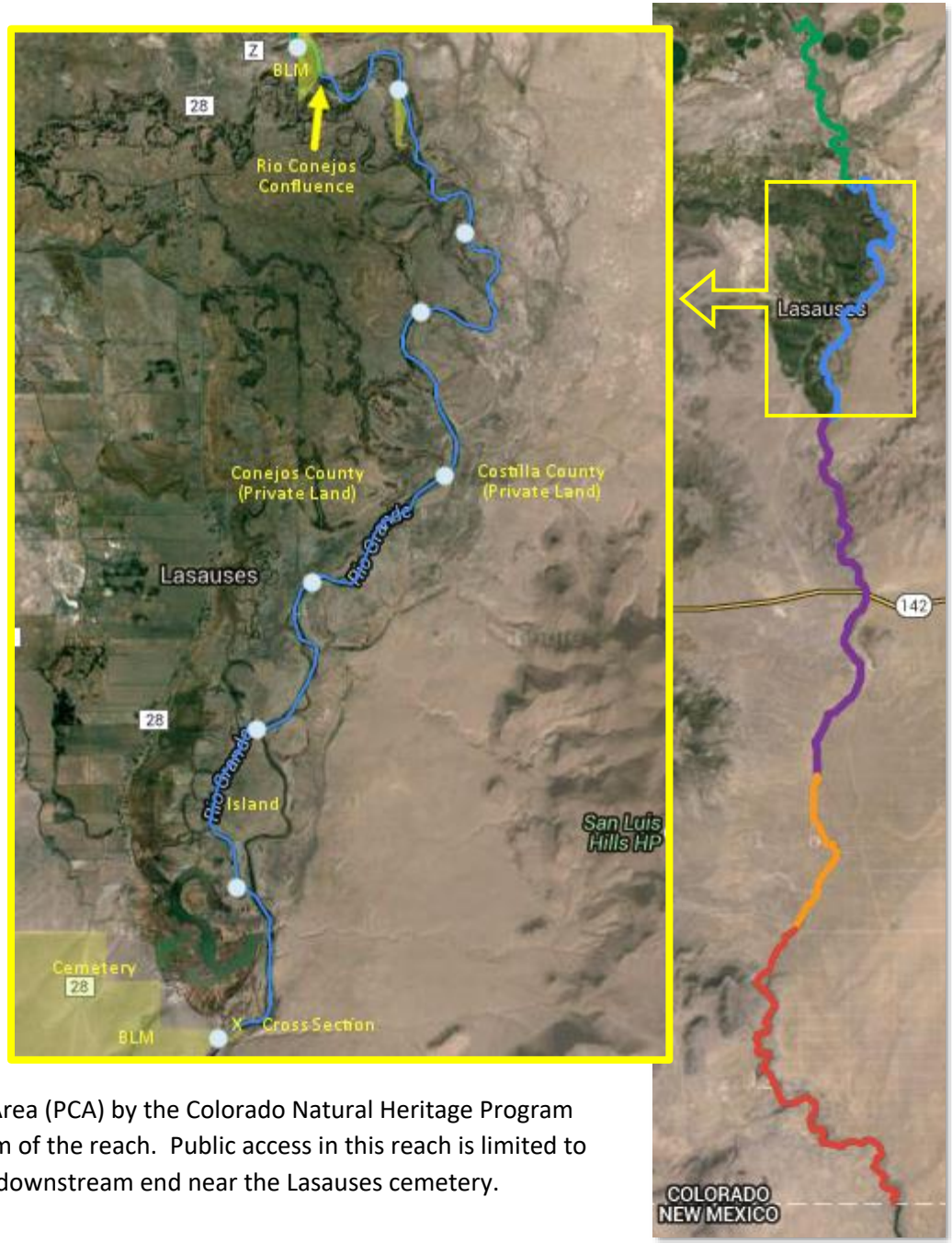
- Channel shaping to help the river adjust to the reduction in natural flows
- Bank stabilization with rock and woody log structures
- Riparian rehabilitation—planting and transplanting (grasses, sedges, shrubs, and trees)
- Recreation access improvements on BLM land near the Z Road Bridge.
- Riparian Fencing
- Landowner education about livestock's effect on bank stabilization and noxious weeds
- Stakeholder engagement locally and upstream to address altered hydrology, coordinate pulse flow(s)

Reach #2

Location Description

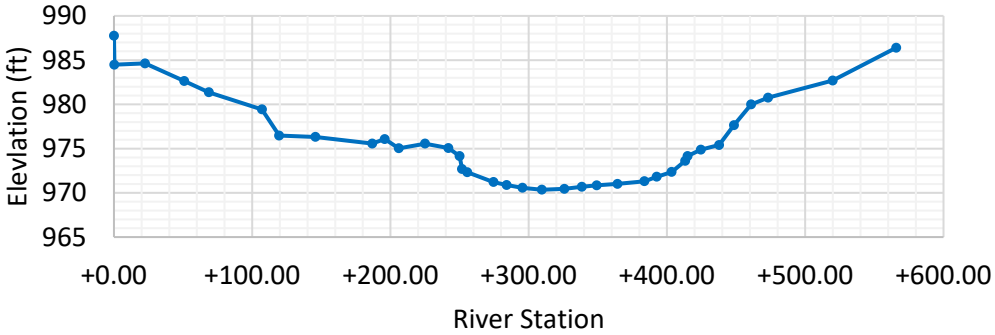
Reach #2 begins where the Rio Coñejos confluences with the Rio Grande from the west just below the Z Road Bridge, and ends ~7.7 miles downstream where the BLM property begins on river right (west side).

This entire study area on the Rio Grande does not have any surface water diversions. Reach #2 has significant agriculture on river right, however it is fed from irrigation diversions on the Rio Coñejos, benefitting the Rio Grande with a moderately healthy wetland and riparian zone, mostly on river right. A high desert ecosystem dominates river left in this reach, and both sides have experienced bank erosion, unstable banks and tributary head-cutting. This reach has a relatively flat slope and evidence of aggradation and recent abandoned channels/ channel migration is visible. Near the bottom of this reach the river is split into two similarly sized channels which persist, creating an island, nearly a mile long. There was also evidence of beaver activity in the area. The river transitions from being flat and wide (over-wide in many places), to more canyon-like and incised, especially on river left. This geologic transition continues in Reaches #3-4, and by Reach #5 the Rio Grande is deep in the rift where it has been for millennia.

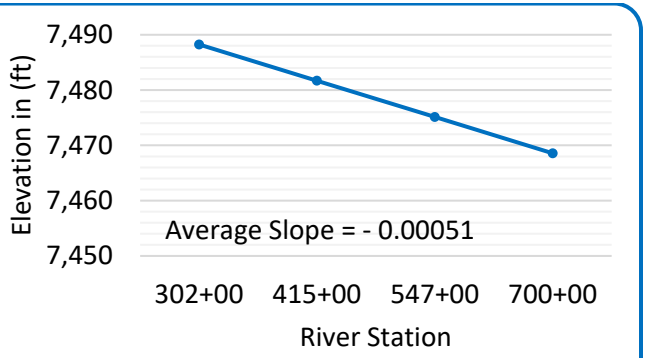


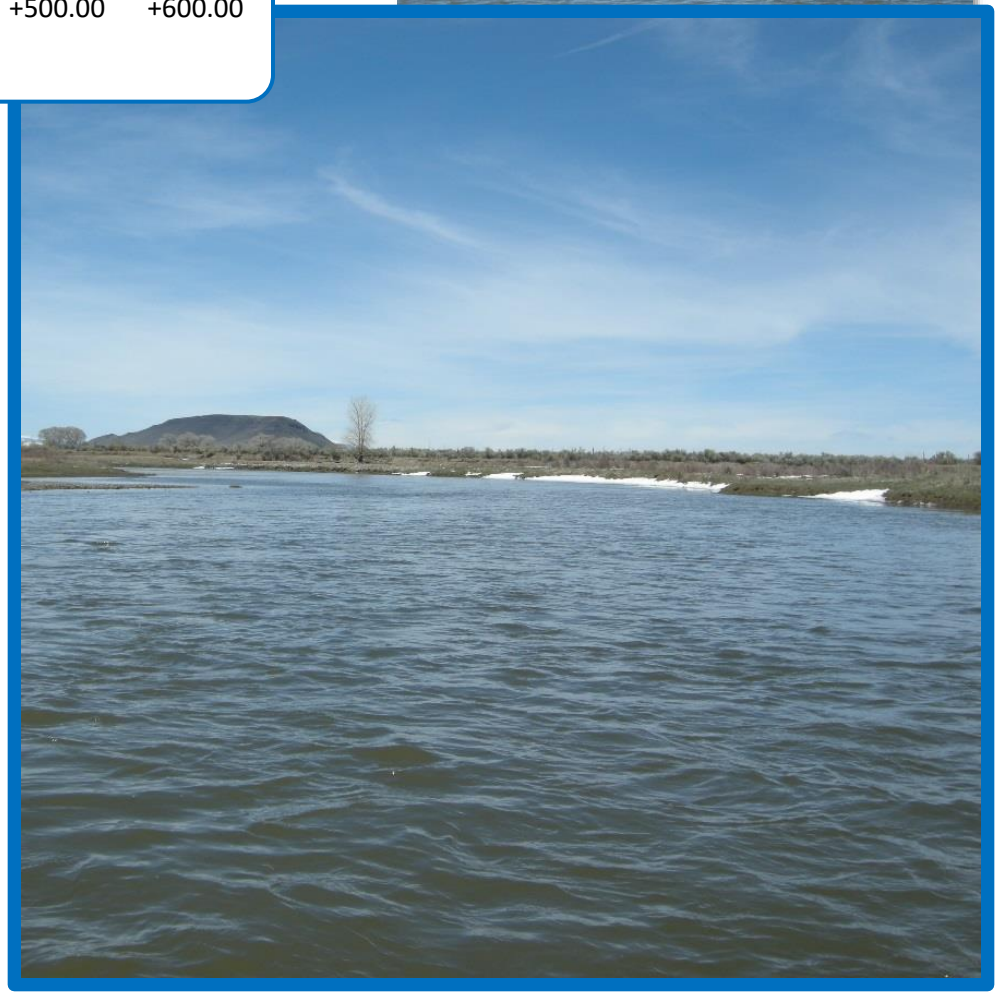
The map shows the town Lasauses (meaning "willow") and this area has been designated a Potential Conservation Area (PCA) by the Colorado Natural Heritage Program (see Vegetation p. 15). Cross section was taken at the bottom of the reach. Public access in this reach is limited to the Z Road Bridge on the upstream end and BLM land at the downstream end near the Lasauses cemetery.

Cross Section



Elevation Profile





Geomorphic Classification

Floodplain Width	=	251 ft
Entrenchment Ratio	=	1.71
Sinuosity	=	1.53
Width/ Depth Ratio	=	36.98
Channel Material	=	sand
Rosgen Classification	=	**B5c**

Summary of Observed Conditions with Notes on Priority

Mileage (Bottom Station)	Condition Notes	High Priority/ Easy Access 5 4 3 2 1 Low Priority
REACH #2 BEGINS BELOW THE Z ROAD BRIDGE ~260+00		
MILE 5-6 (317+00)	The Rio Coñejos confluence on river right, results in moderate riparian habitat. Chanel bars; possible bi-modal bankfull; tiered bank erosion both sides, cut banks (up to 6').	5 BLM polygon of land below the Z Road Bridge enables access for potential improvement projects. Projects could improve the river's health (with channel shaping, bank stabilization, riparian rehabilitation) and, with interest, projects could also include informational signage, wildlife viewing opportunities, parking lot, trail(s)/ river access improvements, etc.
MILE 6-7 (370+00)	River right 4-5' depositional bars, and erosion—some large cottonwoods and riparian vegetation. River left large woody debris. Channel migration evident.	1 This mile (6-7) is private property on both sides of the river with limited access, and generally a healthier riparian zone than most of the study area. With interest from stakeholders, the river would benefit from channel shaping, bank stabilization and riparian vegetation improvements.
MILE 7-8 (422+00)	Recent river migration, old channels are still evident—caused by low slope and overwide floodplain along with reduced flows from historic levels. Moderate riparian vegetation.	2 Entirely within private property, miles 7-11 would require land owner permissions, and construction access point(s). With interest from stakeholders, the river would benefit from channel shaping, bank stabilization and fishery improvements. Riparian rehabilitation and an evaluation land management practices would also be useful to restore the health of the river.
MILE 8-9 (475+20)	Sparse woody riparian vegetation, some grasses—river has wide floodplain, with backwaters, and a very low slope. River left transitions to high desert ecosystem.	
MILE 9-10 (528+00)	Recent river migration, old channels are still evident—caused by ow slope and overwide floodplain along with reduced flows from historic levels.	
MILE 10-11 (580+80)	Little to no woody riparian vegetation, backwaters from wide floodplain observed. River begins to split in two channels at ~580+80.	

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Mileage (Bottom Station)	Condition Notes	High Priority/ Easy Access 5 4 3 2 1 Low Priority
MILE 11-12 (633+60)	The study team floated the west channel and observed a low bench on river right; serious lack of riparian vegetation; rip rap on river right; livestock observed and upslope over grazing appears to be causing erosion.	2 Still entirely within private property, mile 11-12 would require land owner permissions, and likely creation of access point(s). With interest from stakeholders, the river would benefit from channel shaping, bank stabilization and fishery improvements. Riparian rehabilitation and an evaluation land management practices would also be useful to restore the health of the river. Potential for wetland habitat creation utilizing irrigation return water.
MILE 12-13 (686+40)	East channel re-joins at ~658+00 Wide floodplain and alternating high banks on both sides of the river	3 Entirely within private property, mile 12-13 would require access from the downstream limit where BLM property begins on river right. With interest from stakeholders, the river would benefit from channel shaping, bank stabilization and fishery improvements. Potential for wetland habitat creation utilizing irrigation return water.

REACH #2 ENDS WHERE PRIVATE PROPERTY ENDS ON RIVER RIGHT ~684+00

Recommendations for the Future

River Condition	% of Reach Affected	Severity	River Health Benefits	Public & Private Benefits
Actively eroding vertical cut banks	3	3	5	3
Unstable river banks	3	3	5	3
Lack of riparian shrubs & trees	3	3	5	3
Lack of riparian herbaceous cover	2	2	3	2
Inadequate sediment transport	5	4	4	3
Lack of fishery habitat	3	3	3	3
Lack of benthic macroinvertebrates	3	3	4	3
Lack of Recreational Access	2	4	1	5
Upland Conditions*				
Trespass Livestock	3	3	4	3
Noxious Weeds	3	3	4	3

* Upland Conditions were scored primarily by the BLM.

% of Reach Affected		Severity		River Health Benefit		Human Benefit	
5	~81-100%	5	Extreme	5	Very High	5	Very High
4	~61-80%	4	Very Severe	4	High	4	High
3	~41-60%	3	Severe	3	Moderate	3	Moderate
2	~21-40%	2	Moderate	2	Low	2	Low
1	~1-20%	1	Mild	1	Very Low	1	Very Low
0	none	0	Not a problem	0	No Benefit	0	No Benefit

Similar to Reach #1, Reach #2 is affected by actively eroding vertical cut banks. By addressing bank stability as a priority, the compromised aquatic and riparian habitat, impaired water quality, and very poor sediment transport will also be improved. Projects that utilize irrigation return water to create riparian wetland areas may be feasible in this reach. The majority of this reach is private property, much of that being managed with livestock which currently has unlimited access to the river.

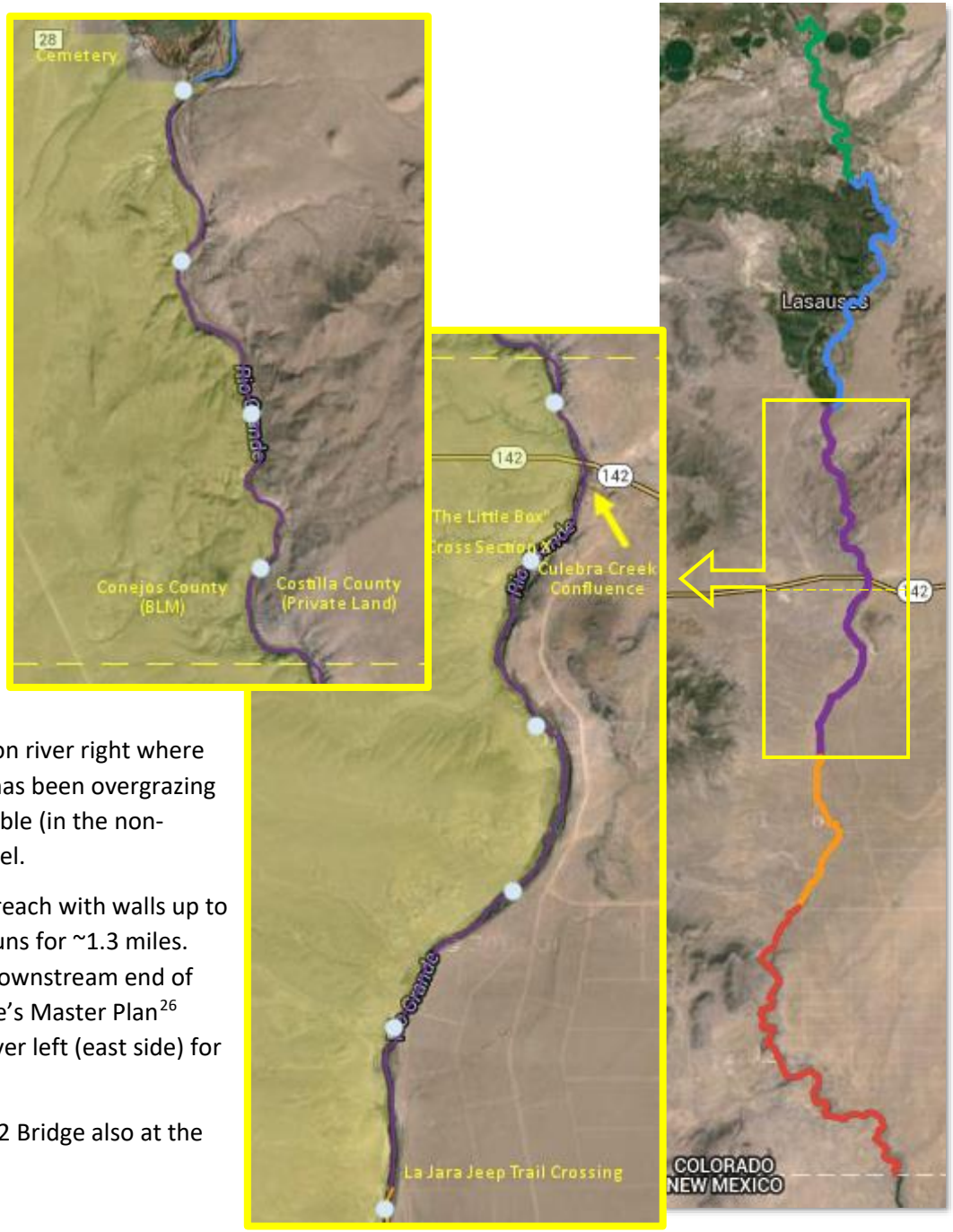
Suggested projects include:

- Channel shaping to help the river adjust to the permanent reduction in natural flows
- Rock and woody log structures
- Planting and transplanting riparian vegetation (grasses, sedges, shrubs, and trees) in graded lowland areas utilizing irrigation return water or sub-irrigation waters.
- Riparian Fencing
- Landowner education about livestock's effect on bank stabilization and noxious weeds
- Stakeholder engagement locally and upstream to address altered hydrology, coordinate pulse flow(s)
- River access improvements on public land at bottom of reach

Reach #3

Location Description

Reach #3 is approximately ~8.9 miles in length entirely within BLM property on the west side of the river. It begins where BLM property begins on river right (west side), near the Lasauses Cemetery, and ends ~ 4.5 miles below the HWY 142 Bridge at the La Jara Jeep trail crossing.

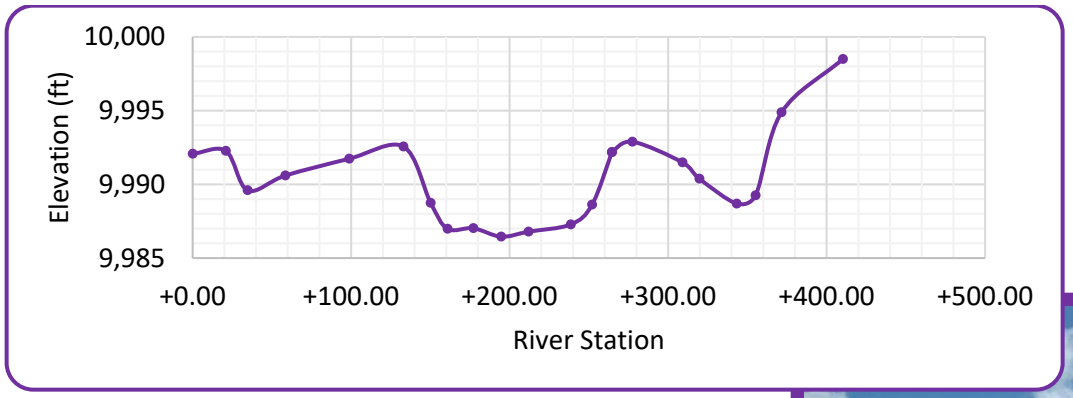


Visible in the study area aerial (far right), this reach is transitions from having an irrigated agricultural land on the west to undeveloped arid range dominating both sides of the river. The geologic land form of this section of river transitions from having a more pronounced floodplain to an incised river channel meandering through the Brownie Hills. This reach is characterized with a predominant high desert ecosystem, consisting of rabbit brush and sage with minimal plat material that can stabilize the banks such as grasses, sedges, willows, cottonwoods, etc. and is influenced by erosion, especially on river right where several alluvial fans constrict the already low flow. There has been overgrazing and heavy anthropogenic activity where the river is accessible (in the non-canyon stretches), leaving an over-wide and shallow channel.

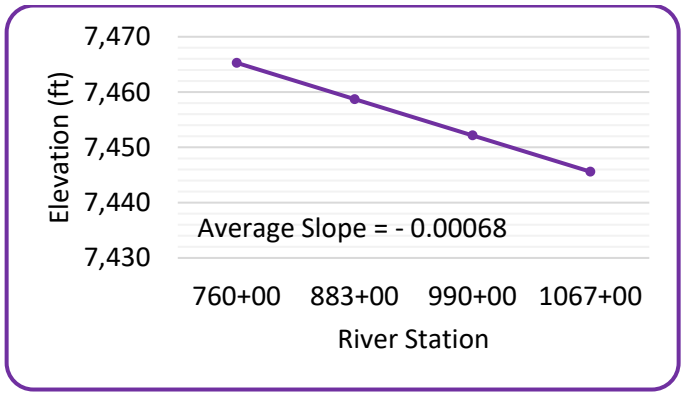
The "Upper Box" is an incised section of lower part of this reach with walls up to 100 feet, it starts ~1 mile below the HWY 142 Bridge and runs for ~1.3 miles. There is an abandoned irrigation diversion located at the downstream end of the box. Costilla County Trails, Recreation, and Open Space's Master Plan[26] includes the establishment a "Rio Grande Greenbelt" on river left (east side) for ~4 miles, at the very bottom of this reach.

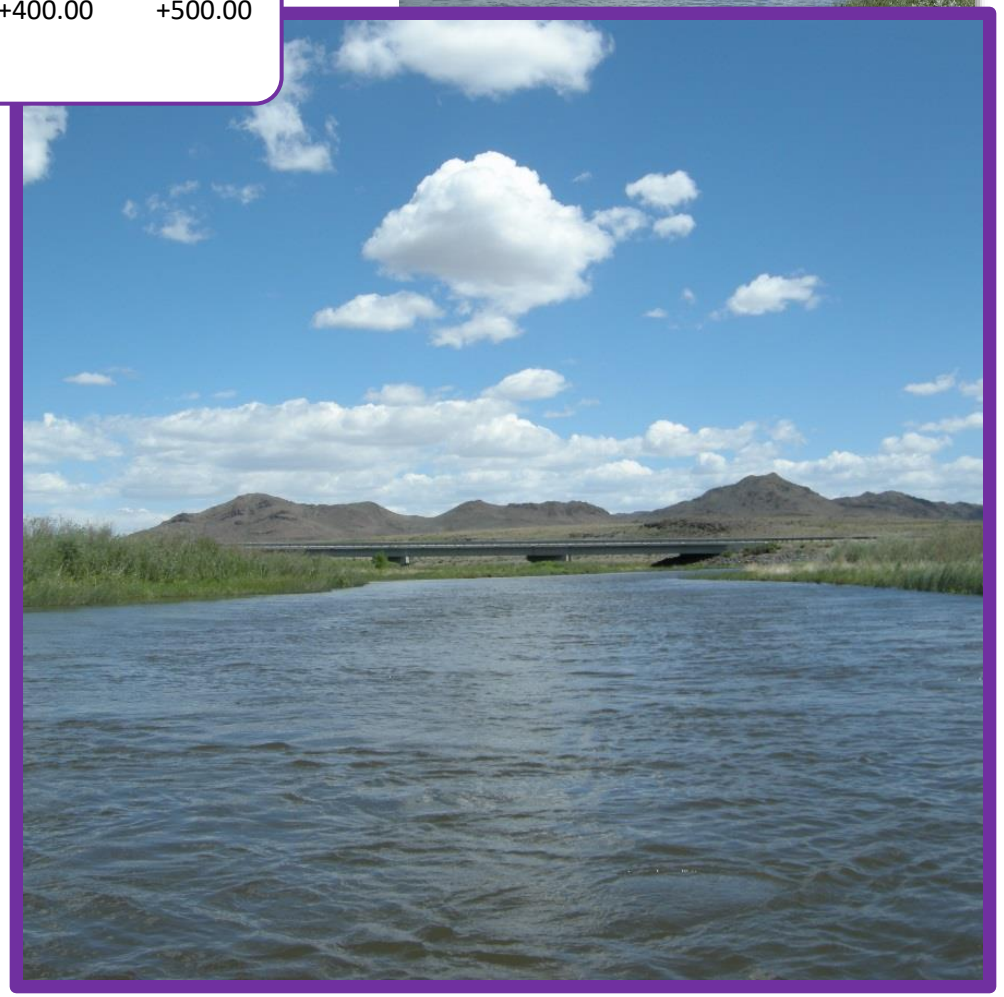
The historic de Vargas Crossing is just south of the HWY 142 Bridge also at the bottom of this reach[27].

Cross Section



Elevation Profile





Geomorphic Classification

Floodplain Width	=	285 ft
Entrenchment Ratio	=	1.82
Sinuosity	=	1.25
Width/ Depth Ratio	=	56.07
Channel Material	=	sand
Rosgen Classification	=	**B5c**

Summary Of observed Conditions and Notes on Priority

Mileage (Bottom Station)	Condition Notes	High Priority/ Easy Access 5 4 3 2 1 Low Priority
REACH #3 BEGINS WHERE BLM PROPERTY BEGINS ON RIVER RIGHT ~684+00		
MILE 13-14 (739+20)	River left begins rocky canyon incision, river right still has flood plain and channel migration. Riffles observed. The bottom three reaches of the study area represent the most scenic because of the geologic and topographic differences.	4 BLM access on river right near the Cemetery makes the top of this reach a good candidate for projects to improve the river's health (with channel shaping, bank stabilization, riparian rehabilitation) and, with interest, recreational improvements could include informational signage, wildlife viewing opportunities, parking lot, trail(s)/ river access improvements, etc.
MILE 14-15 793+00	Little to no riparian vegetation, river is flat and deep, with big channel bars. Floodplain is over wide in this mile, however the geologic transition to a rocky incision persists through end of study area.	2 While river right is entirely BLM property, access is limited due to geologic constraints. There is an increasing amount of rocky incision leading to the edge of water, and minimal existing roads or access points suitable for mechanized equipment. Where access is feasible the river would benefit from some channel shaping and riparian vegetation rehabilitation.
MILE 15-16 844+80	Little to no riparian vegetation, canyon incises some on river right as well. Floodplain within incision is overwide—channel migration and aggradation is evident with bars.	
MILE 16-17 897+60	Several deep gullies confluence on river right, leaving noted depositions which constrict the river. Horses observed near channel split (and overwide floodplain/ water crossing) from ~885+00-893+00.	

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Mileage (Bottom Station)	Condition Notes	High Priority/ Easy Access 5 4 3 2 1 Low Priority
MILE 17-18 950+40	Visible aggradation in this mile with many channel bars; one strong riffle observed. HWY 142 Bridge ~915+00.	
MILE 18-19 1003+00	Alluvial fan and healthy wetland at ~965+00; downstream on river right 400-500 sheep and trampled banks; some good bank stabilization with 4-6' willows; cross channel island suggests aggradation; one strong riffle observed; constricts to no floodplain at one point; silty bottom; other locations have significant bottom rooted channel vegetation.	4 The bottom of this Reach features the "Upper Box," which begins about a mile below the HWY 142 Bridge and is ~1.3 miles long. This geologic constriction and the remnant diversion raise curiosity and are a point of interest, making it a good candidate for recreation and access improvements. This is shown in the Costilla County Trials and Open Space (TROS) Management Plan[28]. The "Rio Grande Greenbelt" project is on river left and starts just below the HWY 142 Bridge, and extends for ~4 miles downstream to the bottom of this reach. Possible improvements the County is considering include informational signage, trails, parking and camping. Again, this reach is entirely BLM property on river right, and could possibly benefit from an evaluation land management practices (livestock grazing leases and fencing). To improve the river's health, projects in could include riparian vegetation rehabilitation and channel shaping, but geology will restrict access through much of the bottom of this reach.
MILE 19-20 1056+00	Hand stacked rock dam observed at ~1025+00; and an abandoned diversion at ~1035+00; some healthy riparian vegetation, river has restricted floodplain due to canyon incision.	
MILE 20-21 1108+80	River out of tight incision temporarily—overgrazing evidence; channel bars and healthy riparian grasses; some large cottonwoods on river right, but generally little woody riparian vegetation; river left 6-10' desert vegetation.	
MILE 21-22 1161+60	The La Jara Jeep Trail Crossing coincides with an alluvial fan on river right which chokes river width because reduced stream power; river is still transitioning in and out of canyon incision that will finally drop in Reach #5 and persist to and past the CO/ NM state line.	

REACH #3 ENDS AT THE LA JARA JEEP TRAIL CROSSING ~4.5 MILES BELOW THE HWY 142 BRIDGE ~1156+10

Recommendations for the Future

River Condition	% of Reach Affected	Severity	River Health Benefits	Public & Private Benefits
Actively eroding vertical cut banks	2	2	4	3
Unstable river banks	2	2	4	3
Lack of riparian shrubs & trees	3	3	5	3
Lack of riparian herbaceous cover	2	2	3	2
Inadequate sediment transport	5	4	4	3
Lack of fishery habitat	2	3	3	3
Lack of benthic macroinvertebrates	3	3	4	3
Lack of Recreational Access	3	2	1	5
Upland Conditions*				
Trespass Livestock	5	4	5	4
Noxious Weeds	3	3	4	3

* Upland Conditions were scored primarily by the BLM.

% of Reach Affected		Severity		River Health Benefit		Human Benefit	
5	~81-100%	5	Extreme	5	Very High	5	Very High
4	~61-80%	4	Very Severe	4	High	4	High
3	~41-60%	3	Severe	3	Moderate	3	Moderate
2	~21-40%	2	Moderate	2	Low	2	Low
1	~1-20%	1	Mild	1	Very Low	1	Very Low
0	none	0	Not a problem	0	No Benefit	0	No Benefit

Reach #3 marks the beginning of a more defined channel as it becomes incised into the valley floor. Construction access with large equipment will be difficult in most locations. Therefore, projects that can be accomplished with minimal heavy equipment are recommended

Suggested projects include:

- Channel shaping to help the river adjust to the permanent reduction in natural flows
- Rock and woody log structures
- Planting and transplanting riparian vegetation (grasses, sedges, shrubs, and trees)
- River access improvements on public land at top of reach, near Cemetery
- Riparian fencing
- Stakeholder engagement locally and upstream to address altered hydrology, coordinate pulse flow(s)

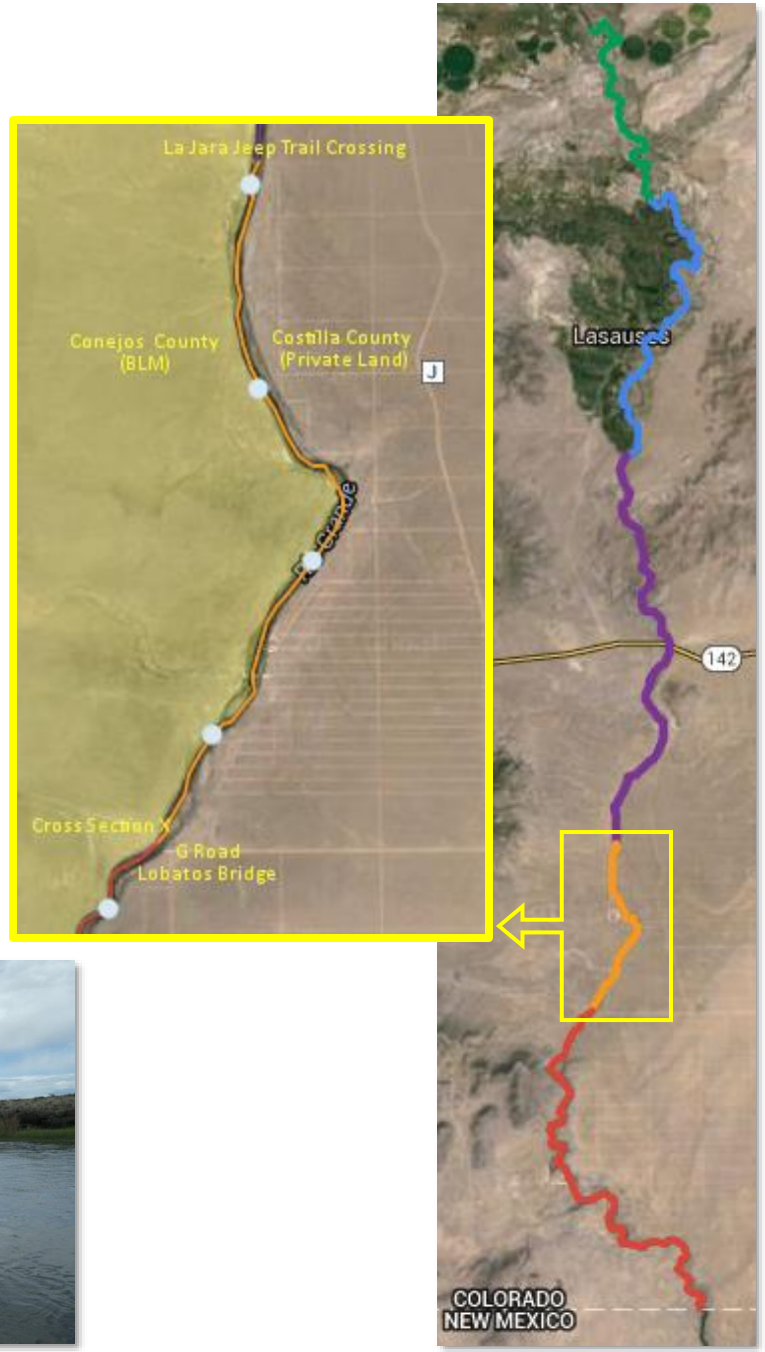
Reach #4

Location Description

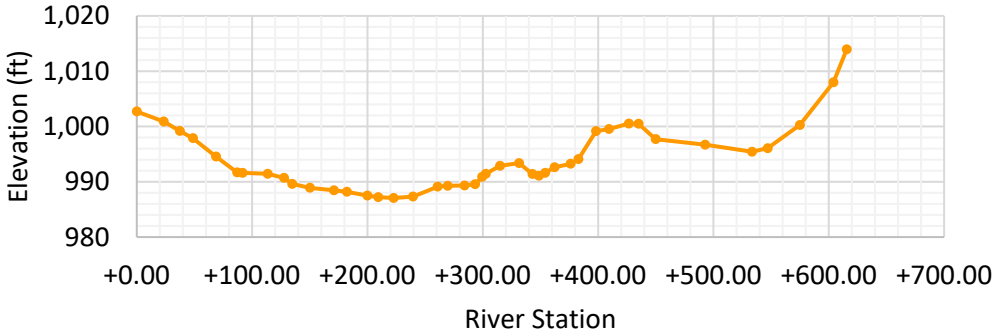
The fourth reach is the shortest at ~3.7 miles and is predominately transitioning geologically to a more incised system.

While overgrazing was observed, there was quite a bit of healthy riparian vegetation and a healthy high desert ecosystem adjacent to the river corridor. There is visible indication of a recent channel migration of the river in one location but the plan form is mostly restricted by incised channel in the valley bottom.

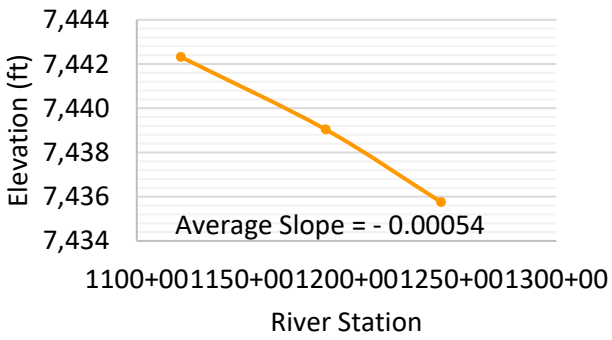
The west side of the river is BLM land and the east side is all private property. As evidenced in the aerial photo the east side landowner(s) have made quite an investment in road infrastructure, but there are no utilities (power, telephone, water, sewer, etc.) and therefore very few visible local residents utilizing this area.



Cross Section



Elevation Profile



Geomorphic Classification

Floodplain Width	=	461 ft
Entrenchment Ratio	=	1.93
Sinuosity	=	1.15
Width/ Depth Ratio	=	47.8
Channel Material	=	sand
Rosgen Classification	=	**B5c**

Summary of Observed Conditions and Notes on Priority

Mileage (Bottom Station)	Notes on Condition	High Priority/ Easy Access 5 4 3 2 1 Low Priority
REACH #4 BEGINS WITH AT THE LA JARA JEEP TRAIL CROSSING, ~4.5 MILES BELOW THE HWY 142 BRIDGE ~1156+10		
MILE 22-23 (1214+40)	Canyon incision flares out to a wider floodplain, some older cottonwoods observed, but minimal riparian vegetation throughout. Horses (possible trespass livestock) observed.	2 Despite BLM-owned land on river right of all of reach #4, most of this reach is highly inaccessible due to geologic constraints and a lack of roads. Fortunately, this has resulted in minimal-no anthropogenic disturbances and the river is responding to the change in historic flows and adjusting to the lower flood stages faster than in the above reaches.
MILE 23-24 (1267+20)	Canyon incision begins again and restricts the floodplain, some older cottonwoods observed, but minimal riparian vegetation throughout.	
MILE 24-25 (1320+40)	Canyon incision remains but floodplain within varies; some older cottonwoods observed, but minimal riparian vegetation throughout.	
REACH #4 ENDS AT THE G ROAD/ LOBATOS BRIDGE ~ 1352+00		

Recommendations for the Future

River Condition	% of Reach Affected	Severity	River Health Benefits	Public & Private Benefits
Actively eroding vertical cut banks	2	2	3	3
Unstable river banks	3	2	4	3
Lack of riparian shrubs & trees	4	4	5	3
Lack of riparian herbaceous cover	2	3	3	2
Inadequate sediment transport	5	4	4	3
Lack of fishery habitat	3	4	3	3
Lack of benthic macroinvertebrates	3	3	4	3
Lack of Recreational Access	3	2	1	5
Upland Conditions*				
Trespass Livestock	5	3	5	4
Noxious Weeds	3	3	4	3

* Upland Conditions were scored primarily by the BLM.

This reach is incised with very limited heavy equipment access points. Where practical, projects that increase aquatic habitat diversity are recommended.

Reach Suggested projects include:

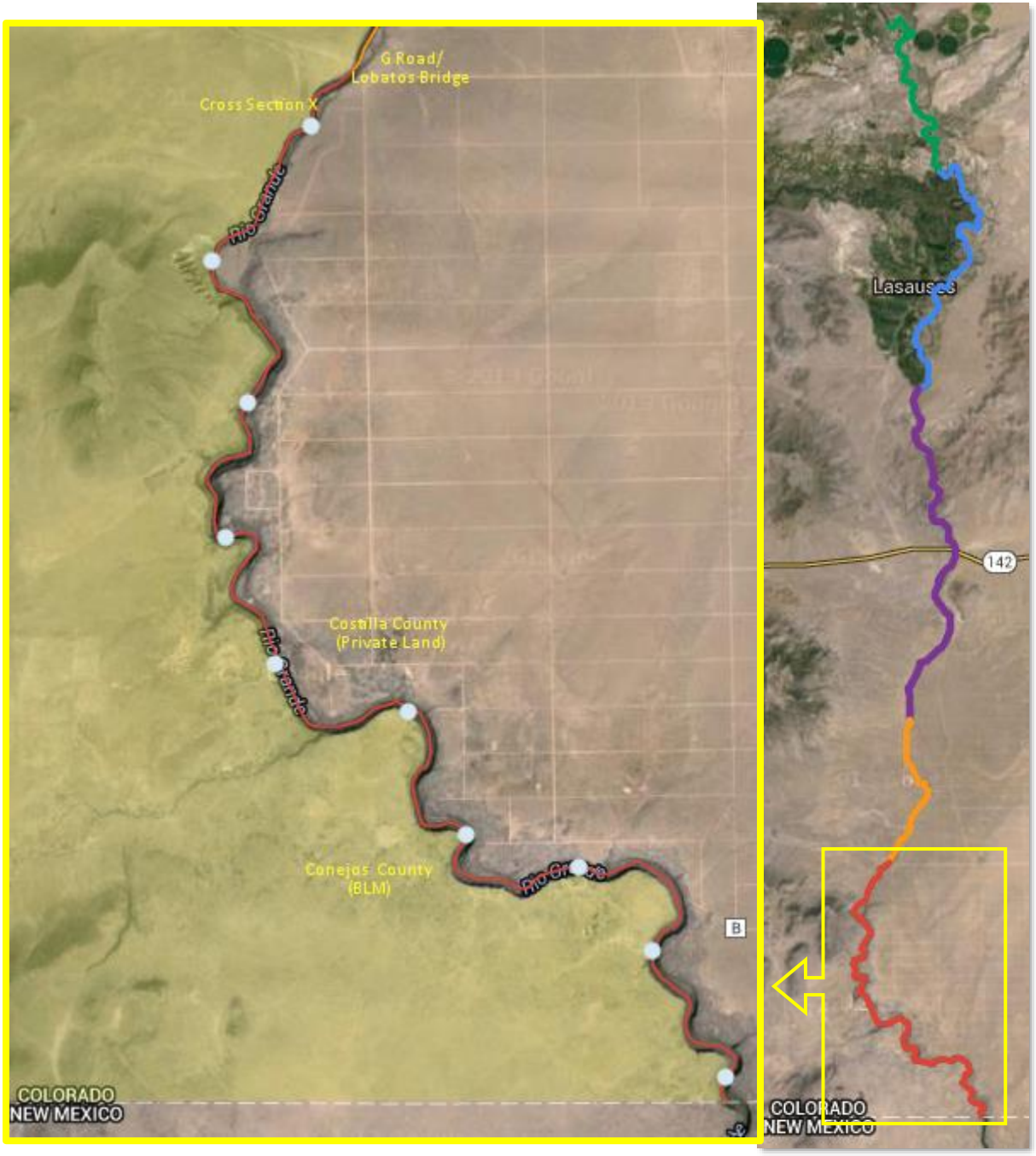
- Channel shaping to help the river adjust to the permanent reduction in natural flows
- Rock and woody log structures
- River access improvements on public land
- Riparian fencing
- Stakeholder engagement locally and upstream to address altered hydrology, coordinate pulse flow(s)

% of Reach Affected		Severity		River Health Benefit		Human Benefit	
5	~81-100%	5	Extreme	5	Very High	5	Very High
4	~61-80%	4	Very Severe	4	High	4	High
3	~41-60%	3	Severe	3	Moderate	3	Moderate
2	~21-40%	2	Moderate	2	Low	2	Low
1	~1-20%	1	Mild	1	Very Low	1	Very Low
0	none	0	Not a problem	0	No Benefit	0	No Benefit

Reach #5

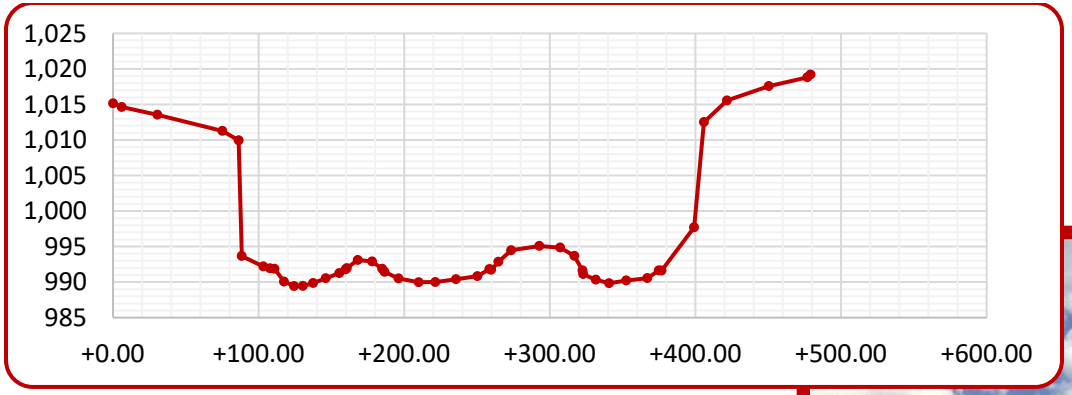
Location Description

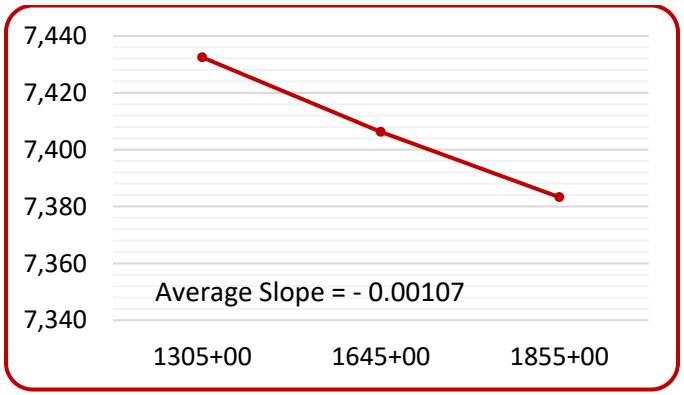
Reach #5 is the longest of the reaches, at ~9.5 miles. This reach begins below the G Road/ Lobatos Bridge, where the deeply incised canyon begins to form what is called the "Lower Box" which extends the length of this entire reach, to the Colorado/ New Mexico state line where the canyon reaches ~200 feet over the riverbed in places. The channel slope is steeper than Reaches #1-4 with and has an increase in overall plan form sinuosity. As a result there are well developed pool riffle complexes located throughout this reach. There is currently good riparian vegetation located between the edge of channel and canyon wall—indicating the river is adjusting to the lower than historic flows. The channel bottom has more large-sized cobble than the upper sections. The G Road/ Lobatos Bridge is a point of interest and access point within this section, and the CO/ NM state line delineates the bottom of this reach, and study area.



Cross Section

Elevation Profile





Geomorphic Classification

Floodplain Width	=	312 ft
Entrenchment Ratio	=	1.21
Sinuosity	=	1.35
Width/ Depth Ratio	=	116.8
Channel Material	=	gravel
Rosgen Classification	=	**F4c**

Summary of observed Conditions and Notes on Priority

Mileage (Bottom Station)	Condition Notes	High Priority/ Easy Access 5 4 3 2 1 Low Priority
REACH #5 BEGINS AT THE ROAD G / LOBATOS BRIDGE ~1352+00		
MILE 25-26 (1327+80)	Canyon incision remains but floodplain within varies; some older cottonwoods observed, but minimal riparian vegetation throughout; horses (trespass livestock) observed.	5 BLM and Costilla County access near the G Road/ Lobatos Bridge makes the top of this reach a good candidate for projects to improve access to the "Lower Box." With interest, projects to encourage boaters and wildlife enthusiasts to use the bottom of the study area could include informational signage, wildlife viewing opportunities, fish habitat structures, parking lot, trail(s)/ river access improvements, etc.
MILE 26-27 1425+60	Canyon incision varies then widens; colluvial rocks in the channel bed; interior bare vegetation 2-3' high no riparian, mostly grasses, rushes, and sedges; heron rookery observed in cottonwoods on river right.	1 Despite BLM-owned land on river right of all of reach #5, most of this reach is highly inaccessible due to geologic constraints and a lack of roads. Happily, this has resulted in minimal-no anthropogenic disturbances and the river is responding to the change in historic flows and adjusting to the lower flood stages faster than in the above reaches.
MILE 27-28 1478+40	River right some cedar and juniper trees; river left old deposition from historic channel; then this mile transitions back into constricted flood plain and canyon type channel; strong riffle observed and healthy riparian vegetation	
MILE 28-29 1532+00	Canyon incision persists to end of study area and beyond the Colorado/ New Mexico state line. Channel bottom is more cobble than upper section and more colluvial rocks are found. Healthy riparian grasses; edges and woody vegetation grow where the limited floodplain allows.	
MILE 29-30 1585+00 … to the end of the Study Area	Slope in the bottom ~5 miles is greater than the rest of the study area, and the canyon remains incised with a substrate of more cobble and rocks than above—this leads to more riffles and obstacles in the river.	5 Costilla County, river left, access is currently private property. BLM access on river right is very steep and quite difficult to manage with small watercrafts. With interest, projects at the state line could include informational signage, wildlife viewing opportunities, parking lot, trail(s)/ river access improvements, etc.
END OF REACH #5 AND THE STUDY AREA IS THE COLORADO/ NEW MEXICO STATE LINE		

Recommendations for the Future

River Condition	% of Reach Affected	Severity	River Health Benefits	Public & Private Benefits
Actively eroding vertical cut banks	1	1	3	3
Unstable river banks	1	1	3	3
Lack of riparian shrubs & trees	2	2	4	3
Lack of riparian herbaceous cover	1	2	3	2
Inadequate sediment transport	1	2	3	3
Lack of fishery habitat	1	2	3	3
Lack of benthic macroinvertebrates	1	2	3	3
Lack of Recreational Access	3	3	1	5
Upland Conditions*				
Trespass Livestock	2	2	5	4
Noxious Weeds	3	3	4	3

% of Reach Affected		Severity		River Health Benefit		Human Benefit	
5	~81-100%	5	Extreme	5	Very High	5	Very High
4	~61-80%	4	Very Severe	4	High	4	High
3	~41-60%	3	Severe	3	Moderate	3	Moderate
2	~21-40%	2	Moderate	2	Low	2	Low
1	~1-20%	1	Mild	1	Very Low	1	Very Low
0	none	0	Not a problem	0	No Benefit	0	No Benefit

* Upland Conditions were scored primarily by the BLM.

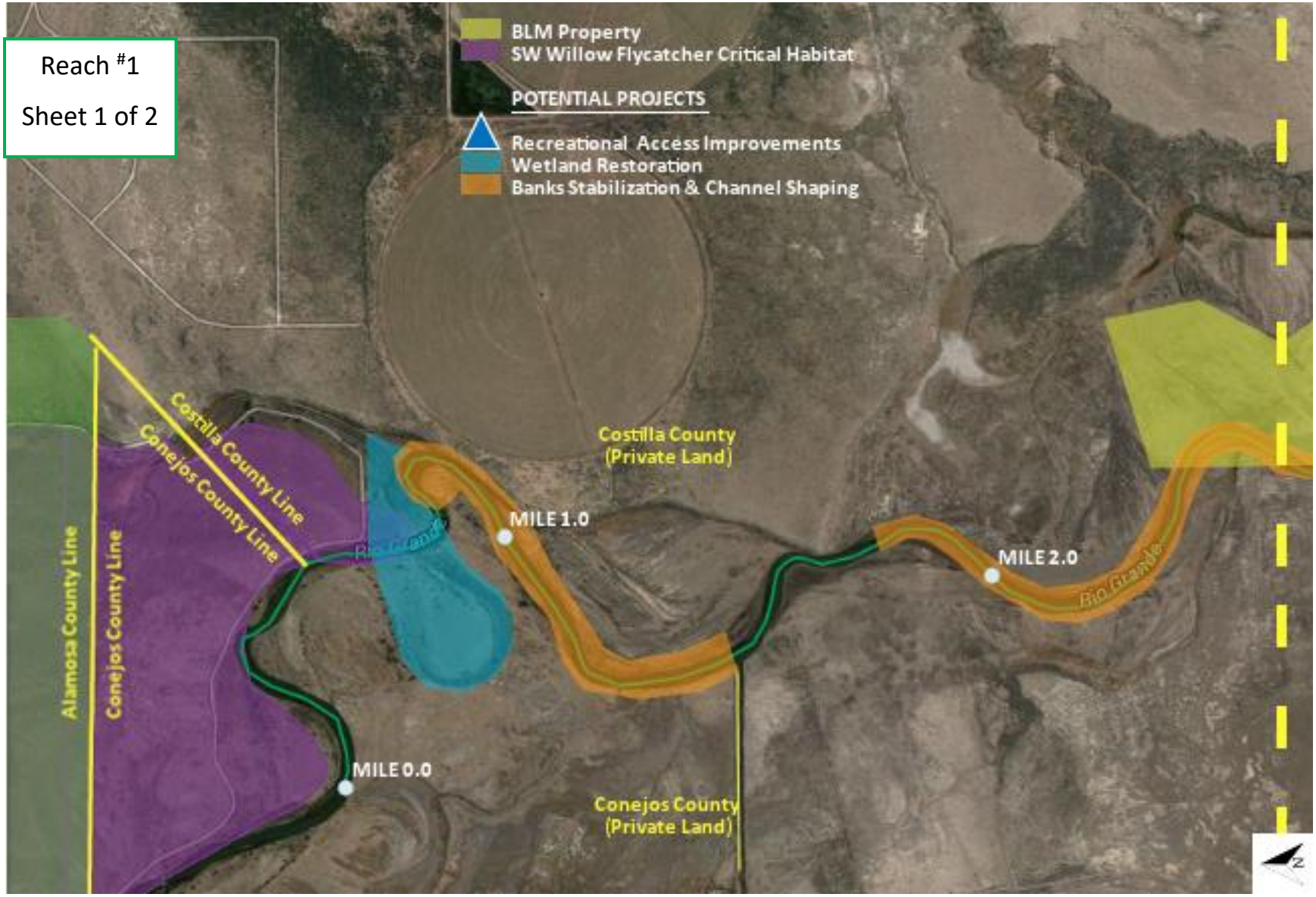
This reach is the most geologically protected of all the areas studied. Projects should be focused on improving public access to this section and protecting existing riparian vegetation

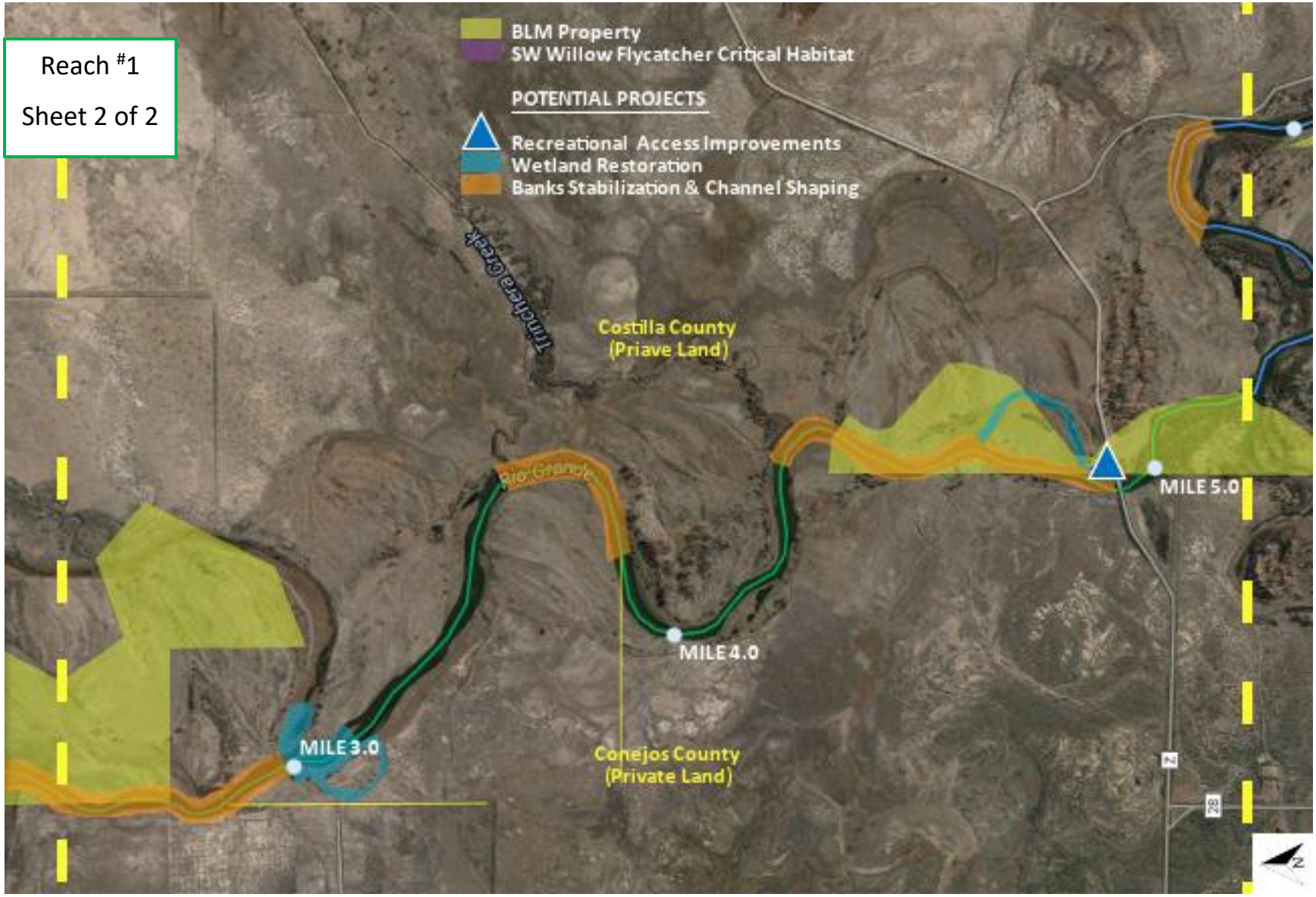
Suggested projects include:

- River access improvements on public land
- Interpretative signage
- Stakeholder engagement locally and upstream to address altered hydrology, coordinate pulse flow(s)

Appendix 1—Maps of Potential Projects

The next 15 pages show detail maps of therecommended potential projects.


Reach #1
Sheet 1 of 2
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County Line
Conejos County Line
Alamosa County Line
Conejos County Line
Costilla County
(Private Land)
MILE 1.0
MILE 2.0
Rio Grande
MILE 0.0
Conejos County
(Private Land)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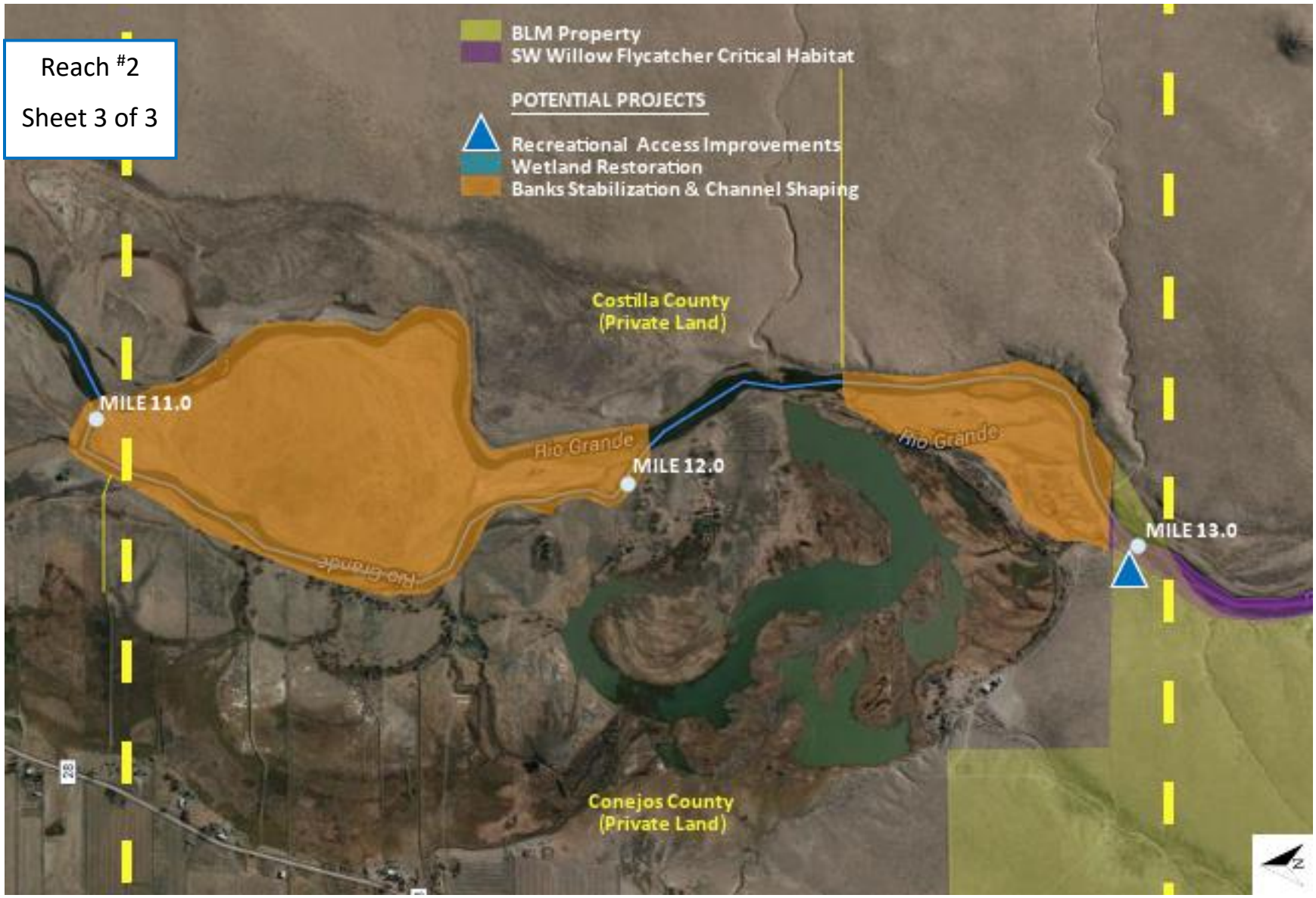
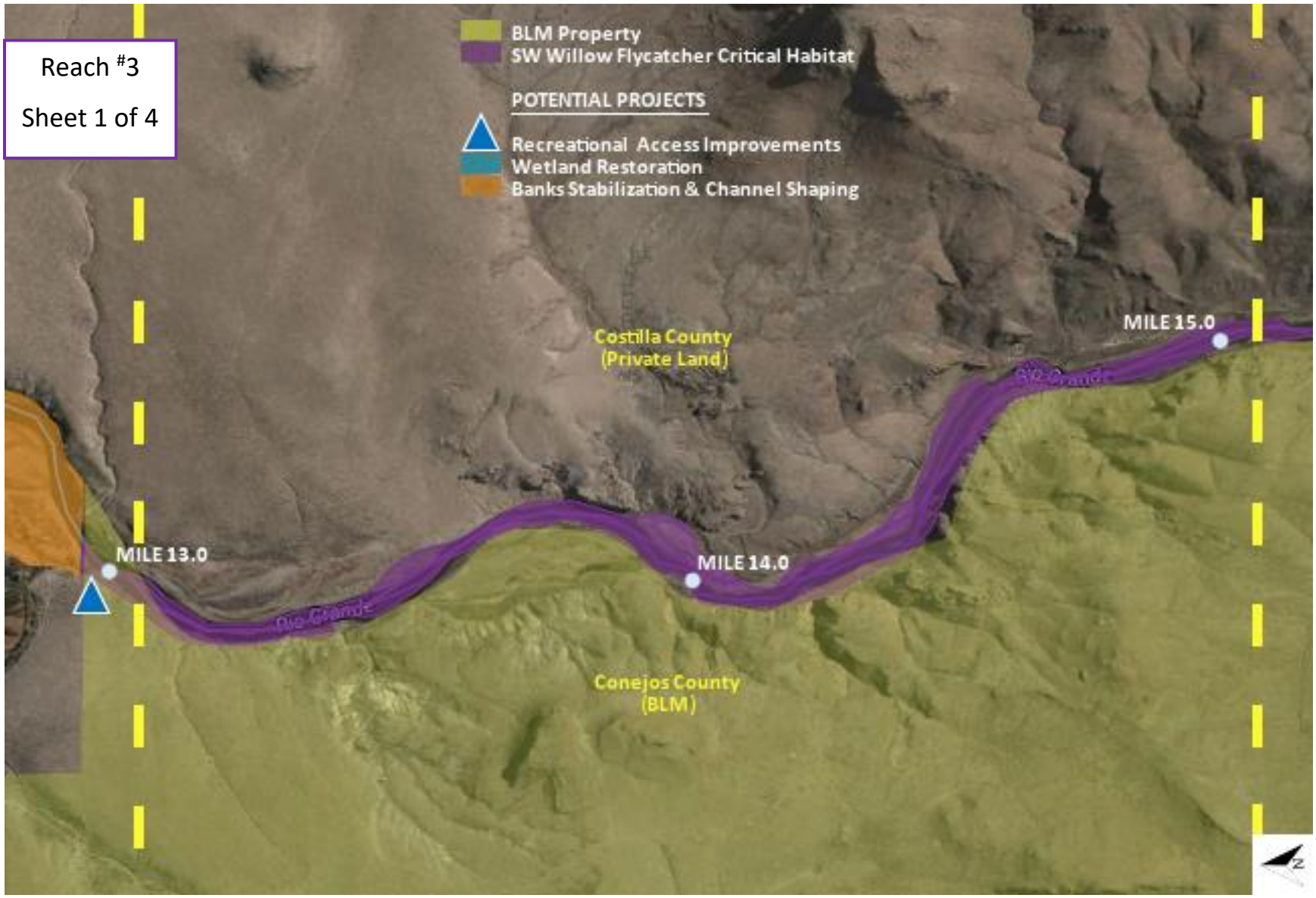
Sheet 2 of 2
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Trinchera Creek
Costilla County
(Priave Land)
Rio Grande
MILE 5.0
MILE 4.0
MILE 3.0
Conejos County
(Private Land)
285
N


Reach #2
Sheet 1 of 3
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County
(Private Land)
MILE 7.0
Conejos County
(Private Land)
MILE 8.0
MILE 6.0
MILE 5.0
Rio Grande
Rio Grande
Rio Grande
Rio Grande


Reach #2
Sheet 2 of 3
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
MILE 9.0
MILE 10.0
MILE 11.0
Rio Grande
Costilla County
(Private Land)
Conejos County
(Private Land)


Reach #2
Sheet 3 of 3
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County
(Private Land)
MILE 11.0
Rio Grande
MILE 12.0
Rio Grande
Rio Grande
MILE 13.0
Conejos County
(Private Land)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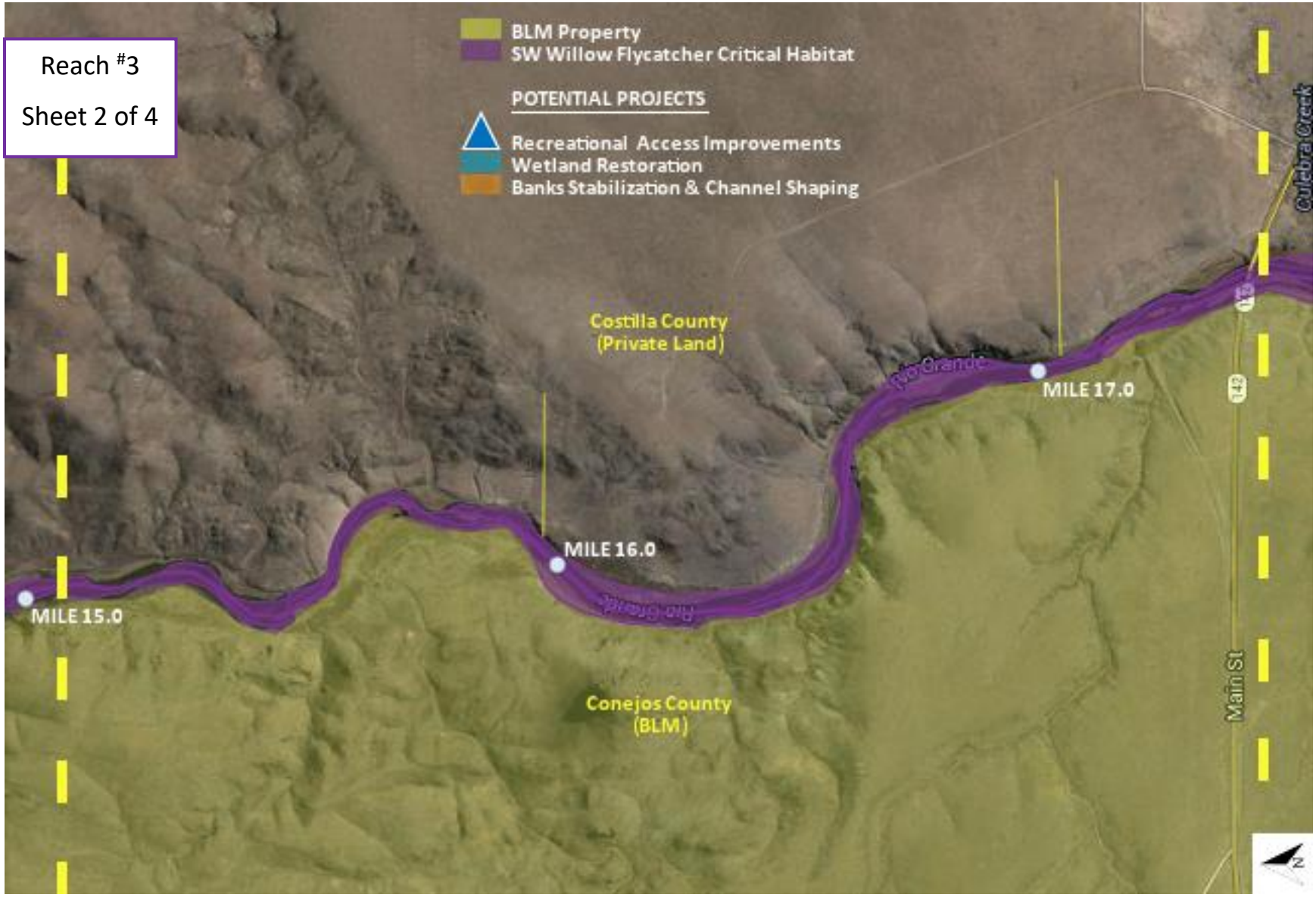
Sheet 1 of 4
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County
(Private Land)
MILE 15.0
Rio Grande
MILE 13.0
MILE 14.0
Rio Grande
Conejos County
(BLM)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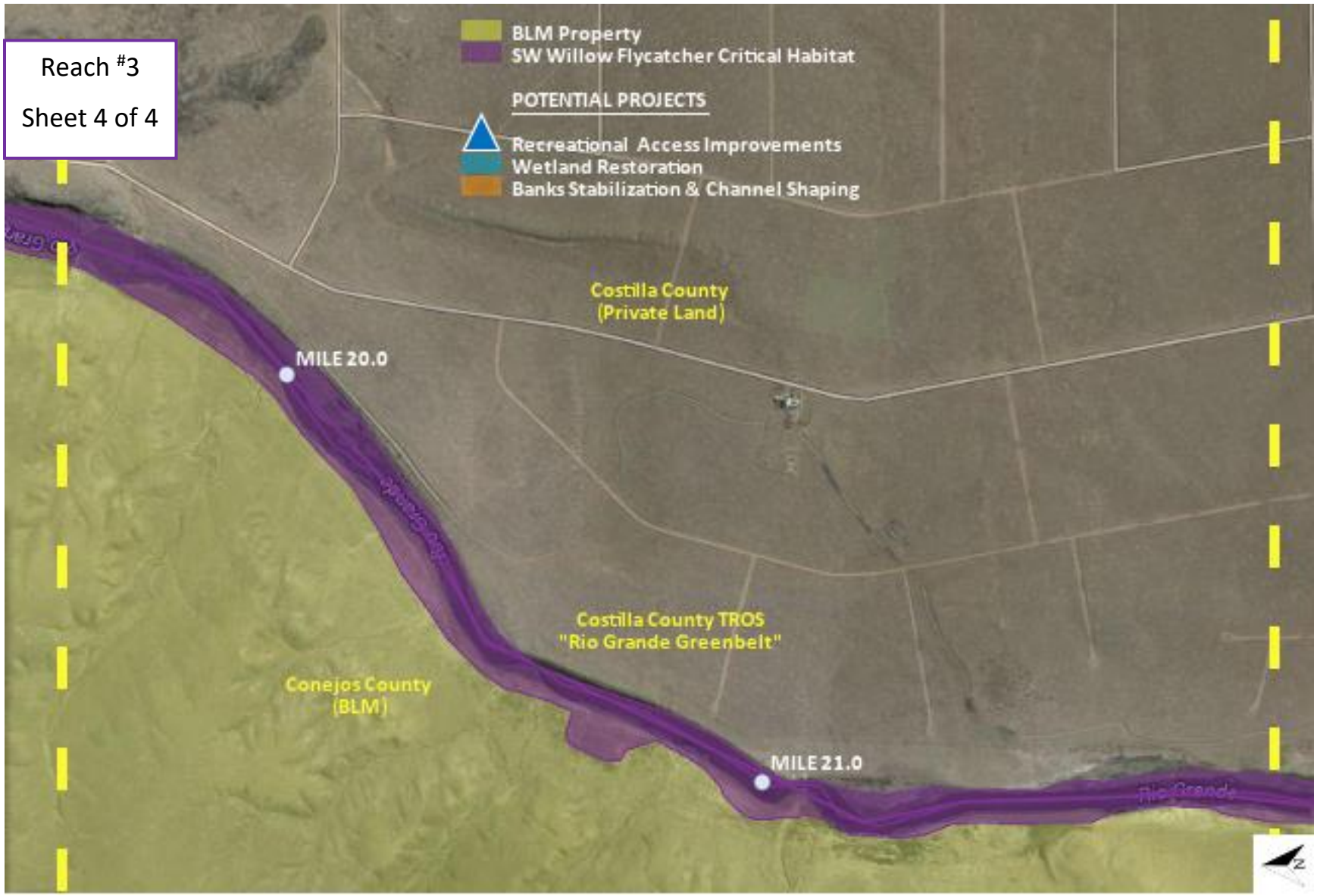
Sheet 2 of 4
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County
(Private Land)
Rio Grande
MILE 17.0
MILE 16.0
MILE 15.0
Conejos County
(BLM)
Culebra Creek
Main St
N


Reach #3
Sheet 3 of 4
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County
(Private Land)
Culebra Creek
Costilla County
(Private Land)
MILE 18.0
MILE 19.0
Costilla County TROS
"Rio Grande Greenbelt"
Conejos County
(BLM)
Main St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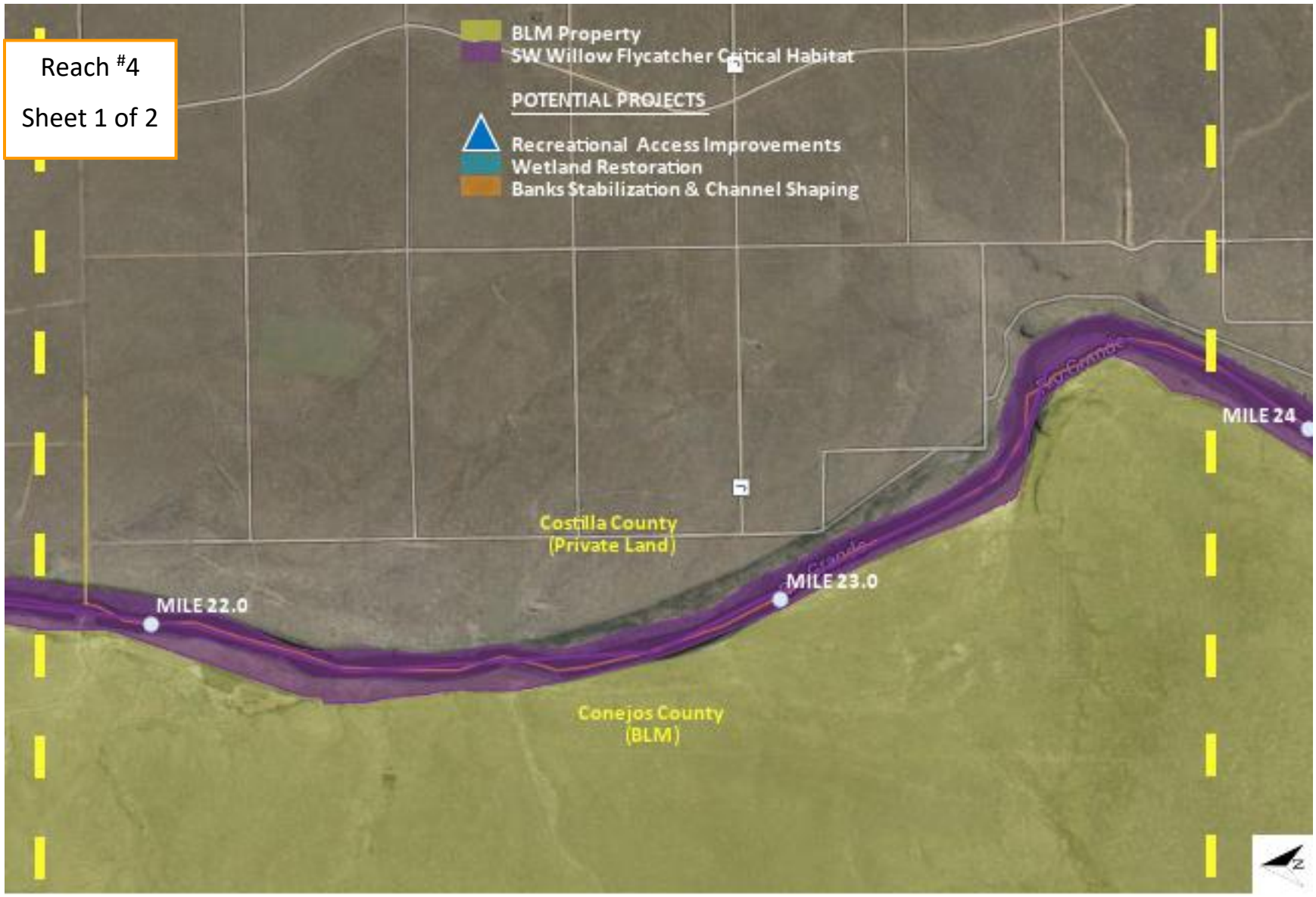
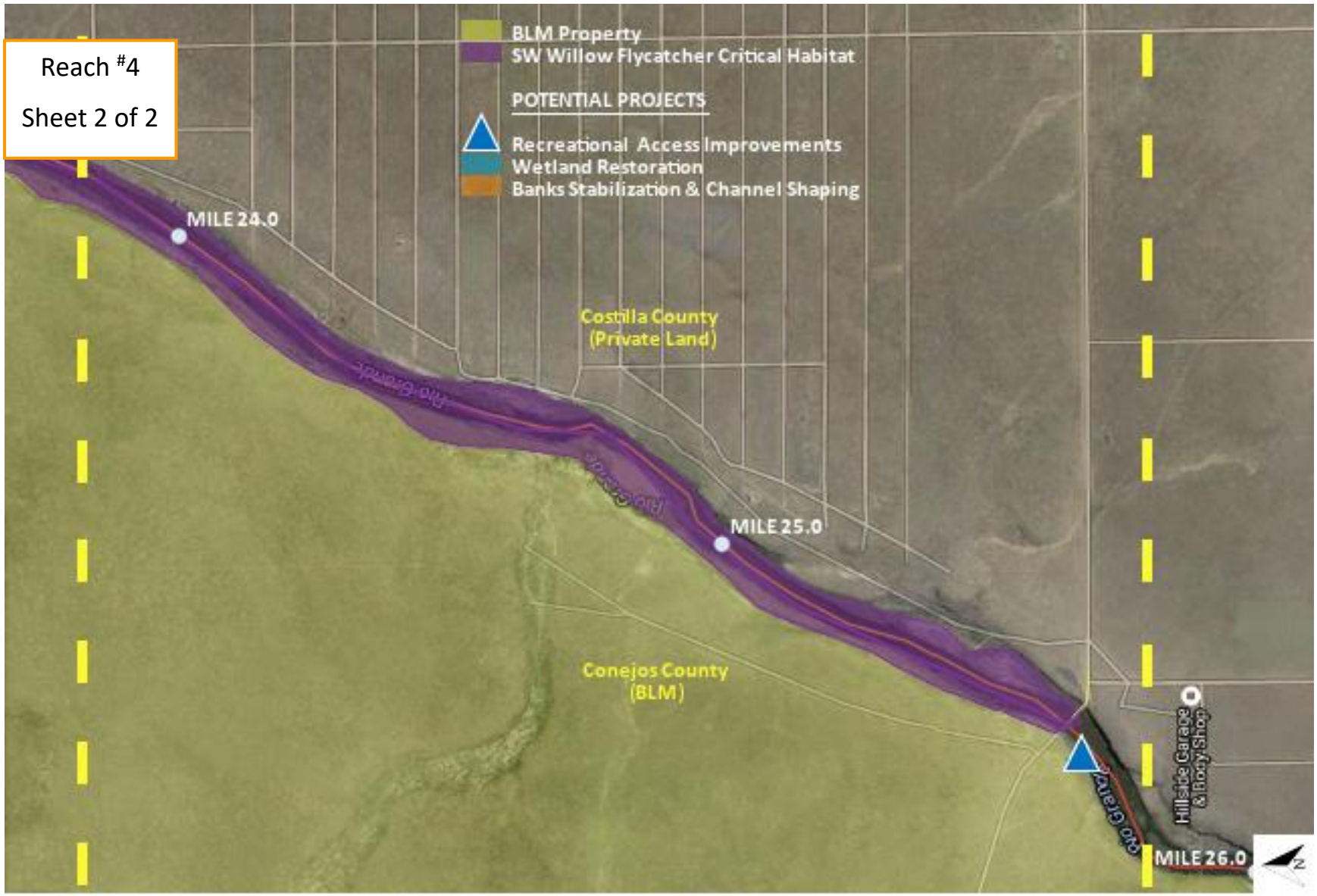
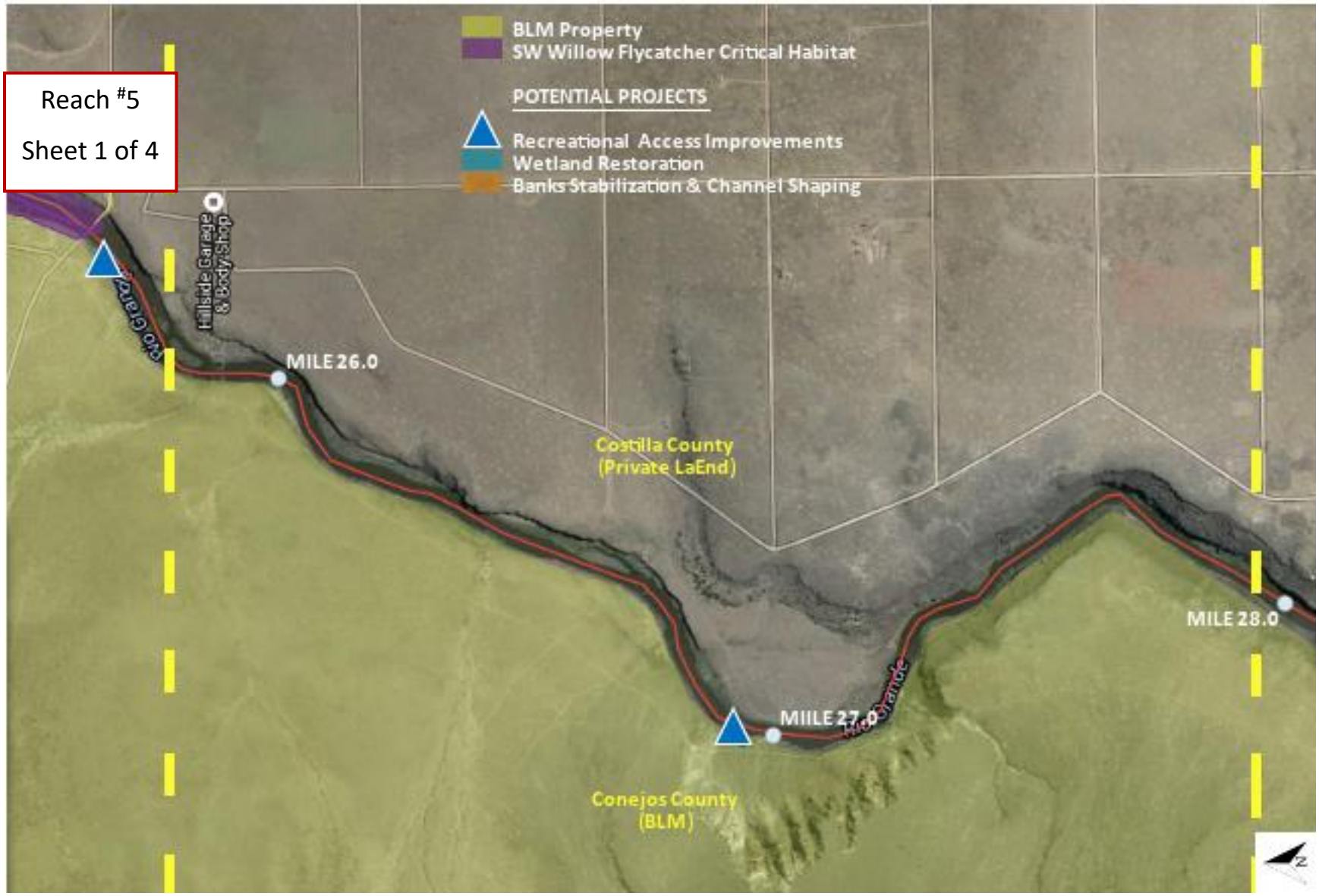
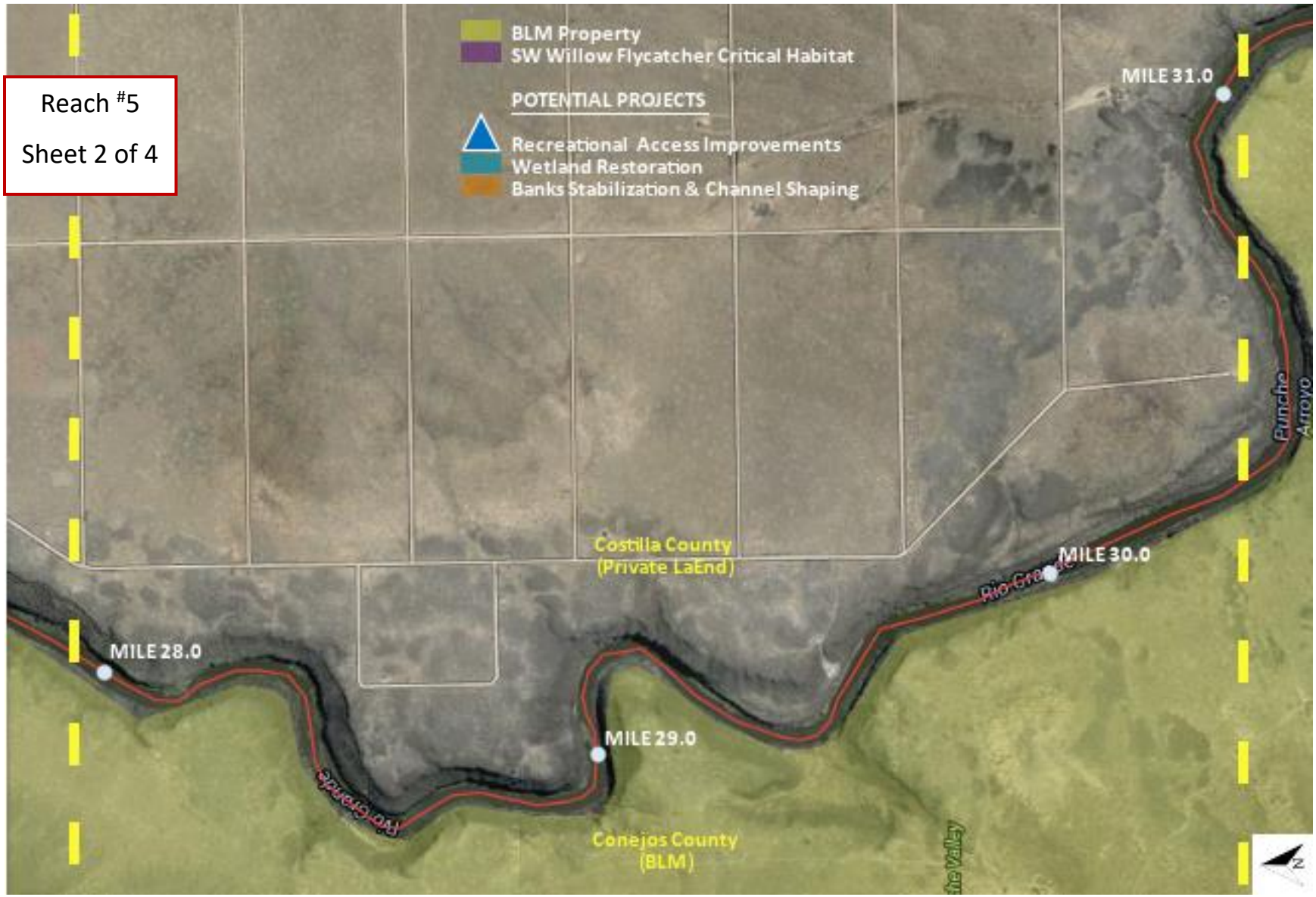
Sheet 4 of 4
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Costilla County
(Private Land)
MILE 20.0
Costilla County TROS
"Rio Grande Greenbelt"
Conejos County
(BLM)
MILE 21.0
Rio Grande


Reach #4
Sheet 1 of 2
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
MILE 24
Costilla County
(Private Land)
MILE 23.0
MILE 22.0
Conejos County
(BLM)


Reach #4
Sheet 2 of 2
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
MILE 24.0
Costilla County
(Private Land)
Rio Grande
MILE 25.0
Conejos County
(BLM)
Hillside Garage
& Rocky Shop
MILE 26.0


Reach #5
Sheet 1 of 4
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Hillside Garage & Body Shop
MILE 26.0
Costilla County (Private LaEnd)
MILE 28.0
MIILE 27.0
Conejos County (BLM)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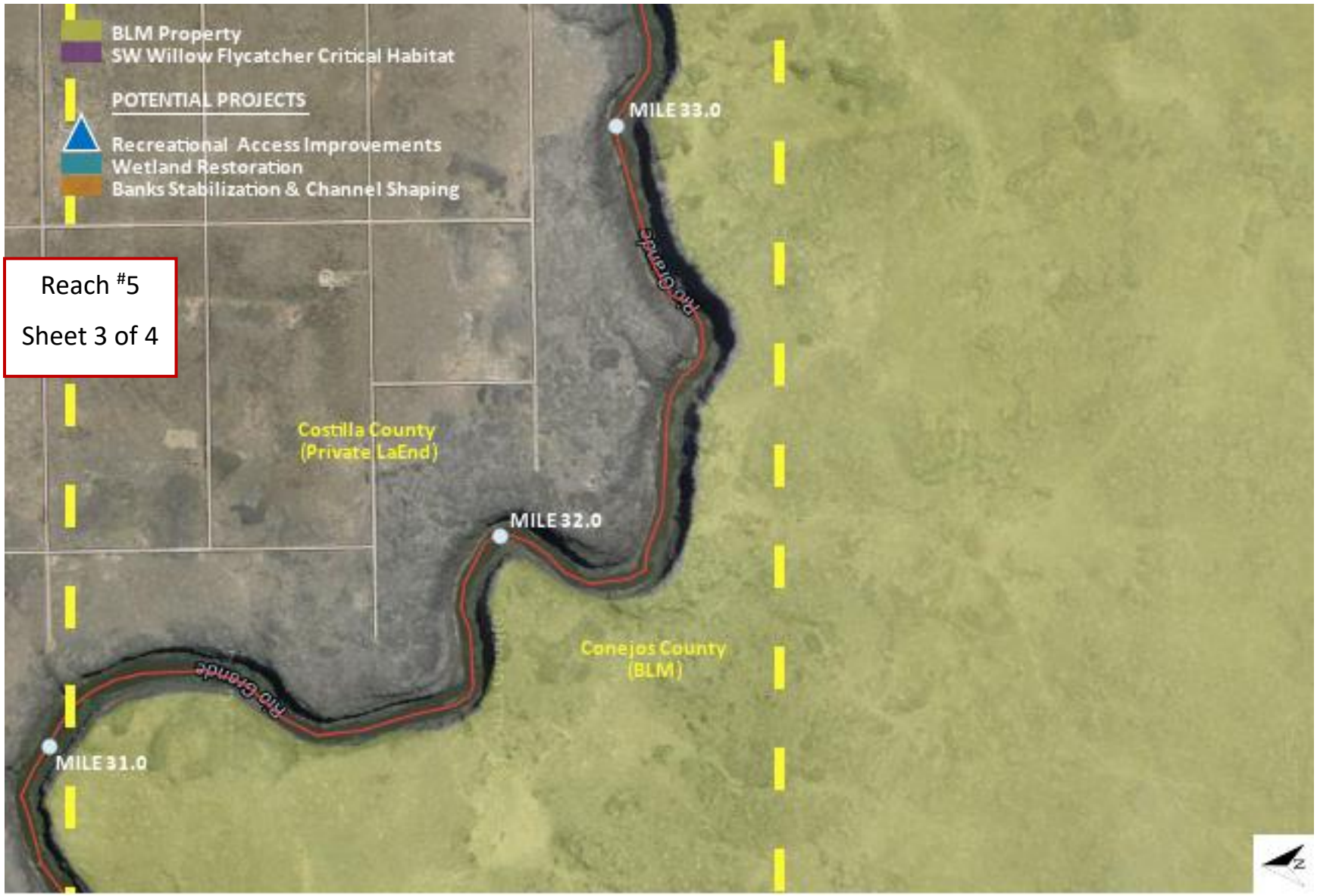
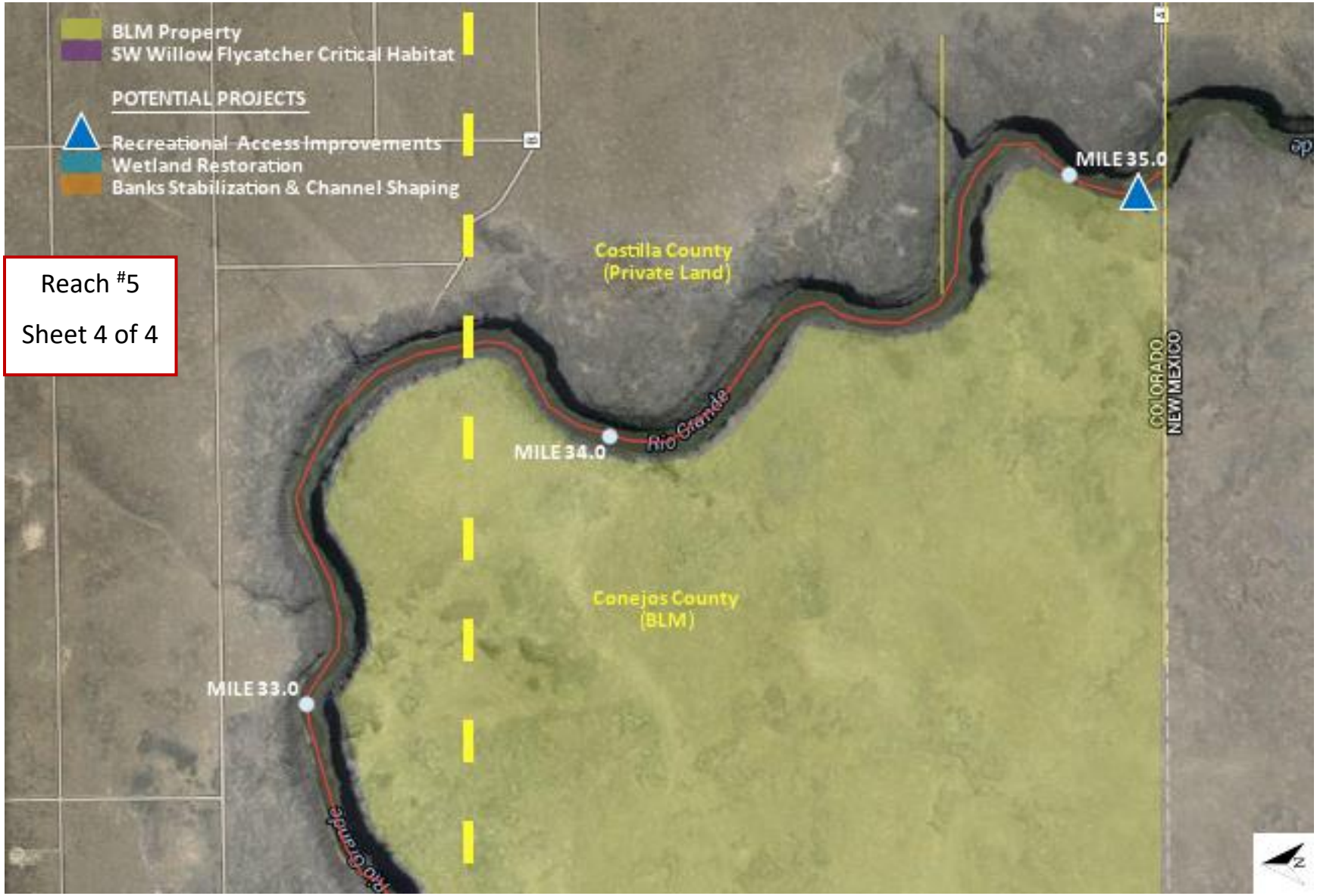
Sheet 2 of 4
BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
MILE 31.0
Costilla County
(Private LaEnd)
MILE 30.0
MILE 28.0
MILE 29.0
Conejos County
(BLM)


BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Reach #5
Sheet 3 of 4
MILE 33.0
Rio Grande
Costilla County
(Private LaEnd)
MILE 32.0
Conejos County
(BLM)
Rio Grande
MILE 31.0


BLM Property
SW Willow Flycatcher Critical Habitat
POTENTIAL PROJECTS
Recreational Access Improvements
Wetland Restoration
Banks Stabilization & Channel Shaping
Reach #5
Sheet 4 of 4
Costilla County
(Private Land)
Conejos County
(BLM)
MILE 35.0
MILE 34.0
MILE 33.0
Rio Grande
COLORADO
NEW MEXICO

Appendix 2—Photo Points

Reach #1



ABOVE: PP #1 (Station 25+00) Downstream |PP #2 (Station 51+00) Downstream | PP #2 (Station 51+00) Right Bank
BELOW: PP #2 (Station 51+00) Upstream | PP #3 (Station 74+00) Downstream | PP #3 (Station 74+00) Upstream
NOTE: Vertical cut banks, channel bars, sparse large riparian vegetation. Water visibility ~1-1½ feet on 20 May 2014.





ABOVE: PP #4 (Station 85+00) Downstream | PP #4 (Station 85+00) Upstream | PP #5 (Station 116+00) Downstream
BELOW: PP #5 (Station 116+00) Left Bank | PP #5 (116+00) Upstream | BOTTOM: PP #6 (130+00) Downstream
NOTE: Cut Banks on both sides. Station 85+00 shows evidence of overgrazing upstream. Minimal riparian vegetation.





ABOVE: PP #6 (Station 130+00) Right Bank | PP #6 (Station 130+00) Upstream | PP #7 (Station 155+00) Downstream
BELOW: PP #7 (Station 155+00) Upstream | PP #8 (Station 195+00) Downstream | PP #8 (Station 195+00) Right Bank
NOTE: Elk and Carp observed. Cut banks in places, and wide grassy sloped banks in others.





ABOVE: PP #8 (Station 195+00) Upstream | PP #9 (Station 218+00) Downstream | PP #9 (Station 218+00) Upstream
BELOW: PP #10 (Station 236+00) Downstream | PP #10 (Station 236+00) Upstream | PP #11 (Station 259+00) Downstream
Note: Vertical cut banks and overgrazing. Top right photo shows USGS gauge. Bottom right photo shows the Z Rd Bridge.



PP #11 (Station 259+00) Upstream

Reach #2



ABOVE: PP #12 (Station 272+00) Downstream | PP #12 (Station 272+00) Upstream | PP #13 (Station 280+00) Downstream
BELOW: PP #13 (Station 280+00) Upstream | PP #14 (Station 327+00) Downstream | PP #14 (Station (327+00) Upstream
NOTE: Top right photo looks toward Rio Conejos confluence. Healthy woody riparian vegetation.





ABOVE: PP #15 (Station 355+00) Downstream | PP #15 (Station 355+00) Upstream | PP #16 (Station 387+00) Downstream
BELOW: PP #16 (Station 387+00) Left Bank | PP #16 (Station 387+00) | PP #17 (Station 418+00) Downstream
NOTE: Vertical Cut banks





ABOVE: PP #17 (Station 418+00) Left Bank | PP #17 (Station 418+00) Upstream | PP #18 (Station 451+00) Downstream
BELOW: PP #18 (Station 451+00) Upstream | PP #19 (Station 472+00) Downstream | PP #19 (Station 472+00) Upstream





TOP: PP #19 (Station 487+00) Downstream | PP #20 (Station 524+00) Downstream | PP #20 (Station 524+00) Upstream
BOTTOM: PP #21 (Station 550+00) Downstream | PP #21 (Station 550+00) Upstream | PP #22 (Station 560+00) Downstream





TOP: PP #22 (Station 560+00) Upstream | PP #23 (Station 577+00) Downstream | PP #23 (Station 577+00) Upstream
BOTTOM: PP #24 (Station 610+00) Downstream | PP #24 (Station 610+00) Upstream | PP #25 (Station 631+00) Downstream





TOP: PP #25 (Station 631+00) Upstream | PP #26 (Station 650+00) Downstream | PP #26 (Station 650+00) Upstream
BOTTOM: PP #27 (Station 670+00) Downstream | PP #27 (Station 670+00) Upstream | PP #28 (Station 720+00) Downstream
NOTE: Canyon incision transition



PHOTO: PP #28 (Station 720+00) Upstream

Reach #3



TOP: PP #29 (Station 738+00) Downstream | PP #29 (Station 738+00) Upstream | PP #30 (Station 783+00) Downstream
BOTTOM: PP #30 (Station 783+00) Upstream | PP #31 (Station 860+00) Downstream | PP #31 (Station 860+00) Upstream





TOP: PP #32 (Station 880+00) Downstream | PP #33 (Station 925+00) Downstream | PP #33 (Station 925+00) Upstream
BOTTOM: PP #34 (Station 945+00) Downstream | PP #34 (Station 945+00) Upstream | PP #35 (Station 955+00) Downstream
NOTE: Transition out of canyon incision



TOP: PP #35 (Station 955+00) Upstream | PP #36 (Station 995+00) Downstream | PP #36 (Station 995+00) Upstream
BOTTOM: PP #37 (Station 1025+00) Downstream | PP #37 (Station 1025+00) Upstream | PP #38 (Station 1045+00) Downstream



PHOTOS: PP #38 (Station 1045+0) Upstream | PP #39 (Station 1065+00) Downstream | PP #39 (Station 1065+00) Upstream

Reach #4



TOP: PP #40 (Station 1085+00) Downstream | PP #40 (Station 1085+00) Left Bank | PP #40 (Station 1085+00) Upstream
BOTTOM: PP #41 (Station 1128+00) Downstream | PP #41 (Station 1128+00) Upstream | PP #42 (Station 1215+00) Downstream





TOP: PP #42 (Station 1161+00) Upstream | PP #43 (Station 1215+00) Downstream | PP #43 (Station 1215+00) Upstream
BOTTOM: PP #44 (Station 1268+00) Downstream | PP #44 (Station 1268+00) Upstream | P #45 (Station 1287+00) Downstream
NOTE: Horses observed on river left. Small grove of old growth cottonwoods on river right.





TOP: PP #45 (Station 1287+00) Upstream | PP #46 (Station 1350+00) Downstream | PP #46 (Station 1350+00) Upstream
BOTTOM: PP #47 (Station 1318+00) Downstream | PP #47 (Station 1318+00) Upstream


Reach #5



TOP: PP #48 (Station 1390+00) Downstream | PP #48 (Station 1390+00) Upstream | PP #49 (Station 1412+00) Downstream
BOTTOM: PP #49 (Station 1412+00) Upstream | PP #50 (Station 1425+00) Downstream | PP #50 (Station 1425+00) Upstream
NOTE: Top of reach is G. Road Bridge. Enters incised canyon with limited floodplain.



TOP: PP # 51 (Station 1448+00) Downstream | PP #52 (Station 1453+00) Downstream | PP #52 (Station 1453+00) Upstream
BOTTOM: PP #53 (Station 1470+00) Downstream | PP #53 (Station 1470+00) Upstream | PP #54 (station 1482+00) Downstream
NOTE: Width of canyon incision and intermittent floodplain changes, but river is bound geologically through much of Reach #5.



TOP: PP #54 (Station 1482+00) Upstream | PP #55 (Station 1495+00) Downstream | PP #55 (Station 1495) Upstream
BOTTOM: PP #56 (Station 1510+00) Downstream | PP #56 (Station 1510+00) Upstream | PP #57 (Station 1515+00) Downstream





TOP: PP #57 (Station 1515+00) Upstream | PP #58 (Station 1535+00) Downstream | PP #58 Station 1535+00 Upstream
BOTTOM: PP #59 (Station 1548+00) Downstream | PP #59 (Station 1548+00) Upstream | PP #60 (Station1561+00) Downstream
NOTE: This section of this reach represents the largest drop in slope in the study area—the boats are beached after an unexpected swim.





TOP: PP #60 (Station 1561+00) Upstream | PP #61 (Station1578+00) Downstream | PP #61 (Station 1578+00) Upstream
BOTTOM: PP #62 Downstream | PP #62 Upstream | PP #63 Downstream
NOTE: Due to the above mentioned swim, data was lost with stationing for the photo points in the last 5 miles above the NM state line.





TOP: PP #63 Upstream | PP #64 Downstream | PP #64 Upstream
BOTTOM: PP #65 Downstream | PP #65 Upstream | PP #66 Downstream
NOTE: River remains well incised in the canyon with few access points up the cliffs. BLM on the right and private on the left.





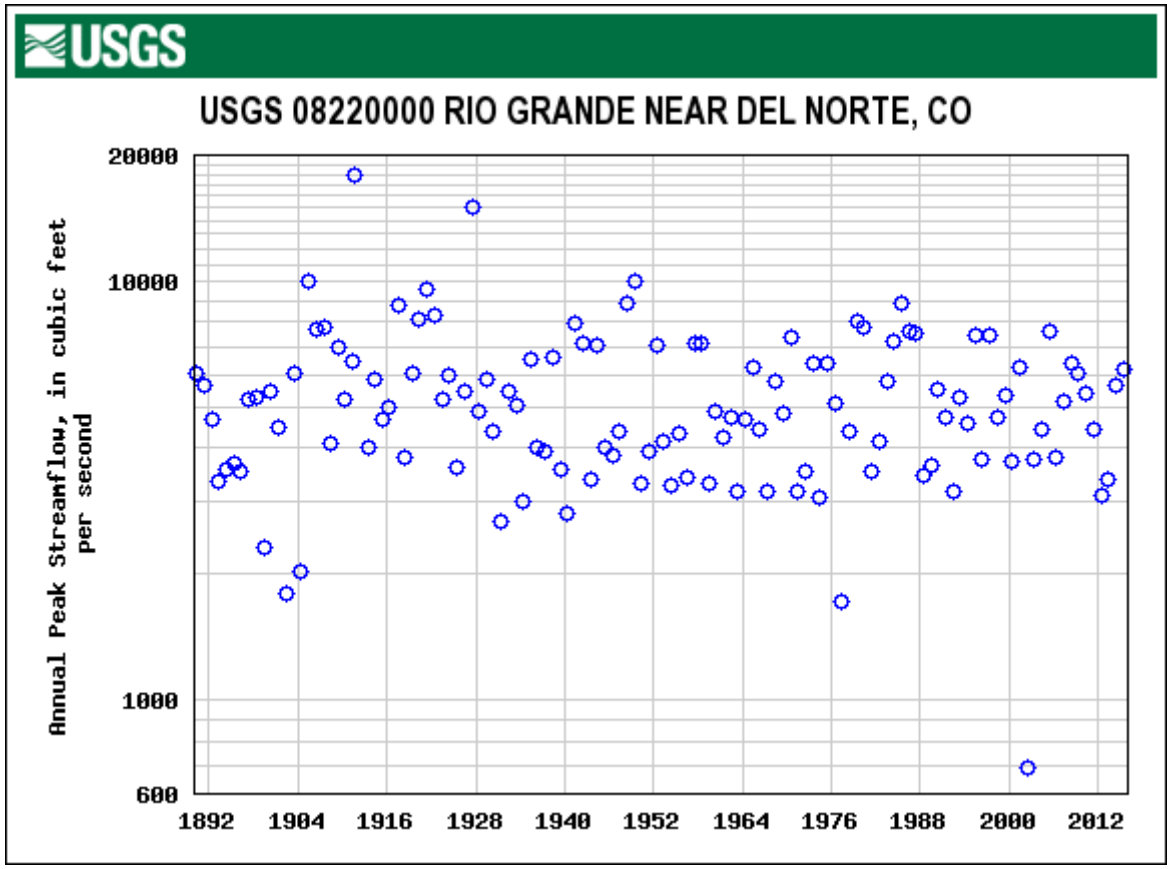
TOP: PP #66 Upstream | PP #67 Downstream | PP #67 Upstream
BOTTOM: PP #68 Downstream | PP #68 Upstream | PP #69 Downstream
NOTE: Incision persists.



PHOTOS: PP #69 Upstream | PP #70 Downstream | PP #70 Upstream
NOTE: The Colorado/ New Mexico state line is unmarked. The study team exited on BLM property above the state line.
NOTE: Incision persists.

Appendix 3—Gauge Data Analysis

Rio Grande near Del Norte—USGS 08220000



Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1890	May 27, 1890	6.39	6,050[2]
1891	May 07, 1891	6.20	5,650[2]
1892	May 24, 1892	5.72	4,710[2]
1893	May 18, 1893	4.90	3,320[2]
1894	May 20, 1894	4.60	3,570[2]
1895	Jun. 12, 1895	4.68	3,690[2]
1896	May 03, 1896	4.56	3,510[2]
1897	May 27, 1897	5.70	5,230[2]
1898	Jun. 03, 1898	5.30	5,270[2]
1899	May 11, 1899	3.62	2,320[2]
1900	May 29, 1900	5.80	5,450[2]
1901	May 21, 1901	5.16	4,480[2]
1902	May 03, 1902	2.86	1,790[2]
1903	Jun. 17, 1903	6.20	6,020[2]
1904	May 20, 1904	3.50	2,040[2]
1905	Jun. 05, 1905	7.05	10,000[2]
1906	Jun. 13, 1906	6.35	7,670[2]
1907	Jul. 01, 1907		7,770[2]
1908	Jun. 11, 1908	3.85[6]	4,130
1909	Jun. 06, 1909	5.20	6,980
1910	May 12, 1910	4.40	5,260
1911	Jun. 09, 1911	4.80	6,450

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1912	Oct. 05, 1911	6.80	18,000[6]
1913	May 27, 1913		4,030[2,6]
1914	Jun. 03, 1914	4.60	5,820[6]
1915	Jun. 20, 1915	4.25	4,690[6]
1916	May 11, 1916	4.20	5,020[6]
1917	Jun. 15, 1917	5.80	8,790[6]
1918	Jun. 11, 1918	3.75	3,820[6]
1919	May 22, 1919	4.75	6,020[6]
1920	Jun. 01, 1920		8,100[2,6]
1921	Jun. 13, 1921	6.10	9,630[6]
1922	May 30, 1922	5.30	8,320[6]
1923	May 26, 1923	4.18	5,210[6]
1924	Jun. 15, 1924	4.50	5,980[6]
1925	Jun. 05, 1925	3.57	3,610[6]
1926	Jun. 06, 1926	4.42	5,450[6]
1927	Jun. 29, 1927	6.40	15,000[6]
1928	Jun. 01, 1928	4.22	4,900[6]
1929	Jun. 07, 1929	4.51	5,830[6]
1930	May 31, 1930	3.93	4,400[6]
1931	Jun. 03, 1931	3.10	2,670[6]
1932	Jun. 16, 1932	4.42	5,460[6]
1933	Jun. 02, 1933	4.27	5,050[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1934	May 10, 1934	3.35	2,980[6]
1935	Jun. 16, 1935	4.93	6,520[6]
1936	May 05, 1936	3.83	4,000[6]
1937	May 18, 1937	3.80	3,920[6]
1938	Jun. 14, 1938	4.87	6,560[6]
1939	May 22, 1939	3.56	3,550[6]
1940	May 15, 1940	3.18	2,810[6]
1941	Jun. 19, 1941	5.56	7,960[6]
1942	May 27, 1942	5.09	7,150[6]
1943	Jun. 01, 1943	3.58	3,380[6]
1944	May 16, 1944	5.22	7,070[6]
1945	Jun. 15, 1945	3.90	4,030[6]
1946	Jun. 07, 1946	3.82	3,860[6]
1947	Jun. 08, 1947	4.03	4,390[6]
1948	May 22, 1948	5.81	8,840[6]
1949	Jun. 19, 1949	6.16	10,000[6]
1950	Jun. 02, 1950	3.53	3,290[6]
1951	May 28, 1951	3.87	3,950[6]
1952	Jun. 12, 1952	5.11	7,050[6]
1953	May 28, 1953	3.92	4,160[6]
1954	May 22, 1954	3.52	3,270[6]
1955	Jun. 09, 1955	4.07	4,320[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1956	Jun. 02, 1956	3.60	3,420[6]
1957	Jul. 27, 1957	5.24	7,120[6]
1958	May 25, 1958	5.06	7,100[6]
1959	Jun. 08, 1959	3.55	3,310[6]
1960	Jun. 04, 1960	4.31	4,910[6]
1961	May 29, 1961	3.93	4,260[6]
1962	May 13, 1962	4.14	4,760[6]
1963	May 19, 1963	3.43	3,170[6]
1964	May 25, 1964	4.22	4,710[6]
1965	Jun. 21, 1965	5.02	6,210[6]
1966	May 08, 1966	4.10	4,450[6]
1967	May 23, 1967	3.40	3,140[6]
1968	Jun. 02, 1968	4.82	5,790[6]
1969	May 23, 1969	4.27	4,820[6]
1970	Sep. 06, 1970	5.36	7,380[6]
1971	Jun. 14, 1971	3.47	3,170[6]
1972	May 31, 1972	3.60	3,520[6]
1973	Jun. 12, 1973	5.08	6,380[6]
1974	May 12, 1974	3.43	3,060[6]
1975	Jun. 15, 1975	5.07	6,350[6]
1976	Jun. 06, 1976	4.52	5,120[6]
1977	Jun. 02, 1977	2.62	1,730[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1978	Jun. 11, 1978	4.18	4,410[6]
1979	May 30, 1979	5.68[2]	8,030[6]
1980	Jun. 10, 1980	5.59	7,750[6]
1981	Jun. 08, 1981	3.74	3,540[6]
1982	Jun. 13, 1982	4.08	4,140[6]
1983	Jun. 12, 1983	4.77	5,790[6]
1984	May 27, 1984	5.43	7,200[6]
1985	Jun. 09, 1985	5.91	8,920[6]
1986	Jun. 07, 1986	5.39	7,620[6]
1987	Jun. 16, 1987	5.22	7,490[6]
1988	Jun. 07, 1988	3.53	3,440[6]
1989	May 30, 1989	3.64	3,640[6]
1990	Jun. 05, 1990	4.62	5,530[6]
1991	May 21, 1991	4.19	4,760[6]
1992	May 21, 1992	3.40	3,140[6]
1993	May 27, 1993	4.52	5,300[6]
1994	May 31, 1994	4.11	4,600[6]
1995	Jun. 18, 1995	5.50	7,410[6]
1996	May 17, 1996	3.72	3,760[6]
1997	Jun. 02, 1997	5.33	7,440[6]
1998	May 22, 1998	4.19	4,760[6]
1999	Jun. 10, 1999	4.52	5,330[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
2000	May 24, 2000	3.72	3,740[6]
2001	May 21, 2001	4.89	6,210[6]
2002	May 20, 2002	1.66[2]	689[6]
2003	May 23, 2003	3.77	3,780[6]
2004	May 21, 2004	4.13	4,450[6]
2005	May 22, 2005	5.40	7,570[6]
2006	May 25, 2006	3.76	3,800[6]
2007	Jun. 06, 2007	4.40	5,180[6]
2008	May 21, 2008	4.92	6,370[6]
2009	May 08, 2009	4.87	6,040[6]
2010	May 29, 2010	4.53	5,430[6]
2011	Jun. 07, 2011	4.18	4,440[6]
2012	May 23, 2012	3.40[2]	3,070[6]
2013	May 18, 2013	3.63	3,360[6]
2014	May 30, 2014	4.68	5,640[6]
2015	Jun. 11, 2015	4.87	6,140[6]

Peak Gage-Height Qualification Codes.

- 2 -- Gage height not the maximum for the year
- 6 -- Gage datum changed during this year

Peak Streamflow Qualification Codes.

- 2 -- Discharge is an Estimate
- 6 -- Discharge affected by Regulation or Diversion

WATSTORE DATA

Z08220000 USGS

H08220000 374119106273500080810 5SW130100011320 7980.25

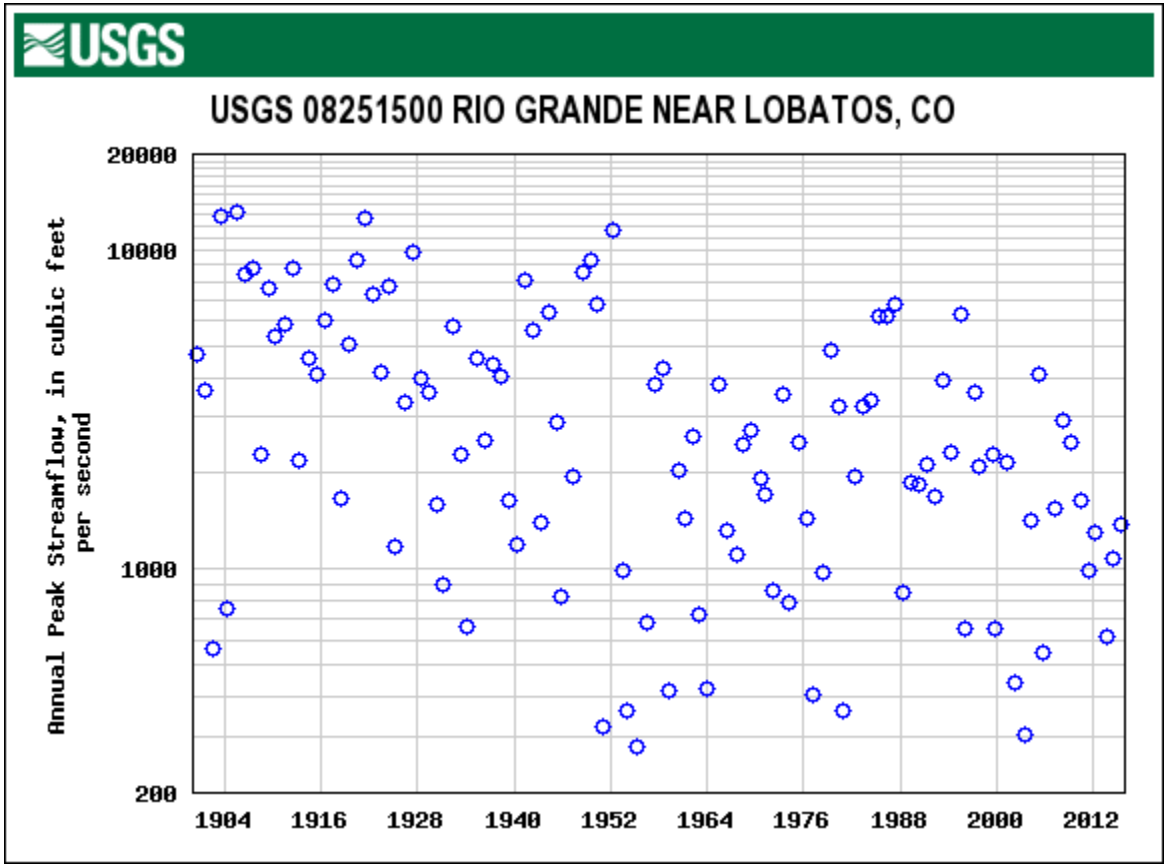
N08220000 RIO GRANDE NEAR DEL NORTE, CO

Y08220000

308220000	18900527	60502	6.39
308220000	18910507	56502	6.20
308220000	18920524	47102	5.72
308220000	18930518	33202	4.90
308220000	18940520	35702	4.60
308220000	18950612	36902	4.68
308220000	18960503	35102	4.56
308220000	18970527	52302	5.70
308220000	18980603	52702	5.30
308220000	18990511	23202	3.62
308220000	19000529	54502	5.80
308220000	19010521	44802	5.16
308220000	19020503	17902	2.86
308220000	19030617	60202	6.20
308220000	19040520	20402	3.50
308220000	19050605	100002	7.05
308220000	19060613	76702	6.35
308220000	19070701	77702	
308220000	19080611	4130	3.856
308220000	19090606	6980	5.20
308220000	19100512	5260	4.40
308220000	19110609	6450	4.80
308220000	19111005	180006	6.80
308220000	19130527	403026	
308220000	19140603	58206	4.60
308220000	19150620	46906	4.25
308220000	19160511	50206	4.20
308220000	19170615	87906	5.80
308220000	19180611	38206	3.75
308220000	19190522	60206	4.75
308220000	19200601	810026	
308220000	19210613	96306	6.10
308220000	19220530	83206	5.30
308220000	19230526	52106	4.18
308220000	19240615	59806	4.50
308220000	19250605	36106	3.57
308220000	19260606	54506	4.42
308220000	19270629	150006	6.40
308220000	19280601	49006	4.22
308220000	19290607	58306	4.51
308220000	19300531	44006	3.93
308220000	19310603	26706	3.10
308220000	19320616	54606	4.42
308220000	19330602	50506	4.27
308220000	19340510	29806	3.35
308220000	19350616	65206	4.93
308220000	19360505	40006	3.83
308220000	19370518	39206	3.80
308220000	19380614	65606	4.87
308220000	19390522	35506	3.56
308220000	19400515	28106	3.18
308220000	19410619	79606	5.56
308220000	19420527	71506	5.09
308220000	19430601	33806	3.58
308220000	19440516	70706	5.22
308220000	19450615	40306	3.90
308220000	19460607	38606	3.82
308220000	19470608	43906	4.03
308220000	19480522	88406	5.81
308220000	19490619	100006	6.16
308220000	19500602	32906	3.53
308220000	19510528	39506	3.87
308220000	19520612	70506	5.11
308220000	19530528	41606	3.92
308220000	19540522	32706	3.52
308220000	19550609	43206	4.07
308220000	19560602	34206	3.60
308220000	19570727	71206	5.24
308220000	19580525	71006	5.06
308220000	19590608	33106	3.55

308220000	19600604	49106	4.31
308220000	19610529	42606	3.93
308220000	19620513	47606	4.14
308220000	19630519	31706	3.43
308220000	19640525	47106	4.22
308220000	19650621	62106	5.02
308220000	19660508	44506	4.10
308220000	19670523	31406	3.40
308220000	19680602	57906	4.82
308220000	19690523	48206	4.27
308220000	19700906	73806	5.36
308220000	19710614	31706	3.47
308220000	19720531	35206	3.60
308220000	19730612	63806	5.08
308220000	19740512	30606	3.43
308220000	19750615	63506	5.07
308220000	19760606	51206	4.52
308220000	19770602	17306	2.62
308220000	19780611	44106	4.18
308220000	19790530	80306	5.682
308220000	19800610	77506	5.59
308220000	19810608	35406	3.74
308220000	19820613	41406	4.08
308220000	19830612	57906	4.77
308220000	19840527	72006	5.43
308220000	19850609	89206	5.91
308220000	19860607	76206	5.39
308220000	19870616	74906	5.22
308220000	19880607	34406	3.53
308220000	19890530	36406	3.64
308220000	19900605	55306	4.62
308220000	19910521	47606	4.19
308220000	19920521	31406	3.40
308220000	19930527	53006	4.52
308220000	19940531	46006	4.11
308220000	19950618	74106	5.50
308220000	19960517	37606	3.72
308220000	19970602	74406	5.33
308220000	19980522	47606	4.19
308220000	19990610	53306	4.52
308220000	20000524	37406	3.72
308220000	20010521	62106	4.89
308220000	20020520	6896	1.662
308220000	20030523	37806	3.77
308220000	20040521	44506	4.13
308220000	20050522	75706	5.40
308220000	20060525	38006	3.76
308220000	20070606	51806	4.40
308220000	20080521	63706	4.92
308220000	20090508	60406	4.87
308220000	20100529	54306	4.53
308220000	20110607	44406	4.18
308220000	20120523	30706	3.402
308220000	20130518	33606	3.63
308220000	20140530	56406	4.68
308220000	20150611	61406	4.87

Rio Grande near Lobatos–USGS Gauge 08251500



Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1900	May 30, 1900	5.00	4,700[5]
1901	May 23, 1901	4.30	3,620[5]
1902	May 15, 1902	2.00	565[5]
1903	Jun. 18, 1903	10.00	12,800[5]
1904	Apr. 19, 1904	2.20	751[5]
1905	Jun. 08, 1905	9.10	13,200[5]
1906	Jun. 17, 1906	6.80	8,380[5]
1907	Jul. 03, 1907	7.00	8,800[5]
1908	Jun. 14, 1908	3.50	2,300[5]
1909	Jun. 10, 1909	6.80	7,640[5]
1910	Apr. 30, 1910	5.50	5,360[6]
1911	Jun. 13, 1911	6.00	5,910[6]
1912	May 29, 1912	7.65	8,770[6]
1913	Mar. 23, 1913	3.52	2,200[6]
1914	Jun. 05, 1914	5.25	4,580[6]
1915	May 19, 1915	4.84	4,070[6]
1916	May 12, 1916	6.00	6,000[6]
1917	Jun. 20, 1917	7.05	7,840[6]
1918	Jun. 16, 1918	3.04	1,670[6]
1919	May 25, 1919	5.40	5,090[6]
1920	May 27, 1920	7.55	9,320[6]
1921	Jun. 16, 1921	9.00	12,600[6]
1922	Jun. 01, 1922	6.30	7,300[6]
1923	Jun. 17, 1923	4.57	4,120[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1924	May 21, 1924	6.22	7,670[6]
1925	Feb. 14, 1925	3.67	1,180[6]
1926	Jun. 04, 1926	4.04	3,330[6]
1927	Jul. 03, 1927	7.43	9,830[6]
1928	Jun. 01, 1928		3,960[1,6]
1929	May 27, 1929	4.24	3,580[6]
1930	Jun. 01, 1930	2.90	1,590[6]
1931	Mar. 22, 1931		900[1,6]
1932	May 24, 1932	5.22	5,780[6]
1933	Jun. 03, 1933	3.49	2,290[6]
1934	Feb. 19, 1934	2.05[1]	663[6]
1935	Jun. 18, 1935	4.81	4,600[6]
1936	May 07, 1936	3.61	2,540[6]
1937	May 19, 1937	4.90	4,370[6]
1938	May 02, 1938	4.69	4,040[6]
1939	Mar. 24, 1939	3.02[1]	1,640[6]
1940	May 19, 1940	2.59	1,190[6]
1941	May 16, 1941	6.83	8,090[6]
1942	May 13, 1942	5.50[2]	5,580[6]
1943	May 04, 1943	2.94	1,400[6]
1944	May 18, 1944	6.25	6,440[6]
1945	May 12, 1945	4.08	2,880[6]
1946	Nov. 12, 1945	2.27	822[6]
1947	May 11, 1947	3.43	1,960[6]
1948	Jun. 07, 1948	7.46	8,600[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1949	Jun. 22, 1949	7.68	9,330[6]
1950	Mar. 30, 1950	6.34	6,820[3,6]
1951	Feb. 19, 1951		320[1,6]
1952	May 08, 1952	8.76	11,600[3,6]
1953	May 30, 1953	2.52[1]	995[6]
1954	Feb. 13, 1954		360[1,6]
1955	Mar. 11, 1955		280[1,6]
1956	Jun. 05, 1956	2.32	681[6]
1957	Jul. 31, 1957	4.92	3,810[6]
1958	May 29, 1958	5.04	4,270[6]
1959	Mar. 02, 1959	1.68	418[6]
1960	Jun. 12, 1960	3.60	2,040[6]
1961	May 02, 1961	3.06	1,440[6]
1962	Apr. 22, 1962	3.88	2,620[6]
1963	Nov. 10, 1962	2.25[2]	724[6]
1964	Nov. 11, 1963	1.82[2]	423[6]
1965	Jun. 22, 1965	4.78	3,790[6]
1966	May 11, 1966	2.98	1,330[6]
1967	Aug. 13, 1967	2.78[2]	1,110[6]
1968	Jun. 01, 1968	3.93	2,470[6]
1969	Jun. 19, 1969	4.29	2,730[6]
1970	Sep. 18, 1970	3.80	1,930[6]
1971	Mar. 30, 1971	3.29[2]	1,720[6]
1972	Mar. 16, 1972	2.41[2]	856[6]
1973	May 23, 1973	4.69	3,560[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1974	Apr. 01, 1974	2.38	784[6]
1975	Jun. 18, 1975	4.17	2,490[6]
1976	May 31, 1976	3.23	1,450[6]
1977	Mar. 22, 1977		405[1,6]
1978	Jul. 01, 1978	3.11	979[6]
1979	Jun. 10, 1979	5.61	4,830[6]
1980	Jun. 13, 1980	4.50	3,230[6]
1981	Dec. 05, 1980		360[1,6]
1982	Jun. 01, 1982	3.72[2]	1,950[6]
1983	Jun. 29, 1983	4.67	3,230[6]
1984	May 31, 1984	4.53	3,390[6]
1985	Jun. 13, 1985	6.42	6,240[6]
1986	Jun. 11, 1986	6.30	6,180[6]
1987	May 19, 1987	6.61	6,760[6]
1988	Apr. 10, 1988	2.21[2]	848[6]
1989	Apr. 11, 1989	3.35	1,870[6]
1990	May 10, 1990	3.27	1,860[6]
1991	May 23, 1991	3.63	2,130[6]
1992	Apr. 15, 1992	3.25[2]	1,700[6]
1993	May 30, 1993	4.92	3,890[6]
1994	Jun. 03, 1994	4.07	2,320[6]
1995	Jul. 05, 1995	6.72	6,330[6]
1996	Feb. 20, 1996	2.03[2]	650[6]
1997	Jun. 05, 1997	4.72	3,610[6]
1998	Oct. 15, 1997	3.75	2,100[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1999	Jun. 20, 1999	3.96	2,310[6]
2000	Oct. 01, 1999	2.44[2]	650[6]
2001	May 31, 2001	3.75	2,170[6]
2002	Mar. 12, 2002	1.72[2]	440[6]
2003	Jun. 10, 2003	1.56[2]	302[6]
2004	Mar. 28, 2004	2.91[2]	1,420[6]
2005	May 26, 2005	5.23	4,090[6]
2006	Nov. 11, 2005	2.05[2]	550[6]
2007	Mar. 20, 2007	3.22[2]	1,560[6]
2008	May 24, 2008	4.63	2,940[6]
2009	May 10, 2009	4.20	2,500[6]
2010	May 31, 2010	3.48	1,640[6]
2011	Jun. 09, 2011	2.71[2]	988[6]
2012	Mar. 29, 2012	2.96[2]	1,310[6]
2013	Sep. 30, 2013	2.17[2]	615[6]
2014	Jun. 01, 2014	2.92[2]	1,090[6]
2015	Jun. 19, 2015	3.13[2]	1,390[6]

Peak Gage-Height Qualification Codes.

- 1 -- Gage height affected by backwater
- 2 -- Gage height not the maximum for the year

Peak Streamflow Qualification Codes.

- 1 -- Discharge is a Maximum Daily Average
- 3 -- Discharge affected by Dam Failure
- 5 -- Discharge affected to unknown degree by Regulation or Diversion
- 6 -- Discharge affected by Regulation or Diversion

WATSTORE PEAKFQ DATA

Z08251500 USGS

H08251500 37044310545250008080 21SW130100027700 4760 7427.63

N08251500 RIO GRANDE NEAR LOBATOS, CO

Y08251500

308251500	19000530	47005	5.00
308251500	19010523	36205	4.30
308251500	19020515	5655	2.00
308251500	19030618	128005	10.00
308251500	19040419	7515	2.20
308251500	19050608	132005	9.10
308251500	19060617	83805	6.80
308251500	19070703	88005	7.00
308251500	19080614	23005	3.50
308251500	19090610	76405	6.80
308251500	19100430	53606	5.50
308251500	19110613	59106	6.00
308251500	19120529	87706	7.65
308251500	19130323	22006	3.52
308251500	19140605	45806	5.25
308251500	19150519	40706	4.84
308251500	19160512	60006	6.00
308251500	19170620	78406	7.05
308251500	19180616	16706	3.04
308251500	19190525	50906	5.40
308251500	19200527	93206	7.55
308251500	19210616	126006	9.00
308251500	19220601	73006	6.30
308251500	19230617	41206	4.57
308251500	19240521	76706	6.22
308251500	19250214	11806	3.67
308251500	19260604	33306	4.04
308251500	19270703	98306	7.43
308251500	19280601	396016	
308251500	19290527	35806	4.24
308251500	19300601	15906	2.90
308251500	19310322	90016	
308251500	19320524	57806	5.22
308251500	19330603	22906	3.49
308251500	19340219	6636	2.051
308251500	19350618	46006	4.81
308251500	19360507	25406	3.61
308251500	19370519	43706	4.90
308251500	19380502	40406	4.69
308251500	19390324	16406	3.021
308251500	19400519	11906	2.59
308251500	19410516	80906	6.83
308251500	19420513	55806	5.502
308251500	19430504	14006	2.94
308251500	19440518	64406	6.25
308251500	19450512	28806	4.08
308251500	19451112	8226	2.27
308251500	19470511	19606	3.43
308251500	19480607	86006	7.46
308251500	19490622	93306	7.68
308251500	19500330	682036	6.34
308251500	19510219	32016	
308251500	19520508	1160036	8.76
308251500	19530530	9956	2.521
308251500	19540213	36016	
308251500	19550311	28016	
308251500	19560605	6816	2.32
308251500	19570731	38106	4.92
308251500	19580529	42706	5.04
308251500	19590302	4186	1.68
308251500	19600612	20406	3.60
308251500	19610502	14406	3.06
308251500	19620422	26206	3.88
308251500	19621110	7246	2.252
308251500	19631111	4236	1.822
308251500	19650622	37906	4.78
308251500	19660511	13306	2.98
308251500	19670813	11106	2.782
308251500	19680601	24706	3.93
308251500	19690619	27306	4.29
308251500	19700918	19306	3.80
308251500	19710330	17206	3.292

308251500	19720316	8566	2.412
308251500	19730523	35606	4.69
308251500	19740401	7846	2.38
308251500	19750618	24906	4.17
308251500	19760531	14506	3.23
308251500	19770322	40516	
308251500	19780701	9796	3.11
308251500	19790610	48306	5.61
308251500	19800613	32306	4.50
308251500	19801205	36016	
308251500	19820601	19506	3.722
308251500	19830629	32306	4.67
308251500	19840531	33906	4.53
308251500	19850613	62406	6.42
308251500	19860611	61806	6.30
308251500	19870519	67606	6.61
308251500	19880410	8486	2.212
308251500	19890411	18706	3.35
308251500	19900510	18606	3.27
308251500	19910523	21306	3.63
308251500	19920415	17006	3.252
308251500	19930530	38906	4.92
308251500	19940603	23206	4.07
308251500	19950705	63306	6.72
308251500	19960220	6506	2.032
308251500	19970605	36106	4.72
308251500	19971015	21006	3.75
308251500	19990620	23106	3.96
308251500	19991001	6506	2.442
308251500	20010531	21706	3.75
308251500	20020312	4406	1.722
308251500	20030610	3026	1.562
308251500	20040328	14206	2.912
308251500	20050526	40906	5.23
308251500	20051111	5506	2.052
308251500	20070320	15606	3.222
308251500	20080524	29406	4.63
308251500	20090510	25006	4.20
308251500	20100531	16406	3.48
308251500	20110609	9886	2.712
308251500	20120329	13106	2.962
308251500	20130930	6156	2.172
308251500	20140601	10906	2.922
308251500	20150619	13906	3.132

Appendix 4—Macroinvertebrate Data

Riverbend CO Rio Grande Benthos 2015
****Calculations use EcoAnalysts Inc. standard attributes****

EcoAnalysts, Inc.
LIFE IN WATER

Site ID	Site #1	Site #2	Site #3	Site #4
Site Description	**Below Z Road Bridge**	**Below the Cemetery near Lasauses**	**Below HWY 142 Bridge**	**Below G Road Bridge**
Collection Date	**07-24-2015**	**07-24-2015**	**07-24-2015**	**07-24-2015**
Percent Sorted	**100.00**	**100.00**	**100.00**	**100.00**
EcoAnalysts Sample ID	**7253.01-1**	**7253.01-2**	**7253.01-3**	**7253.01-4**
Abundance Measures				
Abundance	384.00	681.00	738.00	84.00
EPT Abundance	157.00	495.00	508.00	49.00
Dominance Measures				
Dominant Taxon	Oligochaeta	Tricorythodes sp.	Hydropsyche sp.	Camelobaetidius warreni
Dominant Abundance	103.00	215.00	203.00	29.00
2nd Dominant Taxa	Chironomidae	Cheumatopsyche sp.	Simulium sp.	Hyalella sp.
2nd Dominant Abundance	93.00	135.00	190.00	20.00
3rd Dominant Taxa	Tricorythodes sp.	Oligochaeta	Cheumatopsyche sp.	Acentrella insignificans
3rd Dominant Abundance	57.00	90.00	93.00	8.00
% Dominant Taxon	26.82	31.57	27.51	34.52
% 2 Dominant Taxa	51.04	51.40	53.25	58.33
% 3 Dominant Taxa	65.89	64.61	65.85	67.86

Site Description	Below Z Road Bridge	Below the Cemetery near Lasauses	Below HWY 142 Bridge	Below G Road Bridge
Richness Measures				
Species Richness	21.00	29.00	24.00	13.00
EPT Richness	9.00	12.00	14.00	7.00
Ephemeroptera Richness	5.00	8.00	7.00	5.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	4.00	4.00	7.00	2.00
Chironomidae Richness	1.00	1.00	1.00	1.00
Oligochaeta Richness	1.00	1.00	1.00	1.00
Non-Chiro. Non-Olig. Richness	19.00	27.00	22.00	11.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	24.74	46.70	26.96	54.76
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	16.15	25.99	41.87	3.57
% EPT	40.89	72.69	68.83	58.33
% Coleoptera	0.26	0.15	0.00	0.00
% Diptera	24.48	5.87	29.00	14.29
% Oligochaeta	26.82	13.22	0.68	1.19
% Baetidae	9.38	11.89	21.14	52.38
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	24.22	5.58	3.12	9.52
% Ephemerellidae	0.00	0.00	0.00	0.00
% Hydropsychidae	5.73	24.67	40.11	3.57
% Odonata	1.56	1.62	0.00	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	0.26	0.15	25.75	4.76

Site Description	Below Z Road Bridge	Below the Cemetery near Lasauses	Below HWY 142 Bridge	Below G Road Bridge
Functional Group Composition				
% Filterers	5.99	24.82	65.85	8.33
% Gatherers	75.00	62.56	28.18	82.14
% Predators	6.25	4.70	0.95	0.00
% Scrapers	1.56	5.43	1.90	1.19
% Shredders	9.90	1.32	0.14	0.00
% Piercer-Herbivores	0.52	0.15	0.68	0.00
% Unclassified	0.78	1.03	2.30	8.33
Filterer Richness	3.00	3.00	3.00	3.00
Gatherer Richness	6.00	8.00	11.00	7.00
Predator Richness	7.00	7.00	2.00	0.00
Scraper Richness	2.00	6.00	5.00	1.00
Shredder Richness	1.00	2.00	1.00	0.00
Piercer-Herbivore Richness	1.00	1.00	1.00	0.00
Unclassified	1.00	2.00	1.00	2.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.93	0.95	0.91	0.85
Shannon-Weaver H' (log 2)	3.08	3.17	3.03	2.82
Shannon-Weaver H' (log e)	2.14	2.20	2.10	1.95
Margalef's Richness	3.36	4.29	3.48	2.71
Pielou's J'	0.70	0.65	0.66	0.76
Simpson's Heterogeneity	0.83	0.83	0.83	0.81

Site Description	Below Z Road Bridge	Below the Cemetery near Lasauses	Below HWY 142 Bridge	Below G Road Bridge
Biotic Indices				
% Indiv. w/ HBI Value	91.67	90.46	93.22	57.14
Hilsenhoff Biotic Index	5.67	5.04	4.81	6.35
% Indiv. w/ MTI Value	40.10	67.99	88.21	22.62
Metals Tolerance Index	3.86	4.24	4.81	4.26
% Indiv. w/ FSBI Value	23.96	57.86	85.91	20.24
Fine Sediment Biotic Index	25.00	25.00	35.00	20.00
FSBI - average	1.19	0.86	1.46	1.54
FSBI - weighted average	4.14	3.44	3.96	4.71
% Indiv. w/ TPM Value	45.83	64.17	83.60	44.05
Temp. Pref. Metric - average	0.95	0.79	1.25	1.31
TPM - weighted average	3.55	1.96	3.18	2.95
Karr BIBI Metrics				
Long-Lived Taxa Richness	0.00	1.00	0.00	0.00
Clinger Richness	10.00	12.00	12.00	6.00
% Clingers	35.68	63.29	86.99	21.43
Intolerant Taxa Richness	1.00	2.00	3.00	0.00
% Tolerant Individuals	29.26	18.02	1.31	45.83
% Tolerant Taxa	4.76	20.69	20.83	23.08
Coleoptera Richness	1.00	1.00	0.00	0.00
Montana DEQ Metrics				
MT Biotic Index	5.67	5.04	4.81	6.35
C-Gatherers + C-Filterers	80.99	87.37	94.04	90.48
% Scraper + % Shredder	11.46	6.75	2.03	1.19
% Univoltine	24.22	8.96	3.39	9.52
% Multivoltine	33.85	59.62	60.70	42.86
% Semivoltine	0.00	0.15	0.00	0.00
Community Tolerance Quotient	N/A	N/A	N/A	N/A
% Hydropsychinae	5.73	24.67	40.11	3.57

Site Description	Below Z Road Bridge	Below the Cemetery near Lasauses	Below HWY 142 Bridge	Below G Road Bridge
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	1.70	5.19	1.02	0.00
% Intolerant Indiv. (S.CA)	1.56	4.70	0.95	0.00
% Individuals w/ CAHBI value	33.59	21.59	63.14	8.33
% Intolerant Indiv. (CAHBI)	0.00	0.00	0.00	0.00
% Sensitive EPT (CAHBI)	0.00	0.00	0.00	0.00
% Non-Insect Individuals (S.CA)	32.81	19.53	2.17	27.38
% Non-Insect Taxa	38.10	34.48	29.17	30.77
% Crustacea + Mollusca	1.56	3.38	0.54	26.19
Average Abundance (per Taxon)	18.29	23.48	30.75	6.46
NYDEC PMA Metrics				
% Crustacea	0.00	2.50	0.41	25.00
% Mollusca	1.56	0.88	0.14	1.19
% Non-Chironomidae	42.97	74.89	94.72	63.10

Appendix 5—Threatened & Endangered Species Data

U.S. Fish & Wildlife Service

Rio Grande below Alamosa County, CO to NM State Line

IPaC Trust Resources Report

Generated March 22, 2016 01:09 PM MDT, IPaC v3.0.0

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.

IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

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U.S. Fish & Wildlife Service

IPaC Trust Resources Report

NAME
Rio Grande below Alamosa County, CO to NM State Line

LOCATION
Conejos and Costilla counties, Colorado

DESCRIPTION
River Condition Assessment

IPAC LINK
https://ecos.fws.gov/ipac/project/7MKKR-ZHDKJ-EEVNO-B4DZF-KBPKJA

U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

Colorado Ecological Services Field Office
Denver Federal Center
P.o. Box 25486
Denver, CO 80225-486
(303) 236-4773

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Documents section in IPaC or from the local field office directly.

The list of species below are those that may occur or could potentially be affected by activities in this location:

Birds

Gunnison Sage-grouse Centrocercus minimus — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0B0

Mexican Spotted Owl Strix occidentalis lucida — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B074

Southwestern Willow Flycatcher Empidonax traillii extimus — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B094

Yellow-billed Cuckoo Coccyzus americanus — Threatened

CRITICAL HABITAT
There is **proposed** critical habitat designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06R

Mammals

Black-footed Ferret Mustela nigripes — Experimental Population, Non-Essential

CRITICAL HABITAT
No critical habitat has been designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A004

Canada Lynx Lynx canadensis — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A073

New Mexico Meadow Jumping Mouse Zapus hudsonius luteus — Endangered

CRITICAL HABITAT
There is **proposed** critical habitat designated for this species.
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0BX

Critical Habitats

This location overlaps all or part of the critical habitat for the following species:

Southwestern Willow Flycatcher Critical Habitat Final designated
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B094#crithab

Yellow-billed Cuckoo Critical Habitat Proposed
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06R#crithab

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/akn-histogram-tools.php

The following species of migratory birds could potentially be affected by activities in this location:

American Bittern Botaurus lentiginosus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Black Rosy-finch Leucosticte atrata — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0J4

Brewer's Sparrow Spizella breweri — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HA

Brown-capped Rosy-finch Leucosticte australis — Bird of conservation concern
Season: Wintering

Burrowing Owl Athene cunicularia — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0NC

Cassin's Finch Carpodacus cassinii — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0J6

Ferruginous Hawk Buteo regalis — Bird of conservation concern
Seasons: Wintering, Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06X

Flammulated Owl Otus flammeolus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DK

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Breeding

Golden Eagle Aquila chrysaetos — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DV

Grace's Warbler Dendroica graciae — Bird of conservation concern
Season: Breeding

Juniper Titmouse Baeolophus ridgwayi — Bird of conservation concern
Year-round

Lewis's Woodpecker Melanerpes lewis — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HQ

Loggerhead Shrike Lanius ludovicianus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FY

Long-billed Curlew Numenius americanus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06S

Mountain Plover Charadrius montanus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B078

Olive-sided Flycatcher Contopus cooperi — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0AN

Peregrine Falcon Falco peregrinus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FU

Pinyon Jay Gymnorhinus cyanocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0I0

Prairie Falcon Falco mexicanus — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0ER

Sage Thrasher Oreoscoptes montanus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0ID

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Swainson's Hawk Buteo swainsoni — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B070

Veery Catharus fuscescens — Bird of conservation concern
Season: Breeding

Virginia's Warbler Vermivora virginiae — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0IL

Western Grebe aechmophorus occidentalis — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0EA

Williamson's Sapsucker Sphyrapicus thyroideus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FX

Willow Flycatcher Empidonax traillii — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F6

Wildlife refuges and fish hatcheries

Refuge and fish hatchery data is unavailable at this time.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

This location overlaps all or part of the following wetlands:

Freshwater Emergent Wetland

PEMA	6590.0 acres
PEMC	2810.0 acres
PEMF	254.0 acres
PEMJ	39.5 acres
PEMAx	6.29 acres
PEMAh	0.593 acre

Freshwater Forested/shrub Wetland

PSSC	259.0 acres
PFOA	39.6 acres

Freshwater Pond

PABF	104.0 acres
PABFh	6.55 acres
PABFx	3.91 acres

Lake

L2ABG	3.77 acres

Other

PUSC	6.48 acres
PUSAh	2.46 acres
PUSAx	2.32 acres
PUSCx	0.568 acre

Riverine

R2UBH	450.0 acres
R3UBH	395.0 acres
R2USC	77.1 acres
R3USC	45.8 acres
R3UBG	19.0 acres
R5UB	5.33 acres

A full description for each wetland code can be found at the National Wetlands Inventory website: http://107.20.228.18/decoders/wetlands.aspx

Appendix 6—Geology Data

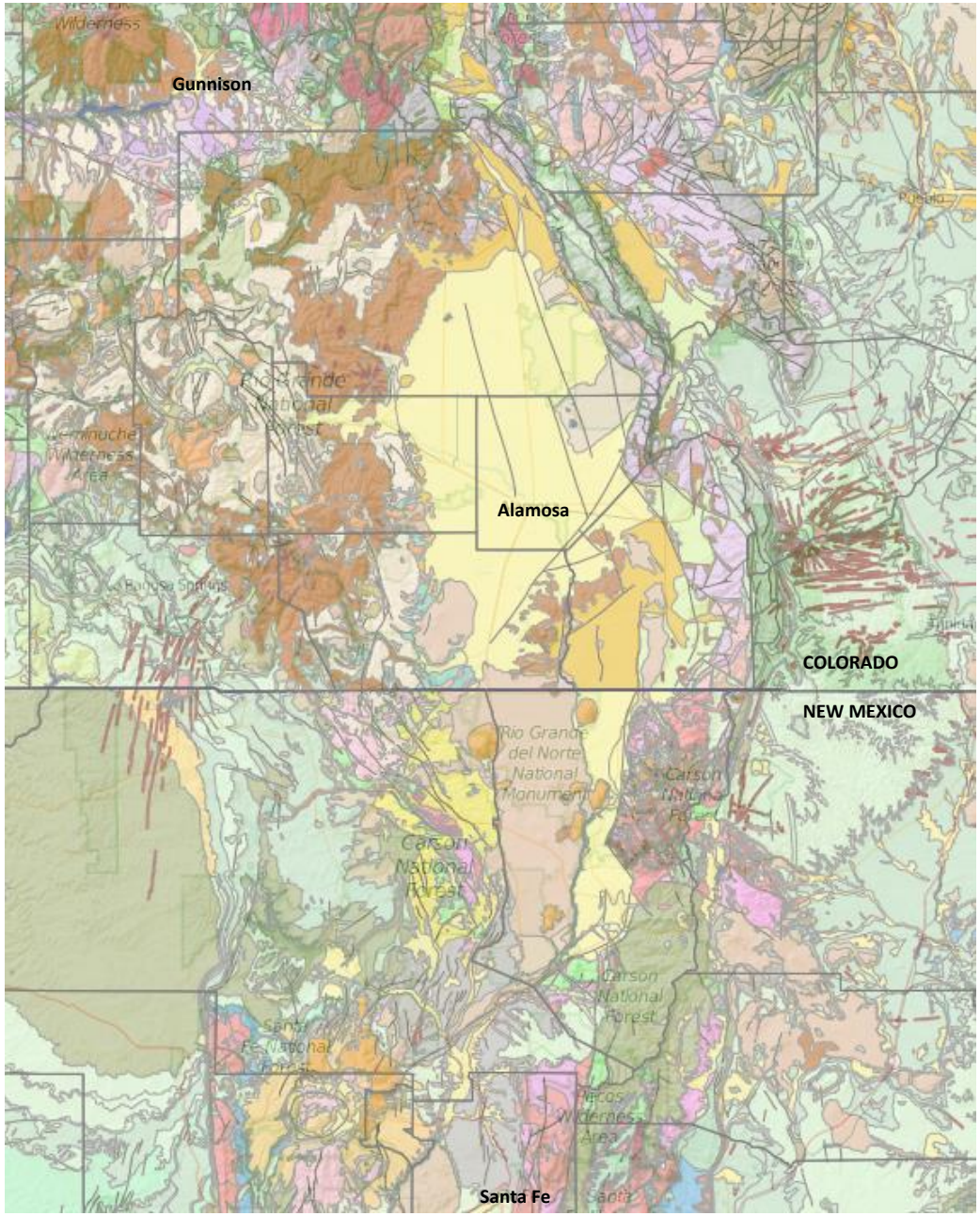
United States Geologic Survey (USGS)
Mineral Resources On-Line Spatial Data

MAP:

https://mrdata.usgs.gov/geology/state/map.html?#

LEGEND:

https://mrdata.usgs.gov/catalog/lithrgb.txt



- Unconsolidated material
- Alluvium
- Silt
- Sand
- Flood plain
- Gravel
- Levee
- Delta
- Alluvial fan
- Alluvial terrace
- Lake or marine sediment
- Playa
- Mud flat
- Beach sand
- Terrace
- Eolian material
- Dune sand
- Sand sheet
- Loess
- Volcanic ash
- Mass wasting material
- Colluvium
- Mudflow
- Lahar
- Debris flow
- Landslide
- Talus
- Glacial drift
- Till
- Moraine
- Stratified glacial sediment
- Glacial outwash sediment
- Sub/supra-glacial sediment
- Glaciolacustrine sediment
- Glacial-marine sediment
- Biogenic material
- Peat
- Coral
- Residuum
- Clay or mud
- Sedimentary rock
- Clastic rock
- Mudstone
- Claystone
- Bentonite
- Shale
- Black shale
- Oil shale
- Argillite
- Siltstone
- Fine-grained mixed clastic rock
- Sandstone
- Arenite
- Orthoquartzite
- Calcarenite
- Arkose
- Wacke
- Graywacke
- Medium-grained mixed clastic rock
- Conglomerate
- Sedimentary breccia
- Coarse-grained mixed clastic rock
- Olistostrome
- Mélange
- Carbonate rock
- Limestone
- Dolostone
- Mixed carbonate/clastic rock
- Mixed volcanic/clastic rock
- Phosphorite
- Chemical sedimentary rock
- Evaporite
- Chert
- Novaculite
- Mixed coal/clastic rock
- Volcanic rock
- Glassy volcanic rock
- Obsidian
- Vitrophyre
- Pumice
- Pyroclastic rock
- Tuff
- Welded tuff
- Ash-flow tuff
- Ignimbrite
- Volcanic breccia
- Lava flow
- Bimodal suite
- Felsic volcanic rock
- Alkali-feldspar rhyolite
- Rhyolite
- Rhyodacite
- Dacite
- Alkali-feldspar trachyte
- Trachyte
- Quartz latite
- Latite
- Intermediate volcanic rock
- Trachyandesite
- Andesite
- Mafic volcanic rock
- Trachybasalt
- Basalt
- Tholeiite
- Hawaiite
- Alkaline basalt
- Alkalic volcanic rock
- Phonolite
- Iron formation
- Exhalite
- Porphyry
- Lamprophyre
- Pegmatite
- Granitoid
- Alkali-feldspar granite
- Quartz monzodiorite
- Monzodiorite
- Quartz diorite
- Diorite
- Diabase
- Granite
- Peraluminous granite
- Metaluminous granite
- Subaluminous granite
- Peralkaline granite
- Granodiorite
- Tonalite
- Trondhjemite
- Alkali-feldspar syenite
- Quartz syenite
- Syenite
- Quartz monzonite
- Monzonite
- Gabbroid
- Quartz monzogabbro
- Monzogabbro
- Quartz gabbro
- Gabbro
- Norite
- Troctolite
- Anorthosite
- Alkalic intrusive rock
- Tephrite
- Ultramafitite
- Volcanic carbonatite
- Plutonic rock
- Pyroxenite
- Hornblendite
- Intrusive carbonatite
- Metamorphic rock
- Hornfels
- Eclogite
- Greisen
- Skarn
- Calc-silicate rock
- Serpentinite
- Metasedimentary rock
- Meta-argillite
- Slate
- Quartzite
- Metaconglomerate
- Marble
- Metavolcanic rock
- Felsic metavolcanic rock
- Metarhyolite
- Keratophyre
- Intermediate metavolcanic rock
- Mafic metavolcanic rock
- Metabasalt
- Spilite
- Greenstone
- Phyllite
- Schist
- Greenschist
- Blueschist
- Mica schist
- Nepheline syenite
- Ultramafic intrusive rock
- Peridotite
- Dunite
- Kimberlite
- Porphyry
- Pelitic schist
- Quartz-feldspar schist
- Calc-silicate schist
- Amphibole schist
- Granofels
- Gneiss
- Pelitic schist
- Mafic gneiss
- Orthogneiss
- Paragneiss
- Migmatite
- Amphibolite
- Granulite
- Tectonite
- Tectonic mélange
- Tectonic breccia
- Cataclasite
- Phyllonite
- Mylonite
- Flaser gneiss
- Augen gneiss
- ice
- water

Appendix 7—Consulting Team

Riverbend Engineering, LLC is a water resources consulting engineering company with offices in Durango, CO, Pagosa Springs, CO, and Albuquerque, NM. We specialize in geomorphic based river restoration/habitat enhancement/bank stabilization projects. Since 1999 years we have completed more than 150 projects in rivers, streams and wetlands across Southwest Colorado and Northern New Mexico. We provide expertise in river restoration, bank stabilization, surface water diversions, hydrologic and hydraulic modeling of fluvial systems, sediment transport analysis, assessment of aquatic and riparian habitat conditions, floodplain management and FEMA map changes, wetlands restoration and mitigation, and water quality monitoring. Riverbend's river engineering experience covers a wide range of river systems varying in elevation, size of the watershed, size of the bed sediments, condition of the riparian ecosystem, level of anthropogenic disturbance both in the river itself and in the adjacent watershed (current and historic), surface water extractions, presence of T & E species, etc. Our services regularly include topographic surveys of the river & adjacent floodplain, hydraulic calculations to support discharge measurements, assessment of the current morphologic condition of the river, statistical analysis of stream gauge data, qualitative analysis of sediment transport, condition assessments of aquatic species and their habitat, macroinvertebrate sampling, and condition assessments of riparian vegetation diversity and density. We do all this with a highly skilled small staff of two registered engineers, a field technician, and an aquatic biologist.

Appendix 8—List of Abbreviations

ANWR	Alamosa National Wildlife Refuge
BLM	Bureau of Land Management—in this report, referring to the San Luis Valley Field Office
HCP	Habitat Conservation Plan
HWY	Highway—Colorado State Highway
IPaC	Information for Planning and Conservation—USFWS Report
NRCS	National Resources Conservation Services
PCA	Potential Conservation Area
RGHRP	Rio Grande Headwaters Restoration Project
RGNA	Rio Grande Natural Area
RGWCCD	Rio Grande Water Conservation District
SLV	San Luis Valley
SVAP	Stream Visual Assessment Protocol
TROS	Trails, Recreation and Open Space—referring to the Costilla County, CO Master Plan
USFWS	U.S. Fish and Wildlife Service

Appendix 9—References

[1] Rio Grande Natural Area Act
The legislation that created the Rio Grande Natural Area established in 2006 by the U.S. Congress through Public Law 109-337
[2] Pitts, M. Bureau of Land Management San Luis Valley Field Office RGNA Commission Draft Management Plan (July 2015)
[3] Costilla County, Colorado Trails, Recreation and Open Space Master Plan Project (2012)—Rio Grande Greenbelt Project
[4] Gonzalez, L. (2013) The Sangre de Cristo National Heritage Area Plan
[5] Costilla County, Colorado GIS Parcel Viewer
[6] Conejos County, Colorado GIS Parcel Viewer
[7] Chronic, H. (1980, 16th printing 1998) *Roadside Geology of Colorado*
[8] United States Geologic Survey (USGS) Mineral Resources On-Line Spatial Data (accessed February, 2016)
[9] Riverbend Engineering used a survey grade Topcon RTK GPS system.
[10] Rosgen, D. (1996—2nd Edition) *Applied River Morphology*—Wildland Hydrology
[11] Flow analysis was conducted using the USGS provided PeakFQ program (v. 7.1.28513)
[12] Additional data can be found online: USGS 08220000 Rio Grande at Del Norte Gauge Data & USGS 08251500 Rio Grande at Lobatos Gauge Data
[13] In the event of a flood event, the Rio Grande above Alamosa, Colorado is administered in accordance with the priority system. During high flow events, most or all ditches are in priority and allowed to take their full decreed water right. There is also an informal agreement that the ditches can be used as a tool to take excess water to prevent flooding in Alamosa. (RGHRP, 2016)
[14] Riverbend Engineering used an Oakton PCSTestr 35 water sampling kit to determine acidity (pH), temperature, and Turbidity (clarity)
[15] USGS Lobatos Gauge Data Inventory (08251500)
[16] U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Colorado Coldwater Fish Stream Habitat Technical Note
[17] USDA NRCS Colorado Stream Visual Assessment Protocol (SVAP) Version 2 Colorado, February 2012
[18] Wolman, M.G. (1954). "A Method of Sampling Coarse River-Bed Material." Transactions American Geophysical Union. Volume 35 (6). 951-956.
[19] USGS National Fish Habitat Partnership—National Assessment Data.
[20] Environmental Assessment for the San Luis Valley Regional Conservation Plan—Prepared for USFWS by ERO Resources Corporation (October 2012).
[21] Biological Inventory of Rio Grande and Conejos Counties, CO: A Natural Heritage Inventory and Assessment of Wetlands and Riparian Areas in Rio Grande and Conejos Counties (2000)
[22] Biological Inventory of Rio Grande and Conejos Counties, Colorado—Colorado Natural Heritage Program at Colorado State University (2000).
[23] U.S. Fish and Wildlife Service Critical Habitat Mapping Tool (2016).
[24] U.S. Fish and Wildlife Service USFWS Information for Planning and Conservation (IPaC) Report (2016)
[25] Cudmore, B., The Audubon Society, "How to Protect the Birds That Fly the Farthest" (December 2015)
[26] Costilla County Trails, Recreation, Open Space Management Plan (2012)
[27] Pitts, M. Bureau of Land Management San Luis Valley Field Office RGNA Commission Draft Management Plan (July 2015)
[28] Costilla County Trails, Recreation, Open Space Management Plan (2012)