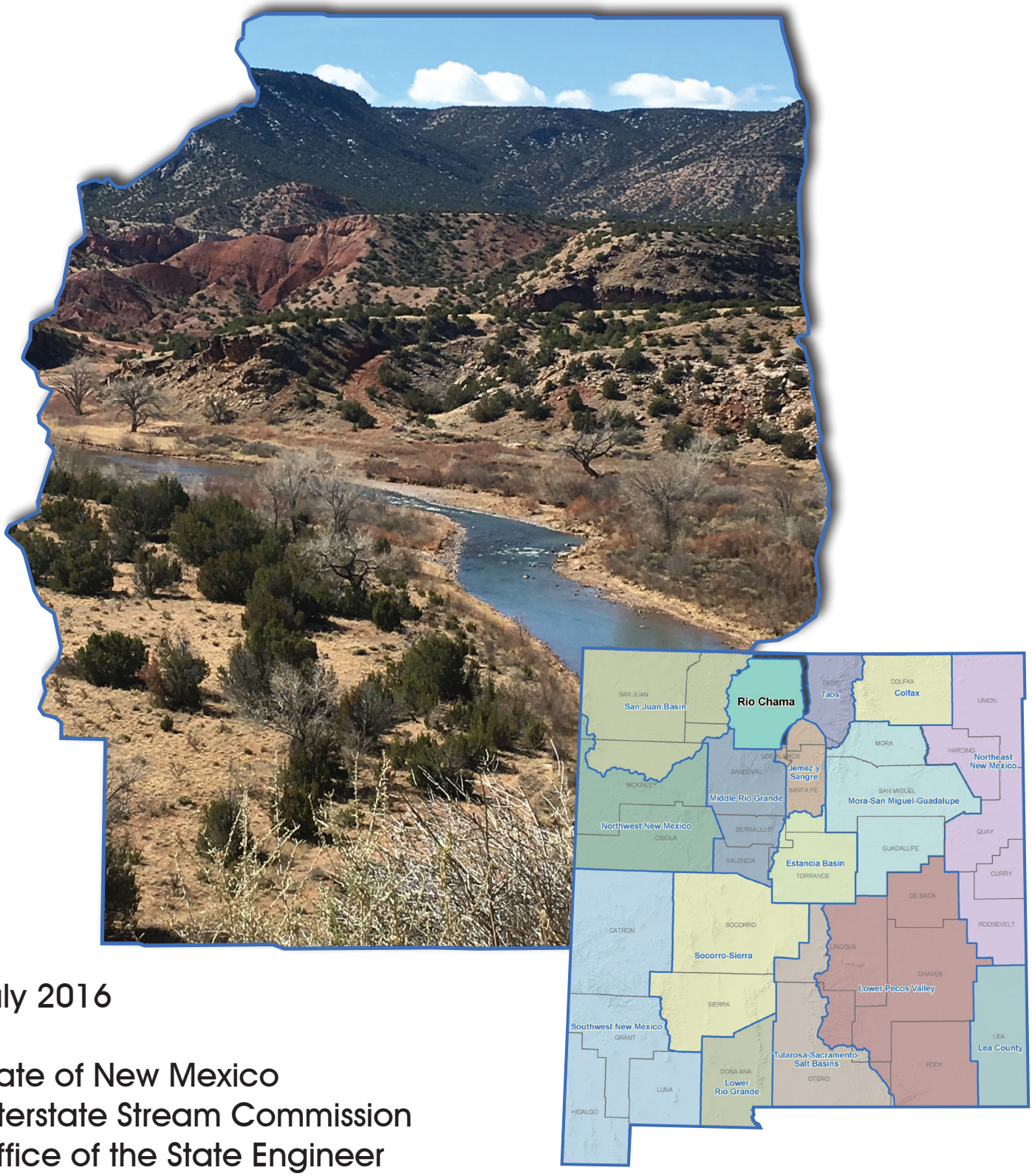
Rio Chama Regional Water Plan



July 2016

State of New Mexico
Interstate Stream Commission
Office of the State Engineer

Cover photograph: Rio Chama, near Abiquiu

Table of Contents

List of Figures

List of Tables

List of Appendices

Note: Appendix designations indicate corresponding section in plan.

List of Acronyms

°F	degrees Fahrenheit
ac-ft/yr	acre-feet per year
AMO	Atlantic multidecadal oscillation
AWRM	Active Water Resource Management
BBER	Bureau of Business and Economic Research
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CID	Carlsbad Irrigation District
COG	Council of Governments
CWA	Clean Water Act
DWS	Domestic Well Statute
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
ft amsl	feet above mean sea level
FY	fiscal year
GIS	geographic information system
gpcd	gallons per capita per day
GWQB	Ground Water Quality Bureau [New Mexico Environment Department]
ICIP	Infrastructure Capital Improvement Plan
in/yr	inches per year
IPCC	Intergovernmental Panel on Climate Change
LQ	location quotient
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDWCA	mutual domestic water consumers association
NASS	National Agricultural Statistics Service
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NMAC	New Mexico Administrative Code
NMBGMR	New Mexico Bureau of Geology & Mineral Resources

NMED	New Mexico Environment Department
NMG&F	New Mexico Department of Game and Fish
NMISC	New Mexico Interstate Stream Commission
NMOSE	New Mexico Office of the State Engineer
NMSA	New Mexico Statutes Annotated
NMSU	New Mexico State University
NMWQCC	New Mexico Water Quality Control Commission
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PCB	polychlorinated biphenyl
PDO	Pacific decadal oscillation
PDSI	Palmer Drought Severity Index
PPP	project, program, and policy
PSTB	Petroleum Storage Tank Bureau (NMED)
PVACD	Pecos Valley Artesian Conservancy District
RCAA	Rio de Chama Acequias Association
RWP	regional water plan
SJCP	San Juan-Chama Project
SDWA	Safe Drinking Water Act
SNOTEL	snowpack telemetry
SWCD	soil and water conservation district
TDS	total dissolved solids
TMDL	total maximum daily load
U.S. EPA	U.S. Environmental Protection Agency
UNM	University of New Mexico
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
UST	underground storage tank
UWB	underground water basin

WBP	watershed based plan
WQA	Water Quality Act [New Mexico]
WRAS	Watershed Restoration Action Strategy
WRCC	Western Regional Climate Center
WSD	water and sanitation district
WUA	water users association
WWTP	wastewater treatment plant

Executive Summary

The Rio Chama Water Planning Region, which falls within Rio Arriba County (Figure ES-1), is one of 16 water planning regions in the State of New Mexico. Regional water planning was initiated in New Mexico in 1987, its primary purpose being to protect New Mexico water resources and to ensure that each region is prepared to meet future water demands. Between 1987 and 2008, each of the 16 planning regions, with funding and oversight from the New Mexico Interstate Stream Commission (NMISC), developed a plan to meet regional water needs over the ensuing 40 years. The Rio Chama Regional Water Plan was completed and accepted by the NMISC in 2006.

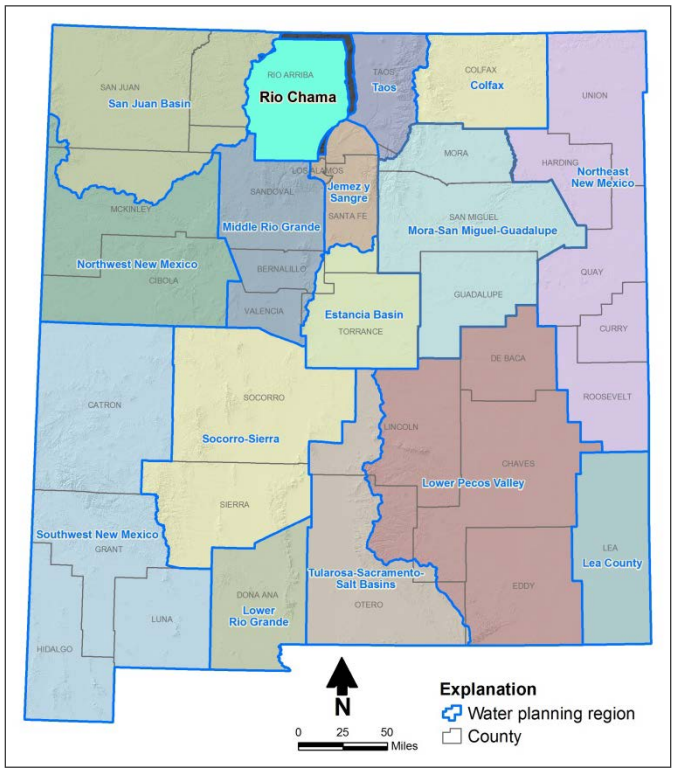


Figure ES-1. Rio Chama Water Planning Region

The purpose of this document is to provide new and changed information related to water planning in the Rio Chama region and to evaluate projections of future water supply and demand for the region using a common technical approach applied to all 16 planning regions statewide. Accordingly, this regional water plan (RWP) update summarizes key information in the 2006 plan and provides updated information regarding changed conditions and additional data that have become available.

Based on the updated water demand (Figure ES-2) data, Figure ES-3 illustrates the total projected regional water demand under high and low demand scenarios, and also shows the administrative water supply and the drought-adjusted water supply. The administrative water supply is based on 2010 withdrawals of water and is an estimate of future water supplies that considers both physical availability and compliance with water rights policies. Low and high future water demand projections indicate that no to low growth in water use is anticipated; these projections are greatly influenced by agriculture which is the largest sector in the region. However, in the Rio Chama planning region, surface water supplies about 97 percent of the total supply, and thus the region is very vulnerable to drought and large drought shortages are experienced even without substantial growth in new water demand.

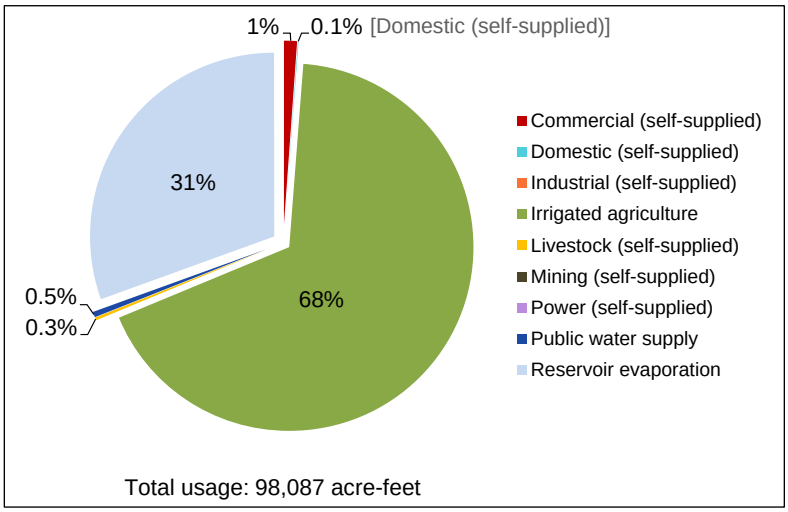


Figure ES-2. Total Regional Water Demand, 2010

Note: Tribes and Pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this figure.

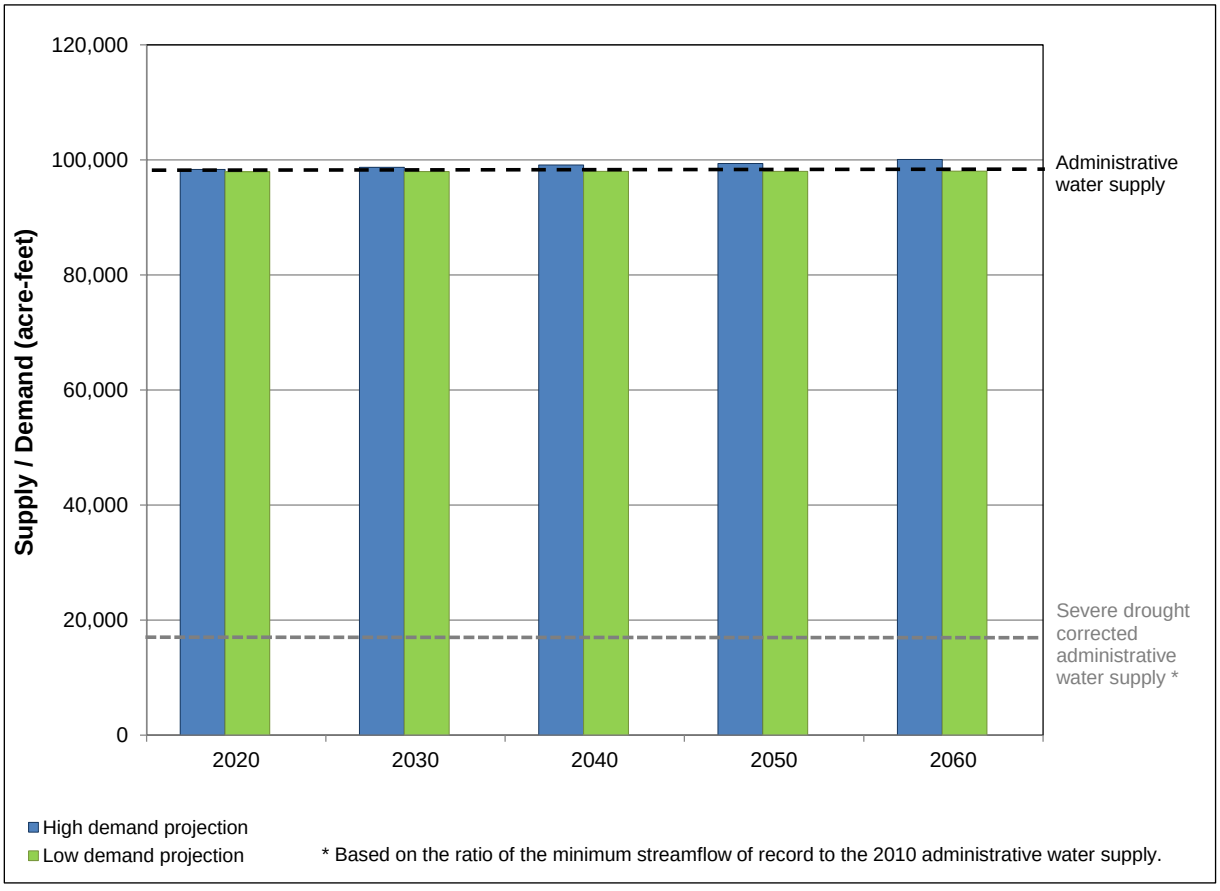


Figure ES-3. Available Supply and Projected Demand

Note: Tribes and Pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this figure.

The estimated shortage in future drought years is expected to range from 81,000 to 83,000 acre-feet. Strategies that the region identified for addressing drought shortages and other infrastructure, water management, and water quality issues included conducting flood and hazard mitigation planning and outreach, completing a County 40-year water plan, providing educational resources on water banking, collecting water resources data, developing additional storage, optimizing reservoir releases, protecting against water quality degradation, and conducting watershed restoration.

Planning Method

For this RWP, water supply and demand information was assessed in accordance with a common technical approach, as identified in the *Updated Regional Water Planning Handbook: Guidelines to Preparing Updates to New Mexico Regional Water Plans* (where it is referred to as a common technical *platform*) (Handbook). This common technical approach outlines the basis for defining the available water supply and specifies methods for estimating future demand in all categories of water use:

- The method to estimate supply (referred to as the *administrative water supply* in the Handbook) is based on withdrawals of water as reported in the *New Mexico Water Use by Categories 2010* report prepared by the New Mexico Office of the State Engineer (NMOSE). Use of the 2010 data provides a measure of supply that considers both physical supply and legal restrictions (i.e., the water is physically available for withdrawal, and its use is in compliance with water rights policies) and thus reflects the amount of water available for use by a region.

- An estimate of supply during future droughts is also developed by adjusting the 2010 withdrawal data based on physical supplies available during historical droughts.

- Projections of future demand in nine water use categories are based on demographic and economic trends and population projections. Consistent methods and assumptions for each category of water use are applied across all planning regions.

Common Technical Approach

To prepare both the regional water plans and the state water plan, the State has developed a set of methods for assessing the available supply and projected demand that can be used consistently in all 16 planning regions in New Mexico. The objective of applying this common technical approach is to be able to efficiently develop a statewide overview of the balance between supply and demand in both normal and drought conditions, so that the State can move forward with planning and funding water projects and programs that will address the State's pressing water issues.

Public Involvement

The updated Handbook specifies that the RWP update process "shall be guided by participation of a representative group of stakeholders," referred to as the steering committee. Steering committee members provided direction for the public involvement process and relayed information about the planning effort to the water user groups they represent and other concerned or interested individuals.

In addition to the steering committee, the water planning effort included developing a master stakeholder list of organizations and individuals interested in the water planning update. This list was developed from the previous round of water planning and then expanded through efforts to identify representatives from water user groups and other stakeholders. Organizations and individuals on the master stakeholder list were sent announcements of meetings and the RWP update process and progress.

Over the two-year update process, eight meetings were held in the Rio Chama region. These meetings identified the program objectives, presented draft supply and demand calculations for discussion and to guide strategy development, and provided an opportunity for stakeholders to provide input on the strategies that they would like to see implemented. All steering committee meetings were open to the public and interested stakeholders, and participation from all meeting attendees was encouraged.

Key Water Issues

The key water supply updates and issues currently impacting the Rio Chama region include the following:

- Because the region relies heavily on surface water, drought is a major concern. The climate division that covers almost the entire planning region was in severe to extreme drought in several recent years.

- The preservation of traditional communities, agriculture, and the historical acequia system, which provides the framework for community government as well as water delivery in northern New Mexico, continues to be a key issue for Rio Chama water planning. Funding for repair and maintenance of acequia infrastructure is an ongoing issue, as is protecting water rights and promoting agriculture.

- There is concern that scheduled releases from upstream reservoirs to meet legal obligations and downstream demands do not adequately protect acequia infrastructure in the region. In the spring, damage from high flows can be somewhat mitigated by opening headgates to relieve pressure, but damage is greater during high flow releases that occur after the end of irrigation season, when headgates are closed. To mitigate

damage, the Rio Chama Acequia Association (RCAA) would like to discuss with the reservoir operating agencies the possibility of starting year-end releases earlier (late October rather than mid-November) so that the volume of flows during the non-irrigation season can be reduced to below 800 cubic feet per second.

- In response to recent drought conditions, RCAA and La Asociación de Acéquia Norteñas del Rio Arriba have worked with the NMOSE, with technical assistance from the NMISC, on securing alternative water supplies when available and, when those are exhausted, implementing voluntary shortage sharing programs, including rotations and voluntary curtailment. With much of the water in the basin during drought years destined for downstream San Juan-Chama contractors, the implementation of a shortage sharing system to efficiently manage the limited supplies available to local acequias is a key issue.

- Water planning is a priority for Rio Arriba County, which is actively developing a water rights inventory and database and is investigating development of a water bank that could be used to support agriculture and other economic development in the County and facilitate shortage sharing during drought. In 2016 the County completed an update of its Comprehensive Plan, which includes additional supply and demand information.

- In recent years, administrative efforts by the NMOSE have focused on voluntary shortage sharing to protect local water rights and the local economy from more serious impacts of the prolonged drought. The lower Rio Chama acequias and the upper Rio Chama acequias have had various shortage sharing agreements over the years that cut each ditch's flow when water levels drop below a certain threshold. Additional metering is also being provided by the NMOSE to help better manage flows, and RCAA is interested in continuing to improve metering to all acequias so that better decisions can be made and better shortage sharing agreements implemented.

- Due to the large amount of forested land in the region, coupled with the recent drought conditions, the threat of wildfire and subsequent sedimentation impacts on streams and reservoirs remains a key planning issue. Continued and expanded efforts to reduce catastrophic fire risk through forest management, as well as additional information on the quantitative benefits of various management techniques, are needed. Watershed restoration efforts that will reduce the risk of debris flows from large arroyo systems on federal lands below Abiquiu Dam are a priority for protecting acequia infrastructure in that area.

- The Nature Conservancy is working to develop the Rio Grande Water Fund, which when fully funded, will generate sustainable income for a 10- to 30-year forest restoration program through a multi-party effort. Models of debris flow risk after high-severity fire indicate that key water sources are at risk, and the goal of the program is to reduce the

risk of catastrophic wildfire and subsequent sedimentation and localized water quality degradation to protect the region's water supply.

- The stretch of the Rio Chama between El Vado Reservoir and Abiquiu Reservoir is designated as a Wild and Scenic River, intended to protect its free-flowing nature. There are only two very minor permitted diversions in this stretch (which predate the Wild and Scenic River designation), and a group of local stakeholders has spearheaded the Rio Chama Flow Optimization Project, which aims to improve management through this stretch for environmental, recreational, and acequia benefits. The Bureau of Reclamation and the U.S. Army Corps of Engineers coordinate their water management efforts in this stretch for the same purposes.

- There has been concern expressed by some residents in the region about the potential for hydraulic fracturing for oil and gas extraction to contaminate local water resources due to improperly managed surface or casing operations, or from direct contamination. A proposed oil lease by the Bureau of Land Management northwest of Española is a particular concern. Protecting the water quality of this watershed, which provides drinking water for numerous downstream users, is important to the region.

- There are 23 small rural drinking water systems within the region. These small systems face challenges in financing infrastructure maintenance and upgrades and complying with water quality monitoring and training standards. Though the source water for these systems is generally good quality groundwater (except for the Village of Chama and two state parks that use surface water), the maintenance, upgrades, training, operation, and monitoring that is required to ensure delivery of water that meets drinking water quality standards is a financial and logistical challenge for these small systems.

- The Village of Chama has historically had problems with bacteria and other organisms in its surface water supply due to inadequate treatment capacity. A treatment system added in 1997 improved the situation but has reached its capacity. The Village is currently working on adding another 300,000-gallon storage tank and increasing capacity to treat an additional 300 gallons per minute to provide adequate treated water to the Village. The Village is also working on improved wastewater treatment capacity for its discharge into the Rio Chamita.

- The 2006 water plan identified nitrate and other potential contamination of shallow groundwater and domestic wells due to septic tanks as a potential water quality concern, and a goal identified in the original plan was to encourage community wastewater treatment systems. This issue is still of concern, as many areas in the region have no access to wastewater treatment infrastructure and continue to be served by domestic wells and septic tanks.

- The Federal Emergency Management Administration released new floodplain maps of Rio Arriba County in 2012. The new maps define hazard areas and indicated flood insurance rate boundaries. Continued efforts to update floodplain maps and prepare for and mitigate flood damage are important to the region. Rio Arriba County has three certified floodplain managers and regulates all new development, including changes to historic structures, to comply with flood preparation standards.

Strategies to Meet Future Water Demand

An important focus of the RWP update process is to both identify strategies for meeting future water demand and support their implementation. To help address the implementation of new strategies, a review of the implementation of previous strategies was first completed.

The 2006 Rio Chama Regional Water Plan recommended the following strategies for meeting future water demand:

- Keep water rights within the region
  - Be vigilant about proposed water rights transfers
  - Provide County support for water rights and infrastructure
- Preserve the acequia system
  - Insulate acequias from excessive economic pressures
  - Implement appropriate-scale water banking
  - Maintain and repair acequia systems appropriately
  - Modify the adjudication process
- Enhance growing season streamflows
  - Improve high-altitude upper watershed management
  - Enhance grass cover and infiltration in lower-altitude areas
  - Reservoir storage
  - Aquifer storage and recovery
  - Appropriate flood or wet-year flows
- Support local agriculture
  - Enhance marketing opportunities
  - Help finance local agriculture
  - Help with information sharing and technical assistance
  - Collaborate widely

- Provide reliable community water supplies
  - Consolidate community water systems if appropriate
  - Develop alternatives for additional water rights where needed
  - Optimize locations and depths of community wells
  - Consider other water supply alternatives
  - Conserve water and audit water use in community systems
  - Ensure adequate water supplies for firefighting
  - Protect existing communities from unsustainable water use
  - Provide additional support resources for community systems
  - Collect basic information about our water resources
- Protect water quality
  - Consider and encourage community wastewater treatment
  - Encourage or require better individual liquid waste treatment
  - Control nonpoint-source and agricultural pollution
  - Regulate and discourage development in upper watershed areas
- Conserve and reuse water resources
- Protect and restore watersheds

The steering committee reviewed each of the strategies and indicated that they are all still important to the region.

During the two-year update process the Rio Chama Steering Committee and stakeholders identified projects, programs, and policies (PPPs) to address their water issues. Some water projects were already identified through the State of New Mexico Infrastructure Capital Improvement Plan, Water Trust Board, Capital Outlay, and NMED funding processes; these projects are also included in a comprehensive table of PPP needs. The information was not ranked or prioritized; it is an inclusive table of all of the PPPs that regional stakeholders are interested in pursuing. In the Rio Chama region, projects identified on the PPP table are primarily water system infrastructure, acequia repair, and watershed restoration projects.

At steering committee meetings held in 2015 and 2016, the group discussed projects that would have a larger regional or sub-regional impact and for which there is interest in collaboration to seek funding and for implementation. The following key collaborative projects were identified by the steering committee and Rio Chama region stakeholders:

- Rio Arriba County 40-Year Water Plan: Capture the water use footprint on existing County facilities and identify threats and opportunities for protecting water rights, infrastructure, and supply as demands increase.

- Flood and Hazard Mitigation Planning and Outreach Effort: Encourage development that is acceptable to the conditions on the landscape in terms of soil types and natural resource considerations. The project aims to mitigate private property and public infrastructure flood damage.

- Water Resources Monitoring Network: Set up monitoring system to track groundwater quality and quantity, with emphasis on data quality.

- Upper Watershed Storage: Develop storage on numerous tributaries for the purpose of addressing mid-season irrigation requirements and/or supplementing local domestic water association needs.

- Water Banking: Conduct outreach to acequias and domestic water users on existing rules/policy allowing water banking.

- Alternative Reservoir Release Management and River Maintenance: Explore legal and political issues surrounding water releases from upstream reservoirs and river maintenance projects in order to minimize damage to acequia infrastructure and loss of bosque/riverbank property.

- RCAA Storage Project: Continue water sharing arrangements with upper watershed acequias (with NMISC support) and purchases of San Juan-Chama Project (SJCP) water and temporary storage rights, although the latter become more difficult as SJCP water supplies are reduced and SJCP partners increase.

- Watershed Protection and Restoration: Protect and restore watersheds to support fisheries, recreation, wildlife habitat, and water quality. One aspect is upland land management to reduce the risk of catastrophic wildfire impacts by landscape-scale thinning and prescribed burns. Prescriptions for thinning will focus on habitat restoration and healthy ecosystems. Channel and riparian restoration projects are also encouraged. The project will include area-wide collaboration with all organizations in identifying areas that have been thinned and/or restored and planning what needs to be done moving forward.

- Capacity Building for Small Water Systems (Water as a Human Right): Protect and guarantee the basic human right to drinking/household water and water for health and safety by providing State funding for all community water system infrastructure.

- Data Collection for Watershed Restoration: Support data collection by both citizens and professionals. Potential projects include amphibians and macroinvertebrates. Identify data gaps and determine plan and priority for filling them. Ensure quality assurance/quality control through use of standard methods and protocols.

- Protection against Degradation of Water Resources: Develop source water protection policies to prevent degradation of surface and groundwater quality. Source water protection policies may include education and enforcement to prevent surface contamination by recreational users, energy development, and expanded monitoring, among others. This strategy may also consider revising the Bureau of Land Management Resource Management Plan to declare the Rio Chama watershed a buffer zone that is off limits to oil and gas exploration.

The 2016 Regional Water Plan characterizes supply and demand issues and identifies strategies to meet the projected gaps between water supply and demand. This plan should be added to, updated, and revised to reflect implementation of strategies, address changing conditions, and continue to inform water managers and other stakeholders of important water issues affecting the region.

1. Introduction

The Rio Chama Water Planning Region, which falls within Rio Arriba County (Figure 1-1), is one of 16 water planning regions in the State of New Mexico. Regional water planning was initiated in New Mexico in 1987, its primary purpose being to protect New Mexico water resources and to ensure that each region is prepared to meet future water demands. Between 1987 and 2008, each of the 16 planning regions, with funding and oversight from the New Mexico Interstate Stream Commission (NMISC), developed a plan to meet regional water needs over the ensuing 40 years. The *Rio Chama Regional Water Plan* was completed and accepted by NMISC in 2006 (RCAA and Rio Arriba County, 2006).

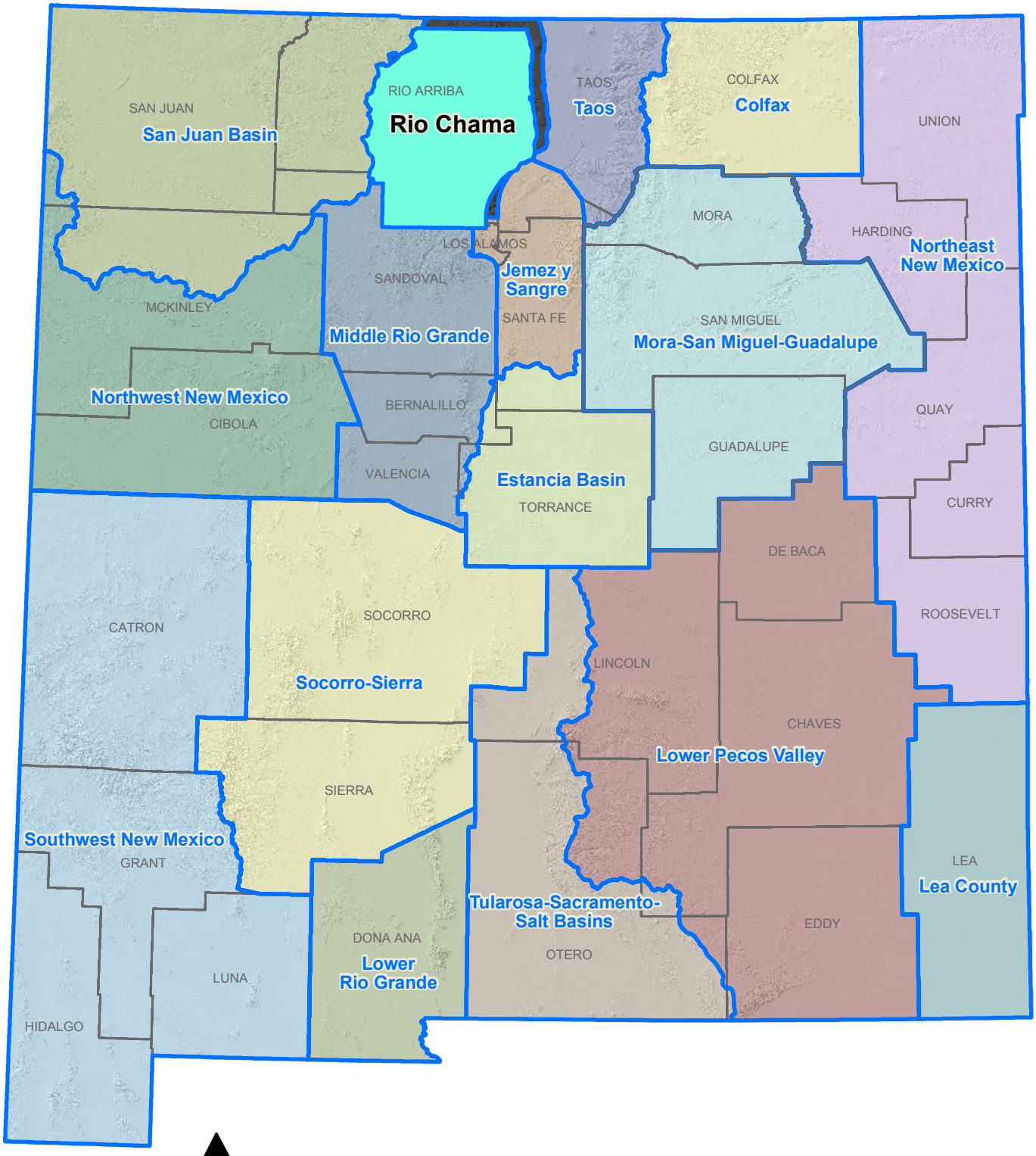
The purpose of this document is to provide new and changed information related to water planning in the Rio Chama region, as listed in the bullets below, and to evaluate projections of future water supply and demand for the region using a common technical approach applied to all 16 planning regions statewide. Accordingly, the following sections summarize key information in the 2006 plan and provide updated information regarding changed conditions and additional data that have become available. Specifically, this update:

- Identifies significant new research or data that provide a better understanding of current water supplies and demands in the Rio Chama region.
- Presents recent water use information and develops updated projections of future water demand using the common technical approach developed by the NMISC, in order to facilitate incorporation into the New Mexico State Water Plan.
- Identifies strategies, including infrastructure projects, conservation programs, watershed management policies, or other types of strategies that will help to balance supplies and projected demands and address the Rio Chama region's future water management needs and goals.
- Discusses other goals or priorities as identified by stakeholders in the region.

The water supply and demand information in this regional water plan (RWP) is based on current published studies and data and information supplied by water stakeholders in the region. Tribes and pueblos in New Mexico are not required to provide water use data to the State, and so tribal water use data are not necessarily reflected in this RWP update.

The organization of this update follows the template provided in the *Updated Regional Water Planning Handbook: Guidelines to Preparing Updates to New Mexico Regional Water Plans* (NMISC, 2013b) (referred to herein as the Handbook):

- Information regarding the public involvement process followed during development of this RWP update and entities involved in the planning process is provided in Section 2.



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RIO CHAMA REGIONAL WATER PLAN 2016

Location of Rio Chama Water Planning Region

Figure 1-1

- Section 3 provides background information regarding the characteristics of the Rio Chama planning region, including an overview of updated population and economic data.
- The legal framework and constraints that affect the availability of water are briefly summarized in Section 4, with recent developments and any new issues discussed in more detail.
- The physical availability of surface water and groundwater and water quality constraints was discussed in detail in the 2006 RWP; key information from that plan is summarized in Section 5, with new information that has become available since 2006 incorporated as applicable. In addition, Section 5 presents updated monitoring data for temperature, precipitation, drought indices, streamflow, groundwater levels, and water quality, and an estimate of the administrative water supply including an estimate of drought supply.
- The information regarding historical water demand in the planning region, projected population and economic growth, and projected future water demand was discussed in detail in the 2006 RWP. Section 6 provides updated population and water use data, which are then used to develop updated projections of future water demand.

Common Technical Approach

To prepare both the regional water plans and the state water plan, the State has developed a set of methods for assessing the available supply and projected demand that can be used consistently in all 16 planning regions in New Mexico. This common technical approach outlines the basis for defining the available water supply and specifies methods for estimating future demand in all categories of water use:

- The method to estimate the available supply (referred to as the *administrative water supply* in the Handbook) is based on withdrawals of water as reported in the *NMOSE Water Use by Categories 2010* report,* which provide a measure of supply that considers both physical supply and legal restrictions (i.e., the diversion is physically available for withdrawal, and its use is in compliance with water rights policies) and thus reflects the amount of water available for use by a region. An estimate of supply during future droughts is also developed by adjusting the 2010 withdrawal data based on physical supplies available during historical droughts.
- Projections of future demands in nine categories of water use are based on demographic and economic trends and population projections. Consistent methods and assumptions for each category of water use are applied

The objective of applying this common technical approach is to be able to efficiently develop a statewide overview of the balance between supply and demand in both normal and drought conditions, so that the State can move forward with planning and funding water projects and programs that will address the State's pressing water issues.

* *Tribes and Pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this plan.*

- Based on the current water supply and demand information discussed in Sections 5 and 6, Section 7 updates the projected gap between supply and demand of the planning region.
- Section 8 outlines new strategies (water programs, projects, or policies) identified by the region as part of this update, including additional water conservation measures.

Water supply and demand information (Sections 5 through 7) is assessed in accordance with a common technical approach, as identified in the Handbook (NMISC, 2013b) (where it is referred to as a common technical *platform*). This common technical approach is a simple methodology that can be used consistently across all regions to assess supply and demand, with the objective of efficiently developing a statewide overview of the balance between supply and demand for planning purposes.

Four terms frequently used when discussing water throughout this plan have specific definitions related to this RWP:

- *Water use* is water withdrawn from a surface or groundwater source for a specific use. In New Mexico water is accounted for as one of the nine categories of use in the *New Mexico Water Use by Categories 2010* report prepared by the New Mexico Office of the State Engineer (NMOSE).
- *Water withdrawal* is water diverted or removed from a surface or groundwater source for use.
- *Administrative water supply* is based on the amount of water withdrawals in 2010 as outlined in the *New Mexico Water Use by Categories 2010* report.
- *Water demand* is the amount of water needed at a specified time.

2. Public Involvement in the Planning Process

During the past two years, the regional water planning steering committees, interested stakeholders, NMISC, and consultants to the NMISC have worked together to develop regional water plan updates. The purpose of this section is to describe public involvement activities during the regional water plan update process, guided by the Handbook, which outlined a public involvement process that allowed for broad general public participation combined with leadership from key water user groups.

2.1 The New Mexico Interstate Stream Commission's Role in Public Involvement in the Regional Water Plan Update Process

The NMISC participated in the public involvement process through a team of contractors and NMISC staff that assisted the regions in conducting public outreach. The NMISC's role in this process consisted of certain key elements:

- Setting up and facilitating meetings to carry out the regional water plan update process.
- Working with local representatives to encourage broad public involvement and participation in the planning process.

- Working to re-establish steering committees in regions that no longer had active steering committees.
- Supporting the steering committees once they were established.
- Facilitating input from the stakeholders and steering committees in the form of compiling comments to the technical sections drafted by the State and developing draft lists of projects, programs, and policies (PPPs) based on meeting input, with an emphasis on projects that could be implemented.
- Finalizing Section 8, Implementation of Strategies to Meet Future Water Demand, by writing a narrative that describes the key collaborative strategies based on steering committee direction.

This approach represents a change in the State's role from the initial round of regional water planning, beginning in the1990s through 2008, when the original regional water plans were developed. During that phase of planning, the NMISC granted regions funding to form their own regional steering committees and hire consultants to write the regional water plans, but NMISC staff were not directly involved in the process. Over time, many of the regional steering committees established for the purpose of developing a region's water plan disbanded. Funding for regional planning decreased significantly, and regions were not meeting to keep their plans current.

In accordance with the updated Handbook (NMISC, 2013b), the NMISC re-established the regional planning effort in 2014 by working with existing local and regional stakeholders and organizations, such as regional councils of government, water providers, water user organizations, and elected officials. The NMISC initiated the process by hosting and facilitating meetings in all 16 regions between February and August of 2014. During these first months, through its team of consultants and working with contacts in the regions, the NMISC prepared "master stakeholder" lists, comprised of water providers and managers, local government representatives, and members of the public with a general interest in water, and assisted in developing updated steering committees based on criteria from the Handbook and recommendations from the stakeholders. (The steering committee and master stakeholder lists for the Rio Chama region are provided in Section 2.2.1 and Appendix 2-A, respectively.) These individuals were identified through research, communication with other water user group representatives in the region, contacting local organizations and entities, and making phone calls. Steering committee members represent the different water users groups identified in the Handbook and have water management expertise and responsibilities.

The steering committee was tasked with four main responsibilities:

- Provide input to the water user groups they represent and ensure that other concerned or interested individuals receive information about the water planning process and meetings.

- Provide direction on the public involvement process, including setting meeting times and locations and promoting outreach.
- Identify water-related projects and programs and policies needed to address water management challenges in the region and future water needs.
- Comment on the draft *Rio Chama Regional Water Plan 2016*, as well as gather public comments. (Appendix 2-B includes a summary of comments on the technical and legal sections of the document that were prepared by the NMISC [Sections 1, 3, 4, 5, 6, and 7].)

In 2016, the NMISC continued to support regional steering committees by facilitating three additional steering committee meetings open to the public in each of the 16 regions. The purpose of these meetings was to provide the regions with their draft technical sections that the NMISC had developed and for the regions to further refine their strategies for meeting future water challenges.

Throughout the regional water planning process all meetings were open to the public. Members of the public who have an interest in water were invited directly or indirectly through a steering committee representative to participate in the regional water planning process

Section 2.2 provides additional detail regarding the public involvement process for the Rio Chama 2016 regional water plan.

2.2 Public Involvement in the Rio Chama Region Planning Process

This section documents the steering committee and public involvement process used in updating the plan and documenting ideas generated by the region for future public involvement in the implementation of the plan.

2.2.1 Identification of Regional Steering Committee Members

The Handbook (NMISC, 2013b) specifies that the steering committee membership include representatives from multiple water user groups. Some of the categories may not be applicable to a specific region, and the regions could add other categories as appropriate to their specific region. The steering committee representation listed in the Handbook includes:

- Agricultural – surface water user
- Agricultural – groundwater user
- Municipal government
- Rural water provider
- Extractive industry

- Environmental interest
- County government
- Local (retail) business
- Tribal entity
- Watershed interest
- Federal agency
- Other groups as identified by the steering committee

Steering committee members were identified and asked to participate through interviews, public meetings, recommendations, and outreach to specific interests. Rio Arriba County helped to identify potential representatives. Through this outreach, the Rio Chama region established a representative steering committee, the members of which are listed in Table 2-1.

The steering committee includes several state and federal agency representatives who participate as technical resources to the region. These individuals are generally knowledgeable about water issues in the region and are involved with many of the PPPs related to water management in the region. The steering committee members also include non-profit groups who are involved in local water-related initiatives and/or have expertise such as watershed restoration or mutual domestic concerns and issues. The steering committee identified Lucia Sanchez, Planning Director, Rio Arriba County Planning and Zoning, as chair of the regional water planning effort and Galen Knight as co-chair. Ms. Sanchez' knowledge about the region, municipalities, and leadership has been helpful to maintain an active steering committee and conduct hands-on outreach to the rural county.

The steering committee discussed the value of developing subcommittees and determined that the following subcommittees would be helpful to identify issues and develop strategies to address supply and demand: Acequia Subcommittee, Watershed Restoration Subcommittee, and Mutual Domestic Subcommittee.

2.2.2 Regional Water Plan Update Meetings

All steering committee meetings and NMISC-facilitated water planning meetings were open to the public and interested stakeholders. Meetings were announced to the master stakeholder list by e-mail, and participation from all meeting attendees was encouraged. Steering committee members served as a conduit of information to others and, through their own organizational communications with other agencies, encouraged participation in the process, and steering committee members were asked to share information about the process with other stakeholders in the region. Generally, steering committee members ensured that other concerned or interested individuals received the announcements and recommended key contacts to add to the master stakeholder list throughout the planning process. A local online newspaper helped by writing summaries of the meetings and posting articles about the meetings on a regular basis.

Table 2-1. Steering Committee Members, Rio Chama Water Planning Region

Page 1 of 2

Water User Group	Name	Organization / Representation
Agricultural – surface water user	Patricio Garcia	Parciante
	Becky Trujillo	Acequia de los Vigiles
	John Salazar	Acequia Hernandez
	Medardo Sanchez	Acequias Nortenas
	Tim Seaman	Rio Chama Acequia Association
	Don Diego Gonzales	Acequia de los Garcias por los Parciantes
Rural water provider	Gloria Gonzales	Agua Sana Water Users Association
	Juan Garcia, Chair MDWA Subcommittee	Rio Arriba Regional Water Users Association
	Stacy Maestas	Ancones Mutual Domestic Water Consumers Association (MDWCA)
Rural water provider - MDWCA	Ramon Lucero	Souder Miller
Municipal government	Jennifer Gallegos	Mayor, Village of Chama
Livestock	Carlos Salazar	Northern New Mexico Stockmen's Association
County government	Chris Madrid	Economic Development Director, Rio Arriba County
	Lucia Sanchez Michael Garcia	Rio Arriba County
Soil & Water Conservation District (SWCD)	Horace Leyba	Upper Chama SWCD Canjilon – Acequia
	Jo Valdez	Upper Chama SWCD
	Kenny Salazar	East Rio Arriba SWCD
Tribal	Wainwright Velarde	Jicarilla Apache Nation
	Ben Chavarria	Director, Rights Protection Office / Tribal Historic Preservation Officer Santa Clara Pueblo, New Mexico
	Gilbert Vigil	Eight Northern Pueblos *(Invited, participation to be determined)*
		Ohkay Owingeh *(Invited)*
Business interest	Daniel Manzanares	Ghost Ranch/Abeyta y Trujilla Acequia
Conservation organization	Laura McCarthy	Nature Conservancy
Watershed interest	Monique DiGiorgio	Chama Peak Land Alliance
	Charlie Cassagnol	Trout Unlimited
	Mike Williams	Trout Unlimited
Federal agency	Sandy Hurlocker	U.S. Forest Service
	Brad Higdon	Bureau of Land Management

Table 2-1. Steering Committee Members, Rio Chama Water Planning Region
Page 2 of 2

Water User Group	Name	Organization / Representation
Federal agency	Ryan Gronewald	Army Corps of Engineers
	Carolyn Donnelly	Bureau of Reclamation
Statewide organization	Norman Vigil	New Mexico Association of Conservation Districts
State agency	Melanie Delgado	New Mexico Environment Department
	Anders Lundahl	NMISC Hydrologist
	Mary Stuever	New Mexico State Forestry
	Eric Ghahate	Northern New Mexico Economic Development District
	Jason Lithgow	New Mexico State Land Office

The steering committee discussed and made the following recommendations regarding meeting times and locations that would maximize public involvement:

- Meetings would be rotated between Española and Chama as appropriate.
- Meetings would continue to be held in Rio Arriba County facilities.
- Weekdays during the day would be the best meeting times; evening meetings might be scheduled to accommodate others as needed.
- Rio Arriba County would continue to send flyers about meetings to post offices, clinics, and other facilities.
- Radio stations (KDCE, Country Time, KSFR) would be asked to run community service announcements.
- Announcements would be sent to as many existing websites and community newsletters as possible.

Over the two-year update process, eight meetings were held in the Rio Chama region. A summary of each of the meetings is provided in Table 2-2.

2.2.3 Current and Future Ideas for Public Outreach during Implementation of the Regional Water Plan Update

The steering committee identified the following process for additional public outreach:

- The local governments will continue to post information about RWP activities on their websites. The group also suggested sending regular updates to the various governing bodies.
- Meetings will continue to be held in either Española, Hernandez, or Abiquiu (Rio Arriba County). The Master Stakeholder List will be maintained by the Rio Arriba County Planning Department.
- The RWP effort will be chaired by Lucia Sanchez, Director of Planning and Zoning, Rio Arriba County.
- Subcommittees are helpful and include the Acequia, Watershed, and Mutual Domestic subcommittees.

Table 2-2. Rio Chama Region Public Meetings

Date	Location	Purpose	Meeting Summary
FY 2014			
3/28/2014	Rio Arriba County Commission Chambers Española, NM	Kickoff meeting: Present the regional water planning update process to the region and continue to conduct outreach to begin building the steering committee.	Representatives from many of the water user groups attended the meeting and were instrumental in identifying other individuals as potential representatives for a particular group. Many of the meeting attendees were not on the master stakeholder list, and those individuals were added to the list.
FY 2015			
10/13/2014	Hernandez Community Center Hernandez, NM	Present the technical data compiled and synthesized for the region.	Data presented included population and economic trends through a series of tables, the administrative water supply, the projected future water demand, and the gap between supply and demand for both normal and drought years. In addition, the presentation reaffirmed the development of a steering committee to guide the process as outlined in the Handbook.
3/16/2015	Rio Arriba County Commission Chambers Española, NM	Review the update process and the timeline for completing the regional water plan (RWP) update.	The group discussed new information from the region and/or the projects, policies, programs (PPPs) that had been implemented since the 2006 plan. The steering committee membership and leadership were affirmed, with alternates named as appropriate. Subcommittees were developed and leadership of the subcommittees affirmed. The group further discussed where future meetings would be held and the time that worked the best for getting the most attendance. A date was set for the next meeting and a summary of the discussion was sent to the master stakeholder list with information about the next meeting including agenda items and location, date, time, and next steps.

Table 2-2. Rio Chama Region Public Meetings

Date	Location	Purpose	Meeting Summary
4/29/2015	Rio Arriba Rural Event Center Abiquiu, NM	Review projects completed since submission of the accepted plan and provide additional input. Discuss potential collaborative projects.	The group reviewed projects completed since submission of the accepted plan and provided additional input. The group discussed how to get more involvement from acequia associations. The group further discussed potential collaborative projects such as water system regionalization/cooperation, monitoring/data collection, watershed restoration, drought contingency planning, local and state water policy recommendations, and water quality protection.
6/8/2015	Hernandez Community Center Hernandez, NM	Discuss elements that would be included in the public involvement chapter and ideas for FY 2015-2016 outreach. Review and discuss future project checklist discussed at previous meeting and sent to stakeholders.	The future project checklist was reviewed and discussed, and a deadline for sending information to the consultants was confirmed. The group participated in a brainstorming activity that helped to identify regional projects that held the potential for the greatest collaboration and effort, ranking the level of interest, although it was noted that there is no official ranking of projects for funding priority as part of the regional water planning update process. The consultants affirmed the next steps for the RWP update effort and a general idea for meeting again in FY 2015-2016. The group indicated that the Watershed Subcommittee and Acequia Subcommittee would continue to meet as needed to work on the PPPs that pertain to their area of interest, though NMISC contractors will not facilitate these meetings. The subcommittee will provide the NMISC contractors additional information as needed on the PPPs.

Table 2-2. Rio Chama Region Public Meetings

Date	Location	Purpose	Meeting Summary
FY 2016			
1/15/2016	Hernandez Community Center Hernandez, NM	Review steering committee membership and leadership. Focus on the PPPs to be included in the update.	The group reviewed the steering committee membership, suggested additional members to fill vacancies, and decided that steering committee leadership would continue to be Lucia Sanchez with support from Rio Arriba County Planning staff. Subcommittees that had met reported to the group. The steering committee and interested stakeholders present participated in a brainstorming activity that helped to identify and rank (although ranking of projects for funding priority is not part of the RWP update process) regional projects that held the potential for the greatest collaboration and effort. The consultants affirmed the next steps for the RWP update effort and a general idea for meeting again in FY 2015-2016.
2/11/2016	Cebolla Community Center Cebolla, NM	Refine the key collaborative PPP recommendations specific to Section 8.	The group identified a number of projects that would potentially have greater interest and benefit multiple stakeholders, and added additional information in a small group format using worksheets.
5/18/2016	Chamita Community Center Chamita, NM	Review the Executive Summary, Public Involvement section (2), and Section 8 key strategies and PPP list.	The group reviewed the Executive Summary, Section 2 (Public Involvement), and the Section 8 key strategies, consolidated comments and the PPP list. Edits were made to some of the documents presented. The group decided on representatives to present the plan to the NMISC and developed ideas for implementation of their RWP. Eric Ghahate of the North Central New Mexico Economic Development District gave a presentation on La Ristra Project, a statewide user friendly database of project information from multiple sectors.

3. Description of the Planning Region

This section provides a general overview of the Rio Chama Water Planning Region. Detailed information, including maps illustrating the land use and general features of the region, was provided in the 2006 RWP; that information is briefly summarized and updated as appropriate here. Additional detail on the climate, water resources, and demographics of the region is provided in Sections 5 and 6.

3.1 General Description of the Planning Region

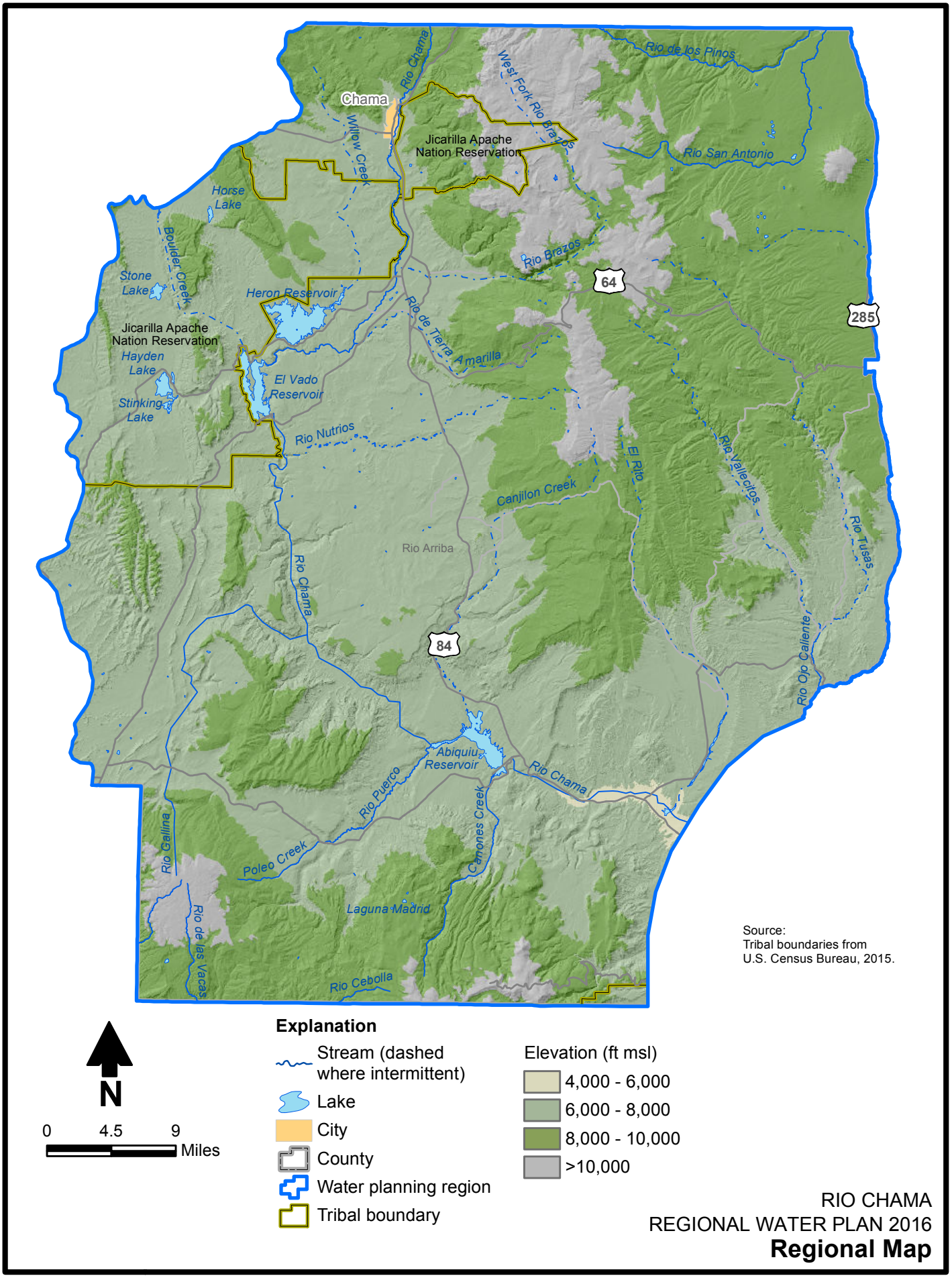
The Rio Chama water planning region encompasses the entire Rio Chama watershed (which straddles the New Mexico/Colorado border) within New Mexico, which includes more than half of Rio Arriba County. The total area of the planning region, which falls entirely within Rio Arriba County, is approximately 3,311 square miles. The region's boundaries are defined by Colorado to the north, the Continental Divide to the west, the Tusas Mountains in Taos and Santa Fe counties to the east, and the confluence of the Rio Chama and the Rio Grande, just north of Española, New Mexico, to the south. Elevations in the planning region range from 11,410 feet at the top of Brazos Peak to 5,620 feet at the confluence of the Rio Chama and the Rio Grande.

The great majority of the landscape within the Rio Chama watershed is rugged, hilly to mountainous, and wooded. Woodland types vary from piñon-juniper at lower elevations, through mixed conifer at intermediate elevations, to alpine spruce-fir forest and montane grassland meadows at the higher elevations above Chama and Tierra Amarilla (Figure 3-1) Irrigated agriculture takes place in the valley bottoms of the Rio Chama and 13 perennial tributaries, wherever topography and water supplies have made it possible to build acequias and irrigate land.

Natural resources in the region have included timber, sand and gravel, mica, gold, silver, and copper. Timber harvesting in the region, while substantial at one time, is constrained by economic factors that negatively affect large-scale commercial forestry throughout the Southwest. Some mining of mica, gold, silver, and copper took place in the 1800s, but ore bodies were limited, and these activities tapered off after the turn of the century. Uranium and copper prospecting has taken place in isolated areas of the region, but commercially viable quantities of ore have not been found. There is currently interest in hydraulic fracturing for oil and gas extraction in the region.

3.2 Climate

The climate of the Rio Chama region is warmer and drier at the lower elevations and colder and wetter in the higher areas. The long-term annual average temperature is 43 degrees Fahrenheit (°F) at the Chama weather station and 51°F at the Abiquiu Dam station. Average annual



RIO CHAMA
REGIONAL WATER PLAN 2016
Regional Map

Figure 3-1

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precipitation varies from 9.8 inches at Abiquiu Dam to 21.3 inches at Chama. Winter precipitation occurs mostly in the form of snow, especially in the northern part of the region, and summer precipitation normally comes in brief but often intense thunderstorms.

3.3 Major Surface Water and Groundwater Sources

The surface water sources present in the Rio Chama region are the Rio Chama and its tributaries, which include 13 tributaries large enough to support irrigated agriculture: Cañones Creek, the Rio Brazos, Rito de Tierra Amarilla, Rio Nutrias, Rio Cebolla, Rio Gallina, Rito de Canjilon, Rio Puerco de Chama, a second Cañones Creek, El Rito, Rio del Oso, Abiquiu Creek, and the Rio Ojo Caliente, which itself is fed by the Rio Vallecitos and the Rio Tusas (Figure 3-1). In addition, San Juan-Chama Project water, which is a portion of New Mexico's allocation under the 1922 Colorado River Compact and the Upper Colorado River Basin Compact, is diverted from the upper reaches of the San Juan River and its tributaries in Colorado through a series of tunnels into the Rio Grande Basin for storage in Heron Reservoir on Willow Creek just above its confluence with the Rio Chama. San Juan-Chama water is then released to project contractors using the Rio Chama for conveyance, with some of the released water stored for specific contractors in two other reservoirs on the Rio Chama (El Vado and Abiquiu), but the majority of the water is contracted to downstream users outside the planning region.

Groundwater resources in the Rio Chama watershed are not as well explored as in other parts of New Mexico because historical water use in the region has been much more focused on surface water due to several factors: there are no major urban areas within the planning region (Española is just outside it), agriculture and the entire community structure of the region have evolved over generations around the acequia system, and surface water resources are relatively more available than in much of New Mexico. However, even though most of the water diverted in the region is surface water (approximately 97 percent), except for the Village of Chama water system, all drinking water supplies in the region are provided by groundwater, either through individual wells or through community water associations. The use of wells to provide replacement supplies or supplies for growth is limited by hydrogeologic constraints as well as water rights.

There is just one NMOSE-declared underground water basin (UWB) in the region, the upper part of the Rio Grande UWB, commonly referred to as the Upper Rio Grande UWB. (A declared UWB is an area of the state proclaimed by the State Engineer to be underlain by a groundwater source having reasonably ascertainable boundaries. By such proclamation the State Engineer assumes jurisdiction over the appropriation and use of groundwater from the source.) This basin is shared primarily with the Taos and Jemez y Sangre water planning regions; the Middle Rio Grande region overlies a small part of the southwestern edge of the Upper Rio Grande UWB. A map showing this basin is provided in Section 4.7.2.

Additional information on administrative basins and surface and groundwater resources of the region is included in Section 4 and Sections 5.2 and 5.3, respectively.

3.4 Demographics, Economic Overview and Land Use

The Rio Chama region is considered "rural," that is, with a population living in communities of less than 2,500 residents. Census figures compiled along watershed boundary lines indicated approximately 6,790 people in the Rio Chama water planning region in 2010. Since 2000, the population in Rio Arriba County has declined slightly.

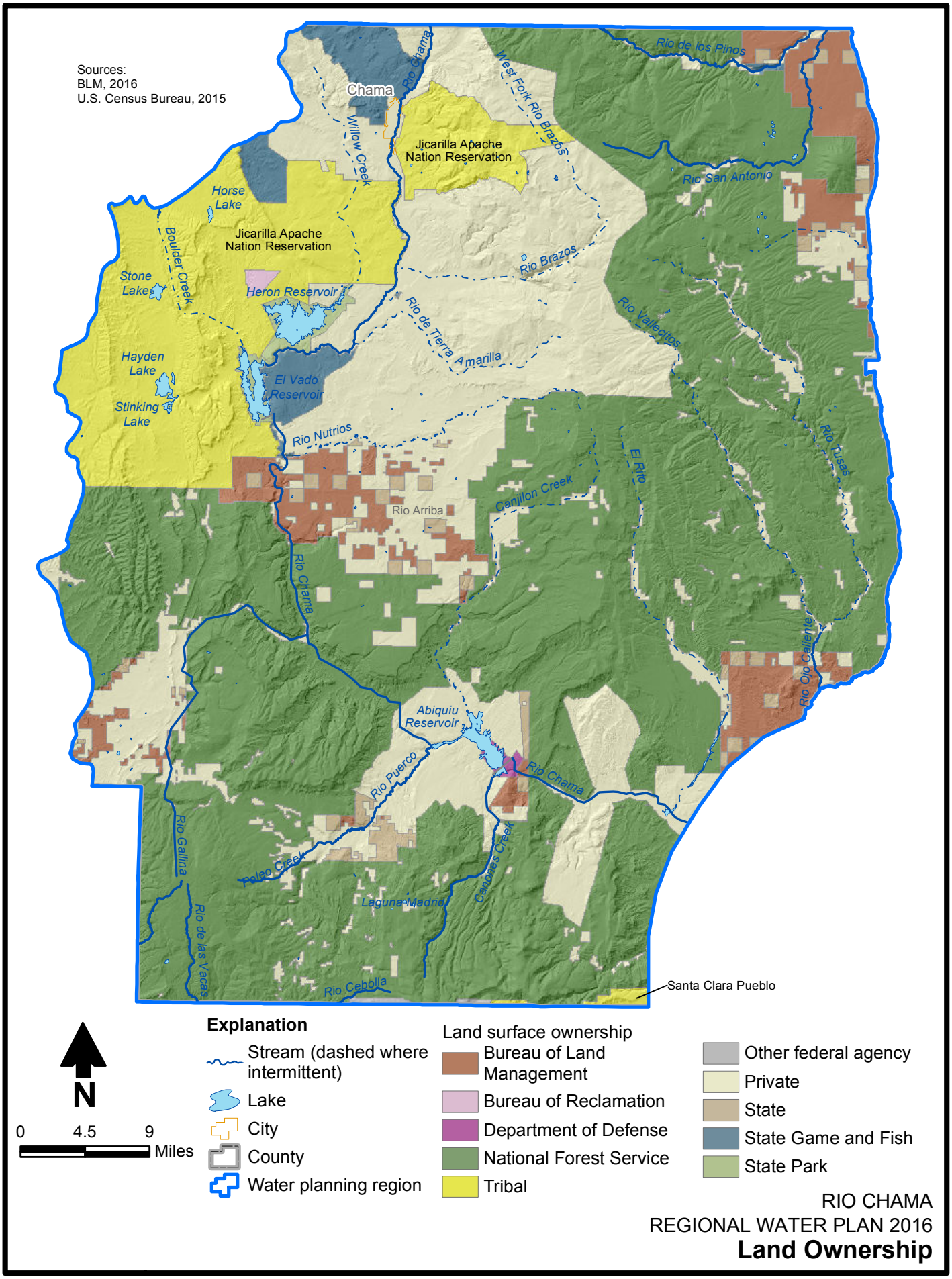
Although culturally rich and geographically attractive, the Rio Chama region is not a financially prosperous area, and in parts of the planning region, a quarter or more of the residents fall below the poverty line. The economy of the planning area has traditionally been focused on agriculture, with tourism and recreation also important activities in parts of the region.

Almost half of the region's land area is national forest (Santa Fe and Carson National Forests). The second highest percentage of land area (about 30%) is privately owned. Indian tribes, primarily the Jicarilla Apache, control about 10% of the land area. There is also a small amount of Santa Clara Pueblo land in the region. The State of New Mexico and Bureau of Land Management manage most of the rest of the region's lands. Land ownership is illustrated on Figure 3-2 and outlined below:

- Federal agencies: 1,949.5 square miles
- Tribes: 380.5 square miles
- State agencies: 133.0 square miles
- Private entities: 848.3 square miles

The largest land use in the region is for agriculture, particularly livestock grazing, much of which occurs on U.S. Forest Service or Bureau of Land Management lands.

Current statistics on the economy and land use in the Rio Chama water planning region, compiled from the U.S. Census Bureau and the New Mexico Department of Workforce Solutions, are summarized in Table 3-1. Additional information on demographics, economics, and land use within the region is provided in Section 6.



RIO CHAMA
REGIONAL WATER PLAN 2016
Land Ownership

Figure 3-2

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Table 3-1. Summary of Demographic and Economic Statistics for the Rio Chama Water Planning Region

a. Population

County	2000	2010	2013
Rio Arriba	41,190	40,246	40,072
Total Region	NA	6,792	NA

Source: U.S. Census Bureau, 2014a

b. Income and Employment

County	2012 Income [a]		Labor Force Annual Average 2013 [b]		
	Per Capita ($)	Percentage of State Average	Number of Workers	Number Employed	Unemployment Rate (%)
Rio Arriba	20,253	85	18,615	16,979	8.3

[a] U.S. Census Bureau, 2014c
[b] New Mexico Department of Workforce Solutions, 2014

c. Business Environment

County	Industry	Number Employed	Number of Businesses
	2008-2012 [a]		*2012* [b]
Rio Arriba	Education/Healthcare	3,735	574
	Professional, scientific and management	2,377	
	Entertainment, recreation, arts, hospitality, restaurant	2,257	
	Public administration	2,214	

[a] U.S. Census Bureau, 2014b
[b] U.S. Census Bureau, 2014c

d. Agriculture

County [a]	Farms / Ranches			Most Valuable Agricultural Commodities
	Number	Acreage		
		Total	Average	
Rio Arriba	1,892	1,432,897	757	Cattle, calves, Other crops and hay Fruit, tree nuts, and berries Vegetables and melons

[a] USDA NASS, 2014 (some sales data withheld to avoid disclosure for individual operations)

4. Legal Issues

4.1 Relevant Water Law

4.1.1 State of New Mexico Law

Since the accepted regional water plan for the Rio Chama Water Planning Region was published in 2006, there have been significant changes in New Mexico water law through case law, statutes, and regulations. These changes address statewide issues including, but not limited to, domestic well permitting, the State Engineer's authority to regulate water rights, administrative and legal review of water rights matters, use of settlements to allocate water resources, the rights appurtenant to a water right, and acequia water rights. New law has also been enacted to address water project financing and establish a new strategic water reserve. These general state law changes are addressed by topic area below. State law more specific to the Rio Chama region is discussed in Section 4.1.2.

4.1.1.1 Regulatory Powers of the NMOSE

In 2003, the New Mexico Legislature enacted NMSA 1978, § 72-2-9.1, relating to the administration of water rights by priority date. The legislature recognized that "the adjudication process is slow, the need for water administration is urgent, compliance with interstate compacts is imperative and the state engineer has authority to administer water allocations in accordance with the water right priorities recorded with or declared or otherwise available to the state engineer." NMSA 1978, § 72-2-9.1(A) (2003). The statute authorized the State Engineer to adopt rules for priority administration in a manner that does not interfere with future or pending adjudications, creates no impairment of water rights other than what is required to enforce priorities, and creates no increased depletions.

Based on Section 72-2-9.1, the State Engineer promulgated the Active Water Resource Management (AWRM) regulations in December 2004. The regulation's stated purpose is to establish the framework for the State Engineer "to carry out his responsibility to supervise the physical distribution of water to protect senior water right owners, to assure compliance with interstate stream compacts and to prevent waste by administration of water rights." 19.25. 13.6 NMAC. In order to carry out this purpose, the AWRM regulations provide the framework for the promulgation of specific water master district rules and regulations. No district-specific AWRM regulations have been promulgated in the Rio Chama region at the time of writing.

The general AWRM regulations set forth the duties of a water master to administer water rights in the specific district under the water master's control. Before the water master can take steps to manage the district, AWRM requires the NMOSE to determine the "administrable water rights" for purposes of priority administration. The State Engineer determines the elements, including priority date, of each user's administrable water right using a hierarchy of the best available

evidence, in the following order: (A) a final decree or partial final decree from an adjudication, (B) a subfile order from an adjudication, (C) an offer of judgment from an adjudication, (D) a hydrographic survey, (E) a license issued by the State Engineer, (F) a permit issued by the State Engineer along with proof of beneficial use, and (G) a determination by the State Engineer using "the best available evidence" of historical, beneficial use. Once determined, this list of administrable water rights is published and subject to appeal, 19.25.13.27 NMAC, and once the list is finalized, the water master may evaluate the available water supply in the district and manage that supply according to users' priority dates.

The general AWRM regulations also allow for the use of replacement plans to offset the depletions caused by out-of-priority water use. The development, review, and approval of replacement plans will be based on a generalized hydrologic analysis developed by the State Engineer.

The general AWRM regulations were unsuccessfully challenged in court in *Tri-State Generation and Transmission Ass'n, Inc. v. D'Antonio,* 2012-NMSC-039. In this case, the New Mexico Supreme Court analyzed whether Section 72–2–9.1 provided the State Engineer with the authority to adopt regulations allowing it to administer water rights according to interim priority determinations developed by the NMOSE.

In *Tri-State* the Court held that (1) the Legislature delegated lawful authority to the State Engineer to promulgate the AWRM regulations, and (2) the regulations are not unconstitutional on separation of powers, due process, or vagueness grounds. Specifically, the Court found that establishing such regulations does not violate the constitutional separation of powers because AWRM regulations do not go beyond the broad powers vested in the State Engineer, including the authority vested by Section 72–2–9.1. The Court further found that the AWRM regulations did not violate the separation of powers between the executive and the judiciary despite the fact that the regulations allow priorities to be administered prior to an *inter se* adjudication of priority. Rather, the Legislature chose to grant quasi-judicial authority in administering priorities prior to final adjudication to the NMOSE, which was well within its discretion to do.

The Court further held that the AWRM regulations do not violate constitutional due process because they do not deprive the party challenging the regulations of a property right. As explained by the Court, a water right is a limited, usufructuary right providing only a right to use a certain amount of water established through beneficial use. As such, based on the long-standing principle that a water right entitles its holder to the use of water according to priority, regulation of that use by the State does not amount to a deprivation of a property right.

In addition to *Tri-State*, several cases that address other aspects of the regulatory powers of the NMOSE have been decided recently. Priority administration was addressed in a case concerning the settlement agreement entered into by the United States, New Mexico (State), the Carlsbad Irrigation District (CID), and the Pecos Valley Artesian Conservancy District (PVACD) related

to the use of the waters of the Pecos River. *State ex rel. Office of the State Engineer v. Lewis*, 2007-NMCA-008, 140 N.M. 1. The issues in the case revolved around (1) the competing claims of downstream, senior surface water users in the Carlsbad area and upstream, junior groundwater users in the Roswell Artesian Basin and (2) the competing claims of New Mexico and Texas users. Through the settlement agreement, the parties sought to resolve these issues through public funding, without offending the doctrine of prior appropriation and without resorting to a priority call. The settlement agreement was, in essence, a water conservation plan designed to augment the surface flows of the lower Pecos River in order to (1) secure the delivery of water within the CID, (2) meet the State's obligations to Texas under the Pecos River Compact (Compact), and (3) limit the circumstances under which the United States and CID would be entitled to make a call for the administration of water right priorities. The agreement included the development of a well field to facilitate the physical delivery of groundwater directly into the Pecos River under certain conditions, the purchase and transfer to the well field of existing groundwater rights in the Roswell UWB by the State, and the purchase and retirement of irrigated land within PVACD and CID.

The Court of Appeals framed the issue as whether the priority call procedure is the exclusive means under the doctrine of prior appropriation to resolve existing and projected future water shortage issues. The Court held that Article XVI, Section 2 of the Constitution, which states that "[p]riority of appropriation shall give the better right," and Article IX of the Compact, which states that "[i]n maintaining the flows at the New Mexico-Texas state line required by this compact, New Mexico shall in all instances apply the principle of prior appropriation within New Mexico," do not require a priority call as the sole response to water shortage concerns. The Court found it reasonable to construe these provisions to permit flexibility within the prior appropriation doctrine in attempting to resolve longstanding water issues. Thus, the more flexible approach pursued by the settling parties through the settlement agreement was not ruled out in the Constitution, the Compact, or case precedent.

In relation to the NMOSE's regulatory authority over supplemental wells, in *Herrington v. State of New Mexico ex rel. State Engineer*, 2006-NMSC-014, 139 N.M. 368, the New Mexico Supreme Court clarified certain aspects of the *Templeton* doctrine. The *Templeton* doctrine allows senior surface water appropriators impaired by junior wells to drill a supplemental well to offset the impact to their water right. *See Templeton v. Pecos Valley Artesian Conservancy District*, 1958-NMSC-131, 65 N.M. 59. According to *Templeton,* drilling the supplemental well allows the senior surface right owner to keep their surface water right whole by drawing upon groundwater that originally fed the surface water supply. Although the New Mexico prior appropriation doctrine theoretically does not allow for sharing of water shortages, the *Templeton* doctrine permits both the aggrieved senior surface appropriator and the junior user to divert their full share of water. The requirements for a successful *Templeton* supplemental well include (1) a valid surface water right, (2) surface water fed in part by groundwater (baseflow), (3) junior

appropriators intercepting that groundwater by pumping, and (4) a proposed well that taps the same groundwater source of the applicant's original appropriation.

In *Herrington* the Court clarified that the well at issue would meet the *Templeton* requirements if it was dug into the same aquifer that fed the surface water. The Court also clarified whether a *Templeton* well could be drilled upstream of the surface point of diversion. The Court determined that the proper placement of a *Templeton* well must be considered on a case-by-case basis, and that these supplemental wells are not necessarily required to be upstream in all cases.

Lastly, the Court addressed the difference between a *Templeton* supplemental well and a statutory supplemental well drilled under NMSA 1978, §§ 72–5–23, -24 (1985). The Court found that a statutory transfer must occur within a continuous hydrologic unit, which differs from the narrow *Templeton* same-source requirement. Although surface to groundwater transfers require a hydrologic connection, this may be a more general determination than the *Templeton* baseflow source requirement. Further, *Templeton* supplemental wells service the original parcel, while statutory transfers may apply to new uses of the water, over significant distances.

Also related to the NMOSE's regulatory authority, the Court of Appeals addressed unperfected water rights in *Hanson v. Turney*, 2004-NMCA-069, 136 N.M. 1. In *Hanson*, a water rights permit holder who had not yet applied the water to beneficial use sought to transfer her unperfected water right from irrigation to subdivision use. The State Engineer denied the application because the water had not been put to beneficial use. The permit holder argued that pursuant to NMSA 1978, § 72-12-7(A) (1985), which allows the owner of a "water right" to change the use of the water upon application to the State Engineer, the State Engineer had wrongly rejected her application. The Court upheld the denial of the application, finding that under western water law the term "water right" does not include a permit to appropriate water when no water has been put to beneficial use. Accordingly, as used in Section 72-12-7(A) the term "water right" requires the perfection of a water right through beneficial use before a transfer can be allowed.

4.1.1.2 Legal Review of NMOSE Determinations

In *Lion's Gate Water v. D'Antonio*, 2009-NMSC-057, 147 N.M. 523, the Supreme Court addressed the scope of the district court's review of the State Engineer's determination that no water is available for appropriation. In *Lion's Gate*, the applicant filed a water rights application, which the State Engineer rejected without publishing notice of the application or holding a hearing, finding that that no water was available for appropriation. The rejected application was subsequently reviewed in an administrative proceeding before the State Engineer's hearing examiner. The hearing examiner upheld the State Engineer's decision on the grounds that there was no unappropriated water available for appropriation.

This ruling was appealed to the district court, which determined that it had jurisdiction to hear all matters either presented or that might have been presented to the State Engineer, as well as new evidence developed since the administrative hearing. The NMOSE disagreed, arguing that only the issue of whether there was water available for appropriation was properly before the district court. The Supreme Court agreed with the NMOSE. The Court found that the comprehensive nature of the water code's administrative process, its mandate that a hearing must be held prior to any appeal to district court, and the broad powers granted to the State Engineer clearly express the Legislature's intent that the water code provide a complete and exclusive means to acquire water rights. Accordingly, the NMOSE was correct that the district court's *de novo* review of the application was limited to what the State Engineer had already addressed administratively, in this case whether unappropriated water was available.

The Court also held that the water code does not require publication of an application for a permit to appropriate if the State Engineer determines no water is available for appropriation, because no third-party rights are implicated unless water is available. If water is deemed to be available, the State Engineer must order notice by publication in the appropriate form.

Based in large part on the holding in *Lion's Gate*, the New Mexico Court of Appeals in *Headon v. D'Antonio*, 2011-NMCA-058, 149 N.M. 667, held that a water rights applicant is required to proceed through the administrative process when challenging a decision of the State Engineer. In *Headon* the applicant challenged the NMOSE's determination that his water rights were forfeited. To do so, he filed a petition seeking declaratory judgment as to the validity of his water rights in district court, circumventing the NMOSE administrative hearing process. 2011-NMCA-058, ¶¶ 2-3. The Court held that the applicant must proceed with the administrative hearing, along with its *de novo* review in district court, to challenge the findings of the NMOSE.

Legal review of NMOSE determinations was also an issue in *D'Antonio v. Garcia*, 2008-NMCA-139,145 N.M. 95, where the Court of Appeals made several findings related to NMOSE administrative review of water rights matters. *Garcia* involved an NMOSE petition to the district court for enforcement of a compliance order after the NMOSE hearing examiner had granted a motion for summary judgment affirming the compliance order. 2008-NMCA-139, ¶¶ 2-5. The Court first found that the right to a hearing granted in NMSA 1978, § 72-2-16 (1973), did not create an absolute right to an administrative hearing. Rather, the NMOSE hearing contemplated in Section 72-2-16 could be waived if a party did not timely request such a hearing. *Id*. ¶ 9. In *Garcia* the defendant had not made such a timely request and therefore was not entitled to a full administrative hearing prior to issuance of an order by the district court.

The Court also examined the regulatory powers of the NMOSE hearings examiner, specifically, whether 19.25.2.32 NMAC allows the hearing examiner to issue a final order without the express written consent of the State Engineer. *Id*. ¶¶ 11-15. The Court held that the regulation allowed the hearing examiner to dismiss a case without the express approval of the State Engineer.

Id. ¶ 14. Finally, the Court held that the NMOSE hearing examiner may dismiss a case without full hearing when a party willfully fails to comply with the hearing examiner's orders. *Id*. ¶¶ 17-18. Accordingly, the Court in *Garcia* upheld the NMOSE hearing examiner's action to issue a compliance order without a full administrative hearing or final approval by the State Engineer. As such, the district court had the authority to enforce that compliance order.

4.1.1.3 Beneficial Use of Water – Non-Consumptive Use

Carangelo v. Albuquerque-Bernalillo County Water Utility Authority, 2014-NMCA-032, addressed whether a non-consumptive use of water qualifies as a beneficial use under New Mexico law and, accordingly, can be the basis for an appropriation of such water. In *Carangelo*, the NMOSE granted the Albuquerque-Bernalillo County Water Utility Authority's (Authority) application to divert approximately 45,000 acre-feet per year of Rio Grande surface water, to which the Authority had no appropriative right. The Authority intended to use the water for the non-consumptive purpose of "carrying" the Authority's own San Juan-Chama Project water, Colorado River Basin water to which the Authority had contracted for use of, to a water treatment plant for drinking water purposes. The Court of Appeals found the NMOSE erred in granting the application because the application failed to seek a new appropriation. The Authority's application sought to divert water, to which the Authority asserted no prior appropriative right, which required a new appropriation. Moreover, the Authority affirmatively asserted no beneficial use of the water. The Court remanded the matter to the NMOSE to issue a corrected permit.

The Court's decision included the following legal conclusions:

- A new non-consumptive use of surface water in a fully appropriated system requires a new appropriation of water. A "non-consumptive use" is a type of water use where either there is no diversion from a source body or there is no diminishment of the source. Neither the New Mexico Constitution nor statutes governing the appropriation of water distinguish between diversion of water for consumptive and non-consumptive uses. Because both can be beneficial uses, New Mexico's water law applies equally to either.

- The Authority did not need to file for a change in place or purpose of use for the diversion of its San Juan-Chama Project water. The Court stated that the San Juan-Chama Project water does not come from the Rio Grande Basin, and the Authority's entitlement to its beneficial use is not within the administrative scope of the Rio Grande Basin. Accordingly, the Authority already had an appropriative right to that water and did not need to file an application with the NMOSE for its use.

4.1.1.4 Impairment

Montgomery v. Lomos Altos, Inc., 2007-NMSC-002, 141 N.M. 21, involved applications to transfer surface water rights to groundwater points of diversion in the fully appropriated Rio

Grande stream system. In order for a transfer to be approved, an applicant must show, among other factors, that the transfer will not impair existing water uses at the move-to location. In *Lomos Altos*, several parties protested the NMOSE's granting of the applications, arguing that surface depletions at the move-to location caused by the applications should be considered *per se* impairment of existing rights. The Court found that questions of impairment are factual and cannot be decided as a matter of law, but must be determined on a case-by-case basis. In doing so, the Court held that surface depletions in a fully appropriated stream system do not result in *per se* impairment, but the Court noted that under some circumstances, even *de minimis* depletions can lead to a finding of impairment. The Court further found that in order to determine impairment, all existing water rights at the "move-to" location must be considered.

4.1.1.5 Rights Appurtenant to Water Rights

The New Mexico Supreme Court has issued three recent opinions dealing with appurtenancy. *Hydro Resources Corp. v. Gray*, 2007-NMSC-061, 143 N.M. 142, involved a dispute over ownership of water rights developed by a mining lessee in connection with certain mining claims owned by the lessor. The Supreme Court held that under most circumstances, including mining, water rights are not considered appurtenant to land under a lease. The sole exception to the general rule that water rights are separate and distinct from the land is water used for irrigation. Therefore, a lessee can acquire water rights on leased land by appropriating water and placing it to beneficial use. Those developed rights remain the property of the lessee, not the lessor, unless stipulated otherwise in an agreement.

In a case examining whether irrigation water rights were conveyed with the sale of land or severed prior to the sale (*Turner v. Bassett*, 2005-NMSC-009, 137 N.M. 381), the Supreme Court examined New Mexico's transfer statute, NMSA 1978, § 72-5-23 (1941), along with the NMOSE regulations addressing the change of place or purpose of use of a water right, 19.26.2.11(B) NMAC. *Turner v. Bassett*, 2005-NMSC-009, 137 N.M. 381. In *Turner* the Court found that the statute, coupled with the applicable regulations and NMOSE practice, requires consent of the landowner and approval of the transfer application by the State Engineer for severance to occur. The issuance of a permit gives rise to a presumption that the water rights are no longer appurtenant to the land. A landowner who holds water rights and follows the statutory and administrative procedures to effect a severance and initiate a transfer may convey the land severed from its former water rights, without necessarily reserving those water rights in the conveyance documents.

In *Walker v. United States*, 2007-NMSC-038, 142 N.M. 45, the New Mexico Supreme Court examined the issue of whether a water right includes an implicit right to graze. After the U.S. Forest Service canceled the Walkers' grazing permits, the Walkers filed a complaint arguing that the United States had taken their property without just compensation in violation of the Fifth Amendment to the United States Constitution. The Walkers asserted a property right to the allotments under New Mexico state law. Specifically, the Walkers argued that the revocation of

the federal permit resulted in the loss of "water, forage, and grazing" rights based on New Mexico state law and deprived them of all economically viable use of their cattle ranch.

The Court found that a stock watering right does not include an appurtenant grazing right. In doing so, the Court addressed in depth the long understood principle in western water law that water rights, unless utilized for irrigation, are not appurtenant to the land on which they are used. The Court also clarified that the beneficial use for which a water right is established does not guarantee the water right owner an interminable right to continue that same beneficial use. The Walkers could have transferred their water right to another location or another use if they could not continue with the original uses. For these reasons, the Court rejected the Walkers attempt to make an interest in land incident or appurtenant to a water right.

4.1.1.6 Deep, Non-Potable Aquifers

In 2009 the New Mexico Legislature amended NMSA 1978, § 72-12-25 (2009), to provide for administrative regulation of deep, non-potable aquifers. These groundwater basins are greater than 2,500 deep and contain greater than 1,000 parts per million of total dissolved solids. Drilling wells into such basins had previously been unregulated. The amendment requires the NMOSE to conduct hydrologic analysis on well drilling in these basins. The type of analysis required by the NMOSE depends on the use for the water.

4.1.1.7 Domestic Wells

New Mexico courts have recently decided several significant cases addressing domestic well permitting, and the NMOSE also recently amended its regulations governing domestic wells.

In *Bounds v. State ex. rel D'Antonio*, 2013-NMSC-037, the New Mexico Supreme Court upheld the constitutionality of New Mexico's Domestic Well Statute (DWS), NMSA 1978, Section 72-12–1.1 (2003). Bounds, a rancher and farmer in the fully appropriated and adjudicated Mimbres basin, and the New Mexico Farm and Livestock Bureau (Petitioners), argued that the DWS was facially unconstitutional. The DWS states that the NMOSE "shall issue" domestic well permits, without determining the availability of unappropriated water or providing other water rights owners in the area the ability to protest the well. The Petitioners argued that this practice violated the New Mexico constitutional doctrine of prior appropriation to the detriment of senior water users, as well as due process of law. The Court held that the DWS does not violate the doctrine of prior appropriation set forth in the New Mexico Constitution. The Court also held that Petitioners failed to adequately demonstrate any violation of their due process rights.

In addressing the facial constitutional challenge, the Court rejected the Petitioners' argument that the New Mexico Constitution mandates that the statutory requirements of notice, opportunity to be heard, and a prior determination of unappropriated waters or lack of impairment be applied to the domestic well application and permitting process. The Court reasoned that the DWS creates

a different and more expedient permitting procedure for domestic wells and the constitution does not require a particular permitting process, or identical permitting procedures, for all appropriations. While holding that the DWS was valid in not requiring the same notice, protest, and water availability requirements as other water rights applications, the court confirmed that domestic well permits can be administered in the same way as all other water rights. In other words, domestic wells do not require the same rigors as other water rights when permitted but, when domestic wells are administered, constitutionally mandated priority administration still applies. Thus the DWS, which deals solely with permitting and not with administration, does not conflict with the priority administration provisions of the New Mexico Constitution.

The Court also found that the Petitioners failed to prove a due process violation because they did not demonstrate how the DWS deprived them of their water rights. Specifically, Bounds failed to show any actual impairment, or imminent future impairment, of his water rights. Bounds asserted that any new appropriations must necessarily cause impairment in a closed and fully appropriated basin, and therefore, granting any domestic well permit had the potential to impair his rights. The Court rejected this argument, finding that impairment must be proven using scientific analysis, not simply conclusory statements based on a bright line rule that impairment always occurs when new water rights are permitted in fully appropriated basins.

Two other significant domestic well decisions addressed domestic well use within municipalities. In *Smith v. City of Santa Fe*, 2007-NMSC-055, 142 N.M. 786, the Supreme Court examined the authority of the City of Santa Fe to enact an ordinance restricting the drilling of domestic wells. The Court held that under the City's home rule powers, it had authority to prohibit the drilling of a domestic well within the municipal boundaries and that this authority was not preempted by existing state law.

Then in *Stennis v. City of Santa Fe,* 2008-NMSC-008, 143 N.M. 320, Santa Fe's domestic well ordinance was tested when a homeowner (Stennis) applied for a domestic well permit with the NMOSE, but did not apply for a permit from the City. In examining the statute allowing municipalities to restrict the drilling of domestic wells, the Court found that municipalities must strictly comply with NMSA 1978, § 3–53–1.1(D) (2001), which requires cities to file their ordinances restricting the drilling of domestic water wells with the NMOSE. On remand, the Court of Appeals held that Section 3-53-1.1(D) does not allow for *substantial* compliance. *Stennis v. City of Santa Fe*, 2010-NMCA-108, 149 N.M. 92. Rather, strict compliance is required and the City must have actually filed a copy of the ordinance with the NMOSE.

In addition to the cases addressing domestic wells, the regulations governing the use of groundwater for domestic use were substantially amended in 2006 to clarify domestic well use pursuant to NMSA 1978, § 72-12-1.1. 19.27.5.1 et seq. NMAC. The regulations:

1. Limit the amount of water that can be used pursuant to a domestic well permit to:

    - 1.0 acre feet per year (ac-ft/yr) for a single household use (can be increased to up to 3.0 ac-ft/yr if the applicant can show that the combined diversion from domestic wells will not impair existing water rights).

    - 1.0 ac-ft/yr for each household served by a well serving more than one household, with a cap of 3.0 ac-ft/yr if the well serves three or more households.

    - 1.0 ac-ft/yr for drinking and sanitary purposes incidental to the operations of a governmental, commercial, or non-profit facility as long as no other water source is available. The amount of water so permitted is subject to further limitations imposed by a court or a municipal or county ordinance.

    The amount of water that can be diverted from a domestic well can also be increased by transferring an existing water right to the well. 19.27.5.9 NMAC.

2. Require mandatory metering of all new domestic wells under certain conditions, such as when wells are permitted within a domestic well management area, when a court imposes a metering requirement, when the water use is incidental to the operations of a governmental, commercial, or non-profit facility, and when the well serves multiple households. 19.27.5.13(C) NMAC.

3. Allow for the declaration of domestic well management areas when hydrologic conditions require added protections to prevent impairment to valid, existing surface water rights. In such areas, the maximum diversion from a new domestic well cannot exceed, and may be less than, 0.25 ac-ft/yr for a single household and up to 3.0 ac-ft/yr for a multiple household well, with each household limited to 0.25 ac-ft/yr. The State Engineer has not declared any domestic well management areas in the planning region.

4.1.1.8 Water Project Financing

The Water Project Finance Act, Chapter 72, Article 4A NMSA 1978, outlines different mechanisms for funding water projects in water planning regions. The purpose of the Act is to provide for water use efficiency, resource conservation, and the protection, fair distribution, and allocation of New Mexico's scarce water resources for beneficial purposes of use within the state. The Water Project Finance Act creates two funds: the Water Project Fund, NMSA 1978, Section 72-4A-9 (2005), and the Acequia Project Fund, NMSA 1978, Section 72-4A-9.1 (2004). Both funds are administered by the New Mexico Finance Authority. The Water Trust Board recommends projects to the Legislature to be funded from the Water Project Fund.

The Water Project Fund may be used to make loans or grants to qualified entities (broadly defined to include public entities and Indian tribes and pueblos). To qualify for funding, the

project must be approved by the Water Trust Board for one of the following purposes: (1) storage, conveyance or delivery of water to end users, (2) implementation of federal Endangered Species Act of 1973 collaborative programs, (3) restoration and management of watersheds, (4) flood prevention, or (5) water conservation or recycling, treatment, or reuse of water as provided by law. NMSA 1978, § 72-4A-5(B) (2011). The Water Trust Board must give priority to projects that (1) have been identified as being urgent to meet the needs of a regional water planning area that has a completed regional water plan accepted by the NMISC, (2) have matching contributions from federal or local funding sources, and (3) have obtained all requisite state and federal permits and authorizations necessary to initiate the project. NMSA 1978, § 72-4A-5.

The Acequia Project Fund may be used to make grants to acequias for any project approved by the Legislature.

The Water Project Finance Act directed the Water Trust Board to adopt regulations governing the terms and conditions of grants and loans recommended by the Board for appropriation by the Legislature from the Water Project Fund. The Board promulgated implementing regulations, 19.25.10.1 et seq. NMAC, in 2008. The regulations set forth the procedures to be followed by the Board and New Mexico Finance Authority for identifying projects to recommend to the Legislature for funding. The regulations also require that financial assistance be made only to entities that agree to certain conditions set forth in the regulations.

4.1.1.9 The Strategic Water Reserve

In 2005, the New Mexico Legislature enacted legislation to establish a Strategic Water Reserve, NMSA 1978, Section 72-14-3.3 (2007). Regulations implementing the Strategic Water Reserve statute were also implemented in 2005. 19.25.14.1 et seq. NMAC.

The statute authorizes the Commission to acquire water rights or storage rights to compose the reserve. Section 72-14-3.3(A). Water in the Strategic Water Reserve can be used for two purposes: (1) to comply with interstate stream compacts and (2) to manage water for the benefit of endangered or threatened species or to avoid additional listing of species. Section 72-14-3.3(B). The NMISC may only acquire water rights that have sufficient seniority and consistent, historical beneficial use to effectively contribute to the purpose of the Reserve. The NMISC must annually develop river reach or groundwater basin priorities for the acquisition of water rights for the Strategic Water Reserve. The Rio Chama is not designated as a priority basin.

4.1.1.10 Acequia Water Use

Two recent cases by New Mexico courts address the issue of acequia water use. *Storm Ditch v. D'Antonio,* 2011-NMCA-104, 150 N.M. 590, examined the process for transferring a landowner's water rights from a community acequia to a municipality. The Court found that actual notice of the transfer application to the acequia was not mandated by statute; instead,

publication of the landowner's transfer application provided sufficient notice to the acequia to inform it of the proposed transfer. Further, the statute requiring that the transfer applicant file an affidavit stating that no rules or bylaws for a transfer approval had been adopted by the acequia was not intended to prove notice. Rather, the statute was directed at providing the State Engineer with assurance that the applicant had met all requirements imposed by acequia bylaws before action was taken on the application, not in providing notice.

Pena Blanca Partnership v. San Jose Community Ditch, 2009-NMCA-016, 145 N.M. 555 involved attempts to transfer water rights from agricultural uses appurtenant to lands served by two acequias to non-agricultural uses away from the acequias. The acequias denied the water rights owners' (Owners) requests to make these changes pursuant to their authority under NMSA 1978, Section 73-2-21(E) (2003). The Owners appealed the acequias decision to district court, where the standard of review listed in Section 73–2–21(E) allowed reversal of the acequia commissioners on appeal only if the court found they had acted fraudulently, arbitrarily or capriciously, or not in accordance with law.

The Owners challenged this deferential standard of review in the Court of Appeals based on two grounds. First, the Owners argued that the *de novo* review standard in Article XVI, Section 5 of the New Mexico Constitution applied to the proposed transfers at issue, not the more deferential standard found in Section 73-2-21(E). The Court disagreed and found that the legislature provided for another review procedure for the decisions of acequia commissioners by enacting Section 73–2–21(E).

The Owners second assertion was that the deferential standard of review in Section 73-2-21(E) violated the equal protection clause of Article II, Section 18 of the New Mexico Constitution. The Owners argued that their equal protection guarantees were violated because water rights transfers out of acequias were treated differently than other water rights transfers. The court again disagreed, finding that although other determinations of water rights are afforded a *de novo* hearing in the district court, since the Owners still had access to the courts and the right of appeal, there were no equal protection violations.

4.1.1.11 Water Conservation

Guidelines for drafting and implementing water conservation plans are set forth in NMSA 1978, Section 72-14-3.2 (2003). By statute, neither the Water Trust Board nor the New Mexico Finance Authority may accept an application from a covered entity (defined as municipalities, counties, and any other entities that supply at least 500 acre-feet per annum of water to its customers, but excluding tribes and pueblos) for financial assistance to construct any water diversion, storage, conveyance, water treatment, or wastewater treatment facility unless the entity includes a copy of its water conservation plan.

The water conservation statute primarily supplies guidance to covered entities, as opposed to mandating any particular action. For example, the statute provides that the covered entity determines the manner in which it will develop, adopt, and implement a water conservation plan. The statute further states that a covered entity "shall consider" either adopting ordinances or codes to encourage conservation, or otherwise "shall consider" incentives to encourage voluntary compliance with conservation guidelines. The statute then states that covered entities "shall consider, and incorporate in its plan if appropriate, . . . a variety of conservation measures," including, in part, water-efficient fixtures and appliances, water reuse, leak repairs, and water rate structures encouraging efficiency and reuse. Section 72-14-3.2(D). Also, pursuant to NMSA 1978, Sections 72-5-28(G) (2002) and 72-12-8(D) (2002), when water rights are placed in a State Engineer-approved water conservation program, periods of nonuse of the rights covered in the plan do not count toward the four-year forfeiture period.

4.1.1.12 Municipal Condemnation

NMSA 1978, Section 3-27-2 (2009) was amended in 2009 to prohibit municipalities from condemning water sources used by, water stored for use by, or water rights owned or served by an acequia, community ditch, irrigation district, conservancy district, or political subdivision of the state.

4.1.1.13 Subdivision Act

The Subdivision Act, NMSA 1978, Section 47-6-11.2 (2013), was amended in 2013 to require proof of water availability prior to final approval of a subdivision plat. Specifically, the subdivider must (1) present the county with NMOSE-issued water use permits for the subdivision or (2) prove that the development will hook up to a water provider along with an opinion from the State Engineer that the subdivider can fulfill the water use requirements of the Subdivision Act. Previously the county had discretion to approve subdivision plats without such proof that the water rights needed for the subdivision were readily available. These water use requirements apply to all subdivisions of ten or more lots. The Act was also amended to prohibit approval of a subdivision permit if the water source for the subdivision is domestic wells.

4.1.2 State Water Laws and Administrative Policies Affecting the Region

In New Mexico, water is administered generally by the State Engineer, who has the "general supervision of waters of the state and of the measurement, appropriation, distribution thereof and such other duties as required." NMSA 1978, § 72-2-1 (1982). To administer water throughout the state the State Engineer has several tools at its disposal, including designation of water masters, declaration of UWBs, and use of the AWRM rules, all of which are discussed below, along with other tools used to manage water within regions.

4.1.2.1 Water Masters

The State Engineer has the power to create water master districts or sub-districts by drainage area or stream system and to appoint water masters for such districts or sub-districts. NMSA 1978, § 72-3-1 (1919). Water masters have the power to apportion the waters in the water master's district under the general supervision of the State Engineer and to appropriate, regulate, and control the waters of the district to prevent waste. NMSA 1978, § 72-3-2 (2007). Currently, there is a water master assigned to the Pecos River and the Gallinas River. Within the planning region, water masters have been assigned to the Upper Chama Water Master District and the Lower Chama Water Master District.

4.1.2.2 Groundwater Basin Guidelines

As noted in Section 3, the sole UWB in the Rio Chama planning region is the upper part of the Rio Grande UWB, commonly referred to as the Upper Rio Grande UWB (Figure 4-1). No basin guidelines have been formally adopted for the Upper Rio Grande UWB.

4.1.2.3 AWRM Implementation in the Basin

The Rio Chama Basin has been identified as a high priority basin for AWRM implementation; however, no AWRM regulations have been issued for the basin. .

4.1.2.4 Special Districts in the Basin

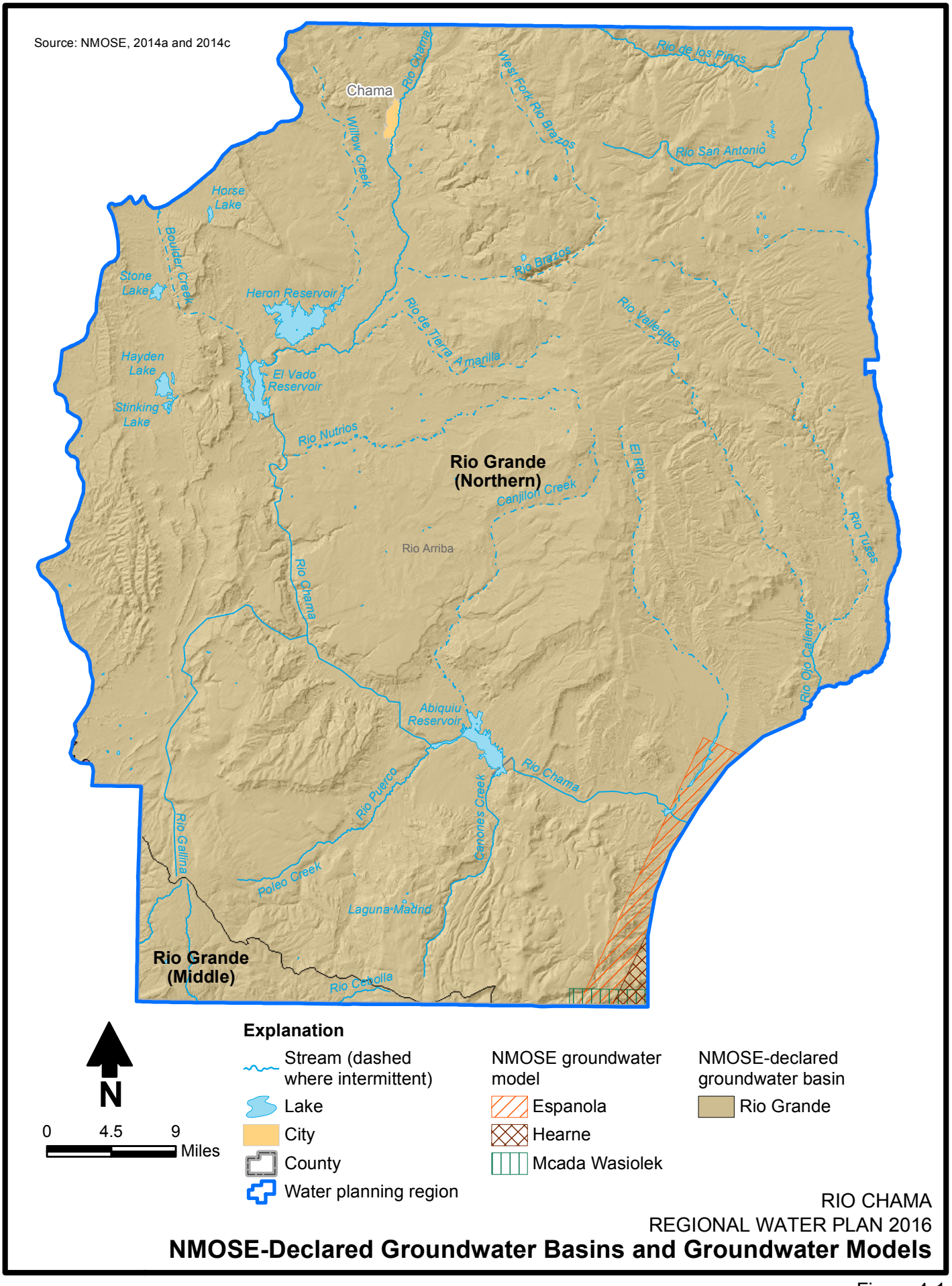
Special districts are various districts within the region having legal control over the use of water in that district. All are subject to specific statutes or other laws concerning their organization and operation. In the Rio Chama planning region, special districts include several acequias, which are governed by NMSA 1978, Sections 73-2-1 through 68, and soil and water conservation districts, which are governed by NMSA 1978, Sections 73-20-25 through 48. Some of the issues surrounding acequias in the region and their involvement in water use and planning are addressed in Section 5.

4.1.2.5 State Court Adjudications in the Basin

Not applicable.

4.1.3 Federal Water Laws

The law of water appropriation has been developed primarily through decisions made by state courts. Since the accepted plan was published in 2006 several federal cases have been decided examining various water law questions. These cases are too voluminous to include here, and many of the issues in the cases will not apply directly to the region. However, New Mexico is a party to one original jurisdiction case in the U.S. Supreme Court involving the Rio Grande Compact and waters of the Lower Rio Grande. Because of its importance to the entire state, especially those regions that include the Rio Grande as a surface water source like the Rio Chama region, it is included here.



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RIO CHAMA
REGIONAL WATER PLAN 2016

NMOSE-Declared Groundwater Basins and Groundwater Models

Figure 4-1

In *Texas v. New Mexico and Colorado*, No. 141 Original (U.S. Supreme Court, 2014), Texas alleges that New Mexico has violated the Rio Grande Compact by intercepting water Texas is entitled to under the Compact through groundwater pumping and surface diversions downstream of Elephant Butte Reservoir but upstream of the New Mexico-Texas state line. Colorado is also a defendant in the lawsuit as it is a signatory to the Rio Grande Compact. The United States has intervened as a Plaintiff in the case. Elephant Butte Irrigation District and El Paso County Water Improvement District Number One have both sought to intervene in the case as well, claiming that their interests are not fully represented by the named parties. The motions to intervene along with a motion to dismiss filed by New Mexico are currently pending.

4.1.3.1 Federal Reservations

The doctrine of federally reserved water rights was developed over the course of the 20th Century. Simply stated, federally reserved rights are created when the United States sets aside land for specific purposes, thereby withdrawing the land from the general public domain. In doing so, there is an implied, if not expressed, intent to reserve an amount of water necessary to fulfill the purpose for which the land was set aside. Federally reserved water rights are not created, or limited, by State law.

Federally reserved water rights on Indian lands are known as "*Winters* reserved rights." The *Winters* Doctrine provides that at the time the United States established an Indian reservation, it also reserved sufficient water to provide for the reservation as a permanent homeland. *Winters v. United States,* 207 U.S. 564 (1908). Neither the priority date nor the amount of *Winters* reserved rights is based on the historical actual beneficial use of water. Under the *Winters* Doctrine, the priority date is based on the date the federal government established the Indian reservation. A *Winters* reserved right is quantified based on the amount of water needed to fulfill the purposes of the reservation. In 1963, the U.S. Supreme Court adopted the "practically irrigable acreage" standard for quantifying federal Indian reserved water rights through a determination of the number of acres that can be practically or feasibly irrigated on the reservation. *Arizona v. California,* 376 U.S. 546 (1963). In New Mexico, courts have faced a different question in the determination of Pueblo Indian water rights. Although one federal district court recognized historically irrigated acreage as the basis for determining the quantity of a pueblo's water right, there is no established law for determining Pueblo Indian water rights. *See New Mexico ex rel. State Engineer v. Aamodt, et al.*, 6:6-CV-6639 (D.N.M.).

Lands with federal reserved rights or aboriginal rights within the Rio Chama planning region include the following:

- Jicarilla Apache Nation
- Santa Clara Pueblo
- Carson National Forest

- Santa Fe National Forest
- Bureau of Land Management Lands

Importantly, the historical and existing reserved rights of the Jicarilla Apache Nation are quantified in the Jicarilla Apache Tribe Water Rights Settlement Act, of October 23, 1992, 106 Stat. 2237. Partial final decrees were entered in *New Mexico v. United States,* No. 75-184, District Court of San Juan County, New Mexico, and *New Mexico v. Aragon,* CIV No. *7941-SC* (D.N.M.) recognizing the settlement. As discussed below, some of the terms of the settlement are still causing some water use disputes in the region.

4.1.3.2 Interstate Stream Compacts

Interstate compacts become federal law once ratified by Congress. The Rio Grande Compact impacts the Rio Chama region by allocating the water of the Rio Grande. Signed in 1938, with Colorado, New Mexico, and Texas as parties, and approved by Congress in 1939, the Rio Grande Compact apportions the waters of the Rio Grande above Ft. Quitman, Texas, among the three states. It provides for administration by a Commission consisting of the state engineers of Colorado and New Mexico, a commissioner appointed by the Governor of Texas, and a federal representative designated by the President of the United States who serves as the Chairman. The Commission meets annually in March to hear reports from the engineer advisors to the compact commissioners and consider and adopt an annual report for the previous calendar year.

The Rio Grande Compact establishes, among other things, annual water delivery obligations and depletion entitlements for Colorado and New Mexico. Given the variable climate, it provides for debits and credits to be carried over from year to year until extinguished under provisions of the Compact. Accrued credits or debits are an important element of compact accounting. The engineer advisers to the compact commissioners meet prior to annual Rio Grande Compact Commission meeting to determine scheduled and actual delivery of water under the Compact.

As discussed above, the three party states are currently involved in litigation over allegations by Texas that New Mexico has violated the terms of the Compact. The allegations primarily involve actions in the Lower Rio Grande of New Mexico. However, the outcome of the suit may very well affect the upper reaches of the Rio Grande in New Mexico, especially those related to storage and relinquishment credits.

4.1.3.3 Treaties

One treaty indirectly governs water use in the Rio Chama region: the Convention with Mexico, May 21, 1906, 34 Stat. 2953, T.S. No. 455, 1 Malloy 1202. This treaty provides for the distribution between the United States and Mexico of the waters of the Rio Grande in the international reach of the river between the El Paso-Juárez Valley and Fort Quitman, Texas. Although this reach is below the Rio Chama region, any use of water upstream of this reach may impact the downstream distribution of water. The treaty is also addressed in the 2006 RWP.

Also discussed in the 2006 RWP, and of importance to water rights administration in the region, is the treaty of Guadalupe Hidalgo, entered into on February 2, 1848 between the United States and Mexico. 9 Stat. 922. The treaty provides that "property of every kind" of the Mexicans shall be "inviolably respected." Accordingly, water rights established prior to 1848, which include many of the water rights in the region, are protected under the treaty.

4.1.3.4 Federal Water Projects

The San Juan-Chama Project (Project), which was also covered in the 2006 RWP, is a federal water project built in the 1960s to transport approximately 110,000 acre-feet of water annually from the San Juan River system to the Rio Grande via the Chama River. The Project was authorized under Section 8 of the Act of June 13, 1962, 76 Stat. 96, and the Act of April 11, 1956, 70 Stat. 105. The Project includes a number of tunnels under the Continental Divide, as well as Heron Reservoir, where San Juan-Chama water is stored after it has been transported through the tunnels from the San Juan tributaries. The purpose of the Project was to make use of water to which New Mexico is entitled under the Colorado River compacts in the Rio Grande Basin.

Under the Project water is supplied for the following municipal, domestic, and industrial purposes:

- City of Albuquerque, 48,200 acre-feet
- City and County of Santa Fe, 5,605 acre-feet
- City of Los Alamos, 1,200 acre-feet
- Village of Los Lunas, 400 acre-feet
- Twining Water and Sanitation District, 15 acre-feet
- City of Española, 1,000 acre-feet
- Village of Taos, 400 acre-feet
- Town of Belen, 500 acre-feet
- Town of Bernalillo, 400 acre-feet
- Jicarilla Apaches, 6,500 acre-feet.

Supplemental water is provided for irrigation of 89,711 acres in the Middle Rio Grande Conservancy District (20,900 acre-feet) and 2,768 acres in the Pojoaque Valley Irrigation District (1,030 acre-feet). An annual allocation of about 5,000 acre-feet is available for the Corps of Engineer's Cochiti Reservoir for fish and wildlife and recreation purposes to maintain a minimum pool of 1,200 surface acres.

The storage facilities for the Project are located in the planning region. Specifically, the regulating and storage reservoir is formed by Heron Dam on Willow Creek just above the point where Willow Creek enters the Rio Chama. The dam forms a reservoir with a capacity of 401,320 acre-feet and a surface area of 5,950 acres. Storage from Heron Dam provides water for municipal, domestic, industrial, recreation, and fish and wildlife purposes and also provides supplemental water for irrigation.

Heron Reservoir is operated by Reclamation in compliance with applicable federal and state laws, including the Project authorization and the Rio Grande and Colorado compacts. Under these laws, only imported Project water may be stored in Heron Reservoir; there are no provisions for storing native Rio Grande water. Thus, all native Rio Grande water is released to the river below Heron Dam.

The outlet works for El Vado Dam, located 6 miles downstream of Heron Dam, were enlarged in 1965-1966 so that Project releases from Heron Reservoir could be passed unimpeded through El Vado Reservoir. The flow of native water in the region must address the storage requirements of Heron and El Vado reservoirs.

4.1.3.5 Federal Adjudications in the Basin

There are two pending adjudications in the Rio Chama region: *State of New Mexico ex rel. State Engineer v. Aragon*, No. 69cv0794 and *State of New Mexico ex rel. State Engineer v. Abbott*, 68cv07488 and 70cv08650, consolidated. *Aragon*, commonly referred to as the Chama adjudication, consists of eight sections, including the claims of the Jicarilla Apache Tribe. The Jicarilla rights are discussed in Section 4.1.3.1. The status of *Aragon* was discussed in the 2006 RWP. Progress has been made in the adjudication, but it is still ongoing. *Abbott* includes the claims of Santa Clara Pueblo to the Rio Santa Cruz and Rio Truchas. Again, progress has been made in the adjudication, but it is still ongoing.

4.1.4 Tribal Law

Water use on the Jicarilla Apache Nation is governed by its Water Code, Title 21. The Jicarilla Water Code is administered by a Water Commission. Chap. 3, § 6. The Code includes provisions for the use and permitting of groundwater and surface water (Chap. 4, Sections 5, 6, Chap. 7, Sections 3, 4), the transfer of permitted water uses (Chap. 10), water marketing (Chap. 15), water conservation (Chap. 16, Section 5), and priority enforcement (Chap. 17).

The Jicarilla Apache Nation also has a Water and Wastewater Utility Code that includes provisions for conservation. Title 24, Chap. 3, § 6.

Santa Clara also has a water code that governs, to an extent, water use on pueblo lands.

4.1.5 Local Law

Local laws addressing water use have been implemented by Rio Arriba County and the Village of Chama within the planning region. The planning region includes insignificant incursions into Taos and Sandoval counties as well. However, because those areas make up such a small part of the region, local laws in those counties are not addressed here.

4.1.5.1 Rio Arriba County

Water use in Rio Arriba County is guided by the Rio Arriba County Comprehensive Plan and its subdivision regulations.

The Rio Arriba Comprehensive Plan (Community By Design, 2009) focuses on water issues in the County and sets forth a number of goals relating to water use and strategies to meet those goals. The major priorities set forth in the Plan are to keep water within the County to foster long-standing agricultural traditions, sustain the acequia system, and provide safe and adequate drinking water into the future. The Plan sets forth a number of strategies to meet the County's goal of protecting, maintaining, and strengthening the relationship between land and water. These strategies include acquiring water rights at risk of loss and placing them to beneficial use, encouraging the adjudication of water rights of all acequias in the County to include historical uses, customs and practices, encouraging acequias to adopt bylaws governing the transfer of acequia rights, encouraging acequias and mutual domestic providers to work with the County, the Office of the State Engineer, and tribal governments to establish conservation and restoration programs, and mapping and inventorying water resources in the County. The Plan also sets as a goal the protection of the County's water supply and quality, and to do so, encourages water conservation measures as well as community water and wastewater systems.

The County's Subdivision Regulations require that a subdivider show that sufficient water is available to fulfill the maximum water requirements of the subdivision and provide a water supply plan including conservation, water quality, and fire protection components. Art. VII, § 2 and Appendix A. For all subdivisions containing 20 or more parcels, any one of which is 2 acres or less in size, the subdivider must provide a State Engineer permit allowing subdivision water use.

4.1.5.2 Village of Chama

The Village of Chama has several ordinances relating to water use. Chama Zoning Ordinance Arts. 12 and 14 require proof of a water supply for a subdivision. Article 16 prohibits any person, if contrary to the orders of an acequia official, from breaking, stopping, or otherwise interfering with a community ditch or acequia, or taking or using water from it.

4.2 Relevant Environmental Law

4.2.1 Species Protection Laws

4.2.1.1 Federal Endangered Species Act

The Endangered Species Act (ESA) can have a tremendous influence on the allocation of water, especially of stream and river flows. 16 U.S. C.§§ 1531 to 1544. The ESA was enacted in 1973 and, with limited exceptions, has remained in its current form since then. The goal of the Act is to protect threatened and endangered species and the habitat on which they depend. 16 U.S.C. § 1531(b). The Act's ultimate goal is to "recover" species so that they no longer need protection under the Act.

The ESA provides several mechanisms for accomplishing these goals. It authorizes the U.S. Fish and Wildlife Service (USFWS) to list "threatened" or "endangered" species, which are then protected under the Act, and to designate "critical habitat" for those species. The Act makes it unlawful for anyone to "take" a listed species unless an "incidental take" permit or statement is first obtained from the Department of the Interior. 16 U.S.C. §§ 1538, 1539. To "take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct." 16 U.S.C. § 1532(19).

In addition, federal agencies must use their authority to conserve listed species. 16 U.S.C. § 1536(a)(1). They must make sure, in consultation with USFWS, that their actions do not jeopardize the continued existence of listed species or destroy or harm habitat that has been designated as critical for such species. 16 U.S.C. § 1536(a)(2). This requirement applies whenever a private or public entity undertakes an action that is "authorized, funded, or carried out," wholly or in part by a federal agency. *Id.* As part of the consultation process, federal agencies must usually prepare a biological assessment to identify endangered or threatened species and determine the likely effect of the federal action on those species and their critical habitat. 16 U.S.C. § 1536(c). At the end of the consultation process, the USFWS prepares a biological opinion stating whether the proposed action will jeopardize the species or destroy or adversely modify its critical habitat. 16 U.S.C. § 1536(c)(4). USFWS may also recommend reasonable alternatives that do not jeopardize the species. *Id.*

The species in the planning region that are subject to protection under the ESA are as follows:

- Jemez Mountains salamander (endangered)
- Yellow-billed cuckoo (threatened)
- Mexican spotted owl (threatened; implementation of final recovery plan)
- Least tern (endangered; implementation of final recovery plan)
- Southwestern willow flycatcher (endangered; implementation of final recovery plan)

- Canada lynx (threatened)
- New Mexico meadow jumping mouse (endangered)

Of the threatened and endangered species found in the Rio Chama region, the protection and recovery of the yellow-billed cuckoo, southwestern willow flycatcher, Jemez Mountains salamander, and New Mexico meadow jumping mouse are most likely to affect water planning within the region because all rely on riparian habitat. In particular, any actions that are likely to harm the habitat used by this species will be subject to strict review and possible limitation.

4.2.1.2 New Mexico Wildlife Conservation Act

The New Mexico Wildlife Conservation Act, enacted in 1974, provides for the listing and protection of threatened and endangered wildlife species in the State. NMSA 1978, §§ 17-2-37 to 17-2-46. In enacting the law, the Legislature found that indigenous New Mexico species that are threatened or endangered "should be managed to maintain and, to the extent possible, enhance their numbers within the carrying capacity of the habitat." NMSA 1978, § 17-2-39(A).

The Act authorizes the New Mexico Department of Game and Fish to conduct investigations of indigenous New Mexico wildlife species suspected of being threatened or endangered to determine if they should be listed. NMSA 1978, § 17-2-40(A). Based on the investigation, the director then makes listing recommendations to the Game and Fish Commission. *Id.* The Act authorizes the Commission to issue regulations listing wildlife species as threatened or endangered based on the investigation and recommendations of the Department. NMSA 1978, § 17-2-41(A). Once a species is listed, the Department of Game and Fish, "to the extent practicable," is to develop a recovery plan for that species. NMSA 1978, § 17-2-40.1. The Act makes it illegal to "take, possess, transport, export, process, sell or offer for sale[,] or ship" any listed endangered wildlife species. NMSA 1978, § 17-2-41(C). However, enforcement of this provision of the Act is very limited.

Pursuant to the Act, the Commission has listed over 100 wildlife species—mammals, birds, fish, reptiles, amphibians, crustaceans, and mollusks—as endangered or threatened. 19.33.6.8 NMAC. As of August 2014, 62 species were listed as threatened, and 56 species were listed as endangered. *Id.* In the Rio Chama planning region, all of the federally listed species discussed above are also protected under the Act.

4.2.2 Water Quality Laws

4.2.2.1 Clean Water Act

The most significant federal law addressing water quality is the Clean Water Act (CWA), 33 U.S.C. §§ 1251 to 1387, which Congress enacted in its modern form in 1972, overriding President Nixon's veto. The stated objective of the CWA is to "restore and maintain the chemical, physical and biological integrity" of the waters of the United States. 33 U.S.C. § 1251(a).

4.2.2.1.1 NPDES Permit Program (Section 402)

The CWA makes it unlawful for any person to discharge any pollutant into waters of the United States without a permit. 33 U.S.C. § 1311(a). Generally, a "water of the United States" is a navigable water, a tributary to a navigable water, or an adjacent wetland, although the scope of the term has been the subject of considerable controversy as described below.

The heart of the CWA regulatory regime is the National Pollutant Discharge Elimination System (NPDES) permitting program under Section 402 of the Act. Any person—including a corporation, partnership, state, municipality, or other entity—that discharges a pollutant into waters of the United States from a point source must obtain an NPDES permit from EPA or a delegated state. 33 U.S.C. § 1342. A point source is defined as "any discernible, confined, and discrete conveyance," such as a pipe, ditch, or conduit. 33 U.S.C. § 1362(14). NPDES permits include conditions setting effluent limitations based on available technology and, if needed, effluent limitations based on water quality.

The CWA provides that each NPDES permit issued for a point source must impose effluent limitations based on application of the best practicable, and in some cases the best available, pollution control technology. 33 U.S.C. § 1311(b). The Act also requires more stringent effluent limitations for newly constructed point sources, called new source performance standards. 33 U.S.C. § 1316(b). EPA has promulgated technology-based effluent limitations for dozens of categories of new and existing industrial point source dischargers. 40 C.F.R. pts. 405-471. These regulations set limits on the amount of specific pollutants that a permittee may discharge from a point source.

The CWA requires the states to develop water quality standards for individual segments of surface waters. 33 U.S.C. § 1313. Water quality standards have three components. First, states must specify designated uses for each body of water, such as public recreation, wildlife habitat, water supply, fish propagation, or agriculture. 40 C.F.R. § 131.10. Second, they must establish water quality criteria for each body of water, which set a limit on the level of various pollutants that may be present without impairing the designated use of the water body. *Id.* § 131.11. And third, states must adopt an antidegradation policy designed to prevent the water body from becoming impaired such that it cannot sustain its designated use. *Id.* § 131.12.

Surface water segments that do not meet the water quality criteria for the designated uses must be listed as "impaired waters." 33 U.S.C. § 1313(d)(l)(C). For each impaired water segment, states must establish "total maximum daily loads" (TMDLs) for those pollutants causing the water to be impaired, allowing a margin of safety. 33 U.S.C. § 1313(d)(1). The states must submit to EPA for approval the list of impaired waters and associated TMDLs. 33 U.S.C. § 1313(d)(2). The TMDL process, in effect, establishes a basin-wide budget for pollutant influx to a surface water. The states must then develop a continuing planning process to attain the standards, including effluent limitations for individual point sources. 33 U.S.C. § 1313(e).

New Mexico has taken steps to implement these CWA requirements. As discussed in Section 4.2.2.3, the New Mexico Water Quality Control Commission has adopted water quality standards for surface waters. The standards include designated uses for specific bodies of water, water quality criteria, and an antidegradation policy. 20.6.4 NMAC. The New Mexico Environment Department (NMED) has prepared a report listing impaired surface waters throughout the state. *State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report – 2014-2016* (Nov. 18, 2014). In the Rio Chama planning region, numerous segments of the Rio Chama and Upper Rio Grande are on the impaired list.

EPA can delegate the administration of the NPDES program to individual states. 33 U.S.C. § 1251(b). New Mexico is one of only a handful of states that has neither sought nor received delegation to administer the NPDES permit program. Accordingly, EPA administers the NPDES program in New Mexico.

4.2.2.1.2 Dredge and Fill Permit Program (Section 404)

The CWA establishes a second important permitting program under Section 404, regulating discharges of "dredged or fill material" into waters of the United States. 33 U.S.C. § 1344. Although the permit requirement applies to discharges of such material into all waters of the United States, most permits are issued for the filling of wetlands. The program is administered primarily by the Army Corps of Engineers, although EPA has the authority to veto permits and it shares enforcement authority with the Corps.

Like the Section 402 NPDES permit program, the CWA allows the Section 404 permit program to be delegated to states. 33 U.S.C. § 1344(g). Again, New Mexico has not received such delegation, and the program is implemented in New Mexico by the Corps and EPA.

4.2.2.1.3 Waters of the United States

The term "waters of the United States" delineates the scope of CWA jurisdiction, both for the Section 402 NPDES permit program, and for the Section 404 dredge and fill permit program. The term is not defined in the CWA, but is derived from the definition of "navigable waters," which means "waters of the United States including the territorial seas." 33 U.S.C. § 1362(7). In 1979, EPA promulgated regulations defining the term "waters of the United States." *See* 40 C.F.R. § 230.3(s) (2014) (between 1979 and 2014, the term remained substantially the same). This definition, interpreted and implemented by both EPA and the Corps, remained settled for many years.

In 2001, however, the Supreme Court began to cast doubt on the validity of the definition as interpreted by EPA and the Corps. The Court took up a case in which the Corps had asserted CWA jurisdiction over an isolated wetland used by migratory birds, applying the Migratory Bird Rule. The Court ruled that the Corps had no jurisdiction under the CWA, emphasizing that the CWA refers to "navigable waters," and that the isolated wetland had no nexus to any navigable-

in-fact water. *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers,* 531 U.S.159 (2001).

The Court muddied the waters further in its 2006 decision in *Rapanos v. United States,* 547 U.S. 715 (2006) (consolidated with *Carabell v. U.S. Army Corps of Engineers*). Both these cases challenged the Corps' assertion of CWA jurisdiction over wetlands separated from traditional navigable waters by a man-made ditch. In a fractured 4-1-4 decision, the Court ruled that the Corps did not have CWA authority to regulate these wetlands. The plurality opinion, authored by Justice Scalia, held that CWA jurisdiction extends only to relatively permanent standing or flowing bodies of water that constitute rivers, streams, oceans, and lakes. *Id.* at 739. Nevertheless, jurisdiction extends to streams or lakes that occasionally dry up, and to streams that flow only seasonally. *Id.* at 732, n.3. And jurisdiction extends to wetlands with a continuous surface connection to such water bodies. *Id.* at 742. The concurring opinion, written by Justice Kennedy, stated that CWA jurisdiction extends to waters having a "significant nexus" to a navigable water, but the Corps had failed to show such nexus in either case. *Id.* at 779-80. In dissent, Justice Stevens would have found CWA jurisdiction in both cases. *Id.* at 787.

There has been considerable confusion over the proper application of these opinions. Based on this confusion, EPA and the Corps recently amended the regulatory definition of "waters of the United States" to conform to the *Northern Cook County* and *Rapanos* decisions. Final Rule, 80 Fed. Reg. 37054 (June 29, 2015) codified at 33 C.F.R. pt 328; 40 C.F.R. pts 110, 112, 116, 117, 122, 230, 232, 300, 302, and 401. The new definition covers (1) waters used for interstate or foreign commerce, (2) interstate waters, (3) the territorial seas, (4) impounded waters otherwise meeting the definition, (5) tributaries of the foregoing waters, (6) waters, including wetlands, adjacent to the foregoing waters, (7) certain specified wetlands having a significant nexus to the foregoing waters, and (8) waters in the 100-year floodplain of the foregoing waters. 40 C.F.R. § 302.3.

Several states and industry groups have challenged the new definition in federal district courts and courts of appeal. In one such challenge, the district court granted a preliminary injunction temporarily staying the rule. *North Dakota v. EPA*, 127 F. Supp. 3d 1047 (D.N.D. 2015). Because the NMED and the NMOSE are plaintiffs in this case, the stay is effective—and the new definition does not now apply—in New Mexico. The United States has filed a motion asking the district court to dissolve the injunction and dismiss the case. This case is likely to be appealed.

4.2.2.2 Federal Safe Drinking Water Act

Enacted in 1974, the Safe Drinking Water Act (SDWA) regulates the provision of drinking water in the United States. 42 U.S.C. §§ 300f to 300j-26. The act's overriding purpose is "to insure the quality of publicly supplied water." *Arco Oil & Gas Co. v. EPA*, 14 F.3d 1431, 1436 (10th Cir. 1993). The SDWA requires EPA to promulgate national primary drinking water standards for

protection of public health and national secondary drinking water standards for protection of public welfare. 42 U.S.C. § 300g-1. To provide this protection, the SDWA requires EPA, as part of the national primary drinking water regulations, to establish maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for drinking water contaminants. 42 U.S.C. § 300g-1(b)(1). The regulations apply to all "public water systems." 42 U.S.C. § 300g.

EPA has promulgated primary and secondary drinking water regulations. 40 C.F.R. pts. 141, 143. Most significantly, the agency has set MCLGs and MCLs for a number of drinking water contaminants, including 16 inorganic chemicals, 53 organic chemicals, turbidity, 6 microorganisms, 7 disinfectants and disinfection byproducts, and 4 radionuclides. *Id*.§§ 141.11, 141.13, 141.61-66. As noted above, New Mexico has incorporated these primary and secondary regulations into the State regulations. 20.7.10.100 NMAC, 20.7.10.101 NMAC.

4.2.2.3 Federal Comprehensive Environmental Response, Compensation, and Liability Act

Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or the "Superfund" law, in 1980 to address the burgeoning problem of uncontrolled hazardous waste sites. 42 U.S.C. §§ 9601 to 9675. CERCLA authorizes EPA to prioritize hazardous waste sites according to the degree of threat they pose to human health and the environment, including surface water and groundwater. EPA places the most serious sites on the National Priorities List (NPL). 42 U.S.C. § 9605. Sites on the NPL are eligible for federal funds for long-term remediation, which most often includes groundwater remediation.

4.2.2.4 New Mexico Water Quality Act

The most important New Mexico law addressing water quality is the New Mexico Water Quality Act (WQA), NMSA 1978, §§ 74-6-1 to 74-6-17. The New Mexico Legislature enacted the WQA in 1967. The purpose of the WQA is "to abate and prevent water pollution." *Bokum Res. Corp. v. N.M. Water Quality Control Comm'n*, 93 N.M. 546, 555, 603 P.2d 285, 294 (1979).

The WQA created the Water Quality Control Commission to implement many of its provisions. NMSA 1978, § 74-6-3. The WQA authorizes the Commission to adopt state water quality standards for surface and groundwaters and to adopt regulations to prevent or abate water pollution. NMSA 1978, § 74-6-4(C) and (D). The WQA also authorizes the Commission to adopt regulations requiring persons to obtain from the NMED a permit for the discharge into groundwater of any water contaminant. NMSA 1978, § 74-6-5(A). The Department must deny a discharge permit if the discharge would cause or contribute to contaminant levels in excess of water quality standards "at any place of withdrawal of water for present or reasonably foreseeable future use." NMSA 1978, § 74-6-5(E)(3). The WQA also authorizes the Commission to adopt regulations relating to monitoring and sampling, record keeping, and Department notification regarding the permit. NMSA 1978, § 74-6-5(I). Permit terms are generally limited to five years. NMSA 1978, § 74-6-5(H).

Accordingly, the Commission has adopted groundwater quality standards, regulations requiring discharge permits, and regulations requiring abatement of groundwater contamination. 20.6.2 NMAC. The water quality standards for groundwater are published at Sections 20.6.2.3100 through 3114 NMAC, and the regulations for discharge permits are published at Sections 20.6.2.3100 through 3114 NMAC, and the regulations for discharge permits are published at Sections 20.6.2.3101 to 3114 NMAC.

An important part of these regulations are those addressing abatement. 20.6.2.4101 - .4115 NMAC. The purpose of the abatement regulations is to "[a]bate pollution of subsurface water so that all groundwater of the State of New Mexico which has a background concentration of 10,000 milligrams per liter or less total dissolved solids is either remediated or protected for use as domestic or agricultural water supply." 20.6.2.4101.A(1) NMAC. The regulations require that groundwater pollution must be abated to conform to the water quality standards. 20.6.2.4103.B NMAC. Abatement must be conducted pursuant to an abatement plan approved by the Department, 20.6.2.4104.A NMAC, or pursuant to a discharge permit, 20.6.2.3109.E NMAC.

In addition, the Commission has adopted standards for surface water. 20.6.1 NMAC. The objective of these standards, consistent with the federal Clean Water Act (Section 4.2.2.1) is "to establish water quality standards that consist of the designated use or uses of surface waters of the [S]tate, the water quality criteria necessary to protect the use or uses[,] and an antidegradation policy." 20.6.4.6.A NMAC. The standards include designated uses for specific bodies of water within the State, 20.6.4.50 to 20.6.4.806 NMAC; general water quality criteria, 20.6.4.13 NMAC; water quality criteria for specific designated uses, 20.6.4.900 NMAC; and water quality criteria for specific bodies of water, 20.6.4.50 to 20.6.4.806 NMAC. The standards also include an antidegradation policy, applicable to all surface waters of the State, to protect and maintain water quality. 20.6.4.8 NMAC. The antidegradation policy sets three levels of protection, closely matched to the federal regulations.

Lastly, the Commission has also adopted regulations limiting the discharge of pollutants into surface waters. 20.6.2.2100 to 2202 NMAC.

4.2.2.5 New Mexico Drinking Water Standards

The New Mexico Environmental Improvement Act created an Environmental Improvement Board, and it authorizes the Board to promulgate rules and standards for water supply. NMSA 1978, § 74-1-8(A)(2). The Board has accordingly adopted State drinking water standards for all public water systems. 20.7.10 NMAC. The State regulations incorporate by reference the federal primary and secondary drinking water standards, 40 C.F.R. parts 141 and 143, established by the EPA under the Safe Drinking Water Act (Section 4.2.2.2). 20.7.10.100 NMAC, 20.7.10.101 NMAC.

4.2.2.6 Tribal Law

Santa Clara Pueblo has adopted water quality standards under the federal Clean Water Act. As part of its water quality standards, Santa Clara Pueblo enforces controls on the discharge of pollutants to tribal waters, with assistance from the EPA.

4.3 Legal Issues Unique to the Region and Local Conflicts Needing Resolution

Legal issues unique to the Rio Chama region include potential changes in upper Rio Grande water operations due to the effects of climate change that may decrease the water supply to the San Juan-Chama Project. Another issue is the increased storage capacity in Abiquiu Reservoir for the Albuquerque Bernalillo County Water Utility Authority as an outcome of litigation brought by the Authority to increase its reservoir storage. Also, as noted above, the continued implementation of the Jicarilla Water Rights Settlement, as well as the claims of the Santa Clara Pueblo in the Santa Cruz/Truchas adjudication, will affect water users in the region.

Other key issues including conflicts in the region identified by the region are summarized in Section 5.

5. Water Supply

This section provides an overview of the water supply in the Rio Chama Water Planning Region, including climate conditions (Section 5.1), surface water and groundwater resources (Sections 5.2 and 5.3), water quality (Section 5.4) and the administrative water supply used for planning purposes in this regional water plan update (Section 5.5). Additional quantitative assessment of water supplies is included in Section 7, Identified Gaps between Supply and Demand.

The Handbook specifies that each of the 16 regional water plans briefly summarize water supply information from the previously accepted plan and provide key new or revised information that has become available since submittal of the accepted regional water plan. The information in this section regarding surface and groundwater supply and water quality is thus drawn largely from the accepted *Rio Chama Regional Water Plan* (RCAA and Rio Arriba County, 2006) and where appropriate, updated with more recent information and data from a number of sources, as referenced throughout this section.

Currently some of the key water supply updates and issues impacting the Rio Chama region are:

- Because the region relies heavily on surface water, drought is a major concern. The climate division that covers almost the entire planning region was in severe to extreme drought in 2011, 2012, and 2013 (NCDC, 2014), and the winter snowpack for 2014 was also very low.

- The preservation of traditional communities, agriculture, and the historical acequia system continues to be a key issue for Rio Chama water planning. As stated in the original plan, acequia irrigation made possible a cherished way of life in the Chama valley and provides the framework for community government as well as water delivery in northern New Mexico (RCAA and Rio Arriba County, 2006). Funding for repair and maintenance of acequia infrastructure is an ongoing issue. Protecting water rights and promoting agriculture in the lower Rio Chama basin is the focus of the Rio de Chama Acequias Association (RCAA), which represents acequias with water right priority dates as early as 1600.

- In response to recent drought conditions, RCAA and the Asociación de Acéquia Norteñas de Rio Arriba have worked with the NMOSE, with technical assistance from the NMISC, on securing alternative water supplies when available and, when those are exhausted, implementing voluntary shortage sharing programs, including rotations and voluntary curtailment (NMISC, 2013a). With much of the water in the basin during drought years destined for downstream San Juan-Chama contractors, the implementation of a shortage sharing system to efficiently manage the limited supplies available to local acequias is a key issue.

- Water planning is a priority for Rio Arriba County, which is actively developing a water rights inventory and database and is investigating development of a water bank that could be used to support agriculture and other economic development in the County and facilitate shortage sharing during drought. In 2016 the County completed an update of its Comprehensive Plan, which includes additional supply and demand information.

- In 2003 the New Mexico Legislature directed the NMOSE to adopt rules to promote expedited leasing and marketing of water in those areas subject to priority administration. The State Engineer created the Active Water Resource Management (AWRM) program to comply with the legislative mandate. The entire Rio Chama watershed in New Mexico, which extends from the state line to the confluence of the Rio Grande just above Española and encompasses 3,000 square miles (NMISC, 2013a), has been designated as a priority basin for AWRM. In recent years, administrative efforts by the NMOSE have focused on voluntary shortage sharing to protect local water rights and the local economy from more serious impacts of the prolonged drought (NMISC, 2013a). The lower Rio Chama acequias and the upper Rio Chama acequias have had various shortage sharing agreements over the years that cut each ditch's flow when water levels drop below a certain threshold. Additional metering is also being provided by the NMOSE to help better manage flows, and RCAA is interested in continuing to improve metering to all acequias so that better decisions can be made and better shortage sharing agreements implemented.

- Due to the large amount of forested land in the region, coupled with the recent drought conditions, the threat of wildfire and subsequent sedimentation impacts on streams and reservoirs remains a key planning issue. Continued and expanded efforts to reduce catastrophic fire risk through forest management, as well as additional information on the quantitative benefits of various management techniques, are needed. In particular, quantification of the effectiveness of riparian vegetation removal, upland conifer thinning, and other water salvage methods needs further study to support well-informed decisions.

- The Nature Conservancy is working to develop the Rio Grande Water Fund, which if funded, will generate sustainable income for a 10- to 30-year forest restoration program through a multi-party effort. Models of debris flow risk after high-severity fire indicate that key water sources are at risk, and the goal of the program is to reduce the risk of catastrophic wildfire and subsequent sedimentation and localized water quality degradation to protect the region's water supply. Details of the program plan are included in the *Rio Grande Fund, Comprehensive Plan for Wildfire and Water Source Protection* (Nature Conservancy, 2015).

- The stretch of the Rio Chama between El Vado Reservoir and Abiquiu Reservoir is designated as a Wild and Scenic River, intended to protect its free-flowing nature. There are only two very minor permitted diversions in this stretch (which predate the Wild and Scenic River designation), and a group of local stakeholders has spearheaded the Rio Chama Flow Optimization Project, which aims to improve management through this stretch for environmental, recreational, and acequia benefits. The Bureau of Reclamation and the U.S. Army Corps of Engineers coordinate their water management efforts in this stretch for the same purposes.

- There has been concern expressed by some residents in the region about the potential for hydraulic fracturing for oil and gas extraction to contaminate local water resources due to improperly managed surface or casing operations, or from direct contamination. A proposed oil lease by the Bureau of Land Management (BLM) northwest of Española is a particular concern. Protecting the water quality of this source watershed is important to the region.

- There are 23 small rural drinking water systems within the region. These small systems face challenges in financing infrastructure maintenance and upgrades and complying with water quality monitoring and training standards. Though the source water for these systems is generally good quality groundwater (except for the Village of Chama and two state parks that use surface water), the maintenance, upgrades, training, operation, and monitoring that is required to ensure delivery of water that meets drinking water quality standards is a financial and logistical challenge for these small systems.

- The Village of Chama has historically had problems with bacteria and other organisms in its surface water supply due to inadequate treatment capacity. A treatment system added in 1997 improved the situation but has reached its capacity. The Village is currently working on adding another 300,000-gallon storage tank and increasing capacity to treat an additional 300 gallons per minute to provide adequate treated water to the Village. The Village is also working on improved wastewater treatment capacity for its discharge into the Rio Chamita.

- The 2006 water plan identified nitrate and other potential contamination of shallow groundwater and domestic wells due to septic tanks as a potential water quality concern, and a goal identified in the original plan was to encourage community wastewater treatment systems. This issue is still of concern, as many areas in the region have no access to wastewater treatment infrastructure and continue to be served by domestic wells and septic tanks.

- The Federal Emergency Management Administration released new floodplain maps of Rio Arriba County in 2012 (FEMA, 2012). The new maps define hazard areas and indicated flood insurance rate boundaries. Continued efforts to update floodplain maps and prepare for and mitigate flood damage are important to the region. Rio Arriba County has three certified floodplain managers and regulates all new development, including changes to historic structures, to comply with flood preparation standards.

5.1 Summary of Climate Conditions

The accepted regional water plan (RCAA and Rio Arriba County, 2006) included an analysis of historical temperature and precipitation in the region. This section provides an updated summary of temperature, precipitation, snowpack conditions, and drought indices pertinent to the region (Section 5.1.1). Studies relevant to climate change and its potential impacts to water resources in New Mexico and the Rio Chama region are discussed in Section 5.1.2.

5.1.1 Temperature, Precipitation, and Drought Indices

Table 5-1 lists the periods of record for weather stations in the Rio Chama planning region and identifies two stations (Abiquiu Dam and Chama) that were used for analysis of weather trends. These two stations were selected based on location and completeness of their historical records. In addition to the climate stations, data were available from eight snow course or snowpack telemetry (SNOTEL) stations and were used to document snowfall in the Sangre de Cristo Mountains (Table 5-1). The locations of the climate stations for which additional data were analyzed are shown in Figure 5-1.

Table 5-1. Rio Chama Climate Stations

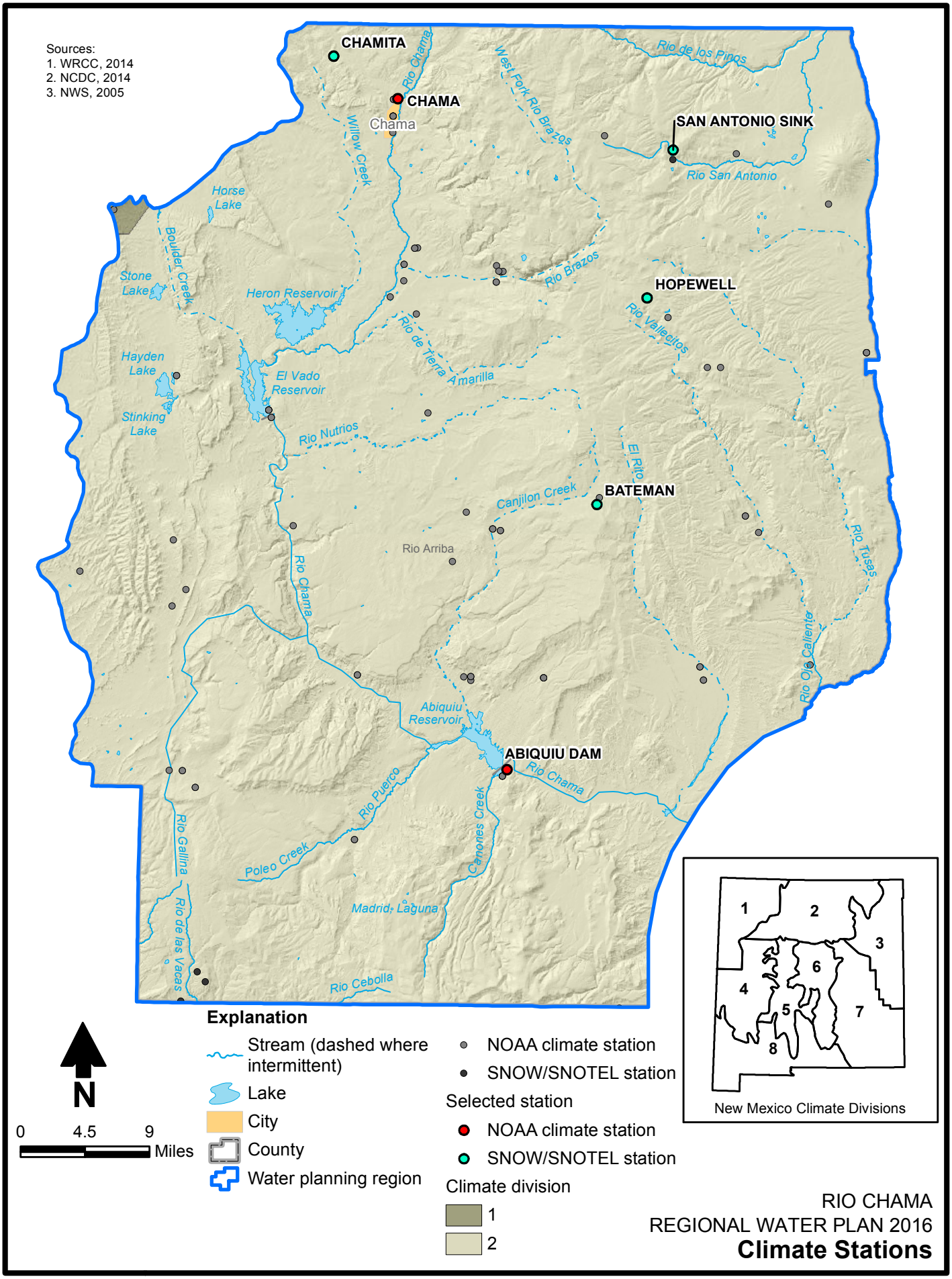
Climate Stations [a]	Latitude	Longitude	Elevation	Precipitation		Temperature	
				Data Start	Data End	Data Start	Data End
Rio Arriba County							
Abiquiu Dam	36.24	–106.43	6,380	6/1/1957	Present	6/1/1957	Present
Aspen Grove Ranch	36.65	–106.17	9,508	7/1/1909	12/31/1948	—	—
Bateman Ranch	36.52	–106.32	8,907	9/1/1909	2/28/1970	—	—
Brazos Lodge	36.74	–106.45	8,005	3/1/1970	1/31/2008	3/1/1970	1/31/2008
Canjilon Ranger Stn	36.48	–106.44	7,828	9/1/1938	Present	—	—
Capulin Ranger Stn	36.23	–106.83	7,300	3/1/1916	9/30/1930	—	—
Chama	36.92	–106.58	7,850	4/1/1893	Present	1/1/1893	Present
El Rito	36.35	–106.19	6,870	10/1/1927	Present	2/1/1962	Present
El Vado Dam	36.59	–106.73	6,740	2/1/1906	Present	2/1/1906	Present
Gavilan	36.43	–106.97	7,425	7/1/1929	1/31/1970	7/1/1929	1/31/1970
Ghost Ranch	36.33	–106.47	6,500	1/1/1942	Present	1/1/1979	2/28/1978
San Antone Ranger Stn	36.87	–106.15	8,900	2/1/1917	9/30/1928	—	—
Skarda	36.82	–106.03	8,507	7/1/1942	12/31/1983	—	—
Tierra Amarilla 4 N	36.77	–106.55	7,464	9/1/1927	6/30/2011	10/1/1927	12/31/2011
Tres Piedras	36.67	–105.98	8,139	4/1/1905	2/28/2011	4/1/1905	2/28/2011
SNOTEL Stations							
Chamita - SNTL	36.96	–106.66	8,400	11/4/1978	Present	NR	NR
San Antonio Sink - Snow	36.87	–106.23	9,200	1969	Present	NR	NR
San Antonio Sink - SNTL	36.86	–106.23	9,100	7/14/2011	Present	NR	NR
Hopewell - SNTL	36.72	–106.26	10,000	10/1/1978	Present	NR	NR
Bateman - SNTL	36.51	–106.32	9,300	10/1/1978	Present	NR	NR
Vacas Locas - Snow	36.02	–106.80	9,306	1996	Present	NR	NR
Vacas Locas - SNTL	36.03	–106.81	9,306	11/8/2001	Present	NR	NR
Senorita Divide #2 - SNTL	36.00	–106.83	8,600	6/5/1980	Present	NR	NR

Source: WRCC, 2014

[a] Stations in **bold** type were selected for detailed analysis.

— = Information not available

NR = Temperature is not recorded at SNOTEL stations.



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RIO CHAMA
REGIONAL WATER PLAN 2016
Climate Stations

Figure 5-1

Long-term minimum, maximum, and average temperatures for the Abiquiu Dam and Chama climate stations are detailed in Table 5-2, and average summer and winter temperatures for each year of record are shown on Figure 5-2.

The average precipitation distribution across the entire region is shown on Figure 5-3, and Table 5-2 lists the minimum, maximum, and long-term average annual precipitation (rainfall and snowmelt) at the Abiquiu Dam and Chama stations. The long-term averages do not reflect the considerable variability of precipitation, which creates a direct challenge for water supply planning. The variability in total annual precipitation for the two selected climate stations is shown in Figure 5-4 and is also reflected in the snow data and drought indices discussed below. In addition to annual variability, monthly variability in precipitation and resulting streamflow also presents a challenge: snowmelt and/or monsoon flows may not occur at times when water is most needed for agriculture or other uses.

The Natural Resources Conservation Service (NRCS) operates six SNOTEL stations in the planning region: Bateman, Chamita, Hopewell, San Antonito Sink, Seniorita Divide, and Vacas. Snow course measurements are also made at the San Antonito Sink and Vacas Locas stations in the planning region (NRCS, 2014a). All six stations provide snow depth and snow water equivalent data.

The snow water equivalent is the amount of water, reported in inches, within the snowpack, or the amount of water that would result if the snowpack were instantly melted (NRCS, 2014b). The end of season snowpack is a good indicator of the runoff that will be available to meet water supply needs. A summary of the early April (generally measured within a week of April 1) snow depth and snow water equivalent information at four of the stations within the region is provided on Figures 5-5a and 5-5b. These figures show that the snowpack and snow water equivalent vary greatly, with early April snow depths ranging from less than 5 to more than 70 inches at the higher elevations.

Another way to review long-term variations in climate conditions is through drought indices. A drought index consists of a ranking system derived from the assimilation of data—including rainfall, snowpack, streamflow, and other water supply indicators—for a given region. The Palmer Drought Severity Index (PDSI) was created by W.C. Palmer (1965) to measure the variations in the moisture supply and is calculated using precipitation and temperature data as well as the available water content of the soil. Because it provides a standard measure that allows comparisons among different locations and months, the index is widely used to assess the weather during any time period relative to historical conditions. The PDSI classifications for dry to wet periods are provided in Table 5-3.

Table 5-2. Temperature and Precipitation for Selected Climate Stations Rio Chama Water Planning Region

Station Name	Precipitation (inches)				Temperature			
					Average (°F)			
	Average Annual [a]	Minimum [b]	Maximum [b]	% of Possible Observations [c]	Annual [d]	Minimum [e]	Maximum [e]	% of Possible Observations [c]
Chama	21.28	8.5	32.34	96.1	42.5	26.1	58.9	70.5
Abiquiu Dam	9.82	4.98	16.58	99.8	51	37.3	64.8	91.5

Source: Statistics computed by Western Regional Climate Center (2014)

ft amsl = Feet above mean sea level

°F = Degrees Fahrenheit

[a] Average of annual precipitation totals for the period of record at each station.

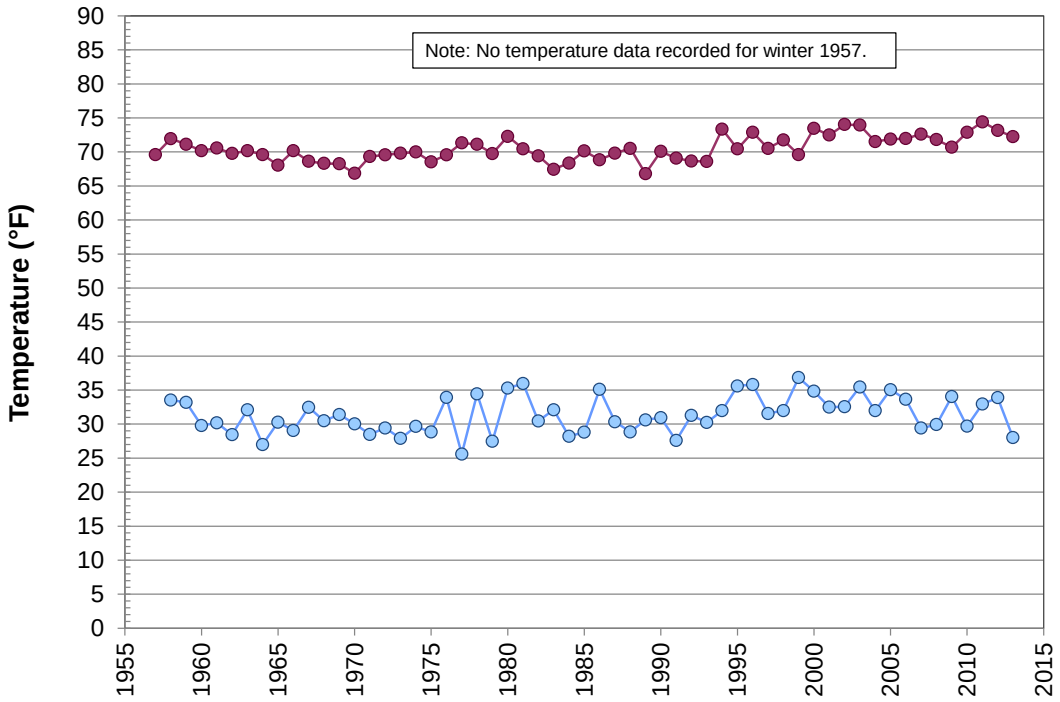
[b] Minimum and maximum recorded annual precipitation amounts for each station.

[c] Amount of completeness in the daily data set that was recorded at each station (e.g., 99% complete means there is a 1% data gap).

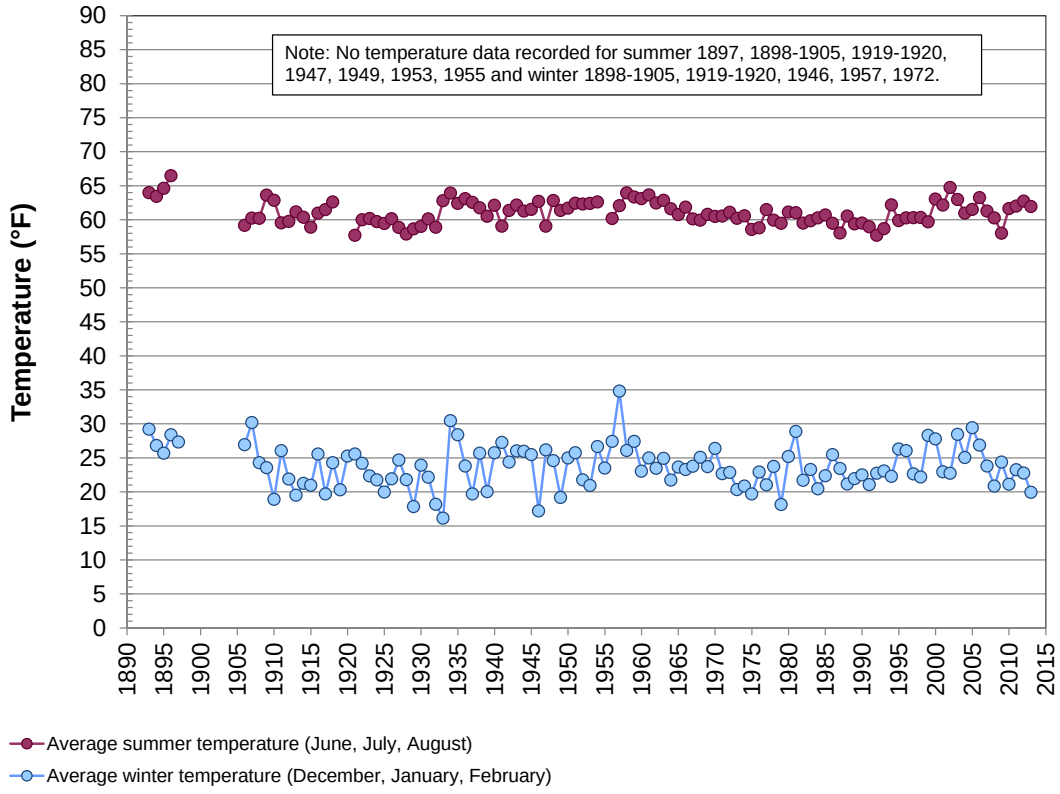
[d] Average of the daily average temperatures calculated for each station.

[e] Average of the daily minimum (or maximum) temperature recorded daily for each station.

Abiquiu Dam



Chama



RIO CHAMA
REGIONAL WATER PLAN UPDATE

Average Temperature
Abiquiu Dam and Chama Climate Stations

Figure 5-2

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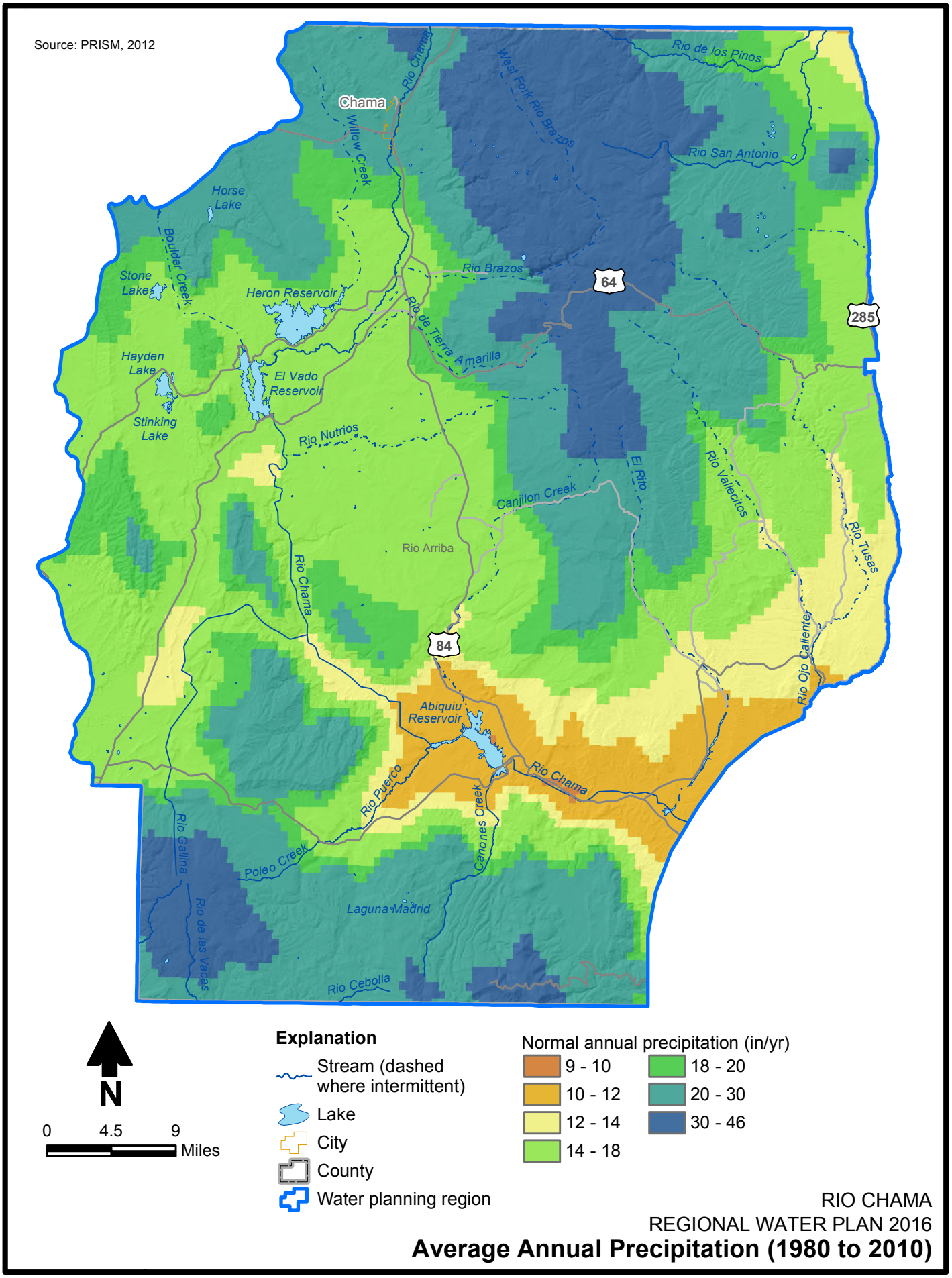

RIO CHAMA
REGIONAL WATER PLAN 2016

Average Annual Precipitation (1980 to 2010)

Figure 5-3

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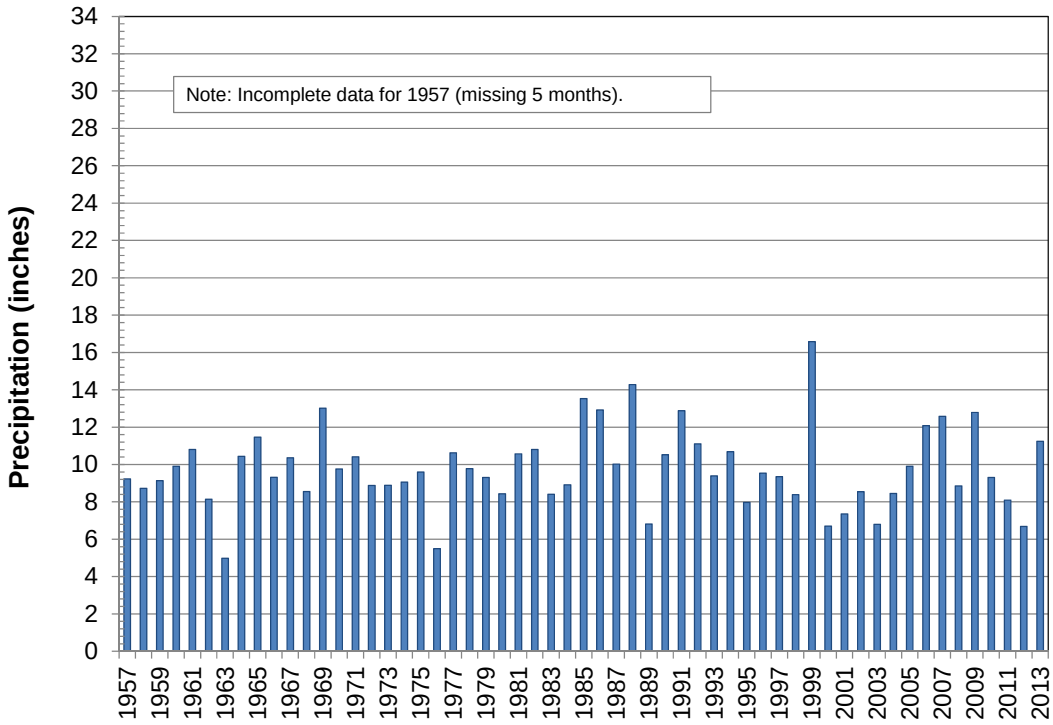
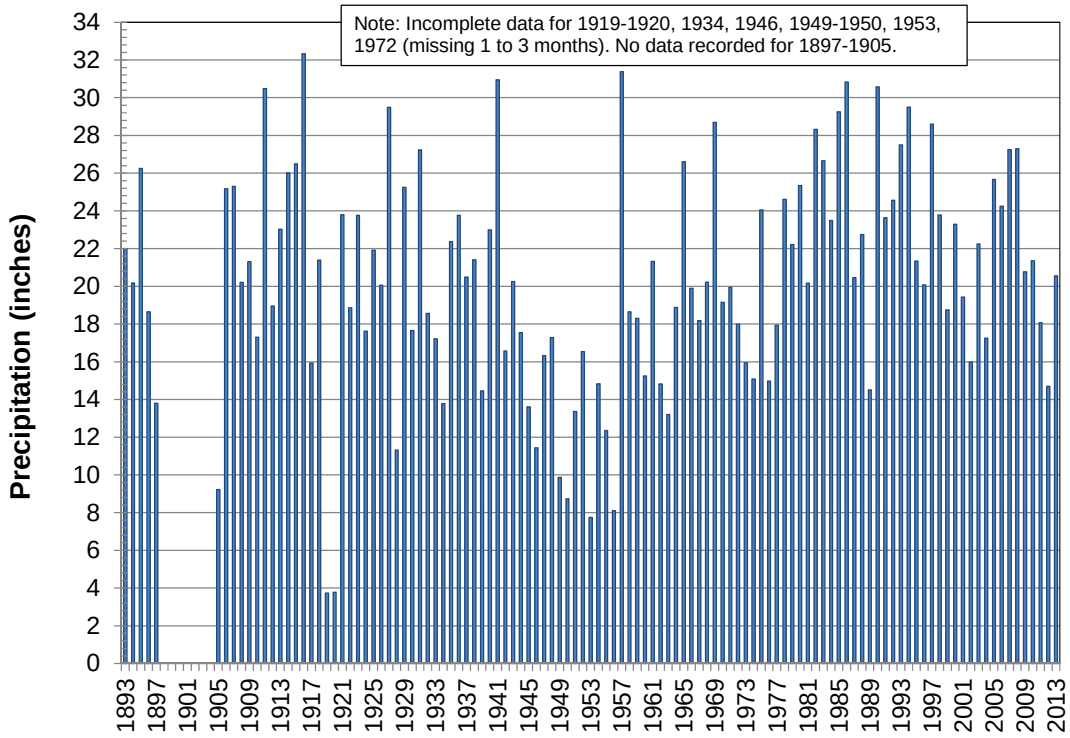
Abiquiu Dam



Chama



RIO CHAMA
REGIONAL WATER PLAN UPDATE

Annual Precipitation
Abiquiu Dam and Chama Climate Stations

Figure 5-4

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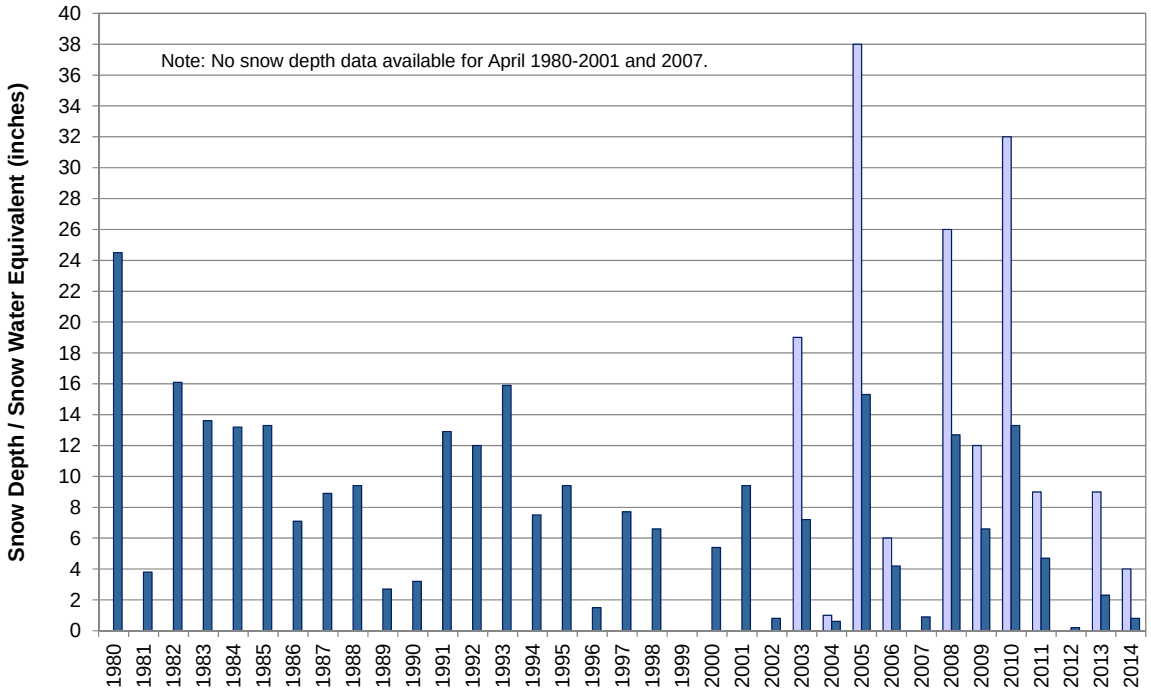
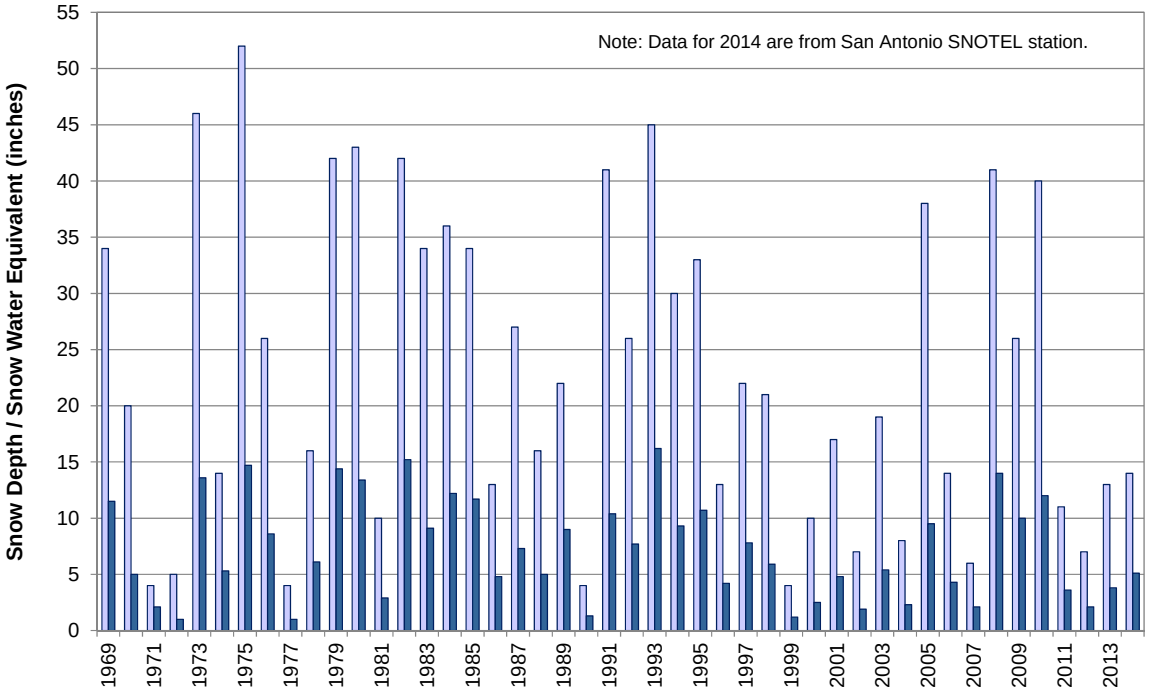
Chamita SNOTEL Station



San Antonio SNOW Course with Aerial Marker



Snow depth

Snow water equivalent (the amount of water that would result if the snowpack were instantly melted)

Notes: 1. Measurements made in the last few days of March or first few days of April.
2. Years with no bars visible are years with zero snow depth (unless otherwise noted).

RIO CHAMA
REGIONAL WATER PLAN UPDATE

Snow Depth and Snow Water Equivalent for April

Figure 5-5a

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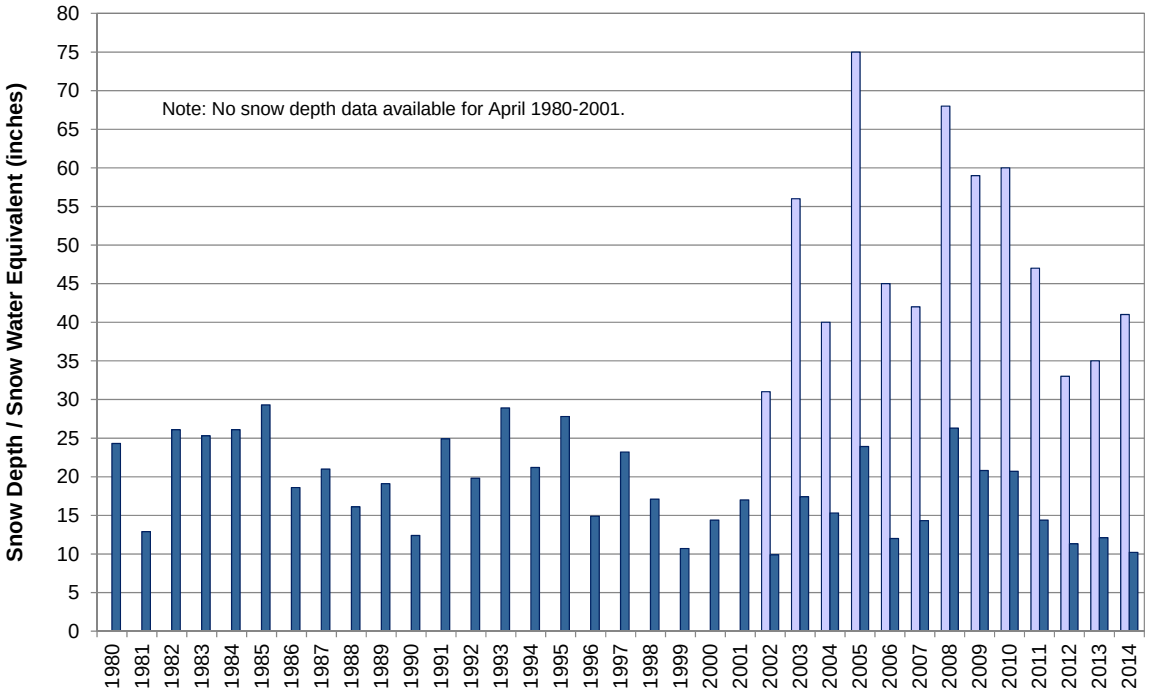
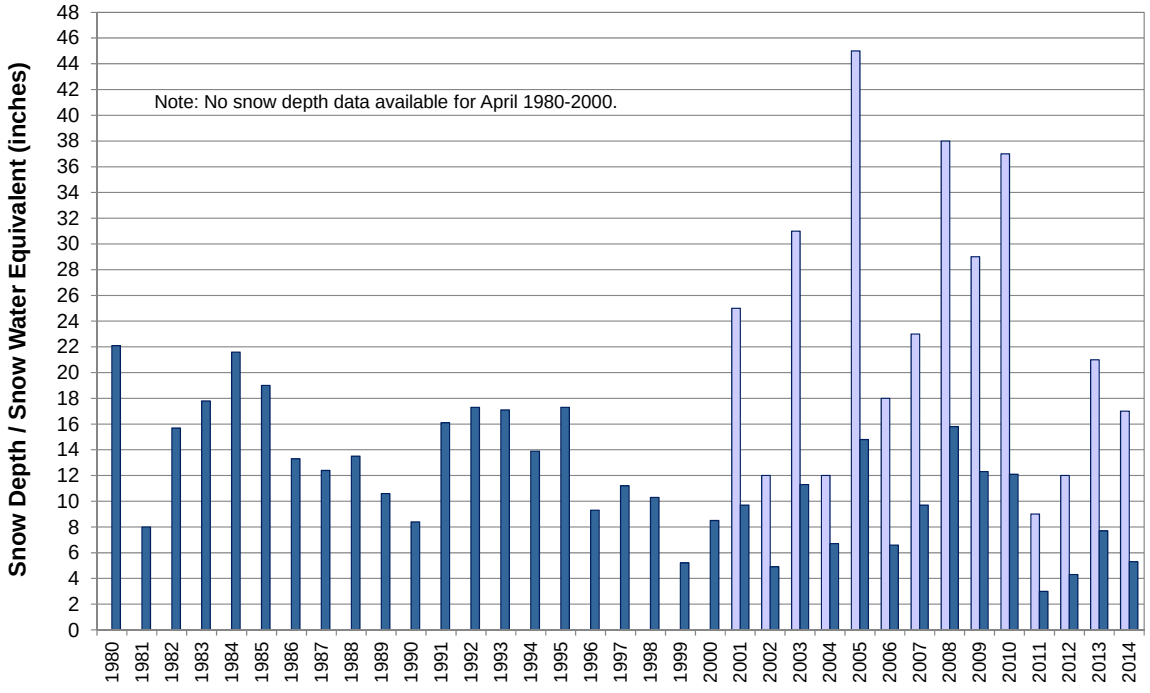
Hopewell SNOTEL



Bateman SNOTEL Station



Snow depth

Snow water equivalent (the amount of water that would result if the snowpack were instantly melted)

Notes: 1. Measurements made in the last few days of March or first few days of April.
2. Years with no bars visible are years with zero snow depth (unless otherwise noted).

RIO CHAMA
REGIONAL WATER PLAN UPDATE

Snow Depth and Snow Water Equivalent for April

Figure 5-5b

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Table 5-3. Palmer Drought Severity Index Classifications

PDSI Classification	Description
+ 4.00 or more	Extremely wet
+3.00 to +3.99	Very wet
+2.00 to +2.99	Moderately wet
+1.00 to +1.99	Slightly wet
+0.50 to +0.99	Incipient wet spell
+0.49 to –0.49	Near normal
–0.50 to –0.99	Incipient dry spell
–1.00 to –1.99	Mild drought
–2.00 to –2.99	Moderate drought
–3.00 to –3.99	Severe drought
–4.00 or less	Extreme drought

There are considerable limitations when using the PDSI, as it may not describe rainfall and runoff that varies from location to location within a climate division and may also lag in indicating emerging droughts by several months. Also, the PDSI does not consider groundwater or reservoir storage, which can affect the availability of water supplies during drought conditions. However, even with its limitations, many states incorporate the PDSI into their drought monitoring systems, and it provides a good indication of long-term relative variations in drought conditions, as PDSI records are available for more than 100 years.

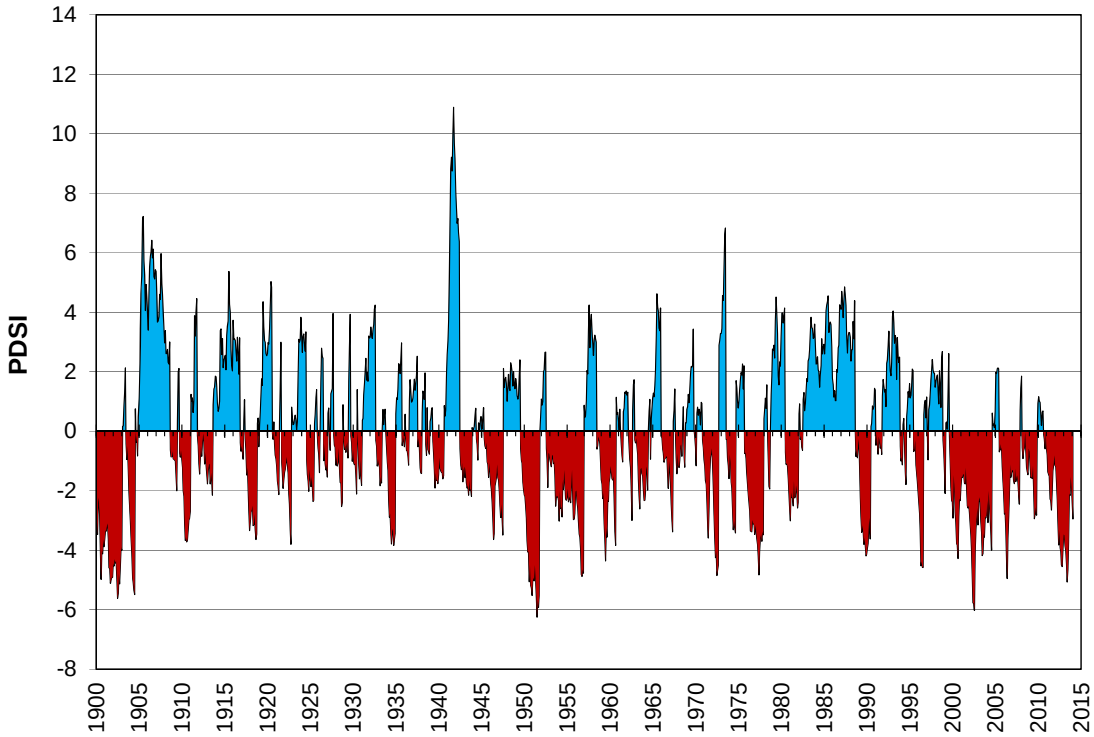
The PDSI is calculated for climate divisions throughout the United States. The Rio Chama region falls almost entirely within New Mexico Climate Division 2 (the Northern Mountains Climate Division) with just a very small portion in the northwest part of the region in Division 1 (Northwestern Plateau) (Figure 5-1). Figure 5-6 shows the long-term PDSI for these two divisions. Of interest are the large variations from year to year in both divisions, which are similar in pattern though not necessarily in magnitude.

The chronological history of drought, as illustrated by the PDSI, indicates that the most severe droughts in the last century occurred in the early 1900s, the 1950s, the early 2000s, and in recent years (2011 to 2013) (Figure 5-6). In 2013, the PDSI in Climate Division 2, which covers almost all of the region, dipped to its lowest index value in almost 50 years (Figure 5-6).

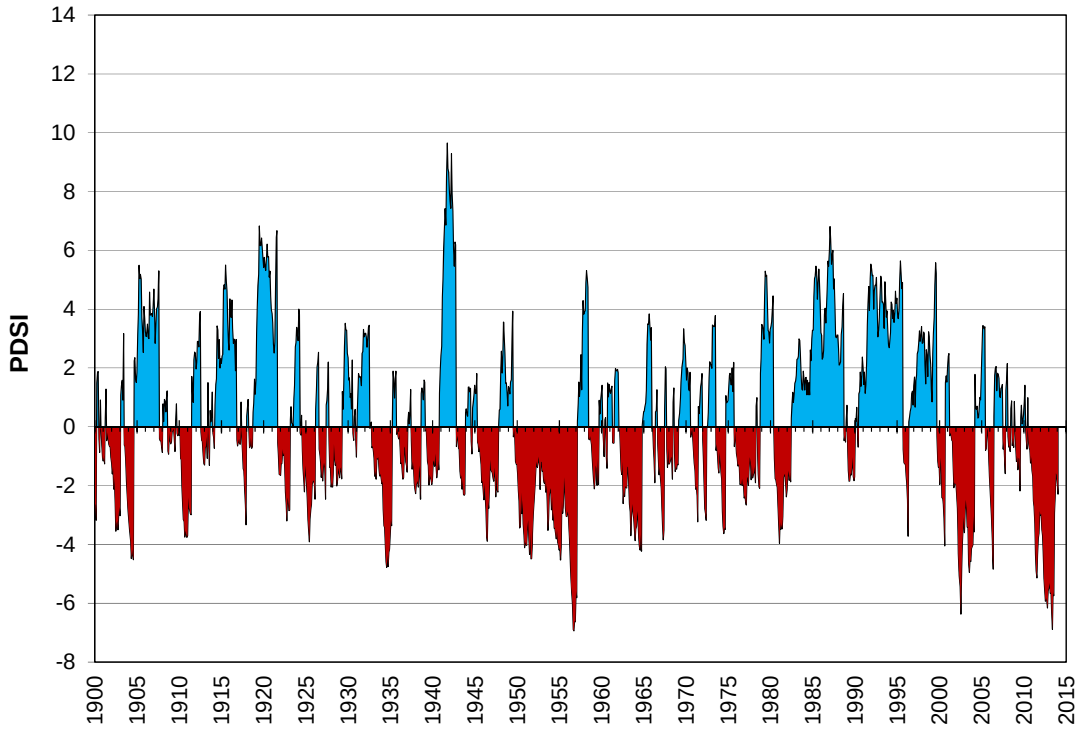
The likelihood of drought conditions developing in New Mexico is influenced by several weather patterns:

- *El Niño/La Niña:* El Niño and La Niña are characterized by a periodic warming and cooling, respectively, of sea surface temperatures across the central and east-central

Climate Division 1



Climate Division 2



Note: Blue indicates wetter than average conditions and red indicates drier than average conditions, as described on Table 5-3.

RIO CHAMA
REGIONAL WATER PLAN UPDATE

Palmer Drought Severity Index
New Mexico Climate Divisions 1 and 2

Figure 5-6

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equatorial Pacific. Years in which El Niño is present are more likely to be wetter than average in New Mexico, and years with La Niña conditions are more likely to be drier than average, particularly during the cool seasons of winter and spring.

- *The Pacific Decadal Oscillation (PDO):* The PDO is a multi-decadal pattern of climate variability caused by shifting sea surface temperatures between the eastern and western Pacific Ocean that cycle approximately every 20 to 30 years. Warm phases of the PDO (shown as positive numbers on the PDO index) correspond to El Niño-like temperature and precipitation anomalies (i.e., wetter than average), while cool phases of the PDO (shown as negative numbers on the PDO index) correspond to La Niña-like climate patterns (drier than average). It is believed that since 1999 the planning region has been in the cool phase of the PDO.

- *The Atlantic Multidecadal Oscillation (AMO):* The AMO refers to variations in surface temperatures of the Atlantic Ocean which, similarly to the PDO, cycle on a multi-decade frequency. The pairing of a cool phase of the PDO with the warm phase of the AMO is typical of drought in the southwestern United States (McCabe et al., 2004; Stewart, 2009). The AMO has been in a warm phase since 1995. It is possible that the AMO may be shifting to a cool phase but the data are not yet conclusive.

- *The North American Monsoon* is characterized by a shift in wind patterns in summer, which occurs as Mexico and the southwest U.S. warm under intense solar heating. As this happens, the flow reverses from dryland areas to moist ocean areas. Low-level moisture is transported into the region primarily from the Gulf of California and eastern Pacific. Upper-level moisture is transported into the region from the Gulf of Mexico by easterly winds aloft. Once the forests of the Sierra Madre Occidental green up from the initial monsoon rains, evaporation and plant transpiration can add additional moisture to the atmosphere that will then flow into the region. If the Southern Plains of the U.S. are unusually wet and green during the early summer months, that area can also serve as a moisture source. This combination causes a distinct rainy season over large portions of western North America (NWS, 2015).

5.1.2 Recent Climate Studies

New Mexico's climate has historically exhibited a high range of variability. Periods of extended drought, interspersed with relatively short-term, wetter periods, are common. Historical periods of high temperature and low precipitation have resulted in high demands for irrigation water and higher open water evaporation and riparian evapotranspiration. In addition to natural climatic cycles (i.e., El Niño/La Niña, PDO, AMO [Section 5.1.1]) that affect precipitation patterns in the southwestern United States, there has been considerable recent research on potential climate change scenarios and their impact on the Southwest and New Mexico in particular.

The consensus on global climate conditions is represented internationally by the work of the Intergovernmental Panel on Climate Change (IPCC), whose Fifth Assessment Report, released in September 2013, states, "Warming of the climate system is unequivocal, and since the 1950s many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" (IPCC, 2013). Atmospheric concentrations of greenhouse gases are rising so quickly that all current climate models project significant warming trends over continental areas in the 21st century.

In the United States, regional assessments conducted by the U.S. Global Change Research Program (USGCRP) have found that temperatures in the southwestern United States have increased and are predicted to continue to increase, and serious water supply challenges are expected. Water supplies are projected to become increasingly scarce, calling for trade-offs among competing uses and potentially leading to conflict (USGCRP, 2009). Most of the major river systems in the southwestern U.S. are expected to experience reductions in streamflow and other limitations to water availability (Garfin et al., 2013).

Although there is consensus among climate scientists that global temperatures are warming, there is considerable uncertainty regarding the specific spatial and temporal impacts that can be expected. To assess climate trends in New Mexico, the NMOSE and NMISC (2006) conducted a study of observed climate conditions over the past century and found that observed wintertime average temperatures had increased statewide by about 1.5°F since the 1950s. Predictions of annual precipitation are subject to greater uncertainty "given poor representation of the North American monsoon processes in most climate models" (NMOSE/NMISC, 2006).

A number of other studies predict temperature increases in New Mexico from 5° to 10°F by the end of the century (Forest Guild, 2008; Hurd and Coonrod, 2008; USBR, 2011). Predictions of annual precipitation are subject to greater uncertainty, particularly regarding precipitation during the summer monsoon season in the southwestern U.S.

In a study outside of the region but relevant to northern New Mexico, Salgado and Gutzler (2013) evaluated climate change impacts on water availability in the Upper Pecos River Basin area, reviewing data from New Mexico Climate Division 2 and streamflow records from the Pecos gage located north of Pecos. They concluded:

- The timing of snowmelt runoff has exhibited a trend of earlier runoff that coincides with warmer temperatures in spring and early summer (March through June).
- Within the most recent 30-year period, the warmer spring and early summer temperature changes account for a larger percentage of the variability in streamflow than does precipitation. This shift may be an indicator of increased evaporation due to increased snowmelt season temperatures.

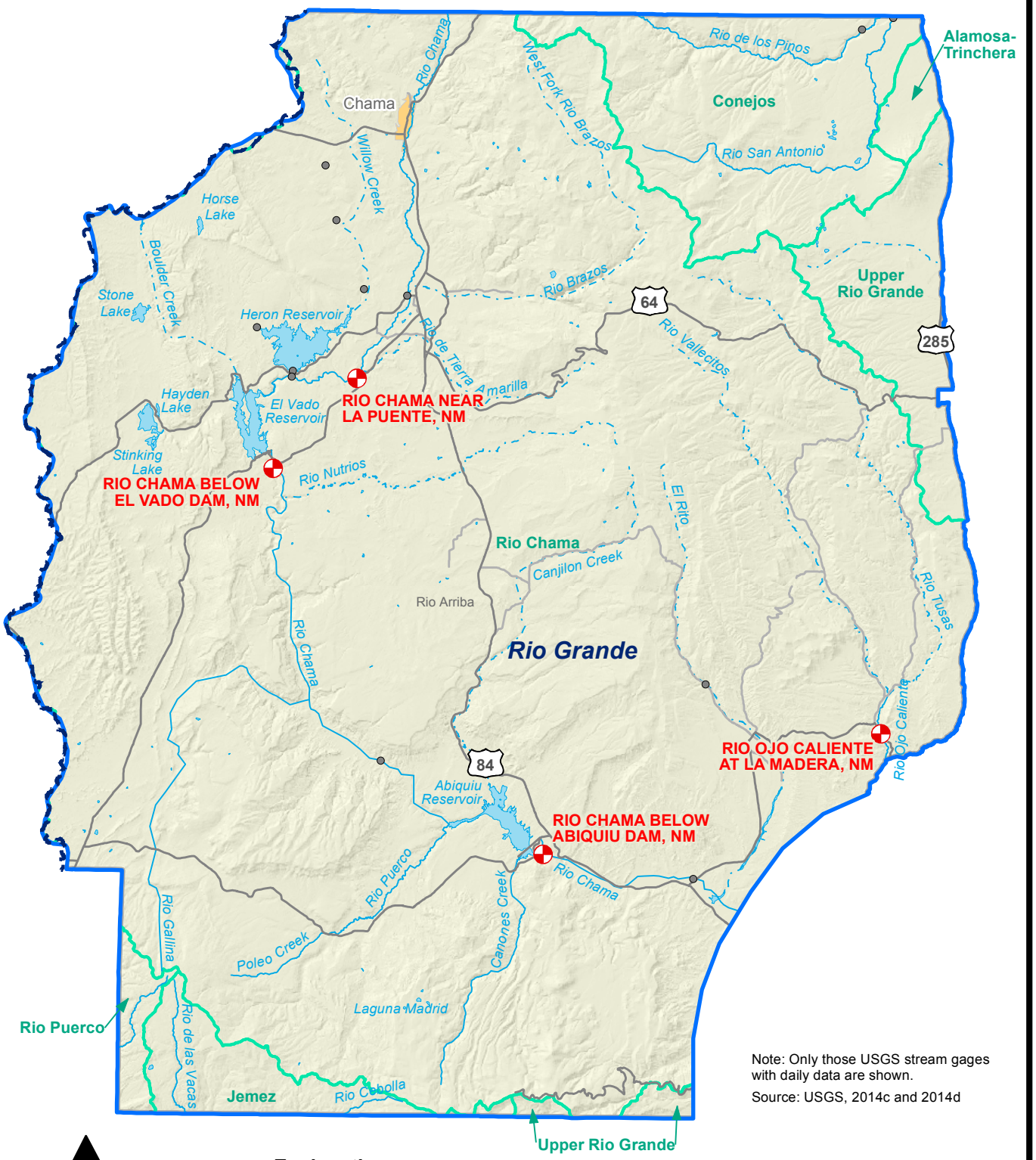
Based on these studies, the effects of climate change that are likely to occur in New Mexico and the planning region include (NMOSE/NMISC, 2006):

- Temperature is expected to continue to rise.
- Higher temperatures will result in a longer and warmer growing season, resulting in increased water demand on irrigated lands and increased evapotranspiration from riparian areas, grasslands, and forests, and thus less recharge to aquifers.
- Reservoir and other open water evaporation are expected to increase. Soil evaporation will also increase.
- Precipitation is expected to be more concentrated and intense, leading to increased projected frequency and severity of flooding.
- Streamflows in major rivers across the Southwest are projected to decrease substantially during this century (e.g., Christensen et al., 2004; Hurd and Coonrod, 2008; USBR, 2011, 2013; Garfin et al., 2013) due to a combination of diminished cold season snowpack in headwaters regions and higher evapotranspiration in the warm season. The seasonal distribution of streamflow is projected to change as well: flows could be somewhat higher than at present in late winter, but peak runoff will occur earlier and be diminished. Late spring/early summer flows are projected to be much lower than at present, given the combined effects of less snow, earlier melting, and higher evaporation rates after snowmelt.
- Forest habitat is vulnerable to both decreases in cold-season precipitation and increases in warm-season vapor pressure deficit (Williams et al., 2010). Stress from either of these factors leave forests increasingly susceptible to insects, forest fires, and desiccation. Greater temperatures increase insect survivability and fire risk.

To minimize the impact of these changes, it is imperative that New Mexico plan for variable water supplies, including focusing on drought planning and being prepared to maximize storage from extreme precipitation events while minimizing their adverse impacts.

5.2 Surface Water Resources

Surface water supplies approximately 97 percent of the water currently diverted in the Rio Chama Water Planning Region, with its primary uses being for irrigated agriculture and reservoir evaporation. The dominant waterway flowing in the region is the Rio Chama, which converges with the Rio Grande just below the regional boundary. Major surface drainages (including both perennial and intermittent streams) and watersheds in the planning region are shown on Figure 5-7. When evaluating surface water information, it is important to note that streamflow does not represent available supply, as there are also water rights and interstate compact



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RIO CHAMA
REGIONAL WATER PLAN 2016

Major Surface Drainages, Stream Gages, Reservoirs, and Lakes

Figure 5-7

limitations and streamflow in this basin below Heron Reservoir includes San Juan-Chama Project water. The administrative water supply discussed in Section 5.5 is intended to represent supply considering both physical and legal limitations, but excluding potential compact limitations. The information provided in this section is intended to illustrate the variability and magnitude of streamflow, and particularly the relative magnitude of streamflow in recent years.

In the Rio Chama planning region, a large portion of the surface water supply is San Juan-Chama Project water that is released from Heron Reservoir. Most of the 96,200 acre-feet of San Juan-Chama water is contracted to downstream users, though the Jicarilla Nation has a contract for 6,500 acre-feet per year and small amounts have been sub-leased to irrigators in the region in the past (RCAA and Rio Arriba County, 2006).

Streamflow and reservoir stage data are collected by the U.S. Geological Survey (USGS), in cooperation with the Bureau of Reclamation, the U.S. Army Corps of Engineers, and NMISC, at a number of stream and reservoir gage sites in the planning region. Table 5-4a lists the locations and periods of record for data collected at stream gages in the region, as well as the drainage area and estimated irrigated acreage for surface water diversions upstream of the station. Table 5-4b provides the minimum, median, and maximum annual yield for all gages that have 10 or more years of record.

In addition to the large variability in annual yield, streamflow also varies from month to month within a year, and monthly variability or short-term storms can have flooding impacts, even when annual yields are low. Table 5-5 provides monthly summary statistics for each of the stations with 10 or more years of record and indicates that most of the streamflow occurs in the March to June snowmelt runoff period, with additional larger flows occurring at some gages in August to October. Relatively low flows are observed in November through February. The stream gages below Abiquiu and El Vado reservoirs reflect reservoir releases and are thus not indicative of natural variability.

For this water planning update, four stream gages, shown on Figure 5-8, were analyzed in more detail. These stations were chosen because of their locations in the hydrologic system, completeness of record, and representativeness as key sources of supply. Figure 5-8 shows the minimum and median annual water yield for these gages, and Figures 5-9a and 5-9b show the annual water yield from the beginning of the period of record through 2013 for the four gages. As shown in these figures, streamflow varies greatly from year to year, with the highest-flow years supplying many times more water than the drier years. The low flows in recent years can be observed at the Rio Chama near La Puente and Rio Ojo Caliente at La Madera gages. There is less variability at the Rio Chama below El Vado and Abiquiu Dam gages, due to reservoir releases. As noted above, much of the surface water supply in the Rio Chama region is legally obligated to downstream users, so flow through the region does not represent flow available to the region.

Table 5-4a. USGS Stream Gage Stations

USGS Station [a]							Period of Record	
Name [b]	Number	Latitude	Longitude	Elevation (ft amsl)	Drainage Area (sq mi)	Irrigated Upstream Land [c] (acres)	Start Date	End Date
Rio Arriba County								
San Antonio River at Ortiz, CO [d]	08247500	36.9930694	–106.038633	7,970	110	NA [e]	10/1/1919	Present
Los Pinos River Near Ortiz, CO [d]	08248000	36.9822359	–106.073633	8,040	167	NA [e]	1/1/1915	Present
Rio Chama at Park View, NM	08283500	36.737514	–106.578369	7,280	405	—	4/1/1913	9/30/1955
Rio Chama Near La Puente, NM	08284100	36.6626583	–106.633367	7,083	480	10,300	10/1/1955	Present
Willow Cr Abv Azotea Cr Nr Park View, NM	08284150	36.8041802	–106.658926	7,404	42	—	4/1/1971	12/31/1973
Azotea Tunnel at Outlet Near Chama, NM	08284160	36.8533464	–106.672259	7,520	—	—	10/1/1970	9/30/2008
Willow C Ab Heron Re Nr Los Ojos, NM	08284200	36.7425141	–106.626703	7,196	112	—	12/1/1962	12/31/2008
Horse Lake C Ab Heron Re Nr Los Ojos, NM	08284300	36.7066806	–106.745594	7,187	45	—	10/1/1962	9/30/2009
Willow Creek Near Park View, NM	08284500	36.6680702	–106.70476	6,945	193	—	10/1/1942	2/21/1971
Willow Creek Below Heron Dam, NM	08284520	36.6627778	–106.705556	6,935	193	—	1/1/1971	9/30/2008
Rio Chama Below El Vado Dam, NM	08285500	36.5803833	–106.724767	6,696	877	10,600	10/30/1935	Present
Rio Chama Above Abiquiu Reservoir, NM	08286500	36.3188222	–106.599531	6,280	1,600	15,000	8/1/1961	Present
Rio Chama Below Abiquiu Dam, NM	08287000	36.2372222	–106.417417	6,040	2,147	17,600	11/1/1961	Present
Rio Chama Near Abiquiu, NM	08287500	36.2166857	–106.250582	5,873	2,284	—	10/1/1941	9/30/1967
El Rito Near El Rito, NM	08288000	36.3916842	–106.23947	7,400	51	—	10/1/1931	9/30/1950
Rio Ojo Caliente at La Madera, NM	08289000	36.3497417	–106.044186	6,359	419	3,500	10/1/1932	Present

Source: USGS, 2014c (unless otherwise noted)

[a] Only those USGS stream gages with daily data are shown.

[b] **Bold** indicates gages in key locations selected for additional analysis.

[c] Source: RCAA / Rio Arriba County, Undated; USGS, 2014a

[d] Gage located in Rio Arriba County, NM, but named after the closest town in Colorado.

[e] Natural flow is affected by irrigation diversion. No acreage listed.

USGS = U.S. Geological Survey
ft amsl = Feet above mean sea level
sq mi = Square miles

NA = Not available
— = Data not available from current source(s).

Table 5-4b. USGS Stream Gage Annual Statistics for Stations with 10 or More Years of Record

USGS Station Name [a]	Annual Yield [b] (acre-feet)			Number of Years [c]
	Minimum	Median	Maximum	
Rio Arriba County				
San Antonio River at Ortiz, CO [d]	1,774	15,638	44,741	73
Los Pinos River Near Ortiz, CO [d]	13,031	77,899	167,309	95
Rio Chama at Park View, NM	85,211	237,896	485,999	25
Rio Chama Near La Puente, NM	33,447	230,221	535,229	57
Azotea Tunnel at Outlet Near Chama, NM	6,306	85,645	164,123	32
Willow C Ab Heron Re Nr Los Ojos, NM	2,288	87,962	179,327	43
Willow Creek Near Park View, NM	1,086	9,013	34,895	28
Rio Chama Below El Vado Dam, NM	138,712	332,735	546,812	43
Rio Chama Above Abiquiu Reservoir, NM	146,459	340,988	604,657	42
Rio Chama Below Abiquiu Dam, NM	149,354	366,182	680,239	42
Rio Chama Near Abiquiu, NM	133,934	266,637	703,189	25
El Rito Near El Rito, NM	2,375	12,126	36,126	18
Rio Ojo Caliente at La Madera, NM	9,339	41,990	152,829	81

Source: USGS, 2014c

[a] Stations with complete years of data only
Bold indicates gages in key locations selected for additional analysis.

[b] Based on calendar years;

[c] Number of years used in calculation of annual yield statistics

[c] Gage located in Rio Arriba County, NM, but named after the closest town in Colorado.

Table 5-5. USGS Stream Gage Average Monthly Streamflow for Stations with 10 or More Years of Record

USGS Station [a]	Complete Years [b]	Average Monthly Streamflow [c] (acre-feet)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
San Antonio River at Ortiz, CO	73	144	205	1,103	5,873	8,379	908	113	162	82	181	222	161
Los Pinos River Near Ortiz, CO	95	901	952	2,197	13,220	36,619	18,511	4,198	2,080	1,463	1,691	1,289	996
Rio Chama at Park View, NM	25	2,749	2,993	7,106	54,317	103,500	43,146	8,544	4,008	3,402	4,584	3,204	2,754
Rio Chama Near La Puente, NM	57	3,410	3,731	11,594	49,389	106,826	39,889	7,301	5,522	4,488	5,371	4,734	3,634
Azotea Tunnel at Outlet Near Chama, NM	32	73	55	1,500	15,233	32,961	29,148	7,392	2,578	1,135	1,159	340	104
Willow C Ab Heron Re Nr Los Ojos, NM	43	112	375	4,467	15,938	26,797	23,650	6,209	2,445	1,050	1,007	379	118
Willow Creek Near Park View, NM	28	106	295	2,858	4,295	631	281	373	776	243	177	144	53
Rio Chama Below El Vado Dam, NM	43	9,284	8,897	17,245	45,615	87,868	47,154	28,061	26,531	21,890	13,250	10,720	16,331
Rio Chama Above Abiquiu Reservoir, NM	42	9,687	9,965	19,465	48,297	93,215	49,267	28,714	27,686	22,404	13,941	10,946	16,601
Rio Chama Below Abiquiu Dam, NM	42	9,470	10,942	22,128	47,767	71,004	60,995	38,990	31,726	26,518	16,939	14,217	16,019
Rio Chama Near Abiquiu, NM	25	3,883	11,109	19,301	37,474	60,439	43,027	28,417	26,518	15,737	8,582	20,278	12,885
El Rito Near El Rito, NM	18	128	145	536	4,792	6,250	895	205	134	100	188	145	116
Rio Ojo Caliente at La Madera, NM	81	1,136	1,268	3,612	15,975	18,625	2,757	591	835	637	888	1,070	1,095

Source: USGS, 2014c

[a] **Bold** indicates gages in key locations selected for additional analysis.

[b] Monthly statistics are for complete months with locations where 10 or more years of complete data were available.

[c] Data from USGS monthly statistics averaged over the entire period of record, converted to acre-feet (from cubic feet per second) and rounded to the nearest acre-foot.

USGS = U.S. Geological Survey

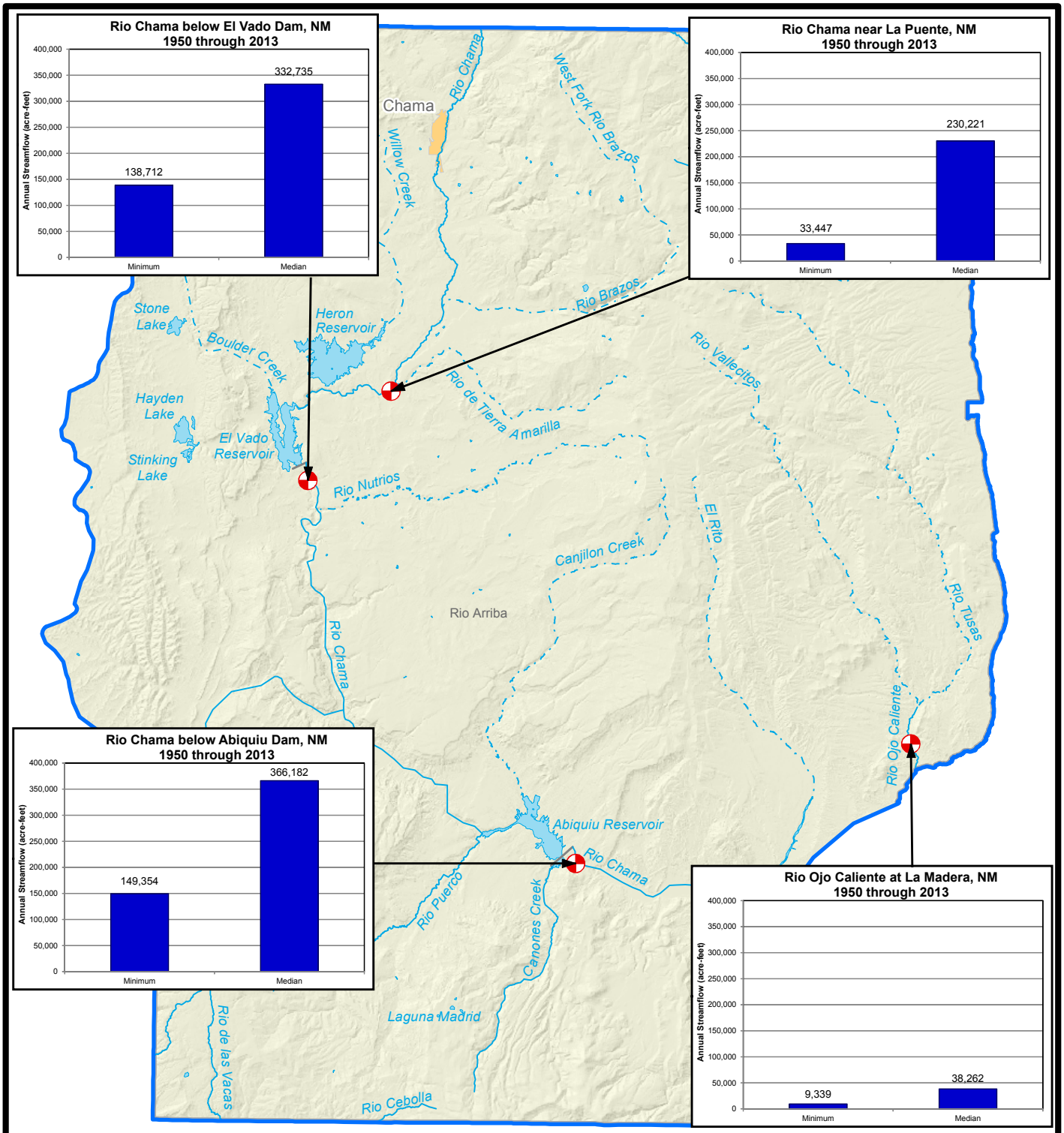

Figure 5-8

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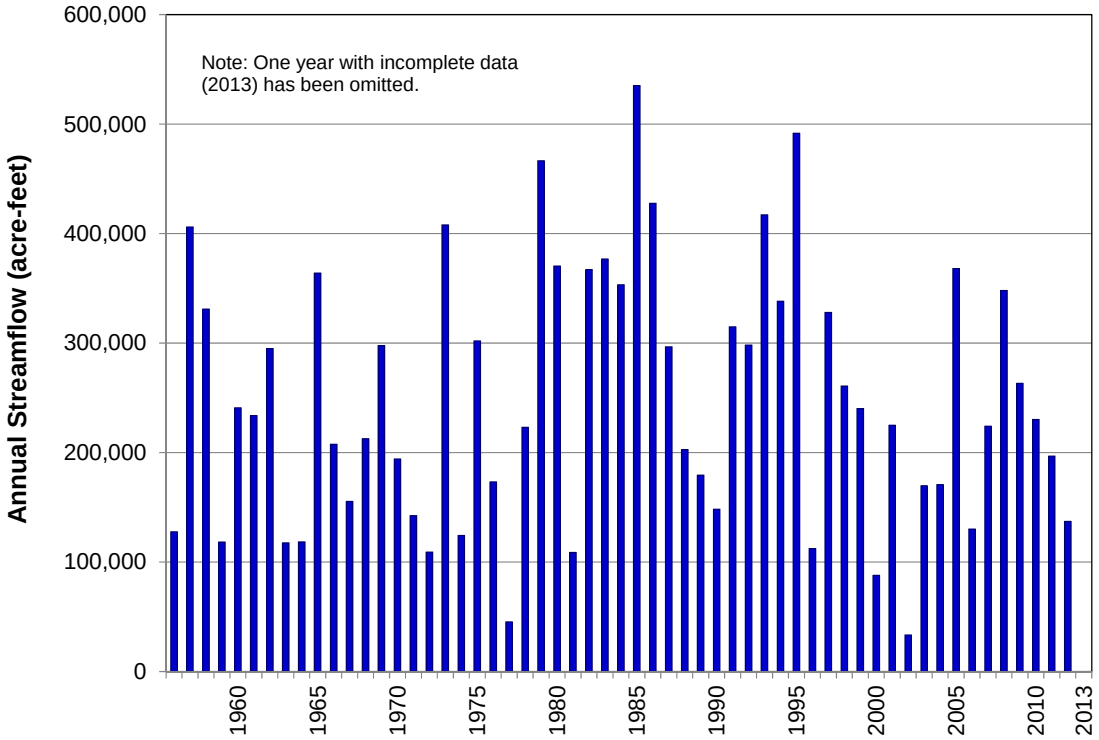
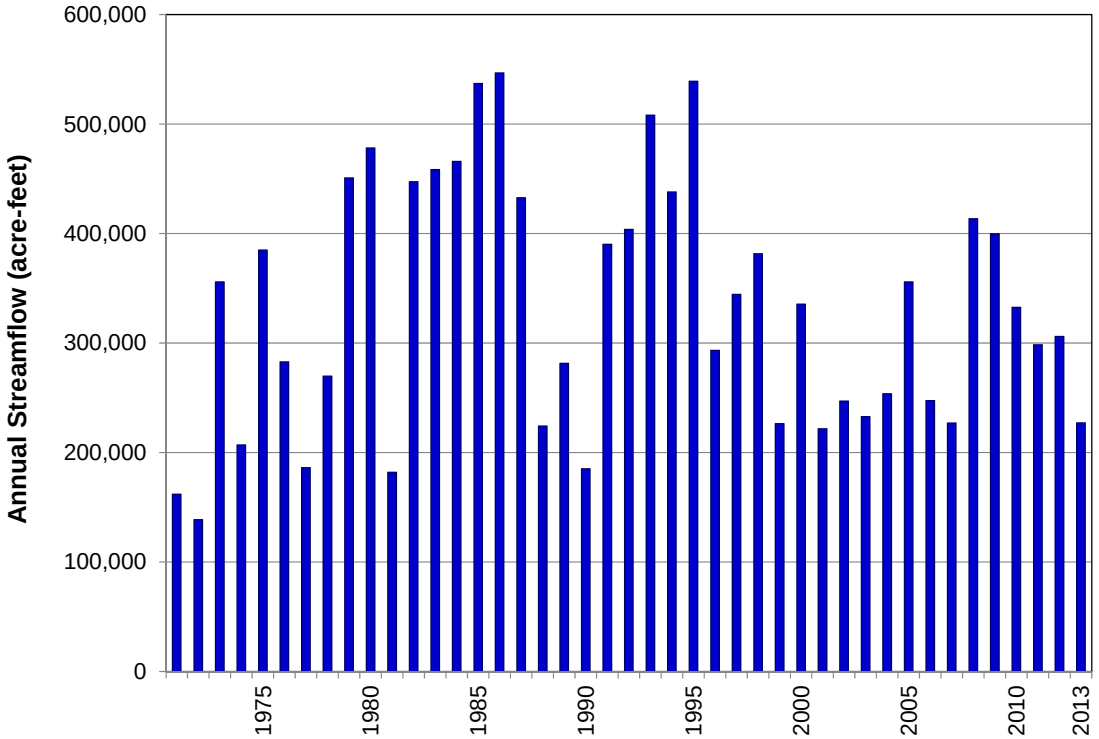
Rio Chama near La Puente, NM



Rio Chama below El Vado Dam, NM



RIO CHAMA
REGIONAL WATER PLAN UPDATE

Annual Streamflow for Selected Gaging Stations on the Rio Chama

Figure 5-9a

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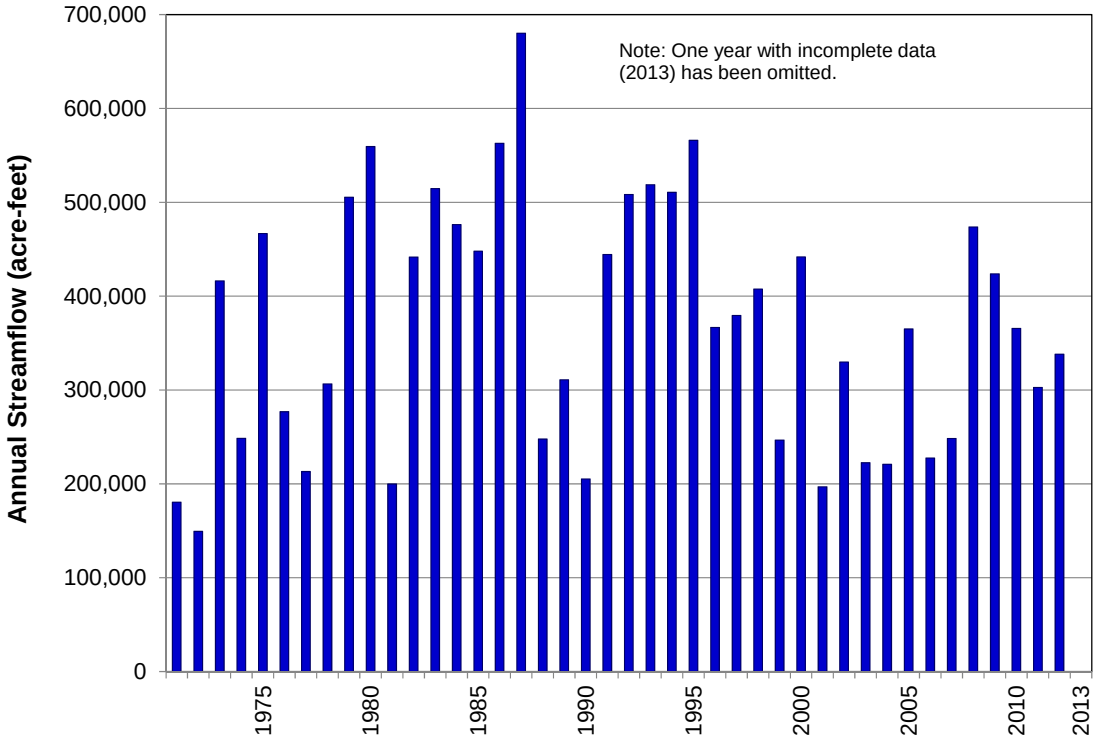
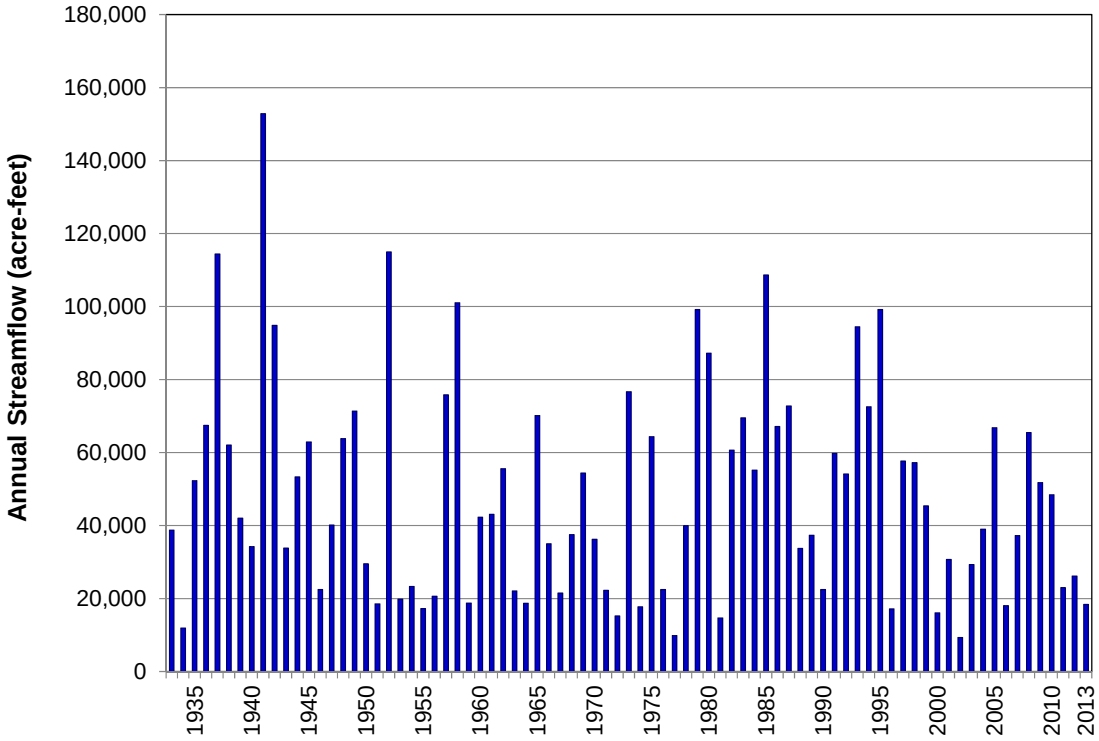
Rio Chama below Abiquiu Dam, NM



Rio Ojo Caliente at La Madera, NM



RIO CHAMA
REGIONAL WATER PLAN UPDATE

Annual Streamflow for Selected Gaging Stations on the Rio Chama and Rio Ojo Caliente

Figure 5-9b

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Several lakes and reservoirs are present in the planning region (Figure 5-7). Table 5-6 summarizes the characteristics of the larger lakes and reservoirs (i.e., storage capacity greater than 5,000 acre-feet, as reported in the *New Mexico Water Use by Categories 2010* report [Longworth et al., 2013]). As indicated on Table 5-6, the three largest reservoirs in the planning region are Heron, El Vado, and Abiquiu reservoirs. While these reservoirs provide important recreational and associated economic benefits to the region, the water stored in them is primarily for users outside the planning region.

The NMOSE conducts periodic inspections of non-federal dams in New Mexico to assess dam safety issues. Dams that equal or exceed 25 feet in height that impound 15 acre-feet of storage or dams that equal or exceed 6 feet in height and impound at least 50 acre-feet of storage are under the jurisdiction of the State Engineer. These non-federal dams are ranked as being in good, fair, poor, or unsatisfactory condition. Dams with unsatisfactory conditions are those that require immediate or remedial action. Dams identified in recent inspections as being deficient, with high or significant hazard potential, are summarized in Table 5-7. The Laguna del Campo dam south of Chama received a high hazard ranking for its undersized spillway.

5.3 Groundwater Resources

Groundwater accounted for only about 3 percent of all water diversions in the year 2010 (Longworth et al., 2013). Nevertheless, groundwater is important to the region as it provides the sole source of drinking water for many communities. The Village of Chama and some small state park systems use surface water, but numerous other small drinking water systems rely on groundwater. However, since the total use of groundwater is small, no recent investigations of hydrogeology or groundwater have been conducted in the region.

5.3.1 Regional Hydrogeology

The geology that controls groundwater occurrence and movement within the planning region was described in the accepted Rio Chama *Regional Water Plan* (RCAA and Rio Arriba County, 2006) and by the New Mexico Bureau of Geology in 2005 (Lucas et al., 2005). A map illustrating the surface geology of the planning region, derived from a geologic map of the entire state of New Mexico by the New Mexico Bureau of Geology & Mineral Resources (2003), is included as Figure 5-10.

Three physiographic provinces exist within the planning region (RCAA and Rio Arriba County, 2006):

Table 5-6. Reservoirs and Lakes (greater than 5,000 acre-feet) in the Rio Chama Water Planning Region

River	Reservoir	Primary Purpose	Operator	Date Completed	Total Storage Capacity (acre-feet)	Surface Area (acres)	Dam Height (feet)	Dam Length (feet)
Rio Arriba County								
Willow Creek/Rio Chama	Heron Dam	Irrigation	Bureau of Reclamation	1970	429,646	5,905	269	1,220
Rio Chama	El Vado Reservoir	Irrigation	Bureau of Reclamation	1934	209,330	3,380	230	1,326
	Abiquiu Dam	Flood control	U.S. Army Corps of Engineers	1963	1,369,000	3,900	340	1,800

Source: USACE, 1999

Table 5-7. Dams with Dam Safety Deficiency Rankings

Dam	Condition Assessment [a]	Deficiency	Hazard Potential [b]	Estimated Cost to Repair ($)
Rio Arriba County				
Dwight Baker Dam	Poor	Crack on upstream edge of crest Outlets not operable Maintenance needed	Low	1,000,000
Hopewell Lake Dam	Poor	Spillway capacity 24% of required flood Maintenance needed Lack of design information	Significant	4,000,000
Laguna Del Campo Dam	Poor	Spillway capacity 6% of required flood Spillway deteriorated Lack of design information	High	4,000,000
San Gregorio Dam	Fair	Spillway capacity 65% of required flood Maintenance needed	Low	2,500,000
La Tierra Grande Dam	Fair	Maintenance needed	Significant	75,000

Source: NMOSE, 2014b PMP= Probable maximum precipitation

[a] Condition assessment:

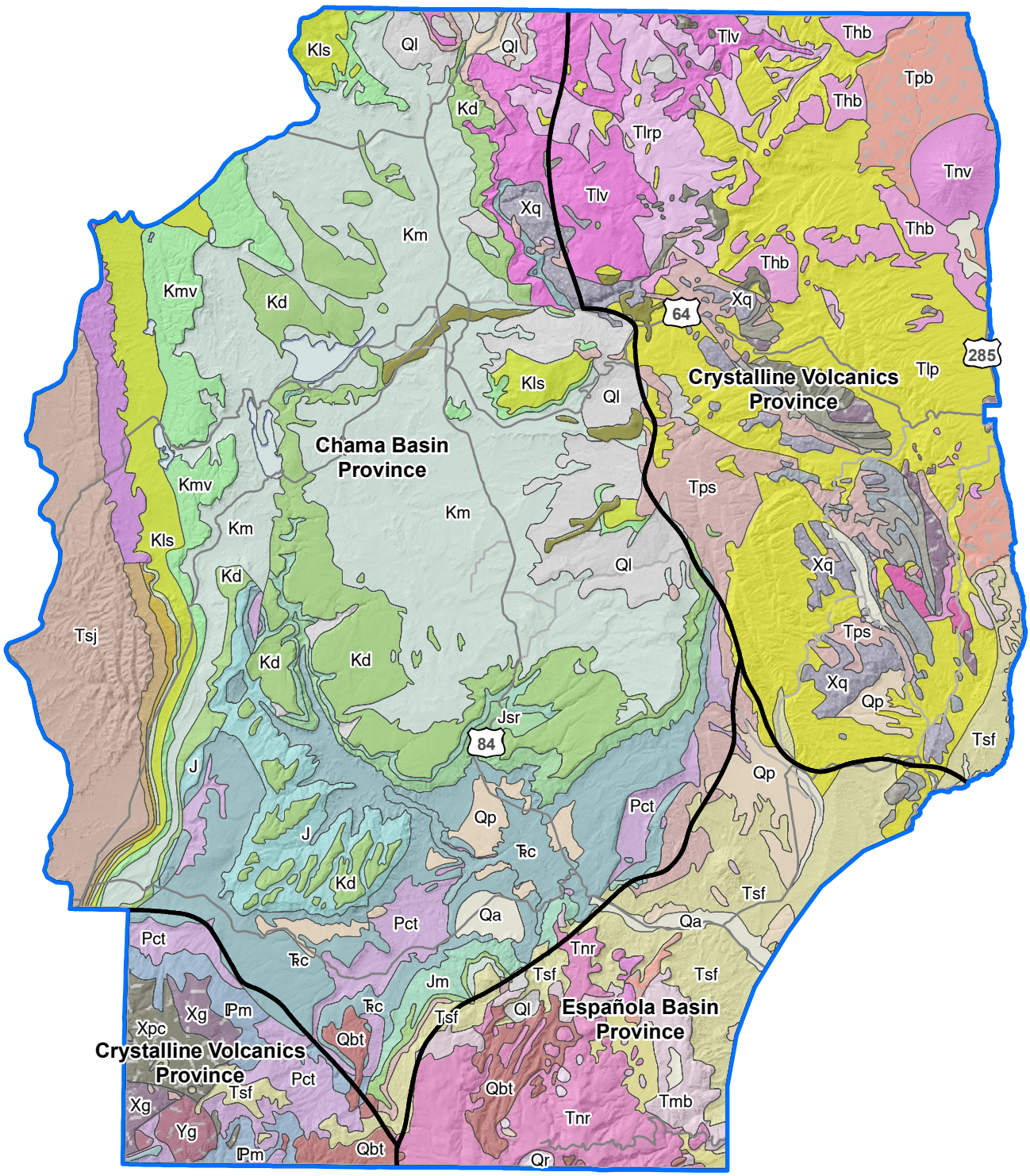
	2008 US Army Corps of Engineers Criteria (adopted by NM OSE in FY09)	*NMOSE Spillway Risk Guidelines*
Fair:	No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range [for the owner] to take further action.	Spillway capacity < 70% but ≥ 25% of the SDF.
Poor:	A dam safety deficiency is recognized for loading conditions, which may realistically occur. Remedial action is necessary. A poor condition is also used when uncertainties exist as to critical analysis parameters, which identify a potential dam safety deficiency. Further investigations and studies are necessary.	Spillway capacity < 25% of the SDF.
Unsatisfactory:	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.	

[b] Hazard Potential Classifications:

High: Dams where failure or mis-operation would likely result in loss of human life.

Significant: Dams where failure or mis-operation would likely not result in loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities, or could impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but may be located in populated areas with significant infrastructure.

Low: Dams where failure or mis-operation would likely not result in loss of life but may result in minimal economic or environmental losses. Losses would be principally limited to the dam owner's property.



N

0 4.5 9 Miles

Explanation

- Physiographic province
- County
- Water planning region

Sources: 1. NMBGMR, 2003
2. RCAA and Rio Arriba County, 2006

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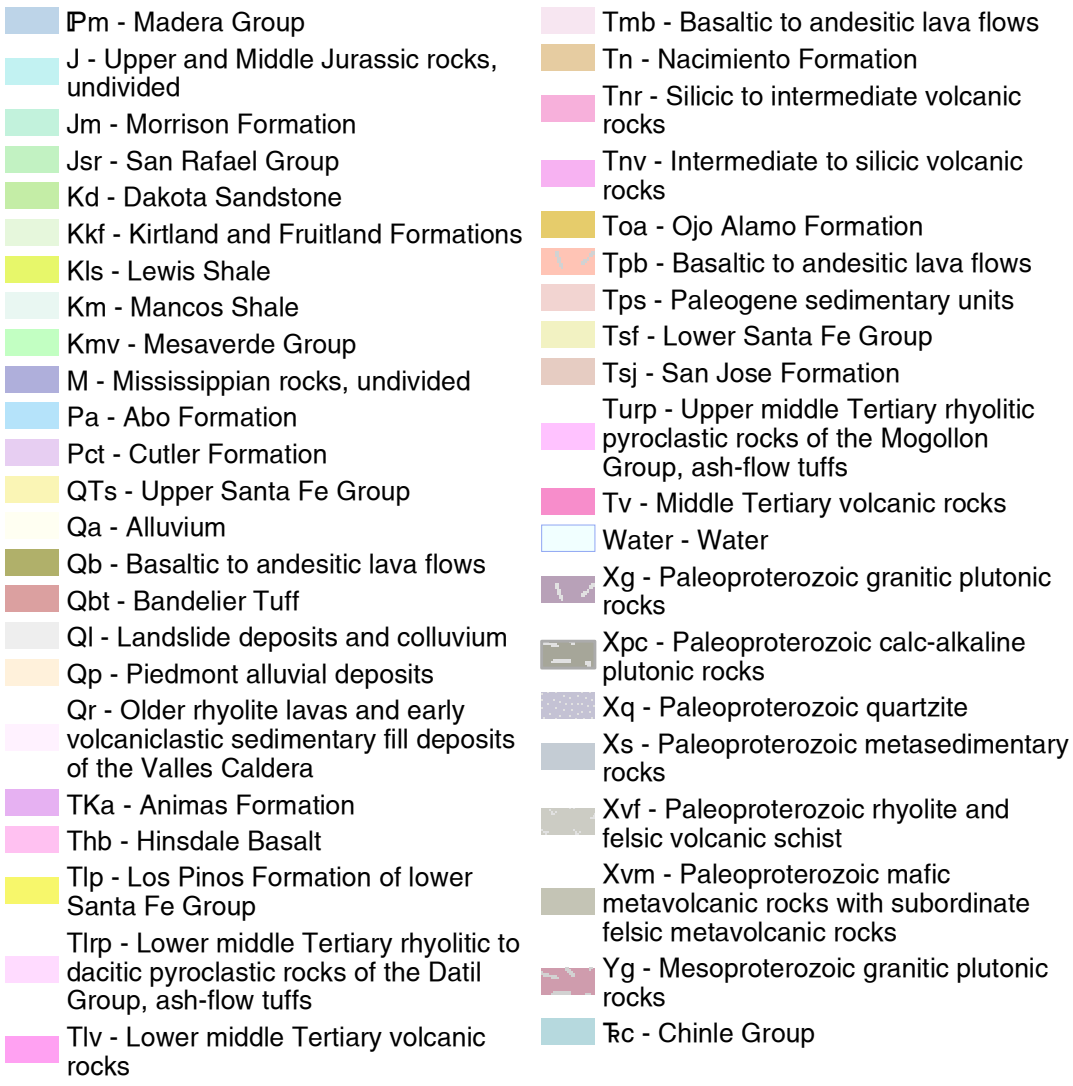
RIO CHAMA
REGIONAL WATER PLAN 2016

Geology and Physiographic Provinces

Figure 10a



Source: NMBGMR, 2003

RIO CHAMA
REGIONAL WATER PLAN 2016
Geology Explanation

Figure 5-10b

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- The Española Basin Province, in the southeastern part of the watershed, consists of a thick, faulted accumulation of basin-fill sandstone, siltstone, and conglomerate, which are slightly consolidated (compacted). The deposits were formed primarily during the Tertiary period and are typically characterized by the Santa Fe Group. These deposits are moderately permeable, contain large amounts of sand and gravel, and are fairly transmissive. Española Basin aquifers usually yield relatively ample supplies of good-quality water. There is also a group of wells below Abiquiu Dam that produces primarily from basin-fill or alluvial sediments. .

- The Chama Basin Province, which covers almost all of the western part of the watershed, consists primarily of the Mancos, Dakota, Morrison, and Chinle aquifer systems. Rocks are largely shale, sandstone, and limestone from the Cretaceous, Jurassic, and Triassic periods. Generally, only the coarser-grained strata in these formations yield water, and these aquifer systems produce small amounts of water in some locations and are dry in other locations. There can be problems with taste, odor, or other chemical contamination of water from these aquifers.

- The Crystalline and Volcanic Province makes up most of the eastern part of the watershed and a small portion of the southwestern part of the watershed, the Tusas and Jemez mountains. The crystalline rocks are granite, gneiss, and quartz-rich metamorphic rocks, primarily Precambrian deposits. These crystalline deposits are overlain by volcanic and volcanic sedimentary rocks of the Tertiary period, which are similar to volcanic deposits in the Española Basin Province, although most of the deposits here are shallow. Where the Tertiary deposits are present, the groundwater is of sufficient quantity and quality to supply some wells, but the Precambrian bedrock is seldom a useful aquifer because little or no water can be obtained unless open fractures are penetrated.

Figure 5-10 shows the approximate extents of these areas within the planning region.

Alluvial valley fill is present in all three provinces in the region, but the depth and extent of the alluvium tends to be quite limited in most of the region; thus the storage capacity of the stream-valley alluvium is small, and the alluvium may dry up in some locations, where perennial flow is inadequate, during drought periods. Nonetheless many wells in the region draw water from these aquifers. Alluvial aquifers, composed largely of gravel and sand, can be a good source of water if the deposits are deep and extensive. However, in the Rio Chama region, the alluvial deposits are shallow and generally not extensive. Alluvial wells are generally well-connected to the surface streams.

5.3.2 Aquifer Conditions

As reported in the accepted regional water plan (RCAA and Rio Arriba County, 2006) there are six principal water-yielding units in the Mesozoic deposits of the Colorado Plateau in the northern, central, and western parts of the region. Further south, the primary water-bearing units are the Santa Fe Group and the Tesuque Formation. Details of the lithology of these units were provided in the original plan.

For the accepted regional water plan (RCAA and Rio Arriba County, 2006), an attempt was made to locate water level data to evaluate trends over time, but few water level measurements were available and the few measurements that were available were insufficient to evaluate trends. For this update, USGS records were searched, but no current USGS groundwater monitoring data were found for the region. Rio Arriba County is working on initiating a groundwater monitoring program.

Similarly, there are few quantitative data on recharge and aquifer properties in the area. The 2006 water plan summarized recharge estimates available near the region and provided an overview of regional hydrogeology and aquifer properties (RCAA and Rio Arriba County, 2006). Though quantitative data were limited, the 2006 plan indicated that based on qualitative assessment of the available data there are no aquifer systems within the Rio Chama watershed that can support large volumes of groundwater withdrawals.

As groundwater supplies only 3 percent of the water in the region, there are no major well fields nor current USGS groundwater monitoring data in the planning region (Figure 5-11).

5.4 Water Quality

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. This section summarizes the water quality assessment that was provided in the accepted regional water plan and updates it to reflect new studies of surface and groundwater quality and current databases of contaminant sources. The identified water quality concerns should be a consideration in the selection of potential projects, programs, and policies to address the region's water resource issues.

Surface water quality in the Rio Chama Water Planning Region is evaluated through periodic monitoring and comparison of sample results to pertinent water quality standards. Several reaches of rivers within the Rio Chama watershed have been listed on the 2014-2016 New Mexico 303(d) list (NMED, 2014a). This list is prepared every two years by NMED and approved by the New Mexico Water Quality Control Commission (NMWQCC) to comply with Section 303(d) of the federal Clean Water Act, which requires each state to identify surface waters within its boundaries that do not meet water quality standards (see Section 4.2.2.1.1).

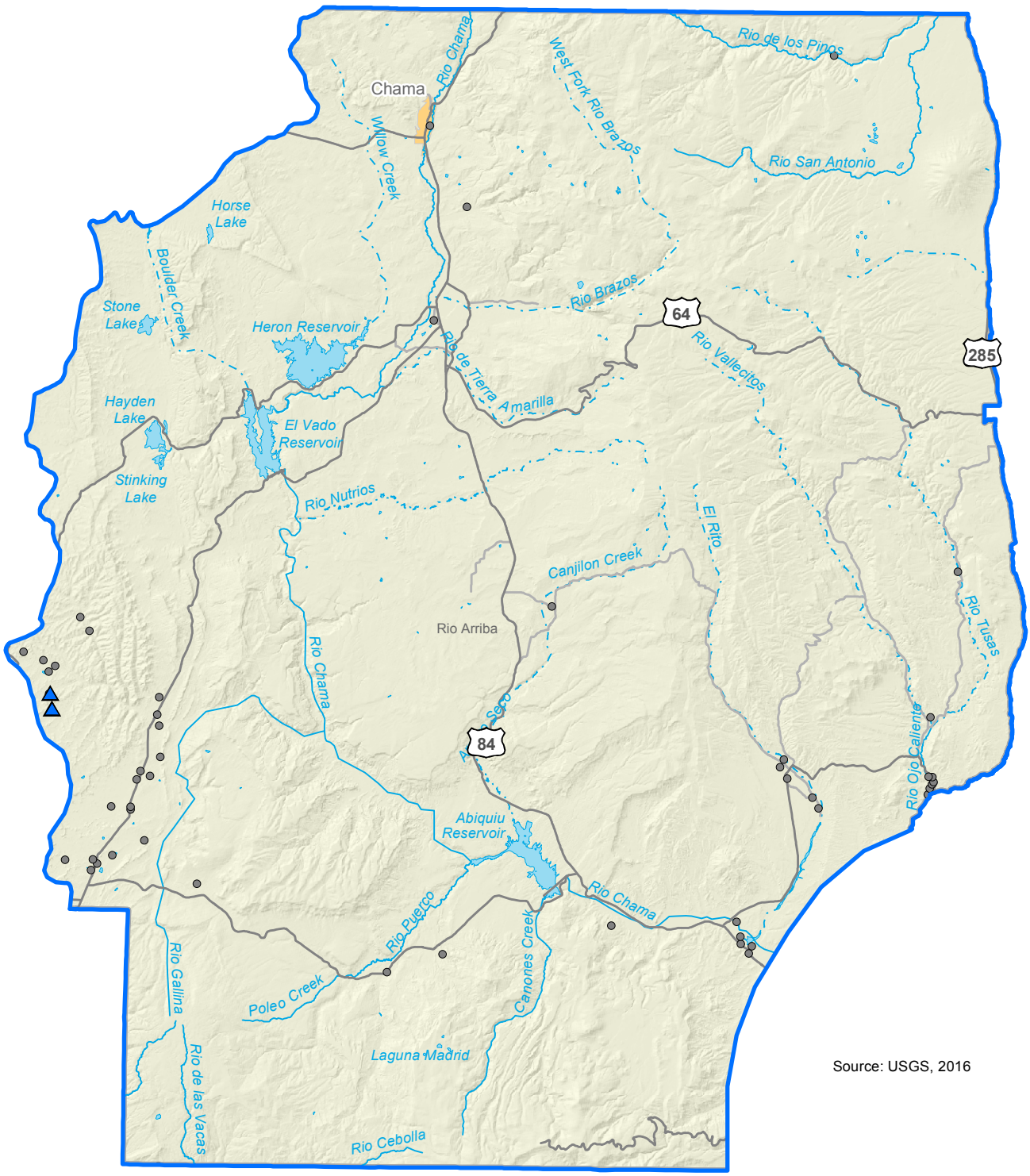
Chama
Rio Chama
West Fork Rio Brazos
Rio de los Pinos
Rio San Antonio
Willow Creek
Horse Lake
Boulder Creek
Stone Lake
Heron Reservoir
Rio Brazos
64
285
Rio Vallecitos
Rio de Tierra Amarilla
Hayden Lake
El Vado Reservoir
Stinking Lake
Rio Nutrios
El Rito
Canjilon Creek
Rio Arriba
Rio Tusas
Rio Chama
84
Rio Ojo Caliente
Abiquiu Reservoir
Rio Chama
Rio Puerco
Canones Creek
Rio Gallina
Poleo Creek
Laguna Madrid
Rio de las Vacas
Rio Cebolla
Source: USGS, 2016
N
0
4.5
9
Miles
Explanation
USGS-monitored well with multiple years of data*
Other USGS-monitored well
Stream (dashed where intermittent)
Lake
City
County
Water planning region
* Data in these wells was for 4 years in the 1980s. No current monitoring well data available.
RIO CHAMA
REGIONAL WATER PLAN 2016
U.S. Geological Survey Wells
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Figure 5-11

Section 303(d) further requires the states to prioritize their listed waters for development of total maximum daily load (TMDL) management plans, which document the amount of a pollutant a waterbody can assimilate without violating a state water quality standard and allocates that load capacity to known point sources and nonpoint sources at a given flow. Figure 5-13 shows the locations of lakes and stream reaches included in the 303(d) list; Table 5-8 provides details of impairment for those reaches. Common causes of impairment in the Rio Chama region included temperature, sediment/turbidity, bacteria, nutrients, dissolved oxygen, and aluminum.

In evaluating the impacts of the 303(d) list on the regional water planning process, it is important to consider that impairments are tied to designated uses. Some problems can be very disruptive to a healthy aquatic community, while others reduce the safety of water recreation or increase the risk of fish consumption. Impairments will not necessarily make the water unusable for irrigation or even for domestic water supply, but the water may need treatment prior to use and the costs of this should be recognized.

Though groundwater use in the planning region is low (3 percent of the total use), it does supply most drinking water systems and wells for private domestic consumption, and thus groundwater quality is also an important consideration in the region. The original plan identified groundwater contamination due to individual septic systems as the primary groundwater quality issue. Nitrate contamination in the Chamita and El Guache-Hernandez areas was identified as a particular concern (RCAA and Rio Arriba County, 2006).

Several types and sources of contaminants that have the potential to impact either surface or groundwater quality are discussed below. Sources of contamination are considered as one of two types: (1) point sources, if they originate from a single location, or (2) nonpoint sources, if they originate over a more widespread or unspecified location. Information on both types of sources is provided below.

5.4.1 Potential Sources of Contamination to Surface and Groundwater

Specific sources that have the potential to impact either surface or groundwater quality in the future are discussed below. These include municipal and industrial sources, leaking underground storage tanks, landfills, and nonpoint sources.

5.4.1.1 Municipal and Industrial Sources

As discussed in Section 4.2.2, a person or facility that discharges a pollutant from a point source to a surface water that is a water of the United States must obtain an NPDES permit. An NPDES permit must assure compliance with the New Mexico Water Quality Standards. A person or facility that discharges contaminants that may move into groundwater must obtain a groundwater discharge permit from the New Mexico Environment Department. A groundwater discharge permit ensures compliance with New Mexico groundwater quality standards. The NMWQCC regulations also require abatement of groundwater contamination that exceeds standards.

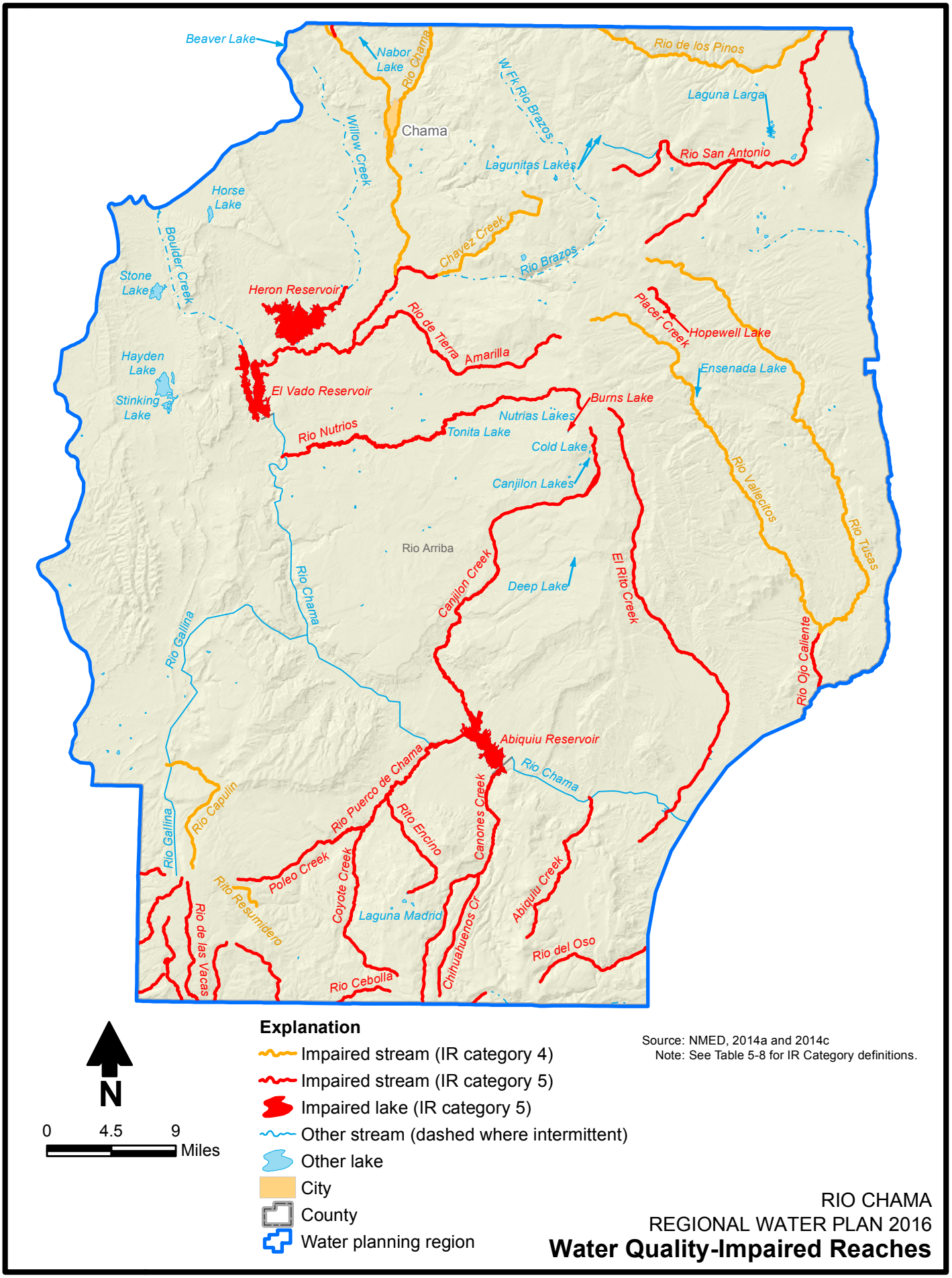

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Figure 5-13

Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Rio Arriba County						
Abiquiu Creek (Rio Chama to headwaters)	NM-2113_50	12.85	On-site treatment systems (septic) Source unknown Rangeland grazing	SC WWAL ColdWAL	Escherichia coli Oxygen, dissolved	5/5A
Abiquiu Reservoir	NM-2114_00	6809.6 [d]	Source unknown	ColdWAL WWAL	Mercury in fish tissue PCB in fish tissue	5/5C
American Creek (Rio de las Palomas to headwaters)	NM-2106.A_44	4.8	Not assessed	—	—	3/3A
Arroyo del Toro (Rio Chama to headwaters)	NM-98.A_006	6.85	Source unknown	MWWAL	PCB in water column	5/5A
Beaver Creek (Rio de los Pinos to headwaters)	NM-2120.A_904	6.58	Not assessed	—	—	3/3A
Burns Lake (Rio Arriba)	NM-9000.B_025	2.5 [d]	Source unknown	—	Nutrient/eutrophication Biological indicators	5/5C
Canada de Horno (Rio Chama to headwaters)	NM-98.A_005	2.81	Source unknown	WWAL	PCB in water column	5/5A
Canada Tio Grande (Rio San Antonio to headwaters)	NM-2120.A_903	9.39	Source unknown	HQColdWAL	Nutrient/eutrophication Biological indicators Temperature, water	5/5A

Source: NMED, 2014a

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[e] Acres

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Canjilon Ck (Perennial portions Abiquiu Rsrv to headwaters)	NM-2116.A_030	36.33	On-site treatment systems (septic) Livestock (grazing or feeding operations) Source unknown Agriculture Wildlife other than waterfowl Drought-related impacts Loss of riparian habitat Road/bridge runoff Streambank modifications/destabilization Flow alterations from water diversions	HQColdWAL	Nutrient/eutrophication Biological indicators Specific conductance Temperature, water Turbidity	5/5C
Canjilon Lake (b)	NM-2116.B_11	1.7 [d]	Not assessed	—	—	3/3A
Canjilon Lake (c)	NM-2116.B_12	3.1 [d]	Not assessed	—	—	3/3A
Canjilon Lake (d)	NM-2116.B_13	1.3 [d]	Not assessed	—	—	3/3A
Canjilon Lake (e)	NM-2116.B_14	4.1 [d]	Not assessed	—	—	3/3A
Canjilon Lake (f)	NM-2116.B_15	2.3 [d]	Not assessed	—	—	3/3A
Canones Creek (Abiquiu Reservoir to headwaters)	NM-2116.A_010	19.62	Source unknown	PC HQColdWAL	Escherichia coli Temperature, water	5/5A
Chavez Creek (Rio Brazos to headwaters)	NM-2116.A_081	12.88	Channelization Habitat modification Loss of riparian habitat	HQColdWAL	Temperature, water	4A
Chihuahuenos Creek (Canones Creek to headwaters)	NM-2116.A_016	9.28	Source unknown	HQColdWAL	Aluminum, chronic Sedimentation/siltation	5/5C

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Clear Creek (Rio de las Vacas to San Gregorio Lake)	NM-2106.A_54	5.14	Source unknown	HQColdWAL	Benthic-macroinvertebrate bioassessments	5/5C
Clear Creek (San Gregorio Lake to headwaters)	NM-2106.A_55	3.9	Not assessed	—	—	3/3A
Cold Lake	NM-9000.B_031	1.5 [d]	Not assessed	—	—	3/3A
Coyote Creek (Rio Puerco de Chama to headwaters)	NM-2116.A_022	13.65	Source unknown	HQColdWAL	Sedimentation/siltation	5/5A
Deep Lake	NM-9000.B_035	4 [d]	Not assessed	—	—	3/3A
East Fork Rio Brazos (Jicarilla Apache bnd to headwaters)	NM-2116.A_088	6.74	Not assessed	—	—	3/3A
El Rito Creek (Perennial reaches above Hwy 554)	NM-2112.A_20	22.4	Source unknown	PC	Escherichia coli Nutrient/eutrophication Biological indicators Temperature, water	5/5C
El Rito Creek (Perennial reaches below Hwy 554)	NM-2113_40	13.11	Source unknown	SC ColdWAL WWAL	Escherichia coli Nutrient/eutrophication Biological indicators	5/5C
El Vado Reservoir	NM-2117_00	3222.27	Source unknown	ColdWAL	Nutrient/eutrophication Biological indicators	5/5C

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Ensenada Lake	NM-9000.B_040	2.8	Not assessed	—	—	3/3A
Heron Reservoir	NM-2117_10	4741.88	Not assessed	ColdWAL	Temperature, water	5/5A
Hopewell Lake	NM-2112.B_00	16.1 [d]	Source unknown	HQColdWAL	Nutrient/eutrophication Biological indicators	5/5C
La Jara Creek (Perennial reaches abv Arroyo San Jose)	NM-2107.A_46	9.86	Source unknown	ColdWAL	Aluminum, acute Aluminum, chronic	5/5A
Laguna Larga	NM-9000.B_057	34.23 [d]	Not assessed	—	—	3/3A
Lagunitas Lake #1	NM-9000.B_063	7.9 [d]	Not assessed	—	—	3/3A
Lagunitas Lake #2	NM-9000.B_064	3.62 [d]	Not assessed	—	—	3/3A
Lagunitas Lake #3	NM-9000.B_065	12.22 [d]	Not assessed	—	—	3/3A
Nabor Creek (Rio Chamita to CO border)	NM-2116.A_111	2.86	Not assessed	—	—	3/3A
Nabor Lake	NM-2116.B_20	4 [d]	Not assessed	—	—	3/3A
Nacimiento Ck (Perennial prt Hwy 126 to San Gregorio Rsvr)	NM-2107.A_42	6.77	Source unknown	DWS ColdWAL	Aluminum, acute Turbidity Uranium	5/5A
Nutrias Lake A (Trout Lake A)	NM-2116.B_30	0.9 [d]	Not assessed	—	—	3/3A

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Nutrias Lake B (Trout Lake B)	NM-2116.B_31	1 [d]	Not assessed	—	—	3/3A
Nutrias Lake C (Trout Lake C)	NM-2116.B_32	4.0 [d]6	Not assessed	—	—	3/3A
Nutrias Lake D (Trout Lake D)	NM-2116.B_33	0.8 [d]	Not assessed	—	—	3/3A
Nutrias Lake E (Trout Lake E)	NM-2116.B_34	3.07 [d]	Not assessed	—	—	3/3A
Placer Creek (Hopewell Lake to headwaters)	NM-2112.A_03	2.38	Source unknown	HQColdWAL	Temperature, water	5/5A
Poleo Creek (Rio Puerco de Chama to headwaters)	NM-2116.A_023	7.97	Source unknown	HQColdWAL	Sedimentation/siltation	5/5A
Rio Brazos (Rio Chama to Chavez Creek)	NM-2116.A_080	3.82	Channelization Source unknown Dredging for navigation channels Loss of riparian habitat	HQColdWAL	Nutrient/eutrophication Biological indicators Temperature, water	5/5C
Rio Capulin(Rio Gallina to headwaters)	NM-2116.A_041	12.08	Source unknown	PC	Escherichia coli	4A

Source: NMED, 2014a

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[e] Acres

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Rio Cebolla (Fenton Lake to headwaters)	NM-2106.A_52	14.63	Source unknown Recreational pollution sources Aquaculture (permitted) Road/bridge runoff Rangeland grazing	HQColdWAL	Aluminum Sedimentation/siltation Turbidity	5/5B
Rio Cebolla (Rio Chama to headwaters)	NM-2116.A_050	23.82	Not assessed	—	—	3/3A
Rio Chama (El Vado Reservoir to Rito de Tierra Amarilla)	NM-2116.A_003	7.66	Municipal point source discharges Recreational pollution sources Source unknown Road/bridge runoff Rangeland grazing Flow alterations from water diversions	HQColdWAL PC	Aluminum Escherichia coli Nutrient/eutrophication Biological indicators Temperature, water	5/5C
Rio Chama (Little Willow Creek to CO border)	NM-2116.A_002	8.97	Recreational pollution sources Impervious surface/parking lot runoff Road/bridge runoff Rangeland grazing	HQColdWAL	Temperature, water	4A
Rio Chama (Rio Brazos to Little Willow Creek)	NM-2116.A_001	13.2	Wildlife other than waterfowl Loss of riparian habitat Rangeland grazing Streambank modifications/destabilization Flow alterations from water diversions	HQColdWAL	Nutrient/eutrophication Biological indicators Temperature, water	4A

Source: NMED, 2014a

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DWS = Domestic water supply
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MWWAL = Marginal warmwater aquatic life
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— = No information provided (reach was not assessed).

Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Rio Chama (Rito de Tierra Amarilla to Rio Brazos)	NM-2116.A_000	6.93	Source unknown Flow alterations from water diversions	HQColdWAL PC	Aluminum Escherichia coli Nutrient/eutrophication Biological indicators Temperature, water	5/5A
Rio Chamita (Rio Chama to CO border)	NM-2116.A_110	12.9	Municipal point source discharges Recreational pollution sources Aquaculture (permitted) Wildlife other than waterfowl Wastes from pets Loss of riparian habitat Road/bridge runoff Rangeland grazing Streambank modifications/destabilization Urban runoff/storm sewers Flow alterations from water diversions	HQColdWAL PC	Ammonia (un-ionized) Escherichia coli Nutrient/eutrophication Biological indicators Temperature, water	4A
Rio de las Vacas (Clear Creek to headwaters)	NM-2106.A_46	10.34	Source unknown	HQColdWAL	Aluminum	5/5B
Rio de los Pinos (New Mexico reaches)	NM-2120.A_900	21.21	Source unknown Rangeland grazing	HQColdWAL	Temperature, water	4A
Rio Gallina (Perennial prt Rio Chama to Hwy 96)	NM-2115_10	24.32	Not assessed	—	—	3/3A

Source: NMED, 2014a

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HQColdWAL = High quality coldwater aquatic life
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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Rio Nutrias (Perennial prt Rio Chama to headwaters)	NM-2116.A_060	34.57	Crop or dry land construction Source unknown Loss of riparian habitat Rangeland grazing Streambank modifications/destabilization	PC HQColdWAL	Escherichia coli Temperature, water Turbidity	5/5A
Rio Ojo Caliente (Rio Chama to Rio Vallecitos)	NM-2113_10	34.91	Source unknown	WWAL ColdWAL	Nutrient/eutrophication Biological indicators	5/5C
Rio Puerco (Perennial prt northern bnd Cuba to headwaters)	NM-2107.A_44	14.48	Source unknown	ColdWAL	Sedimentation/Siltation	5/5A
Rio Puerco de Chama (Abiquiu Reservoir to Hwy 96)	NM-2115_20	13.58	Channelization On-site treatment systems (septic) Source unknown Loss of riparian habitat Impervious surface/parking lot runoff Road/bridge runoff Rangeland grazing	WWAL ColdWAL PC	Escherichia coli Nutrient/eutrophication Biological indicators Temperature, water	5/5C
Rio San Antonio (CO border to Montoya Canyon)	NM-2120.A_902	11.83	Source unknown	HQColdWAL	Oxygen, dissolved Temperature, water	5/5C

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Page 9 of 12

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Rio San Antonio (Montoya Canyon to headwaters)	NM-2120.A_901	17.92	Waterfowl Livestock (grazing or feeding operations) Recreational pollution sources Source unknown Wildlife other than waterfowl Road/bridge runoff Streambank modifications/destabilization	HQColdWAL PC	Escherichia coli Oxygen, dissolved Temperature, water	5/5C
Rio Tusas (Perennial prt Rio Vallecitos to headwaters)	NM-2113_30	42.74	Crop or dry land construction Livestock (grazing or feeding operations) On-site treatment systems (septic) Road/bridge/infrastructure construction Wildlife other than waterfowl Wastes from pets Impervious surface/parking lot runoff Rangeland grazing	WWAL ColdWAL	Nutrient/eutrophication Biological indicators	4A
Rio Vallecitos (Rio Tusas to headwaters)	NM-2112.A_00	35.01	Irrigated crop production Rangeland grazing	HQColdWAL	Temperature, water	4A
Rito de las Palomas (Rio de las Vacas to headwaters)	NM-2106.A_43	5.58	Source unknown Loss of riparian habitat Road/bridge runoff Rangeland grazing Streambank modifications/destabilization	HQColdWAL	Sedimentation/siltation Temperature, water Turbidity	5/5A

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Page 10 of 12

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Rito de los Indios (San Antonio Creek to headwaters)	NM-2106.A_24	4.47	Source unknown	HQColdWAL	Aluminum	5/5C
Rito de los Pinos (Arroyo San Jose to headwaters)	NM-2107.A_45	8.78	Not assessed	—	—	3/3A
Rito de Tierra Amarilla (Hwy 64 to headwaters)	NM-2116.A_072	4.97	Source unknown	HQColdWAL	Aluminum, chronic Temperature, water	5/5C
Rito de Tierra Amarilla (Rio Chama to Hwy 64)	NM-2116.A_070	15.78	Source unknown Loss of riparian habitat Road/bridge runoff Rangeland grazing Streambank modifications/destabilization	HQColdWAL	Sedimentation/siltation Specific conductance Temperature, water Turbidity	5/5C
Rito Encino (Rio Puerco de Chama to headwaters)	NM-2116.A_021	9.85	Source unknown	PC HQColdWAL	Escherichia coli Sedimentation/siltation	5/5A
Rito Penas Negras (Rio de las Vacas to headwaters)	NM-2106.A_42	11.8	Source unknown Loss of riparian habitat Road/bridge runoff Rangeland grazing Streambank modifications/destabilization	HQColdWAL	Nutrient/eutrophication Biological indicators Sedimentation/siltation Temperature, water Turbidity	5/5C
Rito Resumidero (Perennial prt R Puerco de Chama to the hws)	NM-2116.A_025	2.75	Source unknown	HQColdWAL	Low flow alterations	4C

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

Page 11 of 12

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (miles [a])	Probable Sources of Pollutant	Uses Not Fully Supported [b]	Specific Pollutant	IR Category [c]
Santa Clara Creek (Santa Clara Pueblo bnd to headwaters)	NM-2120.A_110	0.88	Not assessed	—	—	3/3A
Sexto Creek (Rio Chamita to CO border)	NM-2116.A_112	1.12	Source unknown	HQColdWAL	Temperature, water	5/5A
Tonita Lake	NM-2116.B_40	1 [d]	Not assessed	—	—	3/3A
West Fork Rio Brazos (Jicarilla Apache bnd to headwaters)	NM-2116.A_087	5.94	Not assessed	—	—	3/3A

Source: NMED, 2014a

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Table 5-8. Total Maximum Daily Load Status of Streams in the Rio Chama Water Planning Region

[d] Impairment (IR) categories are determined for each assessment unit (AU) by combining individual designated use support decisions.

The applicable unique assessment categories for New Mexico (NMED, 2013b) are described as follows:

Category 3: No reliable monitored data and/or information to determine if any designated or existing use is attained. AUs are listed in this category where data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology.

Category 3A: Limited data (n = 0 to 1) available, no exceedences. AUs are listed in this subcategory when there are no exceedences in the limited data set. These are considered low priority for follow up monitoring.

Category 4A: Impaired for one or more designated uses, but does not require development of a TMDL because TMDL has been completed. AUs are listed in this subcategory once all TMDL(s) have been developed and approved by USEPA that, when implemented, are expected to result in full attainment of the standard. Where more than one pollutant is associated with the impairment of an AU, the AU remains in IR Category 5A (see below) until all TMDLs for each pollutant have been completed and approved by USEPA.

Category 4C: Impaired for one or more designated uses, but does not require development of a TMDL because impairment is not caused by a pollutant. AUs are listed in this subcategory if a pollutant does not cause the impairment. For example, USEPA considers flow alteration to be “pollution” vs. a “pollutant.”

Category 5/5A: Impaired for one or more designated or existing uses and a TMDL is underway or scheduled. AUs are listed in this category if the AU is impaired for one or more designated uses by a pollutant. Where more than one pollutant is associated with the impairment of a single AU, the AU remains in Category 5A until TMDLs for all pollutants have been completed and approved by U.S. EPA.

Category 5/5B: Impaired for one or more designated or existing uses and a review of the water quality standard will be conducted. AUs are listed in this category when it is possible that water quality standards are not being met because one or more current designated uses are inappropriate. After a review of the water quality standard is conducted, a use attainability analysis (UAA) will be developed and submitted to U.S. EPA for consideration, or the AU will be moved to Category 5A and a TMDL will be scheduled.

Category 5/5C: Impaired for one or more designated or existing uses and additional data will be collected before a TMDL is scheduled. AUs are listed in this category if there are not enough data to determine the pollutant of concern or there are not adequate data to develop a TMDL. For example, AUs with biological impairment will be listed in this category until further research can determine the particular pollutant(s) of concern. When the pollutant(s) are determined
the AU will be moved to Category 5A and a TMDL will be scheduled. If it is determined that the current designated uses are inappropriate, it will be moved to Category 5B and a UAA will be developed. If it is determined that “pollution” is causing the impairment (vs. a “pollutant”), the AU will be moved to Category 4C.

NPDES-permitted discharges in the planning region are summarized in Table 5-9 and shown on Figure 5-14; details regarding NPDES permits in New Mexico are available on the NMED's website (http://www.nmenv.state.nm.us/swqb/Permits/). The permitted discharges include two public wastewater treatment plants and one fish hatchery. These do not necessarily pose a significant water quality problem.

A summary list of current groundwater discharge permits in the planning region is provided in Table 5-10; their locations are shown in Figure 5-14. Details indicating the status, waste type, and treatment for discharge permits for industrial and domestic waste can be obtained from the NMED Ground Water Quality Bureau website (https://www.env.nm.gov/gwb/NMED-GWQB-PollutionPrevention.htm#PPSlist).

5.4.1.2 Remediation Sites

No sites listed by the U.S. EPA (2014) as Superfund sites are present in the region; thus Table 5-11 is not provided in this regional water plan update for the Rio Chama Water Planning Region.

Sites undergoing investigation or cleanup pursuant to other federal authorities or state authority can be found on the EPA website (https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#NM).

5.4.1.3 Leaking Underground Storage Tanks

Leaking underground storage tank (UST) sites present a potential threat to groundwater, and the NMED maintains a database of registered USTs. Many of the facilities included in the UST database are not leaking and even leaking USTs may not necessarily have resulted in groundwater contamination or water supply well impacts. These USTs could, however, potentially impact groundwater quality in and near the population centers in the future. UST sites in the Rio Chama region are identified on Figure 5-14. Most of the sites are near Chama and Tierra Amarilla. Many of the UST sites listed in the NMED database require no further action and are not likely to pose a water quality threat. Sites that are being investigated or cleaned up by the state or a responsible party, as identified on Table 5-12, should be monitored for their potential impact on water resources.

Additional details regarding any groundwater impacts and the status of site investigation and cleanup efforts for individual sites can be obtained from the NMED database, which is accessible on the NMED website (https://www.env.nm.gov/ust/lists.html).

Table 5-9. Municipal and Industrial NPDES Permittees in the Rio Chama Water Planning Region

Permit No	Municipality/Industry [a]	Permit Type [b]
Rio Arriba County		
NM0024830	Abiquiu MDWCA & MSWA	Municipal (POTW)
NM0027731	Chama, Village of/WWTP	Municipal (POTW)
NM0030139	NMG&FD/Los Ojos State Fish Hatchery [c, d]	Fish hatchery

Source: NMED, 2016c

[a] Names appear as listed in the NMED database.

[b] Facilities and activities covered under the 2015 U.S. EPA NPDES Multi-Sector General Permit (MSGP) for Stormwater Discharges Associated with Industrial Activity (e.g., mining, timber products, scrap recycling facilities, as listed in Appendix D of the MSGP [U.S. EPA, 2015]) are not included due to the large number of facilities.

[c] Major discharger, classified as such by the Regional Administrator, or in the case of approved state programs, the Regional Administrator in conjunction with the State Director. Major municipal dischargers include all facilities with design flows of greater than 1 million gallons per day and facilities with U.S. EPA/State approved industrial pretreatment programs. Major industrial facilities are determined based on specific ratings criteria developed by U.S. EPA/State.

[c] NMED lists two outfall locations

NPDES = National Pollutant Discharge and Elimination System
MDWCA = Mutual domestic water consumers association
MSWA = Municipal sewer and water association
POTW = Publicly owned treatment works
WWTP = Wastewater treatment plant
NMG&FD = New Mexico Game and Fish
U.S. EPA = U.S. Environmental Protection Agency

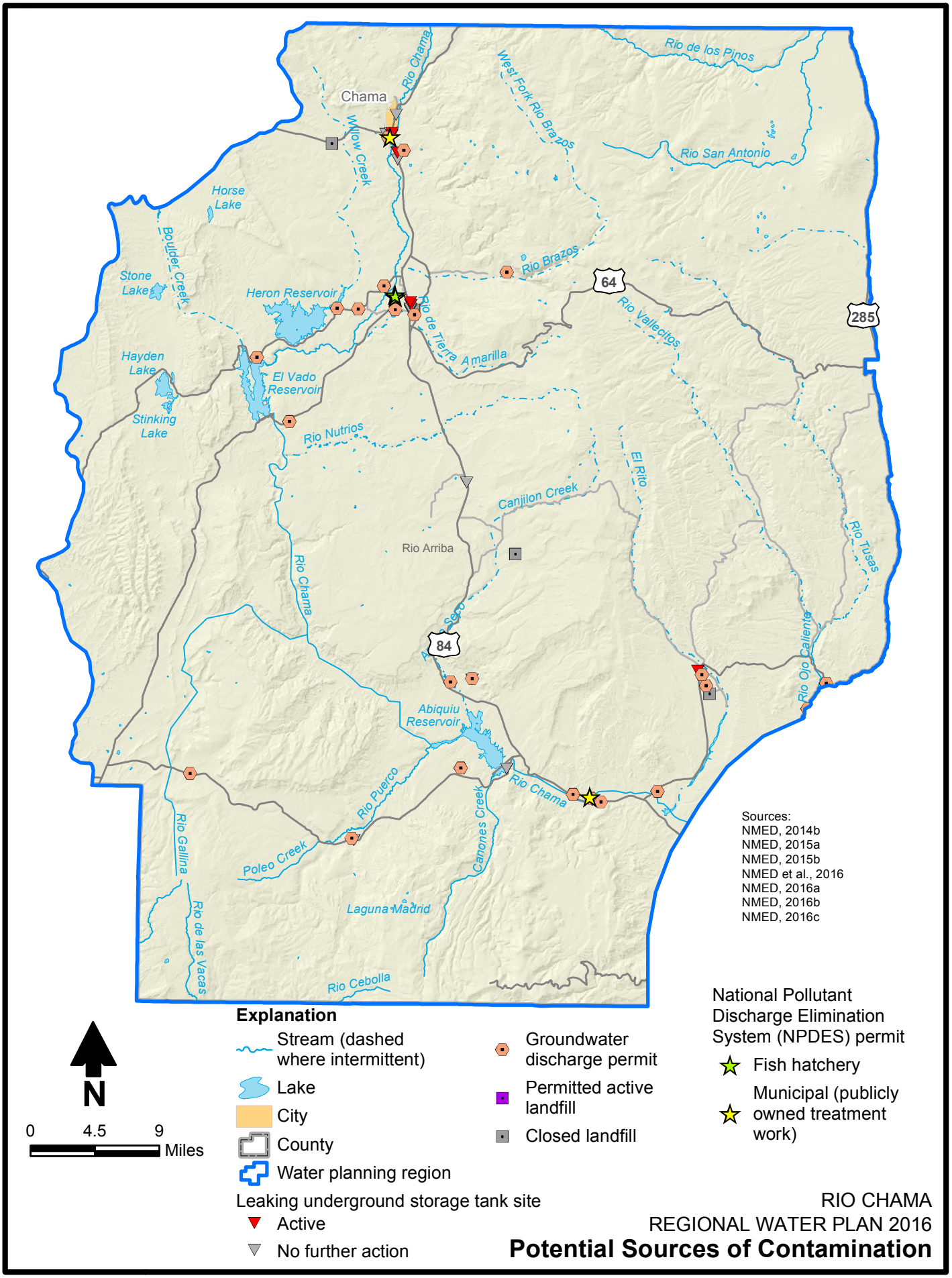

Chama
Rio Chama
West Fork Rio Brazos
Rio de los Pinos
Rio San Antonio
Willow Creek
Horse Lake
Boulder Creek
Stone Lake
Heron Reservoir
Rio Brazos
64
285
Rio Vallecitos
Rio de Tierra Amarilla
Hayden Lake
El Vado Reservoir
Stinking Lake
Rio Nutrios
El Rito
Canjilon Creek
Rio Arriba
Rio Tusas
Rio Chama
84
Rio Ojo Caliente
Abiquiu Reservoir
Rio Puerco
Rio Chama
Rio Gallina
Poleo Creek
Canones Creek
Laguna Madrid
Rio de las Vacas
Rio Cebolla
N
0
4.5
9
Miles
Explanation
Stream (dashed where intermittent)
Lake
City
County
Water planning region
Leaking underground storage tank site
Active
No further action
Groundwater discharge permit
Permitted active landfill
Closed landfill
National Pollutant Discharge Elimination System (NPDES) permit
Fish hatchery
Municipal (publicly owned treatment work)
Sources:
NMED, 2014b
NMED, 2015a
NMED, 2015b
NMED et al., 2016
NMED, 2016a
NMED, 2016b
NMED, 2016c
RIO CHAMA
REGIONAL WATER PLAN 2016
Potential Sources of Contamination
S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_2016\RIO_CHAMA\FIG5-14_CONTAM_SOURCES.MXD 6/3/2016

Figure 5-14

Table 5-10. Groundwater Discharge Permits in the Rio Chama Water Planning Region

County	Facility Name [a]	Permit No.	Status	Permitted Discharge Amount (gpd)
Rio Arriba	Abiquiu (Village of) - Wastewater Treament Plant	DP-1114	Active	44,000
	Abiquiu Elementary School	DP-1646	Active	4,200
	Chama (Village of) - Wastewater Treament Plant	DP-248	Active	325,000
	Corkins Lodge	DP-1661	Active	3,750
	Coyote Elementary	DP-448	Active	2,800
	El Rito Elementary School	DP-1701	Active	4,200
	Escalante High School	DP-1546	Active	10,750
	Gallina Elementary School	DP-441	Active	15,000
	Ghost Ranch Conference Center	DP-869	Active	33,750
	Heron Lake State Park	DP-1426	Active	3,300
	Mesa Vista Schools	DP-1504	Active	9,000
	Naturally NM Food Products	DP-1526	Active	750
	New Mexico Department of Game and Fish Los Ojos Fish Hatchery	DP-481	Active	3,450
	Rio Arriba (County of) - Rural Events Center	DP-1359	Active	6,000
	Rio Arriba County Adult Detention Center	DP-730	Active	16,900
	Stone House Lodge	DP-1743	Active	3,310
	The Abiquiu Inn and Cafe Abiquiu	DP-1597	Active	4,200
	USACE Abiquiu Lake Recreation Area	DP-1653	Active	—

Source: NMED, 2014b, 2016b, NMED et al., 2016

gpd = Gallons per day

[a] Names appear as listed in the NMED database.

— = Not listed on GWQB web site

[b] Facilities with an NMED designated status of active or pending are shown. Inactive facilities are not included; they can be identified on the NMED website.

Table 5-12. Leaking Underground Storage Tank Sites in the Rio Chama Water Planning Region

City [a]	Release/Facility Name [b,c]	Release ID	Facility ID	Physical Address [c]	Status [d]
Rio Arriba County					
Chama	Chama Texaco	768	27303	Hwy 84	Aggr Cleanup Completed, Resp Party
	Conoco Svc Sta	2316	27498	3837 Hwy 64	Aggr Cleanup Completed, St Lead, CAF
	Lodge At Chama (Active)	3409	29116	Hwy 84	Cleanup, Responsible Party
	Lodge at Chama (Former)	3389	29116	Hwy 84	Investigation, Responsible Party
	Sundial Deli-Mart #5	2971	30821	Hwy 84 and 64	Cleanup, Responsible Party
Tierra Amarilla	T A Army Radar Station	3393	31121	12 Miles S of	Referred to Surface Water Quality Bureau
	Chama Valley Schools	2328	27304	PO Drawer 10	Referred to Ground Water Quality Bureau
	NMDOT Tierra Amarilla Patrol Yard 45 62	225	26245	US 84 MM 273 3	Aggr Cleanup Completed, Resp Party
La Madera	La Pasada Store	822	28404	491 State Rd 111	Investigation, Responsible Party
El Rito	El Llano Mercantile	2731	27869	Hwy 554	Cleanup, Responsible Party
Abiquiu	Bode(Karl) Gen Merch	1355	27001	21196 US Hwy 84	Aggr Cleanup Completed, Resp Party

Source: NMED, 2014b, 2016a; NMED et al., 2016

[a] Determined according to latitude/longitude information in NMED database. In some cases this information was inconsistent with the facility address, and where such an inconsistency was identified, county and city were instead determined based on the facility address.

[b] Sites with No Further Action status (release considered mitigated) are not included. Information regarding such sites can be found on the NMED website (http://www.nmenv.state.nm.us/ust/lists.html

[c] Information appears as listed in the NMED database.

[d] Pre-Investigation, Suspected Release: Release not confirmed by definition
Pre-Investigation, Confirmed Release: Confirmed release as by definition
Investigation: Ongoing assessment of environmental impact
Cleanup: Physical removal of contamination ongoing
Aggressive Cleanup Completed (Aggr Cleanup Completed): Effective removal of contamination complete
Responsible Party (Resp Party): Owner/Operator responsible for mitigation of release
State Lead: State has assumed responsibility for mitigation of release
Federal Facility: Responsibility under the Federal Govt
CAF: Corrective action fund

5.4.1.4 Landfills

Landfills used for disposal of municipal and industrial solid waste often contain a variety of potential contaminants that may impact groundwater quality. Landfills operated since 1989 are regulated under the New Mexico Solid Waste Management Regulations. Many small landfills throughout New Mexico, including landfills in the planning region, closed before the1989 regulatory enactment to avoid more stringent final closure requirements. Other landfills have closed as new solid waste regulations became effective in 1991 and 1995. Within the planning region, there are no operating landfills and four closed landfills (two of which are in approximately the same location) (Table 5-13; Figure 5-13).

Table 5-13. Landfills in the Rio Chama Water Planning Region

County	Landfill Name [a]	Landfill Operating Status	Landfill Closure Date
Rio Arriba	Canjilon Landfill	Closed	—
	Chama Landfill	Closed	—
	El Rito Landfill	Closed	—
	Tierra Amarilla Landfill	Closed	—

Sources: NMED, 2014b, 2015a, 2015b; RCAA and Rio Arriba County, 2006. — = Information not available

[a] Names appear as listed in the NMED database.

5.4.1.5 Nonpoint Sources

As noted above, a primary water quality concern in the planning region is groundwater contamination due to septic tanks. In areas with shallow water tables or in karst terrain, septic system discharges can percolate rapidly to the underlying aquifer and increase concentrations of (NMWQCC, 2002):

- Total dissolved solids (TDS)
- Iron, manganese, and sulfides (anoxic contamination)
- Nitrate
- Potentially toxic organic chemicals
- Bacteria, viruses, and parasites (microbiological contamination)

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 the single largest known source of groundwater contamination in New Mexico (NMWQCC, 2002), with many of these occurrences in areas with shallow water tables. The accepted regional water plan identified septic contamination in the Chamita and El Guache-Hernandez areas as a concern (RCAA and Rio Arriba County, 2006).

Other nonpoint sources of pollutants that are concerns for surface water quality in the planning region include wildfires, grazing, agriculture, recreation, flow alterations, streambank destabilization/modification, wildlife, removal of riparian vegetation, road and bridge runoff, silvicultural activities, land disposal, resource extraction, and natural and unknown sources.

One approach to addressing nonpoint source pollution is through Watershed Based Planning or other watershed restoration initiatives that seek to restore riparian health and to address sources of contamination. NMED encourages cooperative planning efforts in watersheds where TMDLS are established (https://www.env.nm.gov/swqb/wps/WBP/index.html). In the Rio Chama region, a Watershed Restoration Action Strategy (WRAS) prepared under an NMED grant identified nonpoint source issues and proposed remediation (Rio Chama Watershed Groups, 2005). The water quality concerns addressed by the WRAS include turbidity, stream bottom deposits, temperature, dissolved oxygen, aluminum, ammonia, phosphorus, specific conductance, and fecal coliform. A number of watershed restoration projects were recommended, including fuels reduction projects, riparian corridor enhancements such as fencing, streambank stability projects, wastewater treatment, vegetation management, grazing management, and off-road vehicle management.

5.5 Administrative Water Supply

The *Handbook* describes a common technical approach (referred to there as a *platform)* for analyzing the water supply in all 16 water planning regions in a consistent manner. As discussed in the Handbook (NMISC, 2013b), many methods can be used to account for supply and demand, but some of the tools for implementing these analyses are available for only parts of New Mexico, and resources for developing them for all regions are not currently available. Therefore, the State has developed a simple method that can be used consistently across all regions to assess supply and demand for planning purposes. The use of this consistent method will facilitate efficient development of a statewide overview of the balance between supply and demand in both normal and drought conditions, so that the State can move forward with planning and funding water projects and programs that will address the regions' and State's pressing water issues.

The method to estimate the available supply, referred to as *the administrative water supply in the Handbook*, is based on withdrawals of water as reported in the *New Mexico Water Use by Categories 2010* report, which provide a measure of supply that considers both physical supply and legal restrictions (i.e., the water is physically available, and its use is in compliance with water rights policies) and thus reflects the amount of water available for use by a region. An estimate of supply during future droughts is also developed by adjusting the 2010 withdrawal data based on physical supplies available during historical droughts, as discussed in Section 5.5.2.

5.5.1 2010 Administrative Water Supply

The administrative water supply (i.e., total withdrawals) in 2010 for the Rio Chama region, as reported in the *New Mexico Water Use by Categories 2010* report (Longworth et al.,2013), was 98,085 acre-feet. Of this total, 95,362 acre-feet were surface water withdrawals and 2,723 acre-feet were groundwater. The breakdown of these withdrawals among the various categories of use detailed in the *New Mexico Water Use by Categories 2010 report* is discussed in Section 6.1. The largest sector of use of the administrative water supply is irrigated agriculture, followed by reservoir evaporation. Because the NMOSE tracks reservoir evaporation in the location of the reservoir, it is recorded as in the Rio Chama region. However, legal rights to water released from reservoirs in the region are held primarily by downstream users and most of the storage in these reservoirs (i.e., Heron, El Vado, Abiquiu) is not available for use in the Rio Chama region.

5.5.2 Drought Supply

The variability in surface water supply from year to year is a better indicator of how vulnerable a planning region is to drought in any given year or multi-year period than is the use of long-term averages. As discussed in Section 5.1.1, the PDSI is an indicator of whether drought conditions exist and if so, what the relative severity of those conditions is. For the two climate divisions present in the Chama region (Divisions 1 and 2, the latter of which covers almost the entire region), the PDSI classifications for 2010 were near normal. Given that the water use data for 2010 represent a normal year, it cannot be assumed that this supply will be available in all years; it is important that the region also consider potential water supplies during drought periods.

There is no established method or single correct way of quantifying a drought supply given the complexity associated with varying levels of drought and constantly fluctuating water supplies. For purposes of having an estimate of drought supplies for regional and statewide water planning, the State has developed and applied a method for regions with both stream-connected and non-stream-connected aquifers. The method adopted for stream-connected aquifers is described below:

- The drought adjustment is applied only to the portion of the administrative water supply that derives from surface water, as it is assumed that groundwater supplies will be available during drought due to the relatively stable thicknesses of groundwater aquifers that are continuously recharged through their connection to streams. While individual wells may be depleted due to long-term drought, this drought adjustment does not include an evaluation of diminished groundwater supplies. Surface water provides 97 percent of the water supply in the Rio Chama region, and thus the region is particularly vulnerable to drought.
- The minimum annual yield for key stream gages on mainstem drainages (Table 5-4b) was compared to the 2010 yield, and the gage with the lowest ratio of minimum annual yield to 2010 yield was selected.

- The 2010 administrative surface water supply for the region was then multiplied by that lowest ratio to provide an estimate of the surface water supply adjusted for the maximum drought year of record.

For the Rio Chama region, the gage with the minimum ratio of annual yield to 2010 yield is the Rio Chama at La Puente, with a ratio of 0.15 for minimum annual yield (33,447 acre-feet in 2002) to 2010 yield (230,222) (USGS, 2014c). Based on the region's total administrative surface water supply of 95,362 acre-feet (Section 5.5.1), the drought-adjusted surface water supply is 14,304 acre-feet. With the 2,723 acre-feet of groundwater supply, the total drought supply is 17,027 acre-feet, or about 17 percent of a normal year administrative water supply.

Though the adjustment is based on the minimum year of streamflow recorded to date, it is possible that drought supplies could be even lower in the future. Additionally, water supplies downstream of reservoirs may be mitigated by reservoir releases in early drought phases, while longer-term droughts can potentially have greater consequences. This approach does not evaluate mitigating influences of reservoir storage in early phases of a drought when storage is available, or potential development of new groundwater supplies. Nonetheless, the adjusted drought supply provides a rough estimate of supply during a severe to extreme drought year.

6. Water Demand

To effectively plan for meeting future water resource needs, it is important to understand current use trends as well as future changes that may be anticipated. This section includes a summary of current water use by category (Section 6.1), an evaluation of population and economic trends and projections of future population (Sections 6.2 and 6.3), a discussion of the approach used to incorporate water conservation in projecting future demand (Section 6.4), and projections of future water demand (Section 6.5).

Four terms frequently used when discussing water throughout this plan have specific definitions related to this RWP:

- *Water use* is water withdrawn from a surface or groundwater source for a specific use. In New Mexico water is accounted for as one of the nine categories of use in the *New Mexico Water Use by Categories 2010* report prepared by the NMOSE.

- *Water withdrawal* is water diverted or removed from a surface or groundwater source for use.

- *Administrative water supply* is based on the amount of water withdrawals in 2010 as outlined in the *New Mexico Water Use by Categories 2010* report.

- *Water demand* is the amount of water needed at a specified time.

6.1 Present Uses

The most recent assessment of water use in the region was compiled by NMOSE for 2010, as discussed in Section 5.5. The *New Mexico Water Use by Categories 2010* report (Longworth et al., 2013) provides information on total withdrawals for nine categories of water use:

- Public water supply
- Domestic (self-supplied)
- Irrigated agriculture
- Livestock (self-supplied)
- Commercial (self-supplied)
- Industrial (self-supplied)
- Mining (self-supplied)
- Power (self-supplied)
- Reservoir evaporation

The total surface water and groundwater withdrawals in the Rio Chama region for each category of use are shown on Table 6-1 and Figure 6-1.

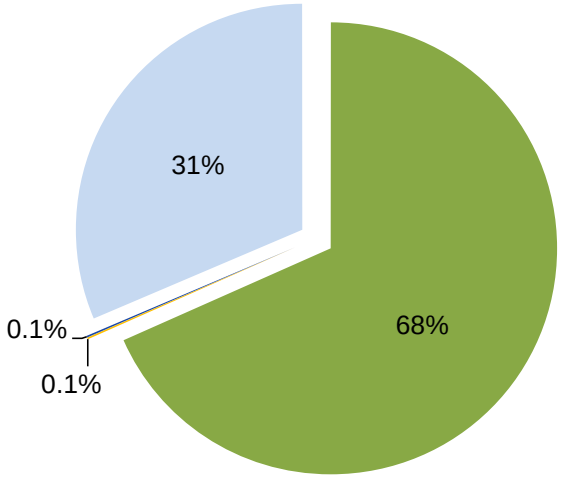
Table 6-1. Total Withdrawals in the Rio Chama Water Planning Region in 2010

Water Use Category	Withdrawals (acre-feet) [a]		
	Surface Water	Groundwater	Total
Commercial (self-supplied)	0	1,132	1,132
Domestic (self-supplied)	0	52	52
Industrial (self-supplied)	0	0	0
Irrigated agriculture	65,181	1,046	66,228
Livestock (self-supplied)	116	132	248
Mining (self-supplied)	0	0	0
Power (self-supplied)	0	0	0
Public water supply	112	364	476
Reservoir evaporation	29,952	0	29,952
Total	95,362	2,726	98,088

Source: Longworth et al., 2013

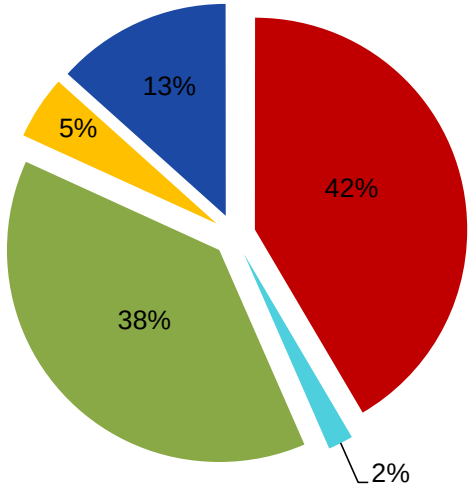
[a] Tribes and pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this table.

Surface Water



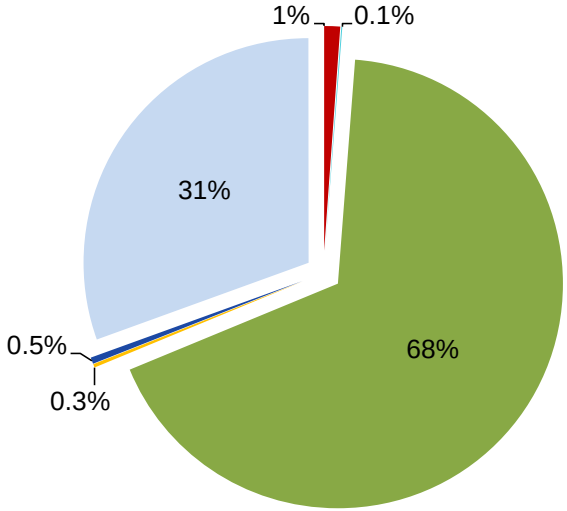
Total usage: 95,362 acre-feet

Groundwater



Total usage: 2,726 acre-feet

Total



Total usage: 98,087 acre-feet

Explanation

- Commercial (self-supplied)
- Domestic (self-supplied)
- Industrial (self-supplied)
- Irrigated agriculture
- Livestock (self-supplied)
- Mining (self-supplied)
- Power (self-supplied)
- Public water supply
- Reservoir evaporation

Source: Longworth et al., 2013

Notes:
1. Only categories with usage above 0.1% are shown.
2. Tribes and pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this figure.

Figure 6-1

RIO CHAMA
REGIONAL WATER PLAN 2016

Rio Arriba County Water Demand, 2010

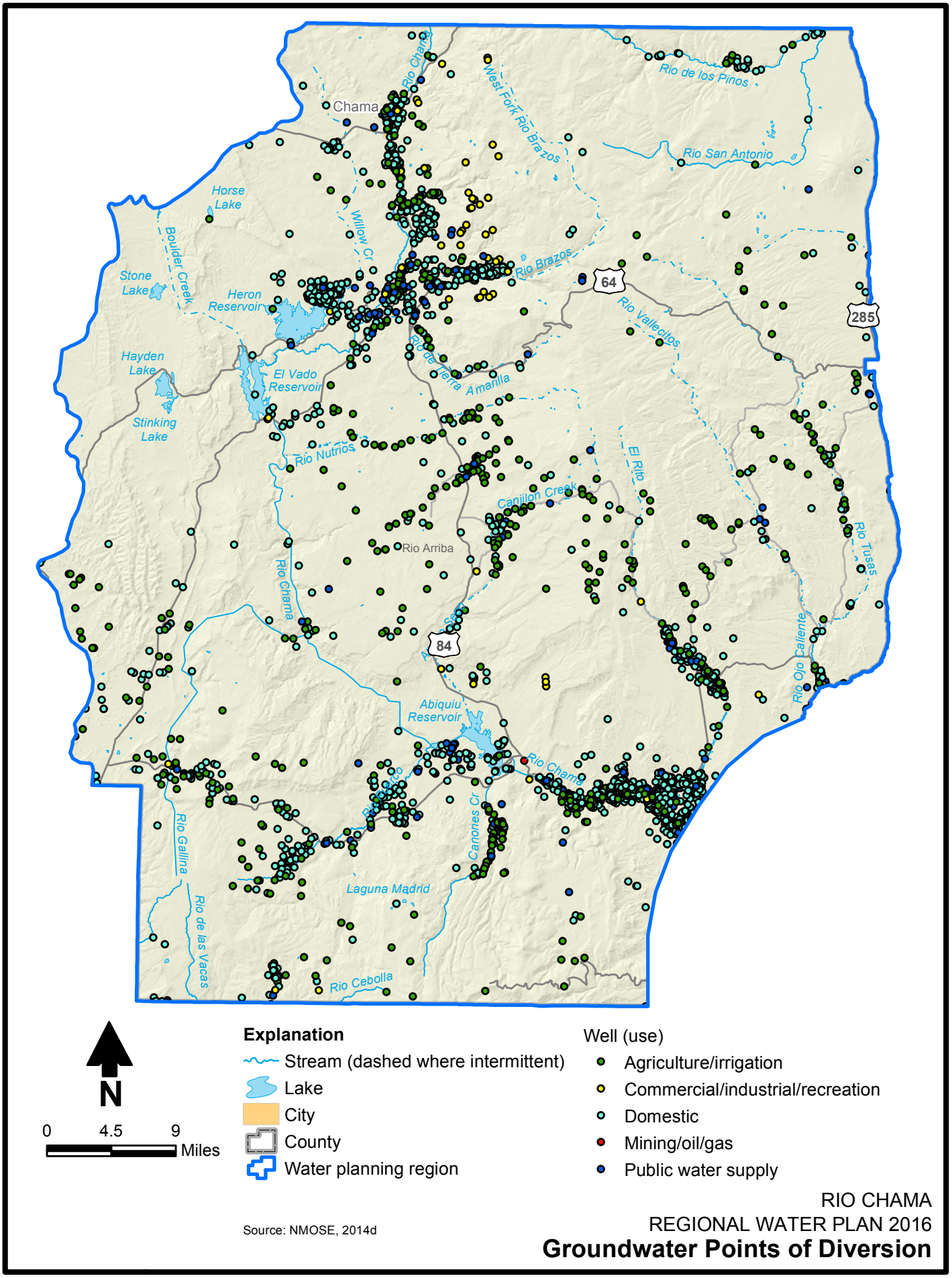
As discussed previously, the vast majority of the water use in the region is provided by surface water, with groundwater diversions in 2010 representing less than 3 percent of the total diversions. The predominant water use in 2010 was for irrigated agriculture (68 percent of total diversion). Reservoir evaporation was the second largest use at 31 percent of the total use. The three large reservoirs in the region, Heron, El Vado, and Abiquiu, primarily store water for use outside of the region. Though the reservoirs benefit downstream users, for reservoirs with a capacity exceeding 5,000 acre-feet the NMOSE accounts for reservoir evaporation based on the location of the reservoir and this category is therefore reflected in Table 6-1 and Figure 6-1.

Most of the groundwater diversion in the region is for commercial use, followed by irrigated agriculture and public water supply. Groundwater also supplies some livestock and domestic wells. Groundwater points of diversion are shown in Figure 6-2.

The categories included in the *New Mexico Water Use by Categories 2010* report and shown on Figure 6-1 and Table 6-1 represent the major demands in the planning region. Tribes and Pueblos in New Mexico are not required to provide water use data to the State; therefore, tribal water use data are not necessarily reflected in this plan. There are also some unquantified additional categories of water use, including riparian evapotranspiration and instream flow.

- *Riparian evapotranspiration:* Some research and estimates have been made for riparian evapotranspiration in selected areas, such as along the middle and lower Rio Grande (Thibault and Dahm, 2011; Coonrod and McDonnell, Undated; Bawazir et al., 2009), but riparian evapotranspiration has not been quantified statewide. The New Mexico Water Resources Research Institute is currently developing those estimates but the results are not yet available. Though riparian evapotranspiration is anticipated to consume a relatively large quantity of water statewide, it will not affect the calculation of the gap between supply and demand using the method in this report, because the gap reflects the difference between future anticipated demands and present uses, and if both present and future uses do not include the riparian evapotranspiration category, then the difference will not be affected. The only impact to the gap calculation would be if evapotranspiration significantly changes in the future. There is potential for such a change due to warming temperatures, but anticipated changes have not been quantified and would be subject to considerable uncertainty. Anticipated changes in riparian and stream evapotranspiration are areas that should be considered in future regional and state water plan updates.

- *Instream flow:* The analysis of the gap between supply and demand relies on the largest use categories that reflect withdrawals for human use or reservoir storage that allows for withdrawals downstream upon release of the stored water. It is recognized that there is also value in preserving instream water for ecosystem and habitat and tourism purposes. Though this value has not been quantified in the supply/demand gap calculation, it may still be an important use in the region, and if the region chooses, it may recommend instream flow protections in its policy, program, and project recommendations.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Canjilon Creek
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Rio Chama
Rio Tusas
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Rio Gallina
Canones Cr
Laguna Madrid
Rio de las Vacas
Rio Cebolla
N
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9
Miles
Explanation
Stream (dashed where intermittent)
Lake
City
County
Water planning region
Well (use)
Agriculture/irrigation
Commercial/industrial/recreation
Domestic
Mining/oil/gas
Public water supply
Source: NMOSE, 2014d
RIO CHAMA
REGIONAL WATER PLAN 2016
Groundwater Points of Diversion
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Figure 6-2

In addition to the special conditions listed above, the 2010 data provided in the *New Mexico Water Use by Categories 2010* report are available for withdrawals only; depletions have not been quantified. In many cases, some portion of diverted water returns to surface or groundwater, for example from agricultural runoff or seepage or discharge from a wastewater treatment plant. In those locations where there is such return flow, the use of withdrawal data for planning purposes will add a margin of safety; thus the use of withdrawal data is a conservative approach for planning purposes.

6.2 Demographic and Economic Trends

To project future water demands in the region, it is important to first understand demographics, including population growth and economic and land use trends as detailed below. The information provided in this section was obtained primarily from telephone interviews with government officials and other parties with knowledge of demographic and economic trends in the Rio Chama region; the list of interviewees is provided in Appendix 6-A. The information in this section was used to project population, economic growth, and future water demand, as presented in Sections 6.3 and 6.5.

The 2013 population of Rio Arriba County was 40,072 (U.S. Census Bureau, 2014a). Historically, the population of Rio Arriba County has generally increased over time. Population increased from 13,777 in 1900 to 25,352 in 1940. The population held steady between 1940 and 1970, before showing steady growth from 1970 to 2000, during which time it increased by 63.7 percent. As shown in Table 3-1a, however, the population of Rio Arriba County decreased by 2.3 percent from 2000 to 2010 and by 0.4 percent from 2010 to 2013.

The economy of Rio Arriba County has traditionally been driven by agriculture, tourism, and government employment, including Los Alamos National Laboratory. The largest employment categories are education/healthcare, professional, scientific, and management, tourism-related services (arts, entertainment, recreation, hospitality, food services), and public administration.

Persons interviewed during preparation of this regional water plan update concur that the recovery from the recession has been slow and that no major increases in economic activity are anticipated in the foreseeable future. Wage and salary employment has generally decreased since 2006 and stood at $16,979 in 2013.

The Arrowhead Center at New Mexico State University (NMSU) analyzed the economy of Rio Arriba County and identified the basic industries that support the economy (Arrowhead Center, 2013). Basic industries bring outside dollars into the economy. A basic industry frequently has a location quotient (LQ) greater than 1.0, which means that its relative share of the local economy is greater than that industry's relative share of the state economy. In Rio Arriba County, the primary basic industries in 2011 were agriculture (LQ of 3.57), government (LQ of 1.60), and arts, entertainment, and recreation (LQ of 1.19). Despite its importance as an

economic driver and in water use, agriculture now accounts for less than 9 percent of all employment within the county.

According to the Census of Agriculture, the most valuable agricultural commodities in Rio Arriba County are cattle and calves, and hay, fruit, tree nuts, berries, and vegetables and melons (USDA NASS, 2014). The number of farms and ranches increased by 44.2 percent, from 1,312 in 2007 to 1,892 in 2012, while the amount of land in farms and ranches declined by 1.9 percent, from 1,460,186 acres to 1,432,897 acres. As a result, the average farm size decreased from 1,113 acres to 757 acres, a decline of 32.0 percent. Also, during that same five-year period, irrigated acreage declined from 30,752 acres to 29,199 acres, a decrease of 5.1 percent, although the County Planning Director believes that some of this decrease is due to farms being considered as tribal land and not counted in the agricultural census. In 2012, the average payment to a farmer participating in agricultural support programs was $4,643, up from $3,675 in 2007, an increase of 26 percent. Total government payments to farmers in Rio Arriba County were $1,277,000 in 2012, an increase of 295 percent over the $323,000 distributed in 2007. The average farm had a net cash operating loss of $1,791. The average age of a farmer in 2012 was 61.2.

Farmers are canceling their farm bill cost share conservation program contracts due to a lack of water. The drought has also had a significant impact on cattle herds in Rio Arriba County. The rangeland is not producing much grass, and because so little hay is available, the supply is limited and very expensive. Due to the drought, it is more difficult to lease ranchland, with many leases being canceled. Therefore, ranchers have sold off a large portion of their herds.

6.3 Projected Population Growth

The population projections for the 2006 Rio Chama Regional Water Plan (RCAA and Rio Arriba County, 2006) encompassed two forecasts, a high and a low, each covering the period from 2000 through 2040, and resulting in total projected population ranging from 11,218 to 22,278 in 2040. The Bureau of Business and Economic Research (BBER) at the University of New Mexico (UNM) has prepared county-level population forecasts using data and historical trends from 1960 up to the 2000 Census. BBER 2003 projections formed a basis for the low forecast in the water plan. The high forecast was based on the actual rate of growth between 1990 and 2000, which was a decade of relatively high growth.

An additional source of population forecasts for Rio Arriba County as a whole is the 2008 County Comprehensive Plan, which was revised in 2010 (Rio Arriba County, 2010). The plan projected that county-wide growth would occur at an annual rate of 0.87 percent from 2005 through 2030. No forecasts were included within the comprehensive plan for individual portions of the county; thus this forecast includes parts of the county that are not within the Rio Chama planning region.

Since 2006, the drought, the national recession that started in 2007, and a reduction in staff at Los Alamos National Laboratory have resulted in a loss of population, in contrast to the growth that had been forecast. The 2006 water plan did not include a forecast for 2010, so the forecasts in the plan cannot be specifically evaluated against the census data; however, since both the high and low forecasts anticipated a higher rate of growth from 2000 to 2010 than actually occurred, it is safe to say that the forecasts were overly optimistic, at least for the period through 2010. The BBER has continued to revise its population projections downward during the past 11 years to reflect slower growth than originally anticipated (BBER, 2012, 2008).

According to the 2010 Census, the population declined in most of the portions of the county that lie within the water planning region. The Chama Census County Division (CCD) saw a decline from 3,777 people in 2000 to 3,517 in 2010 (a loss of 6.9 percent). The Coyote CCD experienced a decline of 17.4 percent, from 1,559 in 2000 to 1,288 in 2010. And the Tierra Amarilla CCD also showed a loss over the decade, from 3,483 to 3,099, a decline of 11.0 percent.

Some officials in Rio Arriba County believe that the number of persons living on reservations and in rural areas in 2010 was undercounted and that the population actually grew between 2000 and 2010. However, if the population was undercounted in 2010, it is quite possible that it was also undercounted in 2000; thus, it is difficult to conclude that the population grew during that decade.

The consensus among those interviewed was that growth, if it occurs at all, will be slow over the next decade, as very little job creation is anticipated and there is a general lack of the infrastructure needed to support growth. A few hopeful developments include the introduction of broadband internet service into rural areas, potential growth in ridership at the Cumbres & Toltec Scenic Railroad, increases in artist studio tours, the availability of hunting guides to attract visitors, interest in real estate purchases in the Chama area, new wastewater systems in Chama and Tierra Amarilla, and the construction of a mini-incubator and commercial kitchen in Tierra Amarilla.

For the population projections through 2060 (Table 6-3), two population forecasts were developed: one based on a moderately optimistic view of the economy for this region over the long term and one that portrays a more pessimistic picture. The 2012 BBER population projections through 2040 could not be used as a starting point for the population projections because the Rio Chama region makes up such a small portion of the county. Instead, the BBER 2008 forecast for the region was used. This forecast projected a slow decline in population from 2005 to 2060, at rates varying from –0.11 percent to –0.54 percent.

The high population projections incorporate the 2008 BBER forecast, assuming a recovery from the recession and drought and some expansion of the tourism industry, as well as some economic diversification. Under the high forecast, the population of the county will slowly decline and reach 5,752 in 2060 (Table 6-3).

Table 6-3. Rio Chama Water Planning Region Population Projections July 1, 2010 to July 1, 2060

a. Annual Growth Rate

County	Projection	Growth Rate (%)				
		2010-2020	2020-2030	2030-2040	2040-2050	2050-2060
Rio Arriba	High	–0.17	–0.26	–0.50	–0.45	–0.27
	Low	–1.10	–1.10	–1.10	–1.10	–1.10

b. Projected Population

County	Projection	Population					
		2010	2020	2030	2040	2050	2060
Rio Arriba	High	6,792	6,677	6,508	6,186	5,911	5,752
	Low	6,792	6,080	5,443	4,873	4,362	3,905

Source: Poster Enterprises, 2014

In the low forecast, the 2008 BBER growth rates were deemed to be too optimistic. Instead, the actual 2000-2010 rate of growth for the region, –1.10 percent, was used. Under the low forecast, county population will decline to 3,905 in 2060 (Table 6-3).

6.4 Water Conservation

Water conservation is often a cost-effective and easily implementable measure that a region may use to help balance supplies with demands. The State of New Mexico is committed to water conservation programs that encourage wise use of limited water resources. The Water Use and Conservation Bureau of the NMOSE developed the *New Mexico Water Conservation Planning Guide for Public Water Suppliers*. When evaluating water rights transfers or 40-year water development plans that hold water rights for future use, the NMOSE considers whether adequate conservation measures are in place. However, the 40 year water development plans are not incorporated into the RWP updates, as the resources needed to complete this work are not currently available. It is therefore important when planning for meeting future water demand to consider the potential for conservation.

To develop demand projections for the region, some simplifying assumptions regarding conservation have been made. These assumptions were made only for the purpose of developing an overview of the future supply-demand balance in the region and are not intended to guide policy regarding conservation for individual water users. The approach to considering conservation in each category of water use for developing water demand projections is discussed

below. Specific recommendations for conservation programs and policies for the Rio Chama region, as identified by the regional steering committee, are provided in Section 8.

Public water supply. Public water suppliers that have large per capita usage have a greater potential for conservation than those that are already using water more efficiently. Through a cooperative effort with seven public water suppliers, the NMOSE developed a GPCD (gallons per capita per day) calculation to be used statewide, thereby standardizing the methods for calculating populations, defining categories of use, and analyzing use within these categories. The GPCD calculator was used to arrive at the per capita uses for public water systems in the region, shown in Table 6-4. These rates are provided to assist the regional steering committee in considering specific conservation measures.

The system-wide per capita usage for each water supplier includes uses such as golf courses, parks, and commercial enterprises that are supplied by the system. Hence there can be large variability among the systems. For purposes of developing projections, a county-wide per capita rate was calculated as the total public supply use in the county divided by the total county population (or portion of the county within the region), excluding those served by domestic wells. For future projections (Section 6.5), a consistent method is being used statewide that assumes that conservation would reduce future per capita use in each county by the following amounts:

- For current average per capita use greater than 300 gpcd, assume a reduction in future per capita use to 180 gpcd.
- For current average per capita use between 200 and 300 gpcd, assume a reduction in future per capita use to 150 gpcd.
- For current average per capita use between 130 and 200 gpcd, assume a reduction in future per capita use to 130 gpcd.
- For current average per capita use less than 130 gpcd, no reduction in future per capita use is assumed.

For the Rio Chama region, current per capita demand in the portion of Rio Arriba County within the planning region is 75 gpcd (Table 6-4), so no additional conservation is assumed.

Self-supplied domestic. Homeowners with private wells can achieve water savings through household conservation measures. These wells are not metered, and current water use estimates were developed based on a relatively low per capita use assumption (Table 6-4; Longworth et al., 2013). Therefore, no additional conservation savings were assumed in developing the water demand projections. For purposes of developing projections, a county-wide per capita rate was calculated as the total self-supplied domestic use in the county divided by the total county population (or portion of the county within the region), excluding those served by a public water system.

Table 6-4. 2010 Water Withdrawals for Drinking Water Supply Systems and Rural Self-Supplied Homes

OSE Declared Groundwater Basin(s) [a]	Water Supplier [b]	Population	Per Capita Use (gpcd)	Withdrawals (acre-feet)	
				Surface Water	Groundwater
Rio Arriba County					
Rio Grande (Northern)	Abiquiu MDWCA	400	80	0	36
	Arroyo Del Agua MDWCA	75	80	0	7
	Barranco MDWCA	51	102	0	6
	Brazos MDWCA	160	53	0	9
	Canjilon MDWCA	330	56	0	21
	Canon Plaza MDWCA	60	80	0	5
	Capulin MDWCA	450	80	0	40
	Cebolla MDWCA	300	34	0	11
	Chama Water System (Rio Grande)	1,250	80	112	0
	Chili [c]	51	133	0	8
	Christ In The Desert Monastery	30	80	0	3
	Coyote MDWCA	45	80	0	4
	El Rito Canyon MDWCA	300	80	0	27
	El Rito MDWCA	220	42	0	10
	Ensenada WUA - Los Ojos	150	57	0	10
	Gallina Water System	100	79	0	9
	La Madera MDWCA	36	80	0	3
	Los Brazos MDWCA/La Association De Agua De Los Brazos	30	139	0	5
	Los Ojos MDWCA	500	80	0	45
	Rutheron Mutual Water Association	90	64	0	6

Source: Longworth et al., 2013, unless otherwise noted.

[a] Determined based on NMED Drinking Water Bureau water supply source locations (NMOSE water use database doesn't distinguish groundwater basin).

[b] For systems supplied by surface water withdrawals, the surface water basin is provided in parentheses.

[c] Groundwater basin assumed based on geographic location of water supplier.

gpcd = Gallons per capita per day

Table 6-4 2010 Water Withdrawals for Drinking Water Supply Systems and Rural Self-Supplied Homes

OSE Declared Groundwater Basin(s) [a]	Water Supplier [b]	Population	Per Capita Use (gpcd)	Withdrawals (acre-feet)	
				Surface Water	Groundwater
Rio Arriba County (cont.)					
Rio Grande (Northern) (cont.)	Tierra Amarilla MDWCA	470	97	0	51
	Vallecitos MDWCA	92	80	0	8
	Youngsville MDWCA	40	191	0	9
	Ojo Caliente	350	80	0	31
Rio Arriba County public water supply totals		5,580		112	364
County-wide public water supply per capita use [d]			76		
Rio Grande (Northern and Middle)	Rural self-supplied homes [e]	575	80	0	52
Rio Arriba County domestic self-supplied totals		575		0	52
County-wide domestic self-supplied per capita use [d]			80		

Source: Longworth et al., 2013, unless otherwise noted.

[a] Determined based on NMED Drinking Water Bureau water supply source locations (NMOSE water use database doesn't distinguish groundwater basin).

[b] For systems supplied by surface water withdrawals, the surface water basin is provided in parentheses.

[d] County-wide per capita use, calculated as the total population divided by total withdrawals.

[e] Portion that is in Rio Chama Water Planning Region

gpcd = Gallons per capita per day

Irrigated agriculture. As the largest water use in the region, conservation in this sector may be beneficial. However, when considering the potential for improved efficiency in agricultural irrigation systems, it is important to consider how potential conservation measures may affect the region's water supply.

Withdrawals in both surface and groundwater irrigation systems include both consumptive and non-consumptive uses and incidental losses:

- Consumptive use occurs when water is permanently removed from the system due to crop evapotranspiration (i.e., evaporation and transpiration). Evapotranspiration is determined by factors that include crop and soil type, climate and growing season, on-farm management, and irrigation practices.

- Non-consumptive use occurs when water is temporarily removed from the stream system for conveyance requirements and is returned to the surface or groundwater system from which it was withdrawn.

- Incidental losses from irrigation are irrecoverable losses due to seepage and evapotranspiration during conveyance that are not directly attributable to crop consumptive use.

    - Seepage losses occur when water leaks through the conveyance channel or below the root zone after application to the field and is either lost to the atmosphere or remains bound in the soil column.

    - Evapotranspiration occurs as a result of (1) evaporation during water conveyance in canals or with some irrigation methods (e.g., flood, spray irrigation) and (2) transpiration by ditch-side vegetation.

Some agricultural water use efficiency improvements (commonly referred to as agricultural water conservation) reduce the amount of water diverted, but may not reduce depletions or may even have the effect of increasing consumptive use per acre on farms (Brinegar and Ward, 2009; Ward and Pulido-Velazquez, 2008). These efforts can result in economic benefits, such as increased crop yield, but may have the adverse effect of reducing return flows and therefore downstream water supply. For example, methods such as canal lining or piping may result in reduction of seepage losses associated with conveyance, but that seepage will no longer provide return flow to other users. Other techniques such as drip irrigation and center pivots may reduce the amount of water diverted, but if the water saved from such reductions is applied to on-farm crop demands, water supplies for downstream uses will be reduced.

Due to the complexities in agricultural irrigation efficiency, no quantitative estimates of savings are included in the projections. However, the regions are encouraged to explore strategies for agricultural conservation, especially those that result in consumptive use savings through

changes in crop type or fallowing of land while concentrating limited supplies for greater economic value on smaller parcels. Section 8 outlines strategies developed by the Rio Chama Steering Committee to achieve savings in agricultural water use within the region.

Self-supplied commercial, industrial, livestock, mining, and power. Conservation programs can be applicable to these sectors, but since uses are very low in these categories within the region, no additional conservation savings are assumed in the water demand projections.

Reservoir evaporation. In many parts of New Mexico, reservoir evaporation is one of the highest consumptive water uses, and in the Rio Chama region it is the second highest water use. To reduce usage in this category, some areas outside of the region have considered aquifer storage and recovery to replace some reservoir storage, and it may also be possible in some circumstances to gain some reduction in evaporation by storing more water at higher elevations or constructing deeper reservoirs with less surface area for evaporation. However, due to the legal, financial, and other complexities of implementing these techniques, no conservation savings are assumed in developing the reservoir evaporation demand projections for this region.

6.5 Projections of Future Water Demand for the Planning Horizon

To develop projections of future water demand a consistent method was used statewide. Section 6.5.1 provides a comprehensive discussion of methods applied consistently throughout the state to project water demand in all the categories reported in the *New Mexico Water Use by Categories* reports, and some of the categories may not be applicable to the Rio Chama region. The projections of future water demand determined using this consistent method, as applicable, for the Rio Chama region are discussed in Section 6.5.2.

6.5.1 Water Demand Projection Methods

The *Handbook* provides the time frame for the projections; that is, they should begin with 2010 data and be developed in 10-year increments (2020, 2030, 2040, 2050, and 2060). Projections will be for withdrawals in each of the nine categories included in the *New Mexico Water Use by Categories 2010* report (Longworth et al., 2013) and listed in Section 6.1.

To assist in bracketing the uncertainty of the projections, low- and high-water demand estimates were developed for each category in which growth is anticipated, based on demographic and economic trends (Section 6.2) and population projections (Section 6.3), unless otherwise noted. The projected growth in population and economic trends will affect water demand in eight of the nine water use categories; the reservoir evaporation water use category is not driven by these factors.

The 2010 administrative water supply (Section 5.5.1) was used as a base supply from which water demand was projected forward. As discussed in Section 5.5, the administrative water

supply is based on withdrawals of water as reported in the *New Mexico Water Use by Categories 2010* report, which provide a measure of supply that considers both physical supply and legal restrictions (i.e., the water is physically available for withdrawal, and its use is in compliance with water rights policies) and thus reflects the amount of water available for by a region.

The assumptions and methods used statewide to develop the demand projections for each water use category follow. Not all of these categories are applicable to every planning region. The specific methods applied in the Rio Chama region are discussed in Section 6.5.2.

Public water supply includes community water systems that rely on surface water and groundwater diversions other than from domestic wells permitted under 72-12-1.1 NMSA 1978 and that consist of common collection, treatment, storage, and distribution facilities operated for the delivery of water to multiple service connections. This definition includes municipalities (which may serve residential, commercial, and industrial water users), mutual domestic water user associations, prisons, residential and mixed-use subdivisions, and mobile home parks.

For regions with anticipated population increases, the increase in projected population (high and low) was multiplied by the per capita use from the *New Mexico Water Use by Categories 2010* report (Longworth et al., 2013) (reduced for conservation as specified above), times the portion of the population that was publicly supplied in 2010 (calculated from Longworth et al., 2013); the resulting value was then added to the 2010 public water supply withdrawal amount. Current surface water withdrawals were not allowed to increase above the 2010 withdrawal amount unless there is a new source of available supply (i.e., water project or settlement). Both the high and low projections incorporated conservation for counties with per capita use above 130 gpcd, as discussed in Section 6.4, on the assumption that some of the new demand would be met through reduction of per capita use.

For planning purposes, in counties where a decline in population is anticipated (in either the high or low scenario or both), as a conservative approach it was assumed that public water supply would remain constant at 2010 withdrawal levels based on the 2010 administrative water supply (the water is physically available for withdrawal, and its use is in compliance with water rights policies). Likewise, in regions where the population growth is initially positive but later shows a decline, the water demand projection was kept at the higher rate for the remainder of the planning period.

The *domestic (self-supplied)* category includes self-supplied residences with well permits issued by the NMOSE under 72-12-1.1 NMSA 1978 (Longworth et al., 2013). Such residences may be single-family or multi-family dwellings. High and low projections were calculated as the 2010 domestic withdrawal amount plus a value determined by multiplying the projected change in population (high and low) times the domestic self-supplied per capita use from the *New Mexico Water Use by Categories 2010* report (Longworth et al., 2013) times the calculated proportion of the population that was self-supplied in 2010 (calculated from Longworth et al., 2013). In

counties where the high and/or low projected growth rate is negative, the projection was set equal to the 2010 domestic withdrawal amount. This allows for continuing use of existing domestic wells, which is anticipated, even when there are population declines in a county. In regions where the population growth is initially positive but later shows a decline, the water demand projection was kept at the higher level for the remainder of the planning period, based on the assumption that domestic wells will continue to be used, even if there are later population declines.

The *irrigated agriculture* category includes all withdrawals of water for the irrigation of crops grown on farms, ranches, and wildlife refuges (Longworth et al., 2013). To understand trends in the agricultural sector, interviews were held with farmers, farm agency employees, and others with extensive knowledge of agriculture practices and trends in each county. Additionally, the New Mexico agriculture census data for 2007 and 2012 were reviewed and provided helpful agricultural data such as principal crops, irrigated acreage, farm size, farm subsidies, and age of farmers (USDA NASS, 2014). Comparison of the two data sets shows a downward trend in the agricultural sector across New Mexico. This decline was in all likelihood related at least in part to the lack of precipitation in 2012: in most of New Mexico 2007 was a near normal precipitation year (ranging from mild drought to incipient wet spell across the state), while in 2012 the PDSI for all New Mexico climate divisions indicated extreme to severe drought conditions. Based on the interviews, economic factors are also thought to be a cause of the decline as aquifers go dry.

In much of the state, recent drought and recession are thought to be driving a decline in agricultural production. However, that does not necessarily indicate that there is less demand for water. In areas where irrigation is supplied by surface water, there are frequent supply limitations, with many ditches having no or limited supply later in the season. This results in large fluctuations in agricultural water use and productivity from year to year. While it is possible that drought will continue over a longer term, it is also likely that drought years will be interspersed with wetter years, and there is some potential for renewed agricultural activity as a result. With infrastructure and water rights in place, there is a demand for water if it becomes available.

In regions that use surface water for agriculture withdrawals, the 2010 administrative water supply used as the starting point for the projections reflects a near normal water year for the region. For the 2020 through 2060 projections, therefore, it was generally assumed that the surface water demand is equal to the 2010 administrative water supply for both the high and low scenarios. Even if some farmers cease operations or plant less acreage, the water is expected to be used elsewhere due to surface water shortages. Conversely, if increased agricultural activity is anticipated, water demand in this sector was still projected to stay at 2010 administrative water supply levels unless there is a new source of available supply (i.e., water project or settlement).

In areas where 10 percent or more of groundwater withdrawals are for agriculture and there are projected declines in agricultural acreage, the low projection assumes that there will be a reduced demand in this sector. The amount of decline projected is based on interviews with individuals knowledgeable about the agricultural economy in each county (Section 6.2). Even in areas where the data indicate a decline in the agricultural economy, the high projection assumes that overall water demand will remain at the 2010 administrative water supply levels since water rights have economic value and will continue to be used

The *livestock* category includes water used to raise livestock, maintain self-supplied livestock facilities, and support on-farm processing of poultry and dairy products (Longworth et al., 2013). High and low projections for percentage growth or declines in the livestock sector were developed based on interviews with ranchers, farm agency employees, and others with extensive knowledge of livestock trends in each county (Section 6.2). The growth or decline rates were then multiplied by the 2010 water use to calculate future water demand.

The *commercial (self-supplied)* category includes self-supplied businesses (e.g., motels, restaurants, recreational resorts, and campgrounds) and public and private institutions (e.g., public and private schools and hospitals) involved in the trade of goods or provision of services (Longworth et al., 2013). This category pertains only to commercial enterprises that supply their own water; commercial businesses that receive water through a public water system are not included. To develop the commercial self-supplied projections, it was assumed that commercial development is proportional to other growth, and the high and low projections were calculated as the 2010 commercial water use multiplied by the projected high and low population growth rates. In regions where the growth rate is negative, both the high and low projections were assumed to stay at the 2010 administrative supply water level , based on water rights having economic value. In regions where the population growth is initially positive but later shows a decline, the water demand projection will remain at the higher level for the remainder of the planning period, again based on the administrative water supply and the value of water rights. . This method may be modified in some regions to consider specific information regarding plans for large commercial development or increased use by existing commercial water users.

The *industrial (self-supplied)* category includes self-supplied water used by enterprises that process raw materials or manufacture durable or nondurable goods and water used for the construction of highways, subdivisions, and other construction projects (Longworth et al., 2013). To collect information on factors affecting potential future water demand, economists conducted interviews with industrial users and used information from the New Mexico Department of Workforce Solutions (2014) to determine if growth is expected in this sector. Based on these interviews and information, high and low scenarios were developed to reflect ranges of possible growth. If water use in this category is low and limited additional use is expected, both the high and low projections are the same.

The *mining* category includes self-supplied enterprises that extract minerals occurring naturally in the earth's crust, including solids (e.g., potash, coal, and smelting ores), liquids (e.g., crude petroleum), and gases (e.g., natural gas). Anticipated changes in water use in this category were based on interviews with individuals involved in or knowledgeable about the mining sector. If water use in this category is low and limited additional use is expected, both the high and low projections are the same.

The *power* category includes all self-supplied power generating facilities and water used in conjunction with coal-mining operations that are directly associated with a power generating facility that owns and/or operates the coal mines. Anticipated changes in water use in this category were based on interviews with individuals involved in or knowledgeable about the power sector. If water use in this category is low and limited additional use is expected, both the high and low projections are the same.

Reservoir evaporation includes estimates of open water evaporation from man-made reservoirs with a storage capacity of approximately 5,000 acre-feet or more. The amount of reservoir evaporation is dependent on the surface area of the reservoir as well as the rate of evaporation. Evaporation rates are partially dependent on temperature and humidity; that is, when it is hotter and drier, evaporation rates increase. Surface areas of reservoirs are variable, and during extreme drought years, the low surface areas contribute to lower total evaporation, even though the rate of evaporation may be high.

The projections of reservoir evaporation for each region were based on evaporation rates reported in the *Upper Rio Grande Impact Assessment* (USBR, 2013), which evaluated potential climate change impacts in New Mexico. This report predicted considerable uncertainty, but some increase in evaporation rates and lower evaporation totals overall due to predicted greater drought frequency and resultant lower reservoir surface areas. Although it is possible that total evaporation will be lower in drought years, since the projections are to be compared to 2010 use, assuming lower reservoir evaporation would give a false impression of excess water. Thus, the low projection assumes 2010 evaporation amounts. For the high projection, the same surface areas as 2010 were assumed, but higher evaporation rates, derived from the *Upper Rio Grande Impact Assessment* (USBR, 2013), were used to reflect potentially warmer temperatures. The high scenario projected using this approach represents a year in which there is a normal amount of water in storage but the evaporation rates have increased due to increasing temperatures.

In reality the fluctuations in reservoir evaporation are expected to be much greater than the high/low range projected using this method. To evaluate the balance between supply and demand, the projections are being compared to the administrative water supply, including reservoir evaporation. It is important to not show an unrealistic scenario of excess available water. Therefore the full range starting with potentially very low reservoir surface areas was not included in the projections.

6.5.2 Rio Chama Projected Water Demand

Table 6-5 summarizes the projected water demands for each water use category for the portion of Rio Arriba County that is within the planning region, which were developed by applying the methods discussed in Section 6.5.1. As discussed in Section 6.3, population is projected to decline under the low projection at the current observed rate of decline. For the high growth scenario, population is projected to decline only slightly. The total projected water demand in the county in 2060 ranges slightly, from 98,051 to 100,097 acre-feet per year. Surface water supplies may be considerably lower in drought years, as discussed in Section 5.5.2, but the demand for water does not necessarily decrease when the supply is diminished.

Demand in the *public water supply* category is projected to remain at 2010 water use levels under both the high and low scenarios. As discussed in Section 6.5.1, even though the population is projected to decline, it is anticipated that existing water rights and domestic wells will continue to be used at the 2010 administrative supply level.

Projected water demand in the *commercial* and *domestic* categories is also assumed to remain at current levels under both the high and low projections, again based on the assumption that wells will continue to be used.

Water use in the region occurs primarily in the *agricultural* category, and interviews (Section 6.2) indicated that declines in the sector are anticipated. The agricultural projections are based on the assumption that the current observed declining trend for agriculture will continue for the short trend, through 2020, with agricultural activity beginning to recover by 2030. However, irrigated agriculture in the region is heavily dependent on surface water, which is highly susceptible to drought; therefore, the recent drought and recent recession are thought to be driving the decline. Thus it would not be prudent to assume declining demand for agricultural water in the long term. While it is possible that drought will continue over a longer term, it is also likely that drought years will be interspersed with wetter years, and there is some potential for renewed agricultural activity as a result. With the many adjudicated water rights in the region (RCAA and Rio Arriba County, 2006), there is clearly a demand for agricultural water if it is available.

In any event, the amount of water devoted to irrigated agriculture is expected to remain at 2010 levels throughout the planning horizon under the assumption that available surface water will always be put to some use. The agricultural sector in Rio Arriba County is somewhat reliant on federal government payments. If these were to be reduced or eliminated, it could have a detrimental effect on the agricultural sector and could decrease water usage.

The *livestock* category in the region is expected see a steep decline by 2020, but to recover by 2060 to 85 percent and 95 percent of 2010 water usage in the low and high projections, respectively. In the low scenario, it is expected that some ranches will go out of business.

Table 6-5. Projected Water Demand, 2020 through 2060 Rio Chama Water Planning Region

Use Sector	Projection	Water Demand (acre-feet) [a]					
		2010 [b]	2020	2030	2040	2050	2060
Rio Arriba County							
Public water supply	Low/High [c]	476	476	476	476	476	476
Domestic (self-supplied)	Low/High [c]	52	52	52	52	52	52
Irrigated agriculture	Low/High	66,228	66,228	66,228	66,228	66,228	66,228
Livestock (self-supplied)	High	248	161	186	211	223	236
	Low	248	124	149	174	198	211
Commercial (self-supplied)	Low/High [c]	1,132	1,132	1,132	1,132	1,132	1,132
Industrial (self-supplied)	Low/High	0	0	0	0	0	0
Mining (self-supplied)	Low/High	0	0	0	0	0	0
Power (self-supplied)	Low/High	0	0	0	0	0	0
Reservoir evaporation	High	29,952	30,302	30,665	31,027	31,295	31,973
	Low	29,952	29,952	29,952	29,952	29,952	29,952
Total regional demand	High	98,088	98,351	98,738	99,126	99,406	100,097
	Low	98,088	97,964	97,989	98,014	98,038	98,051

[a] Tribes and pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this table.

[b] Actual withdrawals (Longworth et al., 2013)

[c] Projected future water demand in this sector is based on projected population. Where projected population is lower than the 2010 level, projected demand is set at 2010 withdrawals. The withdrawals in 2010 represent water that has been put to beneficial use and thus represent a valid water right. For planning purposes it is assumed that valid water rights are maintained and will be used in the future.

The Rio Chama region does not have any *mining*, *power*, and *industrial* activity. To project potential future water demand, economists conducted interviews to determine if growth is expected in these sectors. Based on these interviews, no significant activity is expected; therefore, the projected water demand for both the high and low projections in these categories remains at zero.

The Rio Chama region projections include significant water use in the *reservoir evaporation* category due to the presence of Heron, El Vado, and Abiquiu reservoirs. Though these reservoirs are almost entirely for the benefit of the downstream users, the use is recorded in the Rio Chama region (Longworth et al., 2013). As discussed in Section 6.5.1, the projected demand is based on 2010 reservoir surface areas so that it can accurately be compared to the 2010 administrative water supply. The reservoir evaporation category is included for statewide accounting, but has little bearing on the supply available to the Rio Chama region.

7. Identified Gaps between Supply and Demand

Estimating the balance between supply and demand requires consideration of several complex issues, including:

- Both supplies and demands vary considerably over time, and although long-term balanced supplies may be in place, the potential for drought or, conversely, high flows and flooding must be considered. In general, storage, including the capture of extreme flows for future demand, is an important aspect of allowing surface water supplies to be used when needed to meet demand during drought periods (i.e., reservoir releases may sustain supplies during times when surface water supplies are inadequate).

- In wet years where more water is available than in 2010, irrigators can increase surface water diversions up to their water right and reservoirs will fill when inflow exceeds downstream demand, provided that compact requirements are satisfied, to increase storage for subsequent years. Thus, though not quantified, the withdrawals in wet years may be greater than the high projection.

- Supplies in one part of the region may not necessarily be available to meet demands in other areas, particularly in the absence of expensive infrastructure projects. Therefore comparing the supplies to the demands for the entire region without considering local issues provides only a general picture of the balance.

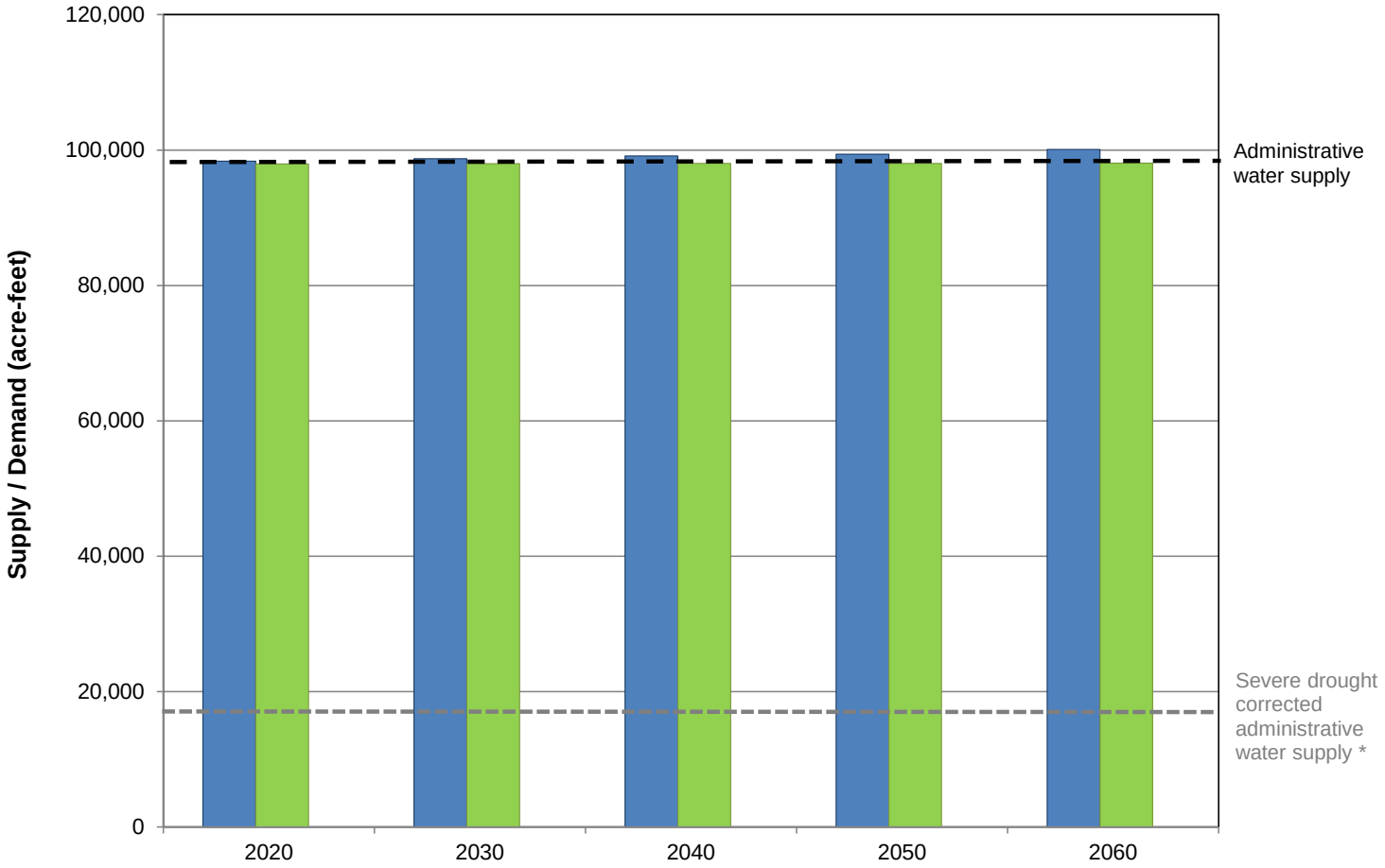
- As discussed in Section 6.5.1, the fluctuations in reservoir evaporation are expected to be much greater than the high/low projected range developed for this balance. When comparing the projected demands to the administrative water supply, which is based on 2010 water withdrawals, 2010 surface areas of reservoirs were used to avoid an

unrealistic scenario of excess available water. The actual amount of water that will be used for reservoir evaporation is dependent on the surface area of the reservoir and temperatures. During the first year of a drought when there is surface water in storage, the reservoir evaporation could be similar to 2010 use, but after subsequent years of drought, when storage and surface areas are lower, reservoir evaporation would be lower. As noted in Section 6.5.2, however, the reservoir evaporation category, while included for statewide accounting, has little bearing on the supply available to the Rio Chama region.

- As discussed in Section 4, there are considerable legal limitations on the development of new surface and groundwater resources, given that surface and surface-connected groundwater supplies are fully appropriated, which affects the ability of the region to prepare for shortages by developing new supplies.

- Besides quantitative estimates of supply and demand, numerous other challenges affect the ability of a region to have adequate water supplies in place. Water supply challenges include the need for adequate funding and resources for infrastructure projects, water quality issues, location and access to water resources, limited productivity of certain aquifers, and protection of source water.

Despite these limitations, it is useful to have a general understanding of the overall balance of the supply and demand. Figure 7-1 illustrates the total projected regional water demand under the high and low demand scenarios, and also shows the administrative water supply and the drought -adjusted water supply. As presented in Section 5.5, the region's administrative water supply is 98,085acre-feet and the drought supply is 17,027acre-feet, or about 17 percent of a normal year administrative water supply. Future water demand projections do not reflect substantial growth in water use (Figure 7-1), as discussed in Section 6.5.2. However, even without significant growth in demand, major supply shortages are indicated in drought years. Because of its reliance on surface water, the region has a very high degree of vulnerability to drought, and the estimated shortage in drought years is expected to range from 81,000 to 83,000 acre-feet. Consequently, increasing storage, developing shortage-sharing agreements, protecting watershed health for the region's surface water supplies, and identifying alternative groundwater supplies are high priorities for the region.



* Based on the ratio of the minimum streamflow of record to the 2010 administrative water supply.

Note: Tribes and pueblos in New Mexico are not required to provide water use data to the State. Therefore, tribal water use data are not necessarily reflected in this figure.

Figure 7-1

RIO CHAMA
REGIONAL WATER PLAN 2016

Available Supply and Projected Demand

8. Implementation of Strategies to Meet Future Water Demand

An objective of the regional water planning update process is to identify strategies that will help the region prepare to balance the gap between supply and demand and to address other future water management challenges, including infrastructure needs, protection of existing resources and water quality, and the need to maximize limited resources through water conservation and reuse. The Rio Chama region considered a variety of strategies for addressing these water management challenges. As discussed in Sections 5 and 7, about 97 percent of the water used in 2010 was supplied by surface water; hence, the region is extremely vulnerable to drought, and there is a large gap between projected demands and drought supplies. In addition to the quantitative gap between supply and demand, the region identified concerns with water quality and source water protection, storage, water banking, acequia and drinking water system infrastructure, management of reservoir releases, and watershed restoration, and the region also considered strategies to address these comprehensive water management issues.

This RWP builds on the 2006 water plan and considers strategies that will enhance and update, rather than replace, the strategies identified in the accepted water plan. Section 8.1 assesses the status of strategies from the previous regional water plan. Additional strategies recommended in this RWP update—including a comprehensive list of projects, programs, and policies, key collaborative projects, and recommendations for the state water plan—are discussed in Section 8.3

8.1 Implementation of Strategies Identified in Previously Accepted Regional Water Plan

An important focus of the RWP update process is to both identify strategies and processes and consider their implementation. To help address the implementation of new strategies, a review of the implementation of previous strategies was first completed.

The 2006 Rio Chama Regional Water Plan recommended the following strategies for meeting future water demand:

- Keep water rights within the region
  - Be vigilant about proposed water rights transfers
  - Provide County support for water rights and infrastructure
- Preserve the acequia system
  - Insulate acequias from excessive economic pressures
  - Implement appropriate-scale water banking
  - Maintain and repair acequia systems appropriately
  - Modify the adjudication process

- Enhance growing season streamflows
  - Improve high-altitude upper watershed management
  - Enhance grass cover and infiltration in lower-altitude areas
  - Reservoir storage
  - Aquifer storage and recovery
  - Appropriate flood or wet-year flows
- Support local agriculture
  - Enhance marketing opportunities
  - Help finance local agriculture
  - Help with information sharing and technical assistance
  - Collaborate widely
- Provide reliable community water supplies
  - Consolidate community water systems if appropriate
  - Develop alternatives for additional water rights where needed
  - Optimize locations and depths of community wells
  - Consider other water supply alternatives
  - Conserve water and audit water use in community systems
  - Ensure adequate water supplies for firefighting
  - Protect existing communities from unsustainable water use
  - Provide additional support resources for community systems
  - Collect basic information about our water resources
- Protect water quality
  - Consider and encourage community wastewater treatment
  - Encourage or require better individual liquid waste treatment
  - Control nonpoint-source and agricultural pollution
  - Regulate and discourage development in upper watershed areas
- Conserve and reuse water resources
- Protect and restore watersheds

The steering committee reviewed each of the strategies and indicated that they are all still relevant to the region. Actions that have been completed in order to implement the strategies identified in the 2006 plan are summarized in Table 8-1.

Table 8-1. Implementation Status of Strategies Identified in Accepted Plan Rio Chama Water Planning Region

Strategy	Status
Keep water rights in the region	Some acequias were protected through updates to bylaws and other governance issues, including water banking.
Preserve the acequia system	The New Mexico Acequia Association did a survey of acequia needs.
Enhance growing season streamflows	Rio Arriba County has encouraged water banking at the time of development approvals.
Support local agriculture	A local food hub has taken off and includes development of cold frames by Natural Resources Conservation Service (NRCS).
	Rio Arriba County has made great strides in addressing food security issues by partnering with Taos County Economic Development to develop ideas on creating and using mobile matanzas (mobile meat processing) for packing beef/lamb and supporting water systems that help food production such as acequias.
Provide reliable community water supplies	Souder Miller has done lots of work in Rio Arriba County including preparating preliminary engineering reports (PERs) and helping mutual domestics pursue funding from community development block grants and the Water Trust Board. They have data that could be compiled to indicate the types of projects funded.
	Cebolla and Canjilon are seeking supplemental water for their communities.
	Identification of aquifers that could store/bank surface water was identified as a data need.
	Rio Arriba County has been working on water banking policies. Use of banked water for mutual domestics would ensure beneficial use of water.
	Fire stations completed expansion including the Rural Event Center.
Protect water quality	$8 million was spent to develop the Chama wastewater treatment facility. Souder Miller prepared the PER and is seeking additional funding.
	Water quality protection by addressing effluent, particularly in the Rio Chamita, that affects local community' supplies and water quality is a priority.
Conserve and reuse water resources	Ro Arriba County completed their Comprehensive Land Use Plan and is working on 40-year water plan; both address wise use of water resources.
Protect and restore watersheds	The Chama Watershed Alliance has applied for a grant from the Department of Energy and will know by June if the grant is awarded and if they will be able to implement a program for thinning and watershed restoration.
	Medanales is an example of federal agencies (Bureau of Land Management / U.S. Forest Service) giving up drylands they manage so that local communities would not need to access "green sites."

Table 8-1. Implementation Status of Strategies Identified in Accepted Plan Rio Chama Water Planning Region

Strategy	Status
Protect and restore watersheds (cont.)	Support for recreation ties into watershed projects and supports the local economy.
	Watershed issues have started to be addressed through funding from the Rio Grande Water Fund, and $400,000 has been allocated for thinning in the Chama watershed. The focus is on private lands.
	Chama Peak Land Alliance will continue to work with funding entities such as Los Alamos National Laboratory to seek Department of Energy funding for biomass development and other energy sources.

8.2 Water Conservation

Municipal and small water system average per capita use in the Rio Chama Water Planning Region is relatively low (Section 6, Table 6-4); many systems have very low per capita use, and the average county-wide per capita use for public water systems is 75 gpcd. The small drinking water systems in the region will continue to work toward improved water conservation and efficiency of water resources. Additionally, some smaller systems could benefit from assistance by the County or agencies (such as the New Mexico Rural Water Association) in developing, updating, and implementing water conservation and drought contingency programs. Acequias in the region are also pursuing efficiency measures to improve delivery to optimize their drought sharing agreements.

8.3 Proposed Strategies (Water Programs, Projects, or Policies)

In addition to continuing with strategies from the previous plan, the Rio Chama region discussed and compiled new project, program, and policy (PPP) information, identified key collaborative strategies, and provided recommendations for the state water plan. The recommendations included in this section were prepared by the Rio Chama Regional Water Planning Steering Committee and other stakeholders, and reflect their interest and intent. The recommendations made by the steering committee and other stakeholders have not been evaluated or approved by NMISC. Regardless of the NMISC's acceptance of this RWP, inclusion of these recommendations in the plan shall not be deemed to indicate NMISC support for, acceptance of, or approval of any of the recommendations, PPP information, and collaborative strategies included by the regional steering committee and other stakeholders.

8.3.1 Comprehensive List of Projects, Programs and Policies

Over the two-year update process, eight meetings were held with stakeholders in the Rio Chama region. These meetings identified the program objectives, presented draft supply and demand calculations for discussion and to guide strategy development, and provided an opportunity for stakeholders to provide input on the PPPs that they would like to see implemented (Section 2). A summary of the PPP information, obtained primarily from input supplied directly by stakeholders, is provided in Appendix 8-A. Information was requested during several open meetings. Requests for input were also e-mailed to all stakeholders who had expressed interest in the regional water planning process.

Some water projects were already identified through the State of New Mexico Infrastructure Capital Improvement Plan (ICIP), Water Trust Board, Capital Outlay, and NMED funding processes; these projects are also included in the Rio Chama PPP table. The projects included are from the 2017-2021 ICIP list (http://nmdfa.state.nm.us/ICIP.aspx, accessed March 2016), which is updated on an annual basis. Other infrastructure projects that are important to the region may therefore be identified before this RWP is updated again. In general, the region is

supportive of water and wastewater infrastructure, water quality protection, watershed restoration, and water rights protection, in accordance with its plan goals.

The PPP list also contains several watershed restoration projects, including some identified in the New Mexico Forest Action Plan (http://www.emnrd.state.nm.us/SFD/statewideassessment.html). New Mexico State Forestry Division provides annual updates to the recommended watershed restoration projects in the New Mexico Forest Action Plan, and the region is supportive of those ongoing watershed restoration projects, even those that are not specifically identified in the PPP list.

The Rio Chama Steering Committee decided to form three subcommittees (Acequia Subcommittee, Watershed Restoration Subcommittee, and Mutual Domestic Subcommittee) to provide input on specific water management issues and strategies in the Rio Chama region, as discussed in Section 2. The Mutual Domestic Subcommittee worked with water systems to identify project needs, which are included in the PPP table in Appendix 8-A. The Watershed Restoration Subcommittee considered landscape-scale restoration projects and policies to improve forest health and reduce the risk of catastrophic wildfire. Recommendations from all the subcommittees were incorporated into the PPP table in Appendix 8-A.

The information in Appendix 8-A has not been ranked or prioritized; it is an inclusive table of all of the PPPs that regional stakeholders are interested in pursuing. It includes both projects that are regional in nature (designated R in Appendix 8-A) and those that are specific to one system (designated SS in Appendix 8-A). The table identifies each PPP by category, including water and wastewater system infrastructure, water conservation, watershed restoration, flood prevention, water reuse, water rights, water quality, and data collection.

In the Rio Chama region, projects identified in the PPP table are primarily water system infrastructure, acequia system repairs, water quality protection, watershed restoration, and drought contingency projects.

8.3.2 Key Strategies for Regional Collaboration

Prioritizing projects for funding is done by each funding agency/program based on their current criteria, and projects are reviewed in comparison to projects from other parts of the State. Consequently, the regional water planning update program did not attempt to rank or prioritize the PPPs identified in Appendix 8-A. However, identifying larger regional collaborative strategies is helpful to successful implementation of the regional plan. At steering committee meetings held in 2015 and 2016, the group discussed PPPs that would have a larger regional or sub-regional impact and for which there is interest in collaboration with entities in other water planning regions to seek funding and for implementation.

The group used an informal process of discussing and refining the definition of potential collaborative strategies and voting to determine the projects of greatest interest and to identify opposition to proposed projects. Key collaborative strategies identified by the steering committee and Rio Chama region stakeholders are shown on Table 8-2.

In order to move forward with implementing the key collaborative projects, additional technical, legal, financial, and political feasibility assessment may be required. A detailed feasibility assessment was beyond the scope and resources of this RWP update.

8.3.3 Key Program and Policy Recommendations

The legislation authorizing the state water plan was passed in 2003. This legislation requires that the state plan shall "integrate regional water plans into the state water plan as appropriate and consistent with state water plan policies and strategies" (§ 72-14-3.1(C) (10)). For future updates of the state water plan, NMISC has asked the regions to provide recommendations for larger programs and policies that would be implemented on a state level. These are distinct from the regional collaborative projects listed in Table 8-2 and the PPPs listed in Appendix 8-A, in that they would be implemented on a state level rather than on a regional or system-specific level. The State will consider the recommendations from all of the regions, in conjunction with state-level goals, when updating the state water plan.

After group discussion, the Rio Chama region identified the following recommendations for PPPs to be considered in the state water plan:

- Support capacity building and funding for small drinking water systems, including resolution about unfunded state and federal regulatory mandates to small entities unable to meet the expected additional responsibilities.
- Support capacity building for acequias.
- Coordinate with federal agencies to explore the possibility of planning dam release schedules for downstream users to minimize negative impacts and maximize benefits to local acequias.
- Develop policies that provide for water quality protection in headwater watersheds, rivers, and creeks.
- Support landscape-scale restoration.
- Meter acequias and mutual domestic water associations so that they may receive return flow credits.
- Support capacity for Councils of Governments (COGs) to address large-scale issues (infrastructure).
- Develop policies for oil and gas development for protection of water quality.

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 1 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
Rio Arriba County 40-Year Water Plan					
Capture the water use footprint on existing County facilities and identify threats and opportunities for protecting water rights, infrastructure, and supply as demands increase.	Rio Arriba County Planning and Zoning Department	Rio Arriba Regional Association of Water Users	The Board of County Commissioners	$10,000 – $20,000 (Funded by the Board of County Commissioners)	• Time / priority changes are always obstacles. • Technical resources and expertise strain already limited resources.
Flood and Hazard Mitigation Planning and Outreach Effort					
Encourage development that is acceptable to the conditions on the landscape in terms of soil types and natural resource considerations. The project aims to mitigate private property and public infrastructure flood damage.	Rio Arriba County with cooperation from the Soil and Water Conservation Districts (SWCDs)	Upper Chama SWCDs	• Federal Emergency Management Agency (FEMA) • NMD #SEM • New Mexico Environment Department (NMED) 319 Grants • Natural Resources Conservation Service (NRCS) • East Rio Arriba SWCD	$100,000 – $500,000	• Interagency collaboration and organizational missions often conflict, creating obstacles for successful project implementation. • FEMA funding is difficult to access.

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 2 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
Water Resources Monitoring Network					
Set up monitoring system to track groundwater quality and quantity, with emphasis on data quality.	Rio Arriba County (with Don Diego Gonzalez and Charley Cassagnol)	• Mutual domestics • Rio Arriba County • Private and commercial landowners • Businesses	• NMED • U.S. Geological Survey (USGS) • New Mexico Office of the State Engineer (NMOSE) • New Mexico Interstate Stream Commission (NMISC) • New Mexico Legislature	$25,000 annual recurring	• Ongoing funding for long-term monitoring and reporting without disruption. • Coordination and data management.
Upper Watershed Storage					
Develop storage on numerous tributaries for the purpose of addressing mid-season irrigation requirements and/or supplementing local domestic water association needs.	• Acequias Norteños • SWCDs • Rio Arriba County	• NMISC • U.S. Forest Service (USFS) • U.S. Army Corps of Engineers (USACE) • NMOSE • Counties • Local SWCDs	• NMISC • USACE • Other federal, State, and local agencies • Water users	$2 million to $10 million	Cost of National Environmental Policy Act (NEPA) compliance, along with initial planning funds, to develop conceptual plans with general cost estimates. Need support or access from technical staff, water rights.

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 3 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
Water Banking					
Conduct outreach to acequias and domestic water users on existing rules/policy allowing water banking.	• Rio Chama Acequia Association (RCAA) • Acequias Norteños	• New Mexico Acequia Association • New Mexico Acequia Commission • East Rio Arriba SWCD • Upper Chama SWCD	• NMISC • Local SWCDs • Federal programs	$200,000 – $500,000	Need resources for overall program/project management and staff to provide direct technical assistance.
Alternative Reservoir Release Management and River Maintenance					
Explore legal and political issues surrounding water releases from upstream reservoirs and river maintenance projects in order to minimize damage to acequia infrastructure and loss of bosque / riverbank property and to improve riparian, recreational, and wild and scenic benefits.	• Rio Grande Restoration • RCAA	• USACE • NMISC • U.S. Bureau of Reclamation (USBR) • Pueblos • Middle Rio Grande Conservancy District (MRGCD) • Abeyta y Trujillo Acequia	• USBR WaterSmart grant funding (current study on release management) • NRCS • NMISC Acequia Program • USACE Water Resources Development Act (WRDA) Section 519 grants • Capital Outlay	• Approximately $20,000 for four meetings, legal advice, etc. • Costs for implementation not yet identified	• Legal requirements. • Institutional barriers.

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 4 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
RCAA Storage Project					
Continue water sharing arrangements with upper watershed acequias (with NMISC support) and leases of San Juan-Chama Project (SJCP) water and temporary storage rights to supplement native water which is scarce in the latter half of the irrigation season, although SJCP purchases become more difficult as SJCP water supplies are reduced and SJCP partners increase.	RCAA	• NMISC • USACE • USBR	• Federal and State • Tax base may contribute to funding	$100,000 for long-term record-keeping and institutional and management costs (no capital appropriation)	• Compact compliance. • Existing reservoir authority. • Internal (RCAA) consensus (joint powers agreement).

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 5 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
Watershed Protection and Restoration					
Protect and restore watersheds to support fisheries, recreation, wildlife habitat, and water quality. One aspect is upland land management to reduce the risk of catastrophic wildfire impacts by landscape-scale thinning and prescribed burns. Prescriptions for thinning will focus on habitat restoration and healthy ecosystems. Channel and riparian restoration projects are also encouraged. The project will include area-wide collaboration with all organizations in identifying areas that have been thinned and/or restored and planning what needs to be done moving forward.	• Chama Peak Land Alliance • East Rio Arriba SWCD • Upper Chama SWCD • New Mexico Department of Game and Fish (NMDGF) for habitat restoration planning	• Santa Fe, Carson, Rio Grande, and San Juan national forests • State Land Office • State Forestry • Wildlife Center • Trout Unlimited • Sierra Club • Audubon Society • Nature Conservancy • Native Plant Society	• State Forestry • Rio Grande Water Fund • NMISC • NRCS • Chama Peak Land Alliance	100s of millions of dollars are needed for landscape-scale restoration.	• Funding. • Archaeology. • Many land owners. • Need for collaboration among diverse stakeholders. • San Juan Chama Community Wildfire Protection Plan will support this effort.

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 6 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
Capacity Building for Small Water Systems (Water as a Human Right)					
Protect and guarantee the basic human right to drinking/household water and water for health and safety by providing state funding for all community water system infrastructure.	Rio Arriba Regional Association of Water Users	• New Mexico Legislature • Churches • Mutual domestics	New Mexico Legislature	To be determined by Legislative Finance Committee	• Lack of concern, commitment, and coordination by government agencies. • Federal ownership of surrounding land. • Federal mandates and management.
Data Collection for Watershed Restoration					
Support data collection by both citizens and professionals. Potential projects include amphibians and macroinvertebrates. Identify data gaps and determine plan and priority for filling them. Ensure quality assurance/quality control through use of standard methods and protocols.	New Mexico Forest and Watershed Restoration Institute	• Wildlife Center • The Nature Conservancy • State Forestry • Chama Peak Land Alliance • Carson National Forest	Unknown	Unknown	Recurring annual funding needed for meaningful long-term data collection.

Table 8-2. Key Collaborative Programs, Projects, and Policies
2016 Rio Chama Regional Water Plan
Page 7 of 7

Project Description	Project Lead	Project Partners	Probable Funding Source(s)	Cost Range	Major Implementation Issues
Protection Against Degradation of Water Resources					
Develop source water protection policies to prevent degradation of surface and groundwater quality. Source water protection policies may include education and enforcement to prevent surface contamination by recreational users, energy development, and expanded monitoring, among others. This strategy may also consider revising the Bureau of Land Management Resource Management Plan to declare the Rio Chama watershed a buffer zone that is off limits to oil and gas exploration.	• Rio Arriba County	Western Environmental Law Center, Taos office	Unknown (to date this has been a community effort)	Unknown	• Opposition by oil and gas and mining industries. • Influence of oil and gas interests with state government. • Conflicts between watershed preservation and economic interests.

During an open meeting the group was given an opportunity to identify any policy recommendations that they thought would be problematic or lacked support, and none were identified.

The 2016 Regional Water Plan characterizes supply and demand issues and identifies strategies to meet the projected gaps between water supply and demand. This plan should be added to, updated, and revised to reflect implementation of strategies, address changing conditions, and continue to inform water managers and other stakeholders of important water issues affecting the region.

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Appendix 2-A

Master Stakeholder List

Rio Chama Region 14 RWP Master Stakeholder List

Updated June 28, 2016

Last	First	Affiliation/Category
		Chama Valley Chamber of Commerce
Atencio	Steve	Rural Water NMRWA Board
Blaine	Tom	State Engineer
Bordegaray	Angela	ISC
Campos	Tomas	Rio Arriba County Manager
Cassagnol	Charles	Trout Unlimited
Chacon	Gerald	
Chavez	Robert	Duranes Acequia
Chavarria	Ben	Natural Resources Dept. Santa Clara Pueblo
Chavarria	J. Michael	Governor, Santa Clara Pueblo
Clark	Bill	RCAA
Cramer	Jennifer	US Forest Service SF National Forest – Planner
Crosby	Doug	OSE
Delgado	Melanie	NMED
DiGiorgio	Monique	Chama Peak Land Alliance
Dixon	Deborah	Director, Interstate Stream Commission
Donnelly	Carolyn	Hydraulic Engineer, U.S. Bureau of Reclamation, Albuquerque Area
Dubois	Clara	East Rio Arriba SWCD
Dunsmore	Bob	Vallecitos MDWA
Dupuis	John	OSE
Gallegos	Brian	District VI Manager, Office of the State Engineer
Gallegos	Gerald	Acequia de los Galleogs
Gallegos	Jennifer	Mayor, Village of Chama
Gallegos	Roddy	NM Dept. of Game & Fish
Garcia	Alfred	Los Salazar's Community Ditch
Garcia	Danny	Commissioner, Rio Arriba County
Garcia	Juan	Vallecitos MDWA
Garcia	Mike	Rio Arriba County Planning
Garcia	Patricio	Agua Sana
Garcia	Seledon	
Geery	Emily	Manager, ISC
Ghahate	Eric	Northern NM Economic Development District Community and Technical Development Director
Gonzales	Don Diego	Acequia, Consultant to Rio Arriba County

Note: Those interested in developing collaborative projects or ongoing planning efforts may contact the NMISC Regional Water Planning Manager for further information about the region's stakeholders.

Rio Chama Region 14 RWP Master Stakeholder List

Updated June 28, 2016

Last	First	Affiliation/Category
Gonzales	Gloria	Agua Sana Water Users Association Chamita MDWCA
Gonzales	Thomas	NRCS
Gronewald	Ryan	Army Corps of Engineers
Gutierrez	Jesse	Santa Clara Pueblo
Harris	Steve	Far-Flung Adventures/Rio Grande Restoration
Hastings	Tom	Bureau of Reclamation
Higdon	Brad	BLM Taos Field Office
Hilton	Joanne	Water Consultant
Hoffman	Leah	Cebolla
Hosterman	Megan	Santa Fe National Forest
Hurlocker	Sandy	USDA Forest Service Espanola Ranger District
Ishihara	Scott	Chama Peak Land Alliance
Jeffers	Orville	Duranes Acequia
Johnston	Jessica	Agua Nortenas Embudo Watershed
Kostelnik	Kim	Technical Advisor, NM Forest Industry Association
Knight	Galen	President, Vitality Therapeutics
Kretzmann	Eliza	NM State Forestry NRCS
Leyba	Horace	Soil & Water Conservation District
Lithgow	Jason	SLO District Resource Manager
Lopez	Juan	
Lorenzo	Monica	Souder Miller & Associates
Lucero	Ramon	Souder Miller & Associates
Lundahl	Anders	ISC
Madrid	Chris	Economic Development Director, Rio Arriba County
Maestas	Richard	Chili Community Ditch
Maestas	Stacy	Ancones MDWCCA
Manzanares	Mariano	
Manzanares	Daniel	Ghost Ranch Abeyta & Trujillo Acequia
Manzanares	Debbie	Ghost Ranch
Martinet	Maceo	USFWS
Martinez	Arturo	Hernandez Community Ditch
Martinez	Felipe	

Note: Those interested in developing collaborative projects or ongoing planning efforts may contact the NMISC Regional Water Planning Manager for further information about the region's stakeholders.

Rio Chama Region 14 RWP Master Stakeholder List

Updated June 28, 2016

Last	First	Affiliation/Category
Martinez	Frank	Upper Chama SWCD
Martinez	Leonard T	San Joaquin Del Rio de Chama Land Grant
Martinez	Patricia	Rio Arriba County County Managers' Office
Martinez	Ramona	OSE
McCarthy	Laura	The Nature Conservancy
McIntosh	Bruce	
McKenna	Yvette	Water Management Division Manager
Mills	Beth	NM Land Conservancy
Mitchell	Toner	CWA Trout Unlimited
Montoya	Alfredo	Las Nueve Acequias
Montoya	Jacob	
Montoya	Johnny	
Muceus	Cheryl	Acequia de Abeyta Trujillo
Noftskers	Christina	OSE Water Rights Section
Olson	Emily	CPLA
Page	Bill	La Cueva Community Ditch
Pegram	Page	OSE
Romero	Alicia	UNM
Romero	Rosemary	Rosemary Romero Consulting
Salazar	Carlos	President, NNM Stockman's Association
Salazar	Donna	Acequia de los Vigiles
Salazar	Joe	Hernandez Ditch
Salazar	John	Acequia Hernandez
Salazar	Kenny	NMACD President, East Rio Arriba SWCD Chairman
Salazar	Rita	Northern NM Stockman's Association
Salazar	Sylvia	Chamita MDWCA
Sanches	Randy & Susan	
Sanchez	Eddy	Outback Support
Sanchez	Lucia	Planning Director, Rio Arriba County
Sanchez	Medardo	Acequias Nortenas
Sandoval	Levi	Water Operator, Village of Chama
Schrader	Rich	RiverSource
Schmidt-Peterson	Rolf	NMISC

Note: Those interested in developing collaborative projects or ongoing planning efforts may contact the NMISC Regional Water Planning Manager for further information about the region's stakeholders.

Rio Chama Region 14 RWP Master Stakeholder List

Updated June 28, 2016

Last	First	Affiliation/Category
Scott	Frank	SEO/Water Master Lower Rio Chama
Seaman	Tim	Acequia de Abeyta Trujillo
Serna	Ricky	Northern NM College
Sisneros	Alex	Chamita Water
Smith	Stef	Chili Community Ditch
Stuever	Mary	District Forester NM State Forestry
Torres	Luis	
Trujillo	David F.	Assistant County Manager, Rio Arriba
Trujillo	Fidel	Acequia de Chamita
Trujillo	Isabel	Director, Pueblo de Abiquiu Library & Cultural Center
Trujillo	Mick	Acequia Mariano
Trujillo	Becky	Acequia de los Vigiles
Trujillo	Richard	OSE/Acequia Liaison
Trujillo	Ted	Attorney
Ulibarri	Pedro	
Valdez	Jo	Upper Chama SWCD
Valdez	Joddie	Agua Sana MDWA
Valdez	Maggie	Village Clerk, Chama
Valdez	Marcos	East Rio Arriba SWCD
Valencia	Cristobal	University of New Mexico Anthropology Dept.
Velarde	Wainwright	Legislative Council Member, Jicarilla Apache Nation
Vigil	Beatriz	Water Master, Office of the State Engineer
Vigil	Clyde	Vigil and Salazar Ditch
Vigil	Fred	RCAA
Vigil	Gilbert	Eight Northern Indian Pueblo Council
Vigil	Norman	NM Association of Conservation Districts
Vollmer	Art	Trout Unlimited
Wagner	Jackie	
Weiss	Lee	Fishtail Ranch
White	Chris	Planner, Rio Arriba County
Whiting	Mely	Trout Unlimited
Williams	Mike	Trout Unlimited
Woolsten	Jackie	

Note: Those interested in developing collaborative projects or ongoing planning efforts may contact the NMISC Regional Water Planning Manager for further information about the region's stakeholders.

Appendix 2-B

Summary of Comments on Technical and Legal Sections: Single Comment Document

Rio Chama Regional Water Plan Compilation of Comments on Draft Plan

NO.	Comment Source	Location (Section/ Page/ Paragraph)	COMMENTS
1	RCAA	General	Reservoir Operations versus acequia operational schedules - RCAA recognizes that COE reservoir control must regulate high flows for a time each Spring because of high runoff and downstream agricultural demand. During scheduled irrigation season, acequias can physically handle high flows up to 1800 cfs by opening our headgates to reduce pressure, although damage to our engineering features and loss of river bank property always results. High winter flows associated with administrative water transport, however, even more damaging to our infrastructure owing to the fact that our headgates are CLOSED after the irrigation season and many cannot withstand flows above 800 cfs in that state. Solution: RCAA recognizes that there are many entities involved in these decisions, and that there are legal deadlines for movement of water at the end of the calendar year, but we believe these high flows could be reduced if started in late October, rather than mid-November, as is current practice.
2	RCAA	General	Seasonal Flooding and Restoration - Every summer the Lower Chama River Valley is subject to severe thunderstorms. Some years these storms are locally intense, causing massive arroyo flooding carrying water and debris from federal property into the valley. Debris flows are especially damaging as they completely block acequias and inundate agricultural fields. In 2013, local floods resulted in a Governor's emergency declaration. More than $25,000 in damages were assessed on one acequia. These losses, mainly incurred for debris removal from acequia ditches and engineering features, were partially reimbursed by State and Federal emergency management programs in 2015. Summer storms will continue, but it is essential that some attention be paid to reducing the magnitude of debris flowing into the valley margins from many large arroyo systems on federal land in the Chama Valley below Abiquiu Dam. Solution: RCAA supports any and all efforts to work with government agencies and private land owners on the restoration of watershed margins.
3	RCAA	General	Water Sharing Agreements & Acequia Metering- Simply put, water sharing is not possible without effective and universal metering of all acequia systems. If we want to continue our efforts to share water during drought periods on the entire Rio Chama, all acequias must be metered and the diversions monitored by the ISC. RCAA understands that priority calls and court intervention are undesirable and to be avoided if sharing agreements can be agreed upon and enforced. RCAA does, however, believe that there can and should be more flexibility in implementation. If the metering system is reliable, compliance with set diversion targets can be ensured while still providing flexibility in irrigation scheduling. Solution: Some RCAA acequias have a need to maintain higher flows to deliver water to all parciantes and could be accommodated by concentrating higher flows in fewer days of the week, while maintaining compliance with target diversions limits. If the metering system is not reliable enough to reach this goal, RCAA believes ISC should request additional resources from the State Legislature. In the long term, we support a plan to allow seasonal water storage for RCAA acequias in upstream reservoirs to alleviate drought.

Appendix 6-A

List of Individuals Interviewed

Appendix 6-A. List of Individuals Interviewed Rio Chama Water Planning Region

Name	Title	Organization	City
Liz Beth Walker	Representative	USDA NCRS	Santa Fe
Russell Naranjo	Planning Director	City of Espanola	Espanola
Lucia Sanchez	Director	Rio Arriba Co. Planning & Zoning	Espanola
Chris Madrid	Director	Rio Arriba Co. Economic Development	Espanola
Duncan Sill	Economic Director	NCNM EDD	Santa Fe
Kathy Keith	Executive Director	Rural Development Corporation	Santa Fe
Jill Lane	Owner	Elkhorn Lodge	Chama
Jennifer Gallegos	Mayor	Village of Chama	Chama
Rose Martinez	Director	Chama Valley Chamber of Commerce	Chama
Kurt Steinhaus	Representative	LANL Community Program Office	Los Alamos
Roberta Martinez	Chief of Staff	Cumbres & Toltec Scenic Railroad	Chama

Appendix 8-A

Recommended Projects, Programs, and Policies

Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

County	Regional (R) or System Specific (SS)	Strategy Type (Project, Program, or Policy)	Category	Project Name	Source of Project Information [a]	Description	Project Lead (Entity or Organization)	Partners (Other Entities or Participants)	Timeframe (Fiscal Year)/ Funding Request	Planning Phase	Cost	Need or Reason for the Project, Program, or Policy	Comments
Rio Arriba	R	Project	Drought Continengency	Upper Watershed Storage	Steering Committee, see Table 8-2	Develop storage on numerous tributaries for the purpose of addressing mid-season irrigation requirements and/or supplementing local domestic water association needs.	A key project from the Steering Committee. The project lead is Acequias Nortenos, Soil and Water Conservation Districts, Rio Arriba County	ISC USFS ACOE NMOSE Local SWCDs Rio Arriba County			$2 million to $10 million		Implementation issues: Cost of NEPA compliance, along with initial planning funds, to develop conceptual plans with general; cost estimates. Need support or access from technical staff, water rights.
Rio Arriba	R	Project	Data Collection	Data Collection for Watershed Restoration	Steering Committee, see Table 8-2	Support data collection by both citizens and professionals. Potential projects include amphibians and macroinvertebrates. Identify data gaps and determine plan and priority for filling them. Ensure quality assurance/quality control through use of standard methods and protocols.	A key project from the Steering Committee. The project lead is NM Forest and Watershed Restoration Institute	• Wildlife Center • The Nature Conservancy • NM State Forestry • Chama Peak Land Alliance • Carson National Forest			unknown		Implementation Issues: recurring annual funding needed for meaningful long-term data collection
Rio Arriba	R	Project	Drought Continengency	RCAA Storage Project	Steering Committee, see Table 8-2	Continue water sharing arrangements with upper watershed acequias (with NMISC support) and leases of San Juan-Chama Project (SJCP) water and temporary storage rights to supplement native water which is scarce in the latter half of the irrigation season, although SJCP purchases become more difficult as SJCP water supplies are reduced and SJCP partners increase.	A key project from the Steering Committee. The project lead is RCAA	ISC COE BOR			$100,000 for long-term record-keeping and institutional and management costs (no capital appropriation)		Implementation issues: Compliance, Existing resevoir authority, Internal RCAA, Concensus, JPA
Rio Arriba	R	Project	Water Banking	Water Banking	Steering Committee, see Table 8-2	Conduct outreach to acequias and domestic water users on existing rules/policy allowing water banking.	A key project from the Steering Committee. The project lead is RCAA, and the Acequias Nortenos	NMAA NM Acequia Commission East Rio Arriba SWCD Upper Chama SWCD			$200,000 – $500,000		Implementation issues: Need resources for overall program/project management and staff to provide direct technical assistance.
Rio Arriba	R	Project	Water Quality Protection	Protection Against Degradation of Water Resources	Steering Committee, see Table 8-2	Develop source water protection policies to prevent degradation of surface and groundwater quality. Source water protection policies may include; education and enforcement to prevent surface contamination by recreational users, energy development and others, along with expanded monitoring. This strategy may also consider revising the BLM Resource Management Plan to declare the Rio Chama watershed a buffer zone that is off limits to oil and gas exploration.	A key project from the Steering Committee. The project lead is Rio Arriba County	Western Environmental Law Center, Taos office			unknown		Implementation Issues: opposition by oil and gas and mining industries, influence of oil and gas interests with state government, conflicts between watershed preservation and economic interests
Rio Arriba	R	Project	Data Collection	Water Resources Monitoring Network	Steering Committee, see Table 8-2	Set up monitoring system to track groundwater quality and quantity, with emphasis on data quality.	A key project from the Steering Committee. The project lead is Rio Arriba County (with Don Diego Gonzalez and Charley Cassagnol)	Mutual domestics Rio Arriba County Private and commercial landowners Businesses			$25,000 annual recurring		Implementation issues: Ongoing funding for long-term monitoring and reporting without disruption, Coordination and data management
Rio Arriba	R	Project	Water Planning	Rio Arriba County 40-Year Water Plan	Steering Committee, see Table 8-2	Capture the water use footprint on existing County facilities and identify threats and opportunities for protecting water rights, infrastructure, and supply as demands increase.	A key project from the Steering Committee. The project lead is Rio Arriba County Planning and Zoning Department	Rio Arriba Regional Association of Water Users			$10,000 – $20,000 (Funded by the Board of County Commissioners)		Implementation issues: Time/priority changes, technical resources and expertise strain already limited resources

[a] ICIP = Infrastructure Capital Improvement Plan (Projects, programs or policies may appear in this table more than once due to the compilation of PPPs and ICIP into one table.)

Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

County	Regional (R) or System Specific (SS)	Strategy Type (Project, Program, or Policy)	Category	Project Name	Source of Project Information [a]	Description	Project Lead (Entity or Organization)	Partners (Other Entities or Participants)	Timeframe (Fiscal Year)/ Funding Request	Planning Phase	Cost	Need or Reason for the Project, Program, or Policy	Comments
Rio Arriba	R	Project	Water System Infrastructure	Capacity Building for Small Water Systems (Water as a Human Right)	Steering Committee, see Table 8-2	Protect and guarantee the basic human right to drinking/household water and water for health and safety, fire protection, and food sustainability by providing state funding for all community water system infrastructure.	A key project from the Steering Committee. The project lead is Rio Arriba Regional Association of Water Users	• New Mexico Legislature • Churches • Mutual domestics			To be determined by Legislative Finance Committee		Implementation Issues: Lack of concern, commitment, and coordination by government agencies, federal ownership of surrounding land, federal mandates and management
Rio Arriba	R	Project	Reservoir Management	Alternative Reservoir Release Management and River Maintenance	Steering Committee, see Table 8-2	Address legal and political issues surrounding water releases from upstream reservoirs and river maintenance projects in order to mini¬mize damage to acequia infrastructure and loss of bosque/ riverbank property.	A key project from the Steering Committee. The project lead is Rio Grande Restoration	COE ISC BOR S. PUEBLOS MRGCD Rio Chama Acequia Association Abeyta y Trujillo Acequia			Approximately $20,000 for four meetings, legal advice, etc.		Implementation issues: Legal requirements, Institutional barriers
Rio Arriba	R	Project	Flood Mitigation/ Preparation	Flood and Hazard Mitigation Planning and Outreach Effort	Steering Committee, see Table 8-2	Encourage development that is acceptable to the conditions on the landscape in terms of soil types and natural resource considerations. The project aims to mitigate private property and public infrastructure flood damage.	A key project from the Steering Committee. The project lead is the Rio Arriba County with Cooperation from the Soil and Water Conservation Districts	Upper Chama Soil and Water Conservation Districts			$100,000 – $500,000		Implementation issues: Interagency collaboration and organizational missions often conflict, creating obstacles for successful project implementation; FEMA funding is difficult to access.
Rio Arriba	R	Project	Watershed Restoration	Protect and Restore Watersheds	Steering Committee, see Table 8-2	The purpose of this project is to protect and restore watersheds to support fisheries, recreation, wildlife habitat and water quality. One aspect is upland land management to reduce the risk of catastrophic wildfire impacts by landscape scale thinning and prescribed burns, Prescriptions for thinning will focus on habitat restoration and healthy ecosystems. Channel and riparian restoration projects are also encouraged. The project will include collaboration area-wide with all organizations, identifying areas that have been thinned and/or restored and planning what needs to be done.	A key project from the Steering Committee. The project leads are Chama Peak Land Alliance, East Rio Arriba SWCD, Upper Chama SWCD, NMDGF for habitat restoration planning	• Santa Fe, Carson, Rio Grande, and San Juan National Forests • State Land Office • State Forestry • Wildlife Center • Trout Unlimited • Sierra Club • Audubon Society • Nature Conservancy • Native Plant Society			100s of millions of dollars are needed for landscape-scale restoration		Implemenation Issues: Funding, archaeology, many land owners, need for collaboration among diverse stakeholders
Rio Arriba	SS	Project	Water System Infrastructure	Acequia de la Otra Vanda repair & restore	Capital Outlay Database	Acequia de la Otra Vanda repair & restore	Acequia de la Otra Vanda				$20,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Acequia de la Plaza de Dixon Phase 2 improvements	Capital Outlay Database	Acequia de la Plaza de Dixon Phase 2 improvements	Acequia de la Plaza de Dixon				$65,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Acequia de las Canovas improvements/piping	Capital Outlay Database	Acequia de las Canovas improvements/piping	Acequia de las Canovas				$10,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Acequia de las Canovas improvements/plan & design	Capital Outlay Database	Acequia de las Canovas improvements/plan & design	Acequia de las Canovas				$15,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Acequia de los Vigiles improvements Rio Arriba co	Capital Outlay Database	Acequia de los Vigiles improvements Rio Arriba Co.	Acequia de los Vigiles				$100,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Acequia de Ojo Sarco improvements Rio Arriba co	Capital Outlay Database	Acequia de Ojo Sarco improvements Rio Arriba Co.	Acequia de Ojo Sarco				$10,000		Fund: STB

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

County	Regional (R) or System Specific (SS)	Strategy Type (Project, Program, or Policy)	Category	Project Name	Source of Project Information [a]	Description	Project Lead (Entity or Organization)	Partners (Other Entities or Participants)	Timeframe (Fiscal Year)/ Funding Request	Planning Phase	Cost	Need or Reason for the Project, Program, or Policy	Comments
Rio Arriba	R	Project	Watershed Restoration; Water Conservation	Water Conservation and Planning in Relation to Forest Management During Climate Change	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	The Project will result in (1) detailed reporting on which guidelines can be developed for forest management to enhance water salvage, and (2) input for regulation of sustainable water use, particularly groundwater, within New Mexico.	Advanced Remote Sensing, Inc.	Chama Peak Land Alliance	2015-2018. Funding request: unknown; pending	Phase I (see separate project spreadsheet)	Annual budget: $176,000		Jurisdiction: multi-state
Rio Arriba	SS	Project	Water System Infrastructure	Arsenic treatment facility	Mutual Domestic Subcommittee, Ramon Lucero	Last 10-Years Project: Two deep water supply wells, water storage tank, and distribution lines to connect 14 communities in the Hernandez area north of Espanola. Proposed 10-Year Projects: Arsenic treatment facility	Agua Sana MDWCA				$750.00		
Rio Arriba	SS	Project	Water System Infrastructure	Water System Improvements (Treatment)	Water Trust Board 2016 Recommendations	Construction	Agua Sana Water Users Association				$579,386		
Rio Arriba	SS	Project	Water System Infrastructure	Alcalde MDWCA Infrastructure and supplemental well	Mutual Domestic Subcommittee, Ramon Lucero	Supplemental water supply well, arsenic treatment media replacement, distribution expansion to the north and south of the existing system	Alcalde MDWCA		This is a proposed 10-yr project.				Last 10-yrs project: new water supply well, booster station and half a mile of new distribution lines
Rio Arriba	SS	Project	Water System Infrastructure	Alcalde MDWC & MWSA water system improvements	Capital Outlay Database	Alcalde MDWC & MWSA water system improvements	Alcalde MDWCA &MWSA				$15,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Infrastructure Upgrades	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* New water supply well, new pumphouse, and fill station. *Proposed 10-Year Projects:* New water system for the communities of Ancones and El Llanito to include water storage tank, 6-inch and 8-inch waterlines, radio read water meters, gate valves and fire hydrants	Ancones MDWCA				$1,700,000		
Rio Arriba	SS	Project	Water System Infrastructure	Ancones Water System Phase I	Water Trust Board Database	Ancones Water System Phase I	Ancones MDWCA		FY2014		$174,074		
Rio Arriba	SS	Project	Water System Infrastructure	Water distribution construction	Water Trust Board Database	Water distribution construction	Ancones MDWCA		FY2015		$499,999		
Rio Arriba	SS	Project	Water System Infrastructure	Ancones Water System Improvement Project	Water Trust Board 2016 Recommendations	Construction	Ancones MDWCA				$717,832		
Rio Arriba	SS	Project	Water System Infrastructure	Water System Improvements	Water Trust Board Database	Water System Improvements	Aqua Sana WUA		FY2015		$923,180		
Rio Arriba	SS	Project	Water System Infrastructure	Canjilon MDWC & MSWA water system improvements	Capital Outlay Database	Canjilon MDWC & MSWA water system improvements	Canijon MDWCA &MWSA				$100,000		Fund: STB

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

County	Regional (R) or System Specific (SS)	Strategy Type (Project, Program, or Policy)	Category	Project Name	Source of Project Information [a]	Description	Project Lead (Entity or Organization)	Partners (Other Entities or Participants)	Timeframe (Fiscal Year)/ Funding Request	Planning Phase	Cost	Need or Reason for the Project, Program, or Policy	Comments
Rio Arriba	R	Project	Riparian Restoration	Rio San Antonio Riparian Restoration	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	The primary purpose of the planning phase of this project is to collect baseline water quality data and develop a Watershed-Based Plan (WBP) and Categorical Exclusion (CE) for the Upper Rio San Antonio watershed. The goals of the project include the following: (1) Identify and involve stakeholders, and lead a collaborative workgroup to assimilate input that will drive the development of a Proposed Action, (2) Identify and quantitatively describe site-specific sources and causes of temperature and dissolved oxygen impairment within the upper San Antonio watershed, (3) Develop a list of implementation measures and a monitoring plan that will effectively reduce the pollutant loading (i.e., reduce temperature and increase dissolved oxygen) within the project reach to levels described within the TMDL (for temperature), and to acceptable thresholds for dissolved oxygen, (4) Quantify the effects that the implementation measures would have on reducing pollutant loading, (5) Conduct appropriate research and prepare a WBP document that assimilates the results of the source impairment data and analyzes the impacts of the management measures developed through the workgroup and public scoping process. The CE has been prepared, which articulates a proposed action, including management measures from the WBP. The WBP has been submitted to the EPA for review, and includes all nine of the elements as described in the EPA Nonpoint Source Program and Grants Guidelines for States and Territories. The implementation phase of this project seeks to carry out the management measures that have been articulated in the planning phase. Funding is being requested for the implementation phase.	Carson National Forest	Rocky Mountain Ecology, Chama Peak Land Alliance, USFS	Implementation would begin as early as the fall of 2016 and continue through 2018. Funding request: $250,000	Underway.	Annual budget: $86,380 - for planning only		Jurisdiction: public lands
Rio Arriba	S	Project	Water System Infrastructure	Cebolla MDWCA Water System Improvements	Cebolla MDWCA, Frank Martinez	Replace existing 4" and 6" lines that are starting to fail, replace main valves, replace some of the radio meters, install 5 fire hydrants	Cebolla MDWCA		2017-2021		$500,000	Deteriorating waterlines resulting in loss of water	
Rio Arriba	R	Project	Riparian Restoration	Rio Chama Riparian Restoration	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	In 2014 and 2015, the Alliance received a National Fish and Wildlife Foundation Conservation Partners grant to launch the San Juan – Rio Grande Riparian Stewardship Program. Through this program, we are working with willing landowners to deliver on-the-ground conservation projects to increase the health and resilience of riparian areas to benefit the Southwestern Willow Flycatcher and other riparian obligate species. Conservation projects are being focused along the Blanco and Navajo Rivers, tributaries to the San Juan Watershed, and along the Chamita, Brazos, and Rio Chama, tributaries to the Rio Grande Watershed. Riparian restoration, both in-stream and bank, along the Rio Chama is a priority for this project. A landowner workshop was hosted in July 2015 and we anticipate a series of private lands water projects associated with this work.	Chama Peak Land Alliance	Trout Unlimited, Rio Grande Restoration, Partners for Fish and Wildlife, NRCS, NMED (319), Upper Chama SWCD, NM Association of SWCDs, US Fish and Wildlife Service, NMDGF, The Nature Conservancy, Bird Conservancy of the Rockies, Institute for Applied Ecology	2016-2018. Funding request: $500,000 - ISC, Water Trust Board (FY 2016/2017)	Underway.	Annual budget: $250,000	To increase the health and resilience of riparian areas to benefit the Southwestern Willow Flycatcher and other riparian obligate species.	Jurisdiction: private lands
Rio Arriba	R	Project	Watershed Restoration	San Juan - Chama Watershed Restoration	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	In 2015, CPLA was awarded $410,000 from The Nature Conservancy's Rio Grande Water Fund for the treatment of 800 acres, through prescribed fire and thinning, over the next three years to improve forest health and restore wildlife habitat on six to ten properties. Through this program, CPLA will be working with landowners and partners to (1) create fire plans for private lands, and coordinate fire management activities across jurisdictional boundaries, including private lands and local, state, federal agencies tribal and other jurisdictions in the project area responsible for fire management, including the U.S. Forest Service, (2) share lessons learned from cross-boundary management in this forested landscape with others restoring forests in the Rio Grande Water Fund area, and with other members of the national Fire Learning Network, and (3) increase the ability of local ranches, community members, and local, tribal, state and federal government partners to conduct prescribed burns through trainings and workshops in the region.	Chama Peak Land Alliance	The Nature Conservancy (Rio Grande Water Fund)	April 2015-December 31, 2017	Underway.	Annual budget: $150,000	To improve forest health and restore wildlife habitat.	Jurisdiction: private lands

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

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Rio Arriba	R	Project	Watershed Restoration	San Juan - Chama Watershed Partnership (Biomass Initiative) (Phase I)	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	In 2012, the Chama Peak Land Alliance and Western Environmental Law Center received $50,000 from the USDA Rural Business Enterprise grant to conduct a healthy forests and wood utilization feasibility study in the San Juan-Chama region. That study was completed in June 2013 and has identified emerging and appropriately scaled technologies and business models to help restore forest health, create jobs and potentially furnish renewable sources of energy. To accomplish the goals set forth in the study, the Chama Peak Land Alliance developed the San Juan–Chama Watershed Partnership to restore forest and watershed health, create local energy, and support the rural economy of the San Juan–Chama region.	Chama Peak Land Alliance	Western Environmental Law Center	Now in Phase II below. Funding request: $0	Complete.	Annual budget: $50,000		Jurisdiction: private, tribe
Rio Arriba	R	Project	Watershed Restoration	San Juan - Chama Watershed Partnership (Biomass Initiative) (Phase II)	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	To further advance the San Juan-Chama Watershed Partnership, the Chama Peak Land Alliance applied to the Department of Energy for a $5 million grant, over a five-year period, to determine the effect of bioenergy development on forested landscapes within the San Juan–Chama Watershed while improving environmental sustainability compared to the baseline forestry production system. Using six sub-watersheds within the SJCW, we will (1) develop and implement a landscape design process for integrating cellulosic feedstock production into the San Juan–Chama forestry system, (2) implement an experimental design that quantifies a variety of environmental sustainability metrics for biomass harvesting and biomass production, (3) develop a reasonable approach for feedstock harvesting and bioenergy production through market-based mechanisms, planning, and bioenergy policy development, and (4) deliver practical science-based tools for use outside the region.	Chama Peak Land Alliance	Los Alamos National Laboratory, Western Ecology, Advanced Remote Sensing Inc., Unique Places LLC, The Nature Conservancy, Forest Guild, Forestry Services of Chama, NM State Forestry, SIMTable, USGS, TSS Consultants	2015-2020. Funding request: unknown; pending.	Underway: initial planning	DOE funding will be announced in June 2015.	To determine the effect of bioenergy development on forested landscapes within the San Juan – Chama Watershed while improving environmental sustainability compared to the baseline forestry production system.	Jurisdiction: private lands
Rio Arriba	R	Project	Water Quality Monitoring	Rio Chama Water Quality Monitoring	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	In 2014,the Chama Peak Land Alliance launched a summer internship program with Colorado State University's Center for Collaborative Conservation (CCC). The goal of this paid internship was to connect motivated CSU students who are passionate about community-led conservation with active collaborative initiatives in the region in need of internship support. Our first intern was Mikinzie Moydell. As part of her internship, Mikinzie developed a protocol for a water quality monitoring program and is integrating streamside habitat monitoring into the program to set a baseline for riparian habitat health in the Alliance region. She also assisted with the day-to-day activities of the organization such as organizing field trips, attending board meetings, creating a Facebook page, making photographs to document Alliance events, and writing grant proposals.	Chama Peak Land Alliance	Western Ecology	FY2016. Funding request: $100,000	Planning	Initial set up $100,000; annual budget $35,0000		
Rio Arriba	SS	Project	Water System Infrastructure	Water System Improvements	Water Trust Board Database	Water System Improvements	Chama West WUA		FY2015		$314,000		
Rio Arriba	SS	Project	Water System Infrastructure	Chamita Uranium treatment system	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* Supplemental water supply well, new pumphouse and fencing. *Proposed 10-Year Projects:* Uranium Treatment Facility	Chamita MDWCA				$850,000		
Rio Arriba	SS	Project	Water System Infrastructure	Uranium treatment system	Water Trust Board Database	Uranium treatment system	Chamita MDWCA		FY2015		$750,000		
Rio Arriba	SS	Project	Watershed Restoration	Riparian Restoration Project through the Greater Rio Grande Watershed Alliance	Water Trust Board Database	Riparian Restoration Project through the Greater Rio Grande Watershed Alliance	Claunch-Pinto SWCD		FY2014		$600,000		
Rio Arriba	SS	Project	Water System Infrastructure	CTRRC water tank supply system	Capital Outlay Database	CTRRC water tank supply system	CTRRC				$30,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Water System Expansion	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* New water supply well, 120,000 gallon water storage tank, 1.5 miles of 6-inch waterline. *Proposed 10-Year Projects:* Install approximately 1,800 linear feet of 6-inch waterline, connect new lines to existing water storage tank, and install approximately 42 water meters	El Rito Canon						

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

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Rio Arriba	SS	Project	Water System Infrastructure	El Rito supplemental well	Mutual Domestic Subcommittee, Ramon Lucero	Supplemental water supply well and provide water to new members	El Rito Regional W&WWA		This is a proposed 10-yr project.				Last 10-yrs project: Interconnection 4 communities including a 120,000-gallon water storage tank, new pumphouse, well rehabilitation, radio read meters, 6-inch distribution, 6-inch fire hydrants and new billing software
Rio Arriba	SS	Project	Water System Infrastructure	Infrastructure Upgrades	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* Interconnection four communities including a 120,000 gallon water storage tank, new pumphouse, well rehabilitation, radio read meters, 6-inch distribution, 6-inch fire hydrants, and new billing software. *Proposed 10-Year Projects:* Supplemental water supply well and provide water to new members.	El Rito Regional W&WWA				$250,000		
Rio Arriba	R	Project	Watershed Restoration	Wildland Urban Interface Hazardous Fuels Treatment - Canjilon, Cebolla, Nutrias	Cebolla MDWCA, Frank Martinez	Treatment areas are located in middle Rio Arriba County (MiRA) near the El Rito WUI areas within the Carson National Forest. Upland forest densities are exceeding 120 square feet of basal area and leading to excessive fuel loadings. Catastrophic fire would result in extensive loss of habitat, timber, and natural resources as well as causing severe erosion and sedimentation of streams and waterways. Removing overstocked, and unhealthy trees will reduce stand density, remove aerial fuel loading, and remove nutrient competition; thus improving the health and vigor of the residual stand. This project area is inclusive of impared waterways, and is within the priority watersheds for the NMSF Chama District.	EMNRD - Forestry Division, Chama District; Upper Chama SWCD; Rio Arriba County	private landowners	next 5 years		~$500,000		
Rio Arriba	SS	Project	Water System Infrastructure	La Asociacion de Agua de los Brazos water system & loan	Capital Outlay Database	La Asociacion de Agua de los Brazos water system & loan	La Asociacion de Aqua de los Bravos				$50,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	La Jara MDWCA improvements	Mutual Domestic Subcommittee, Ramon Lucero	La Jara MDWCA improvements	La Jara MDWCA						
Rio Arriba	SS	Project	Water System Infrastructure	La Madera MDWCA Infrastructure and supplemental well	Mutual Domestic Subcommittee, Ramon Lucero	*Proposed 10-Year Projects:* Supplemental water supply well, rehabilitate existing water supply well, new water storage tank, 6-inch waterlines, water meters, gate valves, and fire hydrants	La Madera MDWCA						
Rio Arriba	SS	Project	Water system infrastructure	Stream Bank Stablization	ISC, Anders Lundahl	Stabalize stream banks that errode during higher flow condtions, specifically along private property and near acequia diversions/presas	Local property owners	Local Acequias	year to year		$5,00-$10,000 per 100 linear feet	Protection of property and irrigation infrastructure	
Rio Arriba	SS	Project	Water System Infrastructure	Lumberton new water supply well and infrastructure	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* New surface water infiltration gallery and treatment facility, new waterlines, new building, new water storage tank and SCADA. *Proposed 10-Year Projects:* New water supply source, upgrade existing waterlines, upgrade surface water treatment facility, address water leaks.	Lumberton MDWCA						
Rio Arriba	R	Program	Acequia Infrastructure	Rio Arriba County acequia Infrastructure Improvements	New Mexico Association of Conservation Districts, Norman Vigil	NMACD, along with partners, has provided initial assessments to acequias in preparation for infrastructure improvements. All partners have been engaged in setting aside financial and technical assistance to assist the acequias as they become ready for infrastructure improvements.	NMACD	ISC, NMAA, NRCS, local SWCD, Rio Arriba Commissioners	2015 and into the future. Strategy: NMACD along with ISC, NMAA, NRCS, and local SWCDs. Funding request: 2015, ISC-90/10, RCPP, Capital Outlay, local conservation districts, Rio Arriba Commissioners	Planning phase in progress.			
Rio Arriba	SS	Project	Water system infrastructure	River maintenance	ISC, Anders Lundahl	Excavate excess in-channel sediment specifically around arroyo mouths. Remove obtructions from the river channel.	NMISC	BOR/Corps	Longer term planning, design, compliance and implementation		$500,000-$1,000,000	Maintain safe channel capacity and necessary conveyance for water management and Rio Grande Compact accounting	
Rio Arriba	SS	Project	Water System Infrastructure	Uranium treatment system	Mutual Domestic Subcommittee, Ramon Lucero	*Proposed 10-Year Projects:* Uranium treatment facility, rehabilitate existing water supply wells, and replace PRVs	Ojo Caliente				$850,000		

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

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Rio Arriba	SS	Project	Drought Management Plan	Drought Management Strategy and Water Conservation Program for Rio Chama Acequia Association	Rio Chama Acequia Association, Tim Seaman	Drought conditions are adversely affecting the water supplies and livelihood of water users within the Rio Chama Acequia Association (RCAA) on the Rio Chama in northern New Mexico. In recent years the RCAA has had shortages of native water from the Rio Chama for irrigation, and relied on the acquisition of imported San Juan-Chama Project (SJCP) water to offset these shortages. Long-range climate predictions project reduced streamflow from snowmelt runoff. The availability of leasing supplemental water from the SJCP is decreasing as the SJCP Contractors move toward full utilization of their annual allocation. Immediate action is needed to investigate alternatives in water management, irrigation operations, and water conservation that can provide the flexibility to manage a decreasing water supply into the future. The proposed work plan describes the framework for developing a water management plan that allows for delayed use of native streamflow during an irrigation season so it can be used in times of limited supply. The biggest hurdles are identifying alternative water operations, locating and securing storage agreements, coordinating with other water management agencies, and complying with state water administration and interstate agreements. Initially the proposed plan needs to feasibly develop a method for managing 1,000 to 2,000 ac-ft per irrigation season. Implementation of this proposed work plan will allow for greater flexibility to manage available water supply during an irrigation season to minimize shortage sharing.	RCAA	NMISC	Project will take several years and require coordination with local state and federal entities. Funding request: SFY16, NM legislature.	Initial planning document completed (contact ISC for copy).	$100,000 (see Description)		
Rio Arriba	SS	Project	Drought Management Plan	Implement a drought management strategy and water conservation program for Rio Chama Acequia Association	Rio Chama Acequia Association, Tim Seaman	The proposed work plan describes the framework for developing a water management plan that allows for delayed use of native streamflow during an irrigation season so it can be used in times of limited supply. The biggest hurdles are identifying alternative water operations, locating and securing storage agreements, coordinating with other water management agencies, and complying with state water administration and interstate agreements. Initially, the proposed plan needs to feasibly develop a method for managing 1,000 to 2,000 ac-ft per irrigation season. Implementation of this proposed work plan will allow for greater flexibility to manage available water supply during an irrigation season to minimize shortage sharing.	RCAA						This info came from an Executive Summary. Document title: waterbanksum.pdf
Rio Arriba	SS	Project	Water System Infrastructure	Rio Arriba Co. detention center wastewater	Capital Outlay Database	Rio Arriba Co. detention center wastewater	Rio Arriba County				$100,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Water Right Acquisition	ICIP 2016-2020	Water Right Acquisition	Rio Arriba County		2016-2017		$500,000		
Rio Arriba	SS	Project	Water System Infrastructure	Alcalde Domestic Water Well	ICIP 2016-2020	Alcalde Domestic Water Well	Rio Arriba County		2016-2020		$6,000,000		
Rio Arriba	SS	Project	Acequia System Infrastructure	Rio Chama Acequias	ICIP 2016-2020	Rio Chama Acequias	Rio Arriba County		2016-2020		$365,000		
Rio Arriba	SS	Project	Water System Infrastructure	Agua Sana Water Mutual Domestic	ICIP 2016-2020	Agua Sana Water Mutual Domestic	Rio Arriba County		2016-2017		$820,000		
Rio Arriba	SS	Project	Water System Infrastructure	El Rito MDWCA	ICIP 2016-2020	El Rito MDWCA	Rio Arriba County		2016-2017		$1,040,000		
Rio Arriba	SS	Project	Water System Infrastructure	El Rito/Placitas-Collection/Treatment Wastewater Project	ICIP 2016-2020	El Rito/Placitas-Collection/Treatment Wastewater Project	Rio Arriba County		2016-2020		$400,000		
Rio Arriba	SS	Project	Water System Infrastructure	Abiquiu Wastewater Improvements	ICIP 2016-2020	Abiquiu Wastewater Improvements	Rio Arriba County		2016-2020		$695,000		
Rio Arriba	SS	Project	Water Rights	Rio Arriba County Water Right Analysis Project	Rio Arriba County, Don Diego Gonzales, Hydrogeologist	Rio Arriba County Water Right Analysis Project	Rio Arriba County	Rio Arriba Acequia Associations and Commissions, federal agencies, state agencies	Ongoing. Rio Arriba County will administer and manage the Planning and Zoning Department. Future projections may create justification to establish a Natural Resources Department. Funding request: 2015-16 Legislature requests and federal and state agencies.	Initial planning is completed.	Combinations of sources of funding will be established, the bulk from the NM Legislature. The total budget cost is estimated at $500,000.		

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Water Planning Region: Rio Chama

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Rio Arriba	SS	Project	Water Quality	Rio Arriba County Water Resources Data and Water Quality Project	Rio Arriba County, Don Diego Gonzales, Hydrogeologist	Rio Arriba County Water Resources Data and Water Quality Project	Rio Arriba County	Rio Arriba Acequia Associations and Commissions, federal agencies, state agencies	Ongoing. Rio Arriba County will administer and manage the Planning and Zoning Department. Future projections may create justification to establish a Natural Resources Department. Funding request: 2015-16 Legislature requests and federal and state agencies.	Initial planning is completed.	Combinations of sources of funding will be established, the bulk from the NM Legislature. The total budget cost is estimated at $500,000.		
Rio Arriba	SS	Project	Water Planning	Rio Arriba County Mutual Domestics and Infrastructure Database	Rio Arriba County, Don Diego Gonzales, Hydrogeologist	Rio Arriba County Mutual Domestics and Infrastructure Database	Rio Arriba County	Rio Arriba Acequia Associations and Commissions, federal agencies, state agencies	Ongoing. Rio Arriba County will administer and manage the Planning and Zoning Department. Future projections may create justification to establish a Natural Resources Department. Funding request: 2015-16 Legislature requests and federal and state agencies.	Initial planning is completed.	Combinations of sources of funding will be established, the bulk from the NM Legislature. The total budget cost is estimated at $500,000.		
Rio Arriba	SS	Project	Water Planning	Rio Arriba County Water Supply and Demand Analysis and Projections	Rio Arriba County, Don Diego Gonzales, Hydrogeologist	Rio Arriba County Water Supply and Demand Analysis and Projections	Rio Arriba County	Rio Arriba Acequia Associations and Commissions, federal agencies, state agencies	Ongoing. Rio Arriba County will administer and manage the Planning and Zoning Department. Future projections may create justification to establish a Natural Resources Department. Funding request: 2015-16 Legislature requests and federal and state agencies.	Initial planning is completed.	Combinations of sources of funding will be established, the bulk from the NM Legislature. The total budget cost is estimated at $500,000.		
Rio Arriba	SS	Project	Water Rights	Rio Arriba County Water Banking	Rio Arriba County, Don Diego Gonzales, Hydrogeologist	Rio Arriba County Water Banking	Rio Arriba County	Rio Arriba Acequia Associations and Commissions, federal agencies, state agencies	Ongoing. Rio Arriba County will administer and manage the Planning and Zoning Department. Future projections may create justification to establish a Natural Resources Department. Funding request: 2015-16 Legislature requests and federal and state agencies.	Initial planning is completed.	Combinations of sources of funding will be established, the bulk from the NM Legislature. The total budget cost is estimated at $500,000.		
Rio Arriba	SS	Project	Water Resources Board	Rio Arriba County Water Resources Board	Rio Arriba County, Don Diego Gonzales, Hydrogeologist	Rio Arriba County Water Resources Board	Rio Arriba County	Rio Arriba Acequia Associations and Commissions, federal agencies, state agencies	Ongoing. Rio Arriba County will administer and manage the Planning and Zoning Department. Future projections may create justification to establish a Natural Resources Department. Funding request: 2015-16 Legislature requests and federal and state agencies.	Initial planning is completed.	Combinations of sources of funding will be established, the bulk from the NM Legislature. The total budget cost is estimated at $500,000.		
Rio Arriba	SS	Project	Water System Infrastructure	IFAS wastewater treatment expansion	Water Trust Board Database	IFAS wastewater treatment expansion	Rio Arriba County		FY2015		$1,500,000		
Rio Arriba	R	Project	Data Collection	Remote Sensing and Satellite for Water Management –move to PPP list	Charley Cassegnol	Develop a tool for New Mexico forestry managers to use in planning thinning and fire management to maximize water salvage (availability). Increase water availability through precision forestry management.	Rio Arriba SWCD (with Charley Cassagnol)	USDA Trout Unlimited Nature Conservancy			• $178,000 first year • $250,000 for 2 subsequent years		Implementation issues: Reluctance from NM State Forestry to fund "research." However, it is not fully a research project as there is a clear interactive product that will be made available to NM Forestry.
Rio Arriba	S	Project	Water Quality Protection	Rio Chama Flow Project and Watershed Planning	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	In 2014, Rio Grande Restoration received a $50,000 grant from the BOR, Cooperative Watershed Management Program to expand the existing Rio Chama Flow Project advisory council to include the Rio Chama watershed in northern New Mexico.	Rio Grande Restoration	Chama Peak Land Alliance		Underway.			Jurisdiction: private and public lands

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

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Rio Arriba	R	Project	Watershed Restoration	Augment & stabilize/naturalize Rio Chama streamflows	Rio Grande Restoration (RGR) -- Steve Harris, 575-751-1269, steve.harris39@gmail.com	Evaluate improvements to irrigation delivery systems, work with acequia organization to implement identified, agreeable improvements	Rio Grande Restoration	Bureau of Reclamation, NMISC, Trout Unltd, Nature Conservancy, CPLA	ten-year program, implemented through San Juan-Chama watershed partnership, implemented 2020	A watershed Restoration Implementation plan is to be submitted to US reclamation, due Nov. 30, 2016.	E-flow implementation will cost $150,000, annual watershed congresso will cost $50,000, engineering studies of irrigation system are one-time cost of $1,000,000		
Rio Arriba	R	Project	Watershed Restoration	Abiquiu Fish and Wetland Project	New Mexico Association of Conservation Districts, Norman Vigil	Rio Cebolla/Nutrias Watershed Group - Planning through 319 funding as well as New Mexico Association of Conservation District assistance in developing coordinated resource management plans on private/public lands has identified watershed treatment necessary to address the resource concerns.	Rio Nutrias/Cebolla Watershed Group & local landowner Gerald Chacon and Max Martinez	NMED, NRCS, NMACD, G&F, Upper Cama SWCD, NM Extension, USFS, BLM, State Lands	2015 and into the future. Funding request: 319 for Rio Nutrias. RCPP for Cebolla and all uplands. Acequia RCPP for irrigated lands.	Planning phase complete. Watershed plan developed for the Rio Nutrias. Multiple coordinated plans developed with landowners.			
Rio Arriba	SS	Project	Watershed Restoration	Riparian Restoration along the Rio Cebolla, NM with Emphasis on Sediment Reduction	NMED	Riparian Restoration along the Rio Cebolla, NM with Emphasis on Sediment Reduction	Rocky Mountain Ecology		12/31/2017		$292,116		State Project #: 15-D
Rio Arriba	SS	Project	Water System Infrastructure	Water storage tank replacement	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* Complete system renovation in the last four years. *Proposed 10-Year Projects:* Water storage tank replacement	Rutheron MDWCA						
Rio Arriba	SS	Project	Water System Infrastructure	San Jose de Hernandez CD improvements, Rio Arriba Co.	Capital Outlay Database	San Jose de Hernandez CD improvements, Rio Arriba Co.	San Jose de Hernandez community ditch				$10,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Sanchez, Lucero, Trujillo acequia, Rio Arriba Co.	Capital Outlay Database	Sanchez, Lucero, Trujillo acequia, Rio Arriba Co.	Sanchez, Lucero, Trujillo Acequia				$30,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Earthen channel embankments to mitigate flood control	Water Trust Board Database	Earthen channel embankments to mitigate flood control	Santa Clara Pueblo		FY2015		$2,000,000		
Rio Arriba	SS	Project	Water System Infrastructure	Water system improvements	Water Trust Board Database	Water system improvements	Santa Clara Pueblo		FY2015		$3,500,000		
Rio Arriba	SS	Project	Water System Infrastructure	Watershed restoration	Water Trust Board Database	Watershed restoration	Santa Clara Pueblo		FY2015		$1,000,000		
Rio Arriba	SS	Project	Water System Infrastructure	Santa Cruz Dam Water Restoration Project	Water Trust Board 2016 Recommendations	Construction and Survey	Santa Cruz Irrigation District				$1,758,900		
Rio Arriba	SS	Project	Water System Infrastructure	Tierra Amarilla MDWA water storage tank	Capital Outlay Database	Tierra Amarilla MDWA water storage tank	Tierra Amarilla				$50,000		Fund: STB
Rio Arriba	SS	Project	Water System Infrastructure	Tierra Amarilla Wastewater	ICIP 2017-2021	Tierra Amarilla Wastewater	Tierra Amarilla		2017		$3,525,000		
Rio Arriba	SS	Project	Fish Habitat	Abuquiu Fish and Wetland Project	Chama Peak Land Alliance, Monique DiGiorgio, Executive Director	Creation of a 2-acre, off-channel wetland just below Abiquiu dam combined with a main channel fish habitat project (about 1/4 mile long) that will have a double benefit by providing a high-water kayaking terrain park.	Trout Unlimited	Army Corps, NM Wildlife Center, Audubon, CPLA and others	FY2016. Funding request: $250,000	Initial.	Annual budget: $250,000		
Rio Arriba	SS	Project	Water System Infrastructure	Vallecitos MDWCA Infrastructure and supplemental well	Mutual Domestic Subcommittee, Ramon Lucero	*Last 10-Years Project:* Improvements to infiltration gallery, new SCADA. *Proposed 10-Year Projects:* New water storage tanks, treatment, improvements to infiltration gallery, new waterlines, and supplemental water supply well	Vallecitos MDWCA						
Rio Arriba	SS	Project	Water System Infrastructure	Sewer Line Extensions II	ICIP 2016-2020	Sewer Line Extensions II	Village of Chama		2018		$450,000		
Rio Arriba	SS	Project	Water System Infrastructure	New Sewer Plant	ICIP 2017-2021	New Sewer Plant	Village of Chama		2017		$10,950,000		
Rio Arriba	SS	Project	Water System Infrastructure	Water Treatment Pod	ICIP 2017-2021	Water Treatment Pod	Village of Chama		2017		$1,148,000		

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Regional Water Planning Update

Projects, Programs, and Policies 6/28/2016

Water Planning Region: Rio Chama

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Rio Arriba	SS	Project	Water System Infrastructure	Sewer Line Extension	ICIP 2017-2021	Sewer Line Extension	Village of Chama		2017		$800,000		
Rio Arriba	SS	Project	Water System Infrastructure	Chama Water Treatment Plant Improvements	Water Trust Board Database	Chama Water Treatment Plant Improvements	Village of Chama		FY2014		$980,000		
Rio Arriba	SS	Project	Water System Infrastructure	Abiquiu MDWCA & MSWA Improve	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To purchase and install a generator and fencing and to plan, design, construct and equip improvements to the water and sewer systems for the Abiquiu mutual domestic water consumers association and mutual sewage works association in Abiquiu					$460,000		
Rio Arriba	SS	Project	Water System Infrastructure	Acequia De La Plaza De Dixon Phase 2	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct phase 2 improvements for the acequia de la Plaza de Dixon					$80,000		
Rio Arriba	SS	Project	Water System Infrastructure	Acequia De Los Barriales Phase 2 Servilleta Plaza	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct phase 2 improvements to the acequia de los Barriales, including the purchase and installation of piping and related equipment, in Servilleta plaza in Rio Arriba county					$400,000		
Rio Arriba	SS	Project	Water System Infrastructure	Acequia De Los Espinosa Improve	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design, renovate and construct improvements to the acequia de los Espinosa					$27,850		
Rio Arriba	SS	Project	Water System Infrastructure	Acequia De Ojo Sarco Erosion Structures	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct erosion prevention structures at the acequia de Ojo Sarco					$70,000		
Rio Arriba	SS	Project	Water System Infrastructure	Acequia De Ojo Sarco Phase 1 Rio Arriba Co .	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct phase 1 improvements to the acequia de Ojo Sarco, including the purchase and installation of piping					$35,000		
Rio Arriba	SS	Project	Water System Infrastructure	Agua Sana WUA Arsenic Treatment Facility	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct an arsenic treatment facility for the Agua Sana water users association in Hernandez					$576,886		
Rio Arriba	SS	Project	Water System Infrastructure	Alcalde MDWC & MSWA Well Pump House & Treatment System	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct a well, pump house and water treatment system for the Alcalde mutual domestic water consumers' and mutual sewage works association					$378,000		
Rio Arriba	SS	Project	Water System Infrastructure	Ancones MDW & WWCA Water System	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct a water system and improvements for the Ancones mutual domestic water and wastewater consumers association					$150,000		
Rio Arriba	SS	Project	Water System Infrastructure	Canjilon MDWC & MSWA Improvements	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct improvements for the Canjilon mutual domestic water consumers and mutual sewage works association in Canjilon					$500,000		
Rio Arriba	SS	Project	Water System Infrastructure	Chama Sewer Line Extension	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct a sewer line extension in Chama					$800,000		
Rio Arriba	SS	Project	Water System Infrastructure	Chama Water Treatment Pod	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct a water treatment pod for Chama					$168,000		
Rio Arriba	SS	Project	Water System Infrastructure	Chama Wastewater Treatment Plant	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct a wastewater treatment plant in Chama					$2,000,000		
Rio Arriba	SS	Project	Water System Infrastructure	East Rio Arriba SWCD Storage Building Construction	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct a storage building for the east Rio Arriba soil and water conservation district in Hernandez					$45,450		
Rio Arriba	SS	Project	Water System Infrastructure	La Madera MDWCA Phase 2 Improvements	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct phase 2 water system improvements for La Madera mutual domestic water consumers association in La Madera					$70,000		

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Regional Water Planning Update

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Rio Arriba	SS	Project	Water System Infrastructure	La Mesilla Community Ditch	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design and construct improvements to La Mesilla community ditch					$26,700		
Rio Arriba	SS	Project	Water System Infrastructure	Rio Arriba Co. Abiquiu VFD Cistern Medanales	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design, construct and plumb a water storage cistern for the Abiquiu volunteer fire department substation in Medanales					$86,000		
Rio Arriba	SS	Project	Water System Infrastructure	Salazar Community Ditch Water Metering Device	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To purchase and install a water metering device for the Salazar community ditch in Hernandez					$30,000		
Rio Arriba	SS	Project	Water System Infrastructure	Vallecitos MDWCA Water System	Legislative Council Service, 52nd Legislature, 2nd Session, 2016	To plan, design, construct and equip water system improvements, including a water tank, water lines and a treatment system, for the Vallecitos mutual domestic water consumers association					$100,000		

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