San Miguel River Restoration Assessment

Volume I: Final Report

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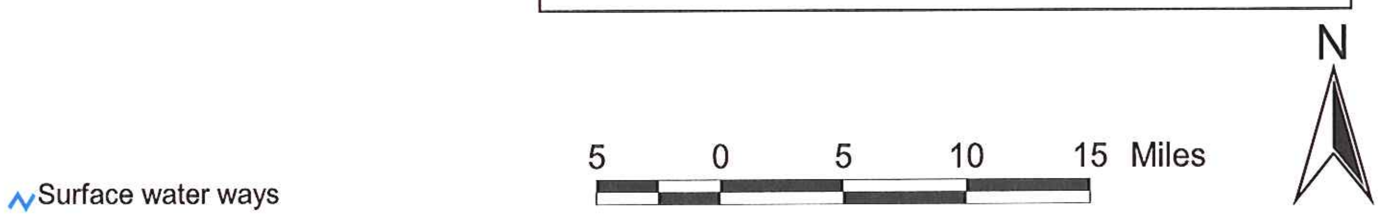
San Miguel River Restoration Assessment

Map 1 : Watershed Map



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The San Miguel River Restoration Assessment

Introduction

The *San Miguel River Restoration Assessment* was conceived to merge scientific information with stakeholder consensus to analyze and prioritize possible restoration sites on the main stem of the San Miguel, and on major tributaries.

The San Miguel River, in southwest Colorado, is one of the west's last free flowing rivers. Although there are some impoundments on tributaries and some diversions, the river is hydrologically intact. Attributable to this are the native riparian plant communities found in the river corridor. Scientific studies recognize the San Miguel as harboring one of the longest and highest-quality stretches of high-quality deciduous and evergreen riparian forests and shrublands (about 80 miles) in the western United States. These studies also establish the ecologic, hydrologic and geomorphologic context in which these San Miguel riparian communities exist.

The watershed supports at least eleven known globally-rare riparian plant communities, 9 high-quality examples of more common plant communities, 6 globally rare animals (including 2 fish), 16 globally rare plants, and 12 declining species (including 2 fish). Declining species are species declining through all or a significant part of their ranges.

The goals of this ***San Miguel River Restoration Assessment*** are to:

1) Identify elements of biodiversity, their condition, and the ecological and hydrological processes that sustain them;
2) Identify and prioritize restoration reaches and activities that will help restore and maintain those elements and processes.

To assist with the prioritization of restoration activities and sites, the assessment included a stakeholder outreach component. Watershed stakeholders were interviewed and/or participated in facilitated meetings to describe unique, local political, economic and social factors relevant to the prioritization process.

The study found that, for the most part, human caused degradation in the San Miguel River corridor is site specific. A variety of human activities degrade specific sites, altering local hydrology, and impacting and fragmenting riparian and aquatic habitat. This restoration assessment identifies those specific sites and the reaches they lie within, and prioritizes them based on projected benefits of restoration to biodiversity.

In all, seventeen potential restoration sites were identified. Five reaches were selected as highest priority, though restoration of any of the sites identified is valuable and each should be pursued subject to local interest and opportunity.

One important addition to the recommendation to restore specific sites is the recommendation that the ice flow phenomenon more carefully studied. Ice flows originate in the South Fork and move more than 20 miles downriver. These releases scour the channel and banks of the river, damage riparian vegetation, destabilize banks, cause erosion and may impact fish habitat. The intensity of ice releases and ice flows appears to be increasing, and may be related to winter water releases from the Ames Power Plant. If studies prove such to be the case, controlling or at least lessening the impact of ice flows may be possible by altering water releases from the Ames plant at critical times of the year.

The ***San Miguel River Restoration Assessment*** was funded by a grant to San Miguel County by the United States Environmental Protection Agency. This assessment has been a cooperative effort of the San Miguel Watershed Coalition, The Nature Conservancy, San Miguel County and the United States Geologic Survey.

Acknowledgments

This assessment has benefited from the work, expertise and assistance of numerous professionals from the scientific community, from conservation organizations, and from government agencies; and from the many local citizens who gave unselfishly their time, insights and opinions. To all of these individuals, we extend our appreciation.

At the risk of unintentionally missing people who contributed to this study, we thank the following individuals (in no particular order):

Lory Herndon, Steve Dunn, Mary Helen deKoevend (Mayor, Town of Nucla), Marie Templin, April Montgomery (San Miguel County Open Space and Parks Department), Pamela Lifton Zoline, Art Goodtimes and Vern Ebert (Commissioners, San Miguel County), Nels Werner, John Buffington, Leigh Sullivan, Ascenzo Digiacomo, Greg Hall (Mayor, Town of Naturita), Lance Wade, Caroline Byrd and Mallory Dimmitt (The Nature Conservancy), Jim Boyd (Natural Resource Conservation Service), Nat Muillo and Mike Wireman (United States Environmental Protection Agency), Sherman Hebein (Colorado Division of Wildlife), Chris Hazen, Dave Schneck (San Miguel County Environmental Health Department), Leigh Sullivan (USFS/BLM San Miguel River Ranger), Dr. David Groeneveld, Rich Madole, Jonathon Friedman (United Stated Geological Survey), Gary Weiner (National Park Service, River and Trails Program) and Dennis Murphy (U.S. Bureau of Land Management).

This study also benefited from a concurrent ***San Miguel River Instream Flow Assessment*** being conducted by the Montrose office of the United States Bureau of Land Management.

San Miguel River Restoration Assessment
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The San Miguel River Restoration Assessment is printed in two volumes as Volume I: Final Report and Volume II: Appendices.

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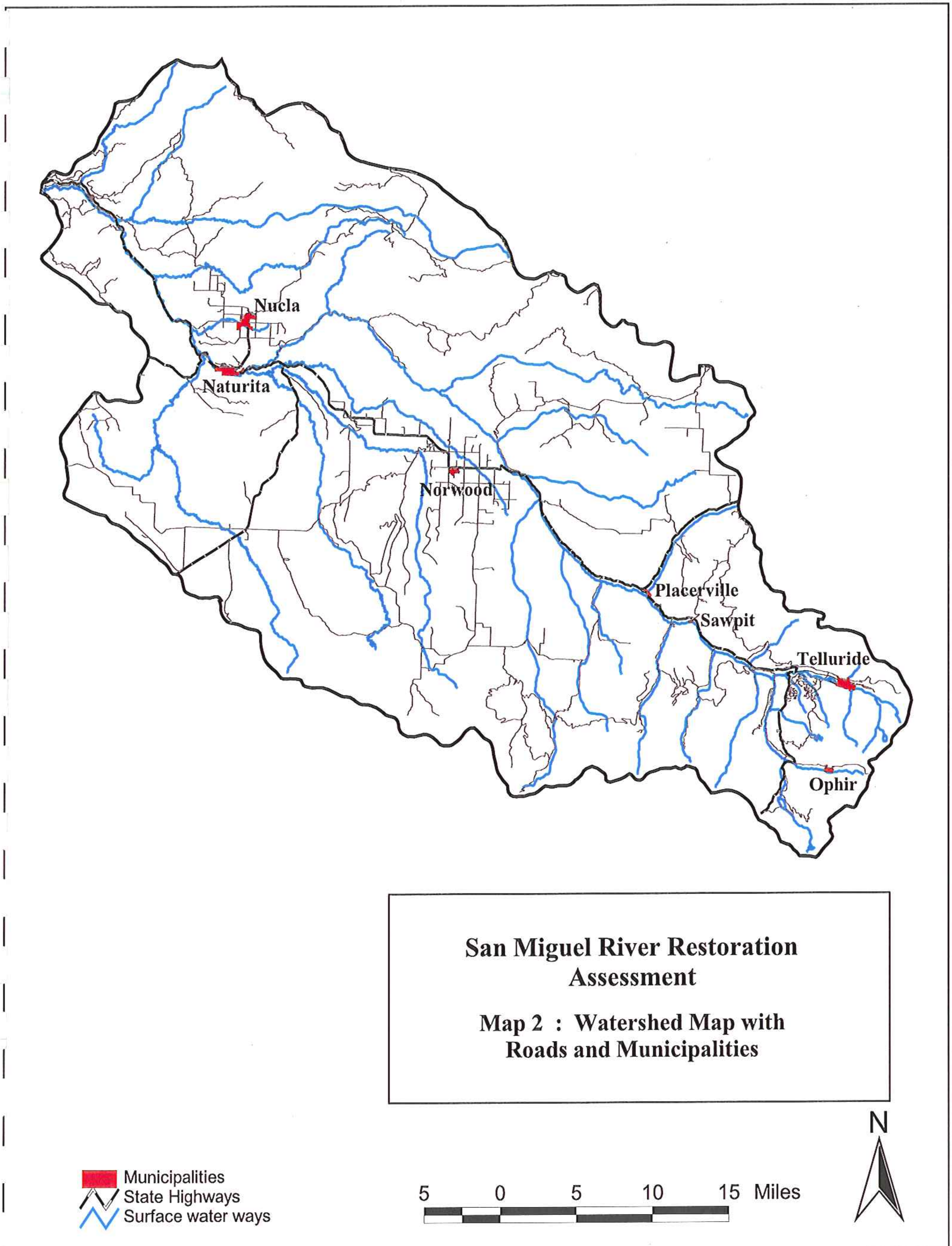

San Miguel River Restoration Assessment

Map 2 : Watershed Map with Roads and Municipalities

Assessment Objectives

The objectives of this assessment are to:

1) Identify elements of biodiversity and their condition, and the ecological and hydrological processes that sustain them;
2) Identify and prioritize restoration reaches and activities that will help restore and maintain these elements and processes.

To accomplish these goals, the assessment management team convened a science team to 1) consolidate and analyze biodiversity information; and 2) develop a list of disturbed sites; and 3) prioritize those sites according to projected benefits to the targeted biodiversity values.

The assessment management team sought to merge the priorities of the science team with those of local citizens via a program of facilitated stakeholder outreach. Watershed stakeholders were interviewed and/or participated in facilitated meetings, and generated a list of prioritized restoration reaches.

Restoration Goals

Syntheses of the science team and stakeholder meetings yielded the following general restoration goals for the San Miguel River:

1) Restore healthy and diverse native habitat and populations, including: native, regenerating riparian plant habitat and communities; aquatic fish and insect habitat and communities; and native bird habitat;
2) Restore and maintain water quality;
3) Re-establish hydrologic processes, including channel migration and re-establishing the hydrologic connection between channel and floodplain.

To help meet these restoration goals, four general conservation recommendations are made for the entire watershed. They are:

1) Maintain seasonal high flows;
2) Re-connect river channel to floodplain where practical, removing dikes and other artificial impediments to flooding, and to natural channel migration;
3) Prohibit cattle from accessing the river channel, and limit grazing in the riparian floodplain to ecologically appropriate times;
4) Control invasive weeds in the riparian zone.

One additional recommendation, specific to the upper watershed, is to study ice flows originating on the South Fork and scouring the channel and banks of the South Fork and mainstem for over twenty miles. Ice flows are a major impact to the health of the river. The intensity of ice releases and ice flows appear to be increasing, and may be related to winter water releases from the Ames Power Plant. Also, homeowners along the South Fork also contend that occasional operating malfunctions at the power plant may be just as responsible for triggering ice flows and bank erosion at other times of the year as actual water releases to generate electricity (Janke, personal communication). If studies prove either or both to be the case, controlling or at least lessening the impact of ice flows may be possible by altering water releases from the Ames plant at critical times of the year (Groeneveld, personal communication). Currently, San Miguel County and the BLM are cooperating to complete such a study.

It is the considered opinion of the science team that these recommendations will allow the San Miguel to regenerate and restore itself in all but the most extremely disturbed locations.

Protecting natural high flows, that is, allowing high flows to continue as a functioning process, is the single most important conservation recommendation of this report. It is also the most cost-effective. In reaches of the San Miguel requiring restoration, the river channel will restore itself, for the most part, if the natural hydrograph is respected and high flows are maintained (Andrews).

Reconnecting channel to floodplain is important because natural flooding improves riparian plant habitat, enables cottonwood regeneration (Fleener), redistributes nutrients, creates and recharges backwater habitat for native fish rearing. Reconnecting channel to floodplain also provides for lateral channel migration, which allows the channel to absorb energy, drop sediment, and to create and maintain riparian plant and aquatic habitat.

The impacts of degraded water quality often migrate downstream and are difficult to completely assess. They affect the health of the riparian plant and aquatic, particularly native fish, communities.

Priority Restoration Reaches

The three highest priority reaches, in order of greatest projected benefits to biodiversity, are:

1) San Miguel River, Dry Creek to Tabeguache Creek;
2) San Miguel River, Horsefly Creek to Cottonwood Creek;
3) Deep Creek and its tributaries;

The next highest priority reaches, with additional information needed, are:

4) Howard Fork of the San Miguel, Swamp Creek to Lake Fork;
5) Telluride Valley Floor, mainstem of the San Miguel, Butcher Creek to Prospect Creek.

Specific restoration recommendations are reported in the site descriptions in section II, Prioritized Restoration Reaches.

The Need for a San Miguel River Restoration Assessment

Despite one hundred and twenty years of intense human use, including mining, road building, logging, agriculture, and, in more recent times, intensifying recreational use and resort development, the San Miguel remains one of the west's few remaining healthy and intact watersheds. Health, however, is a relative term. The high quality riparian plant communities face a variety of threats, and the native aquatic fish communities have all but disappeared. Specific, degraded sites within otherwise intact reaches fragment the ecological and hydrological integrity of the river.

In the upper watershed, localized, disturbed sites, both within and outside the river corridor itself, impact the health of the river. Hard rock mining sites, including tailings and waste rock piles, and open adits continue to degrade water quality, despite most mining activity having ended more than a half century ago. Road building has increased sedimentation, and in places, contributes to straightening and widening of the stream channel. Gravel mining, though now mostly discontinued, has severely impacted the river channel in places. Non-native fish species, including rainbow trout, compete with native species for food and habitat.

Ice flows, perhaps enabled by altered winter stream flows related to hydroelectric power generation at the Ames Power Plant, scour the stream channel and destabilize bank vegetation. Affects of ice flows are observable for over 20 river miles, beginning on the South Fork, in Ilium Valley, and stretching downstream past Placerville. Ice flows may also impact fish populations, as they create dams potentially stranding fish in shallow sections of the river where the they are less able to protect themselves from additional freezing (Murphy, personal communication).

The BLM, consulting with the US Army Cold Regions Research and Engineering Laboratory, concurs that surges from the Ames Power Plant are likely a factor in triggering ice flow releases, and may also contribute to the manner in which ice building occurs in the river channel downstream of the Ames plant. They observe that all ice flow events in recent years have originated in the South Fork below the power plant. Also, all documented ice flows in the last twenty years have occurred in late December or early January (near the winter solstice), and ice release and ice flows are related to consecutive sub-zero temperature days.[1]

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[1]Ferrick, M.G.; and Murphy, D. Unpublished. Investigation of River Ice Process on the San Miguel River, CO. US Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

Some believe that understanding and, if possible, reducing ice flow impacts may be the single most important restoration issue in the upper basin. David Groeneveld writes:

"The simplest hypothesis for loss of bank stability is that it is due to ice flows in recent years that have changed frequency or magnitude due to changes in discharge from the Ames power plant. Power plant discharge provides energy, i.e., surging water that is warmer (by a degree C, or so) than the channel (at 0 degrees C) at much higher volume (probably at least 500% greater) that initiates an ice flow within the ice-bound winter channel. If this is so, a simple set of operating guidelines for power plant operation during December and January could easily reduce the potential for ice flow releases. Since curtailing power generation that offsets extremely high power consumption in the region due to resort operation will likely have an impact upon power plant revenues, conclusive proof is probably necessary. The key will be to first conclusively demonstrate that the Power Plant is responsible for the ice flows that, in turn, impact riparian vegetation and then bank stability and erosion. The key is to demonstrate causality and not just coincidence".[2]

In the lower watershed, dikes and riprap, in places, prevent flooding and inhibit channel migration. Water diversions impact late summer river flows. Irrigation return flows alter water chemistry. Cattle grazing in the river channel and floodplain is altering native vegetation composition and increasing stream bank erosion, contributing to straightening and widening of the stream channel, and warming of the water. Invasive exotic weeds, introduced into the watershed by people and livestock, displace native plants and transpire water out of the ground.

Remediation and mine clean up has occurred at some sites within the watershed, most notably at the Vancorum site downstream of Naturita, at the Umetco Mill site at Uravan, and at Telluride, where Newmont Mining Company is completing remediation of the Idarado millsite and mining complex.

At Uravan, mill tailings were relocated out of the floodplain to an upland hilltop in 1989. Since the removal of the tailings and the resulting decrease in salinity, native fish species not found in the San Miguel in over 40 years have again been sampled. Salinity that once flowed from the base of the Uravan tailings caused what biologists called a "biological dam" that deterred native fish migration to and from the Dolores River. Also, the Dolores itself continues to improve as native fish habitat due to salinity control projects and summer-long water releases from McPhee Dam, over 100 miles upstream on the Dolores from its confluence with the San Miguel.

[2] Groeneveld, David P. 2000. An Overview of Recent Bank Instability on the San Miguel River. Unpublished report. Submitted to San Miguel River Restoration Assessment and San Miguel County, Telluride, CO.

In 1996, members of the San Miguel Watershed Coalition embarked upon a two-year collaborative process to write and distribute the 1998 ***San Miguel Watershed Plan***. The USEPA contributed funds to partially pay for the plan's publication, though the plan is clearly not a regulatory document. Mostly, the plan is a tool to facilitate stakeholder collaboration.

The mission statement of the coalition states: "Through a process of collaborative planning and substantive public involvement, the San Miguel Watershed Coalition will help identify, prioritize, and facilitate action that will conserve and enhance the natural, cultural, and recreational resources and the social and economic vitality of our communities. The Coalition will provide a forum for agencies, jurisdictions, interest groups and individuals to discuss issues and opportunities on an ongoing basis (*San Miguel Watershed Plan*, p. 8). It is in this spirit that this river restoration assessment was undertaken with an emphasis on stakeholder outreach.

The San Miguel Watershed Plan divides issues into five themes: Growth and Community Preservation; Water; Natural Resources; Recreation; and Education and Stewardship. Several objectives and potential actions under the themes of Water and Natural Resources provide the context for a river restoration assessment, including:

Achieve a sustainable condition to the Basin's river, riparian and wetland environments, and the uplands surrounding them. Support the development of restoration plans on high priority sites, based on condition, threat and importance, to re-establish stable channel geometry and healthy riparian vegetation, and to prevent future stream channelization (*Plan*, p.31).

Maintain, and where possible restore natural plant and animal communities in ways that are consistent with watershed objectives. Support and undertake appropriate restoration efforts (e.g. Colorado River cutthroat trout and Gunnison sage grouse). Identify high priority areas for reintroduction (*Plan*, p. 34).

Minimize non-point source pollution of surface and ground water from sediment, biological pathogens, excess nutrients, urban pollutants, heavy metals and hazardous wastes. Support restoration of unstable river reaches to reduce sediment loading and/or promote healthy riparian areas (*Plan*, p. 27).

In addition to the San Miguel Watershed Coalition, the Natural Resources Conservation Service (NRCS) will be a fundamental ally in achieving cooperation with private landowners along the San Miguel River, particularly in Montrose County. NRCS has an established local program, local staff (Jim Boyd), and a local advisory board. The organization is highly regarded for its non-regulatory, incentive-based approach to conservation.

Local Considerations

The San Miguel Watershed Coalition has identified stakeholder values that both support the undertaking of this assessment and recognize that conservation efforts have an obligation to take into account local considerations when planning restoration efforts. Included in those values are:

1) Support a sustainable economy throughout the basin offering opportunities for growth and employment;
2) Maintain a diversity of high quality recreational experiences;
3) Create a cooperative atmosphere where individuals and organizations work together to create a balance between economic opportunity and resource conservation;
4) Promote landscape health through protection and restoration of natural resources;
5) Promote local control, community identity and an educated citizenry.

During stakeholder interviews undertaken by this assessment, citizens were asked to describe what local socio/political factors ought to be considered when contemplating river restoration. Stakeholders emphasized many of the values noted above. Many emphasized that river restoration ought to be compatible with other values and economic goals. Some suggested that river restoration would be viewed most favorably when economic benefits, such as recreational and tourism amenities, are included. A few people expressed a fear that river restoration might invite additional government regulation or be used to justify interfering with personal property rights.

Taking into account the concerns most frequently expressed by stakeholders, this assessment emphasizes the following considerations for all proposed restoration activities in the San Miguel watershed:

1) Portions of proposed restoration reaches include private property. Landowners must be communicated with openly and honestly. Their rights must be respected. Conservation actions on private property suggested in this report often imply additional monetary costs. Conservation must only be undertaken with the willing consent of the landowner. The landowner must be fairly compensated for the use of the property and reimbursed for taking requested conservation actions.

2) Most of the water diverted from the San Miguel River is important for the viability of agriculture. Locals in the lower watershed are concerned about possible water takings. Restoration strategies that seek to achieve mutually beneficial goals dependant upon improving water-use efficiencies must not expect that agricultural water-users pay for any such improvements.

3) Locals in the lower watershed are interested in diversifying the local economy by enhancing recreation and tourism opportunities. Restoration strategies that address this need will be viewed more favorably than those that do not. Also, whenever practical, hire locals to do restoration work.

II. Prioritized Reaches

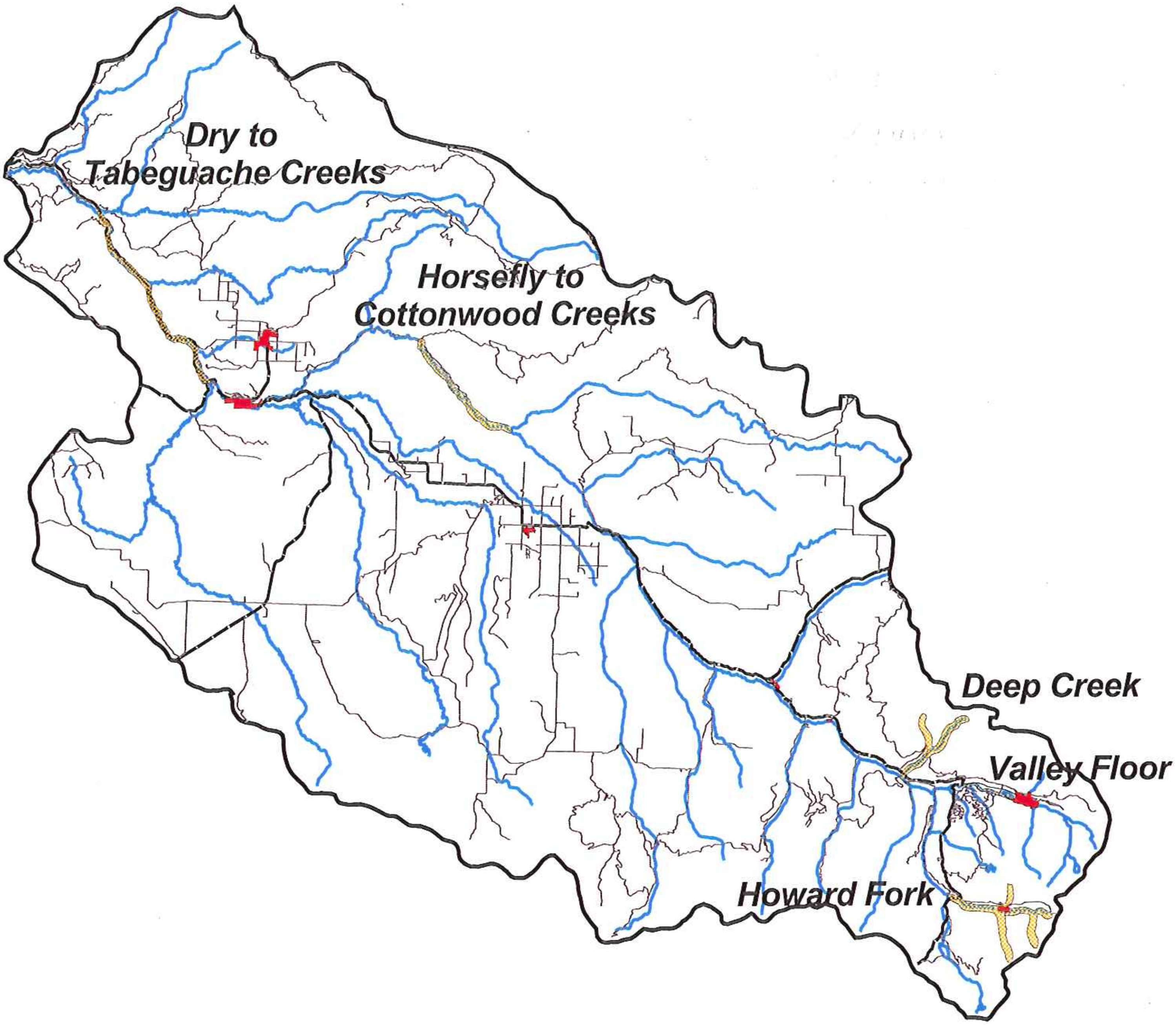
The three highest priority reaches, in order of greatest projected benefits to biodiversity, are:

1) **San Miguel River, Dry Creek to Tabeguache Creek;**
2) **San Miguel River, Horsefly Creek to Cottonwood Creek;**
3) **Deep Creek.**

The next highest priority reaches, with additional information needed, are:

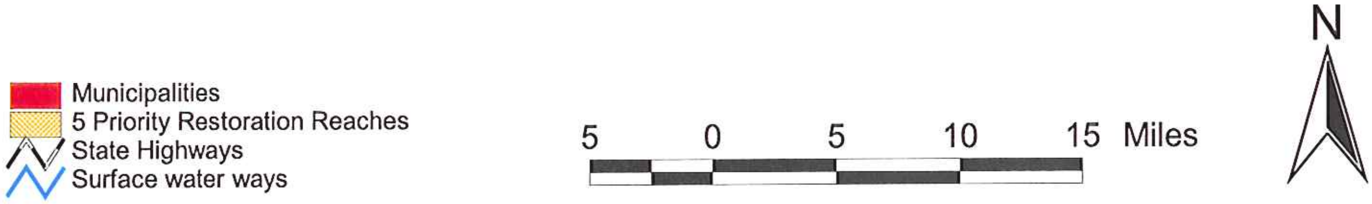
4) **Howard Fork of the San Miguel, Swamp Creek to Lake Fork;**
5) **Telluride Valley Floor, mainstem of the San Miguel, Butcher Creek to Prospect Creek.**

A detailed description of each of the five highest prioritized reaches follows.



San Miguel River Restoration Assessment

Map 3 : Priority Restoration Reaches



San Miguel River, Dry Creek to Tabeguache Creek
Reach Description

This reach is the #1 highest priority for restoration, based on the presence and/or potential for restoration of highly ranked biodiversity values.

Location: The upstream end of this reach, the Dry Creek confluence with the San Miguel River, is located 1 mile northwest of Naturita, Colorado in western Montrose County.

USGS 7.5 minute quadrangles: Naturita, Nucla, Uravan.

Property Ownership: The San Miguel River, Dry Creek to Tabeguache Creek is a 12-mile long reach. All of the land in the river corridor in this reach is privately owned. About 4-miles of the corridor are owned by various private individuals, about 1 mile is known as the Vancorum Millsite, and is owned by the Town of Naturita and Cyprus Corp., and 7 miles are owned by the Nature Conservancy, and known as the San Miguel River Tabeguache Creek Preserve.

General Description:

The San Miguel River, Dry Creek to Tabeguache Creek, is the highest ranked priority restoration reach. This reach includes 7 miles of high-quality riparian area (under ownership of the Nature Conservancy) on the downstream end, and about 5 miles in degraded condition. Proposed restoration activities in this reach focus on localized, disturbed sites that impact the hydrology and fragment habitat.

The Vancorum millsite includes the site of a former vanadium processing facility. The site was subject to extensive remediation and clean up that concluded in 1998, leaving 60 acres re-contoured and reseeded. About 24 acres at Vancorum was deeded to the Town of Naturita in 1999. The remaining acreage is owned by Cyprus Corporation, and may be transferred to Naturita in the future. Remediation was careful to leave the river channel intact in this portion of the reach, but a low earth dike discourages natural channel migration and natural flooding. Local citizens have expressed an interest in constructing a golf course or some other recreational amenity on the site. Advocates for river restoration ought to consider cooperating with Naturita to agree upon mutually beneficial goals for the site.

Downstream of the Vancorum site, at both Calamity Draw and Coal Creek, agricultural return flows from irrigated fields near Nucla enter the river. No water quality data was found, but it is probable that these return flows include contaminants.

Downstream of Calamity Draw, on private ranchland, flooding and channel migration are prevented by a long dike, armored by riprap. The disconnected floodplain appears to have been cultivated at one time.

The Natural Resources Conservation Service (NRCS) will be a fundamental ally in achieving cooperation with private landowners along the San Miguel River in Montrose County. NRCS has an established local program, local staff (Jim Boyd), and a local advisory board. The organization is highly regarded locally for its non-regulatory, incentive-based approach to conservation.

Biodiversity Restoration Potential:

The riparian corridor is characterized by mature cottonwoods, both the narrowleaf and Rio Grande species, as well as their hybrids. The native understory (where it has not been altered by agriculture, dikes, placer or gravel mining) consists of skunkbrush and coyote willow.

The riparian plant communities found at Nature Conservancy preserve present archetypes of what ought to be found upstream in this reach, including high-quality examples of riparian plant communities, including the globally imperiled Rio Grande cottonwood/skunkbrush association, the New Mexico privet riparian shrublands, and the slightly more common Rio Grande cottonwood/coyote willow association.

Within the TNC preserve, the riparian zone varies from narrow and straight in incised canyons, to wide meanders that lead to a multi-layered successional pattern of plant associations on the riverbends. Shrubs generally line the channel, with upland vegetation, including sagebrush, rabbitbrush, rose and serviceberry occurring on the flat meander bends. In some areas, invasive exotic plants, including tamarisk, Russian olive and Chinese elm, have invaded the riparian vegetation, replacing the native New Mexico privet and skunkbrush. Cottonwoods and willows are reproducing successfully along the river, thanks to the natural flooding processes that can occur on this undammed river (Lyon and Sovell).

The riparian plant communities, together with two rare and imperiled native warm-water fish species, roundtail chub and flannelmouth sucker, are the biodiversity restoration targets.

Fish surveys conducted October, 1998 found a few roundtail chub in the San Miguel near Tabeguache Creek (Hebein). Roundtail chub are a native warm-water species, and a Colorado Species of Special Concern. It is estimated that there are less than 20 occurrences of this species in Colorado (Lyon and Sovell). Historic fish inventory records reveal historic sampling of flannelmouth sucker at this same location (Reed), though none were found in 1998. Both the roundtail chub and flannelmouth sucker are vulnerable to elevated sediments, channelization, modified flow regimes, stream dewatering and contaminants.

Restoration Recommendations

1) Maintain seasonal high flows;
2) Re-connect river channel to floodplain, removing riprap and dikes and other artificial impediments to natural channel migration. Identifying and removing selected sections of dikes might encourage the desired flooding and encourage channel migration.
3) Prohibit cows from accessing the river channel, and limit grazing in the riparian floodplain to ecologically appropriate times;
4) Control invasive weeds in the riparian zone;
5) Conduct water quality testing, and, if necessary, improve water quality.
6) Cooperate with the Natural Resource Conservation Service (NRCS) and agricultural water users to improve water use efficiency to reduce contaminant loading in Calamity and Coal Creeks.
7) Conduct minimum stream flow assessment.
8) Cooperate with Colorado Department of Transportation to limit dike building and highway related sedimentation.
9) Cooperate with Town of Naturita to design restoration strategies for Vancorum that compliment recreational use of the property.

Biodiversity Targets: San Miguel River, Dry Creek to Tabeguache Creek

Element	Common Name	G rank	S rank
Forestiera pubescens	New Mexico privet riparian shrubland	G1	S1
Rhus trilobata/Salix exigua	Skunkbrush/Coyote willow riparian shrubland	G2	S1
Poputus deltoides ssp. *wislizenji/Rhus trilobata*	Rio Grande cottonwood/Skunkbrush riparian forest	G2	S1
Populus angustifolia/Rhus Trilobata	Narrowleaf cottonwood/skunkbrush riparian forest	G3	S3
Shepherdia argen tea	Silver buffaloberry riparian shrubland	G3	S1
Gila robuta	Roundtail chub	G2	S2
Castosomus latipinnis	Flannelmouth Sucker	G3	S3

Local Considerations

Stakeholders emphasized the following points regarding restoration activities in the San Miguel River, Dry Creek to Tabeguache Creek reach:

1) All of the land in this reach is private property. It is important to consult, openly communicate with and cooperate with private landowners. Conservation actions on private property must be undertaken with the willing consent of the landowner, and the landowner must be fairly compensated for the use of the property.

2) Water diverted from the San Miguel River is important to the viability of agriculture. Restoration strategies that seek to achieve mutually beneficial goals dependant upon improving water-use efficiencies must not expect that agricultural water-users pay for any such improvements.

3) The Natural Resources Conservation Service should be consulted and cooperated with to devise conservation strategies.

4) Locals are interested in diversifying the local economy by enhancing recreation and tourism opportunities. Locals are interested in the possible construction of a low-impact golf course on the Vancorum property, and the construction of recreational vehicle camping facilities near Tabeguache Creek. Restoration strategies that address this will be viewed more favorably than those that do not.

5) Hire locals to do restoration work.

San Miguel River, Horsefly Creek to Cottonwood Creek
Reach Description

This reach is the #2 highest priority for restoration, based on the presence and/or potential for restoration of highly ranked biodiversity values.

Location: The upstream end of this reach, the Horsefly Creek confluence with the San Miguel River, is located about 5 air miles north of Norwood, Colorado in western Montrose County. Horsefly Creek is about 10 river miles downstream of Norwood Bridge and Colorado Highway 145. Montrose County Road 90 crosses the San Miguel River at Pinyon Bridge, just upstream of Cottonwood Creek, on the downstream (northwest) end of the reach

USGS 7.5 minute quadrangles: Big Bucktail Creek, Norwood.

Property Ownership: The San Miguel River, Horsefly Creek to Cottonwood Creek is a 7- mile long reach. Three miles are privately held. Four miles of the corridor, in the downstream portion of the reach, are publicly owned, and managed by the BLM. BLM lands are administered by the BLM Montrose office. Land at the confluence of Cottonwood Creek is privately owned.

General Description:

Horsefly Creek, on the upstream end of this reach, is located at the downstream end of a 6.5-mile roadless section of mostly BLM land. This roadless section includes mostly high-quality native riparian habitat, dominated by river birch shrubland and Blue spruce/thinleaf alder riparian forest. It is also habitat for wintering Bald Eagles. It is part of the BLM's Area of Critical Environmental Concern.

Just downstream and northwest of Horsefly Creek, the river leaves BLM land and travels for 3 miles through private property. This section has been extensively grazed. The grazing has impacted most of the native vegetation on the property, and broken down and flattened riverbanks. This impact has allowed the river to straighten, widen, and become shallower.

Near the downstream end of the private property, a channel-wide cement weir diverts water into the CC Ditch, and delivers it to Nucla. The water right for the CC Ditch diversion is 145 cfs (Campbell, personal communication). The amount of water diverted by the CC Ditch is relatively small compared to spring snowmelt and flood flows in the San Miguel, but is significant compared to late summer low flows (Andrews, personal communication). Consequently, the CC Ditch diversion appears to have little or no negative impact to the channel building and load carrying capacity of spring high flows. Late summer low flows, on the other hand, particularly during dry years, likely impact aquatic fauna. August 2000 flows immediately downstream of the CC Ditch diversion were estimated to be less than 1 cfs.

One suggestion is to cooperate with water users to conduct a CC Ditch efficiency study, with the goal of trading water efficiency improvements that deliver additional water to Nucla for a guaranteed low water minimum stream flow in the San Miguel downstream of the diversion. For instance, if the conservation community were to fund the lining of the CC Ditch, enabling the ditch to deliver additional water to Nucla (say an additional 10 to 20 cfs, delivered season long), it would appear to be win-win situation to allow a 10 cfs minimum stream flow. Such a minimum flow would only subtract water from the ditch when the river flow at the diversion falls below 145 cfs.

The downstream end of the reach, from the north end of the private property to just upstream of Pinyon Bridge, is BLM land. The BLM has designated their land as a Special Recreation Management Area. Camping, fishing and kayaking are popular, though there are no improved campgrounds or campground facilities. Camping and associated use of motor vehicles has impacted and degraded riparian vegetation in the floodplain.

A dirt road follows the north side of the river. Historical grazing has impacted riparian vegetation, though not to the intense degree found on the private property. The channel braids in places, possibly the result of historical placer mining.

Historical placer mining has reworked and altered the channel in places, and degraded wetlands. Some of the area that was formerly placer mined now has weedy gravel bars with hairy golden aster, dogbane, coyote willow and Russian knapweed. Numerous exotic species are present, including Russian olive, Russian knapweed, Canada thistle, oxeye daisy, yellow sweet clover, and meadow timothy

Recreational and small operation placer mining has experienced increased activity in this stretch in the last 7 years. This new activity is disturbing the floodplain and channel, creating localized impacts to riparian vegetation, aquatic life and river hydrology.

Biodiversity Restoration Potential:

The riparian area upstream of Horsefly Creek gives some indication of what might naturally be found on the private property; i.e. a mosaic of river birch riparian shrublands, Silver buffaloberry riparian shrublands, blue spruce/thinleaf alder/red osier dogwood, and narrowleaf cottonwood/thinleaf alder riparian communities.

Near the confluence of Cottonwood Creek, riparian vegetation begins to take on more low elevation characteristics. Good examples of the globally imperiled skunkbrush riparian woodland, the globally vulnerable narrowleaf cottonwood/skunkbrush association, and an excellent example of the common coyote willow/mesic graminoid community are found here. Plant growth on the floodplain is very dense in places, with thick stands of cottonwood, river birch, box elder, Rocky Mountain juniper, clematis, poison ivy, wild rose, Gambel's oak, skunkbrush, thinleaf alder, gray aster and Fendler's barberry. The tall shrubs strapleaf willow, skunkbrush, chokecherry and red osier dogwood dominate other patches (Lyon and Sovell).

There is some regeneration of cottonwoods on BLM lands. Other riparian species here include lanceleaf cottonwood *(Populus acuminata),* the hybrid of the narrowleaf and Rio Grande cottonwoods, Rocky Mountain juniper, clematis, wild geranium, wild rose, Fender's barberry, red-osier dogwood, and river hawthorn.

Fish surveys conducted on BLM property October, 1998 found mottled sculpin, speckled dace and non-native brown trout (Hebein). Historic fish inventory recorded non-native rainbow trout and bluehead sucker (Reed). It is difficult to know what fish species occurred downstream of the irrigation diversion before it was built in the 1890's. Low water flows, such as those of August, 2000, likely raise water temperature and decrease available oxygen.

Restoration Recommendations

1) Maintain seasonal high flows;
2) Cooperate with, and compensate private landowner to prevent cows from accessing the river channel, and limit grazing in the riparian floodplain to ecologically appropriate times. Fencing may be required;
3) Control invasive weeds, including Russian olive, Russian knapweed, Canada thistle, oxeye daisy, in the riparian zone;
4) Jump-start cottonwood regeneration by plowing/exposing bare, wet, sandy soils to cottonseed dispersal;
5) Conduct minimum stream flow assessment;
6) Cooperate with water users to obtain a CC Ditch efficiency study, with the goal of trading water efficiency improvements that deliver additional water to Nucla for a guaranteed low water minimum stream flow.
7) Limit recreational impacts, particularly vehicle compaction, in the riparian areas. Cooperate with BLM to increase supervision, monitoring and funding. Consider constructing improved camper/visitor facilities to concentrate impacts.
8) Control small operation placer mining to discourage heavy equipment use in the channel and floodplain.

Biodiversity Targets: San Miguel River, Horsefly Creek to Cottonwood Creek

Element	Common Name	G rank	S rank
Rhus trilobata/Salix exigua	Skunkbrush/Coyote willow riparian shrubland	G2	S1
Populus angustifolia/Rhus Trilobata	Narrowleaf cottonwood/skunkbrush riparian forest	G3	S3
Shepherdia argen tea	Silver buffaloberry riparian shrubland	G3	S1
Picea pungens/Alnus incana	Blue Spruce/thinleaf alder	G3	S3
Salix exigua/mesic graminoid	Coyote willow/mesic graminoid	G5	S5

Local Considerations

Stakeholders emphasized the following points regarding restoration activities in the San Miguel River, Horsefly Creek to Cottonwood Creek reach:

1) Locals are interested in diversifying the local economy by enhancing recreation and tourism opportunities. Locals expressed a need for improved recreational vehicle camping opportunities in western Montrose County. The Pinyon Bridge area may be appropriate for construction of improved campsites.

2) Portions of this reach are privately owned. It's important to communicate, cooperate with and respect affected landowners. Any conservation actions on private property must be undertaken with the willing consent of the landowner, and the landowner must be fairly compensated for the use of the property.

3) Water diverted from the San Miguel River is important for the viability of agriculture. Restoration strategies that seek to achieve mutually beneficial goals dependant upon improving water-use efficiencies must not expect that agricultural water-users pay for any such improvements.

4) Hire locals to do restoration work.

Howard Fork of the San Miguel, Swamp Creek to Lake Fork

Reach Description

This reach is the #4 highest priority for restoration, with important information needed to determine value of restoration to biodiversity.

Location: The Howard Fork flows through the Ophir Valley, immediately south of the town of Ophir, 5.5 air miles south of Telluride, Colorado, in southeast San Miguel County.

USGS 7.5 minute quadrangles: Ophir

Property Ownership: Most of the Howard Fork, Swamp Creek to Lake Fork, is private property, owned by a variety of landowners. Small, disconnected portions of the Howard Fork are public lands administered by the US Forest Service, Norwood Ranger District.

General Description: The Howard Fork originates approximately 2-miles east of Ophir, and flows 7-miles west to its confluence with the Lake Fork, near Ames, Colorado. The Howard Fork and the Lake Fork join to create the South Fork of the San Miguel.

The town of Ophir is a small community with an estimated population of 150 people in the year 2000. It sits at an elevation of 9600 feet, in a steep walled canyon. Numerous inactive mines dot the hillsides on each side of the Howard Fork. Ophir obtains municipal water from a hillside spring located north of the town.

Water quality in the Howard Fork has been severely impacted by acid mine drainage. The Colorado Department of Public Health and Environment (CDPHE) concluded in 1999:

> *The entire length of the Howard Fork River, from upstream of Ophir downstream to above the confluence with the South Fork River is impacted by metals contamination as indicated by heavy metals concentrations. Total zinc concentrations are fairly consistent...averaging 130 milligrams per liter (ug/l), above the Superfund Chemical Data Matrix (SCDM) Ambient Water Quality Criteria (AWQC) of 110 ug/l. The average total copper and lead concentrations along the Howard Fork River in this stretch is approximately 17ug/l and 20 ug/l, respectively, above the SCDM AWQC of 12.0 ug/l and 3.2 ug/l.* [3]

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[3] Colorado Department of Public Health and Environment, O' Grady, Martin; Site Inspection Analytical Results Report, Carbonero Mine and Ophir Mining District, San Miguel County Colorado. August 1999.

Sources of contamination along the Howard Fork include:

-the Carbonero Mine adits and tailings pile;
-the Carribbeau Mine adit, waste rock pile, and tailings pile;
-the Silver Bell Mine adit;
-the Roanoke tailings pile;
-the New Dominion Mine waste rock pile and adit;
-the Gamebird Mine waste rock pile and adit.

Most but not all of these sources of contamination are on private property, though at least some, including the Carribbeau Mine adit, may be on US Forest Service land. The Forest Service has budgeted funds for further site investigation and analysis for 2001 (Gusey, personal communication).

During 2000, the owners of the Silver Bell Mine and Roanoke tailings pile completed a re-contouring and capping of the Roanoke tailings pile, designed to direct water around or across the top of the tailings pile, as opposed to leaching through it.

In addition to altering water quality, mining has directly impacted the stream channel, which is choked by mine tailings, causing the channel to braid. The low gradient stream results in flow velocities insufficient to flush excess sediment through the system. These tailings likely have trapped metals that may be released if disturbed.

Not surprisingly, the Howard Fork is mostly devoid of fish. CDOW sampled the Howard Fork in the early 1990's and found no fish and no macro-invertebrates (Hebein, personal communication), although trout have been found more recently in the Howard Fork between State Highway 145 and the confluence with the Lake Fork (Sullivan, personal communication). Beaver populations seem unaffected.

The CDPHE study found elevated zinc levels downstream on the South Fork, apparently the result of contamination of the Howard Fork. USEPA may undertake a metals loading analysis to better determine sources of contamination and potential remediation strategies (Wireman, personal communication).

A number of government agencies have expressed interest in cooperating to further analyze and resolve metals loading and water quality degradation in the Howard Fork. These agencies include San Miguel County, the Town of Ophir, Colorado Department of Public Health and Environment, Colorado Division of Minerals and Geology, US Forest Service, Colorado Division of Wildlife and US Environmental Protection Agency.

Biodiversity Restoration Potential

A fundamental question is: what are the impacts water quality degradation of the Howard Fork to the South Fork and the San Miguel watershed?

The Howard Fork flows into the South Fork, about one mile upstream of a Nature Conservancy preserve. The South Fork Preserve harbors high quality occurrences of several riparian plant communities, including narrowleaf cottonwood and blue spruce dominated riparian forest, and high quality complexes of willows and sedges (Lyon and Sovell). Lacking in the South Fork is any indication of a native fishery. CDOW has observed that stocked trout experience difficulty surviving beyond the season they are stocked (Hebein, personal communication).

Restoration Recommendations: Howard Fork

1) Facilitate the meeting of interested entities, including San Miguel County, the Town of Ophir, Colorado Department of Public Health and Environment, Colorado Division of Minerals and Geology, US Forest Service, Colorado Division of Wildlife and US Environmental Protection Agency.
2) Cooperate with interested entities to analyze the impact of acid mine drainage and metals loading on downstream biodiversity targets.
3) Encourage remediation of acid mine drainage.
4) Analyze in-channel tailings to determine potential for metals release from in-channel mechanical manipulation, with the objective being the directing of braided channels into single channel.

Biodiversity Targets: Howard Fork

Element	Common Name	G rank	S rank
Oncorhynchus clarki Pleuriticus	Colorado River cutthroat trout	G4	S3
Picea pungens/Alnus incana	Blue spruce riparian forest	G3	S3
Salix geyeriana-Salix monticola/mesic graminoid	Montane riparian willow carr	GU	S3

Local Considerations

Stakeholders emphasized the following point regarding restoration activities in the Howard Fork: Private property rights are of concern, and must be respected. Any conservation actions on private property must be undertaken with the willing consent of the landowner, and the landowner must be fairly compensated for the use of the property.

Telluride Valley Floor
San Miguel River, Butcher Creek to Prospect Creek
Reach Description

This reach is the #5 highest priority for restoration, with important information needed to determine value of restoration to biodiversity.

Location:
USGS 7.5 minute quadrangles: Telluride

Property Ownership: Most of the Telluride Valley Floor reach is in private ownership, an 800-acre parcel of private land held by one party, the San Miguel Valley Corporation (SMVC), a subsidiary of a Denver company, Cordillera Corporation. About 70 acres and several hundred yards of river corridor, upstream of the confluence of Mill Creek and the San Miguel River, is owned and managed by the US Forest Service. Telluride Ski and Golf Company holds an easement on 20 acres of SMVC land on the Prospect Creek alluvial fan for the purpose of restoring wetlands.

Known locally as "the Valley Floor," the property has long been the subject of local debate and controversy surrounding potential development, culminating in the Town of Telluride's current contemplation of condemnation. It is not the intent of the river restoration assessment to comment on, attempt to influence, or otherwise be involved in any of the controversy surrounding the Valley Floor. Rather, stakeholders participating in the assessment emphasized that all parties in the Valley Floor conflict generally agree the San Miguel River has been altered and impacted by past human activity, and that restoration is required. It bears repeating here that stakeholders as a group feel strongly that restoration activities anywhere in the San Miguel watershed should be undertaken only with the consent and cooperation of the landowner.

General Description: The Telluride Valley Floor, San Miguel River, Butcher Creek to Prospect Creek is an approximately three mile segment of the San Miguel River west and adjacent to the Town of Telluride.

Among the impacts to the river in this reach are: a built-up railroad grade that forces the river channel to the south side of the property for a distance of about 1.5 miles; trenches cut into the wetlands; grazing; and mining mill tailings transported onto the property from upstream mining and milling activities. The 1991 Idarado consent decree identified more than 20 acres of mine tailings left behind in the floodplain by a shallow reservoir that once inundated the west end of the site. Another 50,000 to 75,000 tons of tailings materials are located along the stream banks of the river between the Town of Telluride and Society Turn, and are not included under the conditions of the consent decree (Price, personal communication).

When river restoration on the Valley Floor will occur and by whom is not clear. Stakeholders felt that, regardless of who owns the property or what the use of the property is, river restoration is needed and will someday likely be undertaken. Because of this, and because the Valley Floor is the largest wetland complex in the watershed, the stakeholders regarded restoration of this reach as a high priority. The science team noted that, aside from the political controversies surrounding the property, scientific questions remain: What is the biodiversity significance of the property? Are water quality impacts from the tailings on the property migrating downstream, and if so, what is the affect of those impacts to downstream flora and fauna? Are flora and fauna in the reach being impacted by the tailings? How should the tailings be remediated?

The abandoned railroad grade confines the channel, eliminating natural flooding and lateral channel migration. Hampering any attempt to remove the railroad grade is the fact that the Town of Telluride's sewer line, connecting the town to the waste treatment plant west of Highway 145, lies in the grade. If the railroad grade is removed someday, in-channel construction would likely be required to re-create sinuosity and channel meander. Unlike other reaches with steeper gradient, the San Miguel through the Valley Floor is a low gradient, lower volume river. Whereas seasonal high flows will allow the channel to restore itself in other stretches of the San Miguel in 10 to 20 years, natural recovery within the Valley Floor reach will require 50 to 60 years or longer (Andrews, personal communication).

Remediation of the Valley Floor tailings is addressed in the Idarado consent decree that settled the lawsuit brought by the State of Colorado against Newmont Mining Company, the owners of the Idarado Mill and mine complex, east of Telluride. The decree gave Newmont and the property owners until December 31, 2000 to either remove to tailings or to stabilize and cap them. However, no remediation has been undertaken to date. The landowner has not given Newmont access to the property to perform the remediation, nor has the landowner submitted its own plan (Price, personal communication).

Fundamental questions regarding the tailings in the floodplain are: if the tailings are left in place, stabilized and capped, will flooding or lateral channel movement allow renewed metals loading into the river? Will restoration-related construction and disturbance in the channel result in releasing metals stored in the channel bottom, renewing loading?

The proposed restoration of 20 acres of wetlands on the Prospect Creek is unrelated to the Idarado consent decree. Telluride Ski and Golf Company (Telski) has acquired an easement to allow the company to restore the alluvial fan and fill 3 trenches that were cut across the fan in 1970, in preparation for additional tailings disposal by Idarado. Telski intends to perform the restoration as part of its ski area wetlands remediation plan (Hazen, personal communication). Work is expected to begin in 2001.

The San Miguel River, from Marshall Creek (just west of the Idarado Mill) to the South Fork confluence, including the Valley Floor reach, is listed by the State of Colorado as a Section 303(d) river, exceeding Total Maximum Daily Load (TMDL) guidelines, not expected to meet applicable water quality standards with technology-based controls alone.

The San Miguel was included on the Colorado 303(d) List, as partially supporting aquatic life, due to high levels of dissolved cadmium, manganese, zinc and sediment. High siltation from urban runoff is identified as a primary contributing non-point source. During the period of late winter/early spring runoff, high siltation from urban street runoff and low flow in the San Miguel River causes a buildup of silt that covers the streambed. When the problem was first identified, it was suspected that sediment was filling the interstices of the gravel bed and likely smothering benthic macroinvertebrates and trout fry (Colorado Water Quality Control Division).

The Town of Telluride has begun to implement a plan to control and reduce sediment load in the river, including: designing a stormwater retention system utilizing a constructed wetland; managing snowmelt from the Town of Telluride snow storage facility located on the west side by directing collected snowmelt through a series of managed wetlands to filter the water prior to entering the river; and restoring a 0.7 mile stretch of the river from below the confluence with Bear Creek to Fir Street, adjacent to Town Park. The goals of the river restoration project are to restore aquatic, wetland and riparian habitat; improve river hydraulics; and balance sediment movement throughout the channel. River restoration and construction began September 2000, and has met unanticipated public criticism and complaints related to construction-related increased turbidity.

Restoration Recommendation

1) Cooperate with the Colorado Department of Public Health and Environment to analyze: metal loading in the channel and in the Valley Floor tailings; potential for metals release from in-channel mechanical manipulation; impacts of metals contamination to flora and fauna in the Valley Floor reach; impacts of metals contamination to flora and fauna downstream of Valley Floor reach.
2) Analyze flora within the reach to determine biodiversity value.
3) Cooperate with the Colorado Department of Public Health and Environment and landowner to remove or otherwise stabilize tailings.
4) Encourage filling drainage trenches.
5) Cooperate with landowner and Town of Telluride to relocate sewer line and remove railroad grade.
6) Engineer and perform in-channel construction to restore sinuosity and meander.

Biodiversity Targets: Telluride Valley Floor

Element	Common Name	G rank	S rank
Populus angustifolia-Picea pungens/Alnus incana	Montane riparian forest	G3	S3
Salix geyeriana-Salix monticola/mesic graminoid	Montane riparian willow carr	GU	S3

Local Considerations

Stakeholders emphasized the following point regarding restoration activities on the Telluride Valley Floor:

It is not the intent of the river restoration assessment to comment on, attempt to influence, or otherwise be involved in any of the controversy surrounding the Valley Floor. Almost all of the land in this reach is privately owned. Any conservation actions on private property must be undertaken with the willing consent of the landowner, and the landowner must be fairly compensated for the use of the property.

III. Prioritization Methodology

The river restoration assessment management team conducted a literature search and analysis to consider natural resource prioritization processes that have been used elsewhere. Based on the available literature, the assessment management team designed this study to merge the recommendations of two components: the assessment science component and the stakeholder outreach component.

A review of the literature suggested the following steps to assessment and prioritization:

1. Describe and assess each site based upon existing available information.
2. Based upon that information, make a preliminary selection of sites for further study.
3. Identify and complete further studies of each site.
4. Develop preliminary solutions for restoration of specific structure and function.
5. Identify potential environmental outputs for each selected site.
6. Quantify environmental outputs for each site.
7. Develop reconnaissance level costs of restoration for each site.
8. Apply economic analysis, the least cost solution for each level of environmental output to determine rank order of sites.

Steps 1 through 5 were completed in this assessment.

Applying economic analysis, as called for in step 8, would require relating dollars to environmental values. This was viewed by the assessment team as a difficult task to accomplish in a meaningful way, and beyond the scope of this analysis. Traditional water resource projects, for the most part, have been valued by a positive economic result. For example, the net value of a dam has in the past been measured by the cost of building the dam (land acquisition, concrete, design etc.) against the economic benefits (irrigation and agricultural, control of floods, recreation). In the case of river restoration, while there will certainly be an economic cost, there may not be a measurable economic benefit. Environmental benefits are generally not quantifiable in dollars. (How does one measure in dollars the value of things one does not buy in the marketplace?). Consequently, one cannot use the traditional American means of selecting among various projects, the greatest economic benefit for the least economic cost. Rather, a different method of selection and prioritization must be used.

No computational procedure by itself will establish either how far restoration should proceed or the relative priorities for funding alternative restoration efforts. Plans for a restoration and priorities for alternative restoration will depend on the current condition pf particular aquatic ecosystem, the knowledge base for restoration of that system, the values gained and lost as a result of the restoration. Because different structures and functions of an aquatic ecosystem yield different values, choosing whether and how to restore amounts to choosing one set of values over another.

The basis for values may be expressions of individual preference (the basis for economic value) or expressions of collective preferences (social norms often expressed in multiple forms of collective action). One way to select and prioritize restoration projects is, in lieu of traditional cost-benefit analysis, to ask the question "how much restoration is enough? Continually questioning the value of the restoration by asking whether an action is "worth" the cost is by many seen as the most practical way to decide how much restoration is enough. But, the interested parties who participate in these social choice processes must be informed in making the decisions, informed about the effectiveness of the technical options for restoration, the aquatic functions that might be restored by the options and the opportunity costs of different levels and strategies of restoration (Pizzi).

Another way to express this sentiment is "Prioritization should be based on both human and ecological values". Evaluation by the scientific community can identify the project most likely to provide the greatest ecological benefits. It may not be able to identify the project that is the maximal choice for society. Prioritization decisions should be made by stakeholders (Stedge and Feather).

There is no hard and fast rule as to how values can be incorporated in the prioritization or selection of river restoration sites. Some studies have simply used professional judgment, As exemplified by the following description:

> *Given several alternatives that have been thoroughly evaluated, the choice should be obvious, right? Usually this is not the case. While IFIM was designed to aid in formulating and evaluating alternatives; however, it still relies heavily on professional judgment by interdisciplinary teams. The teams must integrate their knowledge and understanding of a problem with their professional judgments about biological resources and social needs to reach a negotiated solution implying some kind of balance among conflicting social values.*[4]

The Assessment Science Team

The assessment management team convened a science team to:

1) Consolidate and analyze biodiversity information;
2) Develop broad restoration goals that embody a criteria of benefits to biodiversity values;
3) Develop a list of disturbed sites potentially meeting restoration criteria; and
4) Prioritize sites according to projected benefits to the targeted biodiversity values.

Science team participants were asked to contribute expertise and written information to the assessment management team. Several science team participants represented agencies or private organizations, and were able to contribute information from others, as well as their own expertise. In addition to contributing information and expertise, science team members met together on two occasions, December 8, 1998 and December 7, 1999.

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[4] Stalnaker, *Biological Report #29*, "The Instream Flow Incremental Methodology, A Primer for IFIM".

The San Miguel River Restoration Assessment benefited greatly from the BLM San Miguel Instream Flow Assessment, to be completed in 2001. Many of the restoration assessment science team are cooperating with the BLM on that project, and were able to share relevant information to this river restoration assessment.

In certain instances, science team participants were asked to collect and analyze new data. Those participants, or the organization they represent, were sometimes compensated for the requested data and analysis they provided. Funds to compensate science team members for requested information were included in the EPA grant.

Scientific studies funded by this restoration assessment through the EPA grant to San Miguel County include:

Groeneveld, David P. 2000. An Overview of Recent Bank Instability on San Miguel River. Report Submitted to San Miguel County, San Miguel River Restoration Assessment.

Hebein, Sherman 1999. San Miguel River Fisheries Inventory, Creel Census and Shocking History. Colorado Division of Wildlife 34 pp.

Madole, Richard 2000. Preliminary Report on the Geology and Recent Geologic History of the San Miguel River Valley, Southwestern Colorado. Report submitted to San Miguel County, San Miguel River Restoration Assessment; and to BLM, Montrose District Office.

Reed, A.; Higgins, J.; Wigington, R. 1998. Aquatic Community Classification Pilot for the San Miguel Watershed. The Nature Conservancy. Report Submitted to San Miguel County, San Miguel River Restoration Assessment.

A complete reference bibliography is included at the end of this text.

Science Team Participants:

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Patrick Willits, Conservation Consulting, Ridgway, CO.

Stakeholder Outreach

The assessment management team sought to mesh the priorities of the science team with those of local stakeholders by conducting a series of meetings and interviews with targeted citizens. Pat Willits conducted the outreach. Input regarding the variety of social, political and economic factors that influence potential restoration activity was gathered. Watershed stakeholders were interviewed and/or participated in facilitated meetings, and generated a list of prioritized restoration activities.

All of the literature indicates stakeholder support is critical to the success of a river restoration, including the following:

- Broad-based participation helps ensure that self-interest or agency agendas do not drive the restoration process from the top down (Stream Corridor Restoration 4-4);
- Stakeholder input is necessary for identification of the public's interest in the restoration effort;
- Stakeholder input ensures local values are taken into account during the restoration process;
- In the process of acquiring public input, there is an opportunity to educate and promote the restoration process.

Who are the stakeholders?

Generally, they are private citizens, public interest groups, economic interest groups, public officials and any other group or individual who is interested in or might be affected by restoration efforts. There are several ways in which to identify the key stakeholder participants. They may be identified via announcements to the news media, writing to interest organizations, making public appearances or directly contacting potential partners (Pizzi).

In the case of the *San Miguel River Restoration Assessment*, one of the key participants of this study is the San Miguel Watershed Coalition. It is "a loosely organized alliance and member ship organization dedicated to taking a watershed approach to address concerns and opportunities in a way that balances economic needs and resource conservation" (*The San Miguel Watershed Plan*). The mission of the coalition is to develop and implement a multi-jurisdictional watershed plan for the San Miguel River Watershed. The Coalition has the necessary historical and current interest in watershed issues including restoration.

The Coalition identified stakeholder values in the *San Miguel Watershed Plan* that support the undertaking of this assessment, including:

- Sustainable economy throughout basin offering opportunities for growth and employment

- Diversity of high quality recreational experiences

- Creation of cooperative atmosphere where individuals and organizations work together to create a balance between economic opportunity and resource conservation

- Landscape in good health through protection and restoration of natural resources

- Maintain or promote local control, community identity and educated citizenry

From these meetings and interviews, Willits developed an analysis of the human context of the San Miguel watershed; including an analysis of local values; a list of broad restoration goals; an analysis of river corridor disturbances and threats impacting, or having the potential to impact, significant biodiversity values; and a list of stakeholder prioritized restoration sites. The stakeholder list was then reconciled with the science team identified values and sites, yielding a short list of five potential restoration sites, three of which are of highest priority, and two more of which are of second highest priority with additional information needs.

IV. Conservation Targets

Identifying elements of biodiversity as the conservation targets and the processes that sustain them is critical to evaluate potential environmental benefits of restoration activities. Several studies were relied on to understand conservation targets in the San Miguel watershed.

The Nature Conservancy's ***San Miguel River Site Conservation Plan*** (Neely et al., July 1999) compiles data of terrestrial and aquatic plants and animals. This conservation plan relies upon information and biodiversity rankings compiled by the Colorado Natural Heritage Program, and served as the primary source/summary of biodiversity information for the river restoration assessment. A table of high biodiversity elements from this plan is reprinted as an attachment.

The Colorado Natural Heritage Program's ***A Natural Heritage Assessment: San Miguel and Western Montrose Counties, Colorado*** (Lyon and Sovell, 2000) identifies the localities or rare, threatened, or endangered species and the locations of significant natural plant communities. The three highest priority reaches in this assessment were each identified by the Lyon and Sovell study as "Potential Conservation Areas."

TNC's conservation plan incorporates information on aquatic species compiled by the ***Aquatic Community Classification Pilot for the San Miguel Watershed*** (Reed et al, 1998). The river restoration assessment ordered this study. It researched and analyzed original fish sampling records data, though fish sampling has not been conducted in the watershed in a systematic and regular manner, and has most often been targeted at non-native, cold-water game species such as rainbow trout. The pilot project combined the limited fish data with other ecological and geological characteristics to describe the variety and distribution of aquatic macrohabitats in the watershed.

To address the scarcity of fish data, the river restoration assessment team commissioned an electrofish sampling at five locations on the main stem of the San Miguel. The Colorado Division of Wildlife conducted this sampling October 1999. Results are reported in the CDOW's ***San Miguel River Fisheries Inventory, Creel Census and Shocking History*** (Hebein, 1999).

The USGS report, ***Hydrology, Geomorphology, and Sediment Transport of the San Miguel River, Southwest Colorado*** (Allred and Andrews, 2000) assembled baseline hydrologic data, and documents the timing and magnitude of flood events during historic times.

The USGS report, ***High Flow and Riparian Vegetation Along the San Miguel River, Colorado*** (Friedman and Auble, 2000) relates variables in hydrologic regime with riparian health.

Richard Madole's study, ***Preliminary Report on the Geology and Recent Geologic History of the San Miguel River Valley, Southwestern Colorado***, analyzed four study reaches selected by the restoration assessment science team. It identifies and maps changes in the river channel, flood plain, low terraces and valley-floor deposits over the past half-century. This study was funded, in part, by the San Miguel River Restoration Assessment grant.

Together, these studies recognize the San Miguel as harboring one of the longest and highest-quality stretches of high-quality deciduous and evergreen riparian forests and shrublands (about 80 miles) in the western United States. These studies also establish the ecological process, and the hydrologic and geomorphologic context in which these riparian communities exist.

The watershed supports at least eleven known globally rare riparian plant communities, 9 high-quality examples of more common plant communities, 6 globally rare animals (including 2 fish), 16 globally rare plants, and 12 declining species (including 2 fish). Declining species are species declining through all or a significant part of their ranges (Neely).

V. Ecological Processes

Major ecological processes influencing the riverine system are the watershed **hydrologic and geomorphologic regimes**. The fact that the hydrologic and geomorphic processes are largely intact helps to ensure the long-term viability of the riparian and aquatic targets of the San Miguel River (Neely).

Although there are some impoundments on tributaries, and one major diversion on the main stem downstream of Horsefly Creek, seasonal high flows remain sufficient to serve as a functioning hydrologic process to form and maintain channel and floodplain, to efficiently move sediment through the system, and to provide habitat for riparian plant regeneration.

In many respects, the story of the San Miguel River is the story of two rivers. In the upper watershed, the San Miguel is a steep-gradient, snowmelt driven Rocky Mountain stream, often confined through steep-walled valleys and canyons with little or no floodplain. Periodic ice-flow events scour the channel. Both narrowleaf cottonwood and conifers, including Colorado bluespruce and/or Douglas fir, dominate riparian vegetation.

The confluence of Naturita Creek and the San Miguel is generally regarded as the border between ecoregions. As the river flows toward the lower watershed, the San Miguel River transitions from the Southern Rockies Ecoregion to the Colorado Plateau Ecoregion. It begins to resemble more a classic desert, sediment driven river. The lower San Miguel River is typified by a flatter gradient, a broader floodplain, and experiences more active channel migration than generally is found in the upper basin. Rio Grande cottonwood and shrubs dominate the riparian vegetation. Annual rainfall lessens. Annual average temperatures increase. Summer monsoon thunderstorm events shape the floodplain as much as spring snowmelt flooding does.

Hydrologic Regimes (excerpted from TNC's San Miguel River Site Conservation Plan, used by permission):

Three primary flooding types (Fleener 1997) characterize the San Miguel River:

- *spring plateau snowmelt (April-May)*
- *summer alpine snowmelt (May-June)*
- *late summer rainstorms associated with the southwest monsoon, a persistent climatic feature of the American southwest*

Patterns and processes associated with bottomland change on the lower river are highly variable. Flood duration and magnitude, to a lesser extent, are the principal-driving forces behind floodplain reworking and creation of bare alluvium establishment sites for riparian plant species such as cottonwood and willow (Fleener 1997).

Flooding in the middle reaches of the basin (recorded at Placerville) is strongly related to snowmelt from the San Juan Mountains in May and June. In the lower basin, early summer snowmelt is nearly surpassed by earlier April snowmelt, reflecting the inflow of mid-elevation plateau snowmelt. At Uravan, the greater area of mid-elevation tributaries results in 48% of the annual flood peaks occurring in April, with 40% occurring during the monsoon season. A few of the monsoon season floods at Uravan have exceeded the mean annual flood, including the flood of record on Sept. 6, 1970 (Fleener 1997).

The heavy spring flows cause increased channel migration and sediment transport, which result in dynamic channel morphology. Active channel migration serves a key role in the regeneration of riparian plant species, especially cottonwood and willow species.

Geomorphic Regime

The geomorphic regime, largely affecting sediment transport, is another important factor influencing the riverine system. Periodic late summer monsoon floods, many originating in Dry Creek watershed, bring large amounts of fine sediments downstream to the lower San Miguel near the confluence with Tabeguache Creek. Processes related to braiding and channel abandonment after large floods is the primary sources of bottomland change and the creation of regeneration sites, but flood deposition by fine-sediment laden monsoon flooding is a secondary agent of site creation. The monsoon floods play an important ecological role as floodplain builders, occasionally leaving a fresh depositional surface for seedling establishment (which occurs in the spring), and building the elevation of the floodplain so as to provide some separation and protection between existing trees and subsequent floods (Fleener 1997).[5]

Ice Flows and Ice Scouring:

A less-known process influencing the riverine system of the San Miguel River are ice flows and ice scouring. Ice flows tend to originate in the South Fork below the Ames power plant and have been observed to flow well past Norwood Bridge, 40 miles downstream. These events have removed riparian vegetation and soil and left much of the remaining vegetation scarred and with branches broken to the upper level of the ice flow. Thus, San Miguel River ice flows have significant negative impact upon riparian vegetation (Groeneveld, 2000). Ice flows may also impact fish populations, as they create dams, potentially stranding fish in shallow sections of the river where the fish are less able to protect themselves from additional freezing (Murphy 1998).

The BLM has recently consulted the USACE Cold Regions Research and Engineering Laboratory to try to determine if water releases of the Ames Power Plant for electrical generation have altered ice flows. All documented ice flows in the last twenty years have occurred in late December or early January (near the winter solstice). Ferrick and Murphy present a hypothesis that relates ice release and ice flows to consecutive sub-zero temperature days. They also conclude that surges from the Ames Power Plant are

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[5] Neely, Betsy 1999. San Miguel River Site Conservation Plan, p.7.

likely a factor in triggering ice flow releases, and may also contribute to the manner in which ice building occurs in the river channel downstream of the Ames plant, and that all ice flow events in recent years have originated in the South Fork below the power plant (Ferrick and Murphy, undated).

David Groeneveld believes there are real reasons to suspect that an increase in ice flow activity may constrain riparian vegetation that, in turn, negatively affects bank stability. He further believes that that the understanding and managing ice flows is the most important restoration issue to resolve in the upper-basin (Groeneveld, personal communication). He writes:

"The simplest hypothesis for loss of bank stability is that it is due to ice flows in recent years that have changed frequency or magnitude due to changes in discharge from the Ames power plant. Power plant discharge provides energy, i.e., surging water that is warmer (by a degree C, or so) than the channel (at 0 degrees C) at much higher volume 4} probably at least 500% greater) that initiates an ice flow within the ice-bound winter channel. If this is so, a simple set of operating guidelines for power plant operation during December and January could easily reduce the potential for ice flow releases. Since curtailing power generation that offsets extremely high power consumption in the region due to resort operation will likely have an impact upon power plant revenues, conclusive proof is probably necessary. The key will be to first conclusively demonstrate that the Power Plant is responsible for the ice flows that, in turn, impact riparian vegetation and then bank stability and erosion. The key is to demonstrate causality and not just coincidence".[6]

Beaver activity:

Throughout the San Miguel, herbivory and dam building by beaver is in evidence, and should be regarded as another important process affecting the riparian vegetation and aquatic habitat, even though actual numbers of beaver leaving throughout the river corridor are likely significantly less than pre-European settlement.

In the upper watershed, both the South Fork and the Howard Fork, and numerous tributaries, including Leopard Creek and Turkey Creek, show effects of beaver activity. Beaver ponds contribute to diverse aquatic habitat, and flood and alter woodland species composition. Abandoned beaver ponds revert to meadows and shrublands. Beaver dam breaks can increase erosion and influence the stream channel migration.

On the mainstem in the lower watershed, impacts of beaver activity are less apparent than in the upper watershed, perhaps because channel flows are greater, and flooding events are larger, inhibiting dam building except on braided side channels. Herbivory occurs, but impacts to plant species composition are not well understood.

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[6] Groeneveld, David P. 2000. An Overview of Recent Bank Instability on San Miguel River, p.3.

VI. Human Context

The 1,550 square mile San Miguel watershed lies within parts of two counties, San Miguel and Montrose. An estimated 7,000 people live in the watershed. People are organized geographically, politically and economically in ways that somewhat resemble the changes taking place throughout the western United States.

Communities in the upper watershed such as Telluride and Mountain Village have developed with significant cultural and philosophical differences compared to communities in the lower watershed, including Nucla and Naturita. The community of Norwood lies in between, geographically, economically, and philosophically.

The towns of Telluride and Mountain Village dominate the upper watershed. Telluride is the county seat for San Miguel County. The economy of the upper watershed can be described as a resort and a resort construction economy. Residents tend to embrace more urban and more liberal values compared to residents in the lower watershed. The economy is driven by resort, recreation and construction-associated activities. About 4,000 people live in the upper watershed. Over 50% of the residential dwelling units are lived in part-time.

The watershed becomes more rural as one travels downstream. Norwood lies on the northern edge of San Miguel County. Redvale, Nucla and Naturita are in western Montrose County, separated from the rest of Montrose County and the county seat (Montrose) by the Uncompahgre Plateau. People tend to be more conservative. Agriculture, including ranching and farming, are a higher percentage of the economic activity, though many residents commute to Telluride to work, mostly in construction and in the service sector. Mining dominated the economy of Naturita until the early 1980's. Current mining-related activity is focused on clean up and remediation, as opposed to actual mining.

<u>Conservation Activities</u>

The Nature Conservancy established its first nature preserve along the San Miguel River, thanks in large part to a gift of land to TNC from Umetco Minerals Corporation. TNC has since established two additional preserves along the river. Today, the three TNC San Miguel River preserves total about 1,000 acres and comprise nearly 10 miles of river corridor.

The Nature Conservancy established its first nature preserve along the San Miguel River in 1987, thanks to a gift of land to TNC from Umetco Minerals Corporation. TNC has since expanded its initial San Miguel River preserve and established two additional preserves along the river. Today, the three TNC San Miguel River preserves total about 1,000 acres and comprise nearly 10 miles of river corridor. These three preserves, together, harbor highly ranked occurrences of rare riparian plant communities; including New Mexico privet foothills riparian shrubland, Fremont's cottonwood/Skunkbrush/

Coyote willow riparian shrubland, Narrowleaf cottonwood/Blue Spruce/Alder montane riparian forest, and Western river birch/mesic graminoid lower montane riparian communities (Lyon and Sovell). TNC first staffed the preserves in 1990 with a seasonal preserve manager. TNC currently staffs an office in Telluride year around with a full-time program manger and a full-time stewardship coordinator.

The Bureau of Land Management's Resource Area Office is in Montrose. The BLM designated 33,000 acres as an Area of Critical Environmental Concern (ACEC) and Special Recreation Management Area (SRMA) in 1992. 65% of the land in the San Miguel watershed is publicly owned (35.2% US Forest Service; 26.9% BLM; 2.4% State). The Forest Service's District Ranger Station is in Norwood.

The San Miguel Watershed Coalition

In 1993, the Telluride Institute convened the first meeting of stakeholders in the upper watershed, and helped form what was then called the San Miguel River Coalition. Beginning the following year, the National Park Service Rivers and Trails Program facilitated a series of meetings of stakeholders from the entire watershed, leading to the broadening of the River Coalition into the San Miguel Watershed Coalition. Members of the Watershed Coalition then embarked upon a two-year collaborative process to write and distribute the 1998 ***San Miguel Watershed Plan***. The USEPA contributed funds to partially pay for the plan's publication. The Watershed Coalition has a part-time watershed coordinator, Linda Luther. The organization recently received non-profit, 501(c) 3 status.

The San Miguel Watershed Plan is not, nor was it ever meant to be, a regulatory document. Mostly, the plan is a tool to facilitate stakeholder collaboration. The mission statement of the coalition states: "Through a process of collaborative planning and substantive public involvement, the San Miguel Watershed Coalition will help identify, prioritize, and facilitate action that will conserve and enhance the natural, cultural, and recreational resources and the social and economic vitality of our communities. The Coalition will provide a forum for agencies, jurisdictions, interest groups and individuals to discuss issues and opportunities on an ongoing basis (*San Miguel Watershed Plan*, p. 8). It is in this spirit that this river restoration assessment was undertaken, hence the inclusion of the stakeholder outreach component in this river restoration assessment.

The San Miguel Watershed Plan divides issues into five themes: Growth and Community Preservation; Water; Natural Resources; Recreation; and Education and Stewardship. Several objectives and potential actions under the themes of Water and Natural Resources provide the context for a river restoration assessment, including the following:

Objective: *Achieve a sustainable condition to the Basin's river, riparian and wetland environments, and the uplands surrounding them* (*San Miguel Watershed Plan*, p.31).

Potential Action: *Support the development of restoration plans on high priority sites, based on condition, threat and importance, to re-establish stable channel geometry and healthy riparian vegetation, and to prevent future stream channelization* (Plan, p.31).

Objective: *Protect the ecological as well as human health and safety values of floodplains* (*Plan*, p.32).

Potential Action: *Support the restoration and maintenance of floodplains as well as explore options and incentives to reduce risk to property* (*Plan*, p. 32).

Objective: *Maintain, and where possible restore natural plant and animal communities in ways that are consistent with watershed objectives* (*Plan*, p.34).

Potential Action: *Support and undertake appropriate restoration efforts (e.g. Colorado River cutthroat trout and Gunnison sage grouse). Identify high priority areas for reintroduction* (*Plan*, p. 34).

Objective: *Minimize non-point source pollution of surface and ground water from sediment, biological pathogens, excess nutrients, urban pollutants, heavy metals and hazardous wastes…*(*Plan*, p. 27).

Potential Action: *Support restoration of unstable river reaches to reduce sediment loading and/or promote healthy riparian areas* (*Plan*, p. 27).

VII. Disturbed Sites

Human Impacts

One hundred and twenty years of intense human use, including mining, road building, logging, agriculture, and, in more recent times, intensifying recreational use and resort development have taken a toll on the diverse, native riparian plant communities and on aquatic communities throughout the watershed. Fragmentation, sedimentation, competition, pollution, and altered hydrology are consequences of this human activity.

In the upper watershed, hard rock mining remnants, including tailings and waste rock piles, and open adits continue to degrade water quality, despite most mining activity having ended a half century ago. Road building, use and maintenance contributes to sedimentation, and in places, contributes to straightening and widening of the stream channel. Gravel mining, though now mostly discontinued, has severely impacted the river channel in places. Catastrophic ice flow events, perhaps enabled by altered winter stream flows related to hydroelectric power generation, scour the stream channel. Snowmaking depletes water tables, and reduces wintertime base flows. Non-native fish species, including rainbow trout, compete with native species for food and habitat.

In the lower watershed, dikes and riprap, in places, prevent flooding and inhibit channel migration. Livestock grazing along portions of the river is harming native vegetation, increases stream-bank erosion and contributes to straightening and widening of the stream channel, and warming of the water. Invasive exotic weeds, brought into the watershed by people and livestock, crowd out native plants, and, during the growing season, transpire tens of thousands of gallons of water a day out of the aquifer. Agricultural diversions below Horsefly Creek, in low water years, nearly dewater sections of the mainstem.

Remediation and mine clean up has occurred at some sites within the watershed, most notably at the Vancorum site downstream of Naturita, and at the Umetco Mill site at Uravan. At Uravan, mill tailings were relocated out of the from the floodplain to an upland hilltop in 1989, removing what some biologists have called a "biological dam" that deterred native fish migration to and from the Dolores River. The Dolores itself continues to improve as native fish habitat due to salinity control projects and summer-long water releases from McPhee Dam, over 100 miles upstream on the Dolores from its confluence with the San Miguel.

Throughout the watershed, impacts from development are potentially a threat to biodiversity values. Road building and road maintenance, home building (including septic system operation), golf course building and operation, fire suppression, ground water pumping and stocking of ponds with non-native fish are all threats related to development.

Taking into account the conservation targets and variety of impacts to those targets, a list of disturbed sites was developed. The list was initially compiled at a meeting of the assessment science team in December 1998. It was then refined by considerable effort, including exhaustive on-site investigation by Willits, Andrews, and Groeneveld (April 1998-September, 1999), aerial reconnaissance (Groeneveld; September, 1999 and October, 2000), personal interview, and stakeholder outreach workshops (Willits; May 2000-July 2000).

The stakeholders prioritized the disturbed site list at a workshop held near Norwood on July 13, 2000. The prioritized list became the substance of the final prioritized list for the restoration assessment after it was reviewed by the science team and evaluated based on restoration targets, expected benefits to biodiversity, and information needs.

Results of Stakeholder prioritization:

PRIORITY (10=HIGHEST)	SITE NAME
10	Howard Fork
9	Valley Floor
8	Deep Creek Horsefly Creek to Pinyon Bridge Calamity Creek to Tabeguache Creek
7	Vanadium/Big Bear Creek San Miguel Canyon Naturita Vancorum
6	Down Valley (Placerville and Mesa Development)
5	Keystone Hill Cascabel Fishing Club Uravan
4	Telluride Gravel Sawpit BLM Tram Site Applebaugh County/BLM Leopard Creek/Omega Mine

Table 6: Disturbed and Degraded Sites:	Biodiversity Values	Key Questions
1) Howard Fork **Acid mine drainage, draining adits** **Mine waste** **Water quality impacts** **Mix of public and private property**	High biodiversity value downstream Water quality, impacting river corridor many miles downstream Wetlands Riparian plant communities Aquatic communities	What are the impacts to the river and how far downstream do those impacts migrate? Multiple owners of acid draining mines Not a Superfund site, but on National Priorities List Complex site to successfully remediate with major environmental liability issues. Where would funding come? Who would lead and coordinate?
2) South Fork **Ice flow events** **Scour banks, increase erosion**	**High quality riparian plant communities, bird & fish habitat** Channel integrity Hydrologic processes Fish habitat	Are these events occurring recently? Are human activities causing these events? How far downstream are the impacts migrating?
3) Telluride Gravel **Confluence of South Fork and Mainstem** **Privately-owned gravel mine**	Hydrologic processes Recreational fishery Public education opportunity	Are impacts still migrating upstream and/or downstream? USFS enforcement action done USFS required remediation done Company recently sold to United Gravel Restoration would put back "hard" river "park"
4) Valley Floor **Mainstem of the San Miguel** **West of Town of Telluride** **Dikes, channelization** **Overgrazing** **Town of Telluride River Restoration**	Wetlands Hydrologic processes: Re-establish channel to floodplain Riparian plant communities Recreational fishery Included Telluride's 303(d) TMDL strategy. Work to begin Fall, 2000	Conflict between landowner & Town of Telluride over development plans Do impacts migrate downstream? Restoration would need to balance recreational use & development Developer is committed to some restoration Community committed to restore w/recreational Not included in San Miguel River Restoration Assessment
5) Keystone **Mainstem of San Miguel** **West of Society Turn to S. Fk. Confluence** **Mine tailings in floodplain**	Hydrologic Processes Recreational fishery Riparian plant communities Water quality	Impacts unknown Tailings reclamation still being negotiated Hydro-electric facility proposed
6) Deep Creek **Tributary to San Miguel** **Remnant population of A-Cutthroat** Mix of public and private property	**Native cutthroat trout** Riparian plant communities Water quality	Heavy ORV & other recreational use Mix of public land with multiple private Increasing residential development Source water for Aldassaro residential development Draining mine adit on East Fork

Disturbed Site	Resource values/benefit	Socio-political factors
7) Vanadium- **Confluence, Big Bear Creek & San Miguel mainstem** **Vanadium millsite** **Mostly private property**	Water quality **Native plant communities** Recreational fishery	Impacts unknown Mix of public & private Mine tailings dispersed Tailings along Silver Pick Rd Information on impacts of tailings needed
8) Sawpit Tram Site: **BLM** **Mine Waste**	Water quality	Impacts unknown BLM ownership May be easily remediated
9) Applebaugh **55 acre site downstream of Fall Creek** **Proposed regional park, now owned by San Miguel County and BLM**	Hydrologic processes: Re-establish channel migration Recreational fishery Recreation Public education potential	Now under County/BLM ownership Multiple recreation demands Limited restoration benefit
10) Down Valley **Fall Creek to Placerville** **All private property**	Water quality Riparian plant communities	Concentrated use of septic systems Heavy development pressure Concern of downstream water users Road building and weed issues Do impacts migrate downstream?
11) Leopard Creek Omega Mine Site **Site acquired by BLM 1999.** **Upstream from confluence w/San Miguel**	**Unique aquatic macrohabitat** Water quality Aquatic communities	Limited restoration benefit Site now owned by BLM Need to get info from BLM
12) San Miguel Canyon **Placerville to Norwood Bridge** **Mostly BLM, w/some private, TNC** **Dikes, diversions, berms,** **Debris**	**High quality riparian communities** Hydrologic processes: Re-establish channel migration Recreational fishery, boating Native plant communities	Multiple sites w/variety of small problems in river corridor (dikes, dams, debris, diversions), unclear of cumulative impacts Need a site by site evaluation
13) Cascabel Fishing Club **Downstream of Norwood Bridge**	Re-establish channel migration Recreational fishery Native plant communities	Channelization, construction of off channel reservoir w/ warm water exotic fish species New 35 acre parcel subdivision
14) Horsefly Ck to Pinyon Bridge (Cottonwood Ck) **3 miles private, 4 miles BLM**	**Native fish habitat restoration potential** **Riparian restoration potential** Hydrologic processes Native plant communities Recreational fishery Aquatic communities	Overgrazing on private land Broadening channel Stream braiding Exotic plant invasion Uninterested private landowner

15) Naturita **Naturita Creek to Dry Creek** **All private property**	**Rare aquatic macrohabitat** **Native fish restoration potential** **High Quality riparian plant communities**	Tamarisk & other exotic plants Current & future gravel mining Heavy development
16) Dry Creek to Calamity Creek **AKA Vancorum** **All private property** **Recently reclaimed vanadium mill**	**Rare aquatic macrohabitat** **Native fish restoration potential** **High Quality riparian plant communities** Hydrologic processes: Re-connect channel to floodplain	UMTRA clean up site Multiple mining companies owned Interest in recreational acquisition by Naturita for golf course
17) Calamity Creek to Tabeguache Creek **All private, incl. TNC**	**Rare aquatic macrohabitat** **Native fish restoration potential** **High Quality riparian plant communities** Hydrologic processes: Re-connect channel to floodplain	3miles owned by unwilling private landowner 7 miles owned by TNC Unsupportive County Commissioner Tamarisk Dikes
18) Uravan Superfund Remediation in Progress **All private: Owned by Umetco Minerals** Uravan was not evaluated as a potential restoration site because of current remediation activities	**Rare aquatic macrohabitat** **Native fish restoration potential** **Rare Plant occurrences** Hydrologic processes Water quality issues	Superfund site Numerous abandoned uranium mines Tamarisk County in line for title to ball field (2003) Proposed RV Campground

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Preliminary Report on the Geology and Recent Geologic History of the San Miguel River Valley, Southwestern Colorado. Madole, Richard 2000. Report submitted to San Miguel River Restoration Assessment; and to BLM, Montrose District Office.

Hydrology, Geomorphology, and Sediment Transport of the San Miguel River, Southwest Colorado. Allred, T.M.; and Andrews, E.D. 2000. US Geological Survey.

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Site Inspection Analytical Results Report: Carbonero Mine and Ophir Mining District, San Miguel County, Colorado. Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division 1999.

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COPIES OF VOLUME II: APPENDICES ARE AVAILABLE BY CONTACTINING:

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CONSERVATION TARGETS AND ECOLOGICAL SIGNIFICANCE

Excerpt from:

SAN MIGUEL RIVER SITE CONSERVATION PLAN

July 1999

The Nature Conservancy of Colorado
1244 Pine Street
Boulder, CO 80304

Summary of Ecological Significance:

The San Miguel River, a tributary of the Dolores River in the upper Colorado River Basin, is one of the few remaining naturally functioning riparian ecosystems in Colorado and the Colorado Rocky Mountains Ecoregion. The river harbors one of the longest and highest-quality stretches of high-quality deciduous and evergreen riparian forests and shrublands (about 80 miles) in the Western United States. The river supports a dynamically functioning, rich mosaic of riparian and aquatic types and associated species. The watershed, approximately 1,550 square miles in size, provides habitat for at least 11 known globally rare riparian plant communities tracked by the Colorado Natural Heritage Program. High-quality examples of at least nine more common plant communities also occur within the watershed. The area also supports at least 6 globally rare animals, 16 globally rare plants, and 12 declining species (species declining through all or a significant part of their ranges) (See Map 3).

Riparian areas are of great importance for maintaining water quality and quantity, stabilizing stream banks, and providing habitat for fish and other wildlife species (Hansen et al. 1988). Riparian corridors and wetlands provide important stopover and breeding habitat for neotropical migratory birds, many of which are declining throughout significant portions of their ranges. Riparian habitats are critically important for the survival of neotropical birds in the Western United States (Roth 1992). Riparian corridors are also a significant landscape component in maintaining regional biodiversity. Serving as interfaces between terrestrial and aquatic systems, "natural riparian corridors are the most diverse, dynamic and complex biophysical habitats on the terrestrial portion of the Earth" (Naiman et al. 1993). Yet riparian habitats are highly threatened; over 80% of America's riparian areas have disappeared. They are also one of the most highly threatened systems in Colorado. Because of their position on the landscape, riparian corridors are sensitive to many land and water use activities including water impoundment and diversion, land clearing for agriculture, mining, livestock grazing, introducing non-native species, heavy recreational demand, and road development (Scott et al. 1995, Scott et al. 1994).

Conservation Targets:

The priority targets, the focus of proposed conservation action in this plan, include the riverine systems, consisting of a number of riparian plant communities, fish communities (macrohabitats) and associated animal and plant species. Other targets include the globally rare (G1-G3) plants and animals, declining species, and aggregations of species. The upland species are noted, as they deserve conservation attention, but are not the primary focus of this conservation plan.

TABLE 1: CONSERVATION TARGETS FOR THE SAN MIGUEL RIVER WATERSHED

Common Name	Latin Name	Riparian/ Wetland Or Aquatic	CNHP Rank	Federal Status
Plant Communities (G1-G3)				
Alkali Sacaton Great Plains Salt Meadow Grassland	*Sporobolus airoides*	X	G3Q	
Blue Spruce/Alder Montane Riparian Forest	*Picea pungens/Alnus incana*	X	G3	
Drummond's Willow Lower Montane Willow Carr	*Salix drummondiana/Calamagrostis canadensis*	X	G3	
Foresteria Foothills Riparian Shrubland	*Forestiera pubescens*	X	G1G2	
Fremont's Cottonwood/Skunkbrush Riparian Forest	*Populus deltoides ssp. wislizenii/Rhus trilobata*	X	G1	
Geyers Willow-Rocky Mountain Willow/Mesic Forb Montane Willow Carr	*Salix geyeriana-Salix monticola*	X	G3	
Narrowleaf Cottonwood/Blue Spruce/Alder Montane Riparian Forest	*Populus angustifolia/Picea pungens/Alnus incana*	X	G3	
Narrowleaf Cottonwood/Skunkbrush	*Populus angustifolia/Rhus trilobata*	X	G3	
Shepherdia Foothills Riparian Shrubland	*Shepherdia argentea*	X	G3G4	
Skunkbrush Riparian Shrubland	*Rhus trilobata*	X	G2	
Western River Birch/Mesic Graminoid Lower Montane Riparian Shrubland	*Betula occidentalis*	X	G3	
West Slope Grassland	*Hilaria jamesii*		G3	
Common Plant Communities				
Fremont's Cottonwood Riparian Forest	*Populus deltoides ssp. wislizenii/Salix exigua*	X	GU	
Lower Montane Forest	*Pseudotsuga mensiezii/Acer glabrum*	X	G4	
Alpine Willow Scrub Mesic Forb	*Salix brachycarpa*	X	G4	
Drummond's Willow/Mesic Forb	*Salix drummondiana*	X	G4	
Coyote Willow/Bare Ground	*Salix exigua*	X	G5	
Coyote Willow/Mesic Graminoid	*Salix exigua*	X	G5	
Subalpine Riparian Willow Carr	*Salix planifolia/Caltha leptosepala*	X	G4	
Subalpine Riparian Willow Carr	*Salix planifolia/Carex*	X	G5	

Common Name	Latin Name	Riparian/ Wetland Or Aquatic	CNHP Rank	Federal Status
	aquatilis			
Montane Wet Meadow	*Carex aquatilis*	X	G5	
Potential Aquatic Communities				
Warm Water Fish Lower Mainstems Naturita Creek Cutthroats only Middle Beaver Creek Deep Creek Cutthroats with only warm water fishes Bilk Creek Beaver Creek East Big Bear		X		
Surrogates for Aquatic Communities Unique Macrohabitats Representative Macrohabitats		X		
GI-G3 Species (+T1-T3)				
Animals				
Boreal Toad	*Bufo boreas pop1*	X	G4T1Q	Candidate
Colorado River Cutthroat Trout	*Oncorhynchus clarki pleuriticus*	X	G5T3	
Gunnison Sage grouse	*Centrocercus minimus gunnisonii*		G1QS1	
Ord's Kangaroo Rat	*Dipodomys ordii nexilis*		G5T3?	
Roundtail Chub	*Gila robusta*	X	G3G4	
Southwest Willow Flycatcher	*Empidonax traillii extimus*	X	G5T2	LE
Plants				
Grand Junction Milkvetch	*Astragalus linifolius*		G2Q	
Naturita Milkvetch	*Astragalus naturitensis*		G2G3	
San Rafael Milkvetch	*Astragalus rafaelensis*		G3	
Wetherill Milkvetch	*Astragalus wetherillii*		G3	
Slender Rock-Brake	*Cryptogramma stelleri*		G5	
Arctic Draba	*Draba spectabilis var oxyloba*		G3T3Q	
San Juan Whitlow-Grass	*Draba graminea*		G2	
Colorado Divide Whitlow-Grass	*Draba streptobrachia*		G3	
Payson Lupine	*Lupinus crassus*		G2	
Little Penstemon	*Penstemon breviculus*		G3Q	
Abajo Penstemon	*Penstemon lentus*		G4Q	
Grand Mesa Penstemon	*Penstemon mensarum*		G3	
Canyon Bog - Orchid	*Plantanthera sparsiflora var ensifolia*	X	G4G5T3	
Different Groundsel	*Senecio dimorphophyllus var intermedius*		G4T2	
Parish's Alkali Sakaton	*Sporobolus parishii*			Listed

Common Name	Latin Name	Riparian/ Wetland Or Aquatic	CNHP Rank	Federal Status
				(status unknown)
Altai Chickweed	*Stellaria irrigua*		G4?	
Declining Species (in riverine zone)				
Belted Kingfisher	*Ceryle alcyon*	X		
Boreal Owl	*Aegolius funereus*	X	G5	
Brewer's Blackbird	*Euphagus cyanocephalus*	X		
Bullock's Oriole	*Icterus galbula*	X		
Lewis' Woodpecker	*Melanerpes lewis*	X		
Northern Goshawk	*Accipiter gentilis*	X	G5	
Olive-sided Flycatcher	*Contopus borealis*	X	G5	
Willow Flycatcher	*Empidonax traillii*	X		
Alligator Lizard	*Gambelia wizlizinii*			
Northern Leopard Frog	*Rana pipiens*	X	G5	
Bluehead Sucker	*Catostomus discobolus*	X	G4	
Flannelmouth Sucker	*Catostomus latipinnis*	X	G4	
Aggregations (or critical seasonal habitat)				
Bald Eagle (roosts)	*Haliaeetus leucocephalus*	X	G4	LT
Golden Eagle (nests)	*Aquila chrysaetos*		G5	
Great Blue Heron (nests)	*Ardea herodias*	X	G5	
Prairie Falcon (nests)	*Falco mexicanus*		G4G5	
Peregrine Falcon (nests)	*Falco peregrinus anatum*		G4T4	LE
Other Species Tracked by CNHP (State Rare)				
Wolverine	*Gulo gulo*		G4	
Utah Milk Snake	*Lampropeltis triangulum taylori*		G5T4Q	
Purple Martin	*Progne subis*		G5	
Grizzly or Brown Bear	*Ursus arctos*		G4	
Gray Vireo	*Vireo vicinior*		G4	
Great Purple Hairstreak	*Atlides halesus*		G5	
Theano Alpine	*Erebia theano*		G4	
Brimstone Clubtail	*Gomphus intricatus*	X	G4	
Northern Blue	*Lycaeides idas*		G5	
Two-Banded Skipper	*Pyrgus ruralis*		G4	
Altai Cottongrass	*Eriophorum altaicum var negogaeum*	X	G4T?	
Potential Species				
Mexican Spotted Owl	*Strix occidentalis lucida*		G3T3	
Kit Fox	*Vulpes macrotis*		G5	
Gunnison Prairie Dog	*Cynomys gunnisoni*		G5T3	
Great Basin Silverspot Butterfly	*Speyeria nolomis nokomis*	X	G4T2	
Western Yellow-billed Cuckoo	*Coccyzus americanus*	X	G5T3	

Common Name	Latin Name	Riparian/ Wetland Or Aquatic	CNHP Rank	Federal Status
	occidentalis			
Uncompahgre fritillary	*Boloria acrocnema*	X	G2	LE

LE = Listed by USFWS as endangered
LT = Listed by USFWS as threatened
Candidate = candidate for listing by USFWS
Global Ranks = global rarity ranks are based on the range-wide status of a species.
G1= critically imperiled globally because of rarity (5 or fewer occurrences in the world or very few remaining individuals) or because of some factor of its biology making it especially vulnerable to extinction.
G2 = Imperiled globally because of rarity (6-20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range.
G3 = Vulnerable through its range or found locally in a restricted range (21-100 occurrences)
G4 = Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.
G5 =Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G#T# =Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.

MAPS AND PHOTOGRAPHS

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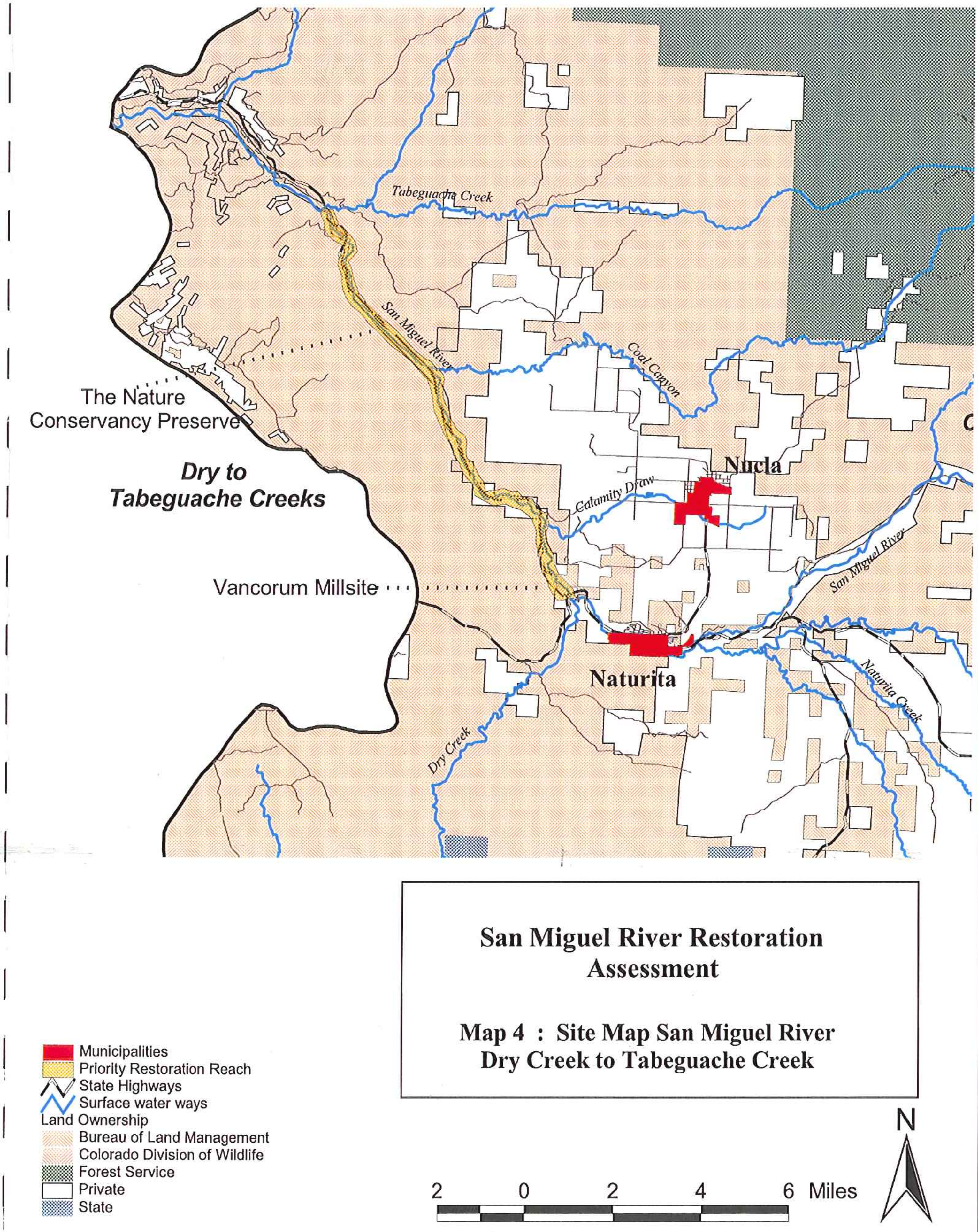
[7] GIS watershed maps, base maps and site maps by Chris Hazen, Telluride Institute.
[8] Digital Ortho Quads by Marc Hitchcox, Southwest Data Center, using USGS data.
[9] Aerial photography by David Groeneveld, 9/28/00.



San Miguel River Restoration Assessment

Map 4 : Site Map San Miguel River Dry Creek to Tabeguache Creek