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1. Introduction

The Estancia Basin Water Planning Region, which encompasses the majority of Torrance County and parts of Bernalillo and Santa Fe counties (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 NMISC-accepted Estancia Basin Regional Water Plan (RWP) was developed in two phases: a Phase I Report that addressed water supply and demand data, completed in January 1997 (JSAI et al., 1997), and an analysis of potential strategies for meeting the region's projected demands, completed in January 1999 (Corbin Consulting, Inc., 1999). The 1999 plan (and by reference the 1997 Phase I Report) was accepted by the NMISC in April 1999. This plan was updated in 2010, with the release of the *Estancia Basin Regional Water Plan: Year 2010 Update* in February 2010 (2010 RWP update [EBWPC and HR, 2010]). The accepted and updated Estancia Basin RWPs covered the area within the Estancia Underground Water Basin (UWB) only and did not include the areas within the planning region (in eastern and southern portions of Torrance County) that are outside of the Estancia UWB.

The purpose of this document is to update the accepted RWP to reflect new and changed information related to water planning in the Estancia Basin Water Planning 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. This information is provided for the entire planning area not just the Estancia UWB. Accordingly, the following sections summarize key information in the accepted and updated plans 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 Estancia Basin Water Planning Region.

- Presents recent water use information and develops updated projections of future water use 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 Estancia Basin 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 RWP update is based on current published studies and data and information supplied by water stakeholders in the region.

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, 2013):

- 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.

- Section 3 provides background information regarding the characteristics of the Estancia Basin 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 accepted and updated RWPs; key information from those plans is summarized in Section 5, with new information that has become available since 2010 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.

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 supply is based on recent diversions, which provide a measure of supply that considers both physical supply and legal restrictions (i.e., the diversion is physically available, permitted, and in compliance with water rights policies) and thus reflects the amount of water that can actually be used by a region. An estimate of supply during future droughts is also developed by adjusting the recent diversion 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 using methods for each category that are applied consistently across all planning regions.

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.

- 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 accepted and updated RWPs. Section 6 provides updated population and water use data, which are then used to develop updated projections of future water use.

- 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, 2013) (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.

2. Public Involvement in the Planning Process

Preliminary Draft.

Estancia Basin Water Planning Region

This is an outline of the public involvement section of the updated Regional Water Plan (RWP). The purpose of this section is to document the public involvement process that has taken place during the update of the RWPs. The table below lists the first two sets of meetings that took place by region:

- Meeting 1: Kick-off meeting
- Meeting 2: Technical components of the regional water plan, presentation of data to the regions

ISC Planning Region		Meeting #1		Meeting #2	
		Date	Location	Date	Location
1	Northeast New Mexico	Jun 30, 2014	Grady	Oct 20, 2014	Tucumcari
2	San Juan Basin	Jul 17, 2014	Farmington	Dec 4, 2014	Farmington
3	Jemez y Sangre	Mar 4, 2014	Santa Fe	Nov 13, 2014	Santa Fe
4	Southwest New Mexico	Aug 13, 2014	Silver City	Mar 12, 2015	Deming
5	Tularosa-Sacramento-Salt Basins	Jul 24, 2014	Tularosa	Jan 14, 2015	Alamogordo
6	Northwest New Mexico	Mar 19, 2014	Grants	Dec 5, 2014	Gallup
7	Taos	Mar 31, 2014	Taos	Oct 30, 2014	Taos
8	Mora-San Miguel-Guadalupe	Feb 27, 2014	Las Vegas	Oct 27, 2014	Las Vegas
9	Colfax	Apr 23, 2014	Cimarron	Oct 29, 2014	Cimarron
10	Lower Pecos Valley	May 9, 2014	Artesia	Feb 13, 2015	Artesia
11	Lower Rio Grande	May 21, 2014	Las Cruces	Jan 13, 2015	Las Cruces
12	Middle Rio Grande	Apr 2, 2014	Albuquerque	Jan 23, 2015	Albuquerque
13	Estancia Basin	Apr 17, 2014	Moriarty	Feb 19, 2015	Estancia
14	Rio Chama	Mar 31, 2014	Española	Nov 13, 2014	Hernandez
15	Socorro-Sierra	May 21, 2014	Truth or Consequences	Oct 28, 2014	Truth or Consequences
16	Lea County	May 8, 2014	Lovington	Feb 12, 2015	Hobbs

2. Public Involvement in the Planning Process *(Prepared by the Region with ISC contractor assistance)*

As specified in the *Updated Regional Water Planning Handbook* (NMISC, 2013), the regional water plan update shall include participation of a representative group of stakeholders, referred to in this document as a steering committee, to guide the public involvement during the update and to identify strategies for addressing water issues and needs in the region. This section documents the steering committee and public involvement process used in the update of the plan.

2.1 Identification of Regional Steering Committee Members and Stakeholders

The RWP Update Handbook (NMISC, 2013) specifies that the steering committee membership include representatives from multiple water user groups. Some of the categories may not be applicable to the 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

The Estancia Basin Water Planning Committee has taken on the responsibility of developing the region's original water plan and updating it periodically. The EBWPC was formed by resolution of three county governments -- Bernalillo, Torrance and Santa Fe – that have chosen to cooperate in the water planning effort. Because of its effectiveness and formality, EBWPC chose to add ad hoc steering committee members to its existing body in order to fulfill the requirements of the ISC updating process. The ad hoc steering committee members were recruited to fill certain categories that were not already filled by the EBWPC existing membership. Through the addition of these ad hoc members, the Estancia Basin Water Planning Committee established a representative steering committee, the members of which are listed in Table 2-1.

Table 2-1. Estancia Basin Water Planning Committee and Ad Hoc Steering Committee Members, Estancia Basin Water Planning Region

Water Use Group	Name	Organization / Representation
Agricultural – groundwater user	Gene Winn	Member Estancia Basin Water Planning Committee, USDA Extension Service, Program Director
	Ryan Schwebach	Schwebach Farms
	Rick Thompson	Estancia Basin Water Planning Committee
Agricultural – surface water user	Herman Salas	Torreon Acequia Association
County government	Joy Ansley, County Manager*	Torrance County
	Steve Guestchow, Planning Director	Torrance County
	Dan McGregor, sec-treasurer EBWPC	Bernalillo County Hydrologist, Member, Estancia Basin Water Planning Committee
	Jerry Schoeppner	Santa Fe County Hydrologist,
Environmental interest	Ted Barela	Estancia Basin Resources Association
	Linda Felipe*	Estancia Basin Resources Association
Extractive industry	NA	
Federal agency (technical support to the region)	John Perea	USDA, Farm Service Agency
	Alan Warren	Forest Service , Range Management Specialist – Cibola National Forest
State agency (technical support to the region)	Tom Perkins	State Land Office, Surface Resources Division, Member Estancia Basin Water Planning Committee
	Lawrence Crane	NM State Forestry

Local (retail) business	David Tixier	Magnum Steel Building Co., Member Estancia Basin Water Planning Committee
Municipal government	Ted Hart, Mayor*	City of Moriarty
	Steve Shepherd	Town of Edgewood
	Rita Loy Simmons	Edgewood town councilor
		Town of Estancia
	Cass Tyler, Sanitation Committee	Town of Willard
	George Immerwahr	Mountainair city councilor
Rural water provider	John Jones	Entranosa Water, Member Estancia Basin Water Planning Committee
Tribal (as applicable)	NA	
Watershed interest Watershed interest	Arthur Swenka	Edgewood Soil and Water Conservation District, Member Estancia Basin Water Planning Committee
	J. Brian Greene	Claunch-Pinto SWCD, Member Estancia Basin Water Planning Committee
Other groups as identified by the steering committee	Rita Loy Simmons	Member Estancia Basin Water Planning Committee
	Debbie Ortiz	Partnership for Healthy Torrance County
Former State Representative	Rhonda King	Estancia Moriarty Willard Torrance County Water Association
	Josh Lewis, intern	Claunch-Pinto SWCD
	[to be contacted]	Wind Farm developer
NM State Legislature	Ted Barela	State senator
Land Grant	John Perea	Torreon Land Grant

*not confirmed

The steering committee includes 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 projects, programs, and policies related to water management in the region. The list also includes non-profit groups who are involved in local water-related initiatives. The steering committee identified *John Jones* as the Chair.Although the steering committee acknowledged that subcommittees could be a useful means of enhancing the planning effort and ensuring implementation of the RWP, they chose not to form any subcommittees at this time.

In addition to the steering committee, the water planning effort included developing a list of stakeholders to facilitate outreach to individuals and entities interested in the water planning update; the list is on file with the ISC. Invitations to the meetings were e-mailed to this list. Steering committee members were asked to share information about the process with stakeholders in the region.

2.2 Description of the Public Involvement Process

The public involvement process was centered on developing a representative steering committee, informing the regions about the process for updating the RWPs, and revitalizing interest in regional water planning. All steering committee 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 to encourage participation in the process.

2.2.1 Regional Water Plan Update Kick Off Meeting (Round 1)

An initial kick off meeting for the Regional Water Plan Update was held in the *Estancia Basin* region on *April 17, 2014*. In preparation for this meeting, *the Estancia Basin Water Planning Committee reviewed its membership for consistency with the ISC template*. Through research, communication with other water user group representatives in the region, contacting local organizations and entities, and making phone calls, additional interests were identified and added to the master stakeholder list. The meeting was announced through e-mails and by telephonic communication with the preliminary stakeholder list.

The purpose of the initial meeting was to present the regional water planning update process to the region and continue to conduct outreach *to enhance the existing EBWPC with ad hoc members to conform to the ISC template for representative groups.* 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.

2.2.2 Presentation of the Technical Information to the Water Planning Region (Round 2)

A second meeting was held for the *Estancia Basin* region on *February 19, 2015*. The purpose of the meeting was to present the technical data compiled and synthesized for the region. The 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 RWP Handbook.

2.2.3 Development of the Public Involvement Process and List of Projects, Programs, and Policies in the Water Planning Region (Round 3)

Several meetings were held in the region to begin working with the steering committee on the public involvement process and on identifying the projects, programs, and policies the regions want to include in the regional water plan update, as well as continued refinement of the steering committee, and locations, dates, and times for future meetings. Several new people attended each meeting, and it was important to reaffirm the goals for the plan update and discuss the process and purpose for developing a list of future projects. Therefore, each of the Round 3 meetings included a brief review of the update process and timeline.

Meeting #3 -- *Moriarty: The EBWPC and interested stakeholders met on April 16, 2015, in Moriarty to plan a way forward for meeting the three requirements before the committee.* The group reviewed the update process, which was important for new people who had not attended meetings before, and the timeline for updating the RWP. *Second, they continued to refine the ad hoc membership of the EBWPC and identified additional representatives of environmental and other interests named in the template. Third, they began the task of identifying the projects, programs, and policies they wanted to include in the regional water plan update. They received forms from Amy Lewis for entering the projects, programs and policies – both completed and anticipated. Finally, they agreed to review their existing Public Involvement Plan and update it if necessary.* 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, and time–and next steps.

Meeting # 4 – Estancia: The steering committee and interested stakeholders met in *Estancia* on *June 18, 2015.* In reviewing the membership of the steering committee, participants suggested additional names to fill unrepresented categories, including the State Legislature and land grants. *The group reviewed the list of projects, programs and policies submitted by EBWPC members and collated by Amy Lewis. There was discussion about the advantages and disadvantages of* *including more specific projects to the list, for example items from the ICIP lists for each municipality. Steering committee members may continue to submit projects, programs and policies for another few days. They also reviewed the Public Involvement Plan template supplied by the ISC and modified it to fit their situation*The group further discussed potential collaborative projects such as agriculture/acequia projects, water system regionalization/cooperation, monitoring/data collection, watershed restoration, drought contingency planning, municipal conservation and reuse, local and state water policy recommendations, endangered species projects, and water quality protection.]

2.3 Public Involvement in *Estancia Basin* Water Planning Region in Fiscal Year 2015-2016

During the Round 3 meetings in the spring of 2015, the steering committee worked with the technical contractors to begin identifying the best approach to develop a public involvement plan and the identification of the projects, programs, and policies to include in the plan. During FY 2015-2016, this process will continue, with the ISC contractors working with the regions to complete the two regional tasks (Sections 2 and 8 of the Updated Regional Water Plan). The ISC contractor is responsible for working with the steering committee to obtain the information necessary to draft both sections. The steering committee is not responsible for drafting the text of these sections; however, they will provide much of the information to be included by the contractor in these sections of the plan. The outcome of the process in 2016 will be completed *Public Involvement in Planning Process* and *Implementation of Strategies to Meet Future Water Demand* sections.

The ISC contractors will facilitate three meetings with the Steering Committee between October 2015 and May 2016 to continue working on identifying projects, programs, and policies, as well as an approach to implementation. The first meeting will be held once the ISC has released a draft of the technical sections of the updated regional water plan. Subcommittees will continue to meet as needed to work on the projects, programs, and policies that pertain to their area of interest. ISC contractors will not facilitate these meetings. The subcommittee will provide the ISC contractors additional information as needed on the projects, programs, and policies reviewed in the subcommittees.

2.3.1 Meeting Locations and Times

The steering committee made the following recommendations regarding meeting times and locations:

- *Moriarty and Estancia*
- *Mangum Steel Building and Torrance County Courthouse for steering committee meetings*

- *Larger facility for public meetings*
- *Third Thursday of every other month (beginning February 2013) at 9:30 am*
- Steering committee members will continue to assist with outreach.

2.3.2 Public Outreach

The regional water planning process will continue to be an open and inclusive process. Meeting invitations will be sent to the entire stakeholder list as well as the steering committee members. The steering committee will continue to keep all water planning meetings open to the general public and to forward the invitation e-mails at their discretion. Generally, steering committee members ensure that other concerned or interested individuals receive the announcement and have communicated key contacts to add to the stakeholder list throughout the planning process. At the present time, it is not anticipated that the ISC will initiate or ask the regions to hold a general public meeting to present the planning process to the public at large. Because public outreach has been inclusive throughout the update process, members of the public who have an interest in water have either been invited directly or indirectly through the steering committee representative. The contractors will continue to encourage the steering committee members to communicate with interested stakeholders about the planning process.

3. Description of the Planning Region

This section provides a general overview of the Estancia Basin Water Planning Region. Detailed information, including maps illustrating the land use and general features of the region, was provided in the accepted and updated RWPs; 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 Estancia Basin Water Planning Region is located in central New Mexico, covering the majority of Torrance County and the portions of Santa Fe and Bernalillo counties that overly the Estancia UWB. Approximately 80 percent of the land area within the hydrographic boundaries of the Estancia UWB is in Torrance County. Santa Fe and Bernalillo counties also play significant roles in the Estancia Basin due to burgeoning residential housing that is expanding eastward into the planning region.

The region is bounded on the north by the crest of the San Pedro Mountains in Santa Fe County and by San Miguel County, on the west by the Estancia UWB boundary and by Valencia County, on the south by Lincoln and Socorro counties, and on the east by Guadalupe County (Figure 3-1). The total area of the planning region is approximately 3,800 square miles, but only about 2,200 square miles fall within the Estancia UWB. The total area of the planning region is distributed among the three counties as follows:

- Santa Fe County: 435 square miles
- Bernalillo County: 113 square miles
- Torrance County: 3,278 square miles

The planning region encompasses varied terrain, from mountainous areas in the north, west, and south, to plains and rangeland in the central and south-central portions of the region. Elevations range from 10,097 feet above mean sea level at Manzano Peak to 6,050 feet in the Laguna del Perro area.

Natural resources include sand and gravel, forest products, and minerals, including four precious metals mines or prospects and one uranium mining claim (Corbin Consulting, Inc., 1999). Exploration wells have found very deep oil and gas resources (Broadhead, 1997); to date, these have not been developed, but as oil and gas prices rise, increased oil and gas activities are likely (EBWPC and HR, 2010). The 2010 RWP update reiterated the assertion in the Phase I report that the region's groundwater, particularly the Valley Fill aquifer generally located in the central portion of the basin, is its most important natural resource.

3.2 Climate

The varied terrain of the planning region results in significant climate variations. Average annual precipitation, including both snowmelt and rainfall, ranges from about 12 inches in the lower elevations (Pedernal 4 E) to more than 20 inches along the eastern slopes of the Sandia and Manzano Mountains. Most of the region receives 14 to 18 inches of precipitation annually. Very little runoff occurs from rainfall or snowmelt due to the high permeability of the upland areas (fractured limestone); thus a reduction in precipitation would result in less recharge.

Further information regarding climate and its effect on the region's water supplies is provided in Section 5.1.

3.3 Major Surface Water and Groundwater Sources

No significant streams exist in the region and most surface water flow occurs as ephemeral flow in drainages and arroyos. Two small freshwater lakes and numerous playa lakes are present within the planning region. The region relies solely on groundwater and precipitation for water supply, and the vast majority of the current water supply is derived from the Valley Fill aquifer system generally located in the central portion of the Estancia Basin.

The primary OSE-declared Underground Water Basin (UWB) in the region is the Estancia UWB; small portions of the Upper Pecos, Fort Sumner, Roswell, Tularosa, Rio Grande (Middle), and Sandia UWBs are also present beneath the peripheries of the region. (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.) While the Estancia UWB supplies most of the region's population and economy, the eastern and southern parts of the region obtain water from adjacent UWBs that are shared with other regions:

- Upper Pecos UWB: Mora-San Miguel-Guadalupe region
- Fort Sumner UWB: Mora-San Miguel-Guadalupe and Lower Pecos Valley regions
- Roswell UWB: Mora-San Miguel-Guadalupe and Lower Pecos Valley regions
- Tularosa UWB: Tularosa-Sacramento-Salt, Lower Rio Grande, and Socorro-Sierra regions
- Rio Grande (Middle) UWB: Socorro-Sierra and Middle Rio Grande regions

The Sandia UWB, shared with the Middle Rio Grande region, is present in a small part of the northwest portion of the Estancia Basin and supplies water to domestic wells. A map showing the UWBs in the region 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 Estancia Basin Water Planning Region includes all of Torrance County and small portions of Santa Fe and Bernalillo counties that, because of their residential population, play significant roles in the region. The total 2013 population of Torrance County was 15,717 (U.S. Census Bureau, 2014a). No reliable figures for the portions of Santa Fe and Bernalillo counties that fall within the Estancia Basin region are available for 2013. As shown in Table 3-1a, between 2010 and 2013, the population of Torrance County declined from 16,383 to 15,717 (about 4.1 percent).

The portion of Santa Fe County within the Estancia Basin Water Planning Region had a population of 10,014 in 2010, as determined by DBS&A from U.S. Census data. This area has substantial land dedicated to irrigated agriculture.

The small portion of Bernalillo County within the Estancia Basin Water Planning Region had 6,297 residents in 2010, as determined by DBS&A from U.S. Census data. The area is mostly residential with no irrigated agriculture and minimal ranching activity.

The largest employment categories are education/healthcare, retail trade, professional, scientific and management, followed by arts, entertainment, recreation, and accommodation and food services (Table 3-1c). The greatest amount of water has been used for irrigated agriculture.

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

4.1 Relevant Water Law

4.1.1 State of New Mexico Law

The Estancia Basin Water Planning Region is the subject of two water plans. The *Regional Water Plan, Estancia Underground Water Basin, New Mexico* was prepared by Corbin Consulting, Inc. (1999) and included as Volume II a prior plan prepared by John Shomaker & Associates, Inc. (JSAI) in 1997. The plan was accepted by the New Mexico Interstate Stream Commission in April 1999. The *Estancia Basin Regional Water Plan: Year 2010 Update* , was prepared by the Estancia Basin Water Planning Commission and Hydro Resolutions, LLC in 2010. This section updates the information in Section III of the JSAI (1997) plan and Section 5 (Legal Issues) of the 2010 plan update.

These updates are necessary because 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; utilizing settlement 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 establishing a new strategic water reserve. These general state law changes are addressed by topic area below. State law more specific to the region is discussed in Section 4.1.2.

4.1.1.1 Regulatory Powers of the OSE

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" (§ 72-2-9.1(A)). 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 "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" (19.25.1.6 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 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 OSE 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 in order 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 *Tri-State*, 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 OSE.

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 OSE, 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 other cases have been decided recently addressing other aspects of the regulatory powers of the OSE. 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 underground water basin 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.

Also related to the OSE's regulatory authority, the Court of Appeals addressed unperfected water rights in *Hanson v. Turney*, 2004-NMCA-069, 136 N.M. 1, a case that originated in the planning region. 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, Section 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. The Court found 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 OSE 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 there is no water 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 there was no water 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 which might have been presented to the State Engineer, as well as new evidence developed since the administrative hearing. The OSE 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 OSE. 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 OSE was correct that the district court's *de novo* review was limited in its review of the application 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 OSE'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 OSE administrative hearing process. 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 OSE.

Legal review of OSE 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 OSE administrative review of water rights matters. *Garcia* involved an OSE petition to the district court for enforcement of a compliance order after the OSE hearing examiner had granted a motion for summary judgment affirming the compliance order. The Court first found that the right to a hearing granted in NMSA 1978, Section 72-2-16 (1973), did not create an absolute right to an administrative hearing. Rather, the OSE hearing contemplated in Section 72-2-16 could be waived if a party did not timely request such a hearing. 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 OSE 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. The Court held that the regulation allowed the hearing examiner to dismiss a case without the express approval of the state engineer. Finally, the Court held that the OSE hearing examiner may dismiss a case without full hearing when a party willfully fails to comply with the hearing examiner's orders. Accordingly, the Court in *Garcia* upheld the OSE 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 OSE 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 OSE 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 OSE 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 distinguishes 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 OSE 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 OSE'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 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, Section 72-5-23 (1941), along with the OSE regulations addressing the change of place or purpose of use of a water right, 19.26.2.11(B) NMAC. The Court found that the statute, coupled with the applicable regulations and OSE 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 affect 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 United States Forest Service cancelled 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 Domestic Wells

New Mexico courts have decided several significant cases addressing domestic well permitting recently and the OSE 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 OSE "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 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 OSE, 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, Section 3–53–1.1(D) (2001). Section 3-53-1.1(D) requires cities to file their ordinances with the OSE restricting the drilling of domestic water wells. 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 OSE.

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, Section 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). Note that the administrative guidelines for Estancia administrative basin, discussed below in Section 4.1.2.2 limit domestic well permits to 0.5 af/yr. in the basin.
   - 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.

4.1.1.7 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 Water Project Finance 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 Interstate Stream Commission, (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.

4.1.1.8 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. The first purpose is to comply with interstate stream compacts. The second purpose is 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 ISC may only acquire water rights that have sufficient seniority and consistent, historical beneficial use to effectively contribute to the purpose of the Reserve. The ISC must annually develop river reach or groundwater basin priorities for the acquisition of water rights for the Strategic Water Reserve.

4.1.1.9 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).

4.1.1.10 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.

4.1.2 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 underground water basins, and use of the Active Water Resource Management 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). There are no water masters for the region.

4.1.2.2 Groundwater Basin Guidelines

The OSE has declared ground water basins and implements guidelines in those basins for the purpose of carrying out the provisions of the statutes governing underground waters. *See* NMAC 19.27.48.6. The Estancia region is comprised primarily of the Estancia UWB, surrounded by the Fort Sumner, Rio Grande, Roswell, Sandia, Tularosa, and Upper Pecos UWBs (Figure 4-1).

Groundwater basin guidelines are in place for several basins within the region, as described below.

- Estancia : In 2002, guidelines were established for the Estancia UWB. The *Estancia Underground Water Basins for Review of Water Right Applications* (NMOSE, 2002) specify the criteria for administering existing water rights throughout the UWB, including within designated critical management areas, through evaluating water levels and the rate of water level decline on both a regional and local basis. The guidelines use two approaches to administer water in the basin. In aquifers with a relatively thin saturated thickness, declines are limited to a prescribed level over a prescribed period. In aquifers with a relatively thick saturated thickness, the rate of groundwater decline is limited. Critical management areas have been designated in areas with water declines of 1.5 feet per year or greater, or where the saturated thickness of the aquifer is expected to be below 80 feet by 2040.

- Fort Sumner: There are no specific guidelines governing appropriations in the Fort Sumner UWB. However, State Engineer Order No. 183 (05/23/2013) requires the metering of groundwater in the UWB.

- Roswell UWB: The *Roswell Basin Guidelines for Review of Water Right Applications* (NMOSE, 2005), which are applicable to the small portion of the Roswell UWB that falls within the region, are discussed in the Lower Pecos Valley Regional Water Plan.

- Tularosa: This basin was extended in 2005 (19.27.64.1 *et seq.* NMAC). In 2014, the NMOSE put forth an *Update to the Alamogordo-Tularosa Administrative Guidelines for Review of Water Right Applications* (NMOSE, 2014e) that provides guidelines on the procedures for processing pending and future water rights applications filed within the Alamogordo-Tularosa Administrative Area (ATAA). The updated guidelines replace the *Tularosa Basin Administrative Criteria* adopted by the OSE in 1997.

4.1.2.3 AWRM Implementation in the Basin

No priority basins for implementation of AWRM regulations have been designated in the planning region.

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 Estancia Basin region, special districts include a number of soil and water conservation districts, which are governed by NMSA 1978, §§73-20-25 through 48.

4.1.2.5 State Court Adjudications in the Basin

Adjudications in the region, or more precisely, the lack of adjudications in the region, are discussed in the 2010 update to the 1999 plan, Section 5.3. Adjudication of Estancia Basin water rights are not pending. Adjudication of the Upper Pecos Underground Water Basin is ongoing and discussed more extensively in the Mora San Miguel Guadalupe regional water plan.

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 2003 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 United States Supreme Court involving the Rio Grande Compact and waters of the Lower Rio Grande. It is included here because of its importance to the entire State of New Mexico.

In *Texas v. New Mexico and Colorado*, No. 141 Original (United States 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 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 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.

On federal lands (e.g., Forest Service, Park Service), water rights are reserved by the United States for use on those lands. The priority date of federally reserved water rights is the date the United States reserved the land for the particular use. In some cases, the United States may have State law rights under the prior appropriation system, for instance, if the United States acquires lands with existing water rights. The only federally reserved land with the Estancia Basin planning region is Cibola National Forest.

4.1.3.2 Interstate Stream Compacts

Not applicable.

4.1.3.3 Treaties

Not applicable.

4.1.3.4 Federal Water Projects

Not applicable.

4.1.3.5 Federal Adjudications in the Basin

Not applicable.

4.1.4 Tribal Law

Not applicable.

4.1.5 Local Law

Local laws addressing water use have been implemented by both municipalities and counties within the planning region.

4.1.5.1 Torrance County

Water use in Torrance County is guided by the *Comprehensive Land Use Plan for Torrance County, New Mexico* (MRCOG, 2003) and regulated by ordinance.

The Torrance County comprehensive plan recognizes that there is no regional authority to manage the consumptive use of water resources in the County, with many decisions affecting water resources in the County made by individual local governments and by private sector water providers. The plan recognizes that water is easily the most serious issue affecting the County. The plan sets forth a goal of balancing the needs of a growing population while retaining the rural residential character and culture of the County. The plan also sets as a goal ensuring an adequate and sustainable supply of quality water for current and future needs of the County. The plan outlines the following objectives to meet these goals:

- Administer water rights in the Estancia Basin as a Special Groundwater Management Area.
- Educate water users about the necessity of water conservation, while offering conservation techniques.
- Protect groundwater by preventing land uses that pollute the groundwater.
- Support a Basin-wide program of comprehensive monitoring, metering, and ongoing investigation of water resources in the Estancia Basin.

- Promote the efficient use of centralized water and wastewater systems in the urbanizing areas of the County.

Torrance County subdivision regulations §5.7 require that subdivisions containing 20 or more parcels with at least one parcel of two acres or less must have a State Engineer permit to appropriate for or transfer water to the subdivision.

4.1.5.2 City of Moriarty

Water use in the City of Moriarty is guided by the *Moriarty Comprehensive Plan Update* (MRCOG, 2012), the *Water Conservation Program for the City of Moriarty* (MRCOG, 2013) (as adopted by Resolution 11-12-33), and by ordinance.

The comprehensive plan recognizes that water quality and the wise use of water are critical issues for Moriarty residents. One goal set forth in the plan is to provide drinking water and wastewater disposal services to all City residents. The objectives to meet that goal include the following:

- Prepare and maintain a current 40-year water plan to ensure adequate water resources and sufficient water rights to meet projected future demands.
- Implement the recommendations identified in the Moriarty water conservation program.
- Educate water users about the costs and benefits of water conservation, and identify specific water conservation techniques, incentives, and practices.
- Protect groundwater by preventing specific land use activities that may contaminate groundwater.
- Regulate development in flood prone areas and wellhead protection zones through the zoning ordinance.
- Maintain the public drinking water system by improving the pumping and storage capabilities and minimizing leakage throughout the water.
- Provide adequate wastewater collection and treatment for all residences, businesses, and industries in the City.
- Improve the effluent reuse system to provide landscape water for City parks and recreation fields.

The Water Conservation Program has ten basic elements establishing a framework of conservation activities for implementation and promotion by the City: (1) recordkeeping and water system audits, (2) monitoring and measuring, (3) water pricing, (4) low-flow plumbing fixtures, (5) xeriscaping, (6) regulating outdoor watering, (7) water harvesting, (8) graywater use, (9) public education and outreach, and (10) development of an emergency water shortage plan.

The City of Moriarty Ordinance No. O-2012-01 establishes an emergency water shortage plan to manage water use in response to emergencies or unexpected events that may disrupt or endanger the municipal water supply. The ordinance outlines three water emergency stages, depending on the severity of the water emergency.

4.1.5.3 Town of Estancia

Estancia has no specific ordinances or comprehensive plan relating to water use.

4.1.5.4 Town of Mountainair

Mountainair has no specific ordinances or comprehensive plan relating to water use.

4.1.5.5 Village of Willard

Willard has no specific ordinances or comprehensive plan relating to water use.

4.1.5.6 Santa Fe County

Local law for Santa Fe County is set forth in the Jemez y Sangre Regional Water Plan.

4.1.5.7 Town of Edgewood

Water use in the Town of Edgewood is governed by ordinance and the *Town of Edgewood Comprehensive Land Use Plan* (MRCOG 2008).

Subdivision Ordinance No. 2014-03 sets forth water availability requirements for subdivisions.

The *Comprehensive Land Use Plan* sets as a goal the protection of the water resources of the Edgewood community through the following objectives:

- Establish a ground water protection plan that regulates land use activities in order to prevent the contamination of water resources.
- Develop and implement a water conservation program and a drought contingency plan.
- In order to protect the community from property damage and contamination caused by stormwater runoff, regulate development in designated floodplains, and protect the natural drainage features in the community.
- Encourage rainwater harvesting and use of gray water systems in the community.

Provide for the collection and treatment of wastewater in appropriate areas of the community to protect groundwater from contamination.

4.1.5.8 Bernalillo County

Water use in Bernalillo County is regulated by ordinances and guided by a water conservation plan and the *Albuquerque/Bernalillo County Comprehensive Plan* (COA, as amended through 2013).

The Bernalillo County Code of Ordinances has a number of provisions relating to water use.

- Section 30-153 of the Code establishes a combined city, water authority, and county board called the Water Protection Advisory Board, the purpose of which is to advise the three governmental entities on surface and groundwater protection concerns. These concerns include policies necessary to enhance protection of surface and groundwater quality, oversee implementation of the groundwater protection policy and action plan, promote consistency in city, authority, and county actions to protect surface and groundwater quality, and advocate effective protection of surface and groundwater quality.
- Section 30-241 of the Code sets forth water conservation requirements in order to reduce per capita water use, encourage responsible use of water, reduce water waste, require conservation measures for new developments, and preserve water supplies within the County.
- Section 30-247 outlines outdoor water restrictions.
- Section 30-248 prohibits water waste.
- Section 30-249 sets forth design and construction requirements for new developments.

Bernalillo County's Water Conservation Plan (04/21/2006) outlines initial goals for the plan and its implementation:

- Evaluate current water usage
- Evaluate mandatory, voluntary, and other conservation measures for the Water Conservation Plan
- Determine resource levels for water conservation program
- Determine sources of funding for water conservation program
- Develop priorities
- Set measurement goals and criteria
- Improve baseline information on County water usage and update annually

- Gather information on domestic well permits and domestic well usage on an ongoing basis
- Gradually develop appropriate ordinance(s) from the Water Conservation Plan

The *Albuquerque/Bernalillo County Comprehensive Plan* includes policy goals for both water quality and water management (Sections II(C)(2) and II(D)(2)). The water quality goal is to maintain a dependable, quality supply of water for the urbanized area's needs. The policies for meeting this goal are to minimize the potential for contaminants entering the community water supply, minimize water quality degradation resulting from on-site liquid waste disposal systems, and minimize water quality contamination from solid waste disposal. The water management goal is efficient water management and use. The polices for meeting this goal are to adopt measures to discourage wasteful water use, encourage maximum absorption of precipitation through retention of natural arroyos and other means of runoff conservation, and protect existing water rights and acquire new rights to meet increasing population needs.

4.2 Relevant Environmental Law

4.2.1 Species Protection Laws

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:

- Southwestern willow flycatcher (endangered, final recovery plan - Santa Fe County);
- Yellow-billed cuckoo (threatened – Santa Fe County):;
- Mexican spotted owl (threatened, implementation of final recovery plan – Santa Fe and Torrance counties); and
- Sprague's pipit (candidate – Bernalillo County).

Of the threatened and endangered species found in the Estacia region, the protection and recovery of the Southwestern willow flycatcher and yellow-billed cuckoo is most likely to affect water planning within the region. Both birds rely on riparian habitat for survival. 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 Estancia region, all of the federally listed species discussed above are also protected under the Act, along with several others.

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 below, the N.M. 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 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 Estancia planning region, some segments of the headwaters of the Pecos River are on the impaired list, but these are not the primary waters in the region.

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 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, per Justice Kennedy, stated that CWA jurisdiction extends to waters having a "significant nexus" to a navigable water, such nexus the Corps had failed to show 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*, 2015 WL 5060744 (Aug. 27, 2015). Because the New Mexico Environment Department and the New Mexico Office of the State Engineer are plaintiffs in this case, the stay is effective – and the new definition does not now apply – in New Mexico. The United States is likely to appeal the decision.

4.2.2.2 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. 40 C.F.R. §§ 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 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 ground waters 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 New Mexico Environment Department 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 ground water quality standards, regulations requiring discharge permits, and regulations requiring abatement of groundwater contamination. 20.6.2 NMAC. The water quality standards for ground water 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 (discussed above) 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. The standards also include 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.

4.2.2.4 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 U.S. Environmental Protection Agency (EPA) under the Safe Drinking Water Act (discussed above). 20.7.10.100 NMAC, 20.7.10.101 NMAC.

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

4.3.1 Ongoing or Threatened Litigation that May Affect Water Management

There is no ongoing or threatened litigation that may affect water management in the Estancia Basin Region as of the time of writing.

5. Water Supply

This section provides an overview of the water supply in the Estancia Basin 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 *Updated Regional Water Planning Handbook* (NMISC, 2013) 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 prior Estancia Basin RWPs (JSAI et al., 1997; Corbin Consulting, Inc., 1999; EBWPC and HR, 2010) 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 Estancia Basin region are:

- Large-scale agricultural pumping has been occurring in the region since about 1950. Groundwater mining (i.e., pumping more water from the aquifer than is replenished) has resulted in serious water level declines in the Valley Fill aquifer system, causing some wells to go dry, and computer modeling of the basin predicts that water levels will continue to decline in the coming decades. Average water level declines are over 1 foot per year in the Valley Fill, which is on average only 131 feet thick (EBWPC and HR, 2010). However, declines up to 5 feet per year in the Valley Fill have been observed.

- For many areas, the Valley Fill aquifer is underlain by other geologic formations that have been designated as critical management areas (CMAs). The Estancia UWB guidelines adopted by the NMOSE do not allow the deepening of wells producing from the Valley Fill aquifer into an underlying CMA.

- New appropriations of groundwater are not permitted within the Estancia UWB. Groundwater rights may be obtained by transferring a valid water right that has been put to beneficial use from an owner who is, willing, to transfer that right. Water right licenses, declarations, and permits in the Estancia UWB far exceed the amount of water that has been put to beneficial use. The NMOSE calculated the total irrigated agricultural pumping for the basin in 2010 to be 79,298 ac-ft/yr (Longworth et al., 2013), much less than the permitted diversion of 158,475 ac-ft/yr (HydroResolutions, LLC, 2013).

- The Estancia UWB guidelines limit the number of years in which extensions of time may be filed to 10 years. Permits are typically conditioned to require that proof of beneficial use be submitted within 4 years following the permit approval date. If the application of water to beneficial use cannot be filed within the specified time, an extension of time may be filed. More than 35 permits have been canceled because proof of beneficial use was not filed within 10 years.

- Regional water planning efforts by the EBWPC have focused on preventing transfers to other basins and achieving water self-sufficiency and sustainability.

- 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 individual farms.

- Most irrigation wells are not metered, which limits the ability of models to accurately characterize the stresses on the water resources.

- The increase in population since the release of the 1999 regional water plan (Corbin Consulting, 1999) has resulted in an increase in domestic use of water in the Estancia Basin. In addition, proposed alternative energy projects and other business ventures will increase demand. To meet these new demands, other water rights, such as irrigation rights, will have to be discontinued. The transfer of irrigation rights to other uses results in a decrease in pumping, because only the consumptive use amount, not the diversion amount, may be transferred.

- Interest in the development of brackish groundwater resources with associated development of two intra-basin pipelines could help meet the region's water demand, but could also increase stress on the aquifer.

- The updated RWP (EBWPC and HR, 2010) expressed concern about NMOSE administrative policies that restrict transfers of water rights to alternate points of diversion within the basin and the impact of such restrictions on economic development along the I-40 corridor. To provide a water source alternative and allow farmers flexibility to lease their water over the short term, the EBWPC identified development and construction of an intra-basin pipeline(s) as one of its five-year regional water plan priorities to allow the physical transfer of water within the region.

- Notices of intent have been filed by three entities under New Mexico Statutes 72-12-25 through 72-12-28 to drill up to 32 wells, each over 2,500 feet in depth, and divert up to 50,500 acre-feet per year of non-potable groundwater. These notices have not yet been followed by any action by the applicants.

- Reducing depletions in the Valley Fill aquifer system and achieving self-sufficiency and sustainability with respect to water supply and demand are paramount to the economic and cultural viability of the Estancia Basin.

- Nitrate contamination of groundwater is a concern because of the high density of septic tanks in the region (EBWPC and HR, 2010).

- Saline water may be migrating into areas with better water quality.

- Critical issues to better understand are the connection between the Madera and Valley Fill aquifers and the potential for subsidence in the Valley Fill and saline water intrusion (EBWPC and HR, 2010).

- Forest restoration efforts have helped to reduce the risk of wildfire, but the reduction in evapotranspiration from reduced vegetation is not easy to measure, particularly during dry periods when the remaining vegetation transpires the limited amount of precipitation. Continued monitoring will be crucial to understanding the role vegetation management plays on the region's water budgets.

5.1 Summary of Climate Conditions

The accepted regional water plan (JSAI et al., 1997) included an analysis of historical precipitation in the Estancia UWB. This section provides an updated summary of temperature, precipitation, snowpack conditions, and drought indices pertinent to the entire planning region (Section 5.1.1). Studies relevant to climate change and its potential impacts to water resources in New Mexico and the Estancia Basin Water Planning 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 Santa Fe, Bernalillo, and Torrance counties (within the planning region) and identifies two stations that were used for detailed analysis of weather trends. These stations were selected based on location, how well they represented conditions in their respective counties, and completeness of their historical records. The region contains no snow course or snowpack telemetry (SNOTEL) stations that can be used to document snowfall in the region. The locations of the climate stations for which additional data were analyzed are shown in Figure 5-1.

Long-term minimum, maximum, and average temperatures for the two representative 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 at the two representative stations in the planning region. Total annual precipitation for the selected climate stations is shown in Figure 5-4.

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.

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 Estancia Basin Water Planning Region falls primarily within New Mexico Climate Division 6 (the Central Highlands Climate Division) with a small portion of the southwestern corner of the region in Division 5 (the Central Valley Climate Division) (Figure 5-1). Figure 5-6 shows the long-term PDSI for these two climate 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 1930s, the 1950s, the early 2000s, and in recent years (2011 to 2013) (Figure 5-6). The PDSI indicates that the region can expect protracted periods of drought (as occurred 1950-1958) and moderate-length wet periods similar to those in 1905-1909 and 1985-1989). However, given that the period of record is relatively short, one should not expect this century to necessarily be patterned after the last.

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 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 long-lived 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 of 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 of 5° to 10°F by the end of the century (Hurd and Coonrod, 2008; USBR, 2011). Predictions of precipitation changes are subject to greater uncertainty, particularly regarding precipitation during the summer monsoon season in the southwestern U.S.

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.

To minimize the impact of these changes, it is imperative that New Mexico plan for dealing with 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 in the Estancia Basin are very minor and supply only approximately 0.1 percent of the water currently diverted in the Estancia Basin Water Planning Region, with its sole use for livestock. The major surface watershed boundaries in the planning region are shown on Figure 5-7.

There are no major or perennial streams, and streamflow is therefore not monitored in the planning region. The springs in the Manzano Mountains at the western edge of the planning region are the only freshwater riparian areas of note in the region. In ephemeral streams, flows vary from a typical condition of no flow to several thousand cubic feet per second. More than 30 springs are present in the basin and some sustain surface flows for short distances.

No fresh water lakes or reservoirs with greater than 5,000 acre-feet storage capacity are present in the planning region (Figure 5-7), but two small dams store ephemeral flows. Runoff is locally captured in stock tanks and in the two small freshwater lakes, Manzano and Sherwood Forest Lakes, created to capture ephemeral streamflows. The Estancia Basin once contained an ancient lake, the remnants of which have been studied by Keyes (1903) and Meinzer (1911). The lake existed during the Pleistocene Age, when precipitation was greater and temperatures were lower (Leopold, 1951). Because the Estancia Basin is a closed basin, the water in this lake (prior to pumping) discharged through evaporation, leaving behind numerous playa lakes where salt has been harvested for centuries (Titus, 1973). At least 85 saltwater lakes, such as Laguna del Perro, which has a surface area of more than 13,000 acres, are present in the central part of the basin.

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 don-federal dams are ranked as being in good, fair, poor, or unsatisfactory condition. Unsatisfactory conditions are defined as "dam safety deficiency . . . that requires immediate or emergency remedial action for problem resolution" (NMOSE, 2014b). Dams with unsatisfactory conditions are those that require immediate or remedial action. The two dams within the Estancia Basin region have not been identified in recent inspections as being deficient, with high or significant hazard potential.

5.3 Groundwater Resources

Groundwater accounted for about 99.9 percent of all water depletions in the year 2010, with its primary use being for irrigated agriculture (Longworth et al., 2013). As described in Chapter 4, the Estancia Basin Water Planning Region contains seven declared groundwater basins (Figure 4-1). The Estancia Basin is contained wholly within the water planning region, and according to JSAI et al. (1997), 98 percent of the water pumped in the Estancia Basin is from the Valley Fill aquifer. Review of data compiled by Longworth et al. (2013) shows that the total from the Valley Fill in 2010 is 92 percent. Thus, the focus of the Estancia Basin Regional Water Plan is on the Valley Fill aquifer, but other geologic formations, described in Section 5.3.1, provide water to domestic and stock wells.

5.3.1 Regional Hydrogeology

The geology that controls groundwater occurrence and movement within the planning region was described in the accepted and updated RWPs (JSAI et al., 1997; Corbin Consulting Inc., 1999; EBWPC and HR, 2010), based on studies by Smith (1957), Titus (1969, 1980), and Hawley (2004, 2005). In addition to the Valley Fill aquifer in the Estancia Basin has multiple aquifer (water-bearing) units, including the Madera Limestone, the Abo-Yeso Formation, and the San

Andres-Glorieta Formation, that provide water to numerous domestic wells, stock wells, water systems, and irrigation wells. 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 regions exist within the planning region (ArcGIS USGS, 2015). From the west to the east, these are:

- Basin and Range (Mexican Highland Section)
- Basin and Range (Sacramento Section)
- Las Vegas Plateau

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

Geologic strata exposed in the planning region range from crystalline bedrock to sedimentary units such as shale, sandstone, and limestone, to unconsolidated valley fill deposits. The geologic formations present in planning region include (from oldest to youngest):

- Precambrian-age rock
- Pennsylvanian-age rock including the Sandia and Madera Formations
- Permian-age rock including the Abo, Yeso, Glorieta, and San Andres Formations
- Triassic-age rock including the Santa Rosa Formation and Quaternary-age sediments including valley fill

The major aquifers in the planning region consist of:

- The Madera Group in the west-central and northwestern portions of the basin consists of limestone, with sandstone and shale.
- The Yeso Formation, composed of sandstone, limestone, and gypsum, is present in the areas north and east of Chupadera Mesa; Mountainair has water supply wells in the Yeso.
- The Glorieta Sandstone is an important aquifer beneath valley fill near Lobo Hill.
- The Valley Fill aquifer system extends across about 625 square miles of the central portion of the basin. It is composed of up to 400 feet of sand, silt, and gravel, but the thickness decreases to a feather edge toward the margins of the basin floor. Most of the irrigation wells in the basin draw from this aquifer.

In bedrock aquifers, fracturing tends to enhance well yield. Other units provide minor water supplies for domestic and stock purposes, such as the Abo Formation, Triassic-age rocks, and thin deposits of alluvium in drainages. The Precambrian-age formations provide relatively limited quantities of water to wells. White (1994) provides an excellent overview of the water-bearing properties of the geologic formations in the Estancia Basin. The San Andres Limestone lies above the water table where present and is not considered to be an aquifer within the Estancia Basin (EBWPC and HR, 2010).

5.3.2 Aquifer Conditions

As reported in the accepted and updated RWPs (JSAI et al., 1997; Corbin Consulting Inc., 1999; EBWPC and HR, 2010), the primary aquifer in the planning region is the Valley Fill aquifer system. Wells completed in this aquifer are capable of producing hundreds of gallons per minute (gpm) (EBWPC and HR, 2010). Recent work by Hawley (2004, 2005) suggests that the effective saturated portion of the valley fill may be much more limited in the east-west direction than previously thought.

Other aquifers in the region are generally less productive. Wells completed in the Madera Group are capable of producing anywhere from 1 to 1,000 gpm, but the vast majority produce between 1 and 15 gpm (EBWPC and HR, 2010). Wells completed in the Yeso Formation are capable of producing as much as 3,000 gpm (JSAI et al., 1997), but most supply less than 15 gpm. Wells producing from the Glorieta Sandstone are capable of producing several to more than 1,000 gpm, but the productivity is a function of the amount of fracturing present in the area (Smith, 1957).

While the Madera can be very productive, many wells drilled into the formation are dry due to the fractured nature of the rock in the northeast side of the Estancia Basin Water Planning Region (Titus, 1980; White, 1994). Limestones typically have very low primary porosity and are productive only where fractured and (or) dissolved by solution. The sandstones in the lower member of the Madera do not appear to yield much water to wells or springs (Bartolino et al., 2011). The town of Encino, in the eastern part of the Estancia Basin Water Planning Region, receives its water from the town of Vaughn, outside of the region (Phillips, 2015). Groundwater quality and quantity in local aquifers were insufficient to meet Encino’s water demands.

In order to evaluate changes in water levels over time, the U.S. Geological Survey (USGS) monitors groundwater wells throughout New Mexico (Figure 5-11). Hydrographs illustrating groundwater levels versus time, as compiled by the USGS (2014b), were selected for 5 monitor wells with longer periods of record and are shown on Figure 5-12. Examination of hydrographs for wells completed in the Valley Fill aquifer system in the northern (350344106004601) and southern (343443106024401) portions of Estancia Basin show a long-term trend of decreasing water levels. The average rate of decline in those USGS wells with decreasing water levels is about 1.23 ft/yr (from 1985 to 2014).

HydroResolutions, LLC (2013, 2014) recently evaluated groundwater level data from wells within the Estancia Basin that are included in the Estancia Basin Water Planning Committee (EBWPC) hydrogeologic monitoring program and water level data from USGS monitor wells dating back to the 1950s. Water level monitoring in the alluvial aquifer in the northern, central, and southern parts of the basin show an overall decrease in water levels since about 1950, with a tapering off of the decline rate starting around 1985 in response to increased annual precipitation (with a lag time of five years). HydroResolutions (2013) showed that changes in water levels vary from a 5-foot decline per year to no change, with the greatest decline in the central part of the basin near high-capacity irrigation pumping wells. In some of the wells within the EBWPC network, water levels have risen since monitoring began in 2008. The different water level trends in these wells illustrate the complexity of the basin hydrology.

The aquifers in the planning region are generally recharged through direct infiltration of precipitation, infiltration of surface water runoff in stream channels, arroyos, or road ditches, and infiltration of wastewater discharged to septic systems (Bartolino et al., 2011). The RWPs and the 2013 HydroResolutions, LLC report provided the following published estimates of recharge in the region, both for the Valley Fill aquifer system:

- 22,000 acre-feet per year (Keyes and Frost, 2001)
- 37,800 acre-feet per year (Corbin Consulting Inc., 1999)
- 50,000 acre-feet per year (Smith, 1957)
- 38,000 acre-feet per year (JSAI et al., 1997)
- 30,100 acre-feet per year (Shafike and Flanigan, 1999)

The major well fields in the planning region, along with the basins they draw from, are:

- Edgewood (Estancia)
- Entranosa Water & Wastewater Association (Estancia)
- Estancia (Estancia)
- Moriarty (Estancia)
- Mountainair (Estancia)
- Tranquillo Pines (Middle Rio Grande)
- Willard (Estancia)

In addition to these well fields, numerous irrigation, domestic, and stock wells are located throughout the Estancia UWB.

5.4 Water Quality Assessment

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 Estancia Basin Water Planning Region is evaluated through periodic monitoring and comparison of sample results to pertinent water quality standards. The limited data available indicate that the quality of the surface water is highly variable. Spring-flow quality, as reflected by electrical conductivity, has been reported to range from 151 to 1,700 microSiemens per centimeter (µS/cm). The water quality standard for electrical conductivity for the designated use of public water supply is less than 300 µS/cm (NMWQCC, 2002). No water quality analyses for Manzano Lake and Sherwood Forest Lake have been reported, but it is thought that the lakes probably have good water quality based on their location in the mountains. The salt lakes in the central basin receive groundwater discharge and have very high concentrations of total dissolved solids (TDS) and specific conductance ranging from 20,500 µS/cm to 187,000 µS/cm.

Two lakes and one playa within the Central Closed watershed have been listed on the 2012-2014 New Mexico 303(d) list (NMED, 2014a). This list is prepared by NMED to comply with Section 303(d) of the federal Clean Water Act, which requires each state to identify surface waters within its boundaries that are not meeting or not expected to meet water quality standards. 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 the lakes and playa that have been identified as having impaired water quality; these have not yet been fully assessed. Table 5-8 provides listing information for those reaches.

In evaluating the impacts of the 303(d) list on the regional water planning process, it is important to consider the nature of water quality impairment and its effect on potential use. Problems such as stream bottom deposits and turbidity will not necessarily make the water unusable for irrigation or even for domestic water supply (if the water is treated prior to use). However, the presence of the impaired reaches illustrates the degradation that can occur in the water supply, and some of these impairments can be very disruptive to a healthy aquatic community.

Generally the quality of groundwater in the planning region is highly variable, ranging from relatively fresh water in the Madera limestone and in parts of the alluvial aquifer to relatively salty, low-quality water around the playa lakes and in the deeper aquifers. In the Valley Fill aquifer system, the salinity of the groundwater is much higher in the east-central portion of the basin due to natural evapotranspiration of water in the closed basin.

The primary sources of man-made contamination in the planning region are leaking underground storage tanks and septic tanks.

Specific sources that have the potential to impact either surface or groundwater quality in the future are discussed below. Sources of contamination are considered as one of two types: (1) point sources (Section 5.4.1), if they originate from a single location, or (2) nonpoint sources

(Section 5.4.2), if they originate over a more widespread or unspecified location. Information on both types of sources is provided below.

5.4.1 Point Sources

Point source discharges to surface water must comply with the Clean Water Act and the New Mexico Water Quality Standards (20 NMAC 6.4.1) by obtaining a National Pollutant Discharge and Elimination System (NPDES) permit to discharge. The only NPDES-permitted discharge in the planning region (Figure 5-14) is an inactive location listed as a minor discharge from HAW Farms.

The NMED Ground Water Bureau regulates facilities with wastewater discharges that have a potential to impact groundwater quality. These facilities must comply with the New Mexico Water Quality Act (NMSA 1978, §§ 74-6-1 through 74-6-17) and the New Mexico Water Quality Control Commission (NMWQCC) regulations (NMWQCC, 2002) and obtain approval of a discharge plan, which provides for measures needed to prevent and detect groundwater contamination. A variety of facilities fall under the discharge plan requirements, including mines, sewage dischargers, dairies, food processors, sludge and septage disposal facilities, and other industries. The NMWQCC regulations contain requirements for cleanup of any groundwater contamination detected under discharge plan monitoring requirements. Until such cleanup is complete, these facilities may impact the availability of water supplies of sufficient quality for intended uses. Details indicating the status, waste type, and treatment for individual discharge plans can be obtained from the NMED Ground Water Bureau website (http://www.nmenv.state.nm.us/gwb/). A summary list of current discharge plans in the planning region is provided in Table 5-10; their locations are shown in Figure 5-14.

No sites in the planning region are listed by the U.S. EPA (2014) as Superfund sites. Therefore, this region does not include Table 5-11.

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 NMED 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 Estancia Basin region are identified on Figure 5-14. 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 (http://www.nmenv.state.nm.us/ust/ustbtop.html).

Landfills used for disposal of municipal and industrial solid waste can 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 two operating landfills and four closed landfills (Table 5-13, Figure 5-14).

5.4.2 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.

Some communities in the west side of the basin (the East Mountain area) have reported septic tank contamination, although only one thus far (Chilili) has reported nitrate concentrations that exceed maximum contaminant levels. In the future, nitrate contamination associated with septic tanks will likely be more of a problem in areas of shallow groundwater or thinly covered fractured bedrock in the Estancia Basin, particularly if septic tank density in the basin increases.

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. In the Estancia Basin region, the Estancia Basin Water Planning Committee has identified the need for a water quality monitoring project within the planning region to protect the existing aquifer water supply from contamination and water quality deterioration. During the 2010 planning process, the Committee conceptualized development and implementation of such a program (EBWPC and HR, 2010) targeting areas of known or potential contamination. Water quality data are being collected by Sandia National Laboratories in a variety of locations within the Estancia Basin in order to provide a four-dimensional picture of water quality and water levels within the Estancia Basin (EBWPC and HR, 2010). Bernalillo

County has also initiated quarterly water level monitoring and annual water quality sampling at five locations in the western Estancia Basin (eastern Bernalillo County) (EBWPC and HR, 2010).

5.5 Administrative Water Supply

The *Updated Regional Water Planning Handbook* (NMISC, 2013) 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, 2013), 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.

To assess the available water supply, the common technical approach considers legal and physical constraints on the supply and a range of conditions from severe drought to normal supply. The method to estimate this supply, hereafter referred to as *administrative water supply*, is based on recent diversions, which provide a measure of supply that considers both physical supply and legal restrictions (i.e., the diversion is physically available, permitted, and in compliance with water rights policies) and thus reflects the amount of water that can actually be used by a region. The recent diversion data are also corrected to reflect drought supplies, as discussed in Section 5.5.2.

5.5.1 2010 and 2060 Administrative Water Supply

The total diversions (i.e., administrative water supply) in 2010 for the Estancia Basin region, as reported by Longworth et al. (2013), were 84,129 acre-feet. Of this total, 60 acre-feet were surface water diversions (from stock ponds for livestock) and 84,069 acre-feet were groundwater. The amount of groundwater pumped from the Valley Fill in 2010 was estimated to be 77,531 ac-ft/yr, and the amount from other formations was 6,538. The breakdown of these diversions among the various sectors of use detailed in the NMOSE water use report is discussed in Section 6.1.

In mined basins such as the Estancia Basin, where the aquifer is depleted, the administrative water supply may not be sustainable in the future. The future available supply was estimated using two methods, as described in the following subsections.

5.5.1.1 Model Predicted Decline

Non-stream connected groundwater basins with available NMOSE administrative models were used to predict the water level declines in the year 2060 based on estimated groundwater diversions (Table 5-14a). For the Estancia declared OSE administrative groundwater basin, the Valley Fill, has been modeled by OSE for administration of the mined basin. The water level declines in the Valley Fill and the calculated available water column in wells were used to estimate the future administrative supply as outlined in Table 5-14a. The predicted drawdown in 2060 from a model cell in a heavily stressed area was selected and compared to the available water column in existing wells to calculate the percentage of wells impacted by the drawdown. This percentage of impacted wells was assumed to reflect a percentage reduction in available supply.

Using this method, the administrative supply in the Estancia Basin in 2060 was calculated to be 58,328 ac-ft/yr from the valley fill, plus 6,538 ac-ft/yr from other aquifers and 60 ac-ft/yr from surface water for a total of 64,926 in a normal (i.e., no drought) year.

5.5.1.2 Observed Rate of Decline

Another method to predict the future decline of the saturated thickness and thus available supply is to use existing wells with water level hydrographs and compare the predicted decline with the available water column in existing wells. Using the average rate of water level decline calculated from USGS monitor wells within the non-stream connected groundwater and assuming this rate would continue until 2060, the water level decline was predicted as shown in Table 5-14b. The percentage of impacted wells was estimated by comparing the predicted drawdown to the available water column in existing wells, and the percentage of impacted wells was assumed to represent the reduction in supply by 2060.

The predicted water level decline in the Estancia Basin Valley Fill is 61.5 feet in 2060, assuming the average water level decline rate of 1.23 ft/yr (Table 5-14b). A decline of 61.5 feet would impact about 24 percent of the wells. Assuming that the 24 percent of impacted wells results in a proportional impact on water supply, then the estimated supply in 2060 from the Valley Fill is 58,714 acre-feet per year, which is within 1 percent of the model-estimated method.

5.5.1.3 Other Considerations

Both of these approaches represent an approximation of the reduction in administrative supply by 2060. Factors that may affect the accuracy of these predictions include:

- The water columns may not represent the available supply because existing wells could possibly be drilled deeper.
- The shallowest wells that are most impacted may not proportionally represent the distribution of pumping (the deeper wells most likely pump more than the shallow wells).

- New wells could be drilled in other parts of the aquifer.

Ideally, the aquifer should be modeled to determine a sustainable rate or lifetime that is desired by the regions and to estimate the best distribution of pumping.

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. To estimate the vulnerability of the closed basins within a planning region to a prolonged drought, groundwater models are used, where available, to predict the potential impact by 2060 of a 20-year drought.

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 main climate divisions present in the Estancia Basin region, the PDSI classifications for 2010 were near normal (Climate Divisions 5 and 6) (Figure 5-6).

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 non-stream connected aquifers is described below:

- The drought correction is applied only to the portion of the administrative water supply that derives water from the mined aquifer and to the minor amount of surface water use.
- In basins for which NMOSE has an administrative model, the simulation period is from 2010 to 2060 as described above, with no recharge from 2020 to 2040.
- For a conservative approximation, the drawdown predicted during the drought period is derived from a model cell in a heavily stressed area at the end of the simulation period (2060) to represent the water column that will be lost due to drought and pumping (Table 5-15).
- This adjusted predicted drawdown is then compared to the median available water column in 2010 (as described in Sections 5.5.1.1) to determine the percentage of wells that are impacted by the 20-year drought and continued pumping.
- This percentage represents the reduction in supply due to drought. The drought supply will be estimated by multiplying the percentage by the 2060 administrative supply.

The estimated reduction in administrative supply due to continued pumping and one 20-year drought with no recharge over the 50-year planning period is 47 percent, resulting in an available water supply for the Valley Fill of 41,400 ac-ft/yr. In the Valley Fill, the adjusted predicted drawdown without the drought is 63 feet, and the additional drawdown due to drought is 55 feet, for a total decline of 118 feet. Comparing the predicted drawdown during a drought to the available water column of 127 feet shows that 47 percent of wells would be impacted. Thus the water supply in 2060 is estimated to be 47 percent less than the 2010 water use or 41,400 ac-ft/yr in the Valley Fill aquifer. This estimate includes only the Valley Fill aquifer; the other aquifers were not analyzed. The total supply for the Estancia Basin in 2060 after enduring a 20-year drought is about 47,900 ac-ft/yr. The 60 acre-feet of surface water diversions throughout the planning region are assumed to be zero for the drought scenario.

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 an evaluation of current water use by sector (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).

6.1 Present Uses

The most recent assessment of water use in the region was compiled by OSE for 2010, as discussed in Section 5.5. The OSE Water Use 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 for each category of use, for each county, and for the entire region, are shown on Table 6-1 and Figure 6-1. The predominant water use in 2010 in the Estancia Basin region was for irrigated agriculture.

Groundwater accounts for more than 99 percent of the total withdrawals in the region, most of which are for irrigated agriculture. Groundwater also supplies nearly all public water supply, domestic, livestock, and commercial uses. Groundwater points of diversion are shown in Figure 6-2.

The categories included in the OSE Water Use Report and shown on Figure 6-1 and Table 6-1 represent the major demands in the planning region. The OSE report does not quantify additional categories of water demand, including riparian evapotranspiration and instream flow; with the exception of evaporation of groundwater from playa lakes, these categories do not represent a significant consumption of water in the Estancia Basin planning region.

- Evaporation from playa lakes is a significant component of the water budget of the Estancia Valley; estimates include 50,000 ac-ft/yr (Smith, 1957), 27,000 to 36,000 ac-ft/yr (DeBrine, 1971), and 12,700 acre-feet per year in 1975 (Sorensen, 1977). As groundwater levels decline, discharge to the playa lakes decline as well, resulting in a decrease in evaporation.

In addition to the special conditions listed above, the 2010 NMOSE data are available for diversions 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 diversion data for planning purposes will add a margin of safety; thus the use of diversion 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 2013 total population of Torrance County was 15,717 (U.S. Census Bureau, 2014a). No reliable figures for the portions of Torrance County, Santa Fe County, and Bernalillo County in Estancia Basin are available for 2013. The Torrance County population declined slightly over the previous 13 years (Table 3-1a).

As noted in Table 3-1d, cattle, calves, and corn for silage are the most valuable agricultural commodities in Torrance County. A land use map was included in the accepted water plan and there have not been substantial changes.

Specific information regarding the population and economic trends in each county is provided in Sections 6.2.1 through 6.2.3. The information provided in these sections was obtained primarily from telephone interviews with government officials and other parties with knowledge of demographic and economic trends in the three counties; the list of interviewees is provided in Appendix 6-A. The information in these following subsections was used to project population, economic growth, and future water demand, as presented in Sections 6.3 and 6.5.

6.2.1 Santa Fe County

The southwestern area of Santa Fe County that is within the Estancia Basin Water Planning Region had a population of 10,014 in 2010 (UNM, 2014). The area has approximately 20,000 acres of irrigated agriculture.

The town of Edgewood is the main population center of this area. It is 20 miles east of Albuquerque and has become a popular bedroom community for commuters. The town's population grew 97 percent between 2000 and 2010, from 1,893 to 3,735 (U.S. Census Bureau, 2014c). The population grew to 3,779 in 2012 (City-data.com, 2014). Most of the new growth is a result of annexation, which now extends into Bernalillo County.

The town's close proximity to I-40 makes it attractive to developers and retailers. New retail stores have recently opened in the community, including the new Walmart SuperCenter has drawn shoppers from Moriarty. The population of the town could increase another 3,500 by the end of 2015 because of additional annexation, but the population of the Estancia Basin Water Planning Region will not increase as a result of the annexations because this population already resides within the region.

6.2.2 Bernalillo County

The small part of Bernalillo County in the Estancia Basin Water Planning Region, less than 10 percent of the county, is predominantly rural residential, served by domestic wells. A small number of livestock are raised here.

6.2.3 Torrance County

The total population of Torrance County (in both the Estancia Basin and Middle Rio Grande Water Planning Regions) declined from 16,911 in 2000 to 16,383 in 2010, and to 15,717 in 2013. The decline can be attributed to the lack of a diversified economy, which resulted in out-migration. After 2010, the drought also contributed. No new subdivisions have been built in many years, and new building permits average less than ten a year.

In 2012 there were 589 farms and ranches in Torrance County, a slight increase over 2007, and the number of acres increased as well, by 4 percent. Of the 589 farms, 379 reported a net loss in 2012, and 307 had sales of less than $2,500 (USDA NASS, 2014). The number of farms participating in agricultural support programs increased from 72 in 2007 to 163 in 2012 and the amount paid per farm increased from $8,353 to $19,991. According to the agriculture census (USDA NASS, 2014), irrigated acreage decreased by 16.5 percent, from 29,942 acres in 2007 to 25,015 acres in 2012. The average age of a producer in the county increased from 61 years in 2007 to 63.5 years in 2012, and there were only 42 producers under 45 years of age (USDA NASS, 2014).

A contributing factor to the downturn in farming is increasing energy costs, as farmers have to run their well pumps for longer periods of time because of the declining water table. Increased water demand during drought in the County exacerbates the lowering of the water table and thus the potential for some private wells to go dry. Corn silage and alfalfa are the main crops. Ranchers have already sold off much of their herds, and are not likely to replenish them until the cost of feed decreases and the price for breeding heifers decreases.

The school-age population has been declining for the past few years as persons of childbearing age leave the county. Two elementary schools in the Moriarty-Edgewood School District closed in 2014.

Education and healthcare provide the largest number of non-farm jobs, with retail trade ranking second.

In 2014, Google purchased Titan Aerospace, an aerial drone manufacturer based in Moriarty. Google plans to build a 60,000-square foot facility at the municipal airport. Titan Aerospace employs about 30 individuals currently, but that number will double shortly and increase more over the next five years, perhaps to as high as 500 jobs as drone production ramps up. In the next year, Google will hire more than 100 employees; many positions will be temporary or part-time. The increase in jobs will not necessarily increase the population because those with the required professional and engineering skills are expected to commute from the Albuquerque area, 40 miles away.

Water availability may become a problem in the future because some municipal wells have required replacement.

Commercial activity in Moriarty is found along Historic Route 66. Traffic comes from I-40, which runs parallel to Route 66. Businesses are mostly travel-related—gas stations, restaurants, motels, and truck stop/travel centers. The town's retail variety store closed recently because many people go to Edgewood to shop.

6.3 Projected Population Growth

The Bureau of Business and Economic Research (BBER) at the University of New Mexico (UNM) prepared county-level population forecasts through 2040 using data and historical trends from 1960 through to the 2000 Census. The Estancia Basin Water Planning Committee (EBWPC) and HydroResolutions, LLC (HR) prepared the *Estancia Basin Regional Water Plan Year 2010 Update,* relying on population data prepared by the BBER in 2008. The EBWPC and HR projection for 2010 of a population of 37,709 residents exceeded the actual population of 32,694.

Since 2010, the drought, the national recession that started in 2007, and an inability to attract jobs to the area have resulted in population losses in Torrance County. While the Google drone factory will add a substantial number of jobs in Torrance County, many of the people who are qualified for those jobs do not live in the County.

For the population projections through 2060 (Table 6-3), two population forecasts were developed: one based on a slightly optimistic view of the economy for this region over the long-term and one that portrays a more pessimistic picture. The BBER population projections through 2040 (Appendix 6-B) were used as a starting point for the high population projections in Torrance County. For the portion of Santa Fe County in the Estancia Basin, a more recent report regarding population estimates and forecasts for Santa Fe County (UNM, 2014) was relied upon. The low population projections for the region incorporate factors that have been affecting New Mexico since 2000, including drought, continuing recession, job losses, and most recently, out-migration, especially of younger residents.

The population projections are detailed in Table 6-3 and summarized by county below:

- *Torrance County:* The population of Torrance County is projected to decline in the low growth scenario but to grow in the high growth scenario. The low growth scenario anticipates that the highly skilled employees required to fill the new jobs anticipated will commute from elsewhere. The high scenario is based on the 2012 BBER forecast and reflects an improvement in both the residential and employment situation, mainly as a result of the planned Google drone manufacturing facility in Moriarty that will employ several hundred persons. Even in the high scenario, it is not expected that the most highly skilled workers will live in the Moriarty area, but there will be an opportunity for more retail businesses to serve the new workforce. Furthermore, complementary businesses such as aircraft repair firms may follow. The northern part of Torrance County may become more of a bedroom community as a less expensive residential alternative to surrounding counties.

- *Santa Fe County:* Population growth is projected in the high scenario through 2050 and in the low scenario through 2030; from that time forward it will start to decline in the low scenario as population becomes more centralized in the Santa Fe urban area. The southern portion of Santa Fe County, mainly Edgewood, is a bedroom community for both Albuquerque and Santa Fe, and may become one for Torrance County as well when the Google plant ramps up.

- *Bernalillo County:* The population of Bernalillo County within the Estancia Basin Water Planning Region is projected to increase modestly in both the high and low scenarios.

  This is primarily a residential area with little economic activity. It may serve as a bedroom community for skilled jobs in Moriarty.

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 our limited water resources. In support of that commitment, the NMOSE, when evaluating water rights transfers or 40-year water development plans that hold water rights for future use, considers whether adequate conservation measures are in place. 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 sector for developing water demand projections is discussed below. Specific recommendations for conservation programs and policies for the Estancia Basin 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 demand in each county by the following amounts:

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

For the Estancia Basin region, current per capita use in Santa Fe and Bernalillo counties is under 130 gpcd (Table 6-4), so no additional conservation is assumed. Torrance County currently has per capita use between 130 and 200 gpcd (Table 6-4), so their future per capita demand is assumed to be reduced to 130 gpcd. In the projections, these reductions are phased in over time.

Self-supplied domestic. Homeowners with private wells can achieve water savings through household conservation measures. Most pre-2002 wells are not metered, unless they serve multiple homes, 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.

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 overall water balance in the region.

Irrigation withdrawals include both consumptive and non-consumptive uses and incidental losses:

- Consumptive uses are permanently removed from the stream system and are due to a crop's potential for evapotranspiration (i.e., evaporation and transpiration), which is determined by factors that include crop variety, soil type, climate and growing season, on-farm management, and irrigation practices.

- Additional water is used non-consumptively for conveyance requirements and is returned to the surface or groundwater system from which it was withdrawn without loss.

- Incidental losses are permanently removed from the stream system and occur through both seepage and evapotranspiration during conveyance through the irrigation system.

    - Seepage losses occur when water leaks through the conveyance channel or below the root zone after application to the field but does not return to the shallow groundwater or stream system.

    - Evapotranspiration occurs as a result of (1) evaporation during water conveyance in canals or with some irrigation methods (e.g., flood, spray irrigation) and (1) 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 and ultimately within a stream system. These efforts can result in economic benefits, such as increased crop yield, but have the adverse effect of reducing return flows. For example, drip irrigation and center pivots may reduce the amount of water diverted, but due to the increased efficiency of application, it actually increases consumptive use.

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 Estancia Basin 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, but in the Estancia Basin region it is zero due to the absence of reservoirs in the region. However, there is evaporation from the playas and areas where the groundwater levels are shallow.

6.5 Projections of Future Water Demand for the Planning Horizon

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

6.5.1 Water Demand Projection Methods

The *Updated Regional Water Planning Handbook* (NMISC, 2013) 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 diversions in each of the nine categories included in the 2010 OSE *Water Use by Categories* (Longworth et al., 2013) report 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 an estimate of the amount of water use in a recent year that considers physical and legal limitations. 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 (i.e., if water were to be available, there is demand and it would be applied to beneficial use). For example, some water right holders may not have put all their rights to beneficial use in some years due to drought or economic conditions. However, as water becomes available in future wet years or the economic climate improves, these existing rights may once again be exercised. Therefore, for planning purposes, it is assumed that existing rights, reflected in the administrative water supply, will be exercised by the owner when needed or may be leased to other users.

The assumptions and methods used statewide to develop the projections for each category follow. Not all of these categories are applicable to every planning region. The specific methods applied in the Estancia Basin 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 2010 Water Use report (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, based on the assumption that some of the new demand would be met through reduction of per capita demand.

In counties where a decline in population is anticipated (in either the high or low scenario or both), it was assumed that public water supply would continue at 2010 rates. 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. Water rights used for public water supply have value and are not likely to be lost through forfeiture or abandonment proceedings; therefore, constant use is assumed even as population declines slightly, as public water suppliers may serve additional customers through annexation or regionalization, or because communities outside the municipal boundaries will request service from the municipal system.

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 2010 Water Use report, 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 parts of the state where the irrigation is supplied by surface water, there are frequent supply limitations, with many ditches having no or limited supply later in the season.

In regions that use surface water for agriculture withdrawals, the 2010 administrative 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 demand for both the high and low scenarios.

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). However, a reduction in demand does not mean additional water would be available for appropriation. Additionally, the Estancia UWB was closed to new groundwater appropriations by order of the State Engineer in 2001. Water that has been applied to beneficial use represents a valid water right that may be licensed or adjudicated. As demand shifts over time, transfers between water use sectors may occur through sales and leases. Even in areas where the data indicate a decline in the agricultural economy, the high projection assumes that overall water uses will remain at 2010 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 amount, based on the assumption that water rights applied to beneficial use would have value and would continue to be used, even though there are economic declines. 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, based on the assumption that if the water is put to beneficial use in the future it will continue to have value and will be used even if there are later economic declines. 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. No reservoirs of this size exist in the planning region. 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.

6.5.2 Estancia Basin Projected Water Demand

Table 6-5 summarizes the projections for each water use category for each of the three counties that were developed by applying the methods discussed in Section 6.5.1. As discussed in Section 6.3, population is projected to increase under the high projections in all three counties, except for a decline in Santa Fe County after 2050 only. For the low growth scenario, population is projected to decline slightly in Torrance County, increase slightly in Santa Fe County through 2030 and then decline, and increase slightly in Bernalillo County.

Demand in the *public water supply* category is projected to increase in all three counties under the high scenario, proportional to the increasing population projections. However, use in this category is not projected to decline proportionally to the low projections for Torrance and Santa Fe counties indicating declining population, because as discussed in Section 6.5.1, the water suppliers retain their water rights via NMSA 1978, Section 72-1-9, and, for planning purposes, it is assumed that use in the public water supply category will remain at 2010 levels (in Torrance County) or 2030 levels (in Santa Fe County).

Projected water demand in the *commercial* and *domestic* categories is assumed to be proportional to the population growth rates, which are anticipated to increase except in Santa Fe and Torrance counties, where a slight decrease is projected under the low scenario for all or some of the future decades. The low projections for Torrance County assume current levels of use for the domestic and commercial categories, and for Santa Fe County, a higher value is projected in 2030 and is assumed to be maintained for decades 2040 through 2060.

The current observed declining trend in *agricultural* water use is expected to continue for the short-term; for the low projection purposes this is assumed to be through 2020 with agriculture beginning to recover by 2030. However, a reduction in demand does not mean additional water would available for appropriation, as the agricultural center of the water planning region has been closed to new appropriations since 2001. Additionally, though water rights transfers in the Estancia UWB are constrained by OSE guidelines (NMOSE, 2002), as demand shifts over time, transfers from agriculture to other water use sectors may occur through sales and leases. Even in areas where the data indicate a decline in the agricultural economy, the high projection assumes that overall water uses will remain at 2010 levels since water rights have economic value and will continue to be used.

For the high scenario, the demand for water devoted to irrigated agriculture in Torrance County is projected to remain at the 2010 level throughout the projection period (regardless of the actual availability of water) to illustrate the potential gap between supply and demand. For the low scenario, an initial steep decline is projected with a gradual rebound to 80 percent of the 2010 level by 2050, remaining steady at that level through 2060.

In Santa Fe County the amount of water devoted to irrigated agriculture is projected to remain stable at the 2010 level through 2060 in the high scenario, but to reach only 90 percent of that level by 2060 in the low scenario.

No irrigated agriculture exists in the Bernalillo County portion of Estancia Basin.

The *livestock* category in Torrance County is expected to recover to 90 percent of 2010 levels by 2060 in the high projection, but to only 80 percent in the low projection. In this scenario, some ranches will go out of business because younger people, who do not view ranching as a desirable or economically viable career choice, will not replace the older generation of ranchers. Similar trends are expected for livestock water use in the portions of Santa Fe and Bernalillo counties within the planning region.

None of the counties within the region have any significant *industrial*, *mining*, or *power generation* activity, and based on the interviews conducted, no growth is expected in the mining and power sectors. A slight increase in the industrial category for Torrance County is anticipated.

The *reservoir evaporation* category is included for statewide accounting, but has little bearing on the supply available to the Estancia Basin region. The Estancia Basin region projections include no water demand in the reservoir evaporation category due to lack of any reservoir greater than 5,000 acre-feet within the planning area. However, various researchers estimated evaporation of groundwater from playa lakes within the planning region to be approximately 50,000 ac-ft/yr (Smith, 1957), 27,000 to 36,000 (DeBrine, 1971), and 12,700 in 1975 (Sorensen, 1977).

7. Identified Gaps between Supply and Demand (Prepared by State)

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

- 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 4, there are considerable legal limitations on the development of water supplies in the Estancia Basin. The basin is closed to new water rights appropriations, other than domestic and livestock wells, which affects the ability of the region to prepare for shortages by developing new supplies within the region and no other source of supply are available.
- 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-corrected water supply. Future water demand projections do not reflect substantial growth in water use (Figure 7-1), due to the declining economy discussed in Sections 3 and 6. The future water supply is represented as declining based on the predicted impact to the Estancia Basin Valley Fill if the aquifer continues to decline at current rates (Figure 7-1, Table 7-1). Comparing the projected demands to the future supply following a prolonged drought shows a range of water shortages between 22,000 and 37,000 acre-feet in 2060. However, water management strategies to mitigate the impacts of diminishing groundwater supplies are high priorities for the region (EBWPC and HR, 2010); thus the rate of decline may change to enhance the life of the aquifer.

2. Implementation of Strategies to Meet Future Water Demand (Prepared by the Regions)

8.1 Water Conservation

8.2 Implementation of Strategies Identified in Previously Accepted Regional Water Plan

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

8.4 Evaluations

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County	Regional or System Specific	Strategy Type (Project, Program or Policy)	Strategy Approach (What issue does strategy address) (see Tab 3)	Subcategory	Project Name	Source of Project Information	Description	Project Lead (Entity or Organization)	Partners (Other Entities or Participants)	Timeframe (Fiscal Year)	Planning Phase	Cost	Need or Reason for the Project, Program, or Policy	Comments
Guadalupe	SS	PJ	Protect Existing Supplies	Changes to Infrastructure	New Transmission Line to Encino	WTB 2015	Transmission line replacement to Encino	Vaughn, Town of	Encino	FY2016		$1,255,000	Pipeline is too small	
Santa Fe	SS	PJ	Improve System Efficiency	Wastewater Reuse	Edgewood Wastewater Reuse	WTB 2015	Wastewater Re-Use System	Edgewood, Town of		FY2016		$1,089,570		
Santa Fe	SS	PJ	Protect Existing Supplies	Infrastructure Improvements to Wastewater	EDGEWOOD WASTEWATER SYSTEM IMPROVEMENTS	SB159	EDGEWOOD WASTEWATER SYSTEM IMPROVEMENTS	Edgewood, Town of		FY2016		$620,000		
Torrance	R	PJ	Protect Existing Supplies	Storm water protection	Floodwater Detention Structure	ICIP, 2014	Storm water control	East Torrance Soil and Water Conservation District		FY2016		$ 3,110,000.00		
Torrance	R	PJ	Protect Existing Supplies	Storm water protection	Water Harvesting System	ICIP, 2014	Storm water control	East Torrance Soil and Water Conservation District		FY2016		$ 40,400.00		
Torrance	R	PJ	Protect Existing Supplies	Storm water protection	Water Harvesting System	ICIP, 2014	Storm water control	East Torrance Soil and Water Conservation District		FY2017		$ 30,400.00		
Torrance	R	PJ	Protect Existing Supplies	Storm water protection	Water Harvesting System	ICIP, 2014	Storm water control	East Torrance Soil and Water Conservation District		FY2018		$ 30,400.00		
Torrance	R	PJ	Protect Existing Supplies	Storm water protection	Water Harvesting System	ICIP, 2014	Storm water control	East Torrance Soil and Water Conservation District		FY2019		$ 30,400.00		
Torrance	R	PJ	Protect Existing Supplies	Storm water protection	Water Harvesting System	ICIP, 2014	Storm water control	East Torrance Soil and Water Conservation District		FY2020		$ 120,400.00		
Torrance	SS	PJ	Increase Water Supply	Drill new well	Estancia Supply Well	WTB 2015	drill new drinking well	Estancia, Town of		FY2016		$500,000		
Torrance	SS	PJ	Protect Existing Supplies	Infrastructure Improvements	Encino Water System Improvement	SB159		Encino, Town of		FY2016		$10,000		
Torrance	SS	PJ	Reduce Demand	Metering	Estancia Water Meters	SB159	Meter residential customers for the town of Estancia	Estancia, Town of		FY2016		$30,000	Residential Customers are not metered for water use	
Torrance	SS	PJ	Protect Existing Supplies	Infrastructure Improvements	MORIARTY WATER SYSTEM IMPROVEMENTS	SB159	Water Line Extension	Moriarty, Town of		FY2016		$330,000	Reach out to new customers	
Torrance	SS	PJ	Reduce Demand	Metering	Bulk Water Kiosk Station	SB159	Construct new metered station for selling treated effluent to road construction, oil & gas contractors	Moriarty, Town of		FY 2017		$35,000	No meter at station for contractors to purchase water	
Torrance	SS	PJ	Increase Water Supply	Drill new well	WILLARD WELL & WATER SYSTEM	SB159	drill new drinking well	Willard, Town of		FY2016		$65,000	Village has only one well, need to have a back up well.	
Torrance, Bernalillo, Santa Fe	R and SS	PJ	restore capacity, improve well efficiency	Infrastructure Upgrades	Repair and replacement wells	Any Community water system	Wells age, aquifers drop, column pipe degrades, screens become fouled	Community water systems	Community water systems, counties, NM Environment department	Varies	varies	project specific	Project specific, but described under 'description'	
Torrance, Bernalillo, Santa Fe	R and SS	PJ	conservation, increase reliability of water supplies	Infrastructure Upgrades	Repair or replace water storage	Any Community water system	Storage tanks degrade and leak - conservation project	Community water systems	Community water systems, counties, NM Environment department,	Varies	varies	project specific	Project specific, but described under 'description'	
Torrance, Bernalillo, Santa Fe	R and SS	PJ	conservation, increase reliability of water supplies, improve	Infrastructure Upgrades	repair, replace, or upgrade water distribution systems	Any Community water system	water lines leak, system demand increases - replace, upsize, or extend lines	Community water systems	Community water systems, counties, NM Environment department,	Varies	varies	project specific	Project specific, but described under 'description'	
Torrance/ Santa Fe	R	PJ	Improve System Efficiency	Changes to Infrastructure	EMWT Pipeline	McGregor, 2015	Central pipeline to transfer water throughout the basin	EMWT Regional Water Association	Estancia, Willard, Moriarty and Torrance	FY2016-2021	conceptual design to construction	60-135M	Transfer water leased through water bank to areas that need the water	Very feasible, dependent on water leases and acquisition of right-of-way
Torrance/ Santa Fe	R	PJ	Reduce Demand	Changes in Crops and Irrigation Methods	Agricultural Conservation	McGregor, 2015	Conservation focused on Agriculture	USDA	East Torrance SWCD & local farmers	FY2016-2018	Pilot project/ implementation	$ 200,000	Reduce water use through alternative crops/irrigation methods	Feasible
Torrance/ Santa Fe	R	PJ	Protect Existing Supplies	Well field management: Install Meters	Water Rights Metering	McGregor, 2015	Install meters on all wells	OSE	EBWPC, SWCD, & Water Right holders	FY2016-2018	Discussion	$ 500,000	Manage resource wisely	Very feasible
Torrance/ Santa Fe	R	PJ	Improve System Efficiency	Water Banking	Water Banking	McGregor, 2015	Allow Farmers to lease rights when desirable	EMWT Regional Water Association	Estancia, Willard, Moriarty and Torrance & Farmers, Southern Santa Fe County	5-10 years (after pipeline in place)	Discussion	$ 700,000	Allows farmers flexibility to lease	
Torrance/ Santa Fe	R	PM	Improve System Efficiency	Groundwater Modeling Studies	Improved Groundwater Model	McGregor, 2015	Basin Computer Model and GIS	OSE	EBWPC, Estancia, Torrance, Southern Santa Fe County		Discussion	$ 50,000	Improve understanding of resource	Very feasible
Torrance/ Santa Fe	R	PM	Increase Water Supply	Groundwater Investigation	Drill Deep Wells	McGregor, 2015	Hydrologic Investigations into other aquifers	EBWPC	East Torrance SWCD & Edgewood SWCD & OSE	FY2016-2018	Discussion	$ 260,000	Drill deep wells with piezometers, better understanding of deeper resources and aquifer interaction	Very feasible
Torrance/ Santa Fe/ Bernalillo	R	PJ	Protect Existing Supplies	Watershed Restoration	Forest Restoration	McGregor, 2015, ICIP Project Summary	Terrain and Vegetative Modification Program	Claunch-Pinto SWCD	State Forestry, Private Land Owners	FY2016-2021	Annual recurrence (ongoing)	$600,000-900,000/ year	Reduce risk of high-intensity fire, improve health and enhance recharge	6,128,568 funded to date

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County	Regional or System Specific	Strategy Type (Project, Program or Policy)	Strategy Approach (What issue does strategy address) (see Tab 3)	Subcategory	Project Name	Source of Project Information	Description	Project Lead (Entity or Organization)	Partners (Other Entities or Participants)	Timeframe (Fiscal Year)	Planning Phase	Cost	Need or Reason for the Project, Program, or Policy	Comments
Torrance-Bernalillo and SF	R	PM	Improve System Efficiency	Monitoring	Water level Monitoring Program	McGregor, 2015, ICIP Project Summary	Monitors water levels with transducers in 8 wells and quarterly manual measurements in 13 wells	East Torrance Soil and Water Conservation District	EBWPC, Estancia, Torrance, Southern Santa Fe County	FY2016		$ 95,000.00	Improve understanding of resource	
Torrance-Bernalillo and SF	R	PM	Improve System Efficiency	Monitoring	Water level Monitoring Program	McGregor, 2015, ICIP Project Summary	Monitors water levels with transducers in 8 wells and quarterly manual measurements in 13 wells	East Torrance Soil and Water Conservation District	EBWPC, Estancia, Torrance, Southern Santa Fe County	FY2017		$ 35,000.00	Improve understanding of resource	
Torrance-Bernalillo and SF	R	PM	Improve System Efficiency	Monitoring	Water level Monitoring Program	McGregor, 2015, ICIP Project Summary	Monitors water levels with transducers in 8 wells and quarterly manual measurements in 13 wells	East Torrance Soil and Water Conservation District	EBWPC, Estancia, Torrance, Southern Santa Fe County	FY2018		$ 35,000.00	Improve understanding of resource	
Torrance-Bernalillo and SF	R	PM	Improve System Efficiency	Monitoring	Water level Monitoring Program	McGregor, 2015, ICIP Project Summary	Monitors water levels with transducers in 8 wells and quarterly manual measurements in 13 wells	East Torrance Soil and Water Conservation District	EBWPC, Estancia, Torrance, Southern Santa Fe County	FY2019		$ 35,000.00	Improve understanding of resource	
Torrance-Bernalillo and SF	R	PM	Improve System Efficiency	Monitoring	Water level Monitoring Program	McGregor, 2015, ICIP Project Summary	Monitors water levels with transducers in 8 wells and quarterly manual measurements in 13 wells	East Torrance Soil and Water Conservation District	EBWPC, Estancia, Torrance, Southern Santa Fe County	FY2020		$ 60,000.00	Improve understanding of resource	

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

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a. Population

County	2000	2010 [a]	2013
Santa Fe	NA	10,014	NA
Bernalillo	NA	6,297	NA
Torrance	16,911	16,383	15,717
Total Region	NA	32,694	NA

Source: U.S. Census Bureau, 2014a, unless otherwise noted.
[a] U.S. Census Bureau, 2010

b. Income and Employment

County	2008-2012 Income [a]		Labor Force Annual Average 2013 [b]		
	Per Capita ($)	Percentage of State Average	Number of Workers	Number Employed	Unemployment Rate (%)
Santa Fe	NA	NA	NA	NA	NA
Bernalillo	NA	NA	NA	NA	NA
Torrance	17,849	75	6,167	5,649	8.4

[a] U.S. Census Bureau, 2014c, American Community Survey 5-Year Estimate
[b] NM Department of Workforce Solutions, 2014

c. Business Environment

County	Industry	Number Employed	Number of Businesses
	2008-2012 [a]		*2012* [b]
Santa Fe	NA	NA	NA
Bernalillo	NA	NA	NA
Torrance	Education/Healthcare	1,045	233
	Agriculture	909	
	Retail trade	810	
	Professional, scientific, management	459	
	Construction	428	

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

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

d. Agriculture

County	Farms / Ranches [a]			Most Valuable Agricultural Commodities [b]
	Number	Acreage		
		Total	Average	
Santa Fe	NA	NA	NA	NA
Bernalillo	NA	NA	NA	NA
Torrance	589	1,864,589	3,166	Cattle, calves Corn for silage

[a] USDA NASS, 2014, Table 1
[b] USDA NASS, 2014, Table 2

Table 5-1. Estancia Basin Climate Stations

Climate Stations [a]	Latitude	Longitude	Elevation	Precipitation		Temperature	
				Data Start	Data End	Data Start	Data End
Santa Fe County							
Clines Corners	35.02	–105.67	7,201	7/1/1959	11/30/1968	7/1/1959	11/30/1968
Edgewood	35.05	–106.13	6,804	7/1/1944	8/31/1959	—	—
Otto FAA Airport	35.08	–106.02	6,234	3/1/1909	10/31/1954	3/1/1909	10/31/1954
Stanley 1 NNE	35.17	–105.96	6,380	3/1/1909	Present	3/1/1909	Present
Bernalillo County							
Barton	35.08	–106.25	6,875	7/1/1914	1/31/1926	7/1/1914	12/31/1925
Torrance County							
Clines Corners 7 SE	34.93	–105.59	6,924	12/1/1968	12/31/2013	12/1/1968	12/31/2013
Duran	34.47	–105.40	6,285	7/1/1908	9/30/1951	8/1/1908	2/28/1933
Gran Quivira Natl Mon	34.27	–106.08	6,600	5/1/1905	Present	1/1/1930	Present
Mc Intosh 4 NW	34.92	–106.08	6,253	1/1/1928	8/31/1976	1/1/1928	8/31/1976
Mountainair	34.52	–106.26	6,520	5/1/1902	Present	5/1/1902	Present
Palma	35.00	–105.45	6,453	5/1/1905	7/31/1968	—	—
Pedernal 4 E	34.63	–105.57	6,200	1/1/1929	Present	7/1/1956	Present
Pfeister Ranch	34.60	–106.22	6,604	3/1/1942	3/31/1955	—	—
Progresso	34.42	–105.89	6,297	7/1/1929	7/31/2012	—	—
Tajique	34.75	–106.28	6,693	11/1/1970	4/30/1979	11/1/1970	4/30/1979
Tajique 4 NW	34.80	–106.30	6,985	4/30/1910	10/31/1970	5/1/1920	10/31/1970
Willard (Near)	34.63	–106.03	6,080	10/1/1912	7/31/1923	10/1/1912	3/31/1923

Source: WRCC, 2014

[a] Stations in **bold** type were selected for detailed analysis. — = Information not available

Table 5-2. Temperature and Precipitation for Selected Climate Stations Estancia Basin 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]
Gran Quivira Natl Mo	15.23	6.26	25.53	98.9	53.4	38.0	68.9	84.1
Pedernal 4 E	12.17	3.82	20.44	76.5	50.8	35.3	66.4	61

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.

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

Table 5-7. Dams with Dam Safety Deficiency Rankings

Dam	Condition Assessment [a]	Deficiency	Hazard Potential [b]	Estimated Cost to Repair ($)
Santa Fe County				
Kinsell Reservoir Dam	Poor	Spillway capacity unknown Rodent infestation, severe erosion Maintenance needed	Low	2,500,000
Torrance County				
Mescalero Reservoir Dam	Poor	Lack of design information	Significant	200,000

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*
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.

[b] Hazard Potential Classifications:

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

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.

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

Waterbody Name (basin, segment)	Assessment Unit ID	Affected Reach (acres)	Probable Sources of Pollutant	Uses Not Fully Supported	Specific Pollutant	IR Category [b]
Torrance County						
Estancia Park Lake	NM-9000.B_042	1	Not assessed	—	—	3/3A
Manzano Lake	NM-9000.B_114	3.2	Not assessed	—	—	3/3A
Mike's Playa	NM-9000.B_085	30	Not assessed	—	—	3/3A

Source: NMED, 2014a

[a] Unless otherwise noted.

[b] 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 (NMED, 2013).

— = No information provided (reach was not assessed).

Table 5-10. Groundwater Discharge Permits in the Estancia Basin Water Planning Region
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County	Facility Name [a]	Permit No.	Status	Permitted Discharge Amount (gpd [b])
Santa Fe	East Mountain Wastewater Limited Partnership	DP-1591	Pending	—
	Edgewood (Town of) - Wastewater Treatment Plant	DP-1654	Active	150,000
	Edgewood Center North	DP-1173	Active	2,000
	Edgewood Elementary School	DP-856	Active	9,500
	Edgewood Middle School	DP-1269	Active	7,000
	Prairie Hills Subdivision	DP-1094	Active	15,000
	South Mountain Elementary	DP-1031	Active	5,000
	Zorro Ranch	DP-1452	Active	10,080
Bernalillo	Green Ridge MDWCA Water Treatment Facility	DP-1805	Active	2,054
	Route 66 Elementary School	DP-1110	Active	3,300
	Solana Wastewater Treatment Plant	DP-1256	Active	60,630
	Woodlands Subdivision Sewer Cooperative Association	DP-1080	Active	31,800
Torrance	Bowlin's Flying C Ranch	DP-399	Active	5,000
	Clines Corners Snack Bar Phillips 66	DP-444	Active	15,000
	Estancia (Town of) - Wastewater Treatment Plant	DP-975	Active	115,000
	Estancia Valley Solid Waste Authority	DP-1708	Active	10,000 [c]
	Keers Environmental Landfill	DP-1012	Active	48,600
	Moriarty (City of) - Wastewater Treatment Plant	DP-910	Active	670,000

Source: NMED, 2014b

[a] Names appear as listed in the NMED database.
[b] Unless otherwise noted
[c] Gallons per week

gpd = Gallons per day
— = Not listed on GWQB web site

Table 5-10. Groundwater Discharge Permits in the Estancia Basin Water Planning Region
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County	Facility Name [a]	Permit No.	Status	Permitted Discharge Amount (gpd [b])
Torrance (cont.)	Mountainair (Town of) - Waste Water Treatment Plant	DP-1440	Active	50,000
	Mountainair Heritage Meat Processing	DP-1551	Active	2,400
	Mountainview Elementary School	DP-447	Active	7,500
	Tagawa Southwest	DP-1144	Active	20,555
	Torrance County Correctional Facility	DP-690	Active	122,500
	Willard (Village of) - Wastewater Treatment Facility	DP-1353	Active	34,200
	Willard Dairy	DP-1004	Active	80,000

Source: NMED, 2014b
[a] Names appear as listed in the NMED database.
[b] Unless otherwise noted
[c] Gallons per week

gpd = Gallons per day
— = Not listed on GWQB web site

Table 5-12. Leaking Underground Storage Tank Sites in the Estancia Basin Water Planning Region

City [a]	Release/Facility Name [b,c]	Release ID	Facility ID	Physical Address c	Status [d]
Santa Fe County					
White Lakes	White Lakes Station	427	8305	NM 285	Cleanup, Responsible Party
Torrance County					
Moriarty	JR Tire Service	1409	28796	601 Hwy 66	Cleanup, Responsible Party
	Old Shell Station	3058	26216	121 Route Hwy 66	Investigation, Responsible Party
	Sierra Cable Vision	1193	30599	1001 Route 66	Investigation, Responsible Party
	JR Tire Service	1409	28796	601 Hwy 66	Cleanup, Responsible Party
Estancia	Giant DBA, Thriftway 7278a	3318	31840	5th and Joseph	Cleanup, Responsible Party
	H&M Service Station	2042	28433	5th and Allen	Investigation, State Lead, CAF
Encino	NMDOT Encino Patrol Yard 45 43, NMSHTD Encino	1985	26233	US 60 MP 253	Aggr Cleanup Completed, Resp Party
	Rio Pecos Truck Stop, Txco & Prp	834	30253	US 285 60 W End of Twon	Cleanup, Responsible Party
Willard	Deans Gas & Grocery	1265	27649	Dunlavy and Hwy 60	Cleanup, Responsible Party
Mountainair	Toms Mini-Mart	2438	31149	US Hwy 60 & Roosevelt Ave	Cleanup, Responsible Party

Source: NMED, 2014e

[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] Investigation: Ongoing assessment of environmental impact
Cleanup: Physical removal of contamination ongoing
State Lead: State has assumed responsibility for mitigation of release
CAF: Corrective action fund
Aggressive Cleanup Completed (Aggr Cleanup Completed): Effective removal of contamination complete
Responsible Party (Resp Party): Owner/Operator responsible for mitigation of release

Table 5-13. Landfills in the Estancia Basin Water Planning Region

County	Landfill Name [a]	Landfill Operating Status	Landfill Closure Date
Bernalillo	Chilili Landfill	Closed	—
Torrance	Estancia Valley Regional Landfill (formerly Torrance County Landfill)	Open	NA
	Keers Asbestos Landfill	Open	NA
	Mountain Refuse Landfill	Closed	—
	Mountainair Landfill	Closed	—
	Willard Landfill	Closed	—

Sources: NMED, 2013a, 2014c

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

NA = Not applicable

— = Information not available

Table 5-14a. Projected Groundwater Supply in 2060 in Estancia Basin Valley Fill Aquifer, Based on Modeled Drawdown

Row	Calculation Step	Estancia Valley Fill	Explanation/Source
1	Estimated groundwater diversions in 2010 (ac-ft/yr)	77,531	Longworth, et al., 2013
2	Modeled pumping (ac-ft/yr)	42,000	Tom Morrison, personal communication, 2015
3	Ratio of administrative supply to modeled pumping	1.85	Row 1 divided by Row 2
4	Median water column (feet)	181	Difference between the water level at the top of the well and total depth of the well, based on 61 wells from WATERS database with post-1997 water level data
5	Available water column (feet)	127	Applying the 70% guideline (feet) from the ISC Handbook
6	Predicted drawdown from model into 2060 (feet)	34	Greatest decline in the Edgewood area, Tom Morrison, personal communication, 2015
7	Adjusted model-predicted drawdown in 2060 (feet)	62.8	Row 3 times Row 6
8	Percentage of wells impacted (percentage reduction in supply)	25%	Row 7 divided by Row 5 times 50% (to account for the median)
9	Revised supply by 2060 due to continued pumping (ac-ft/yr)	58,328	Row 1 reduced by Row 8

ac-ft/yr = Acre-feet per year

Table 5-14b. Projected Groundwater Supply in 2060 in Estancia Basin Valley Fill Aquifer, Based on Observed Rate of Decline

Row	Calculation Step	Estancia Valley Fill	Explanation/Source
1	Estimated groundwater diversions in 2010 (ac-ft/yr)	77,531	Longworth et al., 2013.
2	Median water column (feet)	181	Difference between the water level at the top of the well and total depth of the well, based on 61 wells from WATERS database with post-1997 water level.
3	Available water column (feet)	127	Applying the 70% guideline (feet) from the ISC Handbook.
4	Rate of water level decline (ft/yr)	1.23	Using the water level data for USGS monitor wells within the non-stream-connected groundwater basin (Figure 5-11), the change in water level from the 1980s to the most recent measurement date was calculated and divided by the elapsed time. An average rate of water level decline was estimated for those wells with decreasing water levels.
5	Estimated decline in 50 years (feet)	61.5	The average rate of water level decline was multiplied by 50 years to predict the average drawdown by 2060.
6	Percentage of wells impacted	24%	Row 5 divided by Row 3 and multiplied by 50%.
7	Groundwater supply from mined sub-basins in 2060 (ac-ft/yr)	58,714	Row 1 reduced by Row 6.

ac-ft/yr = Acre-feet per year

Table 5-15. Projected Drought Water Supply in Estancia Basin Water Planning Region in 2060

Row	Calculation Step	Estancia Valley Fill	Explanation/Source
1	Estimated groundwater diversions in 2010 (ac-ft/yr)	77,531	Longworth, et al., 2013
2	Modeled pumping (ac-ft/yr)	42,000	Tom Morrison, personal communication, 2015
3	Ratio of administrative supply to modeled pumping	1.85	Row 1 divided by Row 2
4	Available water column (feet)	127	Applying the 70% guideline (feet) from the ISC Handbook
5	Predicted additional drawdown from 20-year drought (feet)	30	Tom Morrison, personal communication, 2015
6	Adjusted predicted drawdown in 2060 due to drought (feet)	55.4	Row 5 times Row 3
7	Total drawdown due to pumping and drought	118	Row 6 plus Row 7 from Table 5-14a
8	Percentage reduction in supply due to drought and pumping	47%	Row 7 divided by Row 4 times 50%
9	Revised supply by 2060 with 20-year drought (ac-ft/yr)	41,384	Row 1 reduced by Row 8

ac-ft/yr = Acre-feet per year

Table 6-1. Total Diversions in the Estancia Basin Water Planning Region in 2010

Water Use Category	Diversions (acre-feet)											
	Santa Fe County			Bernalillo County			Torrance County			Planning Region		
	Surface Water	Ground-water	Total	Surface Water	Ground-water	Total	Surface Water	Ground-water	Total	Surface Water	Ground-water	Total
Commercial (self-supplied)	0	3	3	0	40	40	0	276	276	0	319	319
Domestic (self-supplied)	0	132	132	0	627	627	0	487	487	0	1,246	1,246
Industrial (self-supplied)	0	0	0	0	0	0	0	1	1	0	1	1
Irrigated agriculture	0	19,693	19,693	0	0	0	0	59,605	59,605	0	79,298	79,298
Livestock (self-supplied)	11	15	26	0.4	24	25	48	550	598	60	589	649
Mining (self-supplied)	0	1	1	0	0	0	0	30	30	0	31	31
Power (self-supplied)	0	0	0	0	0	0	0	0	0	0	0	0
Public water supply	0	911	911	0	40	40	0	1,634	1,634	0	2,584	2,584
Reservoir evaporation	0	0	0	0	0	0	0	0	0	0	0	0
Total	11	20,754	20,766	0.4	732	732	48	62,583	62,631	60	84,069	84,129

Source: Longworth et al., 2013

Table 6-2. Comparison of Projected and Actual 2010 Population

County	2010 Regional Water Plan Projected Population [a]	Actual Population 2010 U.S. Census [b]
Santa Fe	14,531	10,014
Bernalillo	3,339	6,297
Torrance	19,839	16,383
Total Region	37,709	32,694

[a] EBWPC and HR, 2010

[b] U.S. Census Bureau, 2010 (numbers represent portion of population in the water planning region, not total county population)

Table 6-3. Estancia Basin 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
Santa Fe	High	1.73	0.80	0.73	0.18	0.00
	Low	0.18	0.24	–0.34	–0.15	–0.28
Bernalillo	High	0.30	0.31	0.10	0.22	0.15
	Low	0.20	0.18	0.04	0.05	0.05
Torrance	High	0.39	0.35	0.28	0.28	0.28
	Low	–0.35	–0.11	–0.11	–0.10	–0.06

b. Projected Population

County	Projection	Population					
		2010	2020	2030	2040	2050	2060
Santa Fe	High	10,014	11,890	12,880	13,850	14,100	14,100
	Low	10,014	10,200	10,450	10,100	9,950	9,675
Bernalillo	High	6,297	6,486	6,687	6,753	6,902	7,005
	Low	6,297	6,423	6,539	6,564	6,597	6,630
Torrance	High	16,383	17,038	17,652	18,146	18,663	19,195
	Low	16,383	15,826	15,652	15,480	15,325	15,235

Source: Poster Enterprises, 2014

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
Santa Fe County					
Estancia	Entranosa Water and Wastewater Coop - part	4,224	76	0	359
	EPCOR/New Mexico American Water Co. - part	4,320	114	0	551
	Santa Fe County public water supply totals	8,544		0	911
	County-wide public water supply per capita use [c]		95		
Estancia Upper Pecos	Rural self-supplied homes (Rio Grande and Pecos)	1,470	80	0	132
	Santa Fe County domestic self-supplied totals	1,470		0	132
	County-wide domestic self-supplied per capita use [c]		80		
Bernalillo County					
Estancia	Bearcat Homeowners Assn	100	59	0	7
	Chilili WUA	90	70	0	7
	Green Ridge MDWCA	130	32	0	5
Rio Grande (Middle)	Tranquillo Pines Water System [d]	375	52	0	22
	Bernalillo County public water supply totals	695		0	40
	County-wide public water supply per capita use [c]		51		
Estancia Rio Grande (Middle) Sandia	Rural Self-Supplied Homes (Rio Grande)	5,602	100	0	627
	Bernalillo County domestic self-supplied totals	5,602		0	627
	County-wide domestic self-supplied per capita use [c]		100		

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] Rural self-supplied homes are shown for specified surface water basin in parenthesis.
[c] County-wide per capita use, calculated as the total population divided by total withdrawals
[d] Portion that is in Estancia Basin planning region

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
Torrance County					
Estancia	Carlos Lucero Subdivision - Gilbert Lucero	75	50	0	4
	Cassandra Water System	54	80	0	5
	Clines Corners Water System	40	368	0	16
	Echo Valley Water Co.	408	79	0	36
	Edgewood Meadows Water Co-Op	100	62	0	7
	EPCOR/New Mexico American Water Co Edgewood District - part	1,081	114	0	138
	Estancia, Town of	2,200	138	0	341
	Indian Hills Water Company	460	80	0	41
	Manzano MDWCA	95	43	0	5
	Melody Ranch Water Co	193	81	0	18
	Moriarty Water System	1,763	266	0	525
	Mountainair	1,600	125	0	224
	Punta De Agua MDWCA	50	80	0	4
	Squaw Valley Water Supply System	216	80	0	19
	Sunset Acres Subdivision	300	63	0	21
	Tajique MDWCA	181	102	0	21
	Torreon MDWCA	150	23	0	4
	Willard Water Supply System (Rio Grande)	210	91	21	0

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] Rural self-supplied homes are shown for specified surface water basin in parenthesis.

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

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
Torrance County (cont.)					
Fort Sumner	Encino Water System	100	126	0	14
NA	Duran Water System	70	76	0	6
	Homestead Estates	230	156	0	40
	Pine Canyon Ranch	1,366	80	0	122
	Torrance County public water supply totals	10,942		21	1,612
	County-wide public water supply per capita use [c]		133		
Fort Sumner Roswell Upper Pecos	Rural self-supplied homes (Pecos)	109	80	0	10
Estancia Fort Sumner Rio Grande (Middle) Roswell Tularosa Upper Pecos	Rural self-supplied homes (Rio Grande)	5,329	80	0	477
	Torrance County domestic self-supplied totals	5,438		0	487
	County-wide domestic self-supplied per capita use [c]		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] Rural self-supplied homes are shown for specified surface water basin in parenthesis.

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

gpcd = Gallons per capita per day
NA = Information not available

Table 6-5. Projected Water Demand, 2020 through 2060
Estancia Basin Water Planning Region
Page 1 of 2

Use Sector	Projection	Water Demand (acre-feet)					
		2010 [a]	2020	2030	2040	2050	2060
Santa Fe County [b]							
Public water supply	High	911	1,081	1,171	1,259	1,282	1,282
	Low	911	928	950	950 [c]	950 [c]	950 [c]
Domestic (self-supplied)	High	132	157	170	183	186	186
	Low	132	134	138	138 [c]	138 [c]	138 [c]
Irrigated agriculture	High	19,693	19,693	19,693	19,693	19,693	19,693
	Low	19,693	15,754	15,754	16,739	16,739	17,724
Livestock (self-supplied)	High	26	14	16	18	21	22
	Low	26	12	13	16	17	20
Commercial (self-supplied)	High	3	3	4	4	4	4
	Low	3	3	3	3	3	3
Industrial (self-supplied)	Low/High	0	0	0	0	0	0
Mining (self-supplied)	Low/High	1	1	1	1	1	1
Power (self-supplied)	Low/High	0	0	0	0	0	0
Reservoir evaporation	Low/High	0	0	0	0	0	0
Bernalillo County [b]							
Public water supply	High	40	41	42	43	44	44
	Low	40	41	41	42	42	42
Domestic (self-supplied)	High	627	646	666	672	687	698
	Low	627	640	651	654	657	660
Irrigated agriculture	Low/High	0	0	0	0	0	0
Livestock (self-supplied)	High	25	13	14	15	16	18
	Low	25	10	11	13	14	14
Commercial (self-supplied)	High	40	42	43	43	44	45
	Low	40	41	42	42	42	42
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	Low/High	0	0	0	0	0	0

[a] Actual withdrawals (Longworth et al., 2013)
[b] Portion of the county within the planning region
[c] Projections set equal to 2030 decade high

Table 6-5. Projected Water Demand, 2020 through 2060
Estancia Basin Water Planning Region
Page 2 of 2

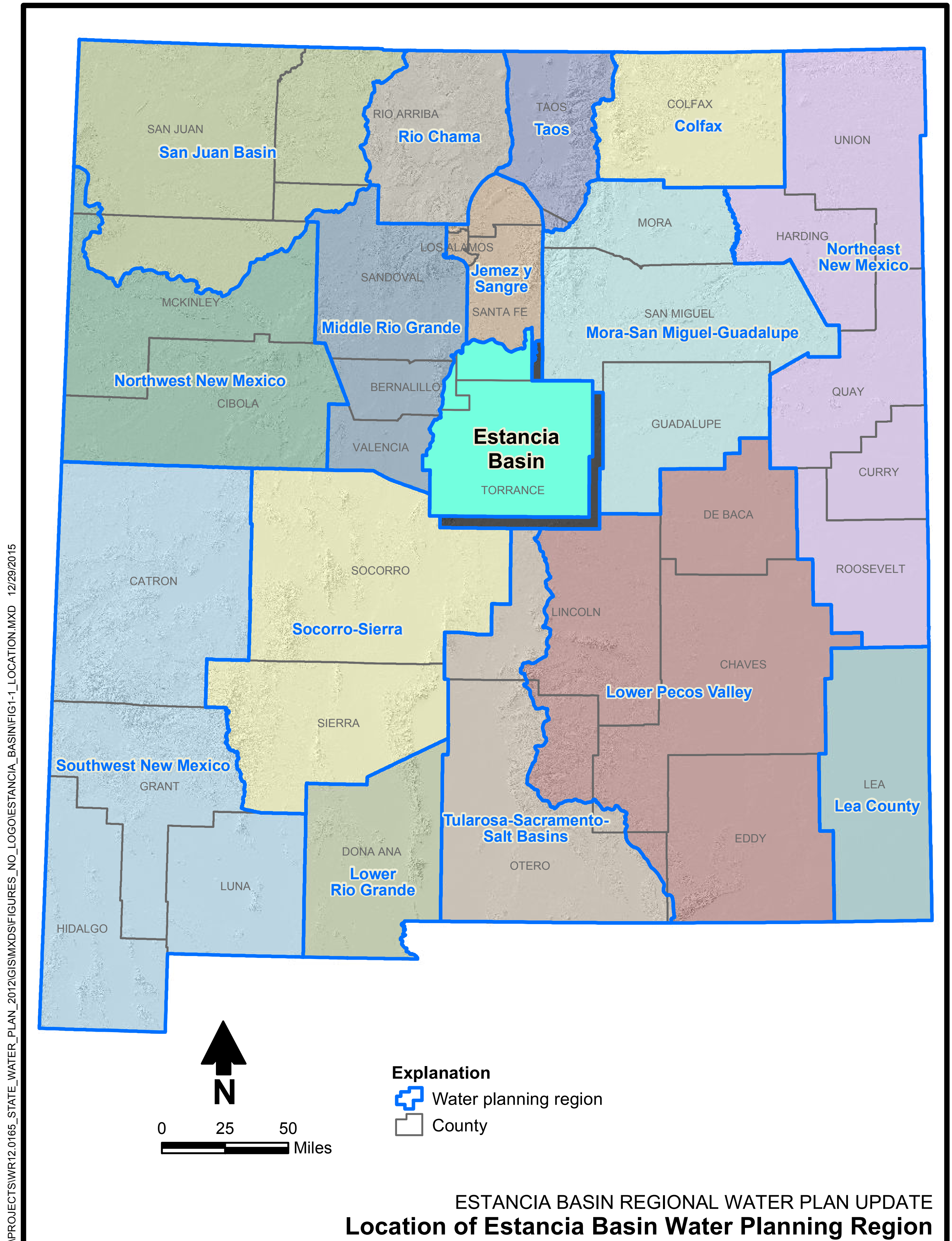
Use Sector	Projection	Water Demand (acre-feet)					
		2010 [a]	2020	2030	2040	2050	2060
Torrance County							
Public water supply	High	1,634	1,698	1,757	1,804	1,853	1,904
	Low	1,634	1,634	1,634	1,634	1,634	1,634
Domestic (self-supplied)	High	487	506	524	539	555	570
	Low	487	487	487	487	487	487
Irrigated agriculture	High	59,605	59,605	59,605	59,605	59,605	59,605
	Low	59,605	41,724	44,704	44,704	47,684	47,684
Livestock (self-supplied)	High	598	329	389	449	508	538
	Low	598	269	329	389	419	478
Commercial (self-supplied)	High	276	287	297	306	314	323
	Low	276	276	276	276	276	276
Industrial (self-supplied)	Low/High	1	3	5	5	6	6
Mining (self-supplied)	Low/High	30	30	30	30	30	30
Power (self-supplied)	Low/High	0	0	0	0	0	0
Reservoir evaporation	Low/High	0	0	0	0	0	0
Total region							
Public water supply	High	2,584	2,820	2,971	3,106	3,178	3,230
	Low	2,584	2,602	2,625	2,626	2,626	2,626
Domestic (self-supplied)	High	1,246	1,309	1,360	1,394	1,428	1,454
	Low	1,246	1,261	1,276	1,278	1,281	1,285
Irrigated agriculture	High	79,298	79,298	79,298	79,298	79,298	79,298
	Low	79,298	57,478	60,458	61,443	64,423	65,408
Livestock (self-supplied)	High	649	356	419	482	545	578
	Low	649	291	353	418	450	512
Commercial (self-supplied)	High	319	332	344	353	363	372
	Low	319	320	321	321	321	321
Industrial (self-supplied)	Low/High	1	3	5	5	6	6
Mining (self-supplied)	Low/High	31	31	31	31	31	31
Power (self-supplied)	Low/High	0	0	0	0	0	0
Reservoir evaporation	Low/High	0	0	0	0	0	0
Total regional demand	High	84,129	84,149	84,428	84,670	84,849	84,969
	Low	84,129	61,986	65,069	66,122	69,139	70,189

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

Table 7-1. Water Use and Estimated Availability in the Estancia Basin Water Planning Region

Source	Basin	2010 Estimated Water Use (ac-ft/yr)	2060 Estimated Water Availability (ac-ft/yr)	
			No Drought	One 20-Year Drought
Valley fill aquifer	Estancia Valley UWB	77,531	58,328	41,384
All other aquifers	Six other UWBs	6,538	6,538	6,538
Surface water	All areas	60	60	0
	Total	84,129	64,926	47,922
	Water use as a percentage of 2010 use		77%	57%

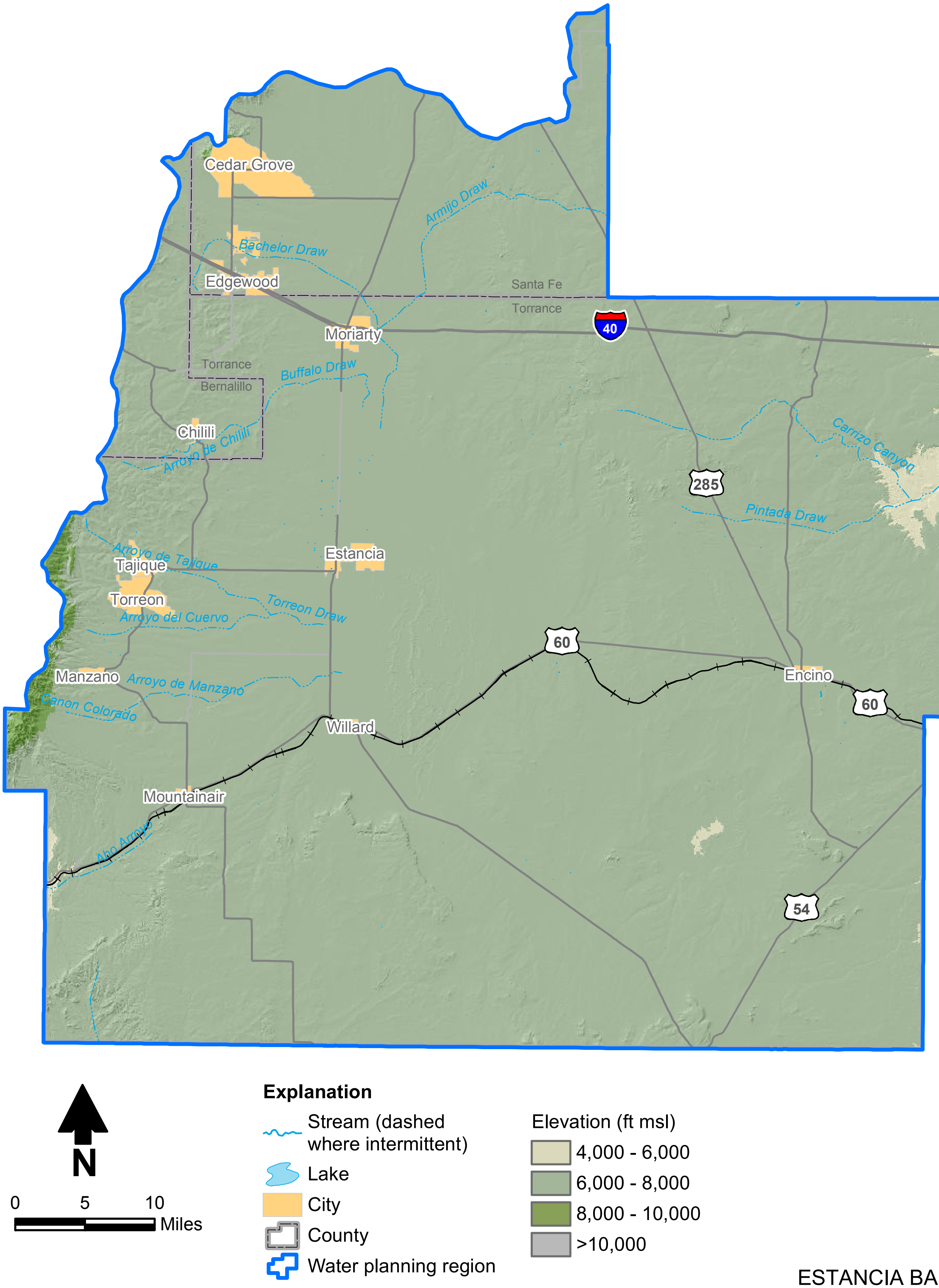
ac-ft/yr = Acre-feet per year
UWB = Underground water basin



ESTANCIA BASIN REGIONAL WATER PLAN UPDATE

Location of Estancia Basin Water Planning Region

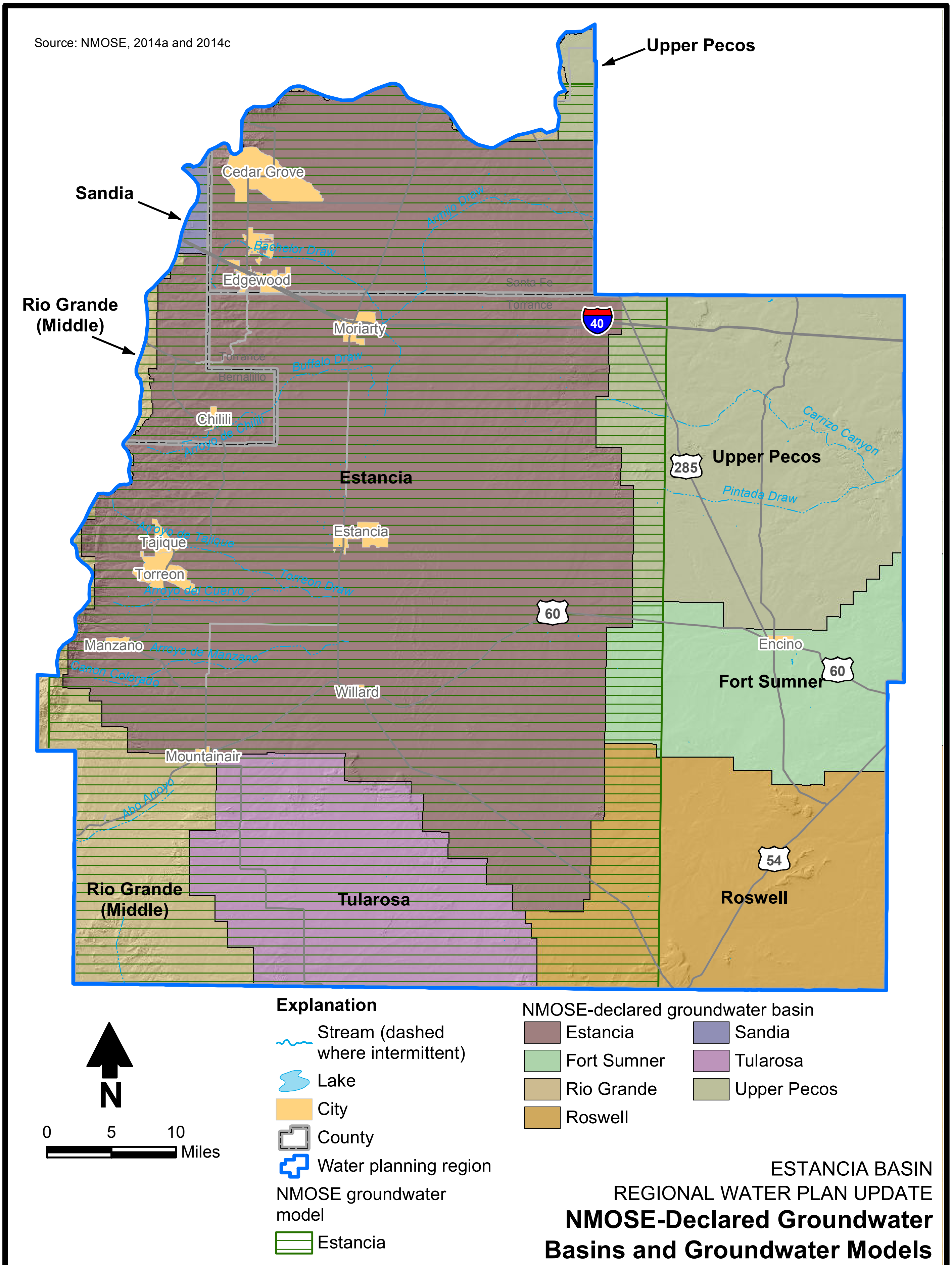
Figure 1-1



ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Regional Map

Figure 3-1

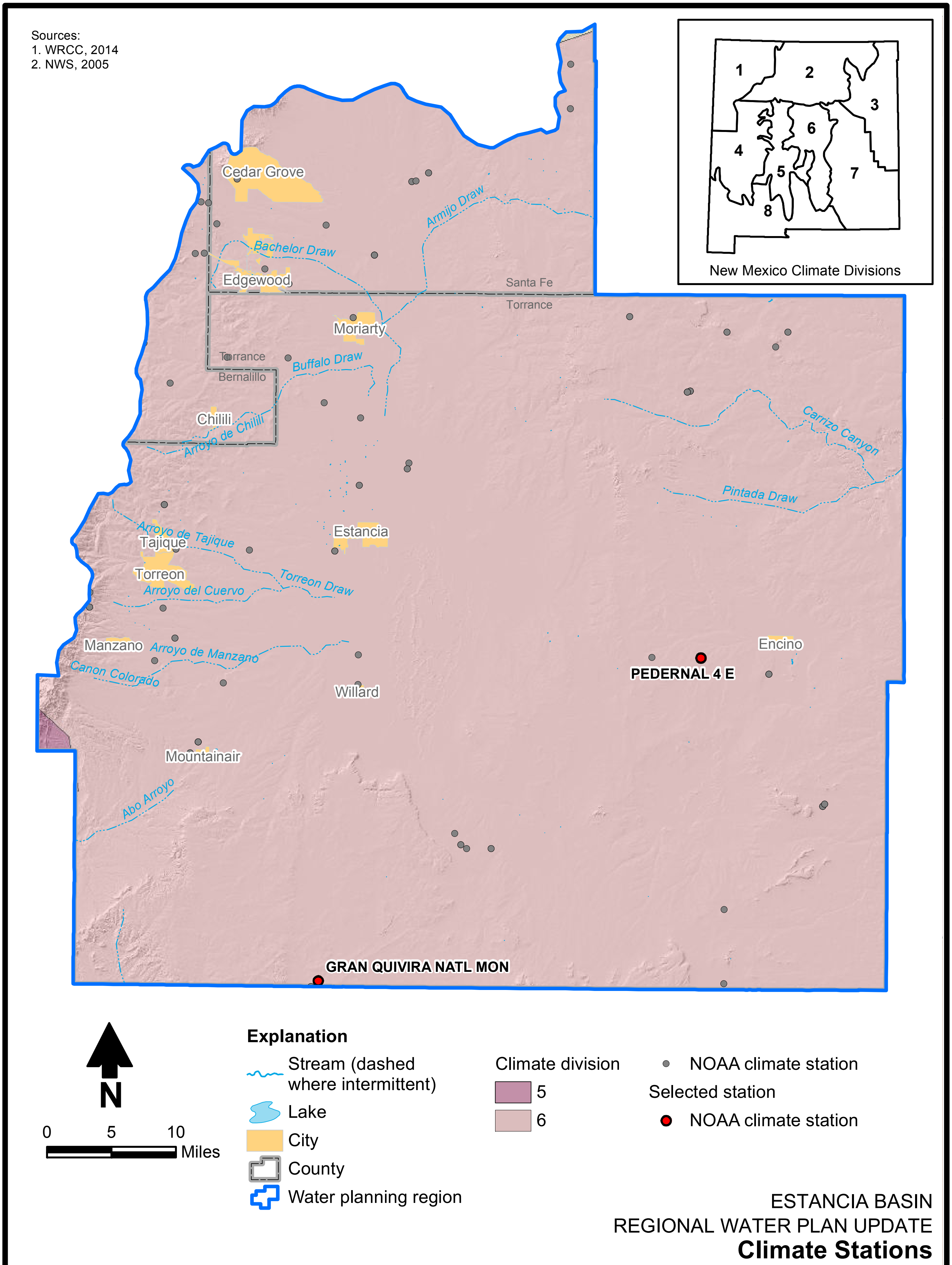
S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG3-1_REGIONAL_MAP.MXD 12/29/2015



ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
NMOSE-Declared Groundwater Basins and Groundwater Models

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG4-1_GW_BASINS_MODELS.MXD 12/29/2015

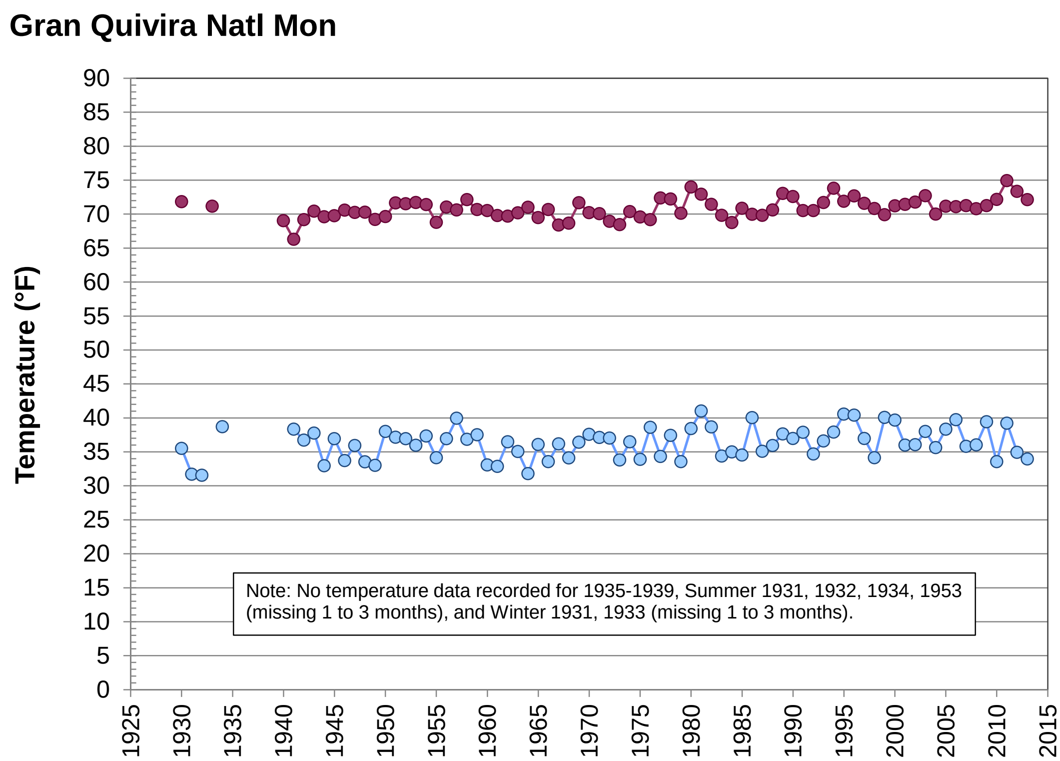
Figure 4-1

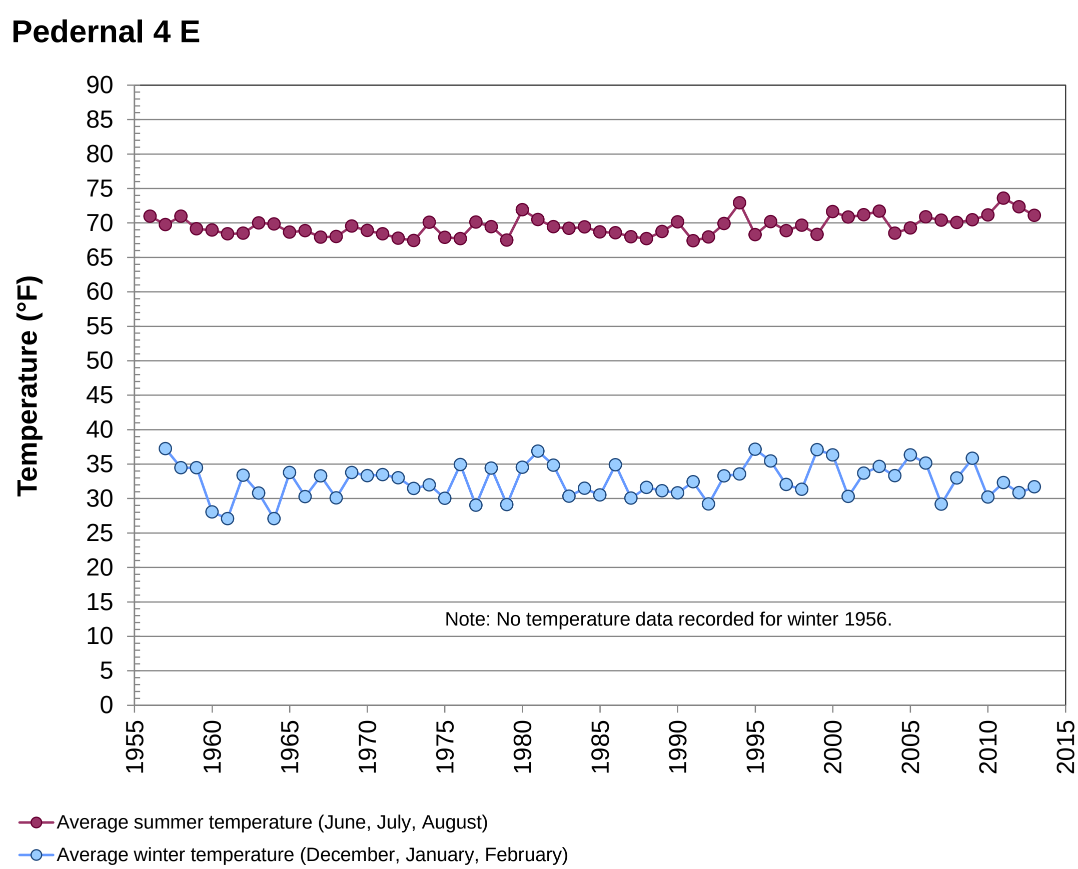


S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-1_CLIMATE_STATIONS.MXD 12/29/2015

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Climate Stations

Figure 5-1



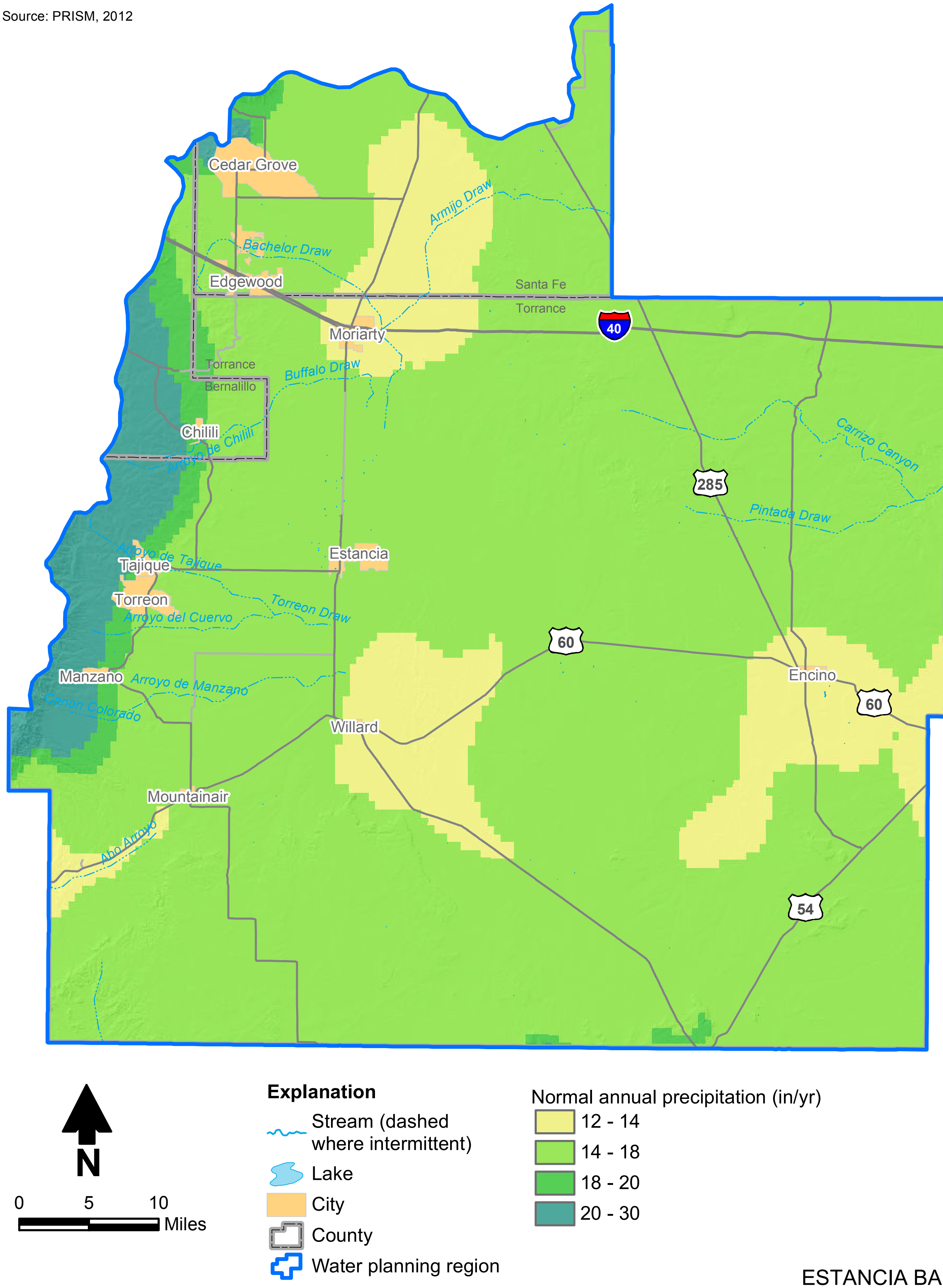


P:_WR12-165\RWPs_2014\13_Estancia\Figures\Fig5-02_Reg 13_Temp.docx 1/11/16

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Average Temperature, Gran Quivira Natl Mon and Pedernal 4 E Climate Stations

Figure 5-2

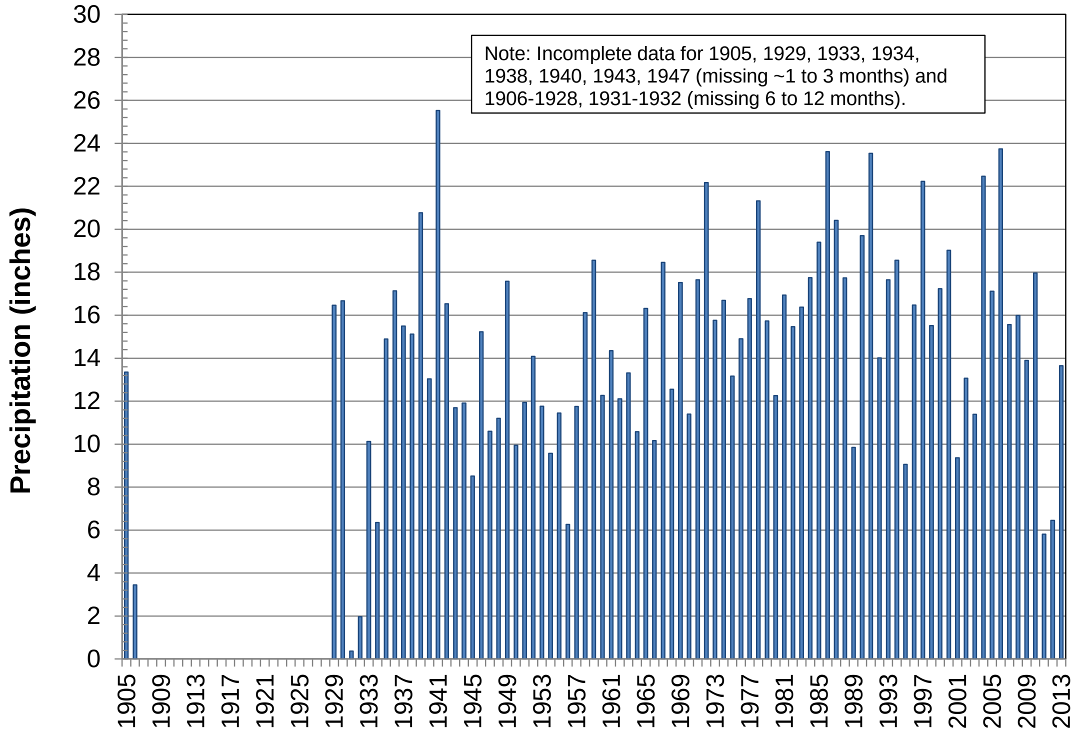


ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Average Annual Precipitation (1980 to 2010)

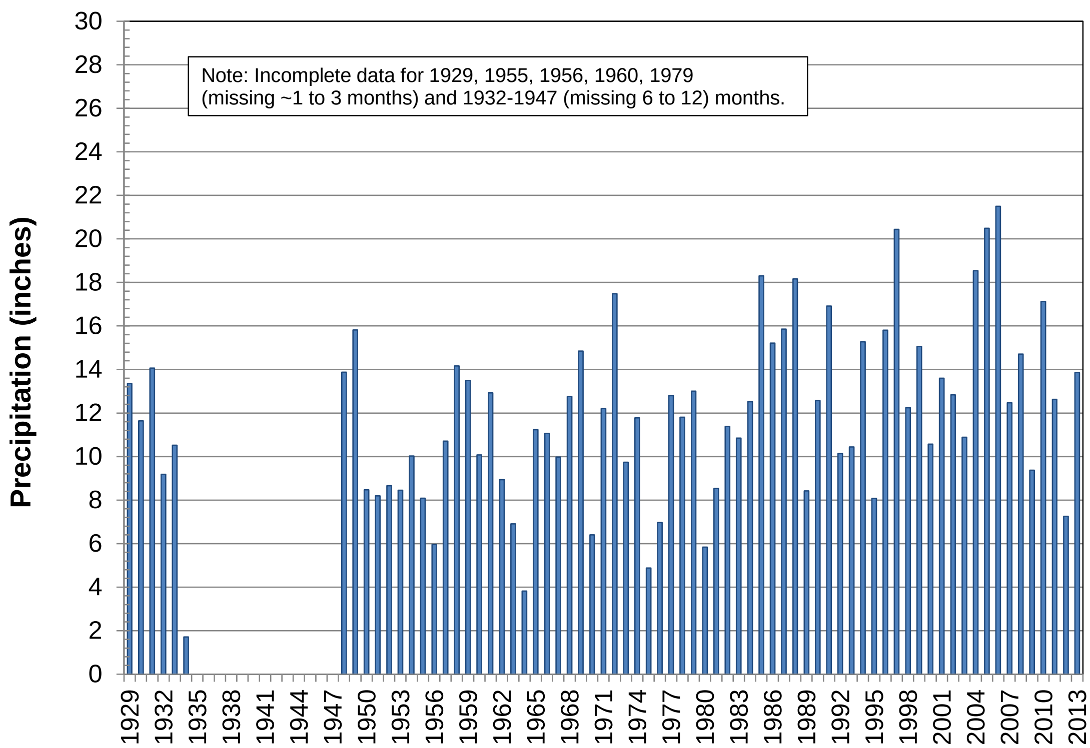
Figure 5-3

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-3_PRECIP.MXD 12/29/2015

Gran Quivira Natl Mon



Pedernal 4 E

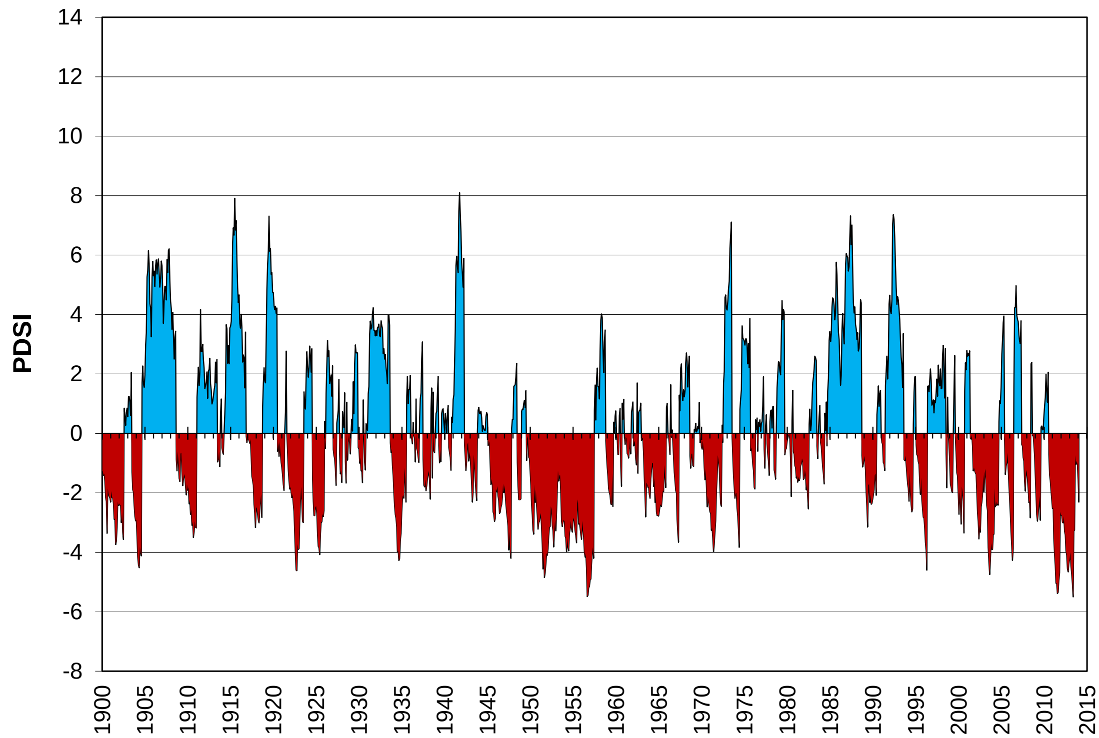


ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

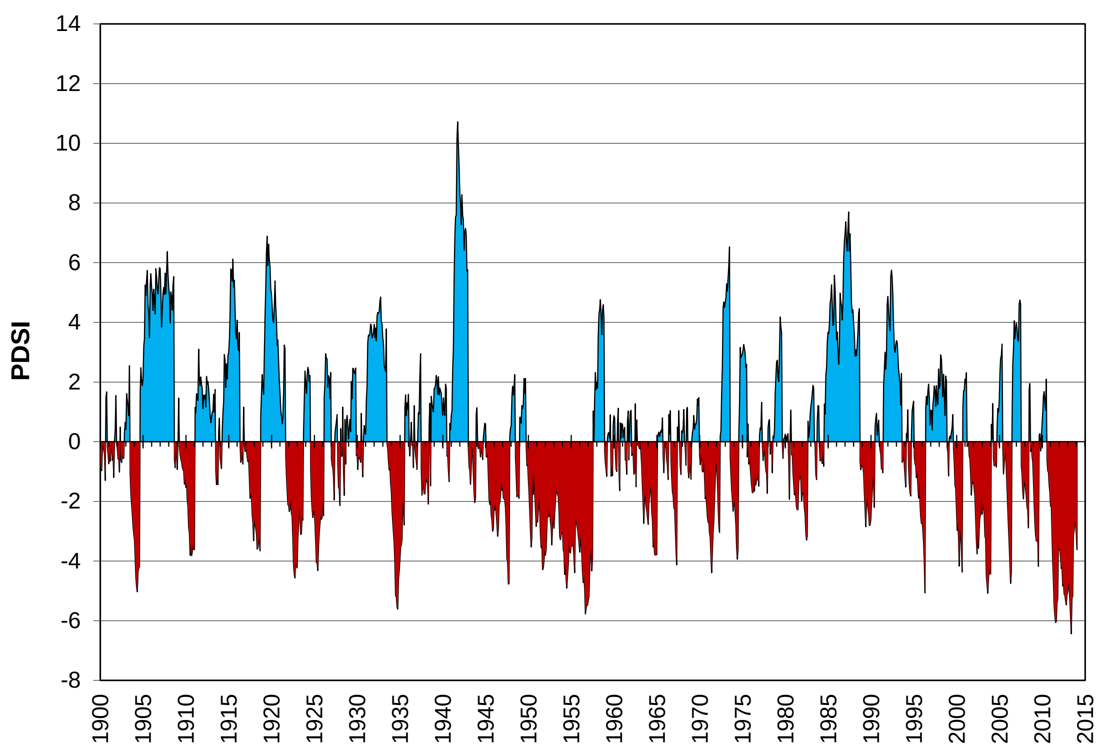
Annual Precipitation, Gran Quivira Natl Mon and Pedernal 4E Climate Stations

Figure 5-4

Climate Division 5



Climate Division 6



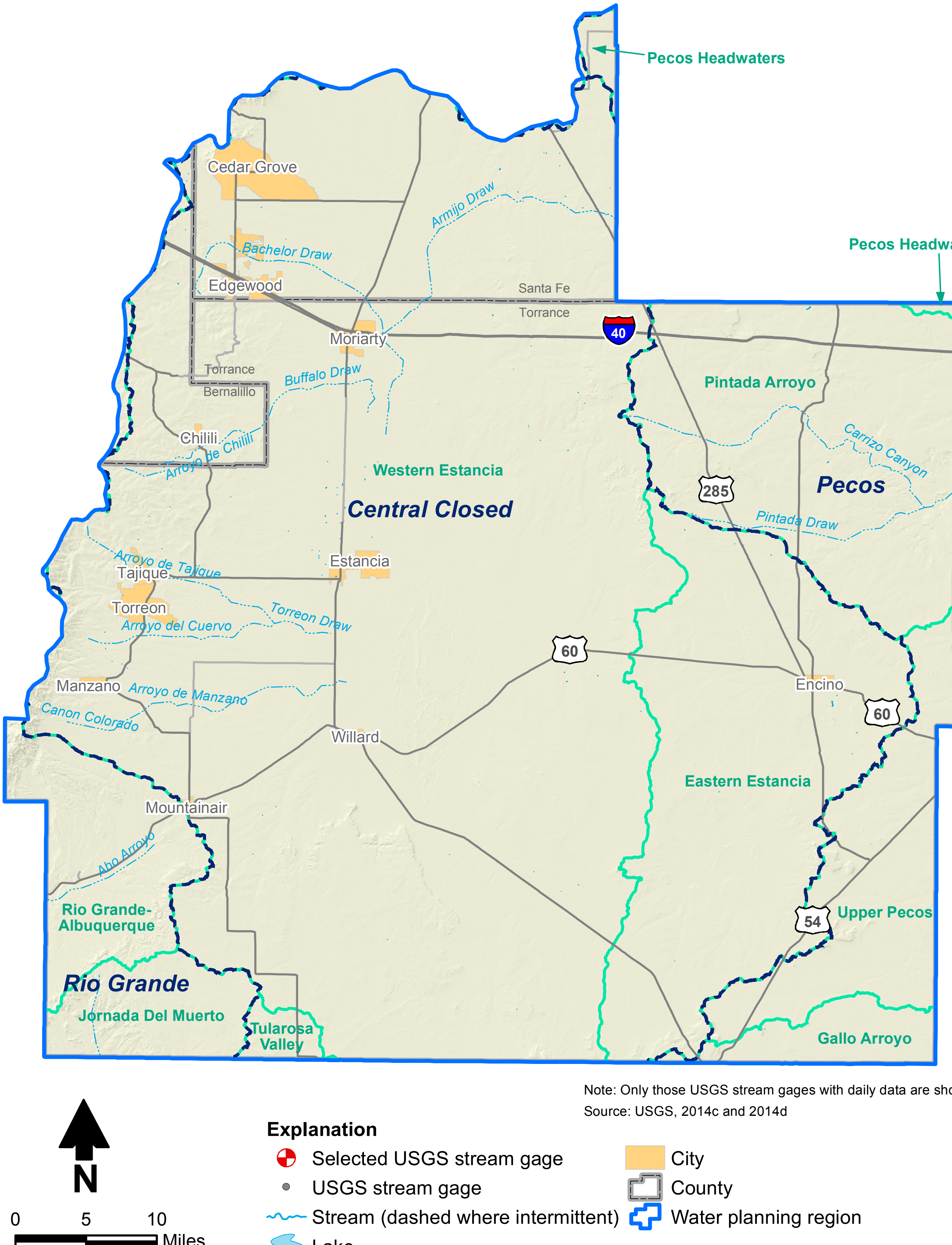
Note: Blue indicates wetter than average conditions and red indicates drier than average conditions, as described on Table 5-3.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Palmer Drought Severity Index
New Mexico Climate Divisions 5 and 6

Figure 5-6

P:_WR12-165\RWPs_2014\13_Estancia\Fig5-06_Reg 13_PDSI Div 5&6.docx 1/11/16



Note: Only those USGS stream gages with daily data are shown.
Source: USGS, 2014c and 2014d

Explanation

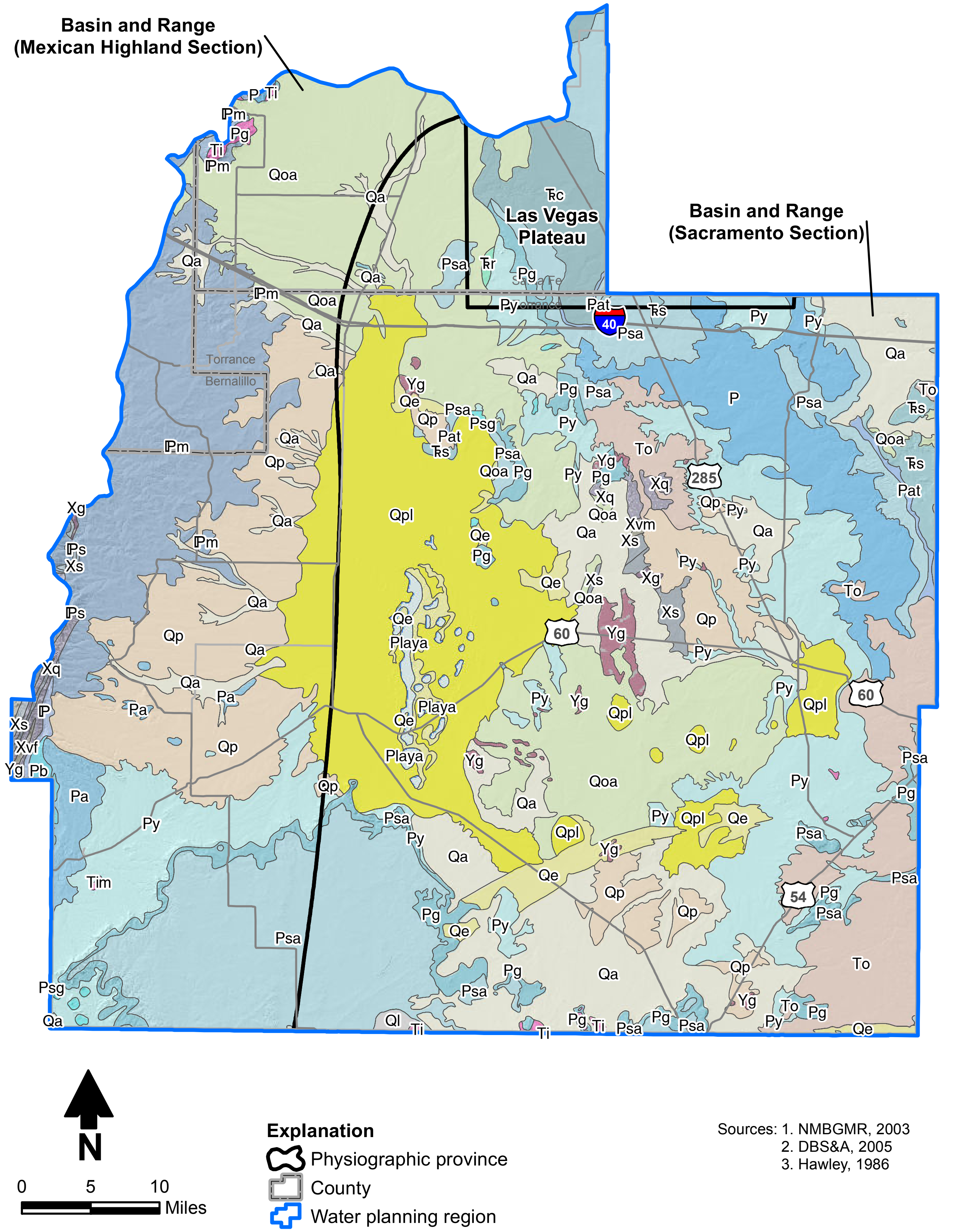
- Selected USGS stream gage
- USGS stream gage
- Stream (dashed where intermittent)
- Lake
- River basin
- Watershed
- City
- County
- Water planning region

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Major Surface Drainages, Stream Gages, Reservoirs, and Lakes

Figure 5-7

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-7_SURFACE_WATER.MXD 12/29/2015



ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Geology and Physiographic Provinces

Figure 5-10a

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-10A_GEOLOGY.MXD 12/29/2015

Geology Explanation

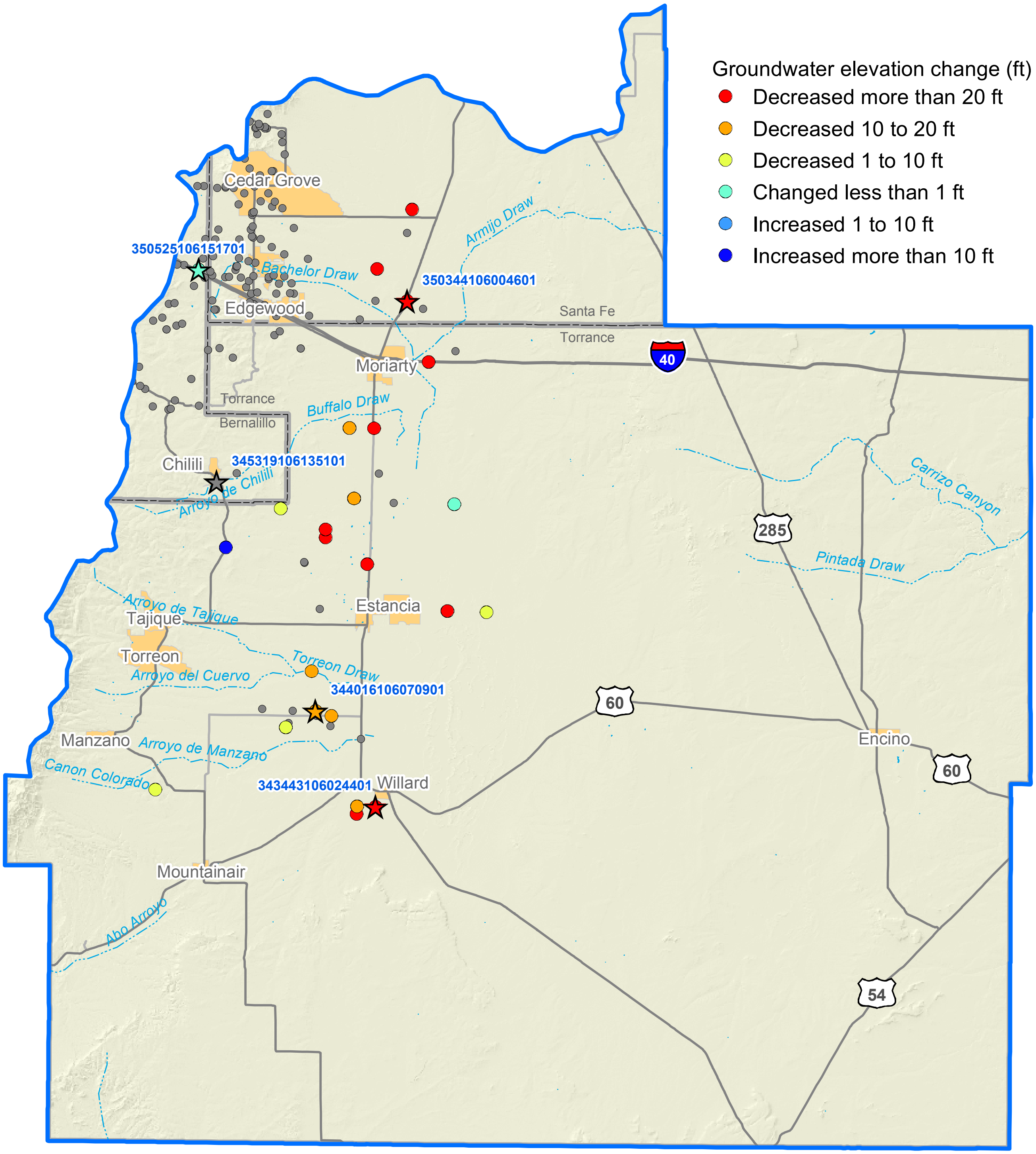
- ℙ - Pennsylvanian rocks undivided
- ℙm - Madera Group
- ℙs - Sandia Formation
- Jsr - San Rafael Group
- Km - Mancos Shale
- P - Permian rocks, undivided
- Pa - Abo Formation
- Pat - Artesia Group
- Pb - Bursum Formation
- Pg - Glorieta Sandstone
- Playa - Playa deposits
- Psa - San Andres Formation
- Psg - San Andres Limestone and Glorieta Sandstone
- Py - Yeso Formation
- Qa - Alluvium
- Qe - Eolian deposits
- Ql - Landslide deposits and colluvium
- Qoa - Older alluvial deposits of upland plains and piedmont areas, and calcic soils and eolian cover sediments of High Plains region
- Qp - Piedmont alluvial deposits
- Qpl - Lacustrine and playa deposits
- Ti - Tertiary intrusive rocks of intermediate to silicic composition
- Tim - Tertiary mafic intrusive rocks
- To - Ogallala Formation
- Xg - Paleoproterozoic granitic plutonic rocks
- Xps - Paleoproterozoic pelitic schist
- Xq - Paleoproterozoic quartzite
- Xs - Paleoproterozoic metasedimentary rocks
- Xvf - Paleoproterozoic rhyolite and felsic volcanic schist
- Xvm - Paleoproterozoic mafic metavolcanic rocks with subordinate felsic metavolcanic rocks
- Yg - Mesoproterozoic granitic plutonic rocks
- Ꞧ - Triassic rocks, undivided
- Ꞧc - Chinle Group
- Ꞧcu - Upper Chinle Group, Garita Creek through Redonda Formations, undivided
- Ꞧr - Redonda Formation
- Ꞧs - Santa Rosa Formation

Source: NMBGMR, 2003

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Geology Explanation

Figure 5-10b

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-10B_GEOLOGY_EXPLANATION.MXD 12/29/2015



Explanation

- Selected USGS-monitored well
- Other USGS-monitored well
- Stream (dashed where intermittent)
- Lake
- City
- County
- Water planning region

N

0 5 10 Miles

Note: Groundwater elevation change calculated by comparing median measurements for each well from the time period 1985 through 1995 with those from 2005 through 2014.

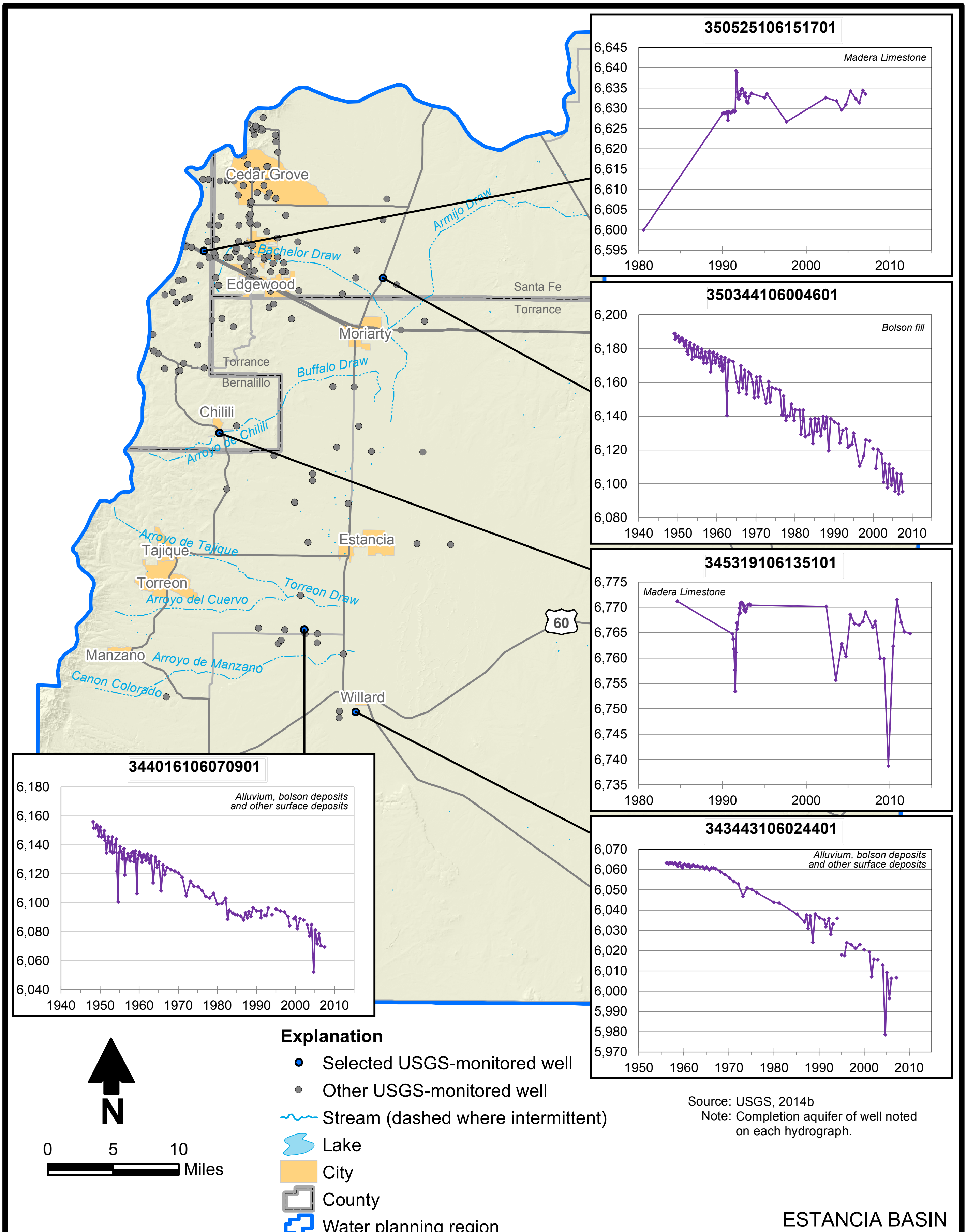
Source: USGS, 2014b

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

U.S. Geological Survey Wells and Recent Groundwater Elevation Change

Figure 5-11

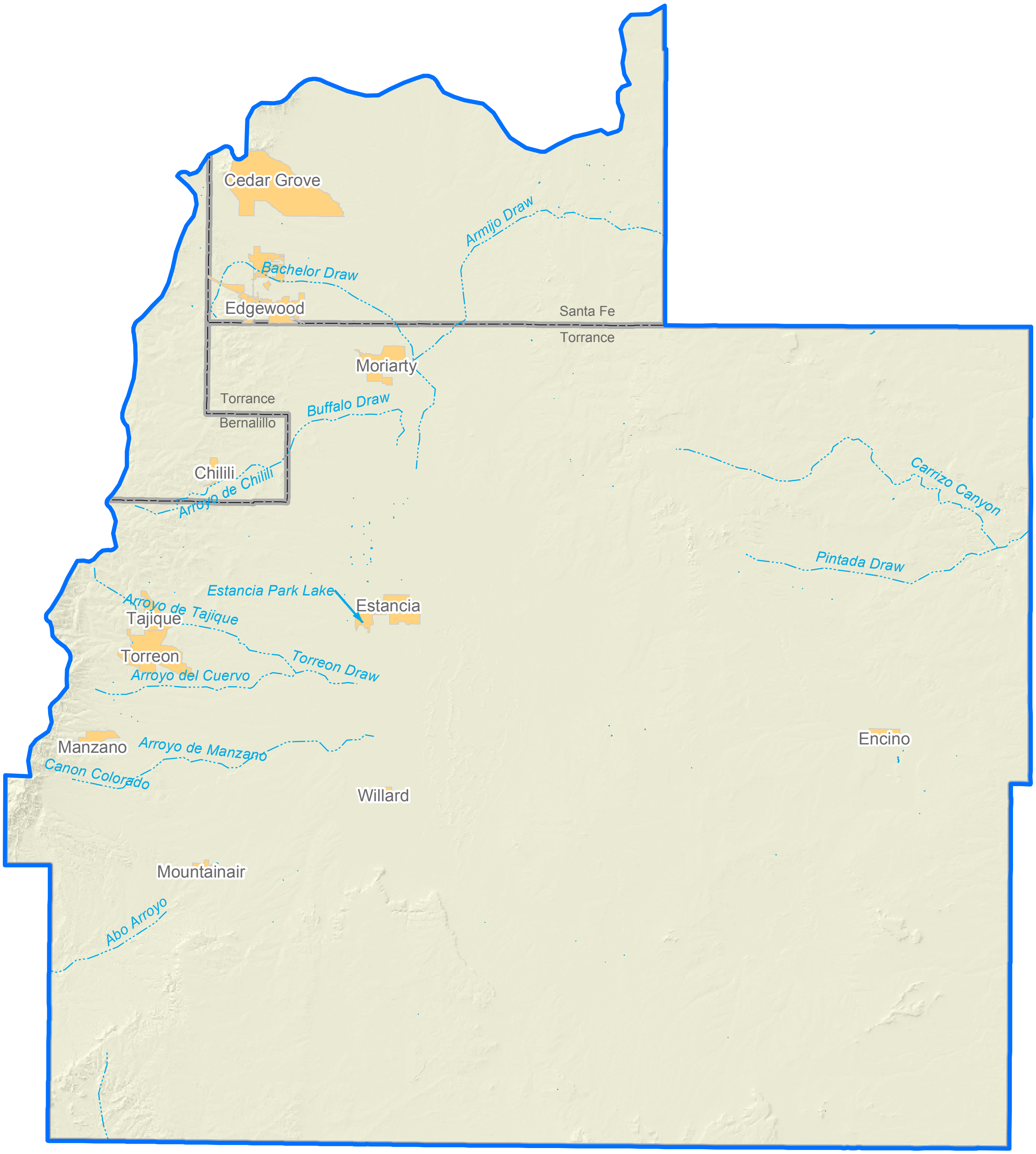
S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-11_USGS_WELLS.MXD 12/29/2015



ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Hydrographs of Selected Wells

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-12_USGS_WELLS_HYDROGRAPHS.MXD 12/29/2015

Figure 5-12



Source: NMED, 2014a and 2014c

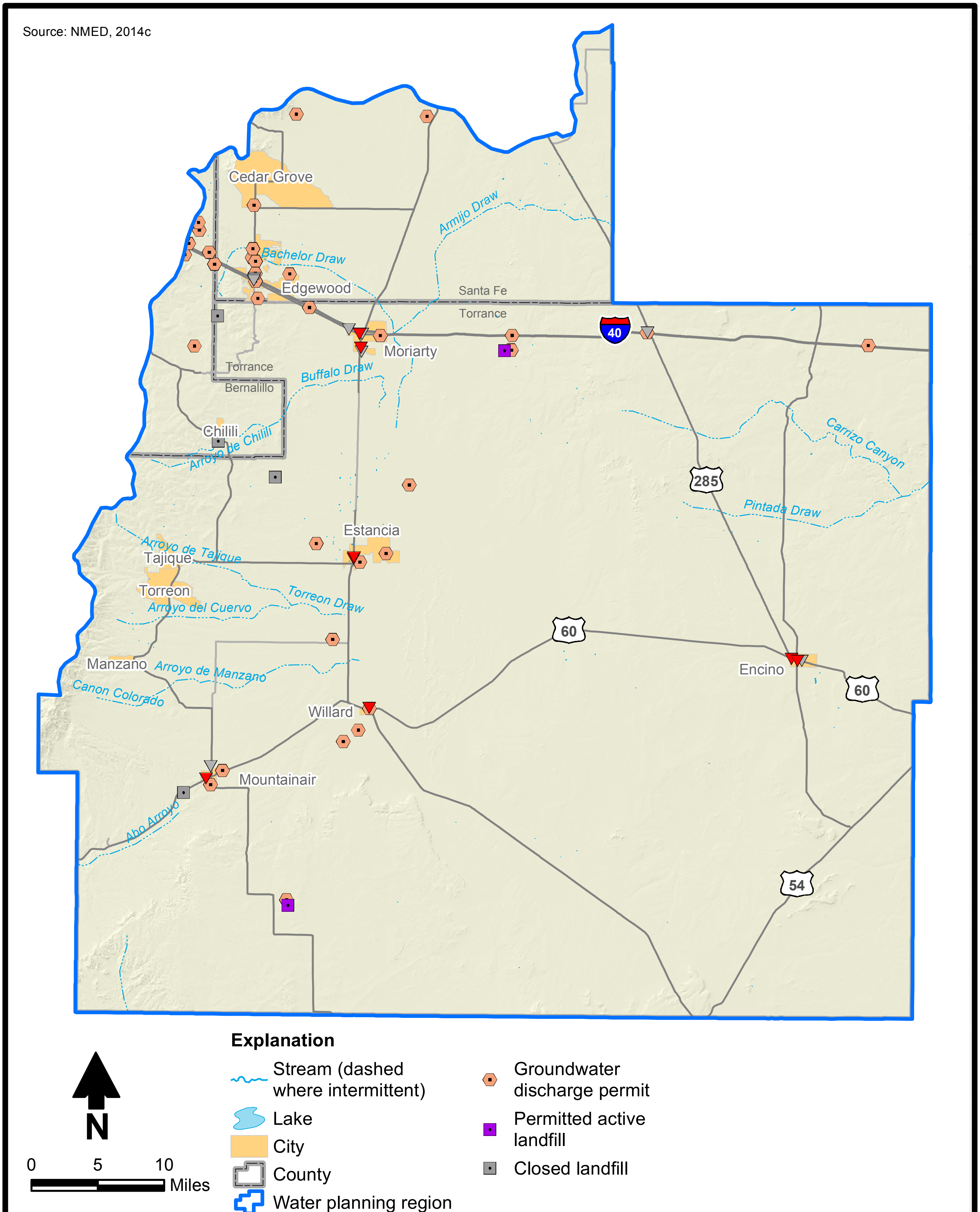
Explanation

Impaired stream (there are none in this region)
Impaired lake (there are none in this region)
Other stream (dashed where intermittent)
Other lake
City
County
Water planning region

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Water Quality-Impaired Reaches

Figure 5-13

S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-13_WQ_IMPAIRED_REACHES.MXD 12/29/2015

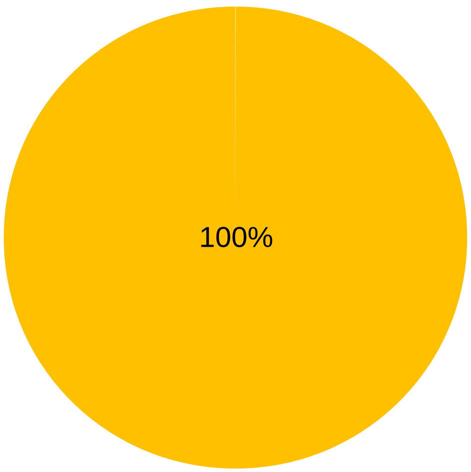


ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Potential Sources of Contamination

Figure 5-14

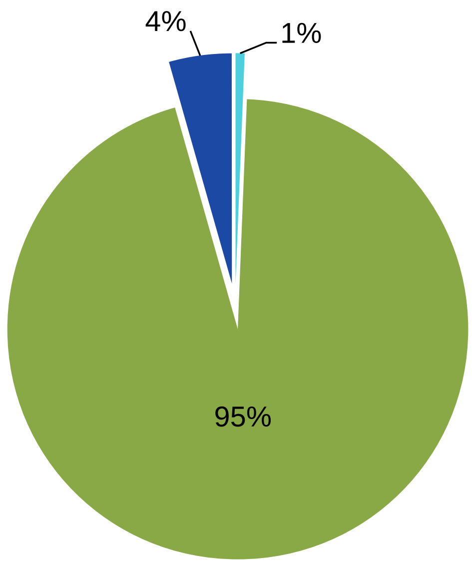
S:\PROJECTS\WR12.0165_STATE_WATER_PLAN_2012\GIS\MXDS\FIGURES_NO_LOGO\ESTANCIA_BASIN\FIG5-14_CONTAM_SOURCES.MXD 1/13/2016

Surface Water



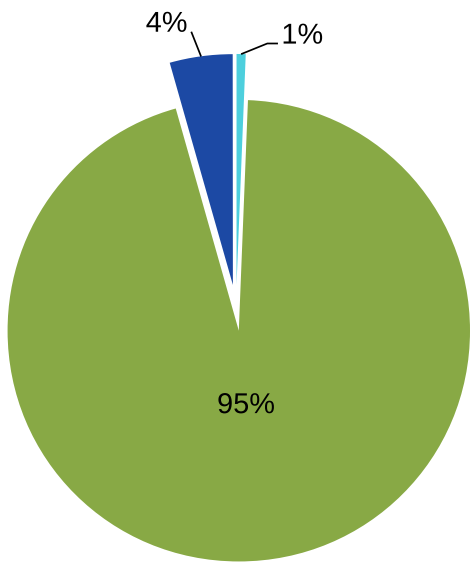
Total usage: 11 acre-feet

Groundwater



Total usage: 20,754 acre-feet

Total



Total usage: 20,766 acre-feet

Explanation

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

Source: NMOSE, 2013

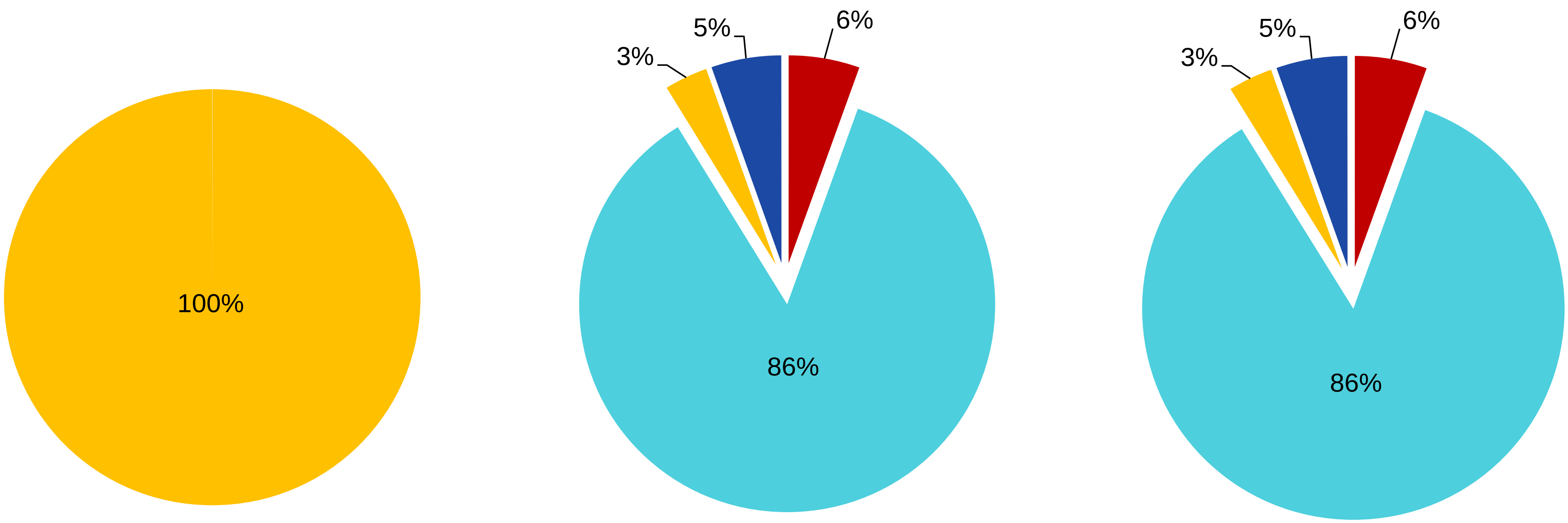
Note: Only categories with usage above 0.1% are shown.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Santa Fe County Water Demand, 2010

Figure 6-1a

Surface Water **Groundwater** **Total**



Total usage: 0.4 acre-feet

Total usage: 732 acre-feet

Total usage: 732 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

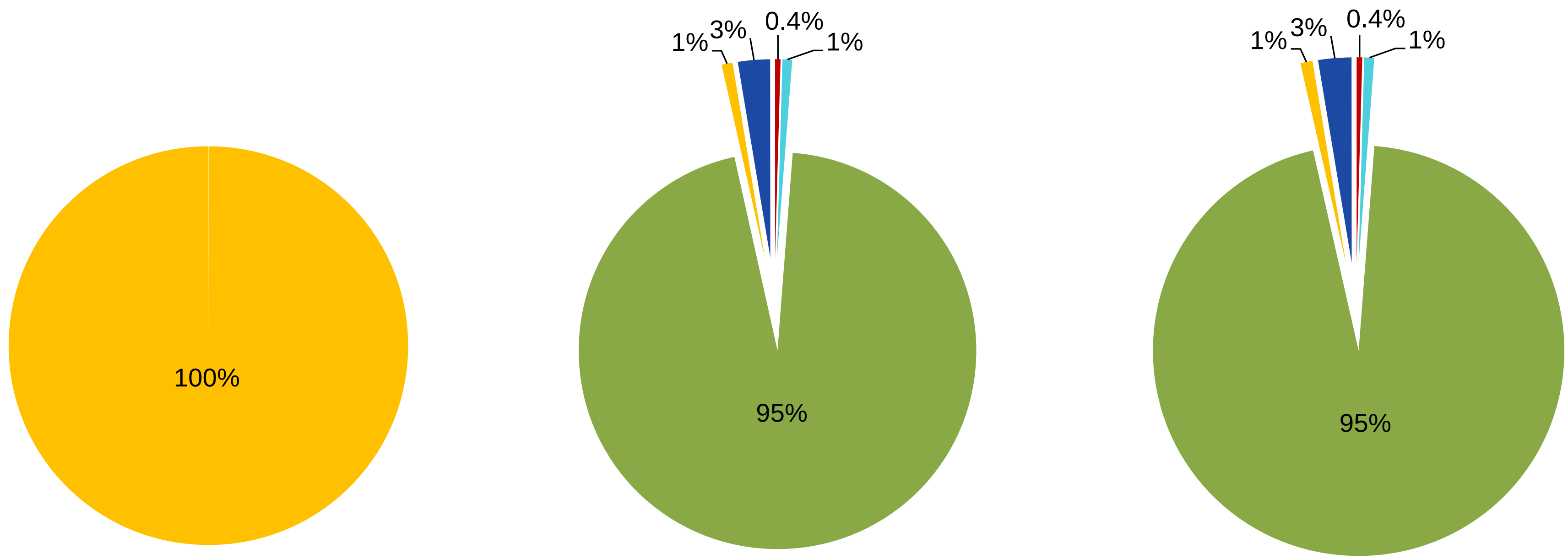
Source: NMOSE, 2013

Note: Only categories with usage above 0.1% are shown.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Bernalillo County Water Demand, 2010

Surface Water | **Groundwater** | **Total**



Total usage: 48 acre-feet

Total usage: 62,583 acre-feet

Total usage: 62,631 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: NMOSE, 2013

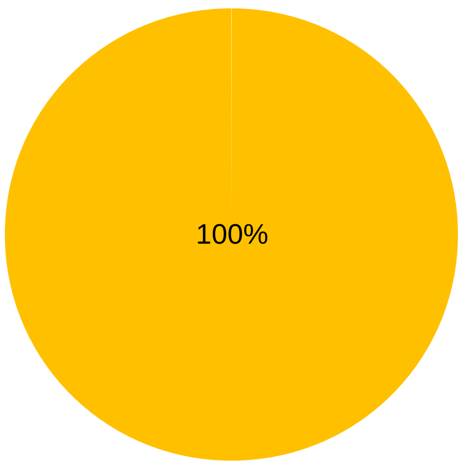
Note: Only categories with usage above 0.1% are shown.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Torrance County Water Demand, 2010

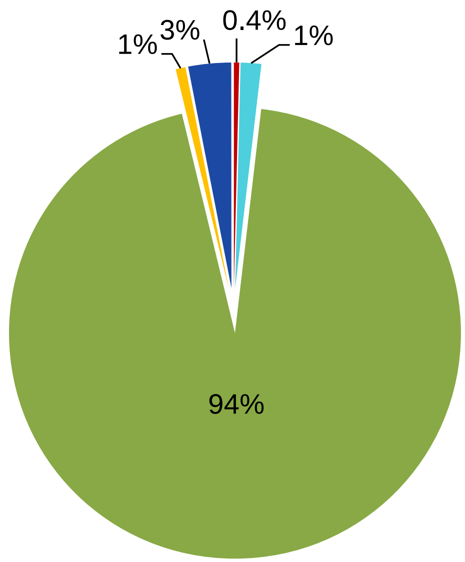
Figure 6-1c

Surface Water



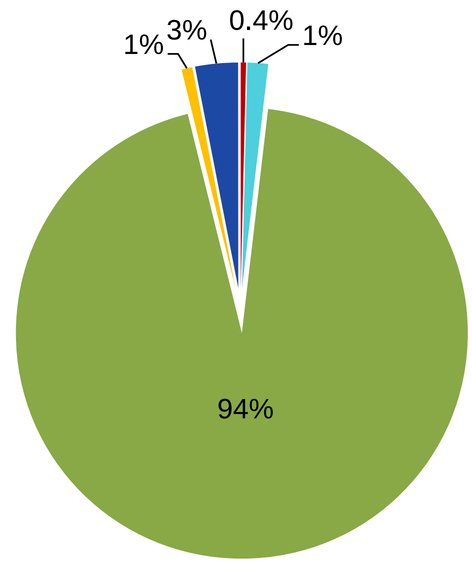
Total usage: 60 acre-feet

Groundwater



Total usage: 84,069 acre-feet

Total



Total usage: 84,129 acre-feet

Explanation

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

Source: NMOSE, 2013

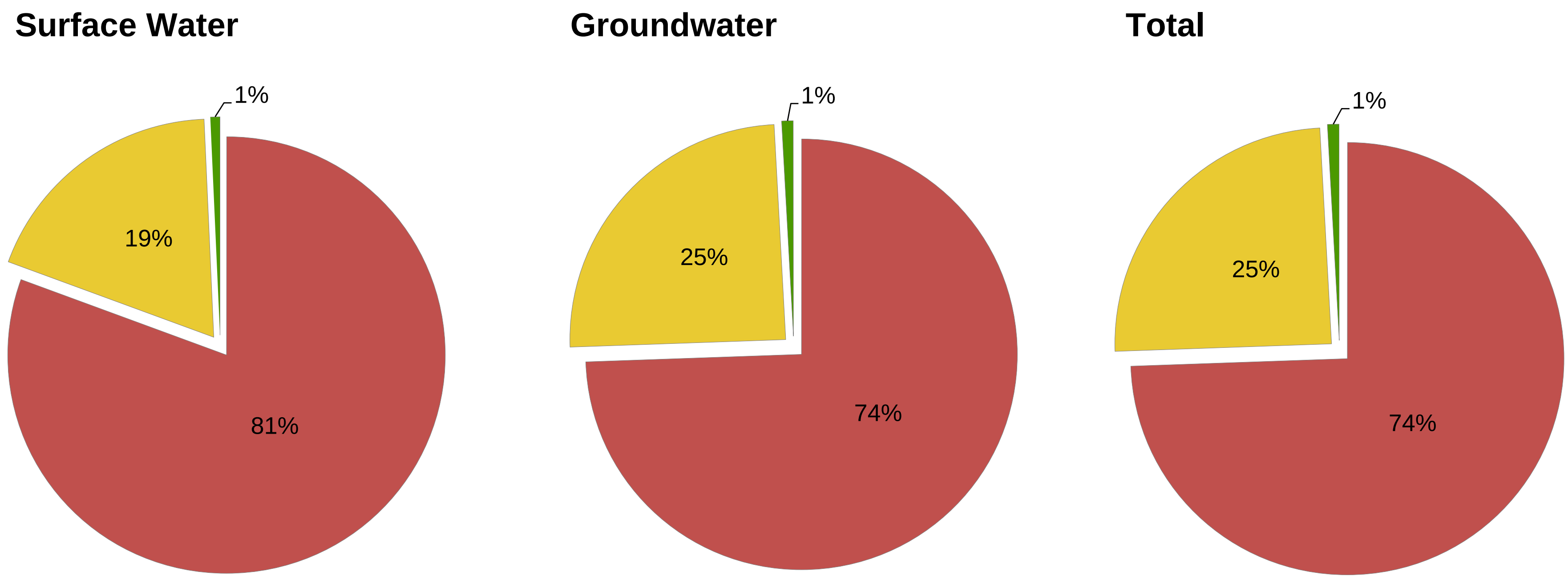
Note: Only categories with usage above 0.1% are shown.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Total Regional Water Demand by Sector, 2010

Figure 6-1d

P:_WR12-165\RWPs_2014\13_Estancia\Figures\Figure 6-1e_Demand_County.docx 1/11/16



Total usage: 60 acre-feet

Total usage: 84,069 acre-feet

Total usage: 84,129 acre-feet

Explanation

- Torrance
- Santa Fe
- Bernalillo

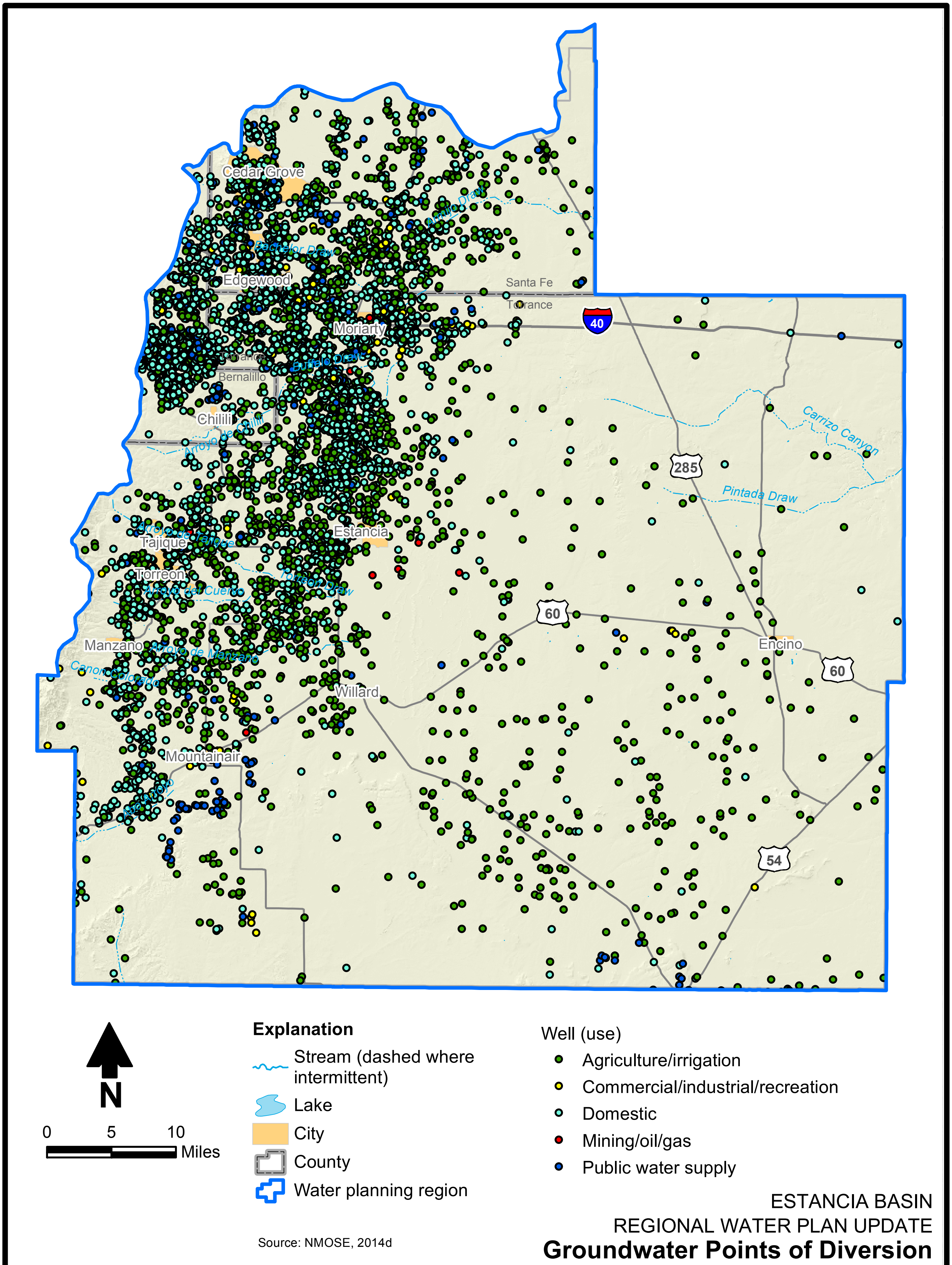
Source: NMOSE, 2013

Note: Due to rounding, the percentages may not add to 100%.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

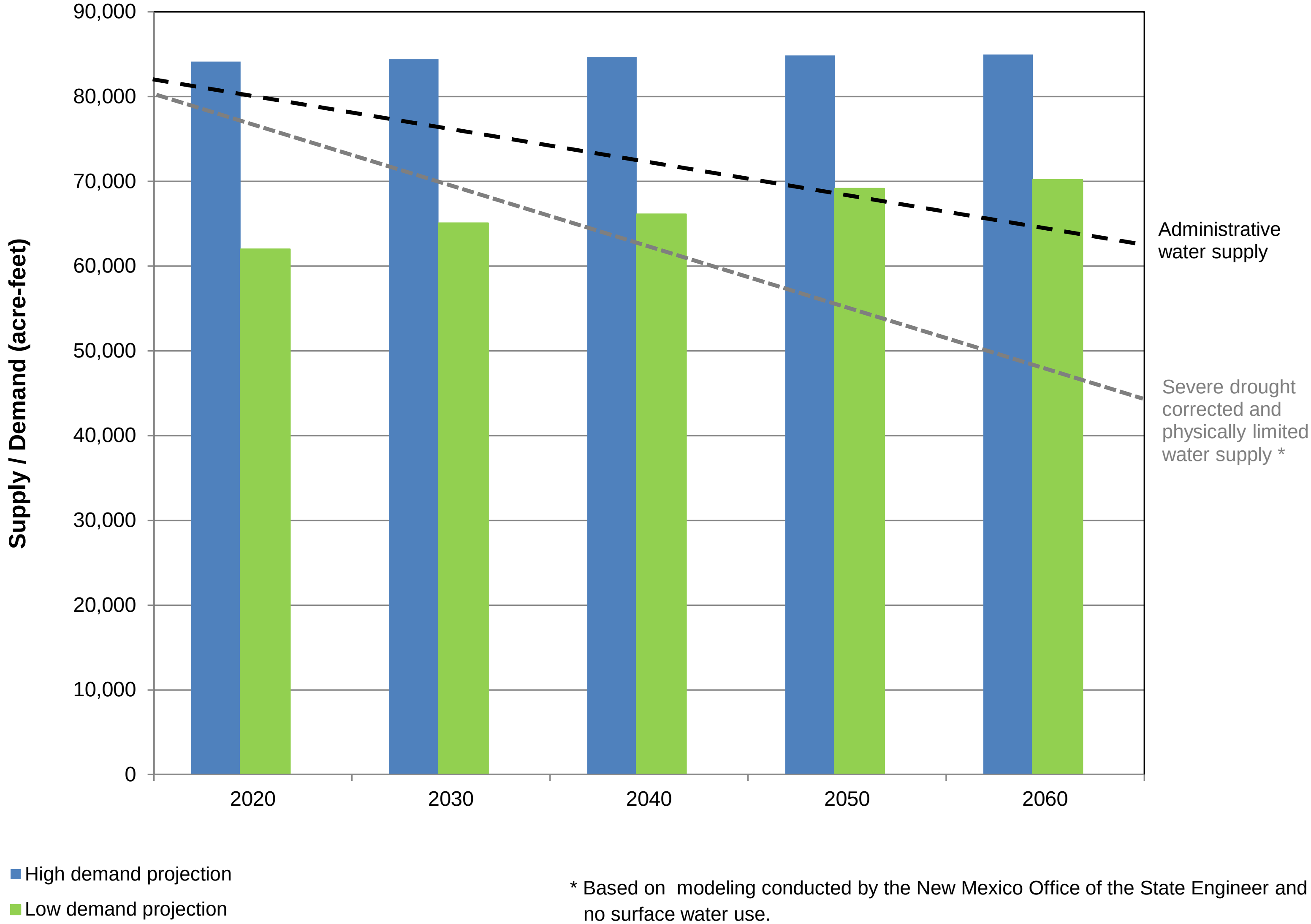
Total Regional Water Demand by County, 2010

Figure 6-1e



ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE
Groundwater Points of Diversion

Figure 6-2



* Based on modeling conducted by the New Mexico Office of the State Engineer and no surface water use.

ESTANCIA BASIN
REGIONAL WATER PLAN UPDATE

Available Supply and Projected Demand

Figure 7-1