UAPP 611 - Group #2 Water Management Plan - First submission - 4/4/2018

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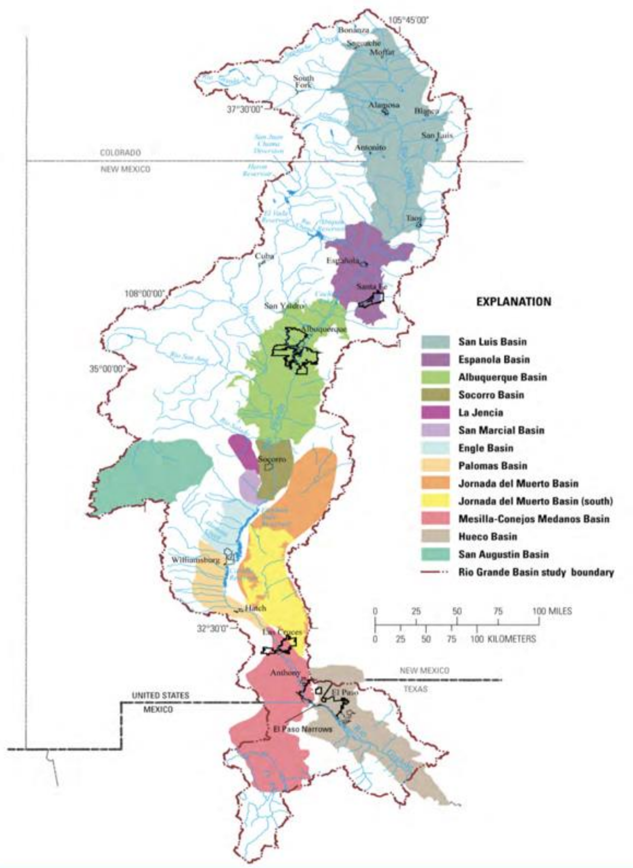
TAOS ACTION PLAN FOR WATER - TAP WATER PROJECT

Mission Statement

The mission of the TAP Water Project is to create a sustainable usage plan for the northernmost reaches of the Rio Grande basin for the next ten years, mainly focusing on the most efficient options for strengthening the resilience of the current socio-ecological systems through community engagement.

Rio Grande River Basin



N. Houston & K. Douglas-Mankin (2017)

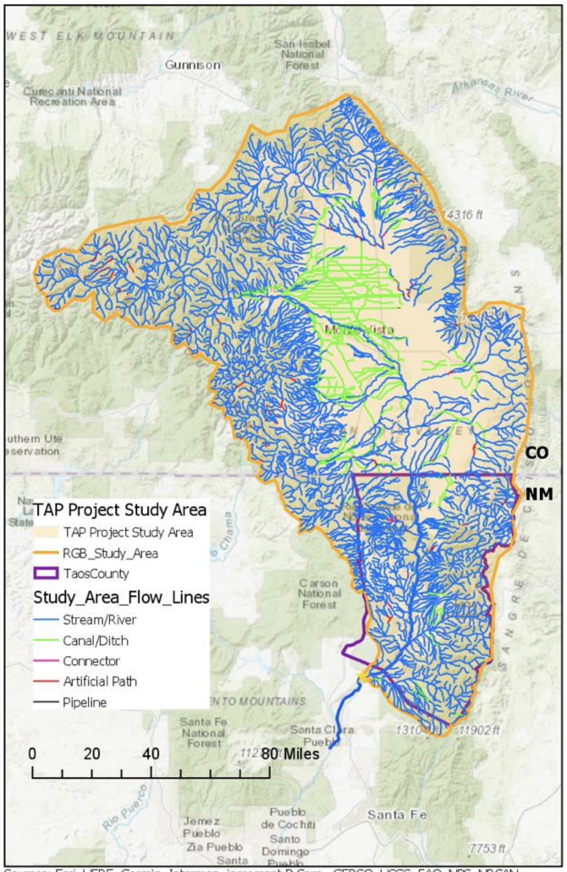
Introduction

The Rio Grande River originates from the San Juan Mountains of southern Colorado, and ends at the Gulf of Mexico. It is 1,885 miles long, making it the fifth longest river in North America, and flows through Colorado, New Mexico, and Texas, as well as defining the boundary between the United States (US) and Mexico. The northernmost reach of the river is the San Luis Basin, which extends from the headwaters in Colorado to the southern border of Taos County in New Mexico. This basin is approximately 16,500 square miles. The TAP Water Project focuses on the New Mexico portion of the basin.

The TAP Water Project will highlight and address three specific problems of the northern Rio Grande Basin (RGB) in pursuit of its mission. These are decreasing water resources and challenges with allocation of the basin resources among its many stakeholders, degradation of riparian habitat, and water quality issues.

To frame our work we will lay out a general history of human habitation of the Rio Grande Basin up until present times and then focus specifically on aspects of water governance. We then move

TAP PROJECT STUDY AREA



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to a discussion of three major water problems of the Upper Rio Grande Basin with particular relevance to Taos County and offer recommendations for solution of these issues. Finally, we conclude our paper by giving an overview of our research and recommendations.

Historical Background

The Rio Grande currently flows through three western US states and between two countries. A modern governance structure has developed over time, which considers present needs, to some extent, but is also built on ancestral and historical traditions. In what follows, we lay out a general history of human habitation of the Rio Grande Basin up until present times and then focus specifically on aspects of water governance. Governance of the Rio Grande has been highly dependent on factors of climate, cultural development and change, and the development of an overarching philosophy of water management in the West that has resulted in issues of allocation, pollution, and habitat degradation within the Rio Grande basin.

The geography and climate of the Rio Grande have been evolving since the end of the last ice age. The area has been continuously inhabited for at least the last 11,000 years. The first evidence of agriculture comes from the Cochise people who were the base of many Southwest cultures that followed (Encyclopedia Britannica). The Anasazi culture developed across the area in a wetter climate than today between BCE 500 and CE 700. The Anasazi culture evolved into the Chaco culture, which is described as a "vast pre-Columbian cultural complex that dominated much of what is now the southwestern United States from the mid-9th to early 13th centuries" (UNESCO). Climate change and/or regional resource depletion forced this culture to migrate and settle in pueblos along the Rio Grande and its tributaries after the year 1300. Many of these pueblos are still in existence and practice their cultural traditions towards water much as they have for centuries (New Mexico Office of the State Historian).

Between 1540 and 1598, New Mexico and southern Colorado were explored and colonized by Spain. The capital of the Spanish province of New Mexico was established at the confluence of the Rio Grande and Rio Chama rivers, but was later moved to Santa Fe in 1610. Santa Fe remains the present capital of New Mexico and is the oldest capital city in the United States. In 1680, the united pueblo peoples of the state would revolt and drive the Spanish south to El Paso. The Spanish would then recolonize the region in 1692. In 1807, Zebulon Pike would lead the first US expedition into New Mexico while exploring the Region around the Red River in Texas. This expedition was coincident with other Jeffersonian expeditions of the West including those of Lewis and Clark. In 1821, Mexico, including the province of New Mexico won independence from Spain. Between 1821 and 1850, the Mexican government would clash with citizens of northern New Mexico as well as fight Texan incursions into the territory. Finally, in 1846, the US would invade New Mexico as part of the Mexican-American War. At the conclusion of the war, Mexico was forced to cede much of its territories in modern-day Texas, Arizona, California, and New Mexico to the US. From this point forward, New Mexico would be a territory and then 47th state of the US as of 1912.

Water Governance Background

Water in the Desert Southwest is extremely important and has allowed for the growth of large population centers, agricultural industries and, to a lesser extent, recreational industries. Before Spanish colonization and US statehood, the prehistoric peoples of the area developed water management systems which were independent of the rivers. The climate along with traditional agricultural practices allowed for the development of sophisticated systems of irrigation, which relied on precipitation and runoff. When these peoples moved to the Rio Grande and its tributary basins, these efficient systems of water management persisted. When the Spanish arrived and established ranchos or land grants, they needed larger allocations of water to sustain them. This led to the adaptation and appropriation of abandoned and extent water management practices in the region. This adaptation led to the development of systems of acequias or community ditches, which transported greater portions of river water across agricultural holdings vastly expanding their potential outputs.

Acequia System of Water Management

The acequia system of water management has persisted into the present day in many parts of the Rio Grande basin. There are especially dense acequia systems in the north-central part of New Mexico. This traditional water management practice arises from the combination of Puebloan and Iberian water use practices. Specifically, the sustainable diversion practices of the native peoples would be combined with the Spanish ‘Laws of the Indies’, which governed the colonization practices of the Spanish Empire (Rivera, 1998). “Successful settlement patterns depended upon observing the limits of the natural system, adaptation to adverse climatic and political conditions, the development of mutual aid mechanisms for labor and defense, and concentration on subsistence production of primary resources” (Henkel, 2014). Before the present water management infrastructure, acequias fostered a land-water connection, which capped the growth of communities by only provisioning enough water to irrigate without unduly stressing the water source. Today, each acequia system that has four or more parciantes (water-rights owners), must have bylaws, a three member elected commission and a mayordomo who is usually elected by the parciantes. These regulations are outlined in the New Mexico State Statutes (Miller, n.d.).

Current Water Compacts, Projects, and other Legal Elements

Despite the persistence of acequia culture along the northern Rio Grande and its tributaries, water governance and watershed management have had to adapt to influences stemming from the inclusion of New Mexico as a US territory and state. These include the commodification of water rights and the subsequent separation of the water from the land, the partitioning and allocation of water between different states and countries.

Water right commodification created three new distinct issues. First, ‘junior’ or young water rights could be endangered by a priority call, which fit better with Anglo-American civil law systems. Prior practice included provisions for sharing water equitably in times of need, but this was essentially abandoned. Secondly, water use was considered part of the public welfare and thus necessary. Water rights could be considered abandoned and reallocated due to lack of use. Lastly, water rights could be separated from the land. This meant that water rights could be sold on a marketplace.

In addition to changes in the traditional water rights and acequia culture, statehood would fold the waters of the Rio Grande into a philosophy of regional and international water management designed to stabilize development in the US Southwest. Unfortunately, many of these agreements would be accomplished during periods of higher annual precipitation than the average thus setting the groundwork for some of the future water shortages is seen presently. These include the Rio Grande Compact of 1938 and treaty between Mexico and the United States resolving water sharing in 1944. These agreements would also serve to institute a series of water banking whereby yearly delivery deficits would need to be made up in the following years. It is easy to see how such a system might unduly stress water users and ecosystems. “This is an issue of scale: the compacts are regional; the stress upon local irrigators [and ecosystems] is local” (Henkel, 2014).

Furthermore, it had been discovered in the 1930s that the hydrologic functions of surface water and groundwater are interrelated, so that excessive withdrawals of groundwater to offset shortfalls in surface water effectively reduce surface flows, placing stress on the riparian zone and a reduction in its biodiversity and productivity (Phillips et, al., 2011). The passage of the National Environmental Policy Act in 1969, and subsequent federal legislation such as the Clean Water Act (1972) and the Endangered Species Act (1973), introduced a broader series of concerns that further constrained the system.

At the local use level, the waters of the Rio Grande and its tributaries in Northern New Mexico were governed by the territorial 'Acequia Act' of 1907. This law centralized the administration of water through the creation of the office of what was to become the State Engineer. The law also provided for the severance of water rights from irrigated land, with transfer to other locations and uses (Henkel, 2014). The fact that the state manages the water law and flow through the offices of the State Engineer and the Interstate Stream Commission can create tension with the unique political subdivisions created by acequia associations. This is especially true when water use, land use, maintenance of habitat, environmental services, development pressures and encroachment by non-rural land uses are all issues to be addressed.

PROBLEM 1 - ALLOCATION ISSUES AND DECREASING WATER RESOURCES

As mentioned earlier, Taos County experiences decreasing water resources and allocation challenges.

The decreasing water problem is caused by recent droughts due to climate change and changing interactions between groundwater and surface water.

Climate change is infamous for unpredictability, and it places additional stress on water resources (Conca, 2012). In addition, climate change increases the intensity and frequency of droughts (Emanuel, 2017). Taos County is already a semi-arid area, with water scarcity (Jordan, 2015), and it is vulnerable to drought (TRWP, 2016). Climate change, in addition to the existing scarcity, makes the situation very difficult for Taos County.

The decreasing water problem is also caused by changing interactions between groundwater and surface water, due to over pumping and the soil type. In Taos County, 80% of the water resources is groundwater (TRWP, 2016), as the soil is permeable and porous. Currently, over pumping groundwater is causing depletion in the region. In addition, due to the uniqueness of the soil in the region, it causes the remaining groundwater to be run off from the area, as it breaks the groundwater – surface water balance (similar to saltwater intrusion).

The allocation challenge is mostly caused by transferring water to the downstream regions, as they have large and increasing water consumption needs (TRWP, 2016). "The largest individually owned potato storage cellar in the world", which has extensive water rights, is located in Taos County (Jordan, 2015). Santa Fe County and four pueblos, further downstream, spent millions of dollars to purchase water rights from the farm (Jordan, 2015). Then, they filed an application to move this water downstream, which can dry up the Taos County (Jordan, 2015).

Goals

Addressing the climate change issue is out of the scope of our research; however, we have four recommendations to address the water transfer and groundwater depletion issues.

- Establishing an intercounty joint committee under the main committee
- Adopting a new tax
- Increasing efficiency via the water transfer program detailed below
- Groundwater recharge via the water transfer program

Joint intercounty committee

There is already an interstate committee in the basin; however, we recommend establishing an intercounty joint committee under the main committee, constituted by the users. According to Elinor Ostrom (2010, 2011), users of common pool resources should develop institutional arrangements and regulations for joint management of their shared resources. Joint committees constituted by the users have governed many shared water bodies very efficiently, including the ones shared by the parties that are in conflict (Altingoz et al., 2018).

We also recommend that, concerning water transfers should also be approved by the intercounty commission, which would investigate the anticipated results of offered transfers for each county, before approving. This would help preventing future conflicts as well (i.e. Santa Fe - Taos County conflict).

Adopting a new tax

In order to encourage water efficient practices, we are recommending adopting a new tax similar to the San Luis Valley initiative. This initiative charges farmers $75 for per acre-feet water they use, which decreased consumption and resulted in replenishment of depleting groundwater resources in the area (Runyon, 2017). The intercounty committee could oversee this. Even though this program might be difficult to adapt due to possible oppositions, it would perhaps have similar favorable impacts for Taos County and downstream, Santa Fe County and the pueblos. In addition, the money generated could be used for other water conservancy projects.

Increasing efficiency and Groundwater recharge

We recommend creating a new water right transfers program that would increase efficiency. This program enables water-seeking parties to install efficient irrigation systems on farmlands in exchange of a portion of water rights of the farmer. These efficient systems can save more water than the transferred portion of the farmer’s water right. Hence, this increases efficiency.

In addition, within this water transfer for efficient irrigation program, Taos County should obtain a percentage of the transfer. This amount could be recharged into wells. This could help fixing the interactions between groundwater and surface water.

For instance, let us suppose, a farmer has 10 CFS water rights. A private company installs efficient irrigation infrastructure to the farm in exchange of 3 CFS water right. Taos County, the main and the intercounty commissions, investigates and approves this. From, this transaction, Taos County obtains 1 CFS.

Figure 1. Water for sale sign in a farm land retrieved from (Runyon, 2017)

The efficient system decreases water use from 10 CFS to 5 CFS, as efficient irrigation systems can save up to 50% water (EPA, 2014). 3 of 5 extra CFS goes to the private company. 1 of 5 extra CFS goes to Taos County, which would be used for groundwater recharge. The last 1 extra CFS remains at the farmer, which might remain in the stream for instream use purposes due to the fact that the farmer would not need this water anymore.

Otherwise, this water could be used for increasing production, which would generate economic gains for the farmer as well as Taos County.

PROBLEM 2 - DEGRADATION OF RIPARIAN HABITAT

The Upper Rio Grande Basin provides critical habitat for endangered and threatened species. The riparian habitat must be improved to protect and support recovery of these species.

Of the roughly 120 New Mexico species identified as Threatened or Endangered by Federal and State agencies, three are most likely to benefit from TAP Water Project efforts due to their reliance on riparian habitat in Taos County. These are the Southwestern Willow Flycatcher (endangered), the New Mexico Meadow Jumping Mouse (endangered), and the Yellow-Billed Cuckoo (threatened). [Taos Regional Water Plan]

The RGB riparian habitat has degraded due to a number of factors, which has resulted in significant habitat loss and subsequent stress on these vulnerable species. Actions, which reverse the degradation, will benefit all three of the identified species as well as other, not immediately threatened species native to the region. A brief discussion of the threats and recommended remedies for the two endangered species follows. (Note that the issues identified for the flycatcher are applicable to the cuckoo, and remediation actions would be beneficial for both.)


New Mexico Meadow Jumping Mouse
Photo Courtesy of Jennifer Frey

New Mexico Meadow Jumping Mouse (Zapus hudsonius luteus)
Habitat: The New Mexico Meadow Jumping Mouse is a small nocturnal mammal. Its habitat requirements include tall (at least 24 inches), dense riparian herbaceous vegetation primarily composed of sedges and forbs. This suitable habitat is found near perennial flowing water and provides the mouse with vital food sources (insects and seeds), as well as the structural material for building day nests that are used for shelter from predators. Reaches of ~700 – 2000 feet located intermittently and connected along a flowing stream for 6 – 15 miles are needed to support resilient populations of the mouse.


Jumping mouse habitat
Photo Courtesy of the USFWS

Stressors: Surveys since 2005 have identified 29 remaining mouse populations spread across eight geographic management areas (2 in Colorado, 15 in New Mexico and 12 in Arizona). Nearly all of these populations are isolated and widely separated, and all have patches of suitable habitat that are too small to support resilient populations of the mouse. Habitat losses are caused by livestock grazing which removes the needed vegetation, water management and use activities which result in vegetation loss from mowing and drying of soils, droughts, wildfires, scouring floods, loss of beaver ponds, and human development activities (roads, residential, commercial, and recreational).

Recommended actions: The US Fish and Wildlife Service found that "the jumping mouse is at an elevated risk of extinction now and no data indicate that the situation will improve without significant conservation intervention. Conservation of the species requires the restoration of habitat within each of the eight conservation areas to provide additional areas for local populations to expand and become established. Consequently, current populations should be expanded as rapidly as possible by protecting and restoring (through grazing management and water management) at least 9 to 24 km (5.6 to 15 mi) of continuous suitable habitat along stream reaches, ditches, or canals…" Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation, grazing management practices, and re-establishment of beavers in some locations), research, captive propagation and reintroduction, and outreach and education.

Southwestern Willow Flycatcher (Empidonax traillii extimus)

Southwestern Willow Flycatcher. Photo: Scarlett Howell/USGS

Habitat: The southwestern willow flycatcher is a small Neotropical migratory bird, whose nesting habitat is restricted to relatively dense growths of trees and shrubs in riparian ecosystems in the arid southwestern United States and possibly extreme northwestern Mexico. The flycatcher was listed as endangered in 1995, and as of 2002 there were an estimated 900 – 1100 pairs across its range. It breeds in relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands including lakes and reservoirs. Historically the flycatcher nested in native vegetation including willows, seep-willow, boxelder, buttonbush, and cottonwood. It still nests in native vegetation but has adapted to changes to riparian communities by also using thickets dominated by non-native tamarisk and Russian olive, or in mixed native/ non-native stands. [USFWS Final Recovery Plan]

Southwestern Willow Flycatcher habitat along the Upper Gila River, AZ.

(Credit: James Hatten, USGS. Public domain.)

Stressors: The flycatcher has declined because removal, thinning, and destruction of riparian vegetation has reduced its suitable habitat. Brood parasitism by Brown-headed Cowbirds has also jeopardized the existing populations. Riparian habitat impairment is caused by water manipulation (diversion, impoundment, pumping, and flood control) which alters vegetation, livestock overgrazing, and fires. Efforts to eradicate invasive exotic plants such as tamarisk and Russian olive can also have a deleterious effect if not combined with restoration of native vegetation. The continuing invasion of the tamarisk leaf beetle (Diorhabda spp.) into New Mexico might also threaten the state's flycatcher populations, due to their ability to defoliate large stands of tamarisk during the flycatcher's breeding season.

Recommendations: The US Fish and Wildlife Service 2002 Final Recovery Plan seeks to downgrade the status of the flycatcher to "threatened" by doubling the area of suitable habitat to support greater and less isolated populations. Recommended actions to achieve these goals include increasing and improving currently suitable and potentially suitable habitat, surveying and monitoring populations, public education and outreach, research, assuring implementation of laws, policies and agreements that benefit the flycatcher, and tracking progress. Examples of habitat recovery actions that can improve riparian habitat include increasing efficiency of water management elements, minimizing clearance of exotic vegetation until an effective riparian vegetation improvement plan can be implemented and managing livestock grazing to protect flycatcher habitat.

TAP Water Project Goal: Increase suitable habitat for mouse and flycatcher by 25% in Taos County over the next 5 years.

Actions:

- Identify suitable stream site for habitat reconstruction and re-introduction of mouse, apply for grants to fund the project, solicit assistance from community youth groups to implement
- Develop guidelines for evaluation of vegetation control options, outreach to educate community, demonstration project to migrate an area from invasive encroachment to native vegetation

PROBLEM 3 - WATER QUALITY ISSUE

Assurance of ability to meet future water demands requires not only water in sufficient quantity, but also water that is of sufficient quality for the intended use. The water quality of Upper Rio Grande watershed is not optimistic, especially in Taos County because of large mining activities. The groundwater was first polluted by several types and sources of contaminants, and this contamination would further impact the surface water and lower part of Rio Grande River. The Red River, one of the major tributaries of Rio Grande River is strongly contaminated for nearly four decades by tons of mine tailings, the water color turned to cloudy blue in the early 1980s, which implicated acid drainage and high metal content (Antencio, 2000). Water quality assessment in 2014 showed that at least 9 established segments of Upper Rio Grande River were listed as impaired (USIBWC Citizens' Forum and Upper Rio Grande Basin Advisory Meeting, 2017), which means the water bodies didn't meet State water quality standards, the major water quality issues are bacteria, salts, nutrients and depressed DO.

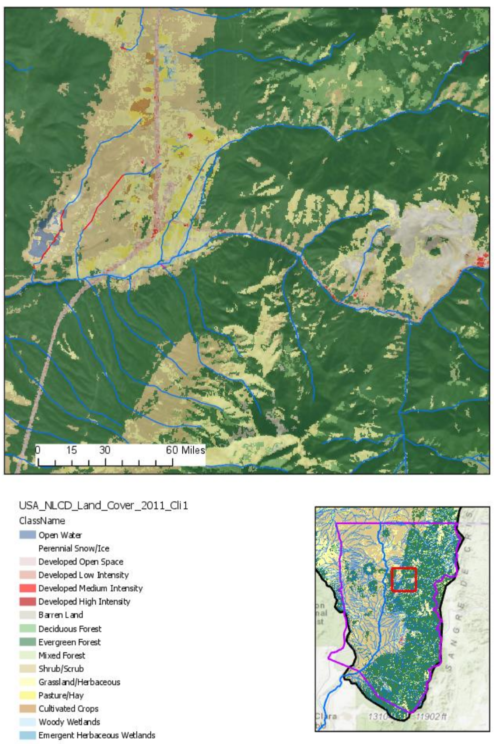
Discharging Foam in the river

Figure 2. Some examples of issues

Potential Causes of Issues

The largest contamination source in Taos County is Chevron Questa Mine, which is located along the Red River, between the Village of Questa and the Town of Red River. The Site includes a former molybdenum mine and milling facility on 3 square miles of land and tailing impoundments on about 1.5 square miles of land. This mine was operated intermittently from 1920 until 2014, when Chevron Mining Inc permanently closed it. Open pit mining took place from 1965 to 1983. Mining operations and waste disposal contaminated soil, sediment, surface water and groundwater. While the mine was operating, about 328 million tons of acid-generating waste rock were excavated and deposited in nine large waste rock piles. After molybdenum was extracted from ore, the tailing was transported by pipeline to a tailing facility where it was deposited in tailing impoundments. EPA (Environmental Protection Agency) re-proposed the mine site to the National Priorities List (NPL) of Superfund Sites in March 2011. Currently, the site is under cleanup process including removal actions, short-term cleanups and revegetation.

Questa Area Land Use / Land Cover



Another primary water quality concern in Taos County is groundwater contamination due to Landfills. Landfills used for disposal of municipal and industrial solid waste contain a variety of potential contaminants that may impact groundwater quality. These operations started since 1989 are regulated under the New Mexico Solid Waste Management Regulations. Currently, one operating landfill is located at the center of Taos County, between Rio Hondo River and Rio Lucero River.

In addition, septic system discharge presents a potential threat to groundwater. The contaminants can percolate rapidly to the underlying aquifer and increase concentrations of Total dissolved solids (TDS), Iron, manganese, sulfide, Nitrate, toxic organic chemicals and Bacteria, viruses (NMWQCC, 2002). Because septic systems are generally spread out over rural areas, they are considered a nonpoint source. Collectively, septic tanks and other on-site domestic wastewater disposal systems constitute one of the largest known sources of groundwater contamination in New Mexico. Other nonpoint sources of pollutants that are concerns for surface water quality in Taos County include wildfires, grazing, agriculture, recreation, hydro modification, removal of riparian vegetation, road and highway maintenance, silvicultural activities, land disposal, and road runoff etc.

Furthermore, a recent study considered climate change impacts to water quality in the Rio Grande Basin (EPA, 2013). In the EPA analyses, absolute reductions in total nitrogen, phosphorus, and suspended solids loads reflect reductions in total flow volumes. However, projected reductions do not reflect how the concentration of these pollutants may change under future climate scenarios. Concentrations of these and other pollutants, and of salt, are expected to increase in the future under projected warming scenarios in response to increased evaporation rates for surface water and increased precipitation intensity that could wash a greater volume of pollutants from the land surface into the river.

Goals

To address these problems, several methods could be considered:

1. Dewatering the underground contaminant area

In the Taos area, lots of groundwater are heavy polluted such as Questa mining area; the exchange between contaminant groundwater with river makes this issue worse and further impact downstream area. Before totally cleanup or remove contaminant soil at these areas, it is better to pump the groundwater at these areas to make the groundwater level lower than the surface water level, so the contamination would not be exchanged to rivers.

2. Continue monitoring the possible leaking from urban pollution system

Waste leaking from landfill or septic system makes a big trouble on local environment, especially for non-point source contamination. Enhance monitoring and checking the system in the area could avoid the leaking problem. The monitoring on non-point source pollutant is not a easy work, some simple filters and treatment systems for domestic water supply may be helpful to mitigate health effects.

3. Establish the watershed protection plan to control the waste discharge

Controlling the waste discharging in the area is necessary, the total maximum daily load (TMDL) management plan of different sub-watershed should be determined for factories and communities near rivers.

CONCLUSION

We are presenting our findings and recommendations in the table below with the purpose of offering a sustainable water plan for the next ten years for Taos County.

Problem	Identified Causes	Goal/ Recommendations
Decreasing water resources and allocation challenges of the basin	Several severe droughts in recent years due to climate change Water rights purchased by downstream areas due to their large and increasing water consumption by agriculture downstream. Changing interactions between groundwater and surface water.	Establishing an intercounty joint committee under the main committee Adopting a new tax Increasing efficiency via the water transfer program Groundwater recharge via the water transfer program
Degradation of riparian habitat	Water management actions negatively impacting native riparian vegetation. (depleted water resources, inundation by reservoirs, removal of vegetation to make more water available for agriculture/livestock, fewer beaver populations) Livestock overgrazing diminishes riparian vegetation. Adverse impacts of invasive species eradication efforts.	Goal: Increase suitable habitat for mouse and flycatcher by 25% in Taos County over the next 5 years. Actions: Identify suitable stream site for habitat reconstruction and re-introduction of mouse, apply for grants to fund the project, solicit assistance from community youth groups to implement Develop guidelines for evaluation of vegetation control options, outreach to educate community, demonstration project to migrate an area from invasive encroachment to native vegetation
Water Quality	Questa mining waste Landfill Septic system and some other non-point source pollution Climate change	Dewatering the underground contaminant area Monitoring the possible leaking Control the waste discharge

Table 1. Summary of Findings and Recommendations

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TAP WATER PROJECT

UAPP 611 Watershed Plan - 4/4/18

Group #2

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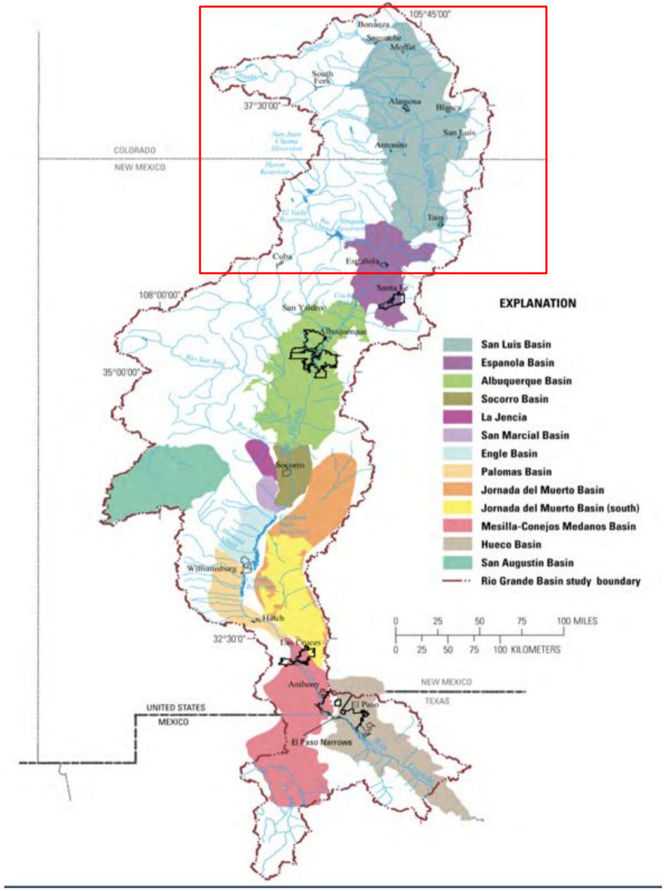
MISSION STATEMENT

The mission of the TAP Water Project is to create a sustainable usage plan for the northernmost reaches of the Rio Grande basin for the next ten years, mainly focusing on the most efficient options for strengthening the resilience of the current socio-ecological systems through community engagement.

INTRODUCTION

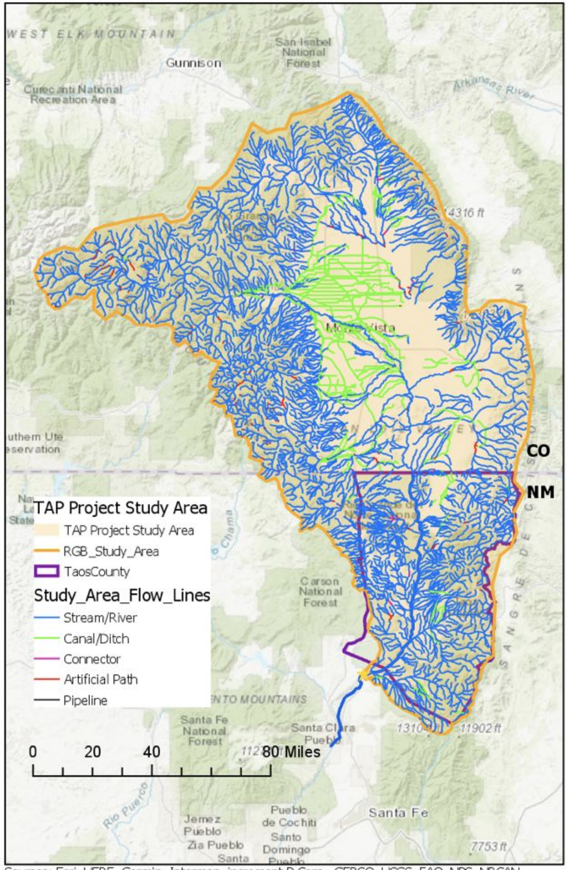
The Rio Grande River originates from the San Juan Mountains of southern Colorado, and ends at the Gulf of Mexico. It is 1,885 miles long, making it the fifth longest river in North America, and flows through Colorado, New Mexico, and Texas, as well as defining the boundary between the US and Mexico. The northernmost reach of the river is the San Luis Basin which extends from the headwaters in Colorado to the southern border of Taos County in New Mexico. This basin is approximately 16,500 square miles.

Rio Grande River Basin



N. Houston & K. Douglas-Mankin (2017)

TAP PROJECT STUDY AREA



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

The Rio Grande and the San Luis sub-basin

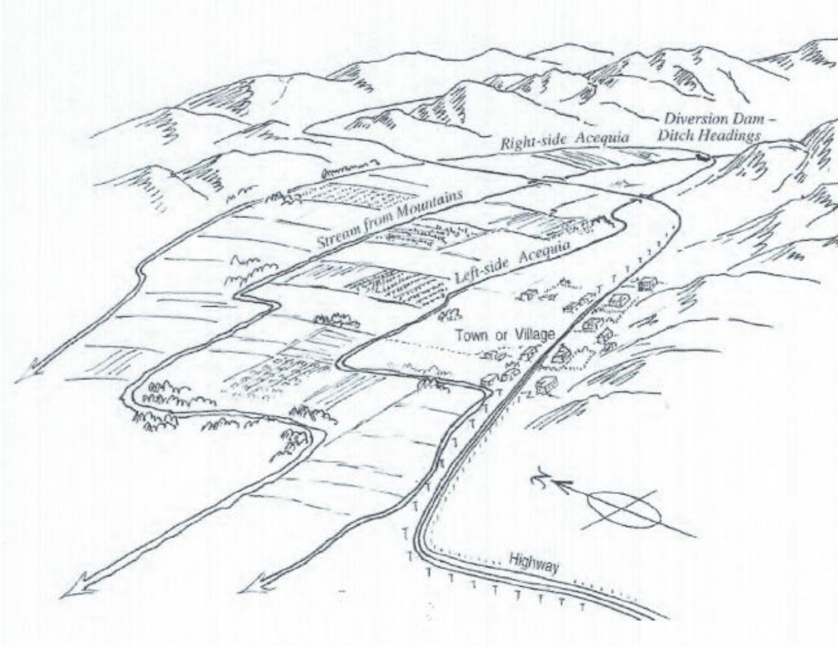
- Length: 1885 miles
- Colorado, New Mexico, Texas, and Mexico share water
- San Luis sub-basin drained area is approximately 16,500 square miles.

BACKGROUND AND HISTORY Part I

- Cochise and Anasazi
  - 10,000 BCE - 70O CE
- Chaco Period
  - CE 700 - 1300
- Pueblo Period
  - CE 1200 - 1500s
- Spanish Colonization
  - 1540 - 1821
- Mexican Independence
- US Territory and Statehood
  - 1850 and 1912

Background and History Part II

- Community, state, and regional governance structures
- Acequias
  - Modeled after native and spanish traditional water management practices
  - Water Rights
  - Water and Land connection
- US Water Law
  - 1907 Acequia Act
  - 1938 Rio Grande Compact
  - 1944 US-Mexico Treaty
- Other factors
  - Groundwater/surface water interactions
  - Interbasin water transfer



Henkel (2014)

Problems

The TAP Water Project will highlight and address three specific problems of the northern Rio Grande Basin (RGB) in pursuit of its mission. These are decreasing water resources and challenges with allocation of the basin resources among its many stakeholders, degradation of riparian habitat, and water quality issues.

Problem 1 - Allocation Issues and Decreasing Water Resources

- Decreasing water resources
  - Severe droughts in recent years due to climate change
  - Groundwater depletion due to changing interactions between groundwater and surface water as well as overpumping
- Allocation issues
  - Due to Santa Fe County and four Pueblos to transfer water further south

Problem 1 - Allocation Issues and Decreasing Water Resources

Addressing the climate change issue is out of the scope of our research; however, we have four recommendations to address the water transfer and groundwater depletion issues.

- Establishing an intercounty joint committee, under the main committee
- Adopting a new tax
- Increasing efficiency via the water transfer program
- Groundwater recharge via the water transfer program

Problem 2: Critical habitat for endangered/threatened species must be improved to protect and support recovery

New Mexico Meadow Jumping Mouse
Photo Courtesy of Jennifer Frey

Stressors on Riparian Vegetation:

- Removal efforts
- Altered water flows
- Destruction by livestock
- Recreational activity

Impact:

NM Meadow Jumping Mouse:

- Isolated Populations, less than required range area

Southwestern Willow Flycatcher:

- Population declines from habitat loss and brood parasitism (Brown Headed Cowbird)

Southwestern Willow Flycatcher. Photo: Scarlett Howell/USGS

Problem 2 Goal: Increase suitable habitat for mouse and flycatcher by 25% in Taos County over the next 5 years.

Jumping mouse habitat
Photo Courtesy of the USFWS

Actions:

- Community based involvement in habitat repair
- Education and outreach
- Funding from Endangered Species protection grant programs

Southwestern Willow Flycatcher habitat along the Upper Gila River, AZ.

(Credit: James Hatten, USGS. Public domain.)

Improvement in habitat benefits many other species, including threatened Yellow Billed Cuckoo

Problem 3 - Water Quality

Major water quality issues:

Bacteria

Salts

Trash

Nutrients

Depressed DO

Potential Causes of Issues:

Point Source:

Questa mining field

Landfill

Non-point Source:

Septic System

Agriculture & Grazing

Removal of riparian vegetation

Engineering Construction

Climate effect

Problem 3 - Goals

To address these issues, three solutions are considered:

Dewatering the underground contaminant area

Pumping the groundwater at contaminant areas to make the groundwater level lower than the surface water level, thus the contaminant would not travel to surface water system.

Continue monitoring the possible leaking from urban pollution system

Continue monitoring and checking the system in the area could avoid the leaking problem from landfill or septic system .

Establish the watershed protection plan to control the waste discharge

Plan the total maximum daily load (TMDL) management for factories and communities near these rivers.

Problem	Identified Causes	Goal/ Recommendations
Decreasing water resources and allocation challenges of the basin	Several severe droughts in recent years due to climate change Water rights purchased by downstream areas due to their large and increasing water consumption by agriculture downstream. Changing interactions between groundwater and surface water.	Establish intercounty joint committee Adopt a new tax Adopt the water transfer for efficient irrigation program Groundwater recharge via the water from the program
Degradation of riparian habitat	Water management actions negatively impacting native riparian vegetation. (depleted water resources, inundation by reservoirs, removal of vegetation to make more water available for agriculture/livestock, fewer beaver populations) Livestock overgrazing diminishes riparian vegetation. Adverse impacts of invasive species eradication efforts.	Goal: Increase suitable habitat for mouse and flycatcher by 25% in Taos County over the next 5 years. Actions: Identify suitable stream site for habitat reconstruction and re-introduction of mouse, apply for grants to fund the project, solicit assistance from community youth groups to implement Develop guidelines for evaluation of vegetation control options, outreach to educate community, demonstration project to migrate an area from invasive encroachment to native vegetation
Water Quality	Questa mining waste Landfill Septic system and some other non-point source pollution Climate change	Dewatering the underground contaminant area Monitoring the possible leaking Control the waste discharge

QUESTIONS AND COMMENTS