# 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 Middle Rio Grande region was for irrigated agriculture, followed by public water supply use.

Most of the groundwater use in the Middle Rio Grande region is for public water supply. Groundwater also supplies self-supplied commercial, domestic, industrial, livestock, mining, and power 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. There are also some unquantified additional categories of water use, including riparian evapotranspiration and instream flow.

- *Riparian evapotranspiration:* Some research and estimates have been made for riparian evapotranspiration in selected areas, such as along the middle and lower Rio Grande (Thibault and Dahm, 2011; Coonrod and McDonnell, Undated; Bawazir et al., 2009), but riparian evapotranspiration has not been quantified statewide. The New Mexico Water Resources Research Institute is currently developing those estimates but the results are not yet available. Though riparian evapotranspiration is anticipated to consume a relatively large quantity of water statewide, it will not affect the calculation of the gap between supply and demand using the method in this report, because the gap reflects the difference between future anticipated demands and present uses, and if both present and future uses do not include the riparian evapotranspiration category, then the difference will not be affected. The only impact to the gap calculation would be if evapotranspiration significantly changes in the future. There is potential for such a change due to warming temperatures, but anticipated changes have not been quantified and would be subject to considerable uncertainty. Anticipated changes in riparian and stream evapotranspiration are areas that should be considered in future regional and state water plan updates. In the Middle Rio Grande region, the updated water budget estimated that riparian evapotranspiration in recent years was about 150,000 acre-feet per year.

- *Instream flow:* The analysis of the gap between supply and demand relies on the largest use categories that reflect withdrawals for human use or reservoir storage that allows for withdrawals downstream upon release of the stored water. It is recognized that there is also value in preserving instream water for ecosystem, to comply with endangered species requirements, and for habitat and tourism purposes. Though this value has not been quantified in the supply/demand gap calculation, it may still be an important use in the region, and if the region chooses, it may recommend instream flow protections in its policy, program, and project recommendations.

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 Middle Rio Grande Region includes the entirety of Valencia County and most of Bernalillo and Sandoval Counties. The 2013 populations of Sandoval, Bernalillo, and Valencia counties were 130,529, 656,267, and 76,569, respectively (U.S. Census Bureau, 2014a). As shown in Table 3-1a, the population all three counties experienced a high rate of population growth from 2000 to 2010; however, since 2010, growth has slowed in Bernalillo and Sandoval counties and population has declined slightly in Valencia County.

The Middle Rio Grande region is virtually coterminous with the Albuquerque Metropolitan

Statistical Area (MSA), which also includes a small part of Torrance County (which is also included in the Middle Rio Grande region). The Albuquerque MSA is the major wholesale and retail trade center for the State of New Mexico. It also houses much of the state's manufacturing, including Intel, located in Rio Rancho. Albuquerque is the state's largest tourism destination (Tourism Economics, 2013) and the home to two of its three largest post-secondary institutions: the University of New Mexico and Central New Mexico Community College.

The largest employment categories in the region are education/healthcare, professional services, retail trade, and tourism-related services (arts, entertainment, recreation, hospitality, and food services). Manufacturing and construction are also important. Agriculture is the largest water user in Sandoval and Valencia Counties, while public water supply is the largest sector in Bernalillo County.

As noted in Table 3-1d, milk from cows is the most valuable agricultural commodity in Valencia County. Livestock are important commodities in all three counties, with nurseries and greenhouses important in Bernalillo County. Land use in the region was described 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 Sandoval, Bernalillo, and Valencia 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 Sandoval County

The City of Rio Rancho comprises about 70 percent of the population of Sandoval County. Sandoval County experienced an explosive rate of growth since 1970, with the population increasing from 17,492 in 1970 to 63,319 in 1990 and 131,561 in 2010. Since 2010, growth has been slower, with the population in 2013 estimated at 136,575 (U.S. Census Bureau, 2014a). Wage and salary employment has increased slightly, from 51,029 in 2010 to 51,509 in 2013.

The Arrowhead Center at NMSU analyzed the economy of Sandoval County and identified the basic industries that support the economy (Arrowhead Center, 2013). Basic industries bring outside dollars into the economy. A basic industry frequently has a location quotient (LQ) greater than 1.0, which means that its relative share of the local economy is greater than that industry's relative share of the state economy. In Sandoval County, the primary basic industries in 2011 were manufacturing (LQ of 3.36), information (LQ of 1.75), and arts, entertainment, and recreation (LQ of 1.40). It should be noted that the LQ for manufacturing dropped from 3.87 in 2007 to 3.36 in 2011; it is likely that manufacturing LQs for more recent years would be somewhat lower, due to job reduction at Intel.

The economy and housing markets in Rio Rancho have slowed in recent years. In 2012, payroll declined by $315 million from 2011 (U.S. Census Bureau, as cited in Albuquerque Business First, 2014). Over that same year, 2,283 non-farm jobs were lost. Single-family residential housing starts peaked at 3,084 in 2005 and have dropped to less than 500 units per year for each of the past four years (City of Rio Rancho, 2014). Housing starts are projected to be at the level of 500 units for the next few years. Beyond that, the market is expected to settle at a level of about 1,000 units per year.

Despite the explosion of urban growth in the county, some agricultural activity still takes place. According to the Census of Agriculture, the most valuable agricultural commodities in Sandoval County are cattle and calves and hay and other related crops (USDA NASS, 2014). The number of farms and ranches increased by 58 percent, from 652 in 2007 to 1,029 in 2012, and the amount of land in farms and ranches increased by 61 percent, from 591,736 acres to 950,133 acres. During that same five-year period, irrigated acreage increased from 8,993 acres to 9,425 acres, a gain of 5 percent. In 2012, farmers participating in governmental agricultural support programs received an average of $7,913, up 44 percent from 2007, with a total of $815,000 in government payments going to farmers in Sandoval County. The average farm had a net cash operating loss of $1,100. The average age of a farmer in 2012 was 60.2.

Alfalfa and pasture grasses are the main crops, with some wheat grown as well. The vast majority of farms (90 percent) are family-owned and under 20 acres, with the bigger farms growing alfalfa. Livestock are primarily beef cattle; herds have been reduced by 30 to 50 percent in the southern part of the county in the past two years, but less so in the north. The majority of farmers are over age 50. Some farmers are looking to alternative crops, such as chile along the Rio Grande, while others are leaving their lands fallow. Little farmland has been sold, with most farmers and ranchers trying to hold on.

### 6.2.2 Bernalillo County

The City of Albuquerque comprises about 82 percent of the population of Bernalillo County. The county experienced relatively steady growth over the past century, with the population of the entire county increasing from 23,606 in 1910 to 262,199 in 1960, 480,577 in 1990, and 662,564 in 2010. Since 2010, growth has been slower, and the population in 2013 was estimated to be 674,221 (U.S. Census Bureau, 2014a). Wage and salary employment has decreased slightly during the past three years, from 280,395 in 2010 to 279,142 in 2013.

The Arrowhead Center at NMSU analyzed the economy of Bernalillo County and identified the basic industries that support the economy (Arrowhead Center, 2013). In Bernalillo County, the primary basic industries in 2011 were professional, scientific, and technical services (LQ of 1.32), information (LQ of 1.43), accommodations and food services (LQ of 0.98), and federal government civilian employment (LQ of 1.20). Military employment is also a basic industry; however, its LQ declined from 0.90 in 2007 to 0.78 in 2011.

The top existing job centers in Albuquerque are the I-25 North Corridor with 38,030 jobs in

2010, the Kirtland Air Force Base area with 30,007 jobs, the downtown area with 24,424 jobs, the UNM main campus with 14,615 jobs, and the midtown industrial area with 13,056 jobs (MRCOG, 2010). By 2035 MRCOG projects that the approximate number of jobs in these areas will increase as follows:

- I-25 North Corridor: 6,000
- Kirtland Air Force Base: 2,000
- Downtown: 1,000
- UNM Main Campus: 4,000

In addition, MRCOG projects that there will be nearly 30,000 jobs at Mesa del Sol by 2035. Mesa del Sol is a new planned community located south of the Sunport on land that was held by the State Land Office. The master plan allows for up to 37,500 homes by 2060. It is projected that 150 to 250 homes will be built per year for the next few years, with an annual average of 600 units after 2017. Currently, 213 lots are completed, with 120 units built or under construction. The master plan would also allow 18,000,000 square feet of commercial space (but excludes heavy industrial uses). There will be a 1,485-acre employment center (equivalent to 9,000,000 square feet of space), with absorption projected at 20 to 25 acres per year.

Another large development project is Santolina, on the West Mesa within Western Albuquerque Land Holdings LLC properties (formerly SunCal's Westland Development Company). The master plan for Santolina will be heard by the County Planning Commission in 2015. The master plan would provide for both residential development and large-scale commercial development on tracts of 200 to 2,000 acres.

City of Albuquerque officials are optimistic about future economic growth and project an annual 2 to 3 percent economic growth rate. Some of the positives include:

- Increasing diversification of the mission at Kirtland Air Force Base
- The continued presence of Sandia National Laboratories, with Lockheed Martin under contract to continue its management role for another three years, along with its support of science and technology, including cybersecurity
- Growth in regional medical care
- Increasing technology commercialization in support of research and development
- The development of an 86-acre aviation technology park near the Sunport
- A resource management consortium at Mesa del Sol
- A lack of weather-related disasters providing a competitive advantage over locations in other states

While there are many positives that could support economic growth, there are also a number of negative factors:

- Albuquerque was unsuccessful in attracting the Tesla battery plant, which is now planned for the Reno, Nevada area.
- Eclipse Aerospace recently announced layoffs, although new hiring could occur when the economy improves (Santa Fe New Mexican, 2014).
- Forbes Magazine recently reported a new study by Moody's Investors Service that ranked Albuquerque number 200 among 200 metro areas in future job growth. Albuquerque is projected to have annual of growth of 0.2 percent over the next three years.
- EMCORE announced in October 2014 that it will no longer have a presence in New Mexico once the sale of its space solar photovoltaics division to Veritas is complete. Veritas has announced that the current 275 Albuquerque employees will retain their jobs, pay rates, and benefits for at least one year (Mayfield, 2014c).

Although not a basic industry in Bernalillo County, some agricultural activity is present. According to the Census of Agriculture, the most valuable agricultural commodities in the county are livestock and poultry, nursery and greenhouse, and hay and other related crops. (USDA NASS, 2014). From 2007 to 2012 the number of farms and ranches increased by 58 percent, from 635 to 1,006, and the amount of land in farms and ranches grew by 47 percent, from 237,735 acres to 350,638 acres. This led to a small decrease in average farm size, from 374 acres to 349 acres in 2012. Between 2007 and 2012 irrigated acreage declined from 7,757 acres to 5,283 acres, a decrease of 32 percent. In 2012, farmers participating in governmental agricultural support programs received an average of $1,982, down 74 percent from 2007, with a total of $172,000 in government payments going to farmers in Bernalillo County. The average farm had a net cash operating loss of $4,262. The average age of a farmer in 2012 was 60.7.

In 2013, four dairies, with 2,900 cows, were located in the county, a decrease of one dairy from 2006. Bernalillo County accounts for about 1 percent of the milk production in New Mexico.

The majority of farms in the county are family-owned and under 10 acres in size, with larger farms mostly for grazing and alfalfa. Farmers are switching to less water intensive crops and using more greenhouses. Most farmers are in their 50s and 60s or older, but there is a resurgence of farming among people in their 20s. Increasing urbanization and pressure from developers is making agriculture more vulnerable, with some water rights being sold off and some farmland being leased out.

### 6.2.3 Valencia County

Los Lunas and Belen are the largest municipalities within Valencia County. A portion of Valencia County was taken to form Cibola County in 1981. From 1990 to 2010, the population of Valencia County has increased steadily, from 45,325 to 76,569, but since 2010, the population has declined slightly, with the population in 2013 estimated at 76,284 (U.S. Census Bureau, 2014a). Wage and salary employment has also decreased slightly from 28,104 in 2010 to 27,547 in 2013.

The Arrowhead Center at NMSU analyzed the economy of Valencia County and identified the basic industries that support the economy (Arrowhead Center, 2013). In Valencia County, the primary basic industries in 2011 were agriculture (LQ of 1.84), health care and social assistance (LQ of 1.40), transportation and warehousing (LQ of 3.09), and state government (1.18). The state government LQ reflects the large employment base of the Central New Mexico Correctional Facility in Los Lunas.

The Village of Los Lunas and the City of Belen are both pursuing economic development opportunities, and both of them have been competing for the new Valencia Regional Medical Center, which could provide up to 450 new jobs. Los Lunas also hopes to land a new west side campus for UNM and to recover jobs that were lost by a cabinet manufacturer. There is the potential for more retail development in Los Lunas, and three housing developers are active in the community. Future growth rates in Los Lunas are expected to exceed pre-recession levels.

In addition to competing for the medical center, Belen is adding a larger cross runway to the airport and will then create a new free trade zone adjacent to the airport. The city is also working on a downtown master plan. Rancho Cielo is a large master planned mixed use community where up to 16,000 homes could be built on 6,000 acres over the next 20 years, along with 100 to 200 new permanent jobs.

According to the Census of Agriculture, the most valuable agricultural commodities in Valencia County are milk from cows, hay and other related crops, and cattle and calves (USDA NASS, 2014). The number of farms and ranches increased by 78 percent, from 901 in 2007 to 1,607 in 2012, and the amount of land in farms and ranches increased by 32 percent, from 505,682 acres to 669,727 acres. Also, during that same five-year period, irrigated acreage increased from 20,951 acres to 23,106 acres, a gain of 10 percent. In 2012, farmers participating in governmental agricultural support programs received an average of $6,280, up 467 percent from 2007, with a total of $641,000 in government payments going to farmers in Valencia County. The average farm had a net cash operating loss of $3,672. The average age of a farmer in 2012 was 57.6, somewhat below the state average.

The major crops grown in the county are alfalfa and pasture grasses. There are also some small vegetable and chili farms. A family-owned 5-acre farm is typical, but there are many 2-acre farms as well and a few large ranches of roughly 60,000 acres. There are about an equal number of beef and dairy cattle. Herds were reduced by about 50 percent during the past two years. Three-fourths of farmers and ranchers are in their 50s and 60s, and some are selling off their land.

## 6.3 Projected Population Growth

The population projections for the 2004 Regional Water Plan (MRCOG and MRGWA, 2004) encompassed three forecasts, each covering the period from 2010 through 2050. The projections were based on county-level population forecasts prepared by the Bureau of Business and Economic Research (BBER) at the UNM using data and historical trends from 1960 up to the 2000 Census. These forecasts were made for the entirety of the three counties.

The high projections for Bernalillo and Sandoval County contained in the water plan were relatively accurate, as compared with 2010 Census data (Table 6-2). The high projection for the total Bernalillo County 2010 population of 663,050 was very close to the census figure of 662,564. The water plan high projection of a 2010 population of 139,803 for all of Sandoval County was relatively close to the census figure of 135,383.

Since 2008, drought and the national recession that started in 2007 have resulted in population growth in Valencia County that was slower than anticipated. Given these changes, the 2004 water plan high and low growth scenarios were each too optimistic for Valencia County (Table 6-2). The BBER and the Middle Region (formerly Middle Rio Grande) Council of Governments have each continued to revise population projections downward during the past 14 years to reflect slower growth than originally anticipated (BBER, 2008, 2012).

New Mexico has been one of the slowest states to recover from the recession, with much of the impact of the recession being felt within the Middle Rio Grande region, which comprises a large portion of the state's economy. The Albuquerque MSA has continued to lose jobs since the end of the recession nationally, with 1,578 jobs being lost from 2010 to 2013 (New Mexico Department of Workforce Solutions, 2014). The unemployment rate has decreased from 8.3 percent in 2010 to 7.2 percent in 2013; however, this decline is due to workers dropping out of the work force (some of whom have moved out of the state), rather than to increased hiring.

Persons who were interviewed for this project are, on the whole, somewhat pessimistic about the near-term future of the region's economy. A researcher who tracks industrial and retail developments of over 10,000 square feet states that currently, no new office construction, little industrial construction, and no new major retail projects are expected in 2015, and only a "minor uptick" in construction activity is expected over the next five years. Whereas the last ten years saw an average of 400,000 square feet added per year, he projects that there will be an average of 250,000 square feet built during each of the next five years. He does see some potential for construction of multi-family and assisted living units.

According to MRCOG, the peak year for residential building permits in the region was 2005, when 10,516 permits were issued. This number has decreased substantially since 2005, with only 1,710 permits issued in 2011.

The New Mexico Department of Workforce Solutions projected in 2013 that the Albuquerque MSA would gain 61,320 jobs between 2010 and 2020, an increase of 15.8 percent or about 1.5 percent per year. (Since the region lost 1,578 jobs between 2010 and 2013, this would imply an addition of 62,898 jobs between 2013 and 2020.) The industries with the greatest growth are expected to be health care and social assistance (an industry that is growing nationally because of the Affordable Care Act), tourism, education, retail, administration, and professional and scientific. Manufacturing is projected to lose 870 jobs, a decline of 5 percent. A more recent 2014 forecast projects a net gain of 56,724 jobs between 2012 and 2022, with a loss of 1,086 jobs in manufacturing.

The MRCOG recognizes that the BBER forecasts of 2012 were probably too optimistic. They have recommended that counties within the region adjust the BBER forecast for 2035, by replacing it with the lower BBER forecast for 2025.

For this regional water plan update population was projected through 2060 (Table 6-3) under two scenarios: one based on a moderately optimistic view of the economy for this region over the long-term and one that portrays a more pessimistic picture. The current (2012) BBER population projections through 2040 were used as a starting point for the high population projections, extrapolated through 2060, except that they were dampened for the 2010 to 2020 period to take into account the actual slower rate of growth that has occurred since 2010 com pared to the forecast for 2020. Under these projections, it is assumed that the Intel jobs will be retained and other major employers will create job opportunities within the region. Under the high scenario, population is projected to reach 1,096,253 in 2060 in Bernalillo County, 311,363 in Sandoval, and 115,943 in Valencia.

The low population projections are lower and assume a loss of the Intel plant and a lower rate of job growth. Under the low forecast, the population in 2060 is projected to reach 928,487 in Bernalillo County, 157,144 in Sandoval, and 97,713 in Valencia (Table 6-3).

## 6.4 Water Conservation

Water conservation is often a cost-effective and easily implementable measure that a region may use to help balance supplies with demands. The State of New Mexico is committed to water conservation programs that encourage wise use of 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 Middle Rio Grande 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 Middle Rio Grande region, Sandoval, Bernalillo, and Valencia counties currently have per capita use between 130 and 200 gpcd (141, 155, and 134 gpcd respectively [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. These wells are not metered, and current water use estimates were developed based on a relatively low per capita use assumption (Table 6-4; Longworth et al., 2013). Therefore, no additional conservation savings were assumed in developing the water demand projections. For purposes of developing projections, a county-wide per capita rate was calculated as the total self-supplied domestic use in the county divided by the total county population (or portion of the county within the region), excluding those served by a public water system.

*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 and therefore downstream water supply. For example, methods such as canal lining or piping may result in reduction of seepage losses associated with conveyance, but that seepage will no longer provide return flow to other users. Other techniques such as drip irrigation and center pivots may reduce the amount of water diverted, but if the water saved from such reductions is applied to on-farm crop demands, water supplies for downstream uses will be reduced.

Due to the complexities in agricultural irrigation efficiency, no quantitative estimates of savings are included in the projections. However, the regions are encouraged to explore strategies for agricultural conservation, especially those that result in consumptive use savings through changes in crop type or fallowing of land while concentrating limited supplies for greater economic value on smaller parcels. Section 8 outlines strategies developed by the Middle Rio Grande 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 require site-specific analyses that are not available; therefore 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 Middle Rio Grande region it is relatively low, 5,170 acre-feet in 2010. NMOSE tracks reservoir evaporation only in reservoirs greater than 5,000 acre-feet of storage and assigns the evaporation use to the county in which the reservoir is located. Therefore, while the Middle Rio Grande region relies on storage in upstream reservoirs (Heron, El Vado, and Abiquiu) and deliveries are required to Elephant Butte which has very high evaporation, those uses are not tracked in the region. To reduce usage in this category, some areas outside of the region have considered aquifer storage and recovery to replace some reservoir storage, and it may also be possible in some circumstances to gain some reduction in evaporation by storing more water at higher elevations or constructing deeper reservoirs with less surface area for evaporation. However, due to the legal, financial, and other complexities of implementing these techniques, no conservation savings are assumed in developing the reservoir evaporation demand projections for this region.

## 6.5 Projections of Future Water Demand for the Planning Horizon

To develop projections of future water demand a consistent method was used statewide, 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 Middle Rio Grande region. The projections of future water demand determined using this consistent method, as applicable, for the Middle Rio Grande 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 Middle Rio Grande 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, 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.

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

In regions that use surface water for agriculture withdrawals, the 2010 administrative 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.  Even if some farmers cease operations or plant less acreage, the water is expected to be used elsewhere due to surface water shortages.  Conversely, if increased agricultural activity is anticipated, water demand in this sector was still projected to stay at 2010 levels unless there is a new source of available supply (i.e., water project or settlement).

In areas where 10 percent or more of groundwater withdrawals are for agriculture and there are projected declines in agricultural acreage, the low projection assumes that there will be a reduced demand in this sector.  The amount of decline projected is based on interviews with individuals knowledgeable about the agricultural economy in each county (Section 6.2).  However, a reduction in demand does not mean additional water would be available for appropriation. 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. The amount of reservoir evaporation is dependent on the surface area of the reservoir as well as the rate of evaporation. Evaporation rates are partially dependent on temperature and humidity; that is, when it is hotter and drier, evaporation rates increase. Surface areas of reservoirs are variable, and during extreme drought years, the low surface areas contribute to lower total evaporation, even though the rate of evaporation may be high.

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

In reality the fluctuations in reservoir evaporation are expected to be much greater than the high/low range projected using this method. To evaluate the balance between supply and demand, the projections are being compared to the administrative water supply, which is based on 2010 water use totals (Longworth et al., 2013) including reservoir evaporation. It is important to not show an unrealistic scenario of excess available water. Therefore the full range starting with potentially very low reservoir surface areas was not included in the projections.

### 6.5.2 Middle Rio Grande Projected Water Demand

Table 6-5 summarizes the projections for each water use category for each of the four counties that were developed by applying the methods discussed in Section 6.5.1. As discussed in Section 6.3, in the three main counties population is projected to grow in the high projection and at a lower rate in the low projection (the Torrance County population in the region is so small that it did not affect future water demand projections).

Demand in the *public water supply category* is projected to increase under both scenarios, proportional to the increasing population projections, but the demand increase is moderated by phased-in conservation, as discussed in Section 6.4.

Projected water demand in the *commercial* and *domestic* categories is assumed to be proportional to the population growth rates. The high projection shows demand almost doubling by 2060 in these categories, and the low projection shows more moderate growth.

Despite the large urban area in the Middle Rio Grande, the highest water use in the region occurs in the *irrigated agricultural category*, and interviews (Section 6.2) indicated that this sector has trended toward increasing urbanization and pressure from developers. The agricultural projections are based on the assumption that the current drought and recent recession is thought to be driving recent declines in agricultural production. While it is possible that drought will continue over a longer term, it is also likely that drought years will be interspersed with wetter years, and there is some potential for renewed agricultural activity as a result. With the many irrigated farms and surface water rights in the region (Section 4), there is clearly a demand for agricultural water if it is available. Hence, water use in this category is projected to remain constant at 2010 levels throughout the planning period. This assumption is made recognizing that the basin is fully appropriated and any new use of water requires a like reduction in use of an existing water right within the Middle Rio Grande Basin.

The *livestock* segment in the three counties is expected see a decline by 2020, but to recover to 80 to 85 percent of 2010 water usage in the low projection and to 90 to 95 percent in the high projections. Under the low scenario, it is expected that 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.

Economic activity in the region includes a considerable amount of industrial activity, along with some power plants and limited mining activity. To project potential future water demand, economists conducted interviews to determine if growth or decline is expected in these sectors. Based on these interviews, each of these sectors is discussed below with regard to future water demand.

Within Bernalillo County, the high scenario for the *industrial* category is predicated on adding 25 percent of 2010 usage during each decade, while the low is based on adding 5 percent of 2010 usage each decade. In Valencia County, the high scenario assumes an additional 15 percent of 2010 usage during each decade, while the low assumes an additional 5 percent of 2010 usage in each decade.

The projections for the *power* plant sector are based on input received from PNM, based on their proposed Integrated Resource Plan, which is currently under review by the New Mexico Public Regulation Commission. That plan calls for the continued operation of the Reeves gas unit in Bernalillo County (which currently uses 466 acre-feet of water, of which 250 acre-feet serves the plant and the balance serves agriculture). Water usage by the plant is projected to increase to 516 acre-feet by 2020 under the low scenario and to 556 acre-feet under the high. It is also assumed that a new plant will be built in Bernalillo County by 2020 and will use an increasing amount of water over time, reaching 250 acre-feet by 2060 under the low scenario and 280 acre-feet under the high. Finally, it is assumed that the La Luz gas plant in Valencia County will be operational by 2020 and will use 50 acre-feet per year under the low scenario and 55 under the high.

For the *mining* sector, no change in water usage is projected through 2060. Most of the mines are relatively small, with the largest being the American Gypsum operation in Valencia County.

The Middle Rio Grande region projections include water use in the *reservoir evaporation* category from Cochiti and Jemez Canyon Reservoirs. Cochiti is primarily a flood control reservoir that has little impact on water supply in the region. As discussed in Section 6.5.1, the projected demand is based on 2010 reservoir surface areas so that it can accurately be compared to the 2010 administrative water supply, with the high projection reflecting increased temperatures and evaporation rates.  The reservoir evaporation category is included for statewide accounting, but has little bearing on the supply available to the region.