Sole Source Aquifer Petition

Support Document

Española Basin Aquifer System

Los Alamos, Mora, Rio Arriba, Sandoval, Santa Fe and Taos Counties

New Mexico

January 10, 2008

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 6, DALLAS, TEXAS

Table of Contents

I. Introduction

A. Section 1424 (e)

Safe Drinking Water Act (SDWA) Section 1424(e) states:

> If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

This allows for the specific designation of areas that are dependent upon an aquifer as their primary drinking water source. Following designation, the review process ensures that Federal agencies will not commit funds toward projects that may contaminate these ground water supplies to create a significant hazard to public health.

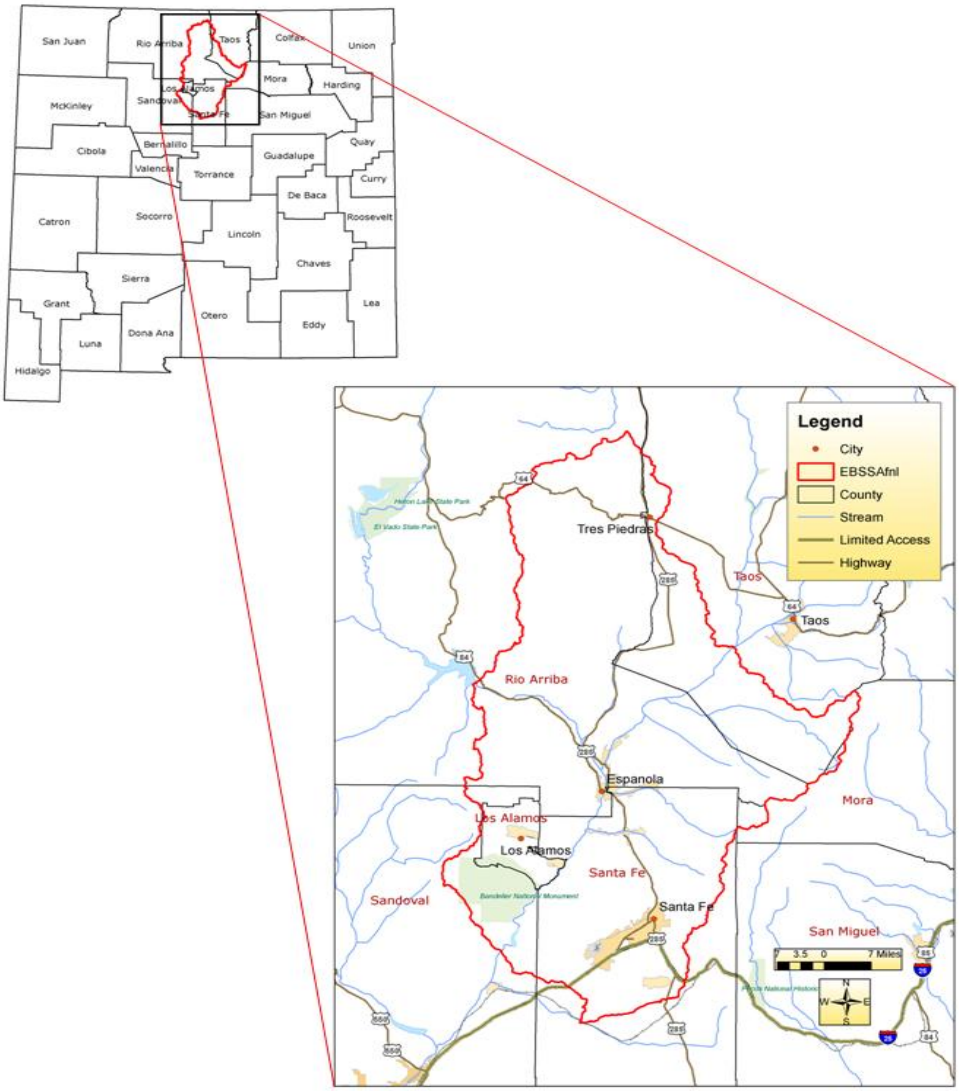
B. Receipt of Petition

On May 25, 2006, the La Cienega Valley Citizens for Environmental Safeguards (LCVCES) petitioned Region 6 of the United States Environmental Protection Agency (EPA) to designate the Española Basin Aquifer System (EBAS) area of New Mexico a sole source aquifer pursuant to SDWA §1424(e). The petition was assembled and submitted by Elaine Cimino, acting for the LCVCES, and the analysis of geology and hydrology for the petition was performed by Zane Spiegel, who has conducted investigations in this area for professional reports. EPA solicited public comments on this request during a public comment period from July 27, 2006, to September 12, 2006, and at a public hearing and town meeting on August 15, 2006 in the city of Santa Fe.

C. Area of Consideration

The proposed designation (Figure 1) covers an area of approximately 3,000 square miles which includes the cities of Santa Fe, Los Alamos and Española. The area also includes the Pueblos of San Juan, Santa Clara, Pojoaque, San Ildefonso, Nambe, Tesuque, Picuris, and Cochiti. The U.S. census for 2000 shows a total population in the petitioned area of approximately 172,749, including around 70,000 in the City of Santa Fe, (U.S. Census Bureau, 2000 and U.S. Environmental Protection Agency, 2006).

Figure 1. Española Basin Aquifer System delineated in red.



D. Criteria for Designation as a Sole Source Aquifer

Pursuant to SDWA §1424(e) and EPA program guidance, eligibility for designation as a sole source aquifer (SSA) requires that:

1. An aquifer, a part of an aquifer, or an aquifer system, and the area it serves must be delineated.
2. The aquifer must supply at least half of the drinking water consumed in the area.
3. Alternative sources of drinking water are insufficient to replace the aquifer should it become contaminated.

The remainder of this document discusses the proposed designation's consistency with these criteria.

II. Hydrogeology

A. Regional Geologic Framework

Ground water in the proposed SSA area is contained primarily in sedimentary layers that form part of a larger aquifer complex known as the Rio Grande aquifer system (Fig. 2). The U.S. Geological Survey describes this system as a "network of hydraulically interconnected aquifers in basin-fill deposits located along the Rio Grande Valley and nearby valleys" (Ground Water Atlas of the United States). In New Mexico, the Rio Grande is bordered by an irregular terrain of mountains and tablelands that close in and constrict the river at various points, producing natural segments or basins along the river. The area proposed for designation encompasses the Española Basin of Northern New Mexico and surrounding drainage areas.

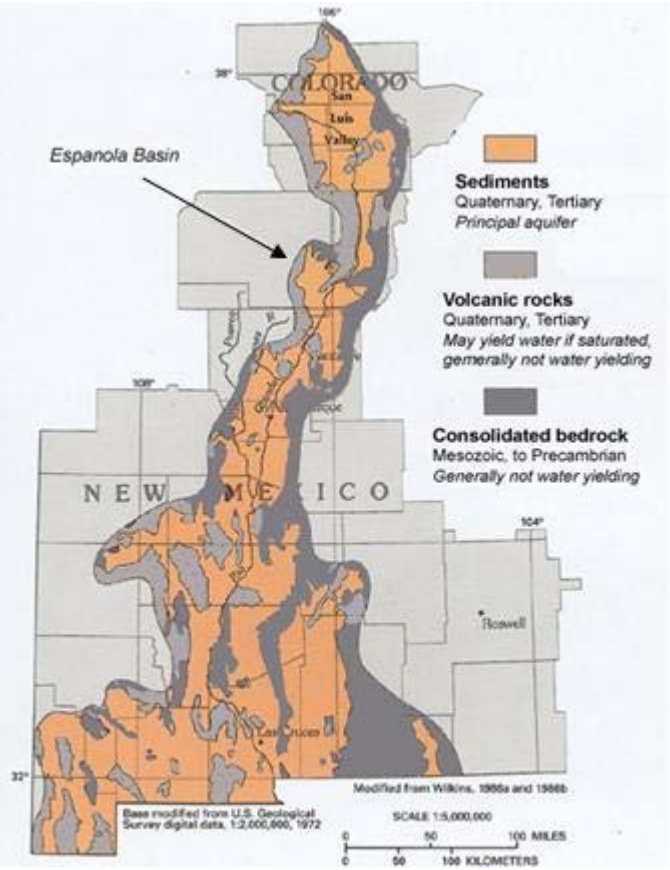


Figure 2. Rio Grande Aquifer System
(modified from USGS Ground Water Atlas of the United States)

The Rio Grande aquifer system and the course of the Rio Grande are controlled by a structural feature called the Rio Grande Rift. Faulting and vertical movement of large blocks of the earth's crust in the Rift control the location of the River and the sedimentary basins along the River. Figure 3 shows the Rift at Albuquerque and illustrates the nature of the processes acting all along the Rio Grande in New Mexico. Downward movements of fault blocks have created a valley between uplifted fault blocks on the east and west. Vertical displacements have been in the thousands of feet for some of the blocks, creating a valley that has been filled with volcanic rocks and sediments shed from the adjacent highlands.

The basin fill is surrounded by bedrock that consists primarily of dense igneous and metamorphic rocks and some sedimentary and volcanic rocks. Most of these rocks have low permeability, and the bedrock as a whole is considered to form an impermeable base to the Rio Grande aquifer system. However, in local areas some volcanic rocks, carbonate rocks or extensively fractured beds can yield water (Fig. 2).

The Rio Grande aquifer consists of several elements. A large amount of the sediment fill near the basin boundaries is coarse sand and gravel that was deposited in alluvial fans by streams flowing off the mountains. Moving inward toward the basin center, these alluvial fan deposits generally grade into and intertongue with either fine-grained playa deposits in closed valleys or

medium-to coarse-grained sediments deposited by the Rio Grande. The fine-grained layers toward the basin center create a set of overlapping and coalescing confining layers interbedded with sand and silt layers. There may be hydrologic communication between the water-bearing layers separated by the confining layers (Parrish, 2006).

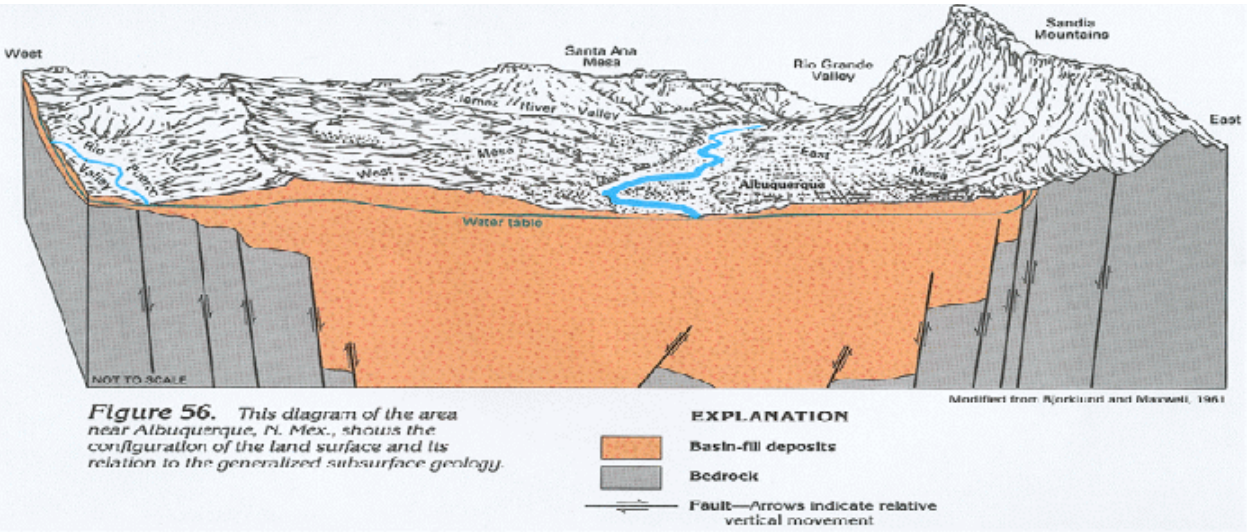


Figure 3. The Rio Grande Rift at Albuquerque

(from USGS Ground Water Atlas of the United States)

The principal water-yielding material of the basin-fill in northern New Mexico is the Tertiary-Quaternary Santa Fe Group. The Group consists of a thick section of unconsolidated or moderately consolidated lenticular deposits of gravel, sand, and clay interbedded in some areas with lava flows, tuffs, and breccias. The younger basin fill of Quaternary age consists of unconsolidated, poorly to well-sorted layers of gravel, sand, silt, and clay. Terrace deposits of gravel, sand and silt stand 30 to 175 feet above the level of the present floodplain of the Rio Grande.

B. Geology and Hydrology of the Sole Source Aquifer Area

The term “Española Basin” refers in general to a physiographic feature defined by the surrounding highlands. However, the Basin is also a hydrologic and geologic feature, and its boundaries have been defined in a variety of ways under different technical studies. Here, the Española Basin is defined as the portion of the Rio Grande aquifer system contained in the Española Basin, (as shown in New Mexico Bureau of Mines and Mineral Resources Circular 163, Sheet 2) along with the immediate surroundings that drain to the Rio Grande.

Figure 4, shown below is a generalized geologic map of the Española Basin area, modified from Woodward and others (1978). The green boundary line outlines the extent of the SSA as shown in the petition to EPA, while the red boundary line represents the final boundary adjusted to correspond to detailed watershed maps available to EPA (as described below). Water-table contours (Coons and Kelly, 1984 and McAda and Wasiolek, 1988) and flow arrows have been added for diagrammatic representation of general ground water flow directions.

As indicated on the map, the sedimentary basin fill which makes up the aquifer system occupies the lowland in the rift, where it interfingers with volcanic layers and is bounded by bedrock of several types. The geology, greatly simplified here, is presented in much greater detail in Map 1, Appendix A of this report. The basin sediments are bounded on the east by Precambrian igneous and metamorphic rocks of the Sangre de Cristo Mountains, and by Paleozoic and Mesozoic sedimentary rocks that yield little water. Similar rocks are found on the northwest side of the basin which is dominated by Precambrian rocks and sedimentary rocks as young as Miocene.

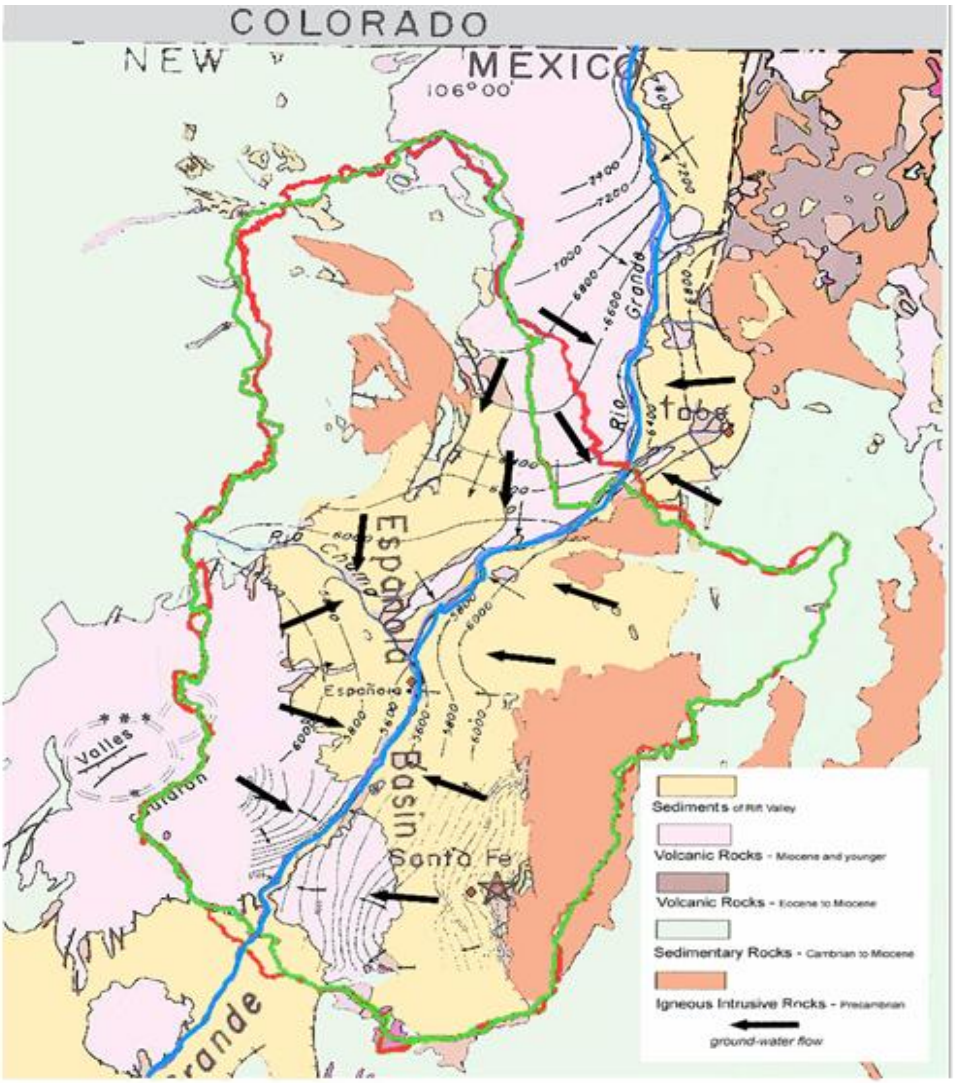


Figure 4. Hydrogeology of the Española Basin.

The west side of the basin is occupied by the Caja Del Rio basalt plateau and the Jemez Mountains, a huge volcanic pile consisting of flows, tuffs and breccias. These volcanic rocks cover the sediments of the basin; their boundaries outline the surface extent of the aquifer, but the aquifer underlies the Caja Del Rio field and extends well under the volcanic layers of the Jemez Mountains. Ground water flow under the volcanic layers may be impeded by intrusive dikes, sills and necks, but generally moves toward the Rio Grande, consistent with the regional flow pattern. Similarly, where the Rio Grande enters the Española Basin on the northeast, much of the basin fill sediments have been covered by basalt flows. Geologic cross-sections through the area illustrate the extent of the aquifer across the basin and the relative thickness of the volcanic sections (Figure 5).

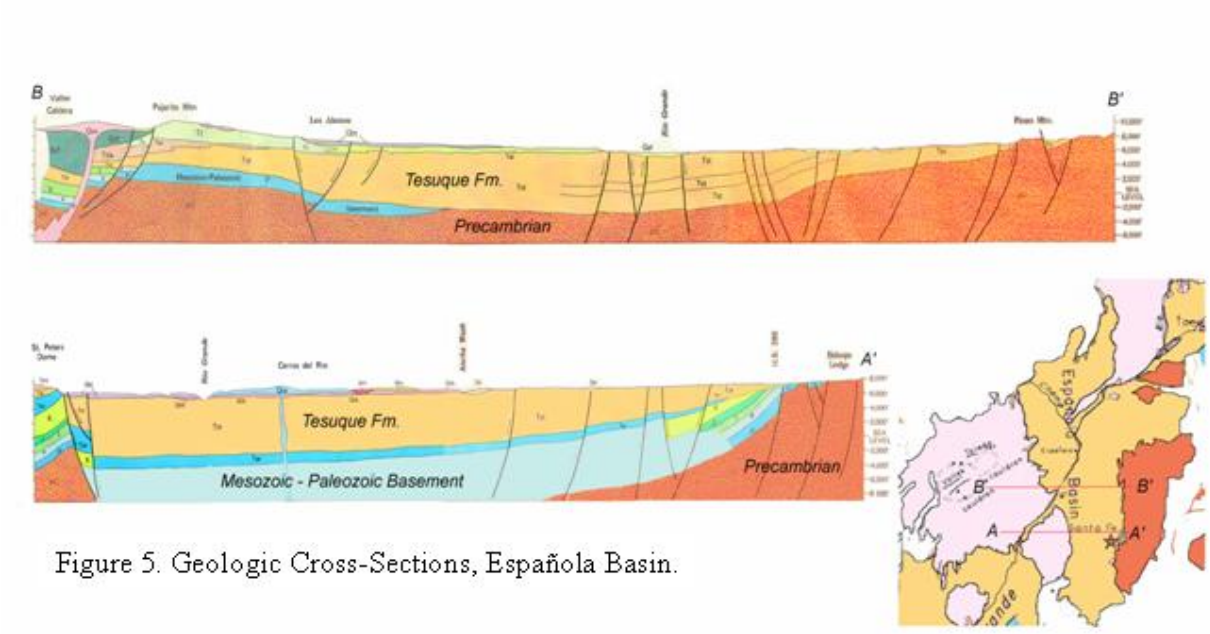


Figure 5. Geologic Cross-Sections, Española Basin.

The sedimentary basin-fill that comprises the aquifer system in the Española Basin ranges from coarse gravel to sand, silt and clay. By far, the greatest bulk of these sediments are contained in the Santa Fe group, described by Baldwin (1963) as containing the Tesuque and Ancha formations. The group has been subdivided into various other stratigraphic units in parts of the Basin, particularly the area west of the Rio Grande, but is recognized throughout the area as containing a set of hydraulically interconnected strata.

The Tesuque Formation forms the major part of the sedimentary basin fill in the area, and has even been described as an aquifer system in itself (Frenzel, 1995, p. 6). The dominance of the Tesuque is evident in cross sections above.

The Española Basin Aquifer System as described in the petition includes the major aquifers of the Rio Grande aquifer system as well as some additional water-bearing materials. The aquifer system is described as containing a number of elements, "all hydraulically connected, thus forming a single aquifer system, termed herein the EBAS." The principal aquifer elements identified in the petition are, "the Tesuque and Ancha formations of the Santa Fe group (upper Tertiary and Pleistocene age, respectively; Baldwin, 1963, p. 86-89) and, in some arroyo channels and fringe areas, Quaternary sediments." Minor aquifer elements are hydraulically connected to adjacent or overlying aquifers in the Santa Fe Group, and include rocks ranging in age from Precambrian to early Tertiary. The aquifer system, thus defined, includes the entire sedimentary basin fill in the area.

On the basis of geophysical studies, the thickness of the Santa Fe Group in the basin (roughly equaling the thickness of the EBAS) is estimated to range up to 12,000 feet near Española, potentially as high as 19,000 feet near Los Alamos and as much as 6,900 feet south of Santa Fe (Wilkins, 1986).

In the cross sections shown in Figure 5, in places the EBAS overlies a section of bedrock consisting of sedimentary layers ranging in age from Cambrian to Tertiary, which in turn, overlies Precambrian basement rocks. These older sedimentary rock formations, contain a number of limestone layers, that contain potable water, but are not present over the entire basin.

C. Basis for Boundaries of Proposed Sole Source Aquifer

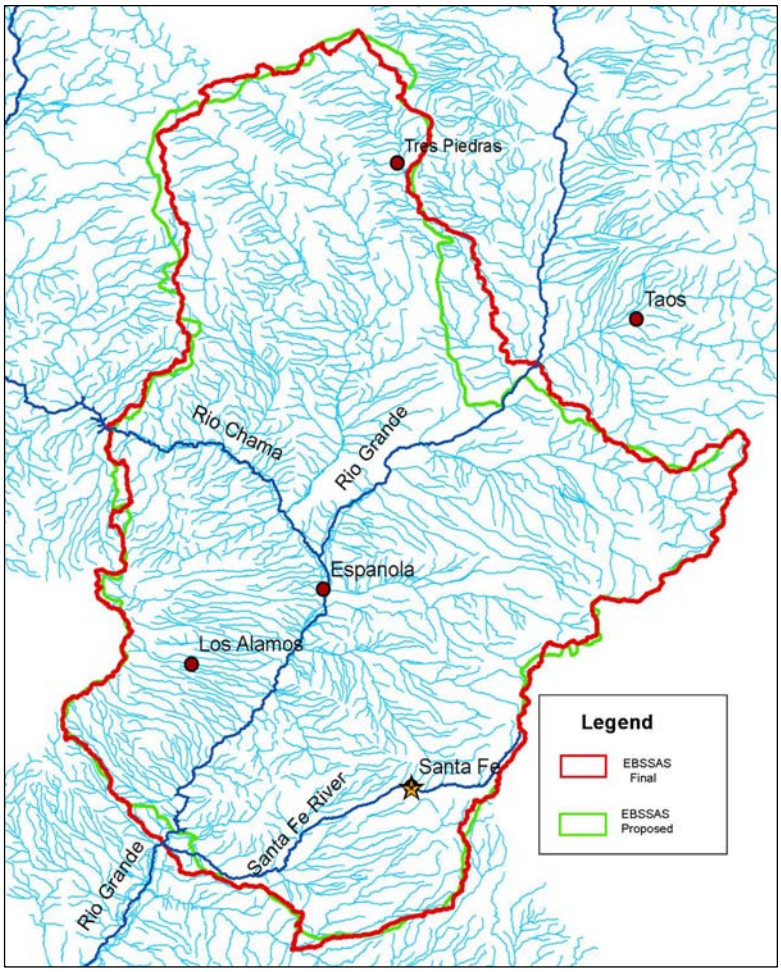


Figure 6. Watershed map of the Española Basin.

The boundaries for the EBAS proposed by the petitioner are intended to delineate an area that can be managed to provide protection for the basin aquifer system. The proposed boundaries are based on the watersheds that drain to the Rio Grande in the Española Basin. The eastern and western sides of the delineated area follow the topographic highs that mark the limits of drainage to the river. On the upstream and downstream sides the boundaries serve as cut-offs to enclose the segment of the Rio Grande defined as the Española Basin.

The use of surface watershed boundaries to define a ground water protection unit is based on the close correspondence between the movements of surface water and ground water over much of the basin area. Ideally, the boundaries should enclose the aquifer to be protected, and include the land areas draining to the aquifer and providing subsurface flow to the aquifer.

A watershed map of the Española Basin, along with the SSA boundary proposed by the petitioner, and a subsequently modified boundary consistent with the intent of the petition, is shown in Figure 6. Changes to the boundaries shown in the petition are mostly a result of minor adjustments based on the use of more accurate watershed maps available from the National Hydrography Dataset Plus-NHDPlus data set (U.S. Environmental Protection Agency and U.S. Geological Survey, 2005). A relatively short segment of the boundary on the north, where the Rio Grande enters the Basin, was adjusted to a larger degree in order to maintain a consistent watershed boundary.

The area protected by an EPA sole source aquifer designation may include not only the aquifer, but also the "stream flow source area" that drains onto the aquifer. In the proposed EBAS, the petitioner has included the stream flow source area as part of the petitioned area.

D. EPA Region 6 Assessment of Petitioned Boundaries

The boundary proposed by the petitioner is intended to enclose an area containing the aquifer system, dominated by the Tesuque and Ancha Formations of the Santa Fe Group, the recharge area for the aquifer and the stream flow source area that drains to the aquifer. The recharge area covers the surface exposures of the sediments named above, but its extent beyond this area is uncertain (Manning, et al. 2006). Recharge occurs through the volcanic layers (which contain perched water in places) near Los Alamos, and the fractured crystalline rocks of the Sangre de Cristo Mountains may be considered a source of recharge for the aquifer or a part of the aquifer system. Recharge for the aquifer might occur over a large part of the basin. Because of the uncertain nature of the recharge areas and interconnected aquifer elements it would be most practical to consider the basin, as outlined in the petition and named the Española Basin Aquifer System, as the sole source aquifer, even though a portion may consist solely of stream flow source area. In any event, the functional unit of designation is the "project review area" that would be identical with the proposed boundary.

The aquifer system is distinguished as a unit on its east and west sides by its termination against older rocks which are generally non-aquifers. Boundaries on the upstream and downstream ends of the Basin have been drawn approximately parallel to ground water flow directions in the aquifer, defining borders across which there will be little inflow of ground water from outside the proposed SSA. These boundaries serve to separate a distinct hydrologic unit.

The stream flow source area boundaries proposed by the petitioner, with minor adjustments as shown here, correspond to the immediate drainage area contributing recharge to the basin. The Rio Grande entering the basin from the northeast, and the Rio Chama entering from the west are both gaining streams in the basin and would not be expected to contribute contaminants in large quantities or in high concentrations from these outside areas.

The proposed boundary outlines an area that can be effectively managed to protect ground water quality in the aquifer.

III. Water Use

A. Sources of Drinking Water in the Petitioned Area

In analyzing water use for the proposed SSA area three water user groups were identified:

- those served by the public water supply system for the City of Santa Fe,
- those served by a public water supply system other than the City of Santa Fe and
- those served by a domestic water supply system.

The public water supply system for the city of Santa Fe uses three sources of water:

- surface water supplied by reservoirs that collect and store mountain run-off from the upper Santa Fe River watershed,
- ground water supplied by the city well field and
- the Buckman well field.

The other public water supply systems and the domestic water supply systems use ground water.

B. Population of the Petitioned Area

The petitioner uses projected population figures from the Jemez y Sangre Water Plan, 2003, of 214,364 and projected population figures for 2005 from the U.S. Census Bureau, 2006, of 210,505 to estimate the population within the EBAS. Santa Fe also has a large nonresident temporary population of tourists and people attending meetings and conventions. On page 14 of the petition, the petitioner uses information from the Santa Fe Convention and Visitor's Bureau to determine that an additional 17,260 visitor years should be added to the City population. The petitioner adds the nonresident population to the 2005 projected resident populations to get a total population for the EBAS region. 214,364 + 17,260 = 231,624 or 210,505 + 17,260 = 227,765.

There are no available estimates of transient population for the area outside the city. Because of the increased concentration of travel lodging within the city and its scarcity outside the city, transient population probably contributes little to drinking water consumption outside the city.

Because the delineated area of the EBAS consists of portions of five counties and the entire county of Los Alamos, the EPA has applied a method which estimates population based on U.S. Census Bureau 2000 data and determines the proportion of the counties contained in the petitioned area using a geographic information system (GIS). The U.S. Census Bureau 2000 data correlates well with water use records supplied by the New Mexico Office of the State Engineer (Wilson and others, 2003). A GIS program was used in combination with the census tract data to determine the population within the EBAS. To determine the population in census tracts that cross the EBAS boundary it was assumed that population was equally distributed; as such, the population was divided proportionately among the areas inside and outside the EBAS based on land area. Adding the population figures for all census tracts that fall within the EBAS a total of 172,749 people were living in the EBAS in 2000.

Table 1. Population Data, U.S. Census Bureau 2000.

New Mexico County Name	Total Population in EBAS	Total Population in County	% of County Population in EBAS	% of County Population in EBAS to Total Population in EBAS [1]
Los Alamos	18,343	18,343	100.0	10.6
Mora	18	5,180	0.3	> 0.1
Rio Arriba	33,125	41,190	80.4	19.2
Sandoval	725	89,908	0.8	0.4
Santa Fe	116,761	129,292	90.3	67.6
Taos	3,777	29,979	12.6	2.2
Population inside EBAS	**172,749**			
State Population	1,819,046	313,892		
% State Population inside EBAS Boundary	9.49%			

[1] Total adds to more than 100% due to rounding.

C. Determination of Sole or Principal Source of Drinking Water

To qualify for designation as a sole source aquifer under Section 1424(e) of the Safe Drinking Water Act, the Aquifer must supply 50% or more of the drinking water in the petitioned area. The following discussion sets forth two methods presented in the petition for determining drinking water use in the Española Basin Aquifer System area. The first method is based on water rights allocations. The second makes use of modified form of a methodology proposed by the City of Santa Fe and makes use of recorded water use in the City of Santa Fe and estimated per capita consumption for the rest of the population in the petitioned area.

Method 1: Estimation Based on Water Rights Allocations

Description: In New Mexico the Office of the State Engineer (OSE) controls water use by issuing water allocations for both surface water and ground water. The petitioner asserts that the Aquifer supplies more than 50% of the drinking water within the petitioned area on the basis of water rights which have been allocated by the OSE. Water rights allocations, as reported by the petitioner from research on OSE records are summarized in Table 2, below.

Table 2. Allocated water rights and known withdrawals within the proposed SSA area, in acre-feet per year (afy).

Water Rights (afy)	Allocated	Withdrawals
Ground Water Sources		
Public Water Systems [1]	30,217	10,914 [2]
Permitted Domestic Wells [1]	50,919	Undetermined [3]
Total Ground Water	81,136	10,914
Surface Water Sources		
County/City of Santa Fe	10,270 [4]	3,682.7 [5]
Native Rio Grande – City of Santa Fe	131	0
Native Rio Grande – Santa Fe County	476 [6]	0
Los Alamos County [6]	1,200	0
City of Española [7]	1,000	0
Las Campanas	1,800	0
Aamodt Settlement [8]	3,660	0
Total Surface Water	18,537	3,682.7

[1] EBAS petition, 2006, Exhibit 3-2, page 18, only major public water systems were considered
[2] EBAS petition, 2006, Table A, page 19, only major public water systems were considered
[3] Actual use of ground water for domestic drinking water can not be determined
[4] San Juan-Chama Project Allocation = 5230 afy, storage allotment from Santa Fe Reservoirs = 5040 afy
[5] City of Santa Fe average 1995 to 2005 Surface Water Withdrawals (Borchert and Gallegos, 2006)
[6] "Table 1 Completed Transfers to the Buckman Wellfield" (Utton and Wust, 2007)
[7] Surface water allocated within the EBAS not listed in the petition (U.S. Department of the Interior, 2007)
[8] Aamodt Settlement for Nambe, Tesuque, Pojoaque, San Ildefonso Pueblos (New Mexico, 2006)

As indicated in Table 2 total allocations for ground water (81,136 afy), which includes withdrawals from both public water supply wells and domestic wells, greatly exceeds the allocations for surface water withdrawals (18,537 afy).

In addition, the petitioner states that the number of wells drilled before 1968 is unknown, but is estimated to be at least 5,000 within the EBAS sub-basin. Inclusion of the undocumented wells would further reinforce the claim that ground water is the principal source of drinking water in the area. However, these totals are not reflected in the petitioner's estimate of ground water use.

Evaluation of Method: The use of water allocations to estimate drinking water usage is subject to certain problems which distort the resulting estimates of water use. The greatest problem in using allocations to estimate water use is that the amount of water allocated may be considerably different than the amount of water actually used. Typically, actual use is much less than the allocation. This reality is recognized in the petition, where it is stated that during 2004 and 2005, allocations per year for public water supply wells was 30,216 afy, but only 10,915 afy was actually used. This discrepancy is probably even greater for domestic wells, all of which are assigned a minimum allocation of three afy (D'Antonio, 2006), or an average of 2,678 gallons per day, which would typically supply water for 33 people.

The relative allocations for ground water and surface water are strongly suggestive that drinking water for the EBAS is supplied predominantly by ground water. However, a more precise, and better documented procedure for estimating the relative use of ground water and surface water is needed to verify this assertion.

Method 2: Estimation Based on Reported Water Use and Per Capita Consumption

An estimate of the percentage of drinking water supplied by the Aquifer can also be made based on records of withdrawals from public water supply systems in the petitioned area, and, where needed, average per capita water use of both public and domestic supplies.

Water withdrawals are recorded by each public water system in order to track compliance with the allotments issued by the State Engineer. In addition, summary water use, by county, for both public and domestic sources, are contained in reports issued periodically by the State Engineer (most recently for the year 2000).

Another useful tool in analyzing water use is EPA's relational database, the Safe Drinking Water Information System (SDWIS) (U.S. Environmental Protection Agency, 2006). The database contains information on all public water supply systems in the country, including location of each system, number of people served by the system and the type of water source (ground water or surface water).

Using the SDWIS 2006 locational data, it was determined that 91 public water systems, serving 138,631 people are located within the EBAS (Appendix A, Figure 2). The Santa Fe Water System alone provides water for more than half (74,684 or 54%) of that total population. Because of its importance as the dominant water supplier in the region, the Santa Fe water system is the first point of investigation on water use.

According to information contained in SDWIS, Santa Fe's water system uses a blend of surface water from the Santa Fe River, reservoirs supplied by the upper Santa Fe Watershed and ground water from several well fields in the aquifer, all sources falling within the area petitioned for designation as a sole source aquifer. The City's water system and four public water systems that purchase water from the City are the only public water supply systems in the EBAS that use surface water. The Aquifer is the source of all drinking water in the EBAS area outside of the Santa Fe area, including the 86 other public water systems that serve 63,947 people and all of the domestic well users.

Because the Santa Fe water system is the only source of surface water used for drinking water in the EBAS, an accurate determination of the City's water use, from both surface and ground water sources, is critical in determining whether the EBAS petition meets the requirement that the Aquifer supply at least half of the drinking water for the area.

During the public comment period for the proposed designation the City provided a table "Data and Assumptions Used to Calculate City of Santa Fe's Gallons per Capita per Day" detailing Santa Fe's drinking water sources. Water use by source, based on data from 1995 to 2005, is summarized in Appendix B, Table 5 and can be seen on the graph below (Figure 7). Because of conservation measures implemented by the City, total water use over the 11-year span has been

remarkably consistent, despite population growth. Taking the average water use for the 11- year period Santa Fe uses 3,683 afy of surface water and 7,829 afy of ground water, or 33 % and 67 % respectively. At no time during that period did yearly surface water use exceed ground water use.

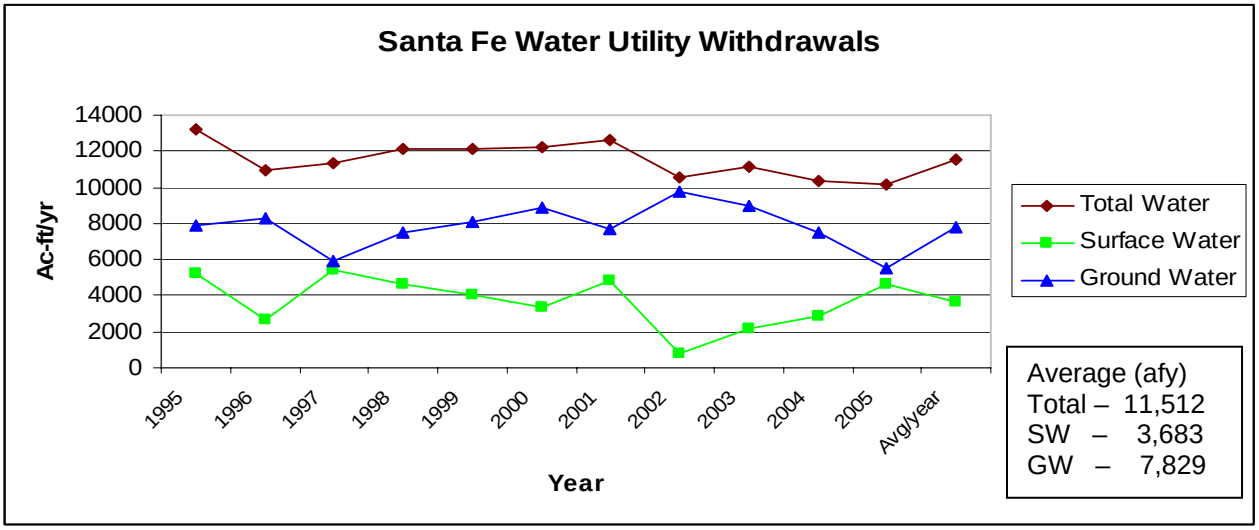


Figure 7. City of Santa Fe water withdrawals.

The fact that the Santa Fe Water System, the only source of surface water for the EBAS area, produces more ground water than surface water is *defacto* evidence that the petition meets the principal drinking water source requirement for designation as a sole source aquifer under the Safe Drinking Water Act.

In order to provide a more complete accounting of all water use in the EBAS area, a more complex process of data analysis is required. Because EBAS boundaries do not coincide with either county lines or with public water supply service district boundaries, water use data must be apportioned among the portions of each county included in the EBAS boundary. In the following discussion, public water supply and domestic well usage are treated in separate sections.

Drinking Water Use from Public Water Supply Systems in the EBAS

The analysis of public water supply use presented below is based on data from the City of Santa Fe (described above), the public and domestic drinking water consumption figures found in the New Mexico Office of State Engineer's Technical Report 51, (Wilson and others, 2003), population figures from the U.S. Census of 2000, and populations served by public water supply systems as reported under the SDWIS, (U.S. Environmental Protection Agency, 2006).

Wilson and others, provide a detailed listing of water consumption by source in New Mexico. These include estimates of volumes of water consumed by public and domestic drinking water supplies in each county. To determine the amount of water used by the public water systems in the EBAS required two steps. First, a per capita consumption rate was calculated for public water supply (PWS) users in each county. This was accomplished by dividing the total PWS

water usage in the county, as reported by Wilson and others, by the number of PWS users contained in EPA's SDWIS system (for details see Appendix B, Table 4). The resulting number is expressed as acre-feet per year per capita (afy/capita).

The second step involved determining the number of public water supply users in the portion of each county included in the EBAS, and multiplying that number by the per capita consumption rate. A listing of public water supplies, their water sources and the population they serve in the petitioned area was available through SDWIS (Appendix B, Table 3). When water use is determined in this way, it is evident that public water supply use is strongly dominated by ground water sources in the EBAS. Table 3, summarizes the results of this process.

Table 3. Drinking Water Use from Public Water Supply Systems in the Proposed SSA Area, in acre-feet per year (afy).

County/City in EBAS	County Average per capita PWS water use (afy/capita) [1]	Drinking Water Use Within EBAS			
		Ground Water		Surface Water	
		Population Served	Use in (afy)[2]	Population Served	Use in (afy) [2]
Los Alamos	0.2512	18,343	4,608	0	0
Mora [3]	0.0791	0	0	0	0
Rio Arriba	0.0909	22,541	2,049	0	0
Sandoval	0.1691	725	123	0	0
City of Santa Fe		*74,684 using blended water* *Metered PWS*	7,829	*74,684 using blended water* *Metered PWS*	3,683
Santa Fe Co. except City	0.1348	18,703	2,521	0	0
Taos	0.1115	3,635	405	0	0
PWS Use in EBAS			17,535 afy		3,683 afy

[1] Acre-feet per year per capita (afy/capita), determined in Appendix B, Table 4
[2] Acre-feet per year (afy) (rounded to nearest whole acre-foot)
[3] Mora county has no Public Water Supply Systems within the EBAS area

Drinking Water Use from Domestic Wells in the EBAS

Using population numbers for the EBAS area from the U.S. Census Bureau, 2000 Table 1 above, then subtracting the population using public water systems by county (U.S. Environmental Protection Agency, 2006) (Appendix B, Table 1) it was determined that drinking water for 34,118 people within the EBAS comes from a domestic wells.

Santa Fe population using PWS		74,684
+	Other population using PWS	63,947
=	Total population using PWS	138,631
Population within the EBAS area		172,749
–	Population using PWS	138,631
=	Population using domestic ground water	34,118.

For the purpose of estimating water use from domestic populations Wilson and others, (2003) found that most New Mexico counties have an area-wide average of 80 gallons per capita per day (GPCD). The yearly amount of ground water use for the domestic population within the EBAS can be calculated by:

W = (POP)(GPCD)/892.74

Where W is annual withdrawal in acre-feet, POP is the population, GPCD is gallons per capita per day and 892.74 is the conversion factor to get afy to gallons per day.

W = (34,118)(80)/892.74

W = 3057.38 afy domestic ground water use in the EBAS

Total Surface Water and Ground Water Use in the EBAS

Determining the total surface water and ground water use in the EBAS consists of adding the water volume used by public water supply systems and domestic water wells.

The annual volume of water used by public water systems using ground water = 17,535 afy
The annual volume of water used by domestic water wells using ground water = 3,057 afy
The annual volume of water used by public water systems using surface water = 3,683 afy
The total annual volume of drinking water used in the EBAS = 24,275 afy

Using Method 2, the aquifer accounts for 20,592 afy or approximately 85% of the total drinking water used in the proposed SSA area. Surface water use in the EBAS accounts for 3,683 afy or 15% of water used for drinking water.

Evaluation of Method: For estimating drinking water use, Method 2 provides more accuracy in that it makes use of metered water sources in the City of Santa Fe. The estimated per capita consumption rate for the area outside the City might be in error to some degree, but is based on reported metered withdrawals of public water supplies from OSE, (Wilson and others, 2003) and the number of people served by these public water supplies (U.S. Environmental Protection Agency, 2006), which are considered the best sources of information.

Because much of the data that forms the basis for these calculations were collected during the year 2000, there has undoubtedly been some change in population and water use in the area. However, this change would not be of such magnitude as to substantially affect the overwhelming dominance of the aquifer as the primary drinking water source in the area. Most importantly, figures for the City of Santa Fe's water use indicate that the City, the only source of surface water used for drinking water in the area, continues to use more ground water than surface water.

Region 6 believes that the method based on per capita consumption and reported water use is more accurate as a predictor of drinking water usage than the water allocation method. The petition and other available evidence indicate that the Aquifer is the principal source of drinking water in the petitioned area.

IV. Alternate Sources of Drinking Water

As described on page one, EPA received public comments on the proposed designation of the EBAS as a Sole Source Aquifer. Some commenters felt that the EBAS should not be considered the sole or principal source of water supply for the designated area because of the future or present availability of water from the Colorado and the Rio Grande Rivers and the purchase of additional water rights.

In considering the feasibility of replacing an aquifer as a water supply source, EPA considers both the availability of other sources of water in the area and the cost of replacement by those sources. Alternate sources must be capable of supplying sufficient water to replace the aquifer as a source, be legally available without other institutional constraints, and the cost of replacement must not impose an economic burden on the population of the area considered for designation. Institutional constraints are legal or administrative restrictions that preclude replacement water delivery and may not be alleviated through administrative procedures or market transactions.

As part of the Colorado River Storage Act, the U.S. Bureau of Reclamation has diverted water from the Colorado River and its tributaries to the Rio Grande Valley through a diversion project called the San Juan-Chama Diversion. A number of cities and counties along the Rio Grande River, including Santa Fe, Los Alamos, and Española, pay an annual lease to the Bureau for rights to the additional water.

The City and County of Santa Fe and the community of Las Campanas have begun planning for construction on a project called the Buckman Direct Diversion (BDD) to help them access their allotted water from the San Juan-Chama project. The Rio Grande and the Colorado Rivers are thus, intended sources of drinking water for the petitioned area as part of the San Juan-Chama' Diversion and BDD projects (U.S. Department of the Interior Bureau of Reclamation, 2006). In addition, the New Mexico Office of the State Engineer issues allocations for use of the native Rio Grande water.

The County of Los Alamos has a right to 1,200 afy and the City of Española has a right to 1,000 afy from water redirected through the San-Juan Chama Diversion (U.S. Department of the Interior Bureau of Reclamation, 2006). An additional 3,660 afy of San Juan-Chama water has been set aside as first water rights for Nambe, Pojoaque, San Ildefonso, and Tesuque Pueblos pending Congressional approval of the Aamodt Settlement Agreement (Aamodt Settlement, 2006). The BDD is scheduled to be online in 2010. The BDD will provide a combination of water from the San Juan-Chama project and native Rio Grande water. The City and County of Santa Fe have a contract for 5,605 afy water from the San Juan-Chama via the BDD. In addition, the City of Santa Fe will divert 131 afy and the County of Santa Fe will divert 476 afy of native Rio Grande water through the BDD. The County of Santa Fe has an agreement with the City of Santa Fe to receive 375 afy of the 5,605 afy from the San Juan-Chama allotment. The community of Las Campanas will also receive their allotment of 1,800 afy of San Juan-Chama water directly through the BDD (U.S. Department of Agriculture et al., 2006).

Purchasing additional water rights has also been presented as a potential alternate source of water in the Jemez y Sangre Regional Water Plan. At this point it is not clear that the necessary legal, technical and political issues involved in providing a new source of water will be resolved in the near future.

Total drinking water usage calculated for the petitioned area is now 20,592 afy of ground water from the aquifer, and 3,683 afy from alternative sources (surface water). If all of the claimed water rights were fully realized and exploited the petitioned area would receive an additional 14,854 afy of surface water for a combined total of 18,537 afy from alternate sources, which is approximately 2,000 afy less than the amount of ground water now supplied by the aquifer. Even if all of the increased surface water use displaced an equal volume of current ground water use it would not be sufficient to satisfy the current demands.

Although the construction of the San Juan-Chama and BDD projects provide an adequate means to transport water from an alternate source to the area, leasing contracts can not supply enough water to replace the amount of ground water used in the area, let alone to "replace the aquifer should it become contaminated," per discussion above and in Section III.

V. Summary

In May 2006, EPA Region 6 received a petition for designation of the Española Basin Aquifer System as a sole source aquifer under Section 1424(e) of the Safe Drinking Water Act. Following a public hearing and receipt of information during the public comment period, the Region has evaluated all of the pertinent information as summarized here.

In its review of sole source aquifer petitions EPA considers 1) the nature of the proposed boundaries for the sole source aquifer, 2) whether the aquifer provides at least half of the drinking water for the area and 3) whether there are any financially feasible alternative sources of water in the area that could replace the aquifer if it were contaminated.

The boundaries of the area proposed for designation are based on surface watershed limits. The proposed boundaries delineate a portion of the Santa Fe group that serves as the aquifer for the area, and watershed areas which drain onto the aquifer. The boundaries define an area which might be effectively managed to protect ground water within its borders.

The petition presents data to show that water rights allocated by the State Engineer's Office permit more water withdrawal from the Aquifer than from other sources (surface water and imported water) in the area proposed for designation. However, these allocations probably do not reflect the actual amounts of water used in the area. Water use records for the City of Santa Fe, calculated water usage from the public water suppliers using ground water and calculations based on estimated per capita water usage rates for domestic ground water users indicate that the aquifer supplies approximately 85% of the drinking water for the area.

The economically feasible alternate sources of water currently available could not replace the aquifer if it were contaminated.

Based upon the information available, the Española Basin Aquifer System meets the technical requirements for SSA designation. The geologic boundaries are acceptable. More than fifty (50) percent of the drinking water for the aquifer service area is supplied by the aquifer and there is no feasible alternative source of water in the area. These results indicate that the area is eligible for designation under Section 1424(e) of the Safe Drinking Water Act.

VI. References Cited

Baldwin, Brewster, 1963. "Geology," in Spiegel and Baldwin, 1963, Geology and Water Resources of the Santa Fe Area, New Mexico, U.S.G.S. Water Supply Paper 1525, 21-90 pp.

Borchert, Claudia, and Gallegos, Robert. (personal communication, September 12, 2006) Table "Data and Assumptions Used to Calculate City of Santa Fe's Gallon per Capita per Day" included in EBAS comments.

Coons, L.M., and T.E. Kelly, 1984. Regional hydrology and the effect of the structural control on the flow of ground water in the Rio Grande rift: New Mexico. pl 63.

D'antonio, J.R., 2006. Rules and Regulations Governing the Use of Public Underground Waters for Household or other Domestic Use, Title 19. Chapter 27. Part 5. Section 9. D. http://www.ose.state.nm.us/PDF/RulesRegsGuidelines/DomesticWells/72-12-1-Rules-2006-08-15.pdf

Dane, Carle H., and Bachman, George O., 1965. Geologic Map of New Mexico, U.S. Geological Survey map, 2 sheets.

Frenzel, P.F., 1995. Geohydrology and Simulation of Ground Water Flow Near Los Alamos, North Central New Mexico, U.S. Geological Survey Water Resources Investigation Report, 95-4091, 6 p.

Hutson, Susan S., Barber, Nancy L., Kenny, Joan F., Linsey, Kristin S., Lumia, Deborah S., and Maupin, Molly A., 2004. Estimated Use of Water in the United States in 2000, U.S. Geological Survey Circular 1268U. http://pubs.usgs.gov/circ/2004/circ1268/htdocs/text-references.html

Jemez y Sangre Regional Water Plan Report, 2003. Jemez y Sangre Water Planning Council on the Daniel B. Stephens website. Report by Stephens, Lewis and Duke Engineering. http://www.dbstephens.com/project_plans.php?plan_id=51

Longmire, Patrick, 1985. A Hydrogeochemical Study Along the Valley of the Santa Fe River, Santa Fe and Sandoval Counties, New Mexico: New Mexico Environmental Improvement Division, EID/GWH-85/3, 35 p.

Manning, Andrew, Elizabeth Keating, Jonathon Saul Caine and Gary Landis, 2006. Insights into Recharge to the Española Basin Provided by Noble Gas, Groundwater Age and Temperature Data, U.S. Geological Survey Open-File Report 2006-1134.

McAda D.P. and Wasiolek, M., 1988. Simulation of the Regional Geohydrology of the Tesuque Aquifer System near Santa Fe, New Mexico, U.S. Geological Survey Water Resources Investigations Report 87-4056, figure 6.
http://www.nmenv.state.nm.us/gwb/GWQ_Atlas/SF_potentiometric.tif

New Mexico ex rel. State Engineer v. Aamodt, No. 66cv06639 MV/LCS-ACE (D.N.M.), Settlement Agreement. January 19, 2006
http://www.ose.state.nm.us/PDF/Settlements/Aamodt/settlement_agreement_aamodt.pdf

New Mexico Bureau of Geology and Mineral Resources, 2003, Geologic Map of New Mexico, 1:500,000: New Mexico Bureau of Geology and Mineral Resources
http://geoinfo.nmt.edu/publications/maps/geologic/state/

Parrish, Jules Campbell, Dynamic Simulation Modeling of Groundwater Basins in the Upper Rio Grande Basin, Colorado-New Mexico, Water Resources Program, University of New Mexico, Publication No. WRP-15, April 2006. www.unm.edu/~wrp

Spiegel, Zane, and Brewster Baldwin, 1963. Geology and Water Resources of the Santa Fe Area, New Mexico, U.S. Geological Survey Water Supply Paper 1525, 258 p.

Stephens, Daniel B, & Associates, Inc., 2002. Jemez y Sangre Water Plan Alternatives Assessment, White paper, Appendix F., Alternative: Purchase Surface Water Rights in the Marketplace. http://www.dbstephens.com/project_plans/AppendixF.pdf

Solley, Wayne B., Pierce, Robert R., and Perlman, Howard A, 1993. Estimated Use of Water in the United States in 1990, U.S. Geological Survey Circular 1081, Table 12.
http://water.usgs.gov/watuse/tables/dotab.st.html

U.S. Census Bureau, Census Block Boundaries (DD, NAD83), Topologically Integrated Geographic Encoding and Referencing system, TIGER/Line files 2000.
http://www.census.gov/geo/www/tiger/

U.S. Department of Agriculture, Forest Service, Southwestern Region, U.S. Department of the Interior, Bureau of Reclamation and New Mexico State Office, 2006. Final Environmental Impact Statement for the Buckman Water Diversion Project. "Santa Fe National Forest and Taos Field Office of the BLM in Santa Fe County, New Mexico," 18 p.

U.S. Department of the Interior, Bureau of Reclamation, n.d., San Juan-Chama Project Colorado and New Mexico, Albuquerque, N.M., 15 March 2007.
http://www.usbr.gov/dataweb/html/sjuanchama.html

U.S. Environmental Protection Agency and the U.S. Geological Survey, National Hydrography Dataset Plus – NHDPlus, Version 1.0, 2005.

U.S. Environmental Protection Agency, 2006, Safe Drinking Water Information System, Personal Communication, Shirley Mlachak, 7 September 2006.

U.S. Geological Survey, Ground Water Atlas of the United States; Arizona, Colorado, New Mexico, Utah, HA 730-C. http://capp.water.usgs.gov/gwa/ch_c/C-text4.html

U.S. Senate and House of Representatives, Chapter 203-Public Law 485 [S.500], Colorado River Storage Project-Authority to construct, Operate and Maintain. April 11, 1956.

Utton, John and Wust, Stephen. (personal communication, October 23, 2007) Table 1 "Completed Transfers to the Buckman Wellfield" prepared by Santa Fe County in Santa Fe Water Rights Transfers, May 9, 2007.

Wilkins, D.W., 1986. Geohydrology of the Southwest Alluvial Basins Regional Aquifer-Systems Analysis, Parts of Colorado, New Mexico, and Texas, U.S. Geological Survey Water-Resources Investigations Report 84-4224, 23 p.

Wilson, Brian, Anthony A. Lucero, John T. Romero and Patrick J. Romero, 2003. Water Use by Categories in New Mexico Counties and River Basins, and Irrigated Acreage in 2000, State Engineer Technical Report 51, 12, 19, 83, 85-87, 89 pp.

Woodward, L.A., Callender, J.F., Seager, W.R., Chapin, C.E., Gries, J.C., Shaffer, W.L. and Zilinksi, R.E. (1978) Tectonic map of Rio Grande Rift region in New Mexico, Chihuahua, and Texas, IN Hawley, J.W., compiler, Guidebook to the Rio Grand Rift in New Mexico and Colorado: New Mexico. Bureau of Mines and Mineral Resources, Circular 163, scale 1:1,000,000, one sheet.