

**North Fork of the Gunnison River
Environmental and Recreation Needs Assessment**

December 2017

Including review of previous assessments, current stakeholder interviews, and recommended priorities aligned with newly developed river segments

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Table of Contents

1.0 Executive Summary.....	2
2.0 Introduction	3
2.1 Morphology and Characteristics of the North Fork of the Gunnison River	3
2.2 Land Use	4
2.3 Flow Data	5
3.0 Environmental and Recreational Assessment by Reach	7
3.1 Reach 1 Overview	10
3.1.2 Conclusions and Recommendations	13
3.2 Reach 2 Overview	14
3.2.2 Conclusions and Recommendations	17
3.3 Reach 3 Overview	17
3.3.2 Conclusions and Recommendations	20
3.4 Reach 4 overview	21
3.4.2 Conclusions and Recommendations	24
3.5 Reach 5 overview	26
3.5.2 Conclusion and Recommendations	31
3.6 Reach 6 Overview	32
3.6.2 Conclusions and Recommendation	36
3.7 Reach 7 overview	37
3.7.2 Conclusions and Recommendations	39
3.8 Reach 8 overview	39
3.8.2 Conclusions and Recommendations	46
4.0 Watershed Planning and Recommendations.....	49
4.1 Improvement prioritization / action strategy	49
5.0 Conclusion	51
List of Appendices.....	53
Appendix A: Maps of the North Fork Gunnison River from Paonia Reservoir to Confluence with the Gunnison River.....	53
Appendix B: Diversion Mapbook	54
Appendix C: Semi-formal interview form	60
Appendix D: List of informal interviews	64
Appendix E: Semi-formal interviews - representative interview results	65
Appendix F: List of previous reviewed assessments	77
Appendix G: About the Western Slope Conservation Center	78

1.0 Executive Summary

This assessment is the product of over a year of data collection, review, and analysis of information by Western Slope Conservation Center staff and volunteers regarding the historic and current environmental health of the North Fork of the Gunnison River.

This assessment has been designed with several key purposes in mind:

1. To synthesize all relevant and pre-existing information, inventories, and assessments of the North Fork of the Gunnison River (North Fork);
2. To assess current stakeholder concerns regarding environmental and recreation needs; and
3. To recommend priorities for addressing those needs according to newly developed planning segments that have divided the river into eight distinct reaches.

These eight reaches were developed in collaboration with the North Fork Water Conservancy District. The District has prepared a North Fork River Irrigation Management Plan (J-U-B Engineers, 2017). The authors of this assessment hope that the environmental and recreation needs described in this assessment can be met in tandem with the irrigation needs described in the North Fork Water Conservancy District's plan to target mutually beneficial infrastructure and environmental projects.

Based on the review of previous assessments and recent stakeholder interviews, this assessment has prioritized a number of short-term, mid-term, and long-term suggested projects on the North Fork of the Gunnison River. The highest priority projects include:

1. Creation of a river stakeholder group to improve multi-use communication and assist in watershed management planning;
2. Improvement upon existing invasive species inventory and monitoring;
3. Invasive phreatophyte and other invasive species removal;
4. Re-initiation of morphological river channel monitoring of established cross-sections;
5. Bank stabilization and riparian corridor development at specific locations;
6. Development of additional public access points and improved boating and fishing infrastructure; and
7. Investigation of market mechanisms for mitigating current and future water use conflict.

The format of this assessment consists of an overview description of the North Fork Gunnison River by distinct reaches, followed by analysis of environmental and recreational issues in each reach, and a discussion of possible solutions to improve environmental conditions in the river and recreation on the river. Cost estimates for each recommendation are provided but are listed as projection windows and not intended to be used as actual budgets.

2.0 Introduction



Figure 2.1.1 Beginning of the North Fork of the Gunnison River at the confluence of Muddy creek and Anthracite Creek

2.1 Morphology and Characteristics of the North Fork of the Gunnison River

The North Fork of the Gunnison River (North Fork) is located in west-central Colorado, and flows through northwestern Gunnison and eastern Delta Counties. Flanked by the West Elk mountain range to the east, the peak elevation in the North Fork watershed is 13,687 feet. The headwaters of the North Fork are in the Gunnison National Forest. The North Fork is formed by the confluence of Muddy Creek and Anthracite Creek downstream of the Paonia Reservoir Dam.

The North Fork flows approximately 35.5 miles in a southwesterly direction from this point to its junction with the Gunnison River at 5,110 ft elevation, approximately 8.5 miles west of the Town of Hotchkiss in Delta County.

Terror, Hubbard, Minnesota, Roatcap, Cottonwood, and Leroux Creeks enter the North Fork between Paonia Reservoir and Hotchkiss. The North Fork watershed (HUC 14020004) drains a basin of approximately 986 square miles. Three small communities line the banks of the North Fork: Somerset, Paonia, and Hotchkiss.

The North Fork Valley consists of multiple river terraces positioned laterally along a highly dissected broad valley with gentle down-valley elevation relief. The soils along the river are deep to moderately deep, nearly level to steep, well-drained gravelly loam and stony loam that formed in outwash alluvium derived from igneous rock. Upstream of Somerset, the North Fork is incised in the Mesa Verde Formation (sandstone, shale and coal), and downstream of Somerset, it is incised in the Mancos Shale. Near the USFWS National Fish Hatchery west of Hotchkiss, the river flows out of the Mancos Shale and is then incised in the Dakota Sandstone. The vegetation is classified as northern desert scrub and consists primarily of juniper, sagebrush, western wheatgrass, muttongrass, fourwing saltbush, and bitterbrush. Figure 2.2.1 shows the location and topographical relief of the North Fork watershed. Volunteer water quality monitoring stations are listed in yellow. (WSCC, 2016)

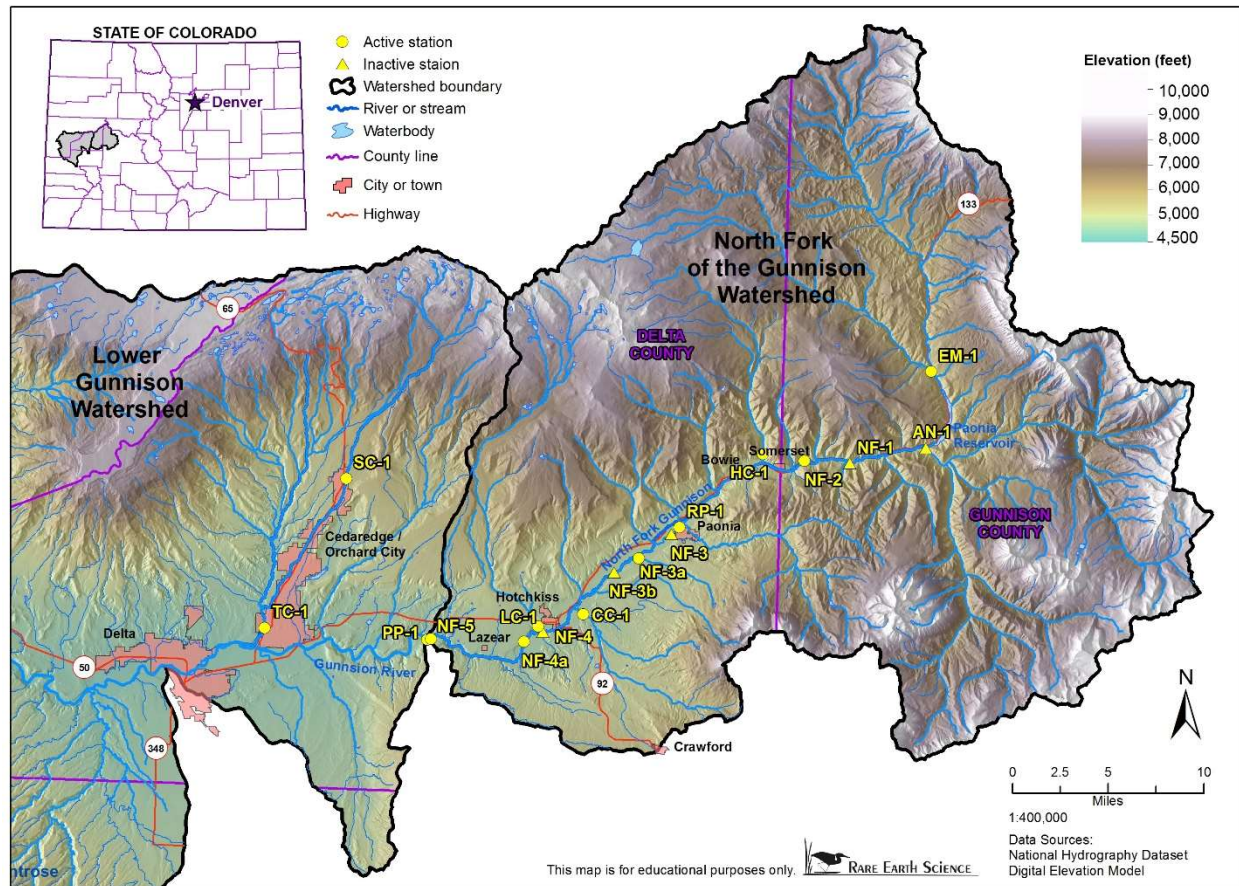


Figure 2.2.1 Location and Topography: North Fork Watershed

2.2 Land Use

Current land use in the North Fork watershed is predominantly agriculture and residential. Of the more than 1,000 parcels adjoining the river, 35 percent are classified as agricultural, consisting of cattle and sheep ranches, crop production and fruit orchards. Extractive industries within the watershed include hard rock coal mining, gravel mining and logging. Tourism and outdoor recreation supplement the general economy. The majority of riverfront property is privately owned.

The land cover in the upper reaches of the watershed, above Somerset, is a mixture of aspen deciduous and coniferous forest. Much of this land is federally owned and managed by the U.S. Forest Service and Bureau of Land Management. Beginning in Paonia and stretching downstream to the confluence with the Gunnison River, the land cover changes to agriculture and shrub/scrub. South West Regional Gap Project land cover data in the North Fork is illustrated in Figure 2.3.1. Volunteer water quality monitoring stations are listed in yellow. (WSCC, 2016)

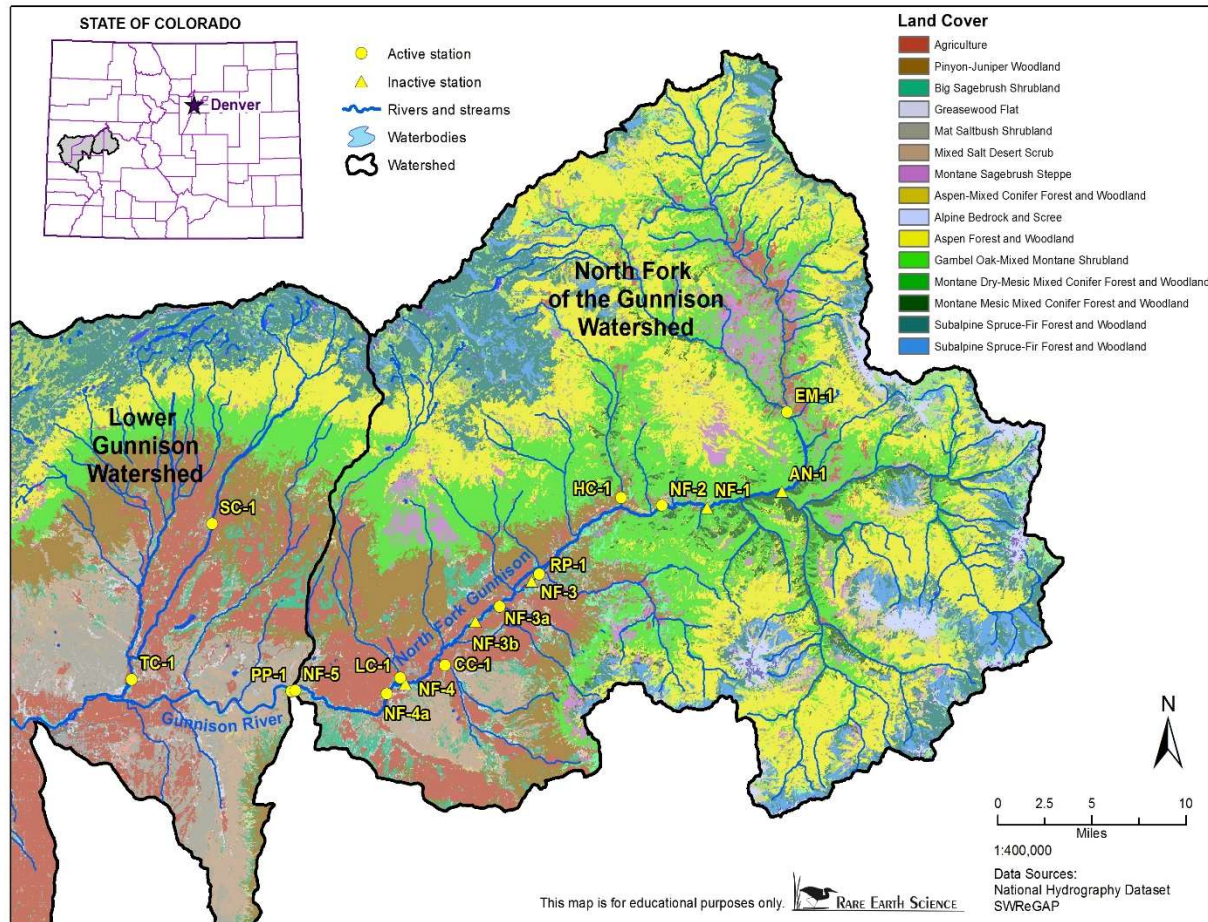


Figure 2.3.1 Land Cover in the North Fork of the Gunnison Watershed (WSCC, 2016 Water Quality Report)

2.3 Flow Data

The North Fork of the Gunnison River is a fourth order perennial stream, fed predominantly by snowmelt, with average bank full widths of 100 to 200 feet. The average flow during spring runoff at USGS 09134100 North Fork Gunnison River Below Paonia is approximately 2,000 cubic feet per second (cfs); irrigation diversions can reduce late summer flows to less than 20 cfs at this location.

The predominant alluvial landforms can produce high bed load and sediment concentrations, especially during spring runoff. The primary tributaries include Muddy Creek, Anthracite Creek, Coal Creek, Hubbard Creek, Terror Creek, Minnesota Creek, and Leroux creek. There are over 80 smaller creeks that flow into these major tributaries or into the North Fork River itself. The USGS hydrologic code is 14020004. (NFRFA, 2000)

Major flooding can occur during spring runoff months from rapid snowmelt that is sometimes augmented by rain. The U.S. Geological Survey (USGS) and Colorado Division of Water Resources (DWR) both manage gaging stations along the North Fork of the Gunnison River and its tributaries. The gages provide real-time flow data that is electronically available. Table 2.4.1 summarizes currently operating stream flow gaging stations in the North Fork watershed

USGS/DWR Gaging Stations in the North Fork Watershed			
USGS Gage Number	DWR Gage Name	Period of Record	Location
3859031072 10800	MUDAPRCO	2013-2017	Muddy Creek above Paonia Reservoir
--	MUDBPRCO	2002-2017	Muddy Creek below Paonia Reservoir
9132095	--	2015-2017	Anthracite Creek, above mouth near Somerset
9132500	NFGSOMCO	1933-2017	North Fork near Somerset
9134100	NFGPANCO	2000-2017	North Fork below Paonia
9136100	--	2009-2017	North Fork Gunnison River above mouth near Lazear

Table 2.4.1 Current Gaging Stations in the North Fork Watershed

3.0 Environmental and Recreational Assessment by Reach

Despite the relatively short length of the North Fork of the Gunnison River, it is a complex system that serves a remarkable number of layered functions and services for local communities, agriculturalists, recreationists, and wildlife. Due to these layered, and currently often competing uses, the river's water users face a number of acute needs that require proactive projects, resources, and planning. To expedite this alignment of resources, uses, and needs, the Western Slope Conservation Center has worked with the North Fork Water Conservancy District and J-U-B Engineers to develop specific river reaches, each with their own characteristics and needs (Table 3.0.1 and Appendix A).

Delineating the North Fork into distinct reaches is intended to lay the groundwork for future watershed improvements based on priority of need for agricultural, environmental and recreation needs within each reach. As stated in the North Fork Irrigation Management Plan,

“To assist in long-term planning and to assist with further projects associated with stream management planning we have established a series of reaches along the river. These reaches are based on locations of larger diversions. These may be used when examining infrastructure needs, looking at environmental concerns on the river, discussions of river health, etc. Table 3.0.1 summarizes the locations of the established reaches. Note that stationing was established with 0+00 at the confluence of Muddy Creek and Anthracite Creek.”

Reach	Description	Starting Sta.	Ending Sta.	Length (mi)	Diversion within Reach
1	Upper North Fork	0+00	376+35	7.13	N/A
2	Fire Mountain to Stewart	376+35	608+87	4.4	Fire Mountain Canal, Carrol Ditch, Lennox Ditch Pump
3	Stewart to N. F Farmers.	608+87	719+59	2.10	Stewart Ditch
4	N.F. Farmers to Paonia	719+59	813+33	1.78	North Fork Farmer's Ditch, Feldman Ditch
5	Paonia to Short	813-33	1060+76	4.69	Paonia Ditch, Monitor Ditch, Shepherd and Wilmont Ditch
6	Short to Vandeford	1060+76	1296+73	4.47	Short Ditch
7	Vandeford to Smith and McKnight	1296+73	1385+65	1.68	Vandeford
8	Lower North Fork	1385+65	1873+55	9.24	Smith and McKnight

Table 3.0.1 Summary of Established Reaches

River Characteristics and Morphology by Reach

Each reach overview will begin with a brief description of river morphology as synthesized from previous North Fork assessments and recent interviews. There are many ways to understand stream morphology. The stream classification system developed by Dave Rosgen has been referenced many times within this assessment as well as in past assessments for the North Fork. Rosgen proposed, tested and explained a river classification system that is used by many river ecologists. The basic premise of Rosgen's classification system is that stream pattern morphology is influenced by eight major variables; width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. A change in any one of these variable sets up a series of channel adjustments, which lead to a change in others, resulting in channel pattern alteration. The classification system has seven types, A to G. In the simplified version each type has six subclasses that describe the size and coarseness of the bed material. (Crane, 1997) A simplified Key to Rosgen's classification system can be found in Figure 3.0.2

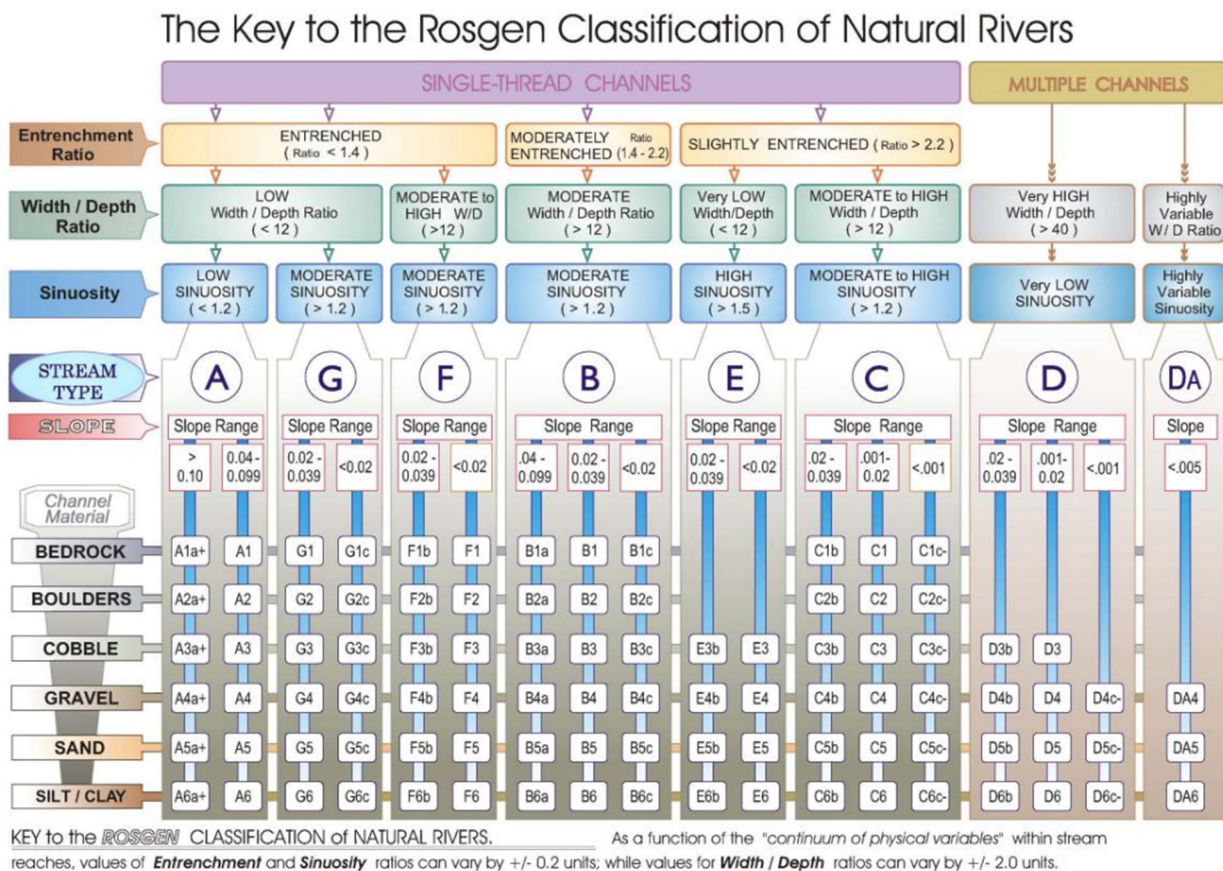


Fig 3.0.2 Key to Rosgen Classification

Riparian Function by Reach

A discussion of the quality of riparian function (good, moderate, or poor) within each reach will also be included in the overview section of each reach. Under natural conditions the riparian community along the North Fork would occupy a broad floodplain. For a reach to exhibit good riparian function the floodplain must be:

- 1) connected to the river hydrology through seasonal flooding via inundation or groundwater recharge to support plant communities,
- 2) exhibit good vegetative structure with multiple levels of canopy and undergrowth to support wildlife, and
- 3) exhibit a geographic area of continuity and connection between corridors along the length of the reach. Reaches that exhibit moderate or poor riparian function are deficient in one or more of these areas.

For example, there are many areas along the North Fork where spring flood inundation does not occur but groundwater charge from the river is able to support riparian vegetation. The width of riparian vegetation in these areas may be limited to a narrow band of less than fifty feet wide and lacks sufficient understory to support wildlife. (NFRIA, 2010) This would be an example of moderate-poor riparian function.

Recreation Assessment by Reach

A discussion of the current state of recreation infrastructure, activities, and opportunities will be included in the overview section of each reach. This information was gathered primarily through on the ground interviews with riverfront landowners, river recreationalists, and other river stakeholders. This data along with information gathered from previous North Fork River assessments assisted in supporting the conclusion and recommendation sections for each reach.

Conclusions and Recommendations

Conclusions and recommendations will follow the overview section for each reach. The conclusions will be synopsis of the most critical components assessed and include recommendations for future improvements as they relate to environmental and recreation needs within the reach. And estimated cost of implementing the recommendations is included. These cost estimates were developed as guideline windows for future projects.

3.1 Reach 1 Overview

River Characteristics, Morphology and Riparian Function in Reach 1

Reach 1 refers to the Upper North Fork and begins with the confluence of Muddy Creek and Anthracite Creek approximately ¼ mi downstream from the Paonia Dam spillway (Appendix A, Figure 2.1.1).

Vegetation along Reach 1 is characterized as mixed coniferous forest with a healthy riparian buffer.

Reach 1 is 7.13 miles in length and ends just upstream of Fire Mountain Canal diversion. Figures 3.1.1 through 3.1.5 illustrate the location and extent of Reach 1.

From the initial confluence of its two major tributaries, the upper North Fork channel can be characterized as a stable C3 stream type. (Rosgen, 1994) The river within this reach is stable, slightly entrenched, meandering, riffle/pool, and cobble dominated substrate. Farther downstream near West Elk Mine and the town of Somerset the channel evolves into an entrenched and channelized stream where road construction has narrowed the river flood plain into a constricted channel (NFRIA, 2010). Narrowing of the flood plain is also due to natural geologic forces within this section such as tributary deltas which have flowed out of adjacent ravines. Reach 1 ends just below Somerset at the Fire Mountain Canal Diversion Structure. Figures 3.1.2 through Figures 3.1.5 illustrate location and extent of Reach 1.

The Raven Gulch drainage enters the North Fork from the south, just before the West Elk Mine property, approximately half way down Reach 1 as can be seen in Figure 3.1.4, 190+00. The Raven Gulch watershed has narrow ravines and geologically unstable soils. For this reason, Raven Gulch can at times deposit heavy sediment loads into the North Fork after major storm events in that area. It is difficult to identify exactly where the sediment loads originate within Raven Gulch, but interviews with individuals familiar with this area indicate that it is likely coming from natural sources.

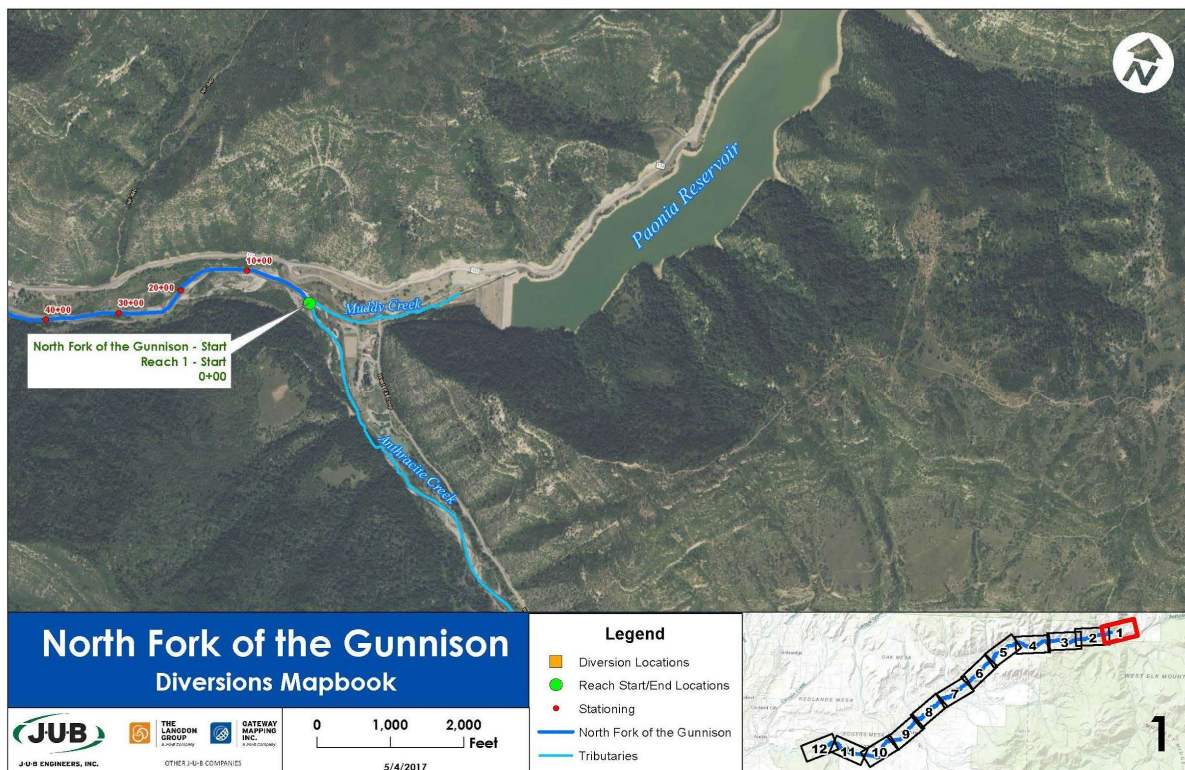


Figure 3.1.2

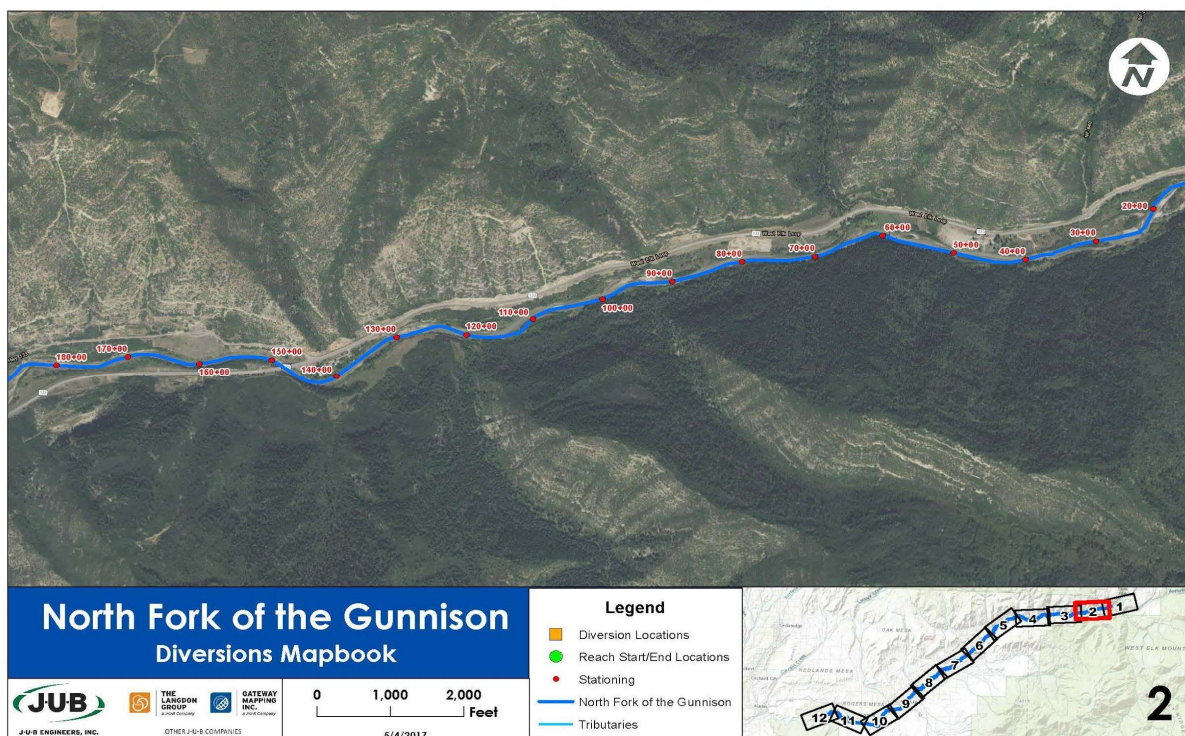


Figure 3.1.3

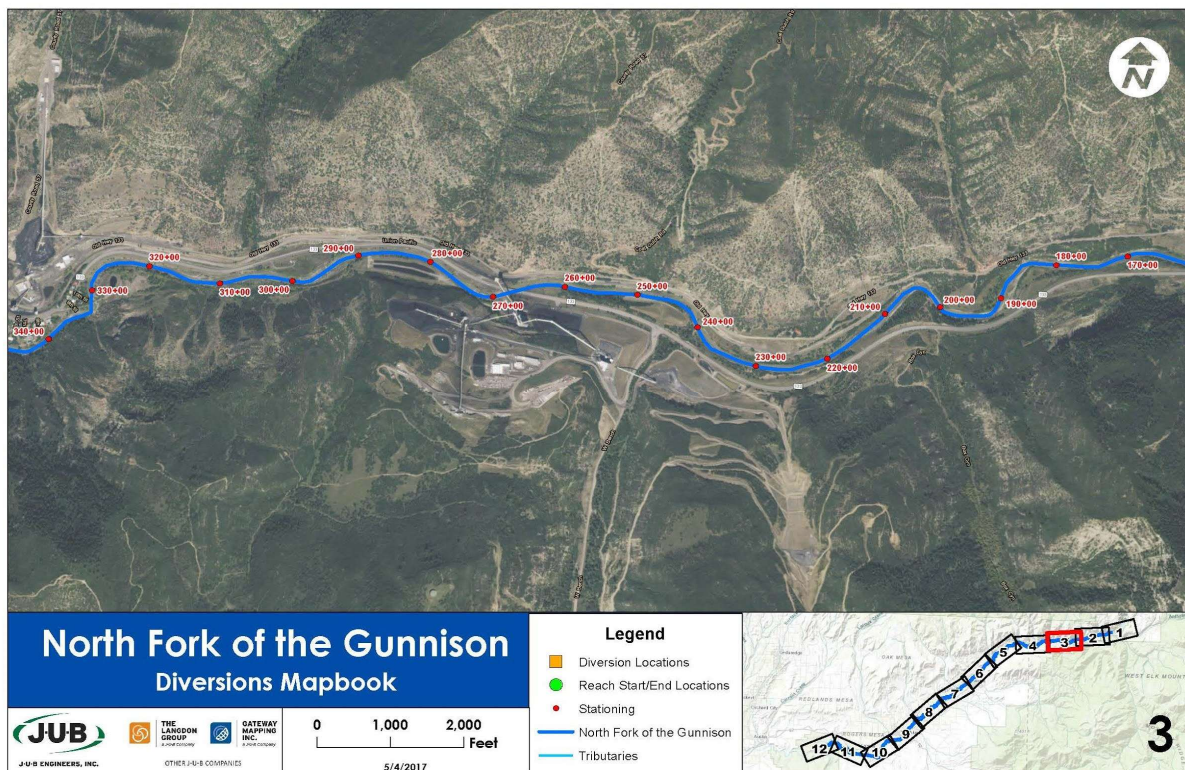


Figure 3.1.4

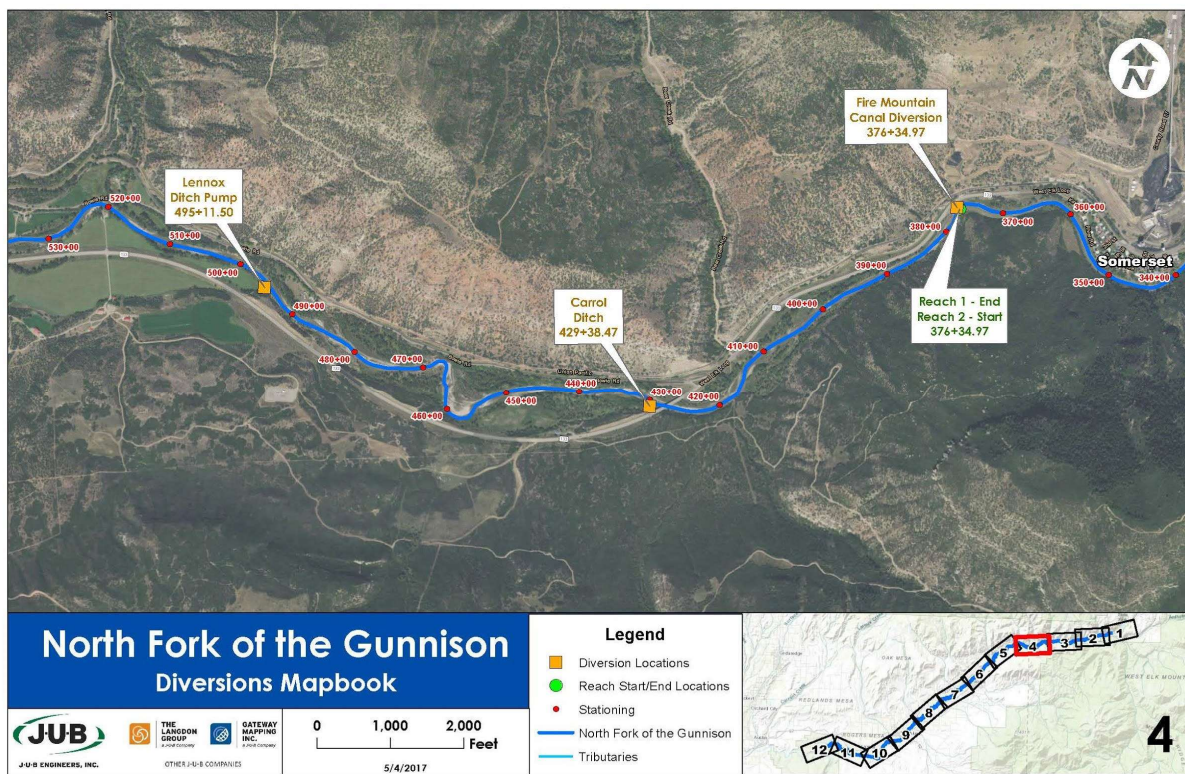


Figure 3.1.5

Recreation in Reach 1

Interviews from primary users of this reach show that the upper North Fork stream morphology has for the most part remained unmodified by humans for most of its history. Some modification to stream morphology took place with the construction of Highway 133 near West Elk Mine. The untouched quality of this particular reach of the North Fork makes it attractive for a wide variety of recreational opportunities. However, there is limited legal public access point on this stretch of the river. Boater access is usually achieved by putting in at Erickson Springs campground, managed by the USFS, on Anthracite Creek, or at the Gunnison County land near 40+00. Take out for most recreation trips within this reach occurs just before Fire Mountain Canal Diversion on private property. Fisheries along Reach 1 represent some of the best quality along the entire river length. Reach 1 maintains extended flows most times during the year due to releases from Paonia Reservoir for agriculture diversions.



Fig. 3.1.6 North Fork, Reach 1, looking downstream

Because there is not adequate formal access within Reach 1, trespassing by recreationalists on private property frequently occurs. There are several stretches along the river which offer attractive access points from Highway 133. From the landowner interviews conducted within this section, trespassing has not resulted in major conflicts. However, the potential for liability damage is a chief concern among landowners.

Despite the lack of formal public access, Reach 1 continues to draw entrepreneurs interested in growth related to recreation for the North Fork watershed. Two private campgrounds are slated to open in 2018 with an emphasis on outdoor recreational opportunities in the area.

3.1.2 Conclusions and Recommendations

Reach 1 represents the most natural section of the North Fork of the Gunnison. Because of its excellent stream ecology, it does not present a high priority for ecological restoration. However, recreation is limited along Reach 1, primarily due to lack of public access. Additionally, one of the most important conclusions from the interviews within this reach is the need for a better system of communication between all water users along the entire river. Changes to river structures, whether they be diversion modifications or sediment releases from Paonia dam, can have detrimental effects on downstream consumptive and non-consumptive water users alike.

Recommendations -

1. Improve public access: There is currently limited and informal public access point for recreational users within this reach of the river. However, there are several sections that are near Highway 133 and are currently utilized illegally for access. Funding for recreational access

easements and other access improvements in these sections could improve boater safety and reduce trespassing. Educational signage at put-in and take-out locations would improve safety for boaters and inform recreationists of public and private property locations.

Estimated Cost: \$5,000 - \$10,000

2. Improve Communication between water users: As the population continues to grow within the North Fork Watershed, the demand for water needs by both consumptive and non-consumptive users also continues to grow. Although relatively few conflicts were reported in our interviews between user groups, some could have easily been avoided had there been a formal system of communication in place. A watershed stakeholder group made of both consumptive and non-consumptive users within the North Fork of the Gunnison watershed would allow these users to be made aware of infrastructure changes and diversion activities within the river system. Additionally, this groups could assist in decisions associated with North Fork watershed management planning.

Cost Estimates: To be determined

3.2 Reach 2 Overview

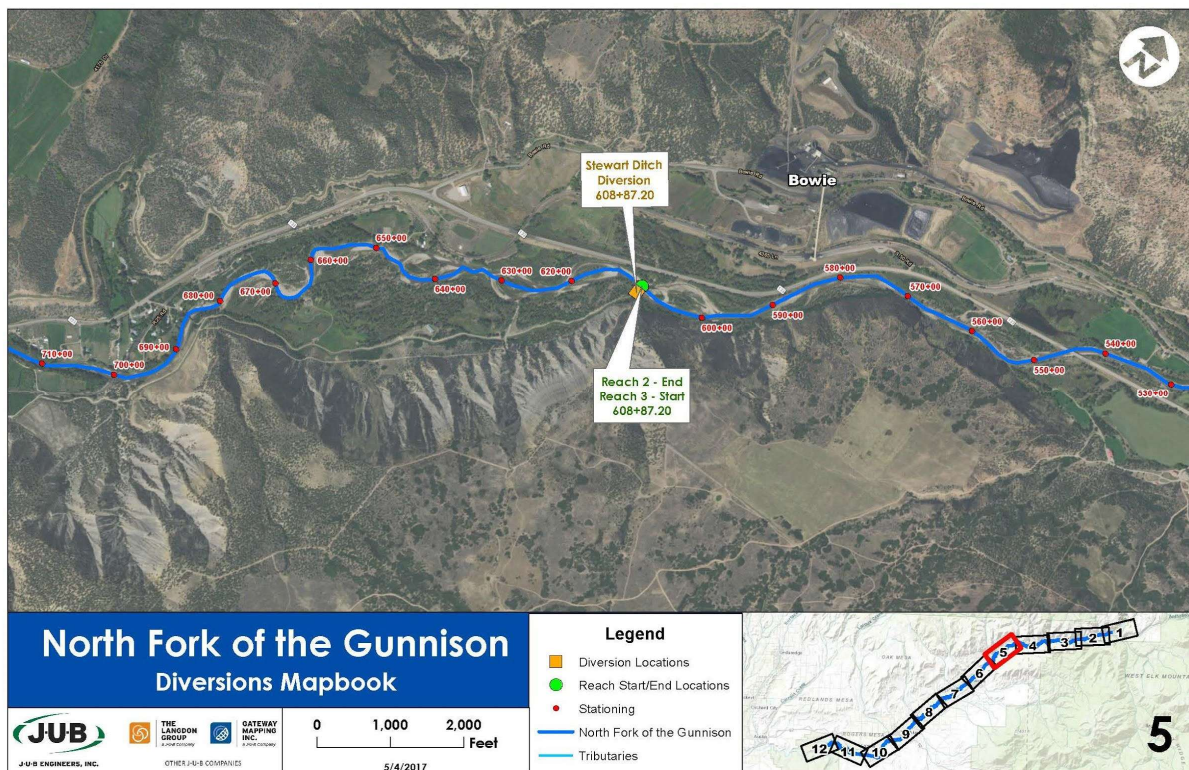
River Characteristics and Morphology in Reach 2

Reach 2 begins at Fire Mountain Canal Diversion and ends directly prior to Stewart Mesa Ditch Diversion. Reach 2 is 4.4 miles in length. Figures 3.2.1 through Figures 3.2.2 illustrate location and extent of Reach 2. Very little is known about the stream morphology of this section due to the lack of any formal cross section analysis. Preliminary observations of this reach show that much of this section contains similar characteristics as Reach 1, though some broadening and braiding begins to occur more frequently near Stewart's Ditch Diversion. The highway and railroad tracks have restricted the floodplain in some areas.

Figure 3.2.1



Figure 3.2.2



Riparian Function in Reach 2

Reach 2 supports a healthy riparian buffer along most banks. Invasive phreatophytes such as Russian Olive (*Elaeagnus angustifolia*) are becoming more widespread within this reach than in Reach 1 due to the lower elevation and proximity to developed land. The riparian community in general exhibits good function. Hubbard Creek enters the North Fork approximately halfway down the length of Reach 2 just upstream of the inactive Bowie load-out site. Hubbard Creek drains a substantial area to the north, originating from sources near Overland Reservoir in the Grand Mesa National Forest.

Fire Mountain Canal is the first and largest diversion on the North Fork of the Gunnison River. The Fire Mountain diversion is constructed of a timber wall that spans the entire width of the river. The wall is backfilled and supported by a large boulder field that gradually slopes to the natural river bottom. (NFWCD, JUB 2017) Fire Mountain Canal diverts the majority of the river's flow during the late summer months which greatly impacts the downstream health of the river.

Recreation in Reach 2

Fire Mountain Canal diversion structure represents a major hazard to boaters, at times rendering passage impossible. The river banks are quite steep surrounding the diversion, making it difficult to exit the river for portage. The diversion intake structure is equipped with a trash rack and floating boom that provides a good measure of safety for boaters unable to make a landing. Fish passage through this diversion is greatly impeded most times of the year. Passage is altogether eliminated during low summer and fall flows.



Fig. 3.2.3 Fire Mountain Canal Diversion, looking upstream

Morphologically, the timber wall structure and physical angle of Fire Mountain Canal Diversion to the river seems to be impeding bed load transport in the river through this area. A combination of these and the changes to river flow at the diversion is likely contributing to build up of a gravel bar directly upstream of the intake structure. Downstream of the Fire Mountain Canal diversion the river continues its natural, slightly entrenched, meandering, riffle/pool course. Although no semi-formal interviews were conducted within Reach 2, discussions with water users indicate that flows in this stretch could do support boater recreation well into the irrigation season. However, a lack of public property within this reach and limited public access from Highway 133 make boating problematic. As was the case in Reach 1, trespassing does occur by fisherman and boaters along areas that provide easy entry from Highway 133. Despite the lack of public access, there are minimal reports of conflicts between landowners and recreationists.

3.2.2 Conclusions and Recommendations

Though Reach 2 contains many of the same characteristics of Reach 1, greater use demands have begun to alter some of the natural morphological stream characteristics, and the floodplain is restricted in some areas by the highway and railroad tracks. Water quality in Reach 2 remains good most times of the year (WSCC, 2016). Residential development continues to be very sparse along Reach 2, although some remnant land disturbance from the coal industry is evident near the inactive Bowie load out site. Overall, the riparian corridor and river channel remain in relatively good condition throughout Reach 2.

Recommendations -

1. Boat Passage: Many recreationists make use of Reach 1 during the late irrigation season due to its continued natural flow. However, passage through Fire Mountain Canal diversion is extremely dangerous, if not impossible, at most flows. Adding boat passage through the diversion would significantly improve safety for recreationists.
2. Improve Public Access: There is currently no public access point for recreational users within this reach of the river. However, there are several sections that are in close proximity to Highway 133 that are currently utilized illegally for access. Funding for recreational access easements in these sections could improve boater safety and reduce trespassing. Educational signage at put-in and take-out locations would improve safety for boaters and inform recreationalists of public and private property locations.

Cost Estimates -

1. Boat Passage: \$25,000 - \$50,000
2. Improve Public Access: \$5,000 - \$10,000

3.3 Reach 3 Overview

River Characteristics and Morphology in Reach 3

Reach 3 begins with Stewart Mesa Ditch diversion and ends just before the North Fork Farmer's Ditch diversion. Reach 3 is 2.1 miles in length, and terminates just upstream of the Town of Paonia. Figures 3.3.1 and 3.3.2 illustrate the location and extent of Reach 3 along the North Fork of the Gunnison. The river within this reach begins to enter the wider section of the North Fork Gunnison River valley. The river begins to increase its meandering path, braiding downstream of Stewart Ditch Diversion, but transitions to a single channel from the Terror Creek delta on the north and steep banks on the south near North Fork Farmer's Diversion. (Crane, 1997) Terror Creek enters the North Fork approximately half way down this reach. Terror Creek drains a substantial area to the north flowing in a southeasterly direction from sources in the Grand Mesa National Forest.

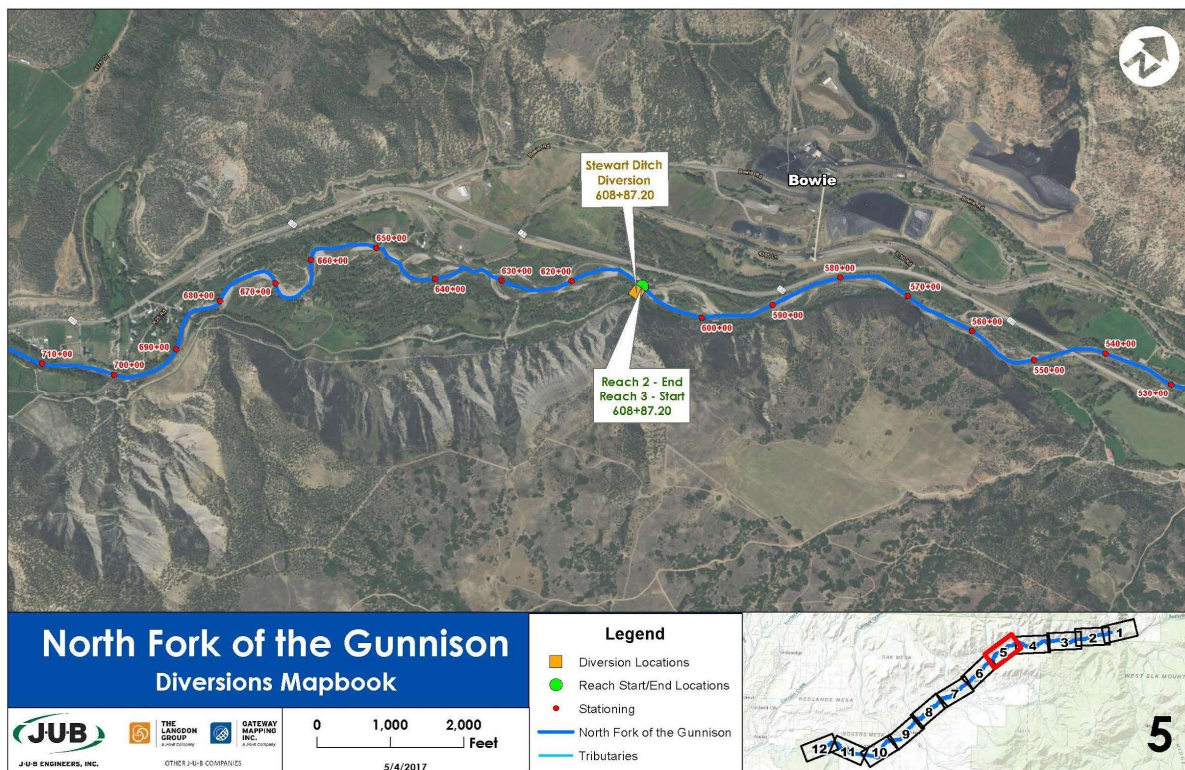


Figure 3.3.1

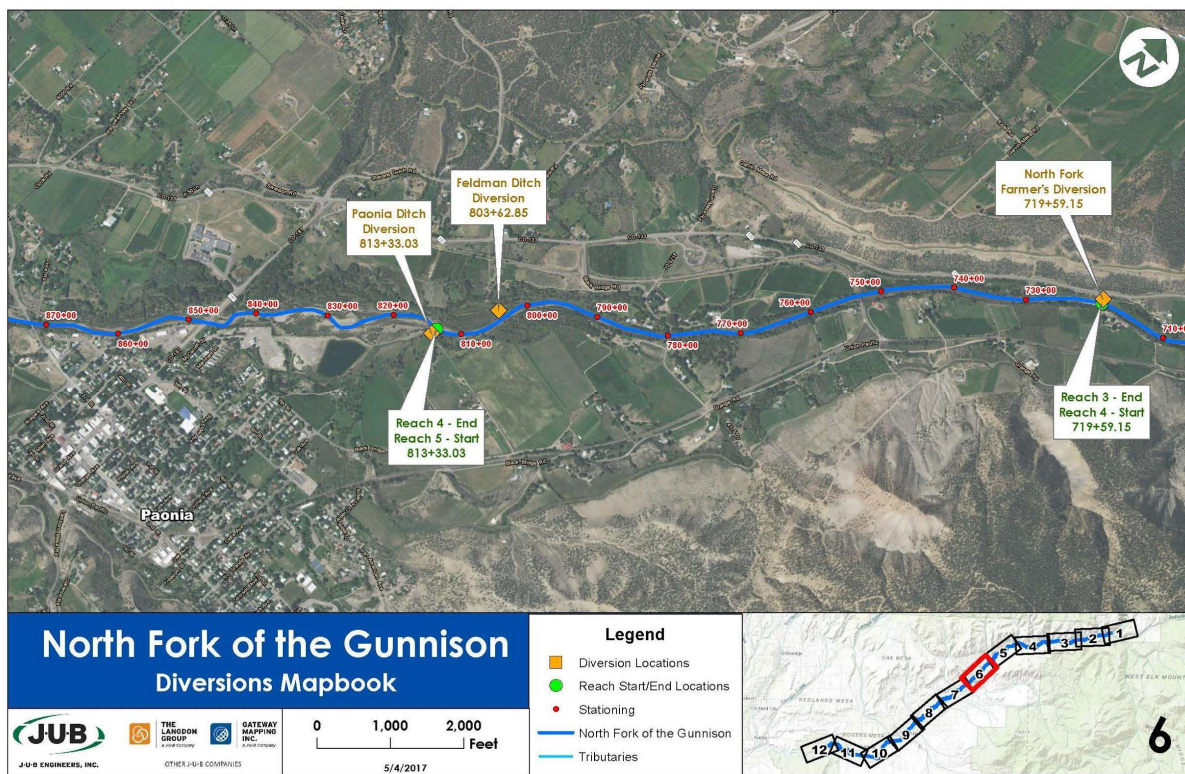


Figure 3.3.2

Several studies and assessments have been completed over the years beginning at Reach 3 and continuing downstream on much of the North Fork. These assessments were completed by the North Fork River Improvement Association (NFRIA) between 1997 and 2010.



Fig. 3.3.3, Reach 3 near cross-section station 1, looking downstream

In 1996 and 1997, NFRIA installed “permanent benchmarks with survey pins and caps, driven flush into the ground with 6” of concrete poured around rebar on stable sites above the active channel” to mark cross-sections along a 16-mile study area to investigate the morphological characteristics of the river channel. (Crane. 1997) The most upstream permanent cross-section Station 1 is within Reach 3 and is located just upstream of the North Fork confluence with Terror Creek. At the time of the 1997 study, the river at cross-section Station 1 had “a very high width/depth ratio of 272 with a large mid-channel bar and a substantial cut-off channel on the north. The river meanders to the south with the apex of the

meander the cross-section. This reach has a moderate sinuosity of 1.31 and is slightly entrenched. Vegetative cover on the outside bank is poor with a bank hazard of very high. The channel material is classified as large cobble with a high bed load. The stream type is classified as an unstable C3.” (Crane, 1997)

Despite some characteristics of instability within Reach 3, it appears that the river has for the most part begun to stabilize in many portions of this reach since the 1997 study. No formal monitoring of the river channel cross sections has taken place since the 1997 study, so it is difficult to say with assurance that this reach has become more stable. The riparian community continues to show a good width to channel ratio in the upper portion of the reach. However, the transitions to a single thread channel and the riparian corridor begins to thin as the valley narrows near the Farmer’s Ditch diversion.

Riparian Function in Reach 3

Despite these restrictions, Reach 3 shows good riparian plant diversity, but riparian function is reduced at the lower end of the reach where the riparian corridor thins. An extensive riparian survey was conducted in 1997 by the Colorado Natural Heritage Program and NRCS and can be found under “Riparian Vegetation” in Appendix E, Watershed Restoration Action Strategy for the North Fork Gunnison River. The WSCC is not aware of any major restoration projects that have taken place along this reach.

Recreation in Reach 3

Stewart’s Ditch diversion represents the largest obstacle to boating with this reach. The diversion makes use of an island bar in the North Fork to separate flows into a diversion channel. The diversion channel is of the same width and size as the main channel. Late in the irrigation season, the diversion channel is

larger than the main channel of the North Fork. This leads to confusion among recreationists floating down the river, who mistakenly find themselves in the diversion channel rather than the main stem of the river. (NFWCD, JUB 2017) The terminus end of the diversion channel is a rock push up dam, for the most part impassible by amateur boaters. A few interviewed recreationists reported that running the diversion boulder weir constituted one of the more enjoyable challenges of the North Fork, but the vast majority of recreational boaters are forced to portage around the push up diversion to avoid the hazard. The diversion itself is unstable, and will likely need frequent maintenance to rebuild the structure via in-stream heavy equipment. There is no public access within Reach 3 and no easy entry point to the river from any main road.

3.3.2 Conclusions and Recommendations

Ecologically, Reach 3 continues to represent an overall good picture for stream resilience. Riparian corridors, although thin in sections, remain continuous along the entire reach. Where the river channel is constricted, there are high banks with moderate erosion in many places. It is difficult to know if the river is stabilizing itself without taking measurements at cross-section Station 1.

Recreation issues within this section are few (other than no public access). Stewart's Ditch diversion represents the greatest hazard to boaters in that it is unclear which is the main channel when floating down stream. The bulldozed rock weir is impassable to most boaters and portage is usually required. A potential future project at this location would be to install signage at the island denoting the main stem of the North Fork from the Stewart's Ditch diversion channel. Stewart's Ditch diversion can also limit fish passage late in the irrigation season due to low flows.

Some channelization occurred just below Stewart Mesa Diversion in 2011 which added to some bank instability. Some efforts have been made in this area to stabilize banks with little coordination between landowners.

Recommendations -

1. Improve River Communication: Installing signs on the river in advance of Stewart Mesa Ditch diversion channel would warn recreationists of the hazards ahead and direct them into the main channel of the North Fork. (NFWCD, JUB 2017)
2. Island and Bank Stabilization: The island that separates the Stewart Mesa Ditch diversion channel from the main stem of the North Fork has the potential to be altered during a high flow flood event. This would put the diversion head gate at risk of losing its ability to collect its decreed volume. This would in turn lead to more heavy equipment and ecological damage within the river system. Armoring the diverting island with embedded boulders would reduce the risk of river movement away from the diversion. (NFWCD, JUB 2017) Additionally, there are several areas just below Stewart Mesa Diversion that
3. Upstream Headwall: The island that separates the Stewart's Ditch diversion channel from the main stem of the North Fork has a tendency to collect considerably more than the decreed volume

for the ditch late in the irrigation season. The diversion structure is a push-up dam design and is difficult to regulate. This can lead to decreased river function for fisheries and wildlife.

Constructing a head wall with sluice at the upstream end of the diversion channel would help reduce the diversion to the decreed volume and also be easily identifiable by recreationists traveling downstream. (NFWCD, JUB 2017)

4. Resume Geomorphological Monitoring of 1997 cross sections: Though a significant effort was made in the 1990s to understand the geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A simple monitoring program that could replicate the initial study would provide an understanding of changes within the North Fork River system since that time. The changes that have occurred in the 20 years between studies would help guide future decisions in river channel restoration. The cost estimate below is for a one-time assessment of all 11 permanently installed cross section stations.

Cost Estimates –

1. Improve River Communication - \$1,000
2. Island Stabilization - \$20,000 - \$50,000
3. Upstream Headwall - \$100,000 - \$300,000
4. Resume Geomorphological monitoring of 1997 cross sections - \$5,000 - \$10,000

3.4 Reach 4 overview

River Characteristics and Morphology in Reach 4

Reach 4 begins at North Fork Farmer's Ditch and ends directly before the Paonia Ditch. Reach 4 is 1.78 miles in length and ends just before the town of Paonia. Figure 3.4.1 illustrates the location and extent of Reach 4. The River morphology becomes much more channelized in this reach, likely due to frequent manipulation that has taken place over decades. Permanent cross sections R-1 and 2 are located within Reach 4. The following is a description of Reach 4 as it was characterized in the 1997 Geomorphological study:

“From North Fork Farmer's Ditch diversion just downstream of Terror Creek, the channel evolves into an entrenched F3 type where agricultural land development on one side and road construction on the other side has pinched the river into a constricted channel. The river upstream of North Fork Farmers Ditch diversion is a stable meandering river. However, from Black Bridge

to beyond the Town of Paonia, the river cascades from an F3 to a B3c to an unstable C3. A series of channelization operations and several encroachments into the floodplain probably caused the change of stream type and reduced riparian function (NFRIA, 2000).”

This continues to be an accurate representation of the morphological characteristics within Reach 4 and continuing downstream through Reach 5. However, it is difficult to say whether agricultural land has in fact “pinched” the river at this location or if it is simply due to neighboring geologic formations within this reach. It is clear that frequent historic manipulation of the river channel to control bank erosion and protect housing or agricultural land has decreased sinuosity and resulted in a steep river gradient within these reaches.

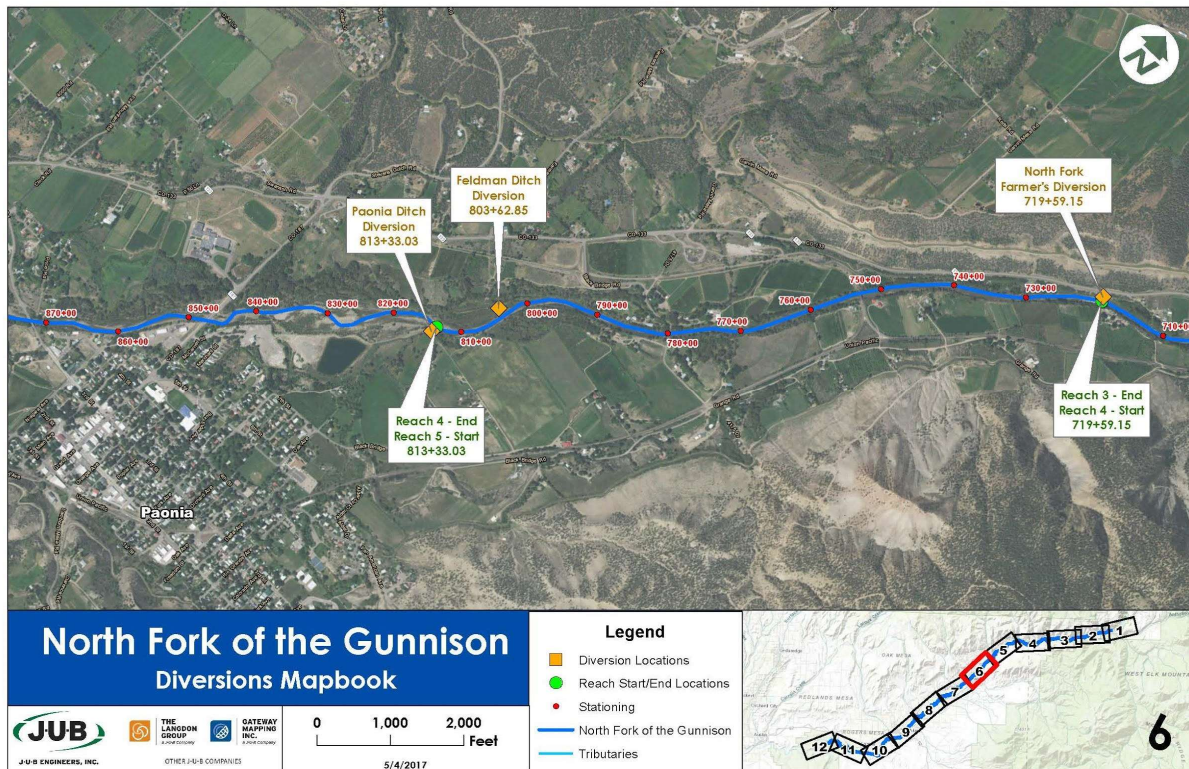


Figure 3.4.1

Riparian Function in Reach 4

Downstream of the Farmer’s Ditch diversion, the river begins to gain speed due to historic channelization. This results in a higher transfer of bed load leading to down cutting and incised banks. The elevation of the riparian corridor in this reach is therefore left significantly higher than the river, and is not able to dissipate its energy during spring flows. This exacerbates the problem and leads to more erosion and cutting downstream. (Crane, 1997)

The riparian corridor within Reach 4 can be quite narrow below Farmer’s Ditch Diversion, sometimes only as wide as 50 feet. Discussions with water users in this area indicate that this section of the North Fork was dredged and straightened in the 1950’s. Agricultural development, including orchards and

pasture acreage, has a much larger presence within Reach 4 than in previous sections. In many ways agriculture land, and especially the established mature orchards along the main channel within this reach, may be substituting as riparian habitat for some species of wildlife.

Invasive phreatophytes (Russian Olive and Tamarisk) become quite common beginning within this reach and continuing downstream for the remaining extent of the North Fork river. There has been a strong concerted effort from local conservation groups to remove Russian Olive and Tamarisk species along Reaches 4 and 5. However, there has been very little inventory and follow up within these treatment areas in the last 5-10 years. In 2017, the WSCC and Tamarisk Coalition began to collect shape file data from past invasive species removal projects throughout the North Fork watershed into a single GIS mapping program. This was a first step in formalizing areas that have been previously treated into one database. Further synthesis of percent cover and regrowth needs to be assessed. Regrowth of Russian Olive and Tamarisk in these treated areas continues to be a major problem. However, good riparian diversity continues to be observed despite the influx of these species within Reach 4. An extensive riparian survey was conducted in 1997 by the Colorado Natural Heritage Program and NRCS and can be found under “Riparian Vegetation” in Appendix E, Watershed Restoration Action Strategy for the North Fork Gunnison River. Despite poor river function, water quality remains good throughout this reach. (WSCC, 2016)

Recreation in Reach 4

There are two significant obstacles to recreation within Reach 4. The first is that there is no public access along this reach. The second are the hazards associated with the North Fork Farmer’s Ditch diversion. North Fork Farmers is a check dam structure made of timber, rock and concrete, supported by a boulder field. High flows through the dam present a significant navigational hazard. Additionally, metal cribbing supporting the diversion structure protrudes above the concrete weir, posing an



Figure 3.4.2 Reach 4 near Black Bridge, looking downstream

extremely dangerous situation to floating watercraft. Furthermore, late in the irrigation season, the Farmer’s Ditch diversion tends to “sweep” the river, leaving the downstream bed void of any water for 0.3 mile before return flows re-enter the main channel. (NFWCD, JUB 2017) This presents an insurmountable barrier to boaters and aquatic species alike.

3.4.2 Conclusions and Recommendations

The main channel of the North Fork has been greatly influenced by human settlement beginning with Reach 4, particularly in the lower end of the reach. Evidence of channel down cutting is apparent as is bed load deposition in slower moving areas. However, no formal monitoring of the river channel cross sections has taken place since the 1997 study, so it is difficult to say with any assurance that changes in channel morphology have occurred since that time.

The North Fork continues to shift into a preferred path within Reach 4. Point bars and scoured banks indicate that the river is in the process of balancing its gradient / slope. Riparian function, though limited within this reach, shows good signs of diversity, despite the influx of Russian Olive and Tamarisk.

Recommendations -

1. Improve North Fork Farmer's Diversion: Provide modification to the diversion structure that would allow minimum flows, those typically returned 0.3 mile downstream, to remain in this reach of the river. This could be simply accomplished with a sectioned portion of the weir that accommodates removable check boards. Additionally, removal of exposed cribbing iron that poses a risk to recreationists should be prioritized. A boat passage could also be incorporated on the south bank of the river. Reorganization of boulders below the diversion could reduce boater risk during high water. (NFWCD, JUB 2017)
2. Implement Inventory of Invasive Species and Phreatophytes: There has been a strong concerted effort on the part of landowners and conservation groups to remove invasive phreatophytes from the riparian corridor over the last 10 years. However, many of those treated areas are in dire need of retreatment. The amount of regrowth within the initial projects areas is unknown, but is expected to be quite high. Building on the work of WSCC and Tamarisk Coalition to inventory parcels that have been treated for invasive species for percent cover and regrowth would assist landowners and conservation groups in identifying priority areas that are in need of treatment. Add data into a GIS database for future projects.
3. Resume Geomorphological Monitoring of 1997 cross sections: Though a significant effort was made in the 1990s to understand the geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A simple monitoring program that could replicate the initial study would provide an understanding of changes within the North Fork River system since that time. The changes that have occurred in the 20 years between studies would help guide future decisions in river channel restoration. The cost estimate below is for a one-time assessment of all 11 permanently installed cross section stations.

Cost Estimates -

1. Improve Farmer's Ditch Diversion - \$75,000 - \$100,000
2. Implement Inventory of Invasive Species and Phreatophytes - \$10,000 - \$20,000
3. Resume Geomorphological monitoring of 1997 cross sections - \$5,000 - \$10,000

3.5 Reach 5 overview

River Characteristics and Morphology in Reach 5

Reach 5 begins at Paonia Ditch and terminates at Short Ditch. Reach 5 is 4.69 miles. Figures 3.5.1 through 3.5.3 illustrate the location and extent of Reach 5. This section of river includes the Town of Paonia and outlying neighborhoods, and represents the highest population density along the North Fork. It is likely that Reach 5 has experienced the highest level of channel manipulation and alteration than any other reach in the North Fork River system. Up until the late 1990s the reach was host to two in-stream gravel mines. The upstream pit has since been reclaimed through conservation efforts and is described in more detail below. In-stream mining no longer takes place at the lower pit. (Crane, 2014)

In addition to in-stream gravel mining operations, this reach of the North Fork has also experienced channel straightening and diking in an attempt to protect private property along the banks. Evidence of gabion structures, levees, and other built embankments are obvious throughout this section. As a result of historical channelization, water velocities are quite high through this area (Crane 2014).

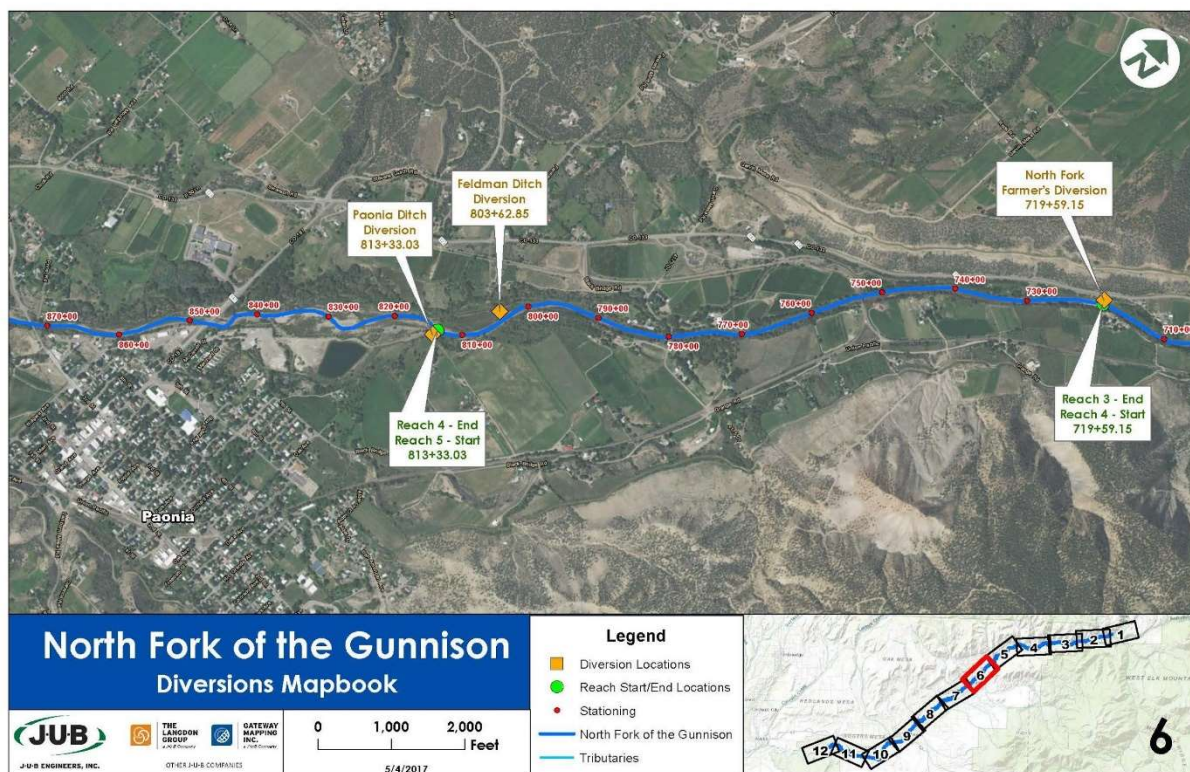


Figure 3.5.1

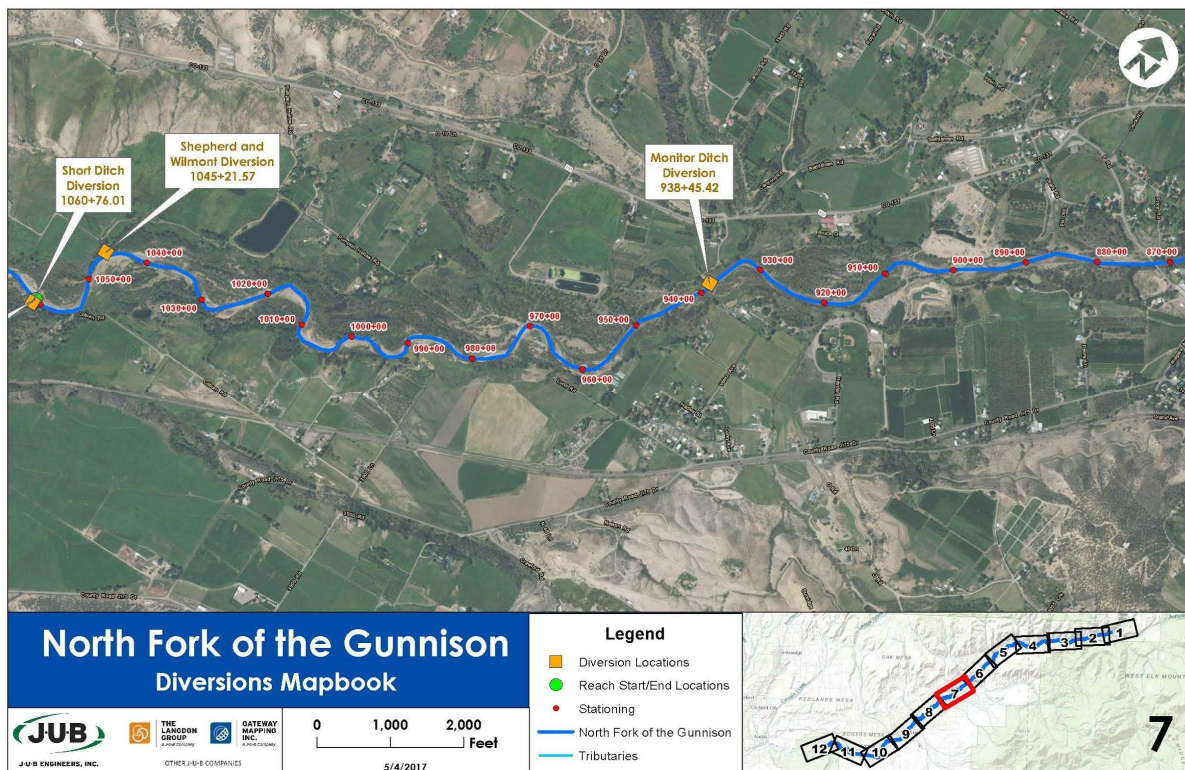


Figure 3.5.2

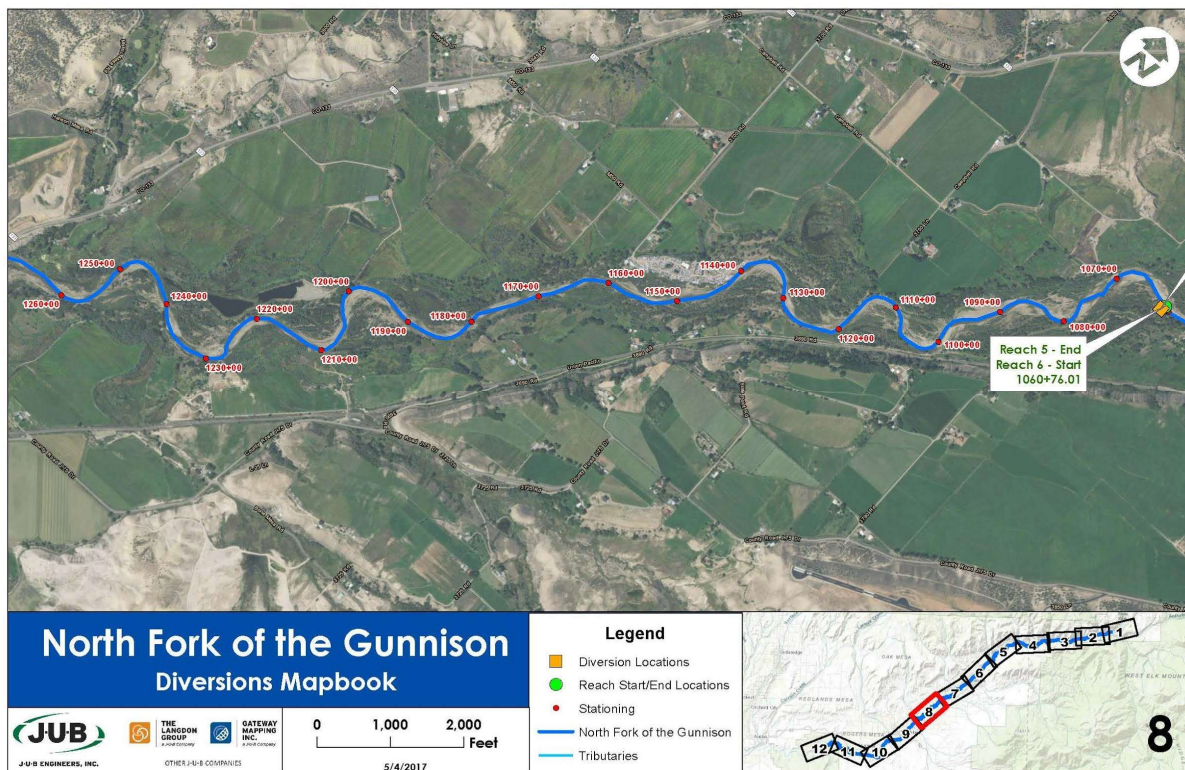


Figure 3.5.3

The river channel within this reach has a propensity for migration due to high spring flow velocities and unnatural bed loading from upstream sources, including historically disturbed areas and lack of fall out areas. The open, wider section of the valley within this reach additionally lend well to channel migration. The natural floodplain here is flat and wide. The combination of a channelized upper section and flat / open lower section has led to frequent flooding and movement of the main channel. Landowner interviews along this reach indicate that, historically, as much as 500 feet of streambank along the river may have been lost in a single flood event. Though interviewees did not report high changes of that nature in recent years, many stated that 3- 5ft bank losses in a year is not uncommon. This indicates that the river is moving into a preferred path through this reach.

The river alternates from single to braided channel throughout Reach 5. Most of the braiding occurs in the lower end of Reach 5 due to high bed load transport through the channelized upper section. Permanent cross section stations 4-6 from the 1997 morphological study are located within this reach. (Crane, 1997) Extreme down cutting was taking place at the time of the 1997 study. Since then several restoration projects have taken place within this reach. The channel of the river continues to exhibit low sinuosity in the populated upper section. In the lower section below the Farnsworth Gravel Company property the river begins to regain its natural course. Without resuming cross section monitoring, it is difficult to determine if down cutting continues to persist in this reach. A summary of river restoration projects can be found below and in Appendix E, Assessment of Aquatic Ecosystem Restoration Projects 1999-2014 (Crane, 2014).

Summary of restoration projects that have taken place in Reach 5:

Paonia Ditch:

The Paonia Ditch diversion project was completed in 2007 with funding from the Gunnison Basin Roundtable. The project was designed to replace the push-up style rock dam diversion and create a permanent concrete head gate with a low-head rock weir at the diversion point to deliver a full decree into the existing ditch supply systems. The Paonia Ditch Diversion project was a great improvement to the diversion infrastructure. (Crane, 2014) The main impact to river function from the Paonia Ditch diversion is that it continues to have the ability to divert almost the entire river during low flow season. This renders the downstream sections nearly completely dewatered during the late summer and early fall months. This has adverse effects on fisheries and boater recreation late in the season. Additional modifications to the diversion structure in an effort to increase the diversion height exacerbates the problem by further reducing fish passage.

(Restoration summary continued on next page)

Paonia River Park:

Reach 5 historically included two instream gravel mines, the first of which was owned by United Companies, and is located directly upstream of the Grand Avenue bridge in Paonia. This site is described in Appendix E, *Assessment of Aquatic Ecosystem Restoration Projects, Paonia River Park DPR 7* (Crane, 2014). In-stream mining at this site during the 1970s to 1990s contributed substantially to the destabilization of the channel and created extensive down cutting of the riverbed both up and downstream of the actual mining boundaries (Crane, 2014). A citizen led restoration effort of this site (known now as the Paonia River Park)



Figure 3.5.5 Reach 5 at Paonia River Park, looking upstream

has resulted in an excellent example of a functioning river corridor along the North Fork of the Gunnison. The Paonia River Park is owned by WSCC and represents one of only two formalized public access points on the river.

Paonia Sewer Crossing:

This project is located just downstream of the Grand Ave bridge and was completed in 2010 by NFRIA. The project was implemented to protect an insufficiently covered sewer line that was underneath the river at this location. A W-weir structure was designed and constructed to protect the Paonia sewer line, which had been buried underneath the North Fork River, but became exposed in 2009. The W-Weir was installed to prevent channel scour and maintain two feet of fill over the top of the buried pipeline. In addition, the W-Weir added stability to the area downstream of the abandoned gravel mine. (Crane, 2014)

Farnsworth Gravel pit:

The other historical in-stream gravel pit was situated at Farnsworth Construction and Gravel, located one-half mile west of the town of Paonia. Farnsworth no longer mines gravel from the river bottom, but rather from adjacent sides of the river. For the purpose of access for mining, the river channel has been bulldozed and widened. Travel from one side of the river to the other occurs through a gravel ford when flows allow. (Crane, 2014)

Monitor Ditch:

To replace an outdated diversion infrastructure, NFRIA gained funds to replace a temporary gravel push-up dam with a grouted boulder weir. The project was largely successful, utilizing a grouted boulder weir construction to deliver a full decree of water while continuing to promote a healthy aquatic and riparian community (Crane, 2014).

Sheppard-Wilmot Ditch:

The Sheppard-Wilmont Ditch diversion is located along a section of the North Fork that tends to experience frequent channel migration. In 2000, NFRIA and partners gained funding to replace the temporary gravel push-up dam with a grouted boulder weir and permanent concrete head gate structure. The project was an improvement to the older structure, but the *Assessment of Aquatic Ecosystem Restoration Projects* report indicates that movement by the river channel at this location will likely continue to be a challenge for the diversion and head gate locations. There is good riparian function surrounding this diversion. (Crane, 2014)

Riparian Function within Reach 5

Riparian function is good through the lower sections of Reach 5 from a structural standpoint. The riparian corridor extends well beyond the river channel and exhibits good density for wildlife movement. The riparian corridor is dominated by high cottonwoods and willow understory. Similar to Reach 4, Russian Olive and Tamarisk have invaded much of the understory within this reach. Russian Olive, in particular, has flourished over the last 20 years, following ditch networks and low areas into much of the floodplain. As such, the main environmental concern for the riparian corridor within this reach is that the diversity of woody native species is declining due to the influx of Russian Olive and Tamarisk. An extensive riparian survey was conducted in 1997 by the Colorado Natural Heritage Program and NRCS and can be found under “Riparian Vegetation” in Appendix E, Watershed Restoration Action Strategy for the North Fork Gunnison River.

Minnesota Creek enters the North Fork in Reach 5 from the south, flowing in a northwesterly direction from its sources in the West Elk Mountains. Minnesota Creek joins the North Fork at Paonia River Park. Minnesota Creek at times contributes a substantial amount of sediment load to the North Fork River due to the nature of its geologic soils.

Roatcap Creek enters the North Fork near permanent cross section number 5 and just upstream of the Monitor Ditch diversion. RoatCap Creek drains Stucker and Oak Mesas to the north of the river.

Recreation with Reach 5

Reach 5 is extensively used for boater recreation during the late spring and early summer months. River access is achieved through the Paonia River Park boat launch, owned by WSCC and the Town of Paonia, located directly upstream of Grand Ave bridge in Paonia.

In 2015, WSCC received a GOCO education signs grant which allowed for the installation of several river informational signs (Figure 3.5.6) The Paonia River Park is the location for many public events throughout the year, including WSCC’s annual Float Fest, which promotes River / Riparian Education and Boater Recreation Safety on the North Fork. Over 300 people attended the event in 2017. The WSCC operates the park for the public and it is used extensively at all times of the year. In addition to the boat launch, the park is heavily used for swimming, fishing, and hiking.



Figure 3.5.6 Boating Etiquette Sign at River Park

Interviews with river recreationists that use Reach 5, and landowners along Reach 5 indicate that for the most part, conflicts are few. Trespassing does not occur frequently as most boaters have just put in at the River Park and have no reason to stop within this reach. Diversion structures within this reach do not typically present a problem to boaters. However, river diversions are void of hazard signage and trash racks, which could present a danger should boaters venture too close to these structures.

3.5.2 Conclusion and Recommendations

Similar to Reach 4, considerable human manipulation of the river has occurred in Reach 5, which is the reach that extends through the community of Paonia. A wide range of instream and riparian restoration project have been completed within Reach 5. These projects (mainly completed 10 or more years ago) have made vast improvements to previous ditch diversion and other infrastructures in the river. However, many of these projects are showing signs of wear or are in need of upgrading as the

river channel has changed over time.

Similarly, riparian habitat restoration projects completed many years ago are in need of retreatment. Riparian understory diversity continues to be threatened by regrowth of Russian Olive and Tamarisk. Streambanks within this reach continue to display evidence of channel down cutting in many areas. It is difficult to determine the current state of channel stability without formal monitoring of established cross-sections, which has not been undertaken for many years.

Many river recreationists use Reach 5 as their first point of entry for river trips. Good signage is in place at the Paonia River Park, but improvements could be made. Additionally, diversion structures are not equipped with signage that indicates hazards.

Recommendations -

1. **Implement Inventory of Invasive Species and Phreatophytes:** There has been a strong concerted effort on the part of landowners and conservation groups to remove invasive phreatophytes from the riparian corridor over the last 10 years. However, many of those areas are in dire need of retreatment. The amount of regrowth within the initial project areas is unknown, but is expected to be quite high. Building on the work of WSCC and Tamarisk Coalition to inventory parcels that have been treated for invasive species for percent cover and regrowth would assist landowners and conservation groups in identifying priority areas that are in need of treatment. Add data into a GIS database for future projects.

2. Resume Geomorphological Monitoring of 1997 cross-sections: Though a significant effort was made in the 1990s to understand the geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A monitoring program that could replicate the initial study would provide an understanding of changes within the North Fork River System since that time. The changes that have occurred in the 20-year period between studies would help guide future decisions in river channel restoration. The cost estimate below is for a one-time assessment of all 11 permanently installed cross section stations.
3. Improve Educational Signage and Boater Safety: A good effort has been made WSCC and local citizens to improve boater safety. These efforts could be expanded by installing a river corridor map that would delineate private / public property and also identify locations of ditch diversions. Signage at diversion structures along the river would also improve boater safety.

Cost Estimates -

1. Implement Inventory of Invasive Species and Phreatophytes - \$10,000 - \$20,000
2. Resume Geomorphological Monitoring of 1997 cross-sections - \$5,000 - \$10,000
3. Improve Educational Signage and Boater Safety - \$5,000 - \$10,000

3.6 Reach 6 Overview

River Characteristics and Morphology in Reach 6

Reach 6 begins at Short Ditch and ends at the Vandeford Ditch Diversion. Reach 6 is 4.47 mi. In length. Figures 3.6.1 through 3.6.2 illustrate the location and extent of Reach 6. Historical information from the 1997 geomorphological study shows that the average slope of the North Fork decreases in this reach and begins to take on a broad meandering, braided path similar to the lower sections of Reach 5. (Crane, 1997)

Between Paonia and Hotchkiss, the valley widens and flattens, and there are a series of terraces and mesas on both sides of the river:

“At this point, the river begins an abrupt transition from excessive channel scour to extreme deposition. Stream velocity decreases and the river is no longer able to transport its bed load, depositing material onto point bars along braided channels. The main channel of the North Fork migrates throughout these braided channels during seasonal flooding” (Crane, 1997).

Permanent cross-sections 7 to 9 were installed within Reach 6 as part of the 1997 study.

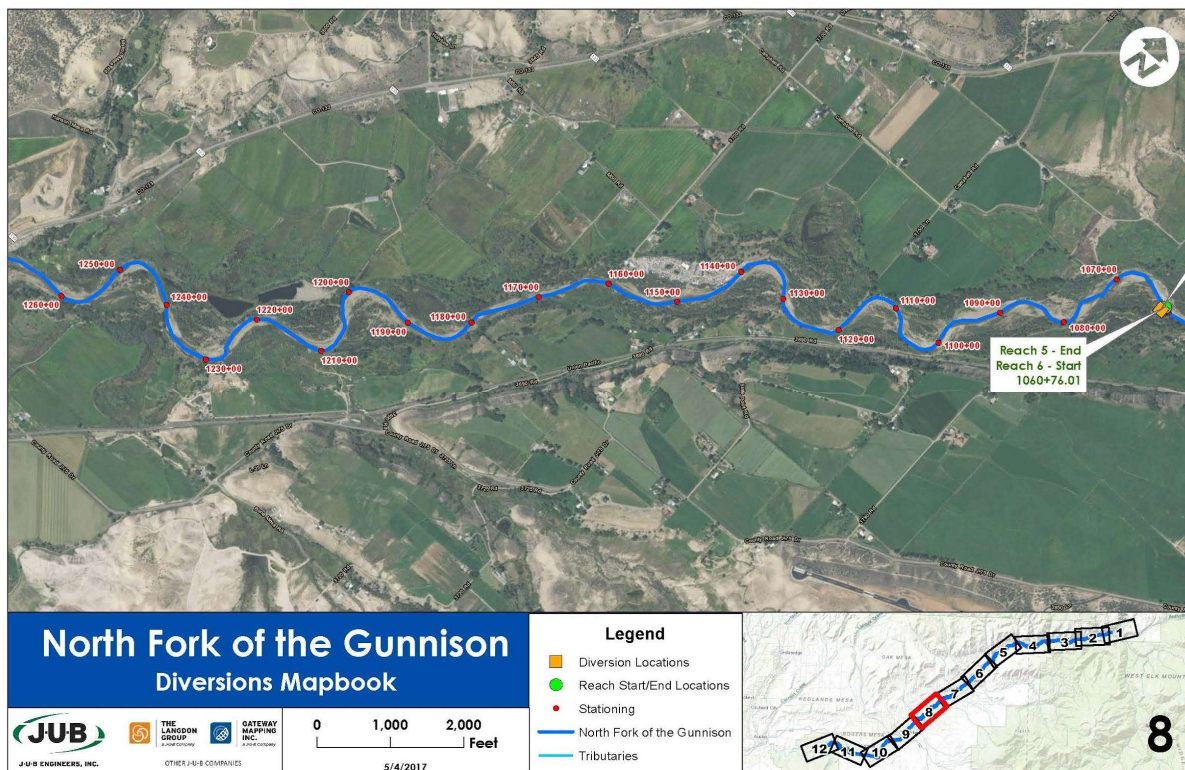


Figure 3.6.1

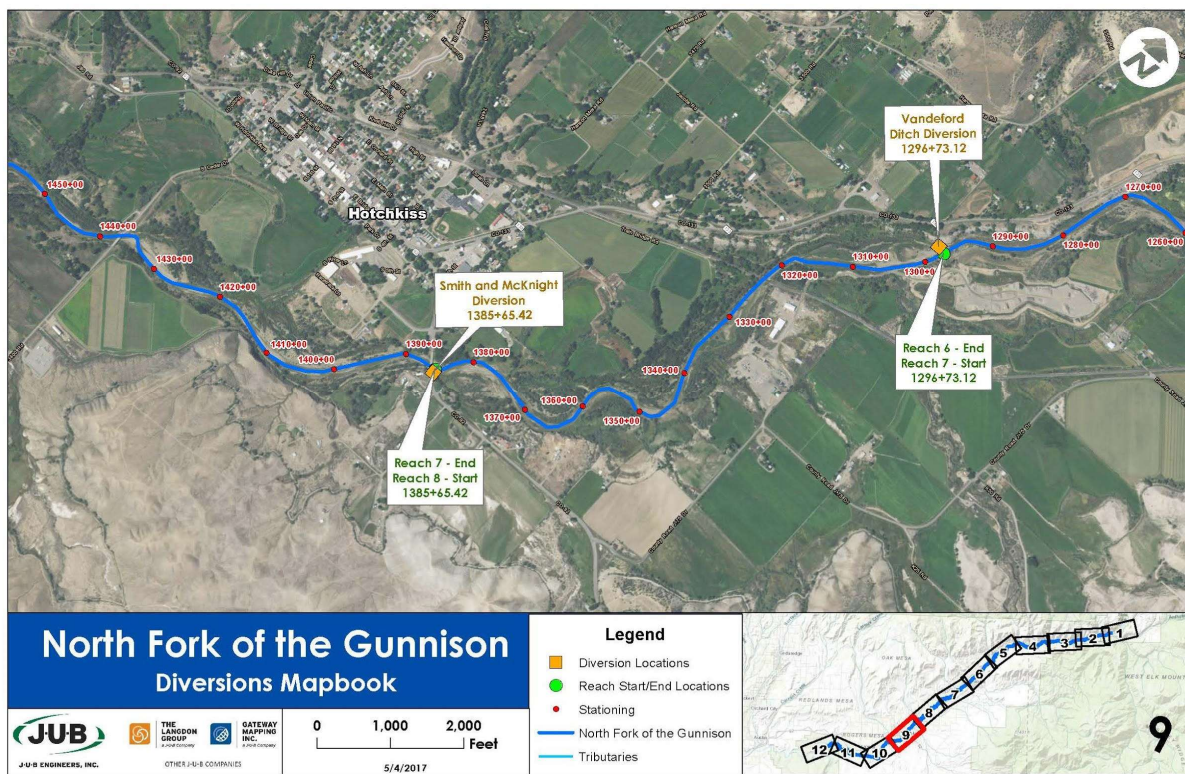


Figure 3.6.2

The meandering, braided path of the river is its preferred natural course. (Crane, 1997) However, evidence of channelization from historic instream bulldozing and excavation in this reach have removed a significant amount of bed material from the river bottom while at the same time short cutting meanders and reducing the linear distance the river must travel to maintain its natural slope. When this happens the river must gain material from elsewhere to balance the differences in grade. This leads to down cutting and stream bank erosion both upstream and downstream of the disturbance to grade. Landowners recall when large piles of gravel were pushed up into the main channel. The river continues to show signs of moving into a preferred path. Information collected at permanent cross-sections 7 to 9 in 1997 describe a river that was extremely unstable throughout this reach. Several river restoration projects have been completed within Reach 6 since the 1997 morphological study. A summary of river restoration projects can be found below and in Appendix E, Assessment of Aquatic Ecosystem Restoration Projects 1999-2014 (Crane, 2014).

Summary of restoration projects that have taken place in Reach 5:

Short Ditch:

In 2002, NFRIA and Short Ditch gained funding to improve the Short Ditch irrigation diversion structure. The previous structure was a temporary push-up dam. The project constructed a sustainable boulder weir diversion structure. The project was an improvement to the previous infrastructure but is still in need of modifications.

Midway Enhancement Project:

Located Mid-way down the extent of the North Fork, this project was funded through NFRIA and landowners in 2001-2002 to improve sinuosity of the river and reduce the amount of braiding that is frequently found in this section. There were several properties along Reach 5 that were targeted for this 4.5-mile project. The main goal of the project was to integrate a braided channel into a single thread main channel in an effort to improve water quality and enhance fish and wildlife habitat. Stream bank stabilization techniques were implemented, rock vanes installed, and some channel realignment took place along this stretch. The project was largely successful but many structures are now in need of upkeep and maintenance. (Crane, 2014)

Upper Curry Restoration Site:

In 2005 this project was implemented to improve 1,600 linear ft of channel and adjacent riparian areas. The project included construction of a new channel to increase sinuosity, reduce grade, widened the riparian zone, and re-established a natural riffle-pool sequence for fish habitat. Large boulders were installed along outside bends of the new channel with typical J-hook structures to reduce bank erosion. Habitat was improved through cottonwood and willows plantings along the extent of the project. Russian Olive and Tamarisk were removed from within the riparian



Figure 3.6.3 Upper Curry Restoration Site, looking upstream

corridor and replaced with cottonwood and willow plantings. The project was highly successful and represents one of the larger intact riparian corridors along the North Fork. (Crane, 2014)

Tri-County Gravel Pit:

Historically, the Tri-County Gravel company operated an in-stream gravel mine at this location north-east of Hotchkiss. The river channel upstream of this location in 1996-1997 exhibited six ft. of channel scour as a head cut progressed upstream due to changes in river gradient from in-stream gravel mining practices. Through the efforts of NFRIA and adjoining landowners, the gravel company abandoned its in-stream mining for an off channel mining operation and the development of a conservation easement along the 1.5-mile-long riparian corridor. (Crane, 2014)

Riparian Function within Reach 6

The riparian corridor within Reach 6 is of moderate quality, exhibiting similar characteristics to Reach 5. Structure is good while diversity within the understory continues to diminish with the higher densities of Russian Olive and Tamarisk. The upper and lower riparian sections are the widest, and exhibit the best quality, while the middle riparian section narrows with the encroachment of pasture on both the north and south sides of the river.

Several landowners along this reach have restored riparian areas on their properties. The Park's and Curry Easement properties exhibit good riparian function. These areas benefit the whole river system by dissipating high velocity spring flood flows into old oxbow meanders, decreasing downstream scour and erosion. During the summer months these oxbows support a wide variety of riparian wildlife including winter elk and the federally threatened Western Yellow-Billed Cuckoo.

This middle section of this reach contains the North Fork Impound property. This site is operated as a temporary lot for abandoned or repossessed vehicles. Some vehicles are parked directly along the bank of the North Fork River. Though the banks of the river at this site seem to be currently stable, historical aerial photos of old oxbows reveal that the entire property is well within the natural meander course of the river. There is a high potential risk for petroleum related pollutants to contaminate the river at this location.

An extensive riparian survey was conducted in 1997 by the Colorado Natural Heritage Program and NRCS and can be found under "Riparian Vegetation" in Appendix E, Watershed Restoration Action Strategy for the North Fork Gunnison River.

Recreation within Reach 6

Interviews with river recreationists and landowners familiar with Reach 6 did not indicate any major conflicts between user groups. Trespassing occurs occasionally by boaters stopping at the many exposed gravel bars within this reach. Interviews did not indicate any history of trouble with diversion structures within this reach. However, as was the case with Reach 5, river diversions here are void of hazard signage and trash racks, which could present a danger should boaters venture too close to these structures. This section of the river also contains what is locally referred to as "the ledges," a series of cascading bedrock formations exposed along the streambed, creating a stair step character enjoyed by recreationists at flow levels of 700 cfs and above.

Late summer flows within this reach are significantly reduced due to irrigation diversions along the North Fork River. Therefore, river recreation is also significantly reduced late in the irrigation season. Ditch companies within this reach continue to operate temporary push-up dams to gain their full decree of water, at times re-entering the river mid-season to maintain proper water levels at the head gate. This method has the potential to over-divert the decreed amount, and negatively impacting river function.

3.6.2 Conclusions and Recommendation

Impressive efforts have been made to restore river function within Reach 6. Interview results have revealed that this section of river has changed dramatically in the past 50 years. Entire sections that were once straightened and channelized have been restored to their meander function. Although there are no longer piles of gravel bulldozed to the center of the river, the river continues to be in the process of finding a stable pattern. There are many areas along this reach where stream bank erosion continues to be a concern. Riparian habitat is reduced within the middle section of Reach 6. Invasive phreatophyte removal efforts in this reach have been less contiguous than in Reach 5. The efforts have largely been made on the part of landowners in isolated patchwork locations.

Recommendations -

1. Implement Inventory of Invasive Species and Phreatophytes: There has been a strong concerted effort on the part of landowners and conservation groups to remove invasive phreatophytes from the riparian corridor over the last 10 years. However, many of those areas are in dire need of retreatment. The amount of regrowth within the initial project areas is unknown, but is expected to be quite high. Building on the work of WSCC and Tamarisk Coalition to inventory parcels that have been treated for invasive species for percent cover and regrowth would assist landowners and conservation groups in identifying priority areas that are in need of treatment. Add data into a GIS database for future projects.
2. Resume Geomorphological Monitoring of 1997 cross-sections: Though a significant effort was made in the 1990s to understand the geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A monitoring program that could replicate the initial study would give a good understanding of changes within the North Fork river system since that time. Changes in the past 20 years would help guide future decisions in river channel restoration. The cost estimate below is for a one-time assessment of all 11 permanently installed cross section stations.
3. Identify areas for Riparian Corridor Development: Due to the historic channelization of the river in Reach 6 and also in Reaches 4-5 above, the main channel of the North Fork exhibits an extreme tendency to migrate during high flows. This is the character of a river finding its preferred path, but can lead to significant loss of agricultural land as well as frustration for diverters who must find a way to provide an adequate supply of water to their ditch head gates. Identifying areas to construct riparian wetlands that can dissipate floodwaters may be a way to reduce unnatural channel migration.

Cost Estimates -

1. Implement Inventory of Invasive Species and Phreatophytes - \$10,000 - \$20,000
2. Resume Geomorphological Monitoring of 1997 cross sections - \$5,000 - \$10,000
3. Identify areas for Riparian Corridor Development - \$10,000 - \$20,000

3.7 Reach 7 overview

River Characteristics and Morphology in Reach 7

Reach 7 begins at the Vandeford Ditch diversion and terminates at the Smith and McKnight Ditch diversion. Reach 7 is 1.86 miles in length. Figure 3.7.1 illustrates the location and extent of Reach 7. This is a short section of river in close proximity to the highest population density along the river, including Hotchkiss and surrounding development. Reach 7 begins where the North Fork makes a sharp turn south as the river abuts a high bluff at the foot of Hanson Mesa. Highway 133 runs atop the bluff directly adjacent to the river, and 150 feet above the river.



Figure 3.7.1

The Tri County Gravel pit is located at the upper end of Reach 7, and was the site of another in-stream gravel mine. (Figure 3.7.2) The pit ceased mining operations in the river channel in the late 1990's and has been operating out of the adjacent floodplain. A conservation easement was put in place to prohibit in-stream gravel mining in perpetuity. (Crane, 2014) WSCC is unaware of any other restoration projects that have taken place within this reach.

Impacts to the river channel from past mining continue to be evident. Permanent cross-section number 10 is located just downstream of the gravel pit. At the time of the 1997 geomorphological study, there was a constructed dike on the north side of the river that isolated the river from its floodplain and forced the river's high flows against the south bank. The result is a vertical south bank, nearly 15 feet high, that still remains. (Crane, 1997) There is a terraced floodplain above this bank. An examination of aerial photos indicates no bank movement evident since the 1997 report, and the steep bank appears to be stable. However, just downstream near the Smith and McKnight Ditch diversion, landowners report that the north bank of the river has eroded significantly in recent years.



Figure 3.7.2 Reach 7 across from Tri-County Gravel Pit, looking upstream

Riparian Function in Reach 7

Riparian function is moderate to poor throughout most of Reach 7. This is primarily due to adjacent industrial development along the south bank at the Tri-County Gravel pit and Todd's Sawmill properties. The riparian buffer is extremely thin to nonexistent along the south bank of Reach 7. The north bank exhibits a moderate riparian buffer dominated by a Cottonwood canopy and Russian Olive understory. An extensive riparian survey was conducted in 1997 by the Colorado Natural Heritage Program and NRCS. A synopsis of those results can be found under "Riparian Vegetation" in Appendix E, Watershed Restoration Action Strategy for the North Fork Gunnison River.

Cottonwood Creek enters the North Fork directly downstream of the Tri County Gravel pit. Cottonwood Creek drains a substantial amount of acreage to the south and southeast of the North Fork, extending nearly to the town of Crawford.

Recreation in Reach 7

Reach 7 is the last section of a river trip for most boaters leaving from Paonia and floating to Hotchkiss. Interviews for this assessment did not indicate any conflicts between recreationists and landowners. There are no known conflicts between recreationists and the Vandeford Ditch diversion.

3.7.2 Conclusions and Recommendations

Reach 7 has been historically manipulated by in-stream gravel mining, channel straightening, and light industry. The river continues to find its preferred path in response to these activities. Stream bank erosion is occurring near the end of this reach.

Recommendations -

1. Resume Geomorphological Monitoring of 1997 cross sections: Though a significant effort was made in the 1990's to understand the Geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A monitoring program that could replicate the initial study would give a good understanding of changes within the North Fork River System since that time. Changes in the past 20 years would help guide future decisions in river channel restoration. The cost estimate below is for a one-time assessment of all 11 permanently installed cross section stations.

Estimated Costs -

1. Resume Geomorphological Monitoring of 1997 cross sections - \$5,000 - \$10,000

3.8 Reach 8 overview

River Characteristics and Morphology in Reach 8

Reach 8 begins at the Smith and McKnight Ditch diversion and ends at the confluence with the Gunnison River. Reach 8 is the longest reach on the North Fork at 9.24 miles. Figures 3.8.1 through 3.8.4 illustrate the location and extent of Reach 8. The reach begins at the Hwy 92 bridge in the town of Hotchkiss. The river takes a wide southwesterly meandering route for nearly 1.5 miles around the Delta County Fairgrounds before it goes under 3400 rd. bridge and exits the west edge of town. The river channel has been historically altered in this section around the town, but appears to be currently stable.

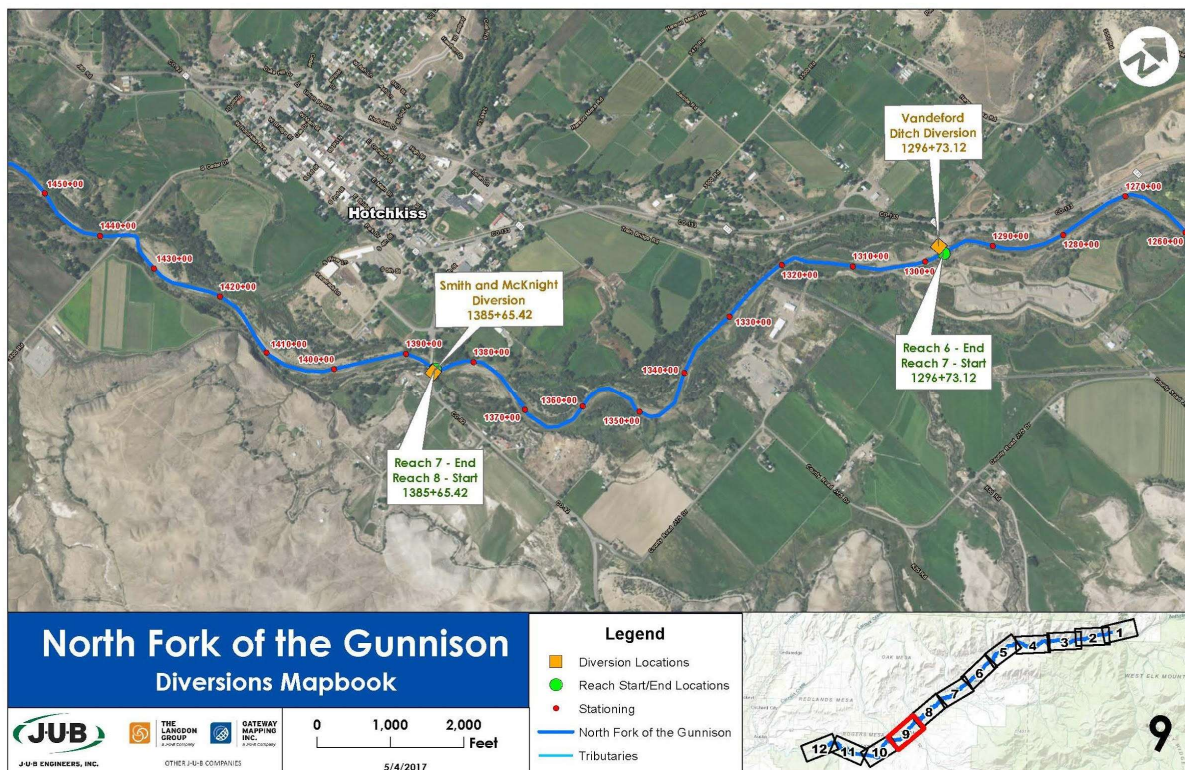


Figure 3.8.1



Figure 3.8.2

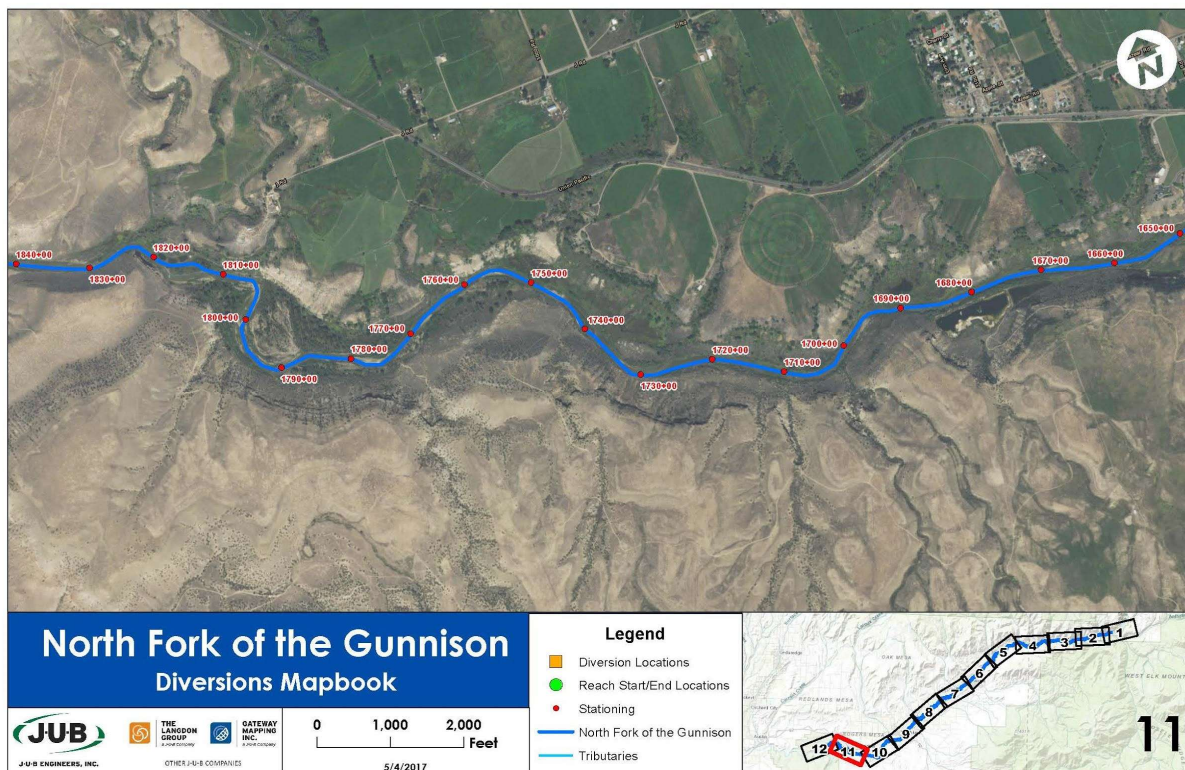


Figure 3.8.3

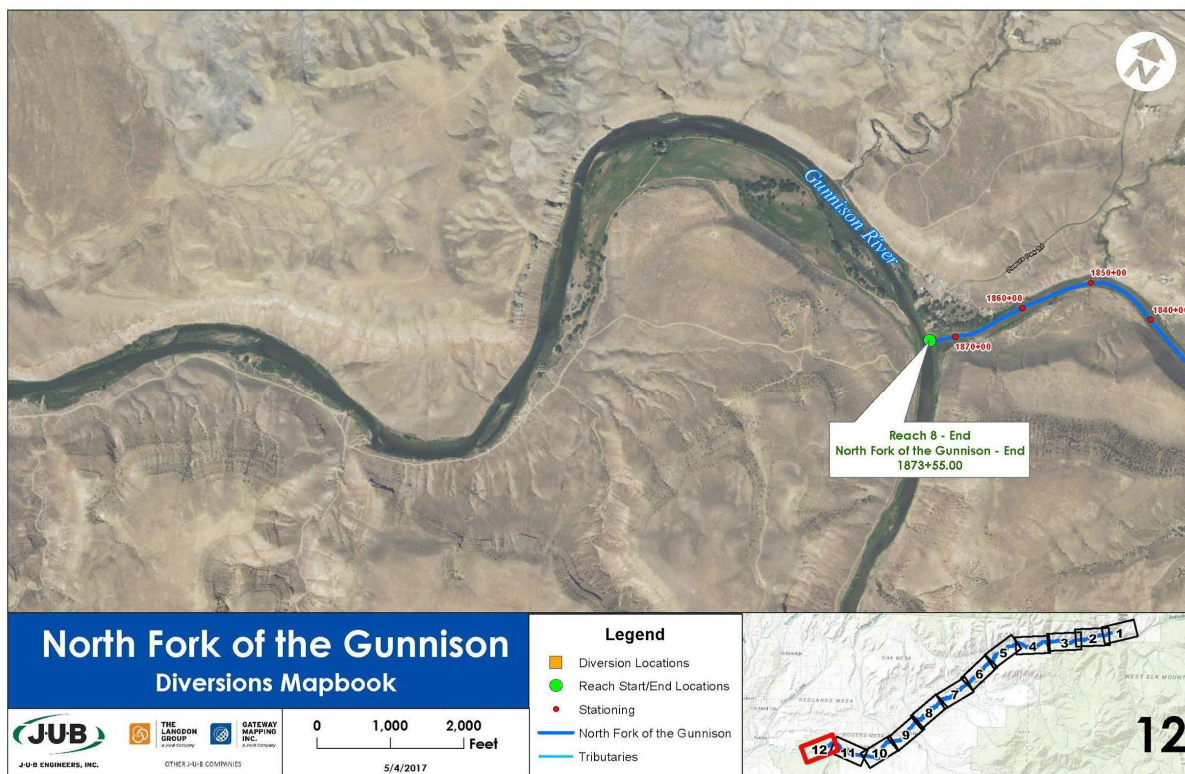


Figure 3.8.4

After leaving the town of Hotchkiss, the river resumes its natural meandering path. However, the flood plain is quickly reduced on the north side of the river where the base of Roger's Mesa pushes hard against the North Fork's efforts to migrate in that direction. The flood plain is significantly reduced on the south side of the river as well due to high vertical banks.

Permanent cross-section 11 is located near the now abandoned Chipeta Fish Hatchery. This is near 1520+00 as indicated in Figure 3.8.2. This cross-section is the last one on the North Fork. The river enters a canyon shortly after cross-section 11 and transitions into single channel morphology. (Crane, 1997). The river continues in this manner until its confluence with the Gunnison River 6 miles downstream. A description of cross-section 11 and the river, as it was in 1997, can be found in appendix E, Geomorphological Assessment of the North Fork of the Gunnison (Crane, 1997)



Figure 3.8.5 Reach 8, looking upstream at 3400 Rd Bridge

There have been 3 major restoration projects that have taken place within this reach. Interviews with landowners of those projects have indicated that though these projects were largely successful in achieving their initial goals, many of them need to be re-assessed and maintained due to the changing morphology of the river. A summary of river restoration projects undertaken within this reach can be found below and in Appendix E, Assessment of Aquatic Ecosystem Restoration Projects 1999-2014. (Crane, 2014).

Summary of restoration projects that have taken place in Reach 5

Hotchkiss Demonstration Project and Smith and McKnight Ditch:

Completed in 1999, the Hotchkiss demonstration Projects was the first major restoration project to take place on the North Fork. The project area encompasses approx. 1.5 miles between the Hwy 92 bridge and 3400 rd. bridge directly adjacent to the Delta County Fairgrounds. This segment of river had previously been impacted by multiple channelization activities in an effort to reduce flooding and loss of agricultural property. The project involved many bank stabilization techniques including installation of rock veins and riparian vegetation plantings.

The Smith and McKnight Diversion was also redesigned and constructed to include a low-profile rock weir which replaced the temporary push-up dam infrastructure. The Diversion is still in need of some improvements as will be discussed further below. (Crane, 2014)

Chipeta Dam Removal:

The Chipeta dam was located just upstream of the abandoned Chipeta Fish Hatchery. The dam spanned the entire North Fork and served the function diverting water to the US Fish and Wildlife Service's (USFWS) National Fish Hatchery. The Hatchery was relocated after a landslide in 1981 and the dam was unused. For many years the dam was a significant hazard to boater safety and a barrier to fish passage. NFRIA and the USFWS removed the dam in 2006. (Crane, 2014)

Tom Kay Property:

This section of Reach 8 exhibited high levels of bank erosion, reportedly as much as several feet per year during 1996-1997. Prior to the project, the land was farmed directly to the river's edge. The primary goal of the project at this location was to stabilize the banks in this section and reduce the loss of agricultural land. The project involved pushing back the agricultural fields, regrade the slopes, and replant a small riparian buffer with native grasses riparian shrubs and cottonwood trees. (Crane, 2014)

Riparian Function within Reach 8

The riparian corridor structure within Reach 8 is substantial in many locations and altogether absent in others. Beginning at Smith and McKnight Diversion and traveling downstream the riparian buffer is of moderate density. However, down cutting from historic channelization within this reach has left much of the flood plain too high to dissipate regular flood charges from the river. Interviews with landowners within this reach indicate the river had historically taken a wide path through this reach. This can be seen in a number of old oxbows within the floodplain. There are also reports of the river altering its main channel by up to 300' during a single storm event.

Plant diversity is diminishing rapidly due to an extreme influx of Russian Olive and Tamarisk in this section. Additionally, one landowner noted that the presence of Russian Olive and Tamarisk were not observed as early as the 1990s within this section. This indicates that the species could stand to dominate the understory of the entire North Fork is left unchecked. A concerted effort has been made by conservation groups, landowners, and Delta County Fairgrounds to remove these species from the riparian corridor section between the two bridges. These efforts have been largely successful thanks to landowners who continue to monitor and retreat these areas.

Downstream of 3400 Rd. bridge, the riparian corridor is well established on both sides of the river until the channel runs into the steep base of Rogers Mesa, where riparian function is limited to the south side of the river. Here agricultural land runs directly up to the river in some locations. Past efforts have been made by landowners and river conservation groups to stabilize some of these steep banks. Interviews with landowners indicate that some of these have been successful while others did not have long term success rates.

The North Fork continues its journey out of agricultural land and into a constricted canyon created by the base of Roger's Mesa on the north and high shale bluffs on the south. The riparian corridor is limited here by the steep natural banks. However, natural riparian function is maintained for the remaining section of Reach 8 until its confluence with the Gunnison River. Russian Olive and especially Tamarisk become more prevalent near the confluence of the two rivers.



Figure 3.8.8 Terminus of Reach 8, Confluence with the Gunnison River, North Fork on the left

Recreation within Reach 8

Recreationalists floating from Paonia to Hotchkiss pass through the Smith McKnight Diversion at Reach 8, adjacent to Hwy 92 bridge before making a landing at the Delta County Fairgrounds site. This is typically a hazard to many boaters and can be quite dangerous during low flows. The diversion itself is a partially submerged boulder weir. However, the diversion seems to be unstable and needs frequent addition of rock throughout the irrigation season to maintain the proper elevation for the head gate. The unstable diversion has disintegrated over the years with high spring flows, leading to a significant hazard below the diversion, especially in conjunction with the Hwy 92 bridge abutment directly downstream. The head gate at the diversion is equipped with a safety fence which prevent boaters from becoming trapped should they venture to close. (NFWCD, JUB 2017)

Reach 8 is a popular section for boater recreationalists intending to float the North Fork from Hotchkiss to the confluence with the Gunnison River at Pleasure Park, on BLM property. River entry is achieved by



putting in at a low flat gravel terrace at the Delta County Fairgrounds. Delta County, WSCC, and other partners are currently in the process of gaining permitting and engineering to construct a formal river recreation access ramp. There is currently no signage to designate where the river access is located within the fairgrounds property. This has led to conflicts with an adjacent landowner when boaters inadvertently trespass on private property. One landowner has currently barricaded off the site to prevent further illegal access.

Figure 3.8.6 Reach 8 at Delta County Fairgrounds, looking upstream

Another popular put-in/take-out location is the US Fish and Wildlife Service (USFWS),

Hotchkiss National Fish Hatchery. This site is located directly adjacent to the North Fork River, south of Lazear, at the base of Rogers Mesa. The river here has entered a canyon with high bluffs on either side. There is no formal public ramp at this location but the USFWS Hatchery allows boaters to use a low flat area at the extreme downstream end of the property for put-in and take-out. There is a gravel road immediately right of the Hatchery entrance that provides access to this area. However, there is no signage at the Hatchery indicating where to access the river and this has led to a few conflicts between recreationalists and USFWS staff as is further described below.

The Hatchery has gone to great lengths to limit the spread of waterborne disease within the Hatchery runways. To reduce the risk of disease, the Hatchery does not draw any water from the North Fork for its operations. Additionally, all North Fork river water is prohibited within the Hatchery spawning facility. Instead, all operational water for the Hatchery is provided through a spring located above the property at the base of Roger's Mesa. Conflicts arise when boaters exit the river at the upstream edge of the hatchery

property and transport their vessels through the parking lot, inadvertently spreading river water through the hatchery facility. Contamination can also occur when fishermen walk up to tour the spawning beds after wading in the river. In 2015 the Hatchery had an outbreak of salmonid bacterial kidney disease. The Hatchery was forced to reduce their population by 50% and an estimated 1.5 million dollars was spent between Hotchkiss and other hatcheries in the west to remove the infection. The contamination came from a batch of infected fish from a state Hatchery in Glenwood Springs but nevertheless, the Hotchkiss facility is very sensitive to disease contamination from any source.

As far as the condition of fisheries within Reach 8 is concerned, interviews with the USFWS staff indicate that the North Fork of the Gunnison does have the potential to gain gold medal trout fishing status due to its location just upstream of the Gunnison River which does hold that designation. The main obstacles to that designation, according to USFWS staff, being high sediment loads, low summer flows (resulting in warm water conditions), and limited public access.



Figure 3.8.7 Reach 8 at USFWS Hotchkiss National Fish Hatchery, looking upstream

Recreational Flows within Reach 8 typically last a little longer than in the upper reaches from Paonia to Hotchkiss. However, by mid-summer flows within this reach are well below 700cfs and will not support conveyance of watercraft without individuals having to exit their boats to portage shoals, thereby trespassing on private property. This has also led to conflicts with a few landowners downstream of Hotchkiss. Liability issues seem to be the major source of frustration between landowners and recreationalists. The question of who is held responsible should trespassers get injured on private land continues to be a difficult one to answer.

Right of way is another issue that poses conflicts between landowners and recreationalists in this and other reaches of the North Fork. Several landowners own both sides of the North Fork within this reach and therefore own the river bottom as well. There has been at least one instance where a landowner was using both sides of the river and came into conflict with boaters needing to float through his property.

3.8.2 Conclusions and Recommendations

Reach 8 is 9.24 miles in length and represents the longest segment along the North Fork of the Gunnison. This reach of the river exhibits a changing morphology from historic channel alterations and also natural causes as it transitions towards its confluence with the Gunnison River. It is clear that the river is still in the process of stabilizing its grade and finding its preferred path through this upper sections of this reach.

Bank stabilization near agricultural fields is a priority need in some areas. The riparian corridor exhibits a moderate structural condition but diversity of species within the corridor is diminishing due to the influx of invasive phreatophytes. Interviews with landowners along this stretch have revealed that Russian Olive was not observed within the valley as recently as the 1990s. There are many opportunities for recreation within this reach. However, there has been very little improvements to recreation infrastructure which has led to conflicts in some cases.

Recommendations -

1. Resume Geomorphological monitoring of 1997 cross sections: Though a significant effort was made in the 1990's to understand the Geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A simple monitoring program that could replicate the initial study would give a good understanding of changes within the North Fork River System since that time. The approx. 20-year difference between studies would help guide future decisions in river channel restoration.
2. Improve Smith and McKnight Diversion: The submerged boulder weir in conjunction with the Hwy 92 bridge abutment poses a significant hazard to boaters during most times of the year. Frequent maintenance to the weir by the ditch company throughout the irrigation season indicates that the diversion is in need of re-engineering. Creating a more efficient low-profile weir farther upstream away from Hwy 92 may be one way of increasing efficiency for the ditch and improve safety for boaters passing through the diversion.
3. Improve River Access and Communication at Delta County Fairgrounds: Efforts are underway to design and construct a gravel boat ramp with parking area at the Delta County Fairgrounds River Access. However, there is currently no signage in place to display important river information. Funding could be secured to develop signage that would display a river corridor map which would delineate between public and private properties along the river. This would make boaters aware of the few legal access points that exist in this reach. Other river safety information could be displayed to inform the public of river hazards and appropriate recreation conditions.
4. Improve Signage at USFWS Hotchkiss National Fish Hatchery: The USFWS operates the Hotchkiss National Fish Hatchery not only as a facility for spawning trout but also as a site to assist the public in aquatic education. As such, the facility allows the public to use the property for river access. However, there is no signage at the facility to inform users of the appropriate location to access the river or the potential risks to the hatchery from user negligence. Signage at the Hatchery entrance and along the river bank at the upstream edge of the property designating the location for river entry or exit would greatly improve communication between recreationalists and the Hatchery. It would also reduce the risk of water borne diseases within the spawning areas of the Hatchery.
4. Identify areas for Riparian Corridor Development: Due to the historic channelization of the river in Reach 8, the main channel of the North Fork exhibits high shear stress on outside banks leading to bank destabilization. This is the character of a river trying to balance its grade but can

lead to significant loss of agricultural land. Identifying areas to improve riparian wetlands which can dissipate the spring flood charge may be a way to assist the river in establishing its preferred path. Additionally, connecting segmented riparian buffers would strengthen destabilized banks and promote wildlife habitat.

5. Improve Communication between water users: As the population continues to grow within the North Fork Watershed, the demand for water needs by both consumptive and non-consumptive users continues to grow as well. Our interviews indicated that Reach 8 has had the most number of conflicts reported between user groups, some could have easily been avoided had there been a formal system of communication in place. A watershed stakeholder group made of both consumptive and non-consumptive users within the North Fork of the Gunnison watershed would allow these users to be made aware of infrastructure changes, recreational activities, and diversion modifications within the river system. Additionally, this groups could assist in future decisions associated with North Fork watershed management planning.

Estimated Costs -

2. Resume Geomorphological monitoring of 1997 cross sections - \$5,000 - \$10,000
3. Improve Smith and McKnight Diversion - \$75,000 - \$150,000
4. Improve River Access and Communication at Delta County Fairgrounds – \$60,000 - \$100,00
5. Improve Signage at USFWS Hotchkiss National Fish Hatchery - \$2,000 - \$5,000
6. Identify areas for Riparian Corridor Development – funding to be determined
7. Improve Communication between water users - funding to be determined

4.0 Watershed Planning and Recommendations

The water users of the North Fork of the Gunnison are fortunate to have a large quantity of data gathered and river assessments completed over the last 20 years that are available to them. Even with this extensive information, significant challenges still exist for those attempting to sustainably manage the competing uses and demands of the river's limited water resources.

After reviewing all of the recent assessments and reports on the North Fork of the Gunnison River, and completing interviews of water users, landowners, and other stakeholders along the various reaches of the North Fork, the Western Slope Conservation Center has identified the following recommendations for action to reduce future water use conflict and improve long-term environmental health of the river corridor.

4.1 Improvement prioritization / action strategy

1) Create a North Fork stakeholder forum.

Historically, communication between consumptive and non-consumptive water users in the North Fork valley has been non-existent to minimal. As the population continues to grow within the North Fork Watershed, the demand for water needs by both consumptive and non-consumptive users continues to grow respectively. Although relatively few conflicts between user groups were reported in our interviews, some could have easily been avoided had there been a formal system of communication in place. A watershed stakeholder group consisting of both consumptive and non-consumptive users within the North Fork of the Gunnison watershed would allow these users to be made aware of infrastructure changes and diversion activities within the river system. Additionally, this group could assist in decisions associated with North Fork watershed management planning.

2) Complete a full inventory of invasive species.

Despite fragmented efforts from various organizations to take on invasive species within the river's riparian corridor, a comprehensive inventory is lacking. In Oct. 2017, The Tamarisk Coalition and WSCC began transferring information from past restoration efforts into shape files which were uploaded into a shared GIS mapping database. All interested stakeholders, especially those who have conducted invasive species control within the river corridor, should be included in the inventory process.

3) Resume geomorphological monitoring of 1997 cross sections.

Although a significant effort was made in the 1990s to understand the geomorphological characteristics of the North Fork, no follow-up monitoring has been completed since the 1997 report. A monitoring program that replicates the initial study would give a good understanding of changes within the North Fork River System during the past 20 years. This would help guide future decisions in river channel restoration.

4) Specific irrigation projects as identified in NFWCD Irrigation Management Plan (2017).

North Fork water users are fortunate to now have the NFWCD Irrigation Management Plan. WSCC encourages additional consideration provided to boat and fish passage, as well as additional environmental restoration and bank stabilization as appropriate on projects included in the NFWCD plan: [See Irrigation management Plan, NFWCD](#). The projects identified include:

- a. A feasibility study on combining the diversion and conveyance infrastructure of the Short and Smith-McKnight Ditches, or reconstruction of the existing Smith-McKnight diversion to allow for bypass flows when appropriate and boat passage and possibly incorporated boater access.
- b. Construction of a new diversion or rehabilitation of the existing
 - i. facilities at the Stewart Ditch, with incorporated riparian bioengineering and geo-stabilization on the “island” created between the diversion channel and the North Fork.
 - ii. Rehabilitation of the existing Fire Mountain Canal facilities, including continued support for reservoir rehabilitation and efficiency projects.
 - iii. Specific emphasis should be placed on eliminating proportional splits of irrigation water within the lateral system on Roger’s Mesa.
 - iv. Rehabilitation of the existing North Fork Farmer’s Ditch diversion structure, to remove the exposed metal cribbing.
 - v. At the Shepherd and Wilmott Ditch, placement of rock rip-rap and in stream low profile rock weir to stabilize river movement.

5) Identify areas for Riparian Corridor Development.

Due to the historic channelization of the river in some reaches, the main channel of the North Fork exhibits an extreme tendency to migrate during high flows. This is the character of a river finding its preferred path, but can lead to significant loss of agricultural land as well as frustration for diverters who must find a way to provide an adequate supply of water to their ditch head gates. Identifying areas to construct riparian wetlands that can dissipate floodwaters may be a way to reduce unnatural channel migration.

6) Improve Public Access and Corresponding Signage and Education.

There is currently limited and informal public access points for recreational users within some reaches of the river. Funding for recreational access easements and other access improvements in these reaches could improve boater safety and reduce trespassing. Educational signage at put-in and take-out locations would improve safety for boaters and inform recreationists of public and private property locations.

7) Investigation of market mechanisms for compensating non-consumptive beneficial use.

Some water users interviewed for this assessment identified a need to investigate and identify possible market mechanisms including but not limited to recreation easements and water banking to solve current and future in-stream and non-consumptive water use conflicts.

5.0 Conclusion

This assessment is the product of over a year of data collection, review, and analysis of information by Western Slope Conservation Center staff and volunteers regarding the historic and current environmental health of the North Fork of the Gunnison River.

Even though a large quantity of information existed regarding the geomorphology, ecology, and water use along the 35.5-mile length of the river, the goal of this assessment was to synthesize that information into a usable form that can spur renewed energy to improve the environmental and recreational health of the North Fork of the Gunnison River.

Beyond our specific recommendations, the biggest innovation in this assessment is the development of eight reaches to better understand, prioritize, and implement improvements on the North Fork. This development was done in close coordination with the North Fork Water Conservancy District. The District has prepared its own assessment and report, North Fork River Irrigation Management Plan (J-U-B Engineers, 2017).

The authors of this assessment hope that the environmental and recreation needs described in this assessment can be met in tandem with the irrigation needs described in the North Fork Water Conservancy District's plan to target mutually beneficial infrastructure and environmental projects.

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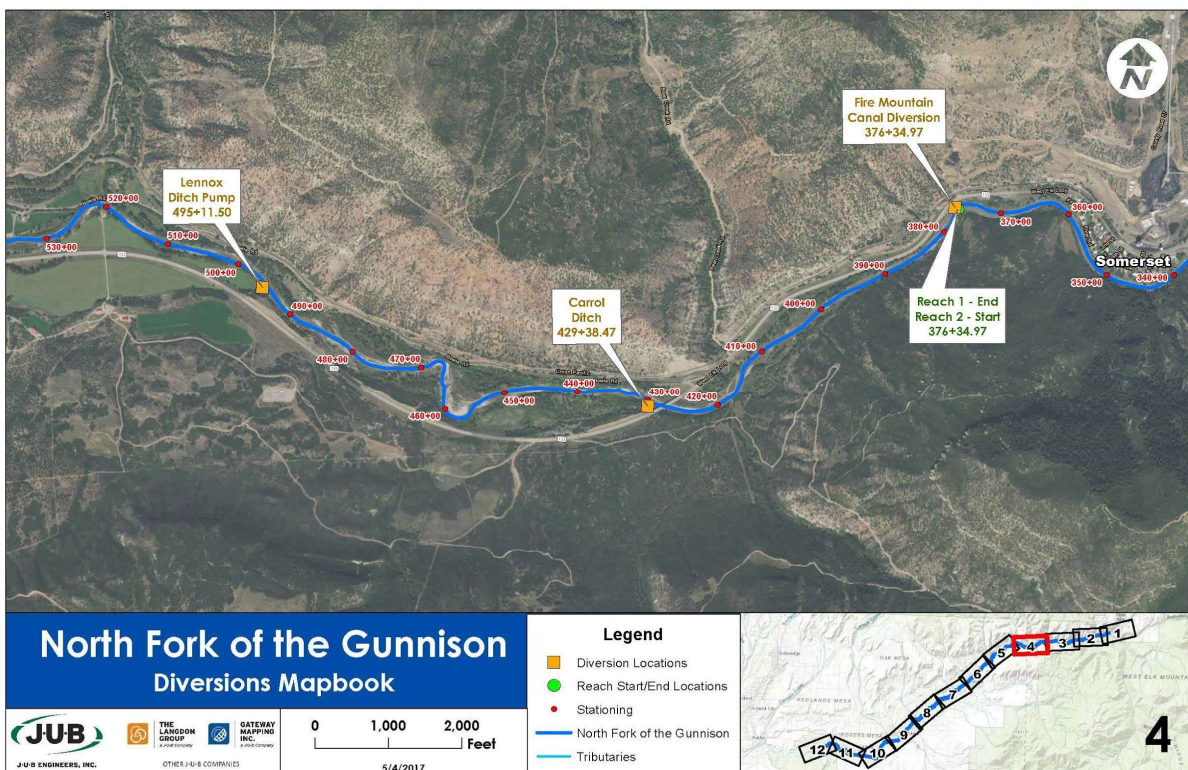
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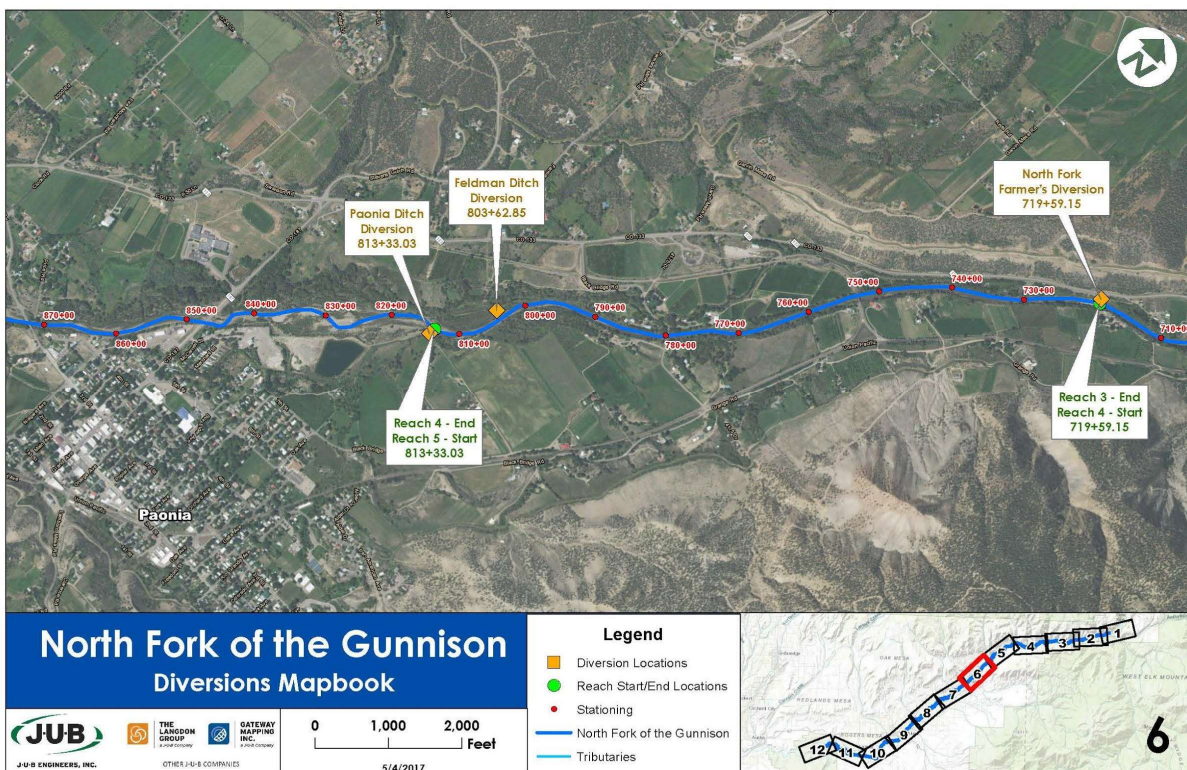
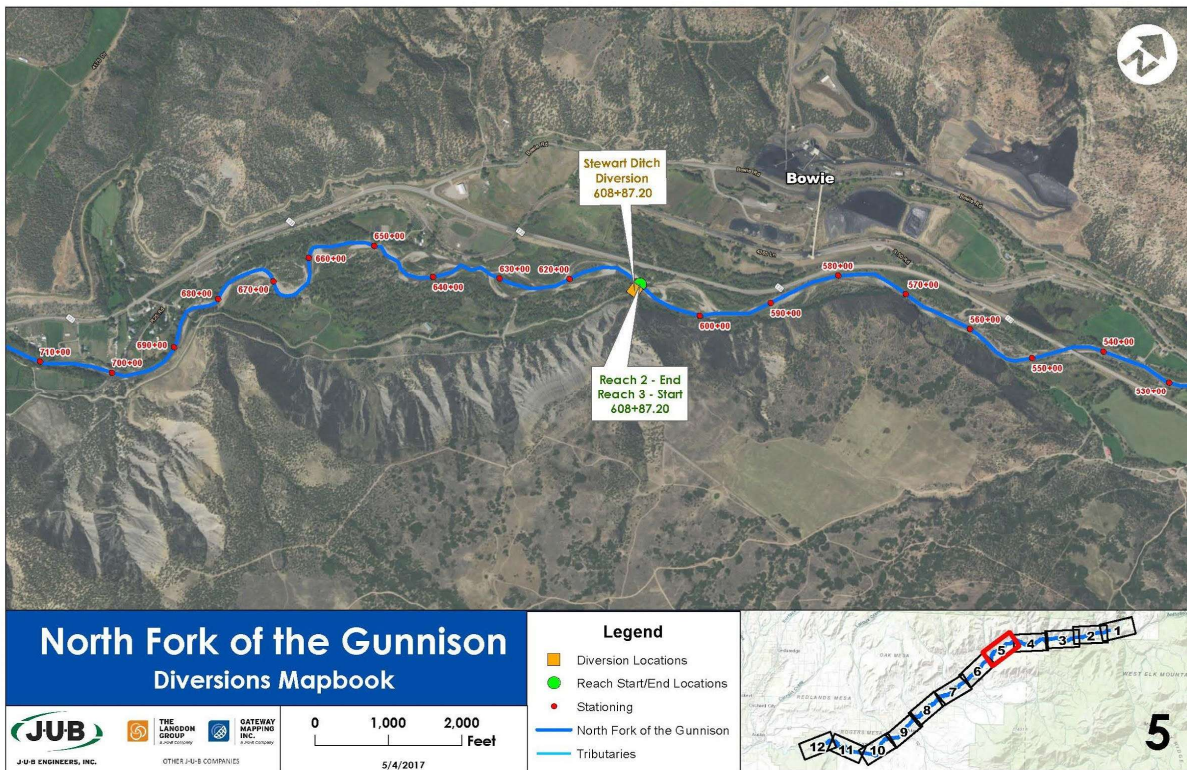
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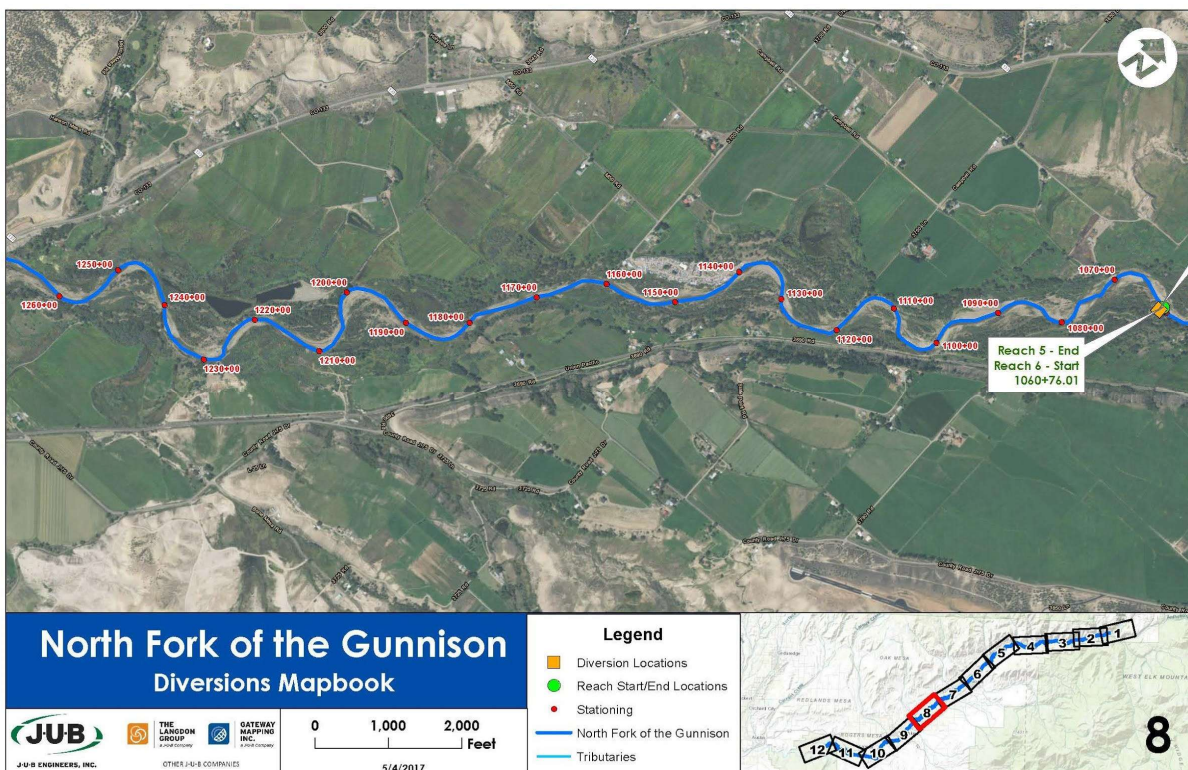
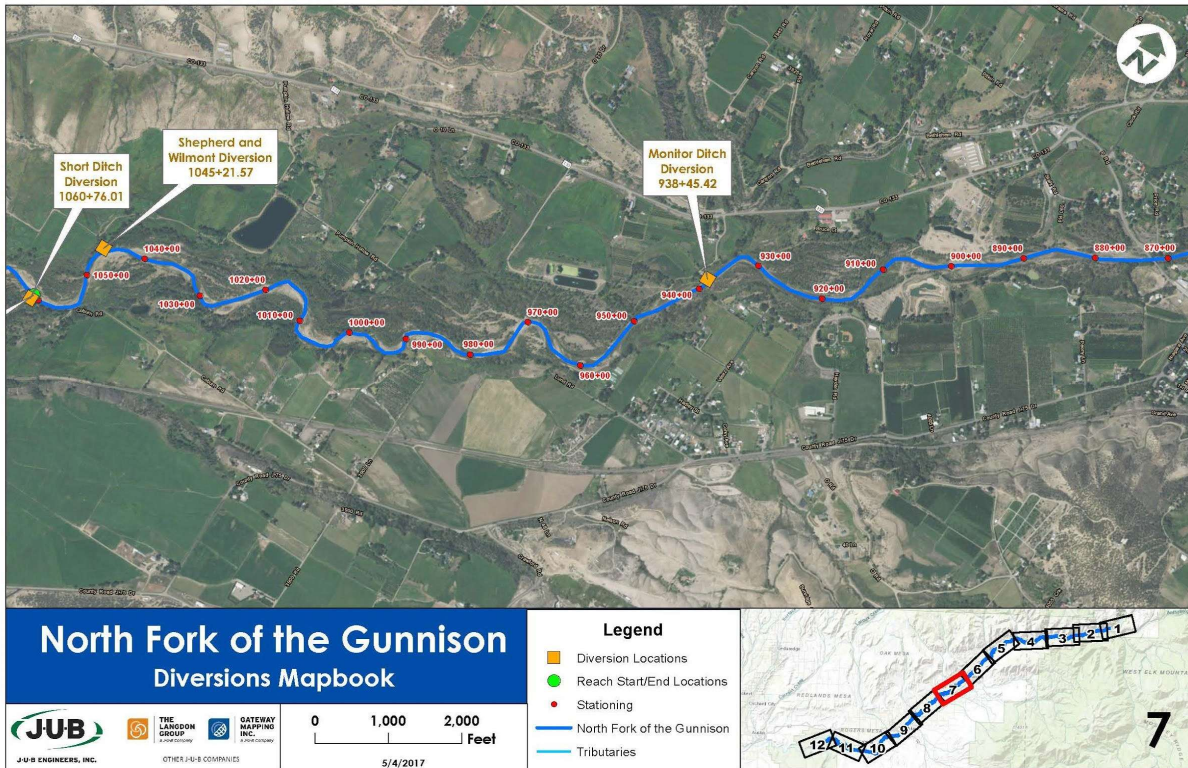
Appendix A: Maps of the North Fork Gunnison River from Paonia Reservoir to Confluence with the Gunnison River

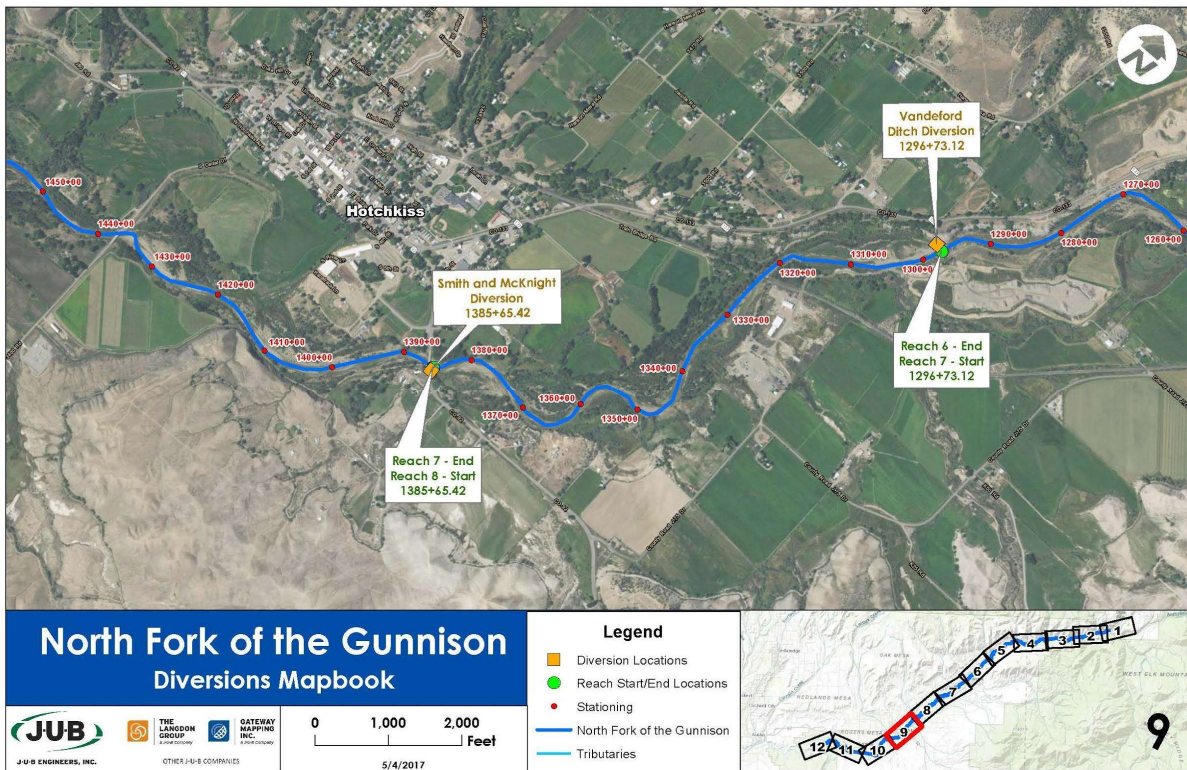
Appendix B: Diversion Mapbook

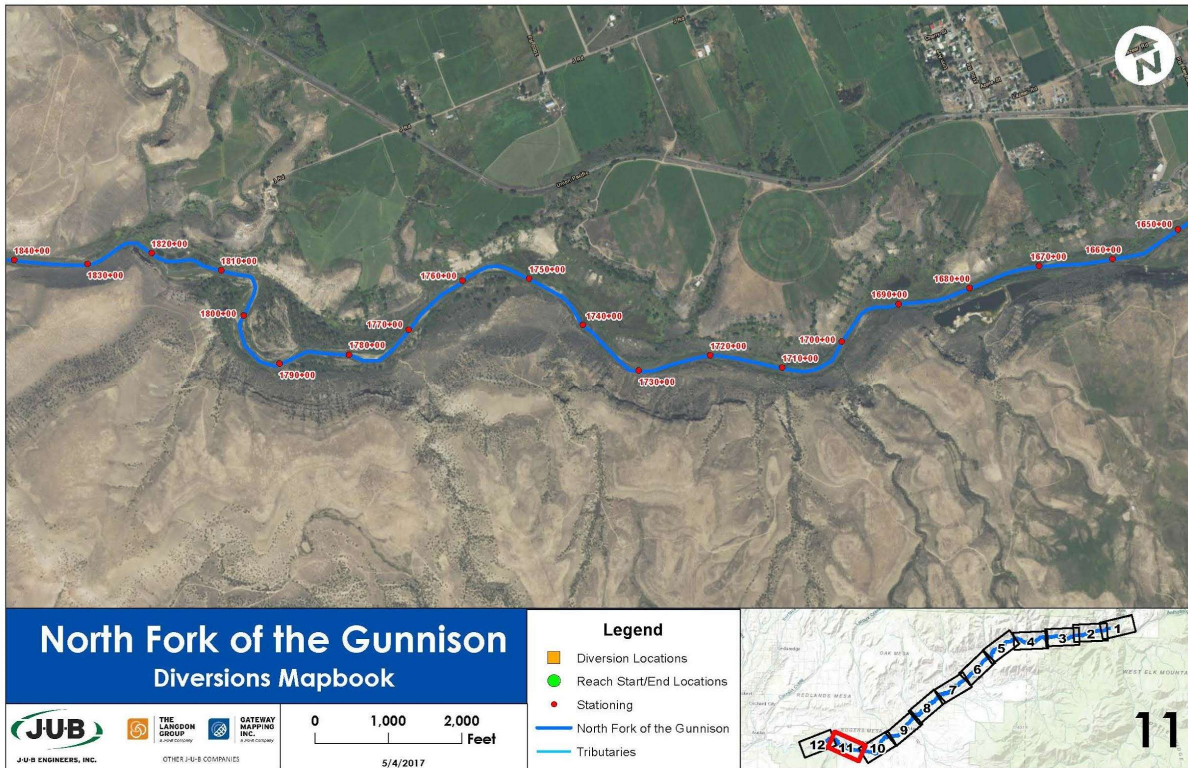












Appendix C: Semi-formal Interview Form

Contact Information:	
Name:	
Landowner Questions:	
1. Do you have agricultural water on your property?	
a. Which diversion serves your property?	
2. Approx. how many miles of river are on your property?	
3. Do you have other live water on your property?	
a. Does that stream or wetland have a name?	
4. How would you describe the river and riparian zone on your property? ie: braided / single channel, canopy cover / understory, wetland	
5. Have you completed any stream or riparian restoration projects on your property?	
a. If so, can you describe the project(s)?	

a. What are other restoration needs on your property?	
6. Do you know of any invasive species concerns associated with your property?	
7. What are your primary concerns as a riverfront landowner?	

Environmental Questions:	
1. How have you observed the river itself change during your time in the North Fork valley? (ie. changes to: in-stream channel, below-bank zone, flow and water quality)	
2. Have you noticed changes to the streambank on your property or elsewhere along the river?	
3. Have you noticed any change in sedimentation loads or deposition over time on your property or elsewhere?	

4. How have you observed the riparian corridor change during your time in the North Fork valley?	
5. What kinds of wildlife do you frequently observe along your property and elsewhere along the river?	
a. Do you know of any seasonal migration routes through your property or elsewhere along the river?	
6. Have you noticed changes to fisheries within the river? ie: spawning, travel, fish kills	
7. How would you characterize the health of the river and riparian corridor of the North Fork along your property as well as elsewhere along its extent?	
8. What do you see as the biggest challenge to water quality in the North Fork River?	

Recreation Questions:	
1. Do you use the North Fork River for recreation? If so, how?	
a. Which locations or sections of the river do you use the most?	

2. How often do come into contact with recreational water users on your property or other elsewhere along the river?	
a. Have you had any conflicts and can you elaborate?	
3. What do you dislike about current river recreation opportunities or management, and what do you see as a present or future problem?	
4. What recreation management problems would you like to see addressed in the river if funding were available?	
a. What areas do you see that need improving?	
5. How have you seen recreational water use change over time? (ie. type of activities, quantities, location)	

Additional notes:

Appendix D: List of informal interviews

Semi-formal interviews

Anonymous

Informal Interviews

Anonymous

Appendix E: Semi-formal interviews - representative interview results

[REDACTED]

Semi-formal Interview

Landowner Questions:

1. N/A
2. 1 mi approx
3. N/A , the North Fork flows into the main Gunnison River at “The Gunnison Forks.”
4. Mostly single channel.
5. Yes, some work with WSCC along the banks. Morgan and others spent some time wire caging cottonwoods last year.
6. Still need work to remove Russian Olive and tamarisk.
7. NCA is focused on stream health and recreation opportunity along this stretch of the North Fork.

Environmental Questions:

1. [REDACTED] has not noticed significant changes in the north fork at his location
2. Russian Olive is certainly a problem once you leave the Gunnison Forks take-out area and head upstream.
3. Sediment loads are an issue during the spring. Gold medal fisheries from the Black Canyon down to the confluence. Managed as gold medal fisheries below but currently does not have the status. Though [REDACTED] thinks believes that if they went through the process, they would probably designate it as such.
4. [REDACTED] has not really spent much time on that particular stretch of river
6. See #3
7. unsure
8. [REDACTED] thinks that Salinity, Selenium, and sediment are the biggest water quality issues coming out of the North Fork.

Recreation Questions:

1. Not very often
2. Frequent recreation use. Most people coming down the North Fork take out at the Gunnison Forks area.
3. [REDACTED] believes that the recreation management along the NCAs north fork section is pretty good. The Gunnison Forks picnic area is nicely kept with tables and shelters.

Additional Notes:

[REDACTED] has managed the Gunnison Gorge NCA for nearly 10 years. His focus has not been at the confluence. [REDACTED] has seen significant increases in recreation at the gorge.

Water quality monitoring has been conducted along the Gunnison River by [REDACTED]

He thinks there could be some improvements made to the riparian corridor, but it hasn't been a large issue for them. Most of the river on the NCA property is void of vegetation until it leaves.

There used to be issues of homeless living along the North Fork at this section but not anymore.

We did talk a lot the opportunities that recreation businesses (such as Western Slope SUP) are bringing to the NCA and the North Fork. [REDACTED] supports that type of business.

Semi-formal Interview

Landowner Questions:

1. Paonia Ditch
2. 1/8 mi approx
3. no
4. Single main channel. Braided (canal?) around large island. Riparian corridor is high cottonwood canopy with willow understory. Lots of tamarisk on his property. Lots of small Russian Olive.
5. No restoration work has been done that [REDACTED] knows of. It does look like someone has dug a canal around the outside of the island. [REDACTED] says he lost some stream bank this year. The banks are steep.
6. Needs additional work to remove Russian Olive. [REDACTED] has done some Russian Olive removal.

Environmental Questions:

1. [REDACTED] has only owned this property for 1 year. He has seen some movement of the river. And he says that it was difficult to get a survey done because the property boundary is vague back there by the river. It may be that he owns river front part of the time but not always.
3. No, but he gets a lot of sediment in his irrigation ditches.
4. See no 1
5. He says he sees all manner of wildlife on this property. Elk, Mule deer. Lots of skunks. We stepped over a big fresh pile of bear scat on the day we visited.
6. No, but he said he has done some fishing in the river. He has caught trout. Not sure what kind.
7. Riparian corridor is quite good along the property, Russian Olive notwithstanding.
8. Did not ask this question.

Recreation Questions:

1. Yes. fishing, floating, swimming. Mostly his own property and downstream
2. [REDACTED] said he hasn't had too many issues with recreationists. He found a half finished 6-pack of beer floating once. He also said that he had some hunters trespassing on his property. He left his number and they called him and stopped by. He said they were confrontational at first,

saying that they had hunted here for 30 years. He kindly explained that it was his property and told them they needed permission.

3. [REDACTED] said he is not opposed to recreation along the river. Would even allow people to fish along the banks as long as they weren't problematic. He doesn't have a problem with people stopping on his property. He thinks there needs to be better signage along the river.

4. See no 3

5. Still new to the area

Additional Notes:

[REDACTED] has just moved to the area from the [REDACTED]
[REDACTED] He is interested in getting rid of his Russian Olive and Tamarisk and would like to find ways to work with us and others.

Semi-formal Interview

Landowner Questions:

2. 2 mi approx

4. Mostly single channel. One -two islands

5. Yes, some work with NFRIA along the banks. J-hooks. Most of the work has eroded away.

[REDACTED] has done a lot of Russian Olive and Tamarisk removal through the Delta Conservation District.

6. Still need work to remove Russian Olive and Tamarisk. [REDACTED] would like to have more Russian Olive removal completed. [REDACTED] remembers a time when you could not find a Russian Olive along the North Fork. This was as recently as the 1990s. While cutting trees on this property last summer, the oldest one found was 37 years old.

7. [REDACTED] primary concern as a riverfront landowner is streambank erosion, trespassing, Russian Olive removal.

Environmental Questions:

1. This particular stretch of river has changed dramatically over the many years of his family's ownership. [REDACTED] showed me sections of the property where the river used to flow nearly ¼ mile away from its current channel. NFRIA did a lot of work on his property, but [REDACTED] feels like there isn't a whole lot you can do to keep this river from moving and is not convinced that people should spend a ton of money trying to make it do a certain thing.

[REDACTED] showed me a place that is now a wetland where the river took out nearly 500 feet of stream bank in a single day. He said it was during a really high flow event. [REDACTED] feels it is more important to be a steward of the land (riparian corridor) than it is to try and force the river to behave a certain way.

2. Yes, see above

3. Sedimentation is an issue, but [REDACTED] has not had any bad experiences as a result. He believes that the sediment rich river is what supplies the valley with nutrients.
4. See above question 1.
5. [REDACTED] property is full of mule deer. He has had bear fairly frequently in the spring. He said there was a mountain lion hanging out down there this past spring. It had kittens on a site just upstream. He is not a fan of the Yellow Billed Cuckoo. He feels the bird has too many protections. He believes getting rid of Russian Olive is way more important. He wonders if clearing out whole sections of understory is really that detrimental to the birds. He feels like they should be able to adapt to change. And he thinks that leaving a few Russian Olives for habitat will only be shooting yourself in the foot.
6. [REDACTED] has not noticed any changes to fisheries.
7. Pretty good. [REDACTED] is thrilled with the removal of Russian Olive. He really appreciates the increase in the amount of pasture land.

Recreation Questions:

1. Fishing when there is time
2. [REDACTED] says he hasn't come into contact with recreationists very often. When he has, it has not been problematic. He has had more trouble with homeless people setting up camp on his property. However, he said that with the removal of Russian Olive, people don't squat like they used to. He said the problem used to be a lot worse.
3. [REDACTED] doesn't have a problem with river recreationists. But when I asked him about the boat ramp and other landowner issues, he said that we need to address those problems. He said they had a meeting several years ago about river access, and he posed the question about who was liable if a boater gets sucked under a downed tree and drowns on your property. No one could come up with a good answer.
4. [REDACTED] says we need more signage at the ramps, but he doesn't want to see a river corridor full of signs.
5. Increase in boaters

Additional Notes:

To reiterate the point, [REDACTED] would like to have more work done to remove Russian Olive. He has done a lot of removal himself with a bulldozer. This has actually been largely successful, but it makes a mess and opens the ground up to other weeds. He has a big section that he cleared of Russian Olive. He struggles with thistles in disturbed areas.

[REDACTED] also said that in his experience it doesn't matter how much Russian Olive you remove, if you don't have a landowner who will follow up and spray it you will not solve the problem. He spends a lot of time spraying re-growth. He also said the cows will graze it off if the new shoots are young enough. Cutting and spraying in mid-summer before the seeds come on has had the best results.

[REDACTED] said that he considers himself an environmentalist and steward of his own land. He says he would be willing to help out with efforts in any way he can.

Semi-formal Interview

Landowner Questions:

1. No agricultural water on the property, water for the Hatchery comes from a spring located at the toe of Rogers Mesa.
2. 1 mile of total river. ½ mi at the old hatchery and ½ mi at the new one
3. Live water from the spring mentioned above.
4. The North Fork is braided with 1-2 islands at the site of the old Hotchkiss hatchery (located approx. 1.5 miles upstream). The river is primarily single channel along the new hatchery. Small boulders are scattered along the sides of the river. I did not get a chance to see the old hatchery site, but it looks to be low-lying floodplain with a lot Russian Olive. The river bank by the new hatchery is steep but stable. The public uses the downstream end of the hatchery as a boat put it. It is a low, easy bank to the river.
5. Yes, restoration along the old hatchery site. NFRIA helped with the removal of the Chipeta diversion dam at the site of the old hatchery. Delta county did some tamarisk spraying a few years back.
6. Bank stabilization still needs to be done in some areas. Russian Olive was removed. Still tamarisk in areas. The old Hotchkiss hatchery site is in need of more restoration work. US Fish and Wildlife would like to find a suitable use for that site, or sell it. some channel work still needs to be done.
7. [REDACTED] primary concern as a landowner is the transportation of invasive species and disease into the hatchery spawning areas. This is a major concern of theirs as recreation numbers increase.

Environmental Questions:

1. [REDACTED] has noticed that the river is decreasing in water quality. He feels this is due to increased sedimentation. He also thinks that the river is too warm most of the year. The fish he catches show signs of water that is too warm. Ex. soft muscle tissue
2. No
3. Yes, [REDACTED] thinks sedimentation is increasing and he is not sure why
4. As US Fish and Wildlife employee, [REDACTED] primary concern is with the hatchery itself. He has not spent a lot of time observing the riparian corridor.
5. Did not ask this question
6. [REDACTED] says there has been a big change in fisheries in the north fork. He says that 20 yrs ago you would never find a Brown trout. Now you find big browns up to 28". There are some big Rainbows too. He caught at 24" rainbow last week near the hatchery. He thinks that Browns can tolerate lower water quality and warmer temperatures.
7. Moderate
8. [REDACTED] feels that sedimentation loads are the biggest threat to water quality in the North Fork

Recreation Questions:

1. Yes, fishing
2. frequent contact with water recreationists. Every weekend. Many people get out at the Hatchery. Many don't know where they are going. North Fork River water is not allowed within the spawning pools. He has had to tell multiple people that river water cannot be brought up to the hatchery.
3. There needs to be more education around the river in general
4. Signage and fishing tourism
5. A substantial increase in boaters

Additional Notes:

One additional reason for interviewing the Hotchkiss Fish hatchery was to give them a chance to formally express their concerns regarding recreation and the spread of aquatic disease. This has been a significant issue for them. Water from the river is strictly forbidden within the hatchery. Water for the hatchery spawning comes from a spring at the toe of Rogers Mesa. They do not want visitors coming up from the river to the hatchery pools and risk transmitting disease. They have had several instances of people pulling their boats up the steep bank and emptying water on the ground. This could lead to contamination if one of the Hatchery staff were come into contact with the water and spread it to the beds

In addition to raising fish, the US FWS is also a public recreation and education entity, so they approve of public access at the hatchery. A major issue for them is that boaters do not know where to go when they enter the hatchery. There is no signage along the river to tell boaters where the put in/ take out is. There is no sign when you come into the hatchery drive letting boaters know where to park for put in/ take out. The Hatchery is hesitant to promote boater access but do not have a problem with people using their site as long as they take out downstream of the hatchery. There is a nice gravel drive for this purpose but again, no sign.

In 2016, the hatchery was infected with a bacterial kidney strain from eggs delivered from a state-run hatchery. [REDACTED] said the cost to clean up was \$1.5 million. They had to kill half of their fish, treat the rest with antibiotics, and completely sanitize the hatchery. They were tested 3 separate times to determine that they were a safe facility to resume the hatchery. Estimated cost to the fishing recreation industry in the US was estimated to be \$35 million. [REDACTED] said that if it ever happened again they would probably just close the doors.

We spoke for a long time about the old hatchery site located upstream. This site was abandoned many years ago. [REDACTED] and I did discuss why it was abandoned. NFRIA helped remove the Chipeta dam, which functioned as the diversion gate for the hatchery. The hatchery site presents an opportunity for riparian restoration.

██████████, Landowner
Semi-formal Interview

Landowner Questions:

1. Yes, Shephard Willmont Ditch diversion. Senior right
2. 1/3- 1/2 river miles
3. Yes, 4 ponds and groundwater connected wetlands, the PPR water ditch - installed many years ago.
4. Previously braided flat river. After NFRIA project it is a single channel with boulders. Riparian vegetation is primarily wetland terraces with multiple pond structures. Canopy is dominated by cottonwoods near the river. Understory is willows with some Russian Olive. Open wet meadows throughout. Some wetland work was completed by enhancing the existing old river oxbows.
5. Yes, NFRIA work. Multi-year project. Braided river to single channel, willow transplants. Wetlands construction completed 2011 through Partners in Wildlife funds.
6. Bank stabilization still needs to be done in some areas. Need Russian Olive Removal. Still some channel work that needs to be done
7. Loss of river front due to stream bank erosion. Forced easement.

Environmental Questions:

1. River has changed from instream gravel piles to channel meanders as a result of the NFRIA projects.
2. Stream banks have deteriorated all along the river. ██████ feels strongly that upkeep of the work NFRIA completed is very important.
3. No
5. A wide variety of wildlife visit ██████ property. 39 acres of waterfowl habitat. One confirmed Yellow Billed Cuckoo sighting. Winter elk in the riparian zone.
6. ██████ believes that oil and gas exploration and livestock pollution represent the biggest threats to water quality along the North Fork.

Recreation Questions:

1. Yes, float, fish, family swimming on the property
2. Infrequent contact with water recreationists. No conflicts.
3. Adequate flow for fisheries
4. River access, Hotchkiss boat ramp, Fish Hatchery
5. Flow issues, NFRIA Float

Additional Notes:

██████ is very interested in continuing the work completed by NFRIA. He is very concerned about keeping the work up to date. Ongoing maintenance is a concern to him because he sees some of those originally structures falling apart

██████ is also concerned about ████████████████████. The North Fork Valley Impound property is located ██████████ along the river. Many old and neglected cars sit directly on the

river bank. There are many cars and trucks in very poor condition. There is a crusher on site and therefore containment petroleum pollutants could be a problem with proximity to the river.

████ and █████ have been in the North Fork for many generations. He remembers when dozers would push the river up into piles of gravel. He was excited about the work that NFRIA did to restore the river and wishes that WSCC would find the funding to do more of the same. He was encouraged by the Watershed Management Planning process taking place. He is hopeful that some funding will come out of it.

Landowner Questions:

Did not discuss

Environmental Questions:

Did not discuss

Recreation Questions:

1. Yes, Kayak / rafts

a. Anthracite Creek Erickson Springs to Fire Mountain Diversion, River Park to Confluence

2. █████ He has occasional interactions with other recreationists on the river

- a. Fire Mountain Canal Diversion has been a dangerous obstacle to boaters. Significant amounts of trash also get caught up in it. █████ says that Fire Mountain Diversion takes nearly 1/3 of the fish out of the River. It is positioned inappropriately to the river flow. █████ recommends that at the very least, they move some of the boulders out of the way so that boats can pass safely through it.
- b. Farmers Ditch is a dangerous diversion. One instance was nearly fatal in 1997. Needs a boat chute. █████ knows of a few recreational conflicts.
- c. There was also the illegal put-in just downstream of the Hwy 92 bridge in Hotchkiss. The property owner has had to put up barricades to keep people from trespassing.

3. Lack of legal access. It curtails promotion and economic development

4. Communication and cooperation. █████ says that one of the biggest challenges to water related issues is that various users do not communicate with each other.

5. █████ has seen a significant increase in boating recreation on the river during his time here. Anthracite Creek used to be closed due to some property owners fencing the river, but not so anymore. Also, Stand UP Paddleboards (SUPs) are changing water recreation. █████ says that SUPs are doing to white water recreation what snowboards did to skiing. Western Slope SUP in Hotchkiss is a good example.

Semi-formal Interview

Landowner Questions:

1. There is a diversion off Anthracite Creek that serves his property. There is one other property owner on the diversion, which is Bear Ranch on Anthracite Creek.
2. 1/4 mi approx of Anthracite Creek, 300' of Muddy cr. The North Fork of the Gunnison begins at his ranch.
3. no
4. Anthracite Creek is braided and rocky. Muddy Creek coming out of Paonia Reservoir dam has been heavily re-channelized, and is essentially a canal from the spillway. Riparian zones on both creeks are small willows and wetland shrubs. A few spruce trees are tucked around between the ranch buildings.
5. [REDACTED] recently purchased the ranch. He did not know if anyone had done significant restoration projects. They are not evident. However, Anthracite Creek has good drop structures and flow behind the property. This is likely natural.
6. [REDACTED] would like to create excellent fishing opportunities for his camp guests. He would be glad to allow public access to the river for boaters as long as it was managed properly. He is considering putting in a low incline ramp.
7. [REDACTED] is very conscious of sustainable recreation. He wants to create an environment where guests can enjoy all of the benefits of river recreation.

Environmental Questions:

1. [REDACTED] has not owned the property very long.
2. No
3. No
4. See no 1
5. [REDACTED] sees a wide variety of montane forest wildlife Such as deer, elk, bear. There were several piles of bear droppings observed while we walked the property. He encountered a bear just last week one evening after walking around the corner of his shed.
6. The fisheries are excellent at [REDACTED] property. He recently had a friend who was once an outdoor writer for the Denver Post up for the weekend and he caught approximately 25 fish with a couple of 17" and 20" browns and rainbows.
7. The confluence and start of the North Fork is quite good. Substantial amount of small willows and wetland shrubs extend out from the peninsula between Anthracite Creek and the Muddy.
8. Did not ask this question

Recreation Questions:

1. [REDACTED] purchased this ranch with the intent to develop the property as a luxury RV camping facility. He plans to build 28 RV Sites, and develop the river for fishing and whitewater recreation.

2. [REDACTED] has not seen much activity on his stretch of the river. Not very many people use Anthracite Creek for recreation. He has seen a fair amount of fishing going on below Paonia Reservoir Dam.
3. [REDACTED] is still unfamiliar with the area. He would like to engage more with the recreation possibilities and planning along the North Fork
4. See no 3
5. Still new to the area

Additional Notes:

[REDACTED] has been involved with the outdoor recreation profession for 20 years. [REDACTED]
[REDACTED]
[REDACTED]. [REDACTED] has a vision for his new property and is looking to partner with conservation and river restoration groups in any way that he can. [REDACTED]

Semi-formal Interview

Landowner Questions:

1. Industrial Ag use. Subterranean gallery intake under the North Fork of the Gunnison. USACE permits for water use. Reclamation water recycled from underground sources. West Elk's junior rights frequently get called out, at which time they begin to divert water from Lost Lake Slough. They do not discharge any water back into the river.
2. 4 mi of river
3. Live water from Sylvester Gulch, an ephemeral stream.
4. The North Fork is mostly single channel along the main property of the mine. Several other stretches are braided. The mine owns property upstream as a mitigation site for work in Sylvester Gulch. The highway bridge crosses West Elk property and is heavily armored around buttresses. River was altered when the old highway was removed.
5. Yes, mitigation work upstream at the mouth of Sylvester Gulch was completed 25 yrs ago, was monitored for 5 yrs ago.
6. Still need to remove Russian Olive and tamarisk. [REDACTED] said 5 years ago they worked with WSCC to remove many of these species along the river in various places.
Still some channel work that needs to be done
7. West Elk's primary concern as a riverfront landowner is issues with trespassing because they own such a long stretch of river and it is not easily managed.

Environmental Questions:

1. The river has changed as you would expect a river to change. Straightening a section of river led to overtopping banks and a cottonwood grove which was drowned.
2. No
3. Yes, [REDACTED] feels like sedimentation is becoming a larger problem as Paonia Reservoir fills in. During May and June, West Elk has a difficult time keeping their intake galleries clear of debris. When they get choked down they clean out the galleries with heavy equipment.

4. [REDACTED] said that she hasn't spent much time observing how the riparian corridor has changed.
5. All along the river is winter elk and mule deer habitat. They see a wide variety of species using the river at all times of the year.
6. [REDACTED] does not know of any changes to fisheries at their location
7. Moderate to good
8. [REDACTED] feels that operationally, sedimentation loads are the biggest challenge to water quality.

Recreation Questions:

1. no
2. Infrequent contact with water recreationists. [REDACTED] [REDACTED] concerns with West Elk's intake galleries. [REDACTED] told me that [REDACTED] was upset with them at one point because of some structures they placed in the river for their intake. A few years ago a large chunk of ice broke free and gouged a new channel around the West Elk water intake. So, they had to do some excavation work to create a "Boulder Garden" that would push back the water into a pool area for their water intake. [REDACTED] [REDACTED] about it and when he came through in a kayak he almost crashed against one of the boulders. [REDACTED] was upset that they didn't let anyone know what they were doing.
3. River Access Opportunities see below...

Additional Notes:

[REDACTED]

Semi-formal Interview

Landowner Questions:

1. Yes, Paonia Ditch
2. ¼ mile
3. Yes, two Beaver Ponds
4. River channel is braided with a large single island. Property is located on the outside bend of the river. Riparian Zone is high canopy cottonwoods with native shrub understory. Some wetland ponds from old ox-bow channels.
5. [REDACTED] has completed several riparian restoration projects on the property including planting of native shrubs. There seem to be remnant J-Hooks on neighbor's opposite side of river. No instream channel work that he knows of on his property.
6. [REDACTED] has done a good job of removing invasive phreatophytes on his property. He does have some issues controlling quack grass in his pastures.
7. Loss of riparian habitat

Environmental Questions:

1. [REDACTED] has owned this property since 2005 (13 yrs.) and has seen the river move a little bit every year.
2. Major flood in early 80's changed the river channel dramatically. Previous landowner says the river channel moved 300' in a single event.

3. He does not know of any major changes to water quality.
4. [REDACTED] believes that in many ways his property and riparian corridor have improved since his time of ownership. He believes that many bird species are using orchards as habitat in the riparian zone.
5. He sees a wide variety of species using the river at all times of the year. [REDACTED] showed me the place where a mountain lion recently killed one of his goats.
6. [REDACTED] does not know of any changes to fisheries in the river. [REDACTED] has conducted a number of bird surveys along the river corridor with the Rocky Mountain Bird Observatory. He believes that populations in general are showing good health here.
7. He believes that the North Fork river corridor represents one of the few relatively intact and unmanaged riparian corridors in Colorado. He recommends keeping it wild and not push development.
8. was not aware of water quality issues

Recreation Questions:

1. Yes, floating. Entire river
2. Infrequent contact with water recreationists. Has not had any problems. Has seen a significant increase in use.
3. None
4. Would like to see more focus around river and riparian education
5. See no. 2

Additional Notes:

[REDACTED] worked for the Rocky Mountain Bird Observatory for many years. He had some good suggestions for improving riparian habitat along the river. [REDACTED] believes removing all Russian Olive and Tamarisk from the understory could be detrimental to wildlife. He understands the invasive nature of these two phreatophytes but also says that they offer important habitat. He recommends a phased approach when removing these species. He also recommends that native understory species be planted at the same time of the removal activities and widening the Cottonwood galleries. [REDACTED] believes that the North Fork of the Gunnison River riparian zones has been relatively unmanaged and undeveloped over the years. He believes that is why the Western Yellow-billed Cuckoo is found here. He recommends that any improvement to the riparian corridor along the North Fork be done in such a way that it remains wild and undeveloped. [REDACTED] encourages recreation improvements but does not support a river developed for the sole purpose of recreation.

Appendix F: List of previous reviewed assessments

1. Preliminary Assessment of the Morphological Characteristics of the North Fork of the Gunnison River, Jeffory P. Crane
2. Watershed Restoration Action Strategy for the North Fork Gunnison River, North Fork River Improvement Association
3. North Fork of the Gunnison River Watershed Plan *Update*, North Fork River Improvement Association
4. Assessment of Aquatic Ecosystem Restoration Projects 1999 - 2014 North fork Gunnison River Delta County, CO. Crane Associates - prepared for the Western Slope Conservation Center
5. Volunteer Water Quality Monitoring Network, April 2001 – April 2014 Data Report, Western Slope Conservation Center

Appendix G: About the Western Slope Conservation Center

Established in 1977, the Western Slope Conservation Center (WSCC) is a 501(c)3 non-profit group that formed to disseminate information about regional energy development and its impacts on the region's natural resources. Today, our mission is to build an active and aware community to protect and enhance the lands, air, water and wildlife of the Lower Gunnison Watershed.

As a result of our work, in 35 years the communities of the Lower Gunnison Watershed will be characterized by intact and functioning ecosystems, clean and abundant water resources, well-managed lands with the highest level of protection they deserve, and informed and an engaged citizenry that understand the connection between the vitality of its ecological and social Communities.

In 2015, the Board of Directors affirmed our commitment to the following goal areas:

- Watershed Stewardship
- Advocacy for the Protection of Public Lands
- Education and Public Outreach

We distinguish ourselves by committing to four unique values.

- Transparent, responsible, and ethical in our actions. We strive for integrity in all of our efforts. We are accountable to our mission, membership, donors, partners, and the public.
- Guided by science. We use reliable, relevant, and the best-available scientific research to guide our decisions whenever possible.
- Respect for the environment and diverse communities. We strive to include the active involvement of the people and partners who are linked to the ecosystems we endeavor to protect. We consider the needs and values of our community. We build relationships based on trust and mutual benefit.
- We seek tangible and enduring results. We use informed debate and creative problem solving to develop locally appropriate solutions to complex conservation problems.