APPENDIX 12.8 - WATER USE

1. *Sample Questionnaire*

MIDDLE RIO GRANDE REGION- NM State Water Planning
RIO PUERCO Y RIO JEMEZ SUBREGIONS
Domestic Water Use Questionnaire

1. What is your current water budget? (What is your current supply source and amount? What are your current population, uses, and amounts)?

2. What are your current rates, (Do you have tiered rates)?

3. What is your projected water budget, by 2050 (see above)? (Possibly look at this in intervals of 10-15 years).

4. What are your plans for water management (transfers, developing supplies, meeting future supply needs?

5. What are your current abilities and future plans for storage and delivery of water for fighting fires?

6. How do you plan to deal with drought?

7. What is your plan for conservation now and in the future?

8. What if any current and previous water quality studies and analysis have been done on your water resources?

9. What water quality issues apply uniquely and specifically to your water resources, and how do these issues correlate with water supply issues?

10. What is the general assessment of the vulnerability of your water resources to contamination in relation to both surface and ground water?

Questionnaire Response - La Jara

1. THE LA JARA WATER USERS ASSOC. WATER SOURCE IS ENTIRELY SURFACE WATER FROM THE LA JARA CREEK. THE DIVISION POINT IS IN THE SANTA FE NATIONAL FOREST IN PROJECTED SECTION 23, T.22N., R.1W., JUST ABOVE THE DIVISION FOR THE LA JARA COMMUNITY ACEQUIA. WE CURRENTLY USE AN AVERAGE OF 35,000 GAL. PER DAY (13,000,000 +/- GAL. PER YEAR). WE HAVE 160 HOOKUPS WITH AN AVERAGE OF 130 BEING ACTIVE. THE U.S CENSUS PLACED THE POPULATION AT 219, BUT MY ESTIMATION IS MORE LIKE 300. THE WATER IS FOR DOMESTIC HOUSEHOLD USE ONLY (NO LANDSCAPE IRRIGATION ETC.) OUR CURRENT OPERATING BUDGET IS $65,000+.

2. CURRENTLY I ESTIMATE THAT THERE IS AN AVERAGE OF 2 TO 4 NEW HOOKUPS PER YEAR. IF WE USE THAT FIGURE TO PROJECT TO 2050 THERE WOULD BE A MAXIMUM OF 200 MORE HOOKUPS, WHICH IS, OF COURSE, UNREALISTIC. I ESTIMATE THAT THE SYSTEM COULD SUPPORT A MAXIMUM OF 200 HOOKUPS, BUT WOULD NOT ALWAYS HAVE ENOUGH WATER TO PROVIDE COMPLETE SERVICE WITH THE PRESENT SYSTEM. USING THE FIGURE OF 200 GAL/DAY WITH OUR PRESENT WATER RIGHTS AT 47.5 ACRE FEET, WE COULD THEORETICALLY PROVIDE WATER TO 212 FAMILIES. BUT THIS WOULD HEAVILY IMPACT THE OTHER MAJOR USER OF THE STREAM, THE LA JARA COMMUNITY ACEQUIA.

3. THE LA JARA COMMUNITY WATER ASSOC. NOW OWNS 47.5 ACRE FEET OF WATER RIGHTS. MORE WATER RIGHTS WOULD HAVE TO BE ACQUIRED TO PROVIDE WATER TO ALL IN THE FUTURE. THERE ARE NO CURRENT PLANS TO AQUIRE WATER RIGHTS. THERE HAS BEEN SOME TALK OF EITHER DRILLING A WELL IN THE LOWER PART OF THE SYSTEM TO INCREASE THE SUPPLY OR OF HOOKING UP TO THE GUTIERREZ SPRINGS, WHICH WAS THE ORIGINAL SOURCE FOR THE WATER SYSTEM. THE PROBLEM OF WATER RIGHTS WOULD STILL BE PRESENT. CONSERVATION OF WATER IS A MAJOR TOOL IN DEALING WITH INCREASED DEMAND.

4. CURRENTLY WE HAVE 3 STORAGE TANKS. ONE 10,000 GAL. TANK AT THE BEGINNING OF THE DISTRIBUTION SYSTEM; ONE 30,000 GAL. TANK MIDWAY; AND ONE 55,000 GAL. TANK NEAR THE END OF THE SYSTEM. TESTS HAVE FOUND THAT THE ONLY HYDRANTS ABLE TO DELIVER WATER AT ANY QUANTITY IS FROM THE HYDRANTS ALONG N.M. ROUTE NO. 96. HOWEVER, EVEN THESE HYDRANTS DO NOT HAVE THE MINIMUM ADEQUATE PRESSURE. PLANS HAVE BEEN DISCUSSED FOR THE INSTALLATION OF A LARGER TANK AT THE BEGINNING OF THE SYSTEM TO INCREASE STORAGE CAPABILITIES. HOWEVER, THE PRESSURES IN THE SYSTEM ARE LIMITED BECAUSE OF THE TREMENDOUS CHANGES IN ELEVATION. THE OVERALL PRESSER COULD BE INCREASED BY THE ADJUSTMENT OF THE PRESSURE RELIEF VALVES; BUT AT THE EXPENSE OF INCREASED BREAKS IN THE LINES AND HOUSEHOLDS.

5. THE FIRST SOLUTION WHICH THE ASSOCIATION IMPLEMENTED WAS THE DRASTIC INCREASE IN PRICE FOR USAGE OVER 6000 GAL./MONTH PER HOUSEHOLD. THIS GOT THE SYSTEM THROUGH A PERIOD OF VERY LOW WATER SUPPLY. A SECOND EMERGENCY SOLUTION WAS FORMULATED WHICH ENTAILED THE PURCHASE OF WATER FROM THE GUTIERREZ SPRINGS AND THE INSTALLATION OF A PORTABLE PROCESSING UNIT AND A LINE TO BE PATCHED IN JUST BEFORE TANK NO. 2. ALSO. THE DRILLING OF A WELL HAS BEEN CONSIDERED FOR EMERGENCY USE.

6. THE PRIMARY SOLUTION IS HIGH RATES FOR CONSUMPTION OVER 6000 GAL./MONTH. EDUCATION OF WATER USERS IN CONSERVATION IS NECESSARY.

7. NONE. THE ASSOCIATION WISHES TO PERFORM A WATERSHED STUDY.

8. SINCE ALL THE WATER USED IS SURFACE WATER, IT IS SUBJECT TO INCREASED RUNOFF DURING SPRING AND THUNDERSHOWERS. OUR PRESENT SYSTEM IS UNABLE TO MEET STATE REGULATIONS ON TURBIDTY AT THESE TIMES. EROSION CONTROL AND THINNING AND BETTER WATERSHED MANAGEMENT MAY PROVE TO HAVE AN IMPACT ON THE WATER QUALITY AND QUANTITY. ALSO, OUR WATER SUPPLY WOULD BE SEVERELY IMPACTED BY ANY FIRES IN OR NEAR THE WATERSHED AND BY AIR QUALITY.

9. SEE NO. 8 ABOVE. IF WELLS WERE TO BE USED THE PRESENCE OF SEPTIC TANKS AND AGRICULTURAL RUN OFF WOULD BE A FACTOR.

TIERED RATES FOR LA JARA ARE:

$30.00 for the first 3000 gallons plus tax ($1.80), then
$.02/gallon up to 6000 gallons,
$?/ gallon for anything above 6000 gallons

REGINA MDWCA, INC.
P.O. Box 427
Regina, NM 87046

April 13, 2003

Steering Committee (NM State Water Planning)

1. ***What is your current water Budget? (What is your current supply source and amount, current population, uses and amounts?)***

Regina has 17.750 Million gallons per year available from 1 well. We have a spring that is not producing at this time. The 17.750 Million/year translates to 1.48 million gallons per month. Our current use is an average of 0.75 million gallons average per month, including leaks and loss. We have 217 meters (Est. population of 500).

2. ***What is your projected water budget, by 2050? (Intervals of 10-15 years).***

Regina currently has a moratorium of installation of new meters. At the present time we will need additional source(s) of supply water before considering increasing the demand.

3. ***What are your plans for water management (transfers, developing supplies, meeting future supply needs).***

Regina has plans to clean and develop the San Jose Spring at such time as the drought allows for new water. The San Jose Spring should develop to a total production of approx. 16 GPM to 20 GPM. Additionally, we have a high loss to leaks that are undetectable which we have plans to try every effort to locate and repair all leaks. The leak repair would release an additional 0.297 million gallon per month. We also have plans to complete the Phase II portion of the upgrade project.

4. ***What are you current abilities and future plans for storage and delivery of water for fire fighting?***

Regina has one (1) 200,000 gallon storage tank with a 6" line from the well site to the tank. The 6" line couples to two (2) 15,000 gallon tanks by way of an altitude valve. The 6" line has four (4) 6" Fire Hydrants and a four (4) inch line is attached to the two (2) 15,000 gallon tanks with one (1) 4" Fire hydrant on it.
Our future plans include the completion of Phase II of the upgrade project, which includes approx. 32,000' of additional 6" line with ten (10) added 6" Fire Hydrants.

5. ***How do you plan to deal with Drought?***

Regina is in one of the longest drought conditions that this area has experienced. We are using our backup source, the San Pedro Well, for primary use at this time due to drought conditions affecting the flow of the San Jose Spring. The only choice of additional supply is for a second deep well. That is not being considered at the present time, but must be considered in the future, especially if the springs do not return to full flow after the drought conditions are past.

6. ***What is your plan for conservation now and in the future?***

Regina is in the process of testing the static level and drawdown level of the San Pedro Well. The test results will determine how aggressive we may have to be toward water use restrictions. The present restrictions regulate outside watering to be done only between the hours of 10:00 PM and 6:00 AM. We have issued letters to users that encourage home conservation of water.
The future restrictions will depend on how long the drought does last and how the single source of the San Pedro well is required to provide the demand.

7. ***What is any current and previous water quality studies and analysis have been done on your resources?***

Both, the San Pedro Well and the San Jose Spring have monthly quality test. The second spring, The South Spring, did test positive as being influenced by surface water and we were required to turn that spring out of the system.
All water for the system is routinely tested according to the Safe Drinking Act, with no negative result. The last Sanitary Survey was completed in September of 2001.

8. ***What water quality issues apply uniquely and specifically to your water resources and how do these issues correlate with water supply issues?***

The only water quality issue that applies to any of our resources is South Spring being influenced by surface water. That does contaminate that spring. The correction will involve reworking that spring and the re-testing of the same. This will only be considered after we are out of the drought conditions.

9. ***What is the general assessment of the vulnerability of your water Resources to contamination in relation to both surface and ground water?***

Regina MDWCA, Inc. does have a wellhead protection plan in effect and it is enforced. All of the storage tanks above ground are fenced and hatch lids remain locked at all times.

Ponderosa Mutual Domestic Association Questionnaire Responses, December 2003.

The Resolution will be presented to our Board at JAN 04 meeting. - Sorry for the Delay —

MIDDLE RIO GRANDE REGION- NM State Water Planning
RIO PUERCO Y RIO JEMEZ SUBREGIONS
Domestic Water Use Questionnaire

1. What is your current water budget? (What is your current supply source and amount? What are your current population, uses, and amounts)? Domestic Drinking water; 78.9 F/Annum of water rights owned by PMDWCA; Population ~325; Supply is Vallecitos feeder springs; current use = 38 AF/Annum
2. What are your current rates, (Do you have tiered rates)? yes
0 - 3000 gals → 18.00 3001 - 7000 → 1.75/1000 +10,000 → 2.25/1000
3001 - 5000 → 1.25/1000 7001 - 10000 → 2.00/1000
3. What is your projected water budget, by 2050 (see above)? (Possibly look at this in intervals of 10-15 years).
We are working on a 40 yr plan at this Time.
4. What are your plans for water management (transfers, developing supplies, meeting future supply needs? Our supply + ownership of water rights exceeds our current need by nearly double. We have already been working on future needs by buying & transferring water rights.
5. What are your current abilities and future plans for storage and delivery of water for fighting fires? We are in a shortage of stored water for fire protection. Our 40 yr plan will include additional storage facilities.
6. How do you plan to deal with drought?
Strict conservation / or penalty.
7. What is your plan for conservation now and in the future?
Human consumption first ALL other needs third
Animal needs Second
8. What if any current and previous water quality studies and analysis have been done on your water resources? Our water is tested monthly + quarterly by NMED. EPA has selected our system to do time / unregulated contaminants on. To date our water is fine!
9. What water quality issues apply uniquely and specifically to your water resources, and how do these issues correlate with water supply issues?
NONE -
10. What is the general assessment of the vulnerability of your water resources to contamination in relation to both surface and ground water?
Our new collection gallery eliminated much of the surface water vulnerability to air + water borne contaminants, Terrorism or vandalism are our concerns now.

Sierra Los Pinos Questionnaire Responses

MIDDLE RIO GRANDE REGION- NM State Water Planning
RIO PUERCO Y RIO JEMEZ SUBREGIONS
Domestic Water Use Questionnaire

1. What is your current water budget? (What is your current supply source and amount? What are your current population, uses, and amounts)?
158 lots ± 3 ~65% developed — ground ~300 ft ~60 acre-ft
house hold use — ~50 acre-ft/year use — $13K/year ± 10k

2. What are your current rates, (Do you have tiered rates)?
Association dues $380 per lot per year and this includes Road maintenance and operating expenses

3. What is your projected water budget, by 2050 (see above)? (Possibly look at this in intervals of 10-15 years).
what ever improvements the population approves and pays for.

4. What are your plans for water management (transfers, developing supplies, meeting future supply needs?
perhaps purchase water rights - installing additional holding tanks - finding the limits of development for this area

5. What are your current abilities and future plans for storage and delivery of water for fighting fires?
water in water tanks - 5K gal in Fire station
some fire stands on the older portion of the sub-division land in newer units served by 2 systems

6. How do you plan to deal with drought?
pray

7. What is your plan for conservation now and in the future?
future installation of meters on all lots - perhaps charge by use

8. What if any current and previous water quality studies and analysis have been done on your water resources?
on going - No problems

9. What water quality issues apply uniquely and specifically to your water resources, and how do these issues correlate with water supply issues?
No water quality issues

10. What is the general assessment of the vulnerability of your water resources to contamination in relation to both surface and ground water?
only - Not anticipated

2. Response from Cuba to Request for Information - included in Appendix 2 of Public Water System Contact Database, Survey, and Survey Responses of *Historical and Current Water Use in the Middle Rio Grande Region,* John Shomaker & Associates and PioneerWest, June 2000.

02/16/00 23:20 FAX 5052993769 VILLAGE OF CUBA

ebruary 04, 2000 11:30 AM To: Osma From: , 505-252-0372 Page: 2 of 2

CUBA WATER + SEWER SYSTEM

Middle Rio Grande Water Assembly
Historic Water Demand Study
Survey of Water Systems
February, 2000

The Middle Rio Grande Water Assembly is carrying out a study of historic and current water demand in the region. The objective is to provide the basis for forecasts of future demand in order to answer one of the five essential questions - How much water is needed now and how much will be needed in the future?

Each of the water systems that supply large and small communities throughout the region deliver a portion of the water that contributes to total demand. So we are asking that you take some time to consider the data that you have about the quantities of water that are supplied by your system and send this data to us.

Here's what we need:
1. Total population served 800
2. Total quantity of water delivered 925000 gallons per day 925,000 gal/day
3. Source of water, quantity from groundwater and surface water. Groundwater
4. Portion of total water delivered for these uses:
   - Residential 448
   - Commercial 97
   - Industrial
   - Recreation (parks and golf courses) 1
   - Agriculture
   - Other (specify - "Internal", mining, livestock, etc.) 2
5. Price of the water delivered 25.00 min - Commercial $8.50 min - residential
6. Total quantity of water returned through a wastewater treatment facility 40,000 gallons per day
7. Treated wastewater discharge location. Rio Puerco SR 197
8. Is treated wastewater reused? If so, specify uses and quantities. no
9. Quantity of water lost through evaporation from wastewater treatment facility. unknown

Please provide this data for the most current year for which complete data is available and for previous years. If you have a demand forecast, please add this as well.

Please provide the following basic information:

10. System name Cuba Water and Sewer System
11. Geographic area served
12. Address, phone, fax and Email P.O. Box 426, Cuba, NM 87013 289-3764 - Vandora 289-3769 - FAX
13. Contact person

Send the data to:
MRG Water Demand Study
John Shomaker & Associates
2703 Broadbent Parkway NE
Albuquerque, NM 87107
FAX: 505-345-9920
Email jsai@shomaker.com

Note: Electronic format, such as Excel or Lotus 123 is preferred.

Many thanks for your assistance with this essential research. If you have questions or need additional information, please call us at 505-265-3231. If you are not on the mailing list of the Middle Rio Grande Water Assembly and would like to receive newsletters and announcements of meetings, please let us know. THANKS!

3. Information about Jemez Springs Domestic Water Cooperative Association

http://www.j-a-r-a.org/

Official web page of the Jemez Area Residents Association
Fall 1998

Cooperative Helps Quench Valley's Big Thirst

Water is literally the life blood of any community. Sources of water for Jemez area residents vary, but none of us is exempt from the need for a safe and reliable source of water. Both quality and quantity are concerns for all of us.

With this in mind, *JARA* recently interviewed Emmett Cart, President, and Tom Abousleman, Vice President of the Jemez Springs Domestic Water Cooperative Association, the major source of water for residents who live in the canyon along Route 4 from just north of Area 3 south to just south of the sewer plant.

"Running Water"

Cart began with a brief description of the system of "running water" in Jemez Springs more than 50 years ago and before the cooperative was formed.

"You got a bucket, ran down to the river, filled the bucket then ran back home. That was running water!" Abousleman's family fared a little better, since their dad had designed and executed a system for pumping water from the river up into a tank situated above what is now the Los Ojos Bar. Gravity pulled water down to the house through a lone faucet in the bathroom. This was when even a bathroom was a luxury for Jemez Springs!

It's no wonder that a fair amount of interest was shown when Tom Abousleman's brother, Fred, called a meeting on Feb 18, 1947 in the dining room of Abouselman's home. The agenda: "A Proposed Water Project." Not everyone was as enthused as Cart and the Abouslemans. Some were skeptical of the daunting task. "If you get the water to my front door, then maybe I'll get involved," one person was reported to have said.

There were enough folks interested, however, so that with a loan of $52,000 and a lot of hard work (both Cart and Abousleman remember hauling cement on their backs) the first spring was tapped in Church Canyon (behind the Jemez State Monument).

Encounter With A bear

Much has happened between 1947 and today, including an episode in which a curious bear chewed through an above-ground main water pipe in the 1950s. Engineers eventually recommended the abandonment of the Church Canyon spring, and it is no longer a source, although there are now three storage tanks there.

Presently, water for the cooperative comes from three springs located in Area 1, Area 3 and and from a site known locally as Gallagher. These continue to be very productive. The Gallagher site, located one mile north of the cooperative's newest 460,000 gallon, glass-lined tank on the west side of Route 4, runs at about 30 gallons a minute. The springs at the top of Area 1 and Area 3 both produce about 15 gallons per minute. Because the water sources are all high mountain springs, the system depends entirely on gravity, and no pumps are required to fill the storage tanks. However, the distribution of water from the three sources to meet the demand in various sections is sometimes tricky, which explains why faucets may run dry in some sections during peak demand until a water employee can redirect the flow from one section to another.

In addition to the new tank on Route 4, storage is provided by three 70,000 gallon tanks located in Church Canyon, two 20,000 gallon tanks atop Area 1 and one 5,000 gallon tank and two 20,000 gallon tanks atop Area 3. The nine tanks provide a combined storage capacity of 755,000 gallons to serve the cooperative's business and residential customers. The system presently has 369 water meters.

Cost Competitive

The cost of water remains very competitive, according to water office manager Susan Stephens. Residents who move here from other communities estimate that in a range of high and low water fees the cooperative's charges fall in the lower third. The monthly basic rate for domestic dwellings is a minimum of $23.68 for up to 2500 gallons and for commercial accounts a minimum of $39.65 for up to 3000 gallons.

According to Cart and Abousleman in all the years since the cooperative began they have never run out of water. When a serious shortage is anticipated customers are notified and serious conservation is expected and observed. Major offenders in the hot summer months are customers with access to the ditch system who use water from the cooperative for irrigating gardens, according to Operator John Kennedy.

"The system was designed to be used for household use, not irrigation," says Kennedy. Free literature from the New Mexico State Engineer Office Water Conservation Program explaining how users can conserve water is available in the Jemez Water Coop office. You can also call the state office at 1-800-WATER-NM.

When asked about water quality, both Abousleman and Cart state that the water is checked on a routine schedule (at least once a month) and that no serious problems have been detected. Periodic fluctuations in quality are normal, according to the two water officials. If there is an indication that water has fluctuated toward unacceptable levels or there is even the possibility of contamination from a break or leak, a burst of chlorine is added to the system. This is called "shocking" the system and might explain the occasional strong taste and smell of chlorine many of us wonder about.

When asked about how the cooperative will meet its future needs, both men emphasize that wise use of water is the key as well as several options to accommodate increased demand on the

system. Adding another spring source, digging wells and increasing storage capacity, are all possibilities.

20 Miles Of Pipes

Because of the age of the system, the pipelines - there may be as many as 20 miles of them - are being replaced in an ongoing effort to upgrade the facilities. Periodic leaks and breaks, of course, get priority. (As some of us can attest to from seeing Operator Kennedy and his assistant, Doug LaRue, working all hours of the night and day to put things right!) PVC is the replacement material of choice for most of the system. A large section of 2-inch galvanized pipe has already been replaced between the Gas Station Theatre and Credit Union.

Abousleman acknowledged that as a member of one of the founding families he has the dubious honor of being named in a lawsuit filed by the federal government in 1983 on behalf of the Zia, Santa Ana and Jemez pueblos against the cooperative. In the official title of the suit he's the Tom in the Tom Abousleman et Al.

660 Non-Indians Also Sued

In the lawsuit the pueblos seek the adjudication of water rights in the entire Jemez River Drainage Basin. In addition to pueblo residents, the suit affects about 660 non-Indian water right holders in the drainage basin. Negotiations continue. For a while there was a monthly surcharge on all coop water bills to pay legal fees, but this has been discontinued until funds from past collections (presently in escrow) have been exhausted.

People at the cooperative take genuine pride in their work. Kennedy noted that cooperative officials give him pretty much free rein to make necessary improvements, and that they always support using the best materials available to avoid costly repairs later on.

Exclusively Spring Water

Water officials take a special pride in the "luxury" that they are the only water cooperative they know of whose exclusive source is mountain springs! So far they haven't picked up on the suggestion that they "bottle" that luxury, but they do hope that members of the cooperative realize the value of what they have. And they urge any member of the cooperative to come by the office if they have any questions

The 1999 Annual Meeting of the Jemez Springs Domestic Water Cooperative will be held at 7 p.m. in the American Legion Hall on April 30th, 1999. ***- Jim Forcier-Call, Fall 1998***

Data from Department of Agriculture

☞ Reported for Sandoval County -- Not Broken out between the three watersheds
This information is included here in as much as agriculture is an important economic activity in both the Río Puerco and the Río Jemez. Agricultural property is taxed at a higher rate than ranchlands, generating revenue to the County.

1997 CENSUS OF AGRICULTURE, COUNTY DATA
USDA, National Agricultural Statistics Service
http://www.nass.usda.gov/census/census97/volume1/nm-31/nm2_06.pdf
2002 Census data will be available June 2004**.**

Table 1. **County Summary Highlights: 1997**

Farms number	353
Land in farms acres	779 766
Average size of farm acres	2 209
Median size of farm acres	60
Estimated market value of land and buildings[1]:	
Average per farm dollars	373 723
Average per acre dollars	178
Estimated market value of all machinery and equipment[1]:	
Average per farm dollars	25 545
Farms by size:	
1 to 9 acres	87
10 to 49 acres	84
50 to 179 acres	62
180 to 499 acres	41
500 to 999 acres	25
1,000 acres or more	54
Total cropland farms	231
acres	31 822
Harvested cropland farms	171
acres	6 410
Irrigated land farms	211
acres	10 731
Market value of agricultural products sold $1,000	9 987
Average per farm dollars	28 291
Crops, including nursery and greenhouse	
crops $1,000	2 137
Livestock, poultry, and their products $1,000	7 850
Farms by value of sales:	
Less than $2,500	173
$2,500 to $4,999	49
$5,000 to $9,999	49
$10,000 to $24,999	40
$25,000 to $49,999	20
$50,000 to $99,999	11
$100,000 or more	11
Total farm production expenses1 $1,000	6 969

Average per farm dollars	19 799
Net cash return from agricultural sales for the	
farm unit (see text)[1] farms	352
$1,000	2 464
Average per farm dollars	7 001
Operators by principal occupation:	
Farming	154
Other	199
Operators by days worked off farm:	
Any	193
200 days or more	119
Livestock and poultry:	
Cattle and calves inventory farms	221
number	16 502
Beef cows farms	192
number	(D)
Milk cows farms	9
number	(D)
Cattle and calves sold farms	194
number	8 709
Hogs and pigs inventory farms	11
number	119
Hogs and pigs sold farms	5
number	176
Sheep and lambs inventory farms	36
number	632
Layers and pullets 13 weeks old and older	
inventory (see text) farms	19
number	529
Selected crops harvested:	
Corn for grain or seed farms	12
acres	769
bushels	41 905
Wheat for grain farms	2
acres	(D)
bushels	(D)
Haymalfalfa, other tame, small grain, wild,	
grass silage, green chop, etc (see text) farms	116
acres	5 146
tons, dry	17 926
Land in orchards farms	42
acres	230

[1]Data are based on a sample of farms.

Table 6. **Farms, Land in Farms, Value of Land and Buildings, and Land Use: 1997 and 1992**
[For meaning of abbreviations and symbols, see introductory text]

FARMS AND LAND IN FARMS	1997		1992
Farms number, 1997	353	1992	345
Land in farms acres, 1997	779 766	1992	770 155
Average size of farm acres, 1997	2 209	1992	2 232
Estimated market value of land and buildings1 farms, 1997	352	1992	344
$1,000, 1997	131 550	1992	248 877
Average per farm dollars, 1997	373 723	1992	723 478
Average per acre dollars, 1997	178	1992	321
1997 size of farm:		1992 size of farm:	
1 to 9 acres farms	87	1 to 9 acres farms	87
acres	344	acres	365
10 to 49 acres farms	84	10 to 49 acres farms	81
acres	1 959	acres	1 771
50 to 69 acres farms	12	50 to 69 acres farms	15
acres	728	acres	870
70 to 99 acres farms	15	70 to 99 acres farms	11
acres	1 303	acres	984
100 to 139 acres farms	15	100 to 139 acres farms	20
acres	1 776	acres	2 294
140 to 179 acres farms	20	140 to 179 acres farms	24
acres	3 163	acres	3 937
180 to 219 acres farms	10	180 to 219 acres farms	11
acres	1 963	acres	2 114
220 to 259 acres farms	6	220 to 259 acres farms	5
acres	1 430	acres	1 233
260 to 499 acres farms	25	260 to 499 acres farms	25
acres	8 796	acres	9 193
500 to 999 acres farms	25	500 to 999 acres farms	22
acres	17 584	acres	15 529
1,000 to 1,999 acres farms	26	1,000 to 1,999 acres farms	16
acres	37 316	acres	22 747
2,000 acres or more farms	28	2,000 acres or more farms	28
acres	703 404	acres	709 118

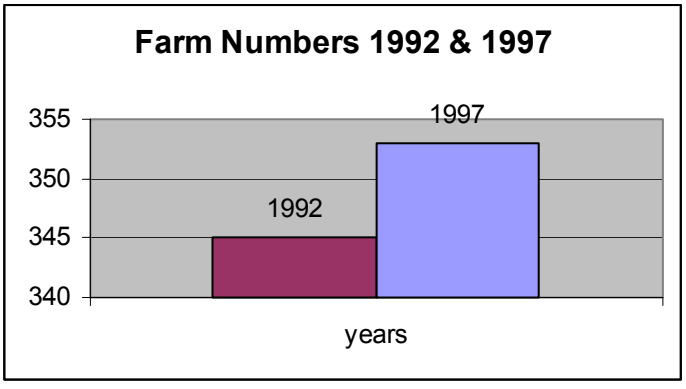


Table 7. **Harvested Cropland by Size of Farm and Acres Harvested: 1997 and 1992**

Farms number, 1997	171	acres harvested, 1997	6 410
1992	171	1992	6 761
HARVESTED CROPLAND BY SIZE OF FARM		HARVESTED CROPLAND BY ACRES HARVESTED	
1997 size of farm:		1997 acres harvested:	
1 to 9 acres farms	48	1 to 9 acres farms	84
acres harvested	128	acres	280
10 to 49 acres farms	63	10 to 19 acres farms	39
acres harvested	690	acres	493
50 to 69 acres farms	6	20 to 29 acres farms	18
acres harvested	167	acres	402
70 to 99 acres farms	6	30 to 49 acres farms	10
acres harvested	227	acres	370
100 to 139 acres farms	5	50 to 99 acres farms	10
acres harvested	(D)	acres	660
140 to 179 acres farms	10	100 to 199 acres farms	3
acres harvested	424	acres	(D)
180 to 219 acres farms	3	200 to 499 acres farms	4
acres harvested	170	acres	1 116
220 to 259 acres farms	3	500 to 999 acres farms	1
acres harvested	120	acres	(D)
260 to 499 acres farms	11	1,000 acres or more farms	2
acres harvested	498	acres	(D)
500 to 999 acres farms	5		
acres harvested	91		
1,000 to 1,999 acres farms	2		
acres harvested	(D)		
2,000 acres or more farms	9		
acres harvested	3 370		
1992 size of farm:		1992 acres harvested:	
1 to 9 acres farms	47	1 to 9 acres farms	84
acres harvested	177	acres	364
10 to 49 acres farms	61	10 to 19 acres farms	41
acres harvested	697	acres	537
50 to 69 acres farms	11	20 to 29 acres farms	16
acres harvested	321	acres	368
70 to 99 acres farms	2	30 to 49 acres farms	13
acres harvested	(D)	acres	478
100 to 139 acres farms	7	50 to 99 acres farms	6
acres harvested	186	acres	(D)
140 to 179 acres farms	11	100 to 199 acres farms	6
acres harvested	611	acres	919
180 to 219 acres farms	6	200 to 499 acres farms	3
acres harvested	269	acres	1 100
220 to 259 acres farms	1	500 to 999 acres farms	–
acres harvested	(D)	acres	–
260 to 499 acres farms	8	1,000 acres or more farms	2
acres harvested	434	acres	(D)
500 to 999 acres farms	3		
acres harvested	(D)		

1,000 to 1,999 acres farms	3
acres harvested	55
2,000 acres or more farms	11
acres harvested	3 845

Total cropland farms, 1997	231
1992	234
acres, 1997	31 822
1992	25 554
Harvested cropland farms, 1997.	171
1992	171
acres, 1997	6 410
1992	6 761
Cropland used only for pasture or grazing farms, 1997	120
1992	123
acres, 1997	17 794
1992	15 990
Other cropland farms, 1997	57
1992	38
acres, 1997	7 618
1992	2 803
Cropland in cover crops, legumes, and soil~improvement grasses, not harvested and not pastured farms, 1997	14
1992	14
acres, 1997	198
1992	99
Cropland on which all crops failed farms, 1997	7
1992	6
acres, 1997	54
1992	(D)
Cropland in cultivated summer fallow farms, 1997	10
1992	5
acres, 1997	393
1992	(D)
Cropland idle farms, 1997	41
1992	23
acres, 1997	6 973
1992	2 593

Total woodland farms, 1997	42
1992	33
acres, 1997	79 201
1992	84 455
Woodland pastured farms, 1997.	33
1992	25
acres, 1997	70 556
1992	79 641
Woodland not pastured farms, 1997	14
1992	8
acres, 1997	8 645
1992	4 814
Other land farms, 1997.	256
1992	223
acres, 1997	668 743
1992	660 146
Pastureland and rangeland other than cropland and woodland pastured farms, 1997	143
1992	128
acres, 1997	654 569
1992	636 907
Land in house lots, ponds, roads, wasteland,, etc. farms, 1997	171
1992	120
acres, 1997	14 174
1992	23 239
Pastureland, all types farms, 1997	246
1992	243
acres, 1997	742 919
1992	732 538
Land under Conservation Reserve or Wetlands Reserve Programs farms, 1997	2
1992	–
acres, 1997	(D)
1992	–

Table 13. **Selected Crops Harvested: 1997 and 1992**

Harvested cropland farms, 1997		171	Wheat for grain farms, 1997		2
	1992	171		1992	6
acres, 1997		6 410	acres, 1997		(D)
	1992	6 761		1992	55
Irrigated farms, 1997		165	bushels, 1997		(D)
	1992	159		1992	2 050
acres, 1997		6 028	Irrigated farms, 1997		1
	1992	6 187		1992	6
Corn for grain or seed farms, 1997		12	acres, 1997		(D)
	1992	10		1992	55
acres, 1997		769	1997 farms by acres harvested:		
	1992	121	Hay, alfalfa, other tame, small grain, wild, grass		
bushels, 1997		41 905	silage, green chop, etc (see text)		
	1992	16 802	farms, 1997		116
Irrigated farms, 1997		8		1992	123
	1992	8	acres, 1997		5 146
acres, 1997		603		1992	4 791
	1992	71	tons, dry, 1997		17 926
1997 farms by acres harvested:				1992	13 744
1 to 24 acres		6	Irrigated farms, 1997		115
25 to 99 acres		4		1992	119
100 to 249 acres		1	acres, 1997		4 940
250 to 499 acres		1		1992	4 349
500 acres or more		–	1997 farms by acres harvested:		
			1 to 24 acres		86
			25 to 99 acres		21
			100 to 249 acres		5
			250 to 499 acres		2
			500 acres or more		2

Table 38. **Operators of Spanish, Hispanic, or Latino Origin: 1997 and 1992**

All farms		Farms with sales of $10,000 or more	
Farms	Land in farms	Farms	Land in farms
49	97,157	37	52,349

http://www.nass.usda.gov/nm/nmbulletin/Farmnum.txt

2000 New Mexico Agricultural Statistics

Census Number of Farms by County1/

County	1987	1992	1997
Sandoval	379	345	353

1/County level data not adjusted for coverage estimation.

Cash Receipts:

All Farm Commodities by County1/

		All Farm Commodities		
County	2000 Rank	19982/	19992/	2000
		1,000 Dollars		
Sandoval	27	12,960	12,636	15,598

1/ Does not include cash receipts received for livestock grazing. May not sum due to rounding.
2/ Revised.

http://www.nass.usda.gov/nm/nmbulletin/Irrcrop.txt

20001/ Irrigated Crop Acreage
Water Use and Conservation Bureau
Office of the State Engineer

County	Alfalfa	Barley	Berries	Chile	Corn	Cotton	Fruit Orchards	Grapes	Other Hay
Sandoval	4,100	---	---	400	425	---	410	35	---

1/2001 data not available.
2/1999 data.

County	Lettuce	Misc Field Melons	Misc Small Crops	Misc Grains	Misc Vegetables	Nursery Stock	Oil Seeds	Onions	Pasture	Peanuts
Sandoval	---	---	400	100	1,000	---	---	---	2,370	---

San Juan Basin Regional Water Plan
Section 9 – Water Plan Alternatives

9.9. Navajo Nation Water Plan Alternatives

The Navajo Nation Department of Natural Resources provided the information for Section 9.9

The Navajo Reservation was established in 1868, and has been expanded through a series of executive orders to become the largest Indian reservation in the United States. Within Region 2, this expansion began with the Navajo Treaty Reservation, which was established by Article 11 of the Treaty on June 1, 1868. It was expanded by the second addition to the Navajo Treat Reservation on the south and the east by executive orders of January 6, 1880, May 17, 1884 and April 24, 1886. A series of later executive orders from 1907 through 1912 added additional land around Crownpoint known as the "Checkerboard". Since the 1960's additional lands were acquired for the Navajo Indian Irrigation Project, and through small acquisitions and exchanges. Larger than the state of West Virginia, the Navajo Nation encompasses more than 27,000 square miles including portions of Arizona, New Mexico, and Utah. According to the U.S. Census Bureau, in 2000 the on-reservation population was 183,000. Approximately one third of the Navajo Nation's land base and population are within the State of New Mexico. The 2000 U.S. Census reported that approximately 300,000 people indicated that they had a Navajo background.

Even after more than 100 years of federal trusteeship, the Navajo Nation faces serious economic and social challenges. In 1999, the Navajo Division of Economic Development reported that the median family income was only $11,885 while the U.S. median family income was more than $30,000. The average per capita income for the Navajo Nation was less than $6,200 while the per capita income for the State of Arizona was approximately $25,000. More than 56 percent of the Navajo families on the reservation lived below the federal poverty levels, compared with less than 13 percent of the general U.S. population, making it among the most impoverished regions in the United States.

The Navajo unemployment rate on the reservation is 54 percent, compared to an unemployment rate for the U.S. of approximately 5 percent. These disparities show no sign of narrowing, and while the surrounding regional economy has boomed, these gaps in income, unemployment, and poverty have widened. The Navajo Housing Authority estimated that the Navajo Nation has an immediate unmet need for more than 20,000 housing units.

The Navajo Nation faces serious water resource problems. Many homes lack indoor plumbing. More than 50 percent of Navajo homes lack complete kitchens and between 20 and 50 percent of Navajo households rely solely on water hauling to meet daily water needs. Safe drinking water is a precondition for health promotion and disease prevention. The Navajo Tribal Utility Authority

(NTUA) water users use far less water per capita than the other water users in the Region, yet pay among the highest water rates.

These grim statistics threaten the survival of the Navajo Nation. According to the Division of Community Development, due to the stagnation of economic development in Navajo country, the Navajo Nation is losing population to off-reservation communities, the Four Corners Area, and the other 46 states. Between 1980 and 1990 the Navajo off-reservation population in New Mexico, Arizona, and Utah grew by 125 percent, the Navajo population in the other 46 states grew by 71 percent, while the on-reservation population grew by only 22 percent. In 1996, the Navajo Nation Division of Community Development estimated that without reducing the out-migration by 2012, more than half of the Navajo people might be living off of the Navajo reservation.

The Indian Health Service (IHS) is the pre-eminent domestic water development agency on the Navajo Nation. Public Law 86-121 authorizes IHS to provide essential water supply and storage facilities for communities and homes on the reservation. The IHS annually compiles the sanitation deficiency report of Sanitation Deficiency System (SDS) list for the Navajo Nation. The SDS ranks proposed water projects on very specific and objective criteria including health impact, water system deficiency, first water service, capital cost, operation and maintenance costs, and other contributions. The most important SDS criterion is the unit cost per house. Due to funding limits, it is not possible for the IHS to provide water from a public water system to every household on the reservation. To be feasible, homes must be served at a cost of less than $40,000 for the water supply and sewer service. In 2001, the IHS identified $294 million in water system deficiencies, $78 million in sewer deficiencies, and $10.5 million in solid waste deficiencies. Approximately 40 percent of these deficiencies are in Region 2. However, the annual IHS budget for addressing sanitation deficiencies is only $13 million per year. The IHS also spent $10 million on water systems for new or nearly new homes. The IHS also leveraged an additional $7 million from other programs to supplement its construction program. Due to lack of funding, the HIS has a ten to twenty-year backlog of projects to meet existing demands.

For municipal water demand planning the NDWR recommends using the U.S. Census Bureau population count adjusted by an estimated undercount, a growth rate of 2.48 percent from the year 2000 through 2050, and a per capita municipal demand of 160 gallons per capita per day. Due to the difficulty in conducting an accurate census, determining the growth rate of the Navajo Nation is difficult. The Navajo Nation's reported annual increase in population changes dramatically from one census to the next. For instance, during the 1950s the reported annual growth rate was 3.57 percent, during the 1960s it was 1.45 percent, during the 1970s it was 1.76 percent, and during the 1980s it was 4.48 percent. (*1990 Census-Population and Housing Characteristics of the Navajo Nation*, Rodgers, 1993).

In 1984, Reclamation used a projected population growth rate of 2.5 percent (*1984 Plan Formulation and Environmental Statement*, Reclamation, 1984). The Institute of Distribution and Development Studies at Colorado State University evaluated the changes in annual growth rates of the Navajo Nation and concluded that a reasonable growth rate for planning is 2.48 percent (*Employment and Incomes in the Navajo Nation: 1987 - 1988, Estimates and Historical Trends,* Eckert. et. al., 1989). In 1993, Northwest Economic Associates also

developed a cohort model of the Navajo population and reached the same conclusion (*Support Documentation for Current and Projected Population of the Little Colorado River and N-Aquifer Basin*, NEA, 1993). Most recently, HDR Inc. reported that 2.48 percent was an appropriate midrange estimate for population projections (*Assessment of Western Navajo and Hopi Water Supply Needs, Alternatives and Impacts*, HDR, 2003). Part of the HDR justification for this growth rate was the possibility for significant in-migration due to the sizable population of Navajos living off of the Navajo Reservation, and the significant investment being made in housing, schools, roads, hospitals, utilities and other critical infrastructure.

A recent 1996 study by the University of New Mexico Bureau of Business and economic Research (BBER) estimated that the 1990 annual growth rate for Native Americans was 1.86 percent. That study combined members of the Navajo Nation, and the Pueblos of Acoma Laguna and Zuni. However, the BBER study did not adequately address how the current lack of critical infrastructure, including water facilities, is one of the greatest factors leading to stagnant economic growth and increased out-migration.

Per capita water use for Chapters depends on the accessibility of the water supply. An increase in per capita water use is correlated with community growth, development, and improved economic standards of living. Historic data for non-reservation communities in the region show that water use has increased over time and current average per capita use is at or exceeds 160 gallons per day. The 160 gallons per capita per day rate includes modest commercial and municipal demands comparable to cities such as Winslow, Arizona, or Gallup, New Mexico. By comparison, the nearby communities of Rio Rancho and Albuquerque use more than 200 gallons per capita per day (Brown et. al., 1996). Therefore, a municipal rate of 160 gallons per capita per day is used to determine the projected water demand.

As challenging as the current circumstances are, without dramatically increased water resource development, the future may be bleaker. Based on an annual growth rate of 2.48 percent and a per capita water demand of 160 gallons per capita per day, the total annual municipal water demand on the reservation will exceed 89,000 acre-feet by the year 2040.

The water delivery systems will require a six-fold increase in capacity. Overcoming the legacy of economic neglect and the readily apparent deficits in the infrastructure will require a very aggressive water development program.

The lack of domestic and municipal water is the greatest water resource problem facing the Navajo Nation. The current demand for municipal water is not met by public water supply systems. No other region in the United States has such a large percentage of its population lacking in such a basic necessity as potable tap water. Access to adequate water is critical for economic growth and the survival of the Navajo culture. In response to this problem, the Navajo Department of Water Resources (NDWR) prepared the *Water Resources Development Strategy for the Navajo Nation* (Strategy Document, NDWR, 2000). A copy of the *Water Resources Development Strategy for the Navajo Nation* is located in **Volume II, Appendix A-5**. That document broadly describes the steps that the Navajo Nation can take to address municipal water development. These steps, and some of the specific projects, are described in the following sections.

9.9.1. **Establishing a Water Resource Development Task Force, Which Will Coordinate Technical and Fiscal Resources of the Navajo Nation and Federal Agencies**

The Navajo Nation will work to ensure that its divisions work together under a single plan, and dedicate staff and resources toward its implementation. However, due to the magnitude and complexity of the deficiencies, to make significant inroads, the Navajo Nation must rely on the budgets and expertise of several Federal agencies. A water resource development task force will coordinate technical and fiscal resources of the Navajo Nation and Federal agencies. This will reduce agency redundancy and enable the agencies to utilize their combined resources more effectively.

9.9.2. **Preparing a Reservation-Wide Needs Assessment and Prioritizing Water Projects**

The Navajo Nation must systematically identify the full scope and needs of water development. The Navajo Nation is preparing a reservation-wide assessment of the local needs by assessing the water resource deficiencies throughout the reservation and establishing federal/tribal coalitions that can effectively construct the infrastructure identified in the needs assessments. The reservation will be assessed regionally by breaking the studies into manageable parts. The regions will be based on the service areas of the major water supply projects and on jurisdictional boundaries.

9.9.3. **Developing Regional Water Supply Projects**

The cornerstones of the Navajo water development strategy are several large, regional water supply projects that will provide new and reliable water for domestic and municipal use. Two of these projects, including the Navajo-Gallup Water Supply Project and the Farmington to Shiprock Pipeline, are in Region 2.

9.9.3.1 **Farmington to Shiprock Pipeline**

The Shiprock Area is one of the fastest growing areas on the Navajo Reservation. By 2040 the population may approach 50,000. The Farmington to Shiprock Pipeline, also referred as the Navajo Municipal Pipeline, will supply water to meet most of the 2020 municipal water demands of seven Navajo Chapters along the San Juan River including Beclabito, Cudei, Hogback, Nenahnezad, San Juan, Shiprock, and Upper Fruitland. The 2020 municipal water demand is expected to exceed 5,100 acre-feet per year. The projected municipal water demands for these Chapters in 2040 are shown in Table 9.1. This pipeline was authorized for construction by the Colorado Ute Settlement Act amendments of 2000 (Public Law 106-554). The Navajo Department of Water Resources has not proposed any municipal groundwater development projects for these Chapters.

Table 9.1: Chapters Served by the Farmington-Shiprock Water Supply Project

Chapter	1990 Population	2040 Population	2040 San Juan Water Demand (AF/year)	Navajo-Gallup San Juan River Diversion	ALP San Juan River Diversion (AF/year)
Beclabito	388	1,321	237	118	119
Cudei	495	1,685	302	151	151
Hogback	740	2,519	451	226	225
Nenahnezad	1,253	4,265	764	382	382
San Juan	540	1,838	329	164	165
Shiprock	8,100	27,570	4,942	2002	2,940
Upper Fruitland	2,288	7,788	1,396	698	698
Total	13,804	46,985	8,421	3,741	4,680

9.9.3.1.1 **Description**

This Farmington to Shiprock Pipeline is described in the *Animas La Plata Project Draft Supplemental Environmental Impact Statement* dated June 2000. The pipeline will divert up to 4,680 acre-feet of Animas La Plata Project water per year for the Navajo Tribal Utility Authority (NTUA) municipal public water system that provides water to the Upper Fruitland, Nenahnezad, San Juan, Hogback, Shiprock, Cudei, and Beclabito Chapters. This pipeline will be 29 miles long with a total storage capacity of 7.0 million gallons. The project water will potentially be conveyed through the City of Farmington's municipal system at a peak flow rate of 8.1 million gallons per day (or 12.6 cubic feet per second). In April 1999, Reclamation estimated that the cost would be approximately $24 million. The Bureau of Reclamation began field investigations in April 2003 and it is scheduled to be completed in 2006.

9.9.3.1.2 **Cost Estimate and Benefit**

The primary benefit of the Farmington to Shiprock Pipeline will be 4,680 acre-feet of municipal water for the Shiprock Area. In the April 1999 Supplemental EIS, Reclamation estimated the cost of the pipeline to be $24 million.

9.9.3.2 **Navajo-Gallup Water Supply Project**

Regional water plans over the past 40 years have repeatedly identified the need for additional domestic, municipal and industrial water for the eastern portion of the Navajo Nation. In 1971, Congress authorized Reclamation to complete feasibility studies for the "Gallup Project." In 1975, the Navajo Tribal Utility Authority requested that the investigation be expanded to include municipal water supplies for Navajo communities in the eastern part of the Navajo Reservation. During the late 1970s and 1980s, investigations were conducted to develop and evaluate alternatives to meet these needs. In 1984, Reclamation completed a draft Environmental Impact Statement. In the late 1980s, the Project stalled in part due to the Navajo Nation's concerns over the failure to complete the Navajo Indian Irrigation Project, and limitations to the Project's proposed service area. It also stalled in part due to Reclamation's concern over the long-term

availability of water, the lack of quantified water rights for the project, difficulty in complying with the Endangered Species Act, and difficulty in financing the Project.

To meet the area's pressing need for domestic and municipal water, Project planning activities were reinitiated during the 1990's. A series of interdisciplinary technical reports was completed addressing engineering, cultural resources, biological resources, and the ability of the participants to pay for the project. These reports culminated in a NDWR March 2001 *Final Draft, Technical Memorandum, Navajo Gallup Water Supply Project* that consolidated the information needed by the Navajo Nation to present the Navajo Gallup Water Supply Project (Project) in the context of regional water development. A copy of the March 16, 2001 *Final Draft, Technical Memorandum, Navajo Gallup Water Supply Project* is located in **Volume II, Appendix A-6**.

To better characterize the water supply and demand of the region and of the Project's service area, the City of Gallup and the Navajo chapters were grouped into twelve municipal subareas. The sub-areas include: (1) The City of Gallup, (2) Central Project Chapters, (3) Crownpoint Area, (4) Gallup Area Navajos (Navajo land adjacent to the City of Gallup), (5) Huerfano Area, (6) Rock Springs Area, (7) Route 666 (now 491) Chapters, (8) San Juan River Chapters, (9) Torreon Area, (10) NAPI, (11) Window Rock, and (12) Thoreau-Smith Lake. Each subarea has a common public water supply system and water supply option. For each subarea both San Juan River surface water and local conjunctive ground water were considered.

Within the State of New Mexico, the Project service area is primarily encompassed by the State Water Planning Regions 2 and 6. The Central Project Chapters (Burnham, Lake Valley, White Rock and Whitehorse Lake), Crownpoint Area (Becenti, Coyote Canyon, Crownpoint, Dalton Pass, Little Water, and Standing Rock), Huerfano Area (Huerfano and Nageezi), Route 491 (666) Chapters (Mexican Springs, Naschitti, Newcomb, Sanostee, Sheep Springs, Tohatchi, Twin Lakes, and Two Grey Hills), San Juan River Chapters (Upper Fruitland, Nenahnezad, San Juan, Hogback, Shiprock, Cudei, and Beclabito), Torreon Area (Counselor, Ojo Encino, Pueblo Pintado, and Torreon), and NAPI are in Region 2. The City of Gallup, Gallup Area Navajos (Bread Springs, Chichiltah, Church Rock, Iyanbito, Mariano Lake, Pinedale, and Red Rock), Rock Springs Area (Manuelito, Rock Springs, and Tsayatoh), and Thoreau-Smith Lake Area are in Region 6. Window Rock, the capital of the Navajo Nation, which is in Arizona, is not in a State of New Mexico planning region. The Navajo Department of Water Resources is completing chapter water plans for the Chapters within Regions 2 and 6.

National Environmental Policy Act (NEPA) compliance work is well underway. During 2001, Reclamation conducted public scoping meetings in Farmington, Shiprock, Crownpoint and Gallup. Based on public input at those meetings the Project's purpose and scope was defined. The Navajo Nation requires a supplemental water supply to augment the groundwater and to promote economic development. The City of Gallup, an important regional economic center to the surrounding Navajo and Zuni reservations, anticipates a one million gallon per day water supply deficit during its peak summer demand period by the year 2010. This project will to provide a forty-year potable water supply to more than 20 Navajo public water supply systems, the City of Gallup, processing water for the Navajo Agricultural Products Industry in New Mexico, and Window Rock, Arizona. As part of the scoping process, service to the southern

portion of the Jicarilla Apache Nation has also been included. In April 2002, Reclamation completed the appraisal level planning report entitled *Navajo Gallup Water Supply Project Appraisal Level Designs and Cost Estimates*. The surface water components of the project have an estimated cost of $441 million. A copy of the *Navajo Gallup Water Supply Project Appraisal Level Designs and Cost Estimates* is located in **Volume II, Appendix A-7**.

The Project will divert approximately 37,700 acre-feet and deplete approximately 35,800 acre-feet of San Juan River Water. Based on the preferred alternative, the Project will divert 15,100 acre-feet water and deplete 13,229 acre-feet of San Juan River water for use within the Upper Colorado River Basin on the Navajo Nation within Region 2. The Project also includes 1,200 acre-feet of depletion that will be used within the Upper Basin by the Jicarilla Apache Nation at the Teepee Junction. The Project includes 13,934 acre-feet of depletion that will be used within the Lower Colorado River Basin in New Mexico. This value includes 7,500 acre-feet of depletion that will be used by the City of Gallup, and 6,434 acrefeet that will be used by Navajo chapters. The Project also includes 1,119 acre-feet of depletion that will be used in the Torreon Area within the Rio Grande Basin. Finally, the Project includes 6,411 acre-feet of water that will be used with the Lower Colorado River Basin in Window Rock, Arizona.

Reclamation investigated 12 configurations to meet the Project's purpose. On March 25, 2002, the Resources Committee of the Navajo Nation Council endorsed the San Juan River "PNM" Alternative, which was selected by the Project participants as the preferred alternative. According to Reclamation, Reclamation anticipates that the Environmental Impact Statement and the Record of Decision should be completed in early 2004.

In addition to the San Juan River depletions, the Project includes a conjunctive groundwater component. In 1998, groundwater production in the Navajo Gallup Water Supply Project service area was approximately 6,800 acre-feet per year. Of that amount, approximately 2,500 acre-feet were for the Navajo public water systems. The groundwater component will increase annual groundwater production to 3,200 acre-feet. This rate is considered sustainable by the Navajo Department of Water Resources (*Navajo-Gallup Water Supply Project Evaluation of Groundwater and Conjunctive Use Alternatives*, January 8, 1998).

Table 9.2 lists the groundwater production, San Juan River diversion, and San Juan River depletions associated with this Project. In May 2003, Reclamation initiated appraisal level studies of these conjunctive groundwater components. The first study will focus on the Dalton Pass, Crownpoint and Becenti NTUA public water system. The second study will focus on the Chapters from Huerfano to Torreon and the third study will focus on the Smith Lake Area. Table 9.2 also presents some non-Project water demands including the ALP San Juan River diversions and the potential demand of a power plant proposed by the Dine Power Authority.

Table 9.2 Municipal Water Demand by Basin for the Navajo-Gallup Water Supply Project

Municipal Subarea	Basin of Use	1990 Census Pop.	2040 Pop.	2040 Demand (AF/yr)	ALP Diversion (AF/yr)	2040 G.W. Production (AF/yr)	2040 SJR Diversion (AF/yr)	2040 SJR Depletion (AF/yr)

Central Area	UC	1,493	5,082	911		77	834	834
Gallup area	LC	7,904	26,903	4,822		506	4,316	4,316
Huerfano	UC	1,492	5,078	910		46	864	864
NAPI	UC	7,274	700	700				
Rock Springs	LC	3,749	12,761	2,287		169	2,118	2,118
Route 491	UC	10,099	34,374	6,161		795	5,366	5,366
San Juan River	UC	13,804	46,985	8,421	4,680		3,741	1,871
Torreon	UC/RG	3,797	12,924	2,316		77	2,240	2,240
Jicarilla	UC	1,200	1,200	1,200				
N.M. Upper Colorado	UC	34,012	115,767	28,023		7,050	16,300	14,429
N.M. Rio Grande	RG	1,960	6,672	1,196		77	1,119	1,119
N. M. Lower Colorado	LC	30,807	86,861	15,568		2,114	13,934	13,934
N.M. Total		66,779	209,300	44,788		9,241	30,153	28,282
Ariz. Total	LC	11,767	40,052	7,179		767	6,411	6,411
Municipal Project Total		78,546	249,352	51,967	4,680	5,328	37,764	35,893
DPA Power Generation				25,000				

9.9.3.2.1 **Description**

The Navajo-Gallup Water Supply Project will deliver San Juan River water to the forty-three Navajo Nation Chapters, the southern portion of the Jicarilla Apache Nation, and the City of Gallup, New Mexico. This Project description is from the technical memorandum prepared by the participants entitled *Final Draft, Technical Memorandum, Navajo-Gallup Water Supply Project* dated March 16, 2001 (**Volume II, Appendix A-6**), and the Reclamation appraisal level planning report entitled *Appraisal Level Designs and Cost Estimates* dated April 2002 (**Volume II, Appendix A-7**). The Project depletions for each Chapter and subarea are shown in Table 9.2.

The preferred Project configuration is the product of approximately 40 years of progressively refined analysis. The San Juan River "PNM" Alternative includes the San Juan River Lateral and the Cutter Lateral. The major features of the Project include:

- San Juan Lateral and the Cutter Lateral
- Spurs to Window Rock, the Gallup Area, and Dalton Pass
- Storage tanks to serve the NTUA systems in each municipal subarea
- The Gallup/Rural Navajo Regional System
- Conjunctive groundwater components
- Water treatment
- Wastewater treatment

The Project will connect to existing and future NTUA, City of Gallup, and Jicarilla Apache public water systems. The conjunctive ground water components will connect separately into the existing public water systems.

The San Juan River Lateral will divert approximately 85 percent of the Project's water supply directly from the San Juan River below the confluences with the Animals and the La Plata Rivers at the Public Service Company of New Mexico's San Juan Generating Station diversion. The annual demand of the San Juan Lateral will be 20,600 acre-feet in 2020 and 33,000 acre-feet in 2040. The peak demand will be 23.9 MGD (or 36.9 cfs) in 2020 and 38.2 MGD (or 59.2 cfs) in 2040.

The San Juan River Lateral begins at the Public Service Company of New Mexico San Juan Generating Station diversion near Kirtland, New Mexico. The intake and water treatment plant will be on the north side of the San Juan River to reduce impacts on the recently completed fish bypass. This point of diversion enables the Project water to remain in the San Juan River to below the confluences of the Animas and La Plata Rivers. This point of diversion increases the hydrologic flexibility of the project's diversion reducing potential impacts on the endangered fish. This point may be able to take advantage of an existing diversion weir. And it ensures that flows released from Navajo Reservoir are in the river as far down stream as practical creating a number of benefits along the river channel. In addition, this point of diversion is upstream of the Chaco Wash, which contributes heavy sediment loads that make water treatment difficult.

The San Juan Lateral will proceed west along the Navajo Route N36 to U.S. Highway 491 (formerly Highway 666) serving the San Juan River Chapters. The route then proceeds south along Highway 491 toward the City of Gallup serving the Route 491 Chapters along the way.

This lateral will have a spur at the junction of Highway 491 and Navajo Route N9 (the Coyote Canyon Junction) which will convey water east to Dalton Pass and the Crownpoint public water system. This lateral will have another spur at the junction of State Highway 264 and Highway 491 (the Yah-ta-hey Junction) that will convey water west to the Rock Springs and Window Rock public water systems. From Yah-ta-hey the Gallup Regional System will convey water through the City of Gallup and to the surrounding NTUA public water system that serve the Chapters of Churchrock, Breadsprings, Red Rock, Manuelito and Tsayatoh.

The Cutter Lateral diverts the balance of the Project water from the Cutter Reservoir in Largo Canyon. Cutter Reservoir is an existing component of the Navajo Indian Irrigation Project. The annual demand of the Cutter Lateral will be 3,000 acre-feet in 2020 and 4,760 acre-feet in 2040. The peak demand of this lateral will be 3.7 MGD (or 5.78 cfs) in 2020 and 5.4 MGD (or 8.3 cfs) in 2040.

The Cutter Lateral begins at the Cutter Reservoir. This lateral will proceed south toward U.S. Highway 550 (State Highway 44) where it will connect with the Huerfano and Nageezi NTUA public water systems. The route follows State Highway 44 for approximately 30 miles to Navajo Route 46. At this junction the Jicarilla Apache Nation will be able to convey water to the Teepee Junction. The route follows Navajo Route 46 south toward Navajo Route 9 serving the Counselor NTUA public water system. From Counselor the route proceeds south to Ojo Encino where it will provide water for the NTUA public water system serving Ojo Encino, Pueblo Pintado, White Horse Lake, and Torreon.

The Central Project Subarea includes the chapters of Burnham, Lake Valley, White Rock and White Horse Lake. The projected annual municipal demand for the area in the year 2040 is 911 acre-feet, of which 77 acre-feet will be met with groundwater. Burnham can be served directly from the San Juan Lateral. Lake Valley and White Horse can be served from the Crownpoint Spur. This subarea is in Region 2.

The Crownpoint Subarea includes the chapters of Becenti, Coyote Canyon, Crownpoint Dalton Pass, Little Water and Standing Rock. The annual projected municipal demand for this subarea in the year 2040 is 3,225 acre-feet, of which 752 acre-feet will be met with groundwater. This subarea will be served by the Crownpoint Spur from the Coyote Canyon Junction. This subarea is in Region 2.

The Huerfano Subarea includes the chapters of Huerfano and Nageezi. The annual projected municipal demand for the Huerfano Subarea in 2040 is 910 acre-feet, of which 46 acre-feet will be met with groundwater. This subarea will be served from the Cutter Lateral. This subarea is in Region 2.

Route 491 (666) Subarea includes the chapters of Mexican Springs, Naschiti, Newcomb, Sanostee, Sheep Springs, Tohatchi, Twin Lakes, and Two Grey Hills. These chapters are located along Highway 491. These public water systems are well situated to take advantage of the Project water as soon as it is available. The annual projected municipal water demand for this subarea in the year 2040 is 6,161 acre-feet, of which 795 acre-feet may come from ground water. This subarea is in Region 2.

The San Juan River Subarea includes the Navajo chapters along the San Juan River. The annual projected municipal water demand by the year 2040 is 8,421 acre-feet per year. The Farmington to Shiprock Pipeline will provide 4,680 acre-feet of that demand, and the Navajo Gallup Water Supply Project will meet the balance of the demand. This subarea is in Region 2.

The Torreon Subarea includes the chapters of Counselor, Ojo Encino, Torreon, and Pueblo Pintado. The annual projected municipal demand of the Torreon Subarea in the year 2040 is 2,317 acre-feet, with groundwater meeting 77 acre-feet of this demand. This area will be served from the Cutter Lateral. This subarea is in Region 2. NAPI has reported plans to develop agricultural processing projects with a total treated water demand of 7,274 acre-feet. The BIA recently consulted with the USFWS on a french-fry processing venture that will require NAPI to deplete 400 acre-feet of water per year. The Navajo Gallup Project depletions include 700 acre-feet of depletion for food processing opportunities such as vegetable canning. This volume includes 400 acre-feet of depletion for a proposed french-fry venture The NAPI potable water demand may be served either from a tap at the junction of the pipeline with Highway 64, or possibly from the Cutter Lateral. NAPI is in Region 2.

The Gallup Area Navajos include the chapters of Breadsprings, Chichilta, Church Rock Iyanbito Marion Lake Pinedale and Red Rock. The projected municipal demand in the year 2040 is 4,822 acre-feet, of which 506 acre-feet will be met with ground water. These chapters will be served from the Gallup Region System. This subarea is in Region 6. The Rock Springs Subarea includes the chapters of Manuelito, Rock Springs, and Tsayatoh.

The annual projected municipal demand is 2,287 acre-feet, of which 169 acre-feet may be met with groundwater. Window Rock will be served from the Window Rock Spur, which starts at the Yah-ta-hey Junction. This subarea is in Region 6.

The Window Rock Subarea includes the chapters of Fort Defiance and Saint Michaels. The annual projected municipal demand for this subarea in the year 2040 is 7,179 acre-feet, of which 767 acre-feet may be from groundwater. Window Rock will be served from the Window Rock Spur, which starts at the Yah-ta-hey Junction. This subarea is in Arizona.

9.9.3.2.2 **Cost Estimate and Benefit**

The benefit to the participants is a renewable water supply that will satisfy much of the municipal water demand through 2040. The Project will encourage economic development and to reduce the percentage of the Navajo population that hauls water. The Jicarilla Apache Nation will also have the opportunity to development in the southern portion of their reservation at Tepee Junction.

In April 2002, Reclamation completed an appraisal level design and cost estimate of the surface water component of the Project. The estimated cost of the surface water components of the Project is $441 million. Of this total, the Navajo Nation's estimated allocated cost is approximately $344 million.

In March 2001, the Navajo Department of Water Resources estimated the conjunctive ground water component for the Navajo Nation Chapters is an additional $73 million. This reconnaissance level estimate is being refined by Reclamation.

9.9.4 **Developing and Rehabilitating Local Public Water Systems**

The six proposed large Navajo regional water supply projects, including the Farmington to Shiprock Pipeline and the Navajo Gallup Water Supply Project, will convey domestic, municipal and industrial water to approximately 67 of the 110 chapters on the reservation, and they will serve approximately 80 percent of the projected reservation wide population of 500,000 by the year 2040. By the year 2040 the Navajo population on the Navajo Reservation within Region 2 will be approximately 150,000. However, without additional local infrastructure, there will be inadequate conveyance and treatment capacity to deliver potable water from the regional systems to many of the local water users. Even with the regional systems and associated local distribution systems fully in place, a significant portion of the chapters will rely on alternative water supply facilities. Many of the smaller water systems require rehabilitation, and in many areas, new systems are needed. In areas where regional distribution systems are infeasible, community wells will be upgraded to improve access for water haulers. Rehabilitation and development of small, local, public water systems is also an important component of the Navajo Nation's water development strategy.

These improvements are essential for conveying water from the regional projects to homes and businesses. These improvements include: 1) improving Public Water Systems Connected with

the Regional Projects, 2) improving public water systems not connected to the regional projects, and 3) improving water service to water users without direct access to public water systems.

9.9.4.1 **Improve Public Water Systems Connected with the Regional Projects**

Additional upgrades may be needed to ensure that the water from the Farmington to Shiprock and Navajo-Gallup Water Supply Projects reach the water users.

9.9.4.2 **Improve Public Water Systems Not Connected to the Regional Projects**

The regional water projects and the associated public water systems will reach 80 percent of the population and 60 percent of the chapters. Much of the remaining population is served by 90 small public water systems that need improvements. These small systems share similar obstacles. They are remote with very limited access. They require long distances between the water sources and places of use. And, the water sources are extremely limited.

These factors result in very expensive water infrastructure. These problems are compounded by the fact that many of these small public water projects do not meet the minimum established criteria for incorporation into NTUA operation. NTUA will not accept a system that has fewer than three water meters per mile or systems requiring major repairs. Many of the public water systems not operated by NTUA depend on tribal subsidies. As the tribal general funds decline, the ability of the Tribal government to maintain these subsidies decreases.

Because these water systems often only serve a few dozen connections, improvement efforts do not fit into traditional construction authorization processes. Developing separate appraisal and feasibility level studies for each project and approaching Congress separately on behalf of each project would create unmanageable administrative and political obstacles. Furthermore, the remote locations make it expensive to repeatedly mobilize technical expertise. For this Strategy, the Navajo Nation may request that Congress grant an overarching or omnibus authority to prepare feasibility studies and to submit multiple projects for Congressional construction authorization.

9.9.4.3 **Improving Water Service to Water Users Without Direct Access to Public Water Systems**

Approximately 40 percent of the Navajo population hauls water to meet their daily household needs. They frequently drive long distances to the nearest public water source. The cost of hauling water in pickup trucks can exceed $16,000 per acre-foot compared to typical urban water rates, which are approximately $600 per acre-foot. This situation means that one of the poorest sectors of the New Mexico population has the most expensive water supply.

Sanitation is also a concern for water haulers. If potable water sources are difficult to access, water haulers frequently get water from non-potable sources such as stock tanks.

Occasionally, even if the water quality at the water point is adequate, unregulated taps can have unsanitary hoses and other conditions that render the water supply unsafe. Furthermore,

households that rely on water hauling have less water available for personal hygiene, which can result in increased health related problems.

The regional water projects will provide indirect relief to the Navajo water haulers. For instance, the distance to reliable water taps will decrease for most Navajo water haulers. However, direct assistance to develop additional local potable water sources, possibly with solar pumps and cisterns, may be required. The Navajo Environmental Protection Agency is completing a joint study on this topic. The objective of the study is to define the nature and extent of the problem, and to pose solutions. The investigation is based on IHS data, literature reviews, interviews, and field trips. The solution strategies will be provided to appropriate individuals and agencies to determine which options have the greatest chance of success.

9.9.5 **Completing the Navajo Indian Irrigation Project**

The Navajo Indian Irrigation Project (NIIP) was jointly authorized with the San Juan Diversion in 1962 by Public Law 87-483. This public law authorized the Secretary of the Interior to construct, operate, and maintain NIIP for the principal purpose of furnishing 508,000 acre-feet of, irrigation water to approximately 110,630 acres of land. NIIP's principle features include the Main Canal which is 46.3 miles long and has an initial capacity of 1,800 cfs., the Gravity Main Canal which is 14.2 miles and has a capacity of which has an initial capacity of 1,285 cfs, the long Amarillo Canal which is 11.2 miles long and has an initial capacity of 385 cfs., the Cutter Reservoir, the Kutz Pumping Plant with a capacity of 128 cfs., the Gallegos Pumping Plant with a capacity of 880 cfs, the proposed Moncisco Pumping Plant with capacity of 400 cfs., and 340 miles of pipeline ranging in diameter for 6 to 84 inches.

NIIP consists of the initial land development, water distribution system, water delivery roads, and other infrastructure. The development of NIIP has been broken into 111 Blocks of approximately 10,000 acres each. Block 1 was first irrigated in 1976. Seven blocks have been completed and portions of Block 8 are now being irrigated.

The Department of the Interior has a 1956 State Water Use Permit for NIIP for the diversion of 640,000 acre-feet of water from Navajo Reservoir and the Navajo Nation has a 1970 Secretarial water contract to divert 508,000 acre-feet of water for agricultural use. For planning purposes, according the Department of the Interior's 1988 Hydrologic Determination, the NIIP will deplete 254,000 acre-feet on an annual basis. This value is based on an assumption than in any given year five percent of the NIIP farmland will be fallow. According to NIIP's recent 1999 Biological Opinion, with a unit depletion of 2.4 acre-feet per acre, when it is completed, NIIP will divert 360,000 acre-feet and, at equilibrium, deplete 270,000 acre-feet of San Juan River water per year. NIIP currently diverts approximately 200,000 acre-feet per year and depletes approximately 160,000 acrefeet per year.

In 2003, NAPI anticipated farming more than 65,000 acres and it generates an annual revenue between $30 and $40 million. NAPI employs almost 200 full time employees and several hundred temporary employees. Eventually, with vertical integration, NAPI may employ more than 1,000 full time employees. However, NIIP has not realized its full economic potential. After more than 40 years, the project is farming less than 60 percent of its authorized project land.

The Navajo Nation has made several specific suggestions to realize NIIP's potential including: increasing the annual construction funds to complete both the distribution systems and on-farm components in a shorter period of time, vertically integrating to increase tribal employment and other economic benefits, and adequately funding the operation and maintenance. The Navajo Nation, Reclamation, NAPI, and the BIA are developing a longrange plan for NIIP that may include the transfer of the facilities to the Navajo Nation.

9.9.6 **Small Agricultural Irrigation Projects**

As part of the regional needs assessments, the small irrigation projects are being assessed by Reclamation, the NRCS, and the Navajo Department of Water Resources. These assessments will evaluate those projects that have the best chance hydrologically, institutionally, and agronomically sustaining themselves. The NDWR is encouraging water users to organize water users associations through their local farm boards, accept additional responsibility for the operation and maintenance, and form partnerships with a broad array of institutions. These efforts may improve the chances of these irrigation projects succeeding.

This approach is consistent with recent Navajo Nation Council directives intended to make decision-making more accountable to local needs and oversight.

Region 2 includes several irrigation projects along the San Juan River including Hogback, Fruitland, Cudei and Cambridge. These irrigation projects include approximately 12,000 acres of land that have been permitted by the Bureau of Indian Affairs. In 1999, the Shiprock Farmboard passed resolutions that helped to establish the San Juan River Dine Water Users Association. Investigations are underway to assess the rehabilitation needs of these irrigation projects. These improvements improve efficiency and conserve water.

Approximately 20 smaller Navajo irrigation projects are located along the tributaries to the San Juan River. The NDWR and the ISC are currently assessing the total acreage of these projects and their hydrologic impact to the San Juan River.

9.9.7 **Water Conservation and Water Reuse**

Navajo communities will need to make every reasonable effort to maximize the available water supply. Therefore, a commitment to water conservation and water reuse is needed. However, due to the already extremely low on-Reservation per capita water use rates, Reclamation concluded that water conservation plans will not significantly enhance the water supply options for the Navajo water users.

The Navajo Nation and Reclamation are investigating water reuse opportunities. Under certain circumstance reclaimed water can be used on outdoor landscaping and athletic facilities. Appraisal level Navajo water use studies have been conducted in Tuba City and Ganado, Arizona. An analysis of opportunities for water conservation and reuse of wastewater will be a component of the reservation-wide needs assessment and appraisals.

9.9.8 **Power Generation**

The Navajo Nation hosts a variety of industrial and mining water users, all of which require a reliable water supply. Mining is the largest revenue producer on the reservation, often producing 75 percent of the total annual tribal general revenue. Regionally the largest industrial water users are coal mining, oil recovery, and power generation.

Six power generating stations operate in the vicinity or on the Navajo Reservation including the Cholla Generating Station, Four Corners Generating Station, Mohave Generating Station, Navajo Generating Station, Plains Electric Generating Station, and San Juan Generating Station. These generating stations, which are located in New Mexico and Arizona, have a combined installed capacity of 10,400 megawatts and an annual water demand of 113,000 acre-feet per year.

Two of these generating stations, the Four Corners Generating Station and the San Juan Generating Station are within Region 2, and Plains Electric (Tri State) is within Region 6. The Four Corners Generating Station is operated by Arizona Public Service. It has an installed capacity of 2,040 megawatts and it uses approximately 23,000 acre-feet per year.

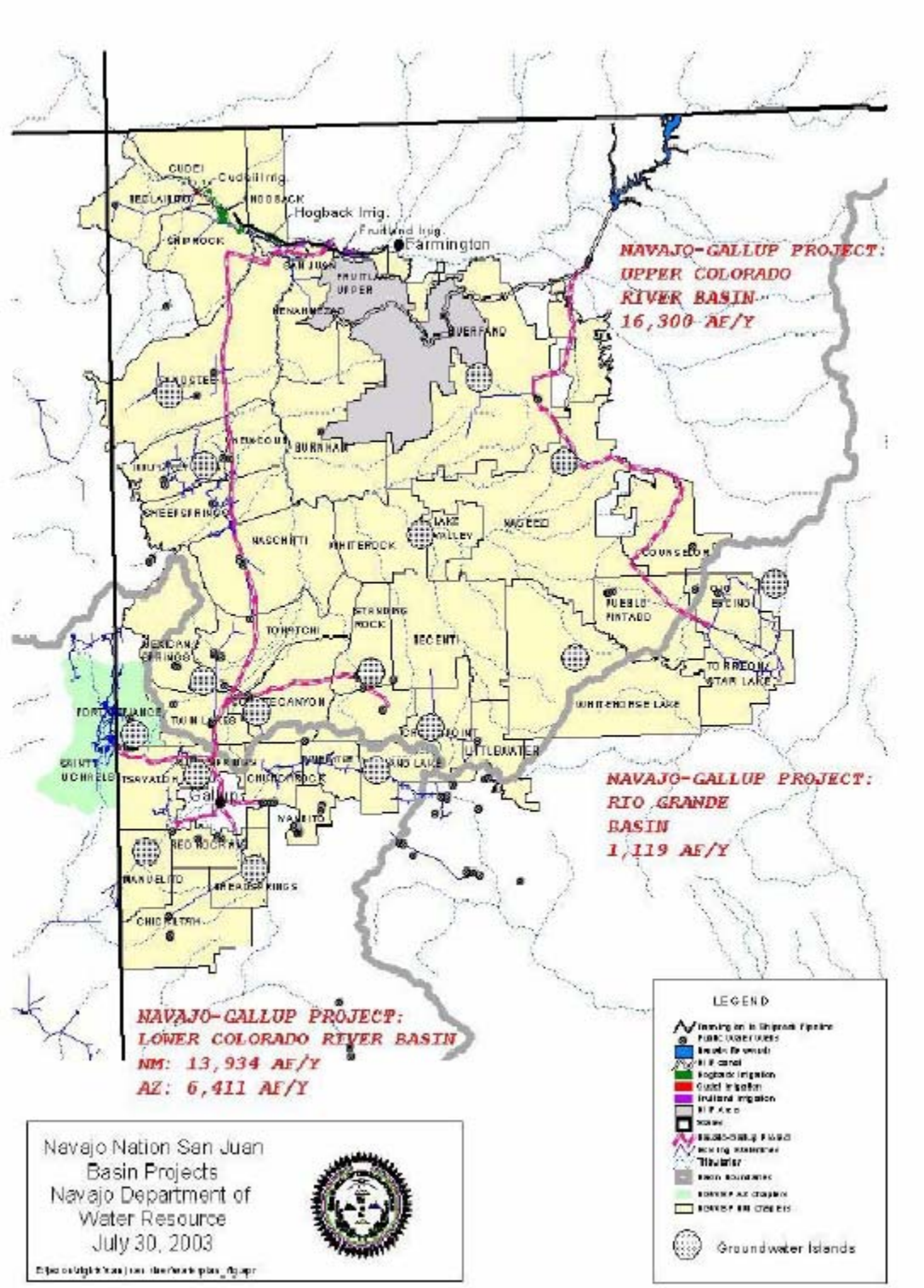
The San Juan Generating Station is operated by the Public Service Company of New Mexico. It has an installed capacity of 1,800 megawatts and it uses approximately 20,000 acre-feet per year.

Region 2 has hundreds of millions of tons of recoverable coal, much of it on the Navajo Reservation. This abundance of coal has led the Navajo Nation to explore numerous opportunities for additional mining and power generation. Currently, the Dine Power Authority is considering a 1,500 megawatt power plant, which would require 20,000 acrefeet of water. Additional water may be needed for mining approximately eight million tons of coal every year.

One potential source of water is groundwater. Several large aquifers underlie much of the Navajo Nation. For instance, the Westwater Aquifer underlies a large portion of the Eastern Navajo Agency and Regions 2 and 6. Adequate yields and water quality are feasible from the Westwater Aquifer near Burnham. However, the recharge rates are extremely low. The result of this pumping would be large cones of depression radiating out from any proposed well field. Technical investigations are required to determine if the impacts of this pumping are acceptable to the Navajo Nation and other affected parties.

The other potential water source is San Juan River surface water. Any surface water option will raises challenges. First, it is unlikely that the Secretary of the Interior would approve a new water contract from Navajo Reservoir if that contract impacts the Indian Trust Assets of either the Navajo Nation or the Jicarilla Apache Nation. And, a new contract would need to address compliance with the Endangered Species Act. Second, the Jicarilla Apache Nation recently decided to subcontract most of its Navajo Reservoir water supply to the Public Service Company of New Mexico for use at the San Juan Generating Station. Third, acquiring and consolidating a block of 20,000 acre-feet of water would require complex water transfers involving dozens, or possibly hundreds, of small water users in the Basin.

Finally, the Navajo Nation's NIIP contract is explicitly for irrigated agriculture use, not industrial use. However, given the appropriate circumstances, the Navajo Nation could investigate the theoretical possibility of transferring water from an irrigation use to an industrial use.



6. DROUGHT INFORMATION

2003 New Mexico Drought Summit Agenda
http://www.seo.state.nm.us/DroughtTaskForce/2003Summit.html

Summit Speakers and Moderators

2003 Drought Summit Presentations

Welcome:

* Lieutenant Governor Diane D. Denish
* State Representative Joe Stell, Chair, Agriculture and Water Resources Committee
* John R. D'Antonio, PE, State Engineer and Chair of Governor's Drought Task Force

Southwest Strategy, Co-Chair Joanna Prukop, Secretary, NMEMNRD

The current drought in historical perspective: Are we facing another Megadrought?
Dr. Julio Betancourt, Desert Laboratory, USGS and University of Arizona
Moderator: Lt. Gov. Diane Denish

What is drought and how is it assessed?
Charlie Liles, Director, National Weather Service Forecast Office
Moderator: Estevan Lopez, Interstate Stream Director

Impacts of drought on hydrologic system functions
Moderator: Ken Maxey, Albuquerque Area Manager, USBR

Surface water and storage facilities
Steve Hansen, Assistant Albuquerque Area Manager, USBR

Groundwater and aquifer recharge
Dr. Rob Bowman, Director of the Hydrology Program, N.M.
Institute of Mining and Technology

Riparian ecosystems
Dr. Cliff Dahm, Professor of Biology, UNM

Breaking the hydro-illogical cycle: Moving from crisis response to risk management for drought mitigation
Dr. Don Wilhite, Director, National Drought Midigation Center
Moderator: Bill Hume, Office of the Governor

Drought planning in Montana: a decade of experience
Jesse Aber, Water Resources Division of Montana Dept. of Natural Resources and Governor's Drought Advisory Committee

Moderator: John R. D'Antonio, State Engineer

Impacts of drought on ecosystem health
Moderator: Rosendo Trevino, USDA NRCS

Drought impacts on watersheds and rangelands
Dr. Kris Havstad, Supervising Scientist, USDA-ARS Jornada Experimental Range

Drought impacts on biodiversity
Dr. Esteban Muldavin, Ecology Coordinator, Natural Heritage New Mexico

Drought impacts on infectious diseases
Dr. Bob Parmenter, Preserve Scientist, Valles Caldera National Preserve

Impacts of drought on forest health
Moderator: Joanna Prukop, Secretary, NMEMNRD

Fire and landscape change in NM forests resulting from drought
Dr. Craig Allen, Station Leader of Jemez Mountains Field Station, USGS

b. Bark beetle and other insect infestations impacted by drought
Dr. Terry Rogers, Forest Entomologist with Forestry and Forest Health, New Mexico Zone, USDA FS

c. Impact of drought on riparian forests and wildlife refuges
Gina Dello Russo, Ecologist, Bosque del Apache National Wildlife Refuge

Dealing with scarcity: public welfare and public policy considerations in times of drought
Dr. F. Lee Brown, Professor Emeritus of Economics and Public Administration, UNM
Moderator: Rep. Joe Stell

Next Steps for New Mexico Drought Management
John R. D'Antonio, State Engineer and Chair of Governor's Drought Task Force
Anne Watkins, Director, Governor's Drought Task Force

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Drought Action Plan for Current Drought July 1 2002

The plan can be found at http://weather.nmsu.edu/ drought/action-plan/index.htm and includes the following topics:

1. Drought Action Plan for conservation of water (power point presentation)
2. Community action plan template to develop drought action plan
3. Example of a community Water Conservation Resolution
4. Economic community assistance from the state of New Mexico for sustaining water supplies

Also at this website is Agricultural Impact Assessment Sub-Group Situation Update, June 17, 2002, which includes:

1. Power point presentation on Farm Economics and Drought
    - Drought Assistance for farmers and businesses from the US Small Business Administration
    - USDA Farm Service Agency disaster assistance program
        - List of county offices of the Farm Service Agency
    - Hay hotline New Mexico Department of Agriculture
2. Drinking Water, Health and Energy Subgroup of the Drought Task Force July 16, 2002 Update
3. Wildlife and wildfire protection subgroup of the Drought Task Force August 19, 2002 update
4. Park and Museum use response to the drought.

The New Mexico Drought Task Force Brochure

Found at http://www.seo.state.nm.us/water-info/drought/drought-brochure.html, the brochure is designed to help communities plan for and cope with the effects of drought. The New Mexico Drought Task Force has prepared this brochure.

National Drought Mitigation Center

The National Drought Mitigation Center, found at http://drought.unl.edu/index.htm, has numerous tools for drought planning. Contents follow:

What is Drought?
Planning for Drought
Monitoring Drought
Understanding Your Risk
Mitigating Drought

Other Resources

Information from the Texas Water Information Network's Drought Monitoring site. is included in the appendices.

The following potential drought stage water reduction goals for utilities are found at http://drought.unl.cdu/wdcc/products/local2.pdf. The goals are as follows:

Moderate Reduction of 20% in residential use, 10% in all other uses, and 15% in overall use.
Severe Reduction of 20% in residential use, 15% in all other uses, and 20% in overall use.
Extreme Reduction of 30% in residential use, 15% in all other uses, and 25% in overall use.

More information is in the appendix titled Local Drought Response Information.

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http://www.twdb.state.tx.us/data/drought/drought_toc.htm

TWDB DATA
DROUGHT

b. What Drought is and How it is Measured.

* Definition of Drought and Related terms - (At National Drought Mitigation Center)
* Drought Indices - (At National Drought Mitigation Center) How the indexes measure the degree of droughts
* Predicting Drought - (At National Drought Mitigation Center)
* Drought Effect On Estuaries
* Agencies that are concerned with Drought (Texas Drought Preparedness Council, TWDB, NOAA, FEMA, TNRCC, National Drought Mitigation Center)

Drought Conditions.

Current Drought Monitoring

The Texas Water Information Network's Drought Monitoring site
Index Maps - (at the Texas Water Information Network site)

* Palmer Drought Severity Index (PDSI)
* Palmer Probability Predictions
* Palmer Drought Severity Index Long-Term Composite,
* 1995 - 2000
* Standardized Precipitation Index
* Crop Moisture Index
* and links to more...

- County Burn Bans - (at Texas Forest Service Web site).
- Statewide Drought Situation Report - by Texas Drought Preparedness Council.
- Summary of Drought Conditions - TWDB's biweekly report on drought conditions.
- Texas Water Conditions Reports - Monthly report on 77 selected reservoirs, streamflow gaging data for 24 stations, and groundwater levels in selected water wells.
- Texas Public Water Systems Limiting Water Use to Avoid Shortages - (At Texas Natural Resource Conservation Commission) Information on public water systems presently concerned with waste supply shortages.
- Also see indexes at DATA-Groundwater, and DATA-Surface Water for links to other information.

Outlook

Climate Prediction Center - Assessment and forecasting of impacts of

short-term climate variability (from The Climate Prediction Center, National Centers for Environmental Prediction, National Weather Service).
Probability Prediction map - (at the Texas Water Information Network site).

Historical Data

Long-term Palmer Drought Severity Index Maps 1995-2000 (at the Texas Water Information Network website).
Drought in Perspective 1996-1998 - Article by TWDB

Mitigating Drought

Contacts at TWDB for assistance in drought impacted areas.
Construction Assistance - Link to TWDB's Financial Assistance Programs which may provide for construction of water supply and reuse facilities to moderate the impact of drought.
Drought Preparedness Council - Membership, purpose, meeting agendas and minutes of the Drought Preparedness Council
Texas Guide to Rainwater Harvesting - A TWDB publication prepared in cooperation with the Center for Maximum Potential Building Systems
Water Conservation and Emergency Demand Management Planning Assistance - Link to TWDB's assistance page for Water Conservation Assistance
Water saving tips
Weather modification (cloud seeding):
- Link to the High Plains Underground Water Conservation District No 1's Precipitation Enhancement Program
- Link to West Texas Weather Modification
- Link to Texas Natural Resource Conservation Cloud Seeding Permitting Program information

Drought Related Links.

WaterSmart.org - Don't Be Waterless. Water Less. Water Smart.
NOAA's Drought Information Center
National Climatic Data Center
National Drought Mitigation Center
National Weather Service - Southern Region Precipitation Links and Maps, current data plus Forecasts and Outlooks
Office of the State Climatologist - Texas Climatic Bulletins
Texas Natural Resource Conservation Commission - Drought Information
Texas Forest Service - Fire Risk Assessment (documents in Adobe Acrobat)
International Boundary and Water Commission - Then click on Rio Grande to access updated Rio Grande water Storage Conditions at the International Amistad and Falcon Dams and stream Flow Conditions.
The Texas Drought - An Updated News Packet Texas A&M agricultural communications World Wide Web site

USGS - Current Hydrologic Conditions in Texas.

Page maintained by Russell Pankratz
Network Optimization, Resouce Information Office, TWDB
Telephone: (512) 475-2157

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c. National Drought Mitigation Center
http://drought.unl.edu/index.htm

What is Drought?

* Understanding and Defining Drought
* Drought Indices
* Predicting Drought
* Drought and Climate Change
* Understanding ENSO and Forecasting Drought
* What is Climatology?
* Important Climatology and Paleoclimatology Links
* Climographs of Selected U.S. Cities
* Historical Maps of the Palmer Drought Index
* Historical Graphs of the Palmer Drought Index
* Drought in the Dust Bowl Years
* Other Resources

Planning for Drought

* Why Plan for Drought?
* Managing Water: Policies and Problems
* The Hydro-Illogical Cycle
* The Basics of Drought Planning: A 10-Step Process
* More Drought Planning Methodologies
* State Drought Plans and Related Documents
* Directory of Drought Contacts
* Other Resources

Monitoring Drought

* The Standardized Precipitation Index
* Interpretation of SPI Map
* Current SPI Maps
* SPI Map Archive
* Early Warning Systems for Drought Preparedness and Drought Management

* Other Drought Monitoring Tools

Understanding Your Risk

* Impacts of Drought
* Drought Impacts in the United States
* A Comparison of Drought, Floods, and Hurricanes in the United States
* The 1996 Drought in the United States: Case Study
* Impacts of Drought in South Africa, 1980-94
* Other Links/Resources

Mitigating Drought

* Mitigation Tools for States
* The Status of State Drought Plans
* Overview of the Idaho Drought Plan
* Overview of the Missouri Drought Plan
* Overview of the Montana Drought Plan
* Overview of the New York Drought Plan
* Overview of the Washington Drought Plan
* Federal and Regional Drought Mitigation Tools
* Links to Drought Mitigation Tools for Agricultural Producers
* Water Conservation Links
* Other Links

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http://drought.unl.edu/plan/plan.htm

d. Planning for Drought

In the last few decades, interest in planning for drought has increased at all levels. In 1980, only 3 states (New York, South Dakota, and Colorado) had drought plans. Today, 38 states either have some type of plan or are in the process of developing a plan. The tremendous cost (economic, social, and environmental) associated with drought impacts is one of the reasons for this interest.

The actual process of planning for drought is not static. It has been evolving since the early 1980s, through trial and error. That process can be confusing, and the prospect of drought planning can be daunting. This website is designed to help people and organizations plan for drought. It is based on the 3 main components of drought planning: monitoring, risk assessment, and mitigation. This section includes an overview of drought planning, a directory of U.S. drought contacts, and links to other planning resources.

Why Plan for Drought?

The Status of State Drought Plans

Managing Water: Policies and Problems

The Hydro-Illogical Cycle

The Basics of Drought Planning: A 10-Step Process This NDMC white paper is a good starting point for those new to drought planning. It is also available as a pdf.

More Drought Planning Methodologies

State Drought Plans The NDMC maintains a list of links to drought plans from a number of U.S. states.

Directory of Drought Contacts Use this list to find drought planners in other U.S. states and regions.

Other Resources

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LOCAL DROUGHT RESPONSE INFORMATION
http://drought.unl.edu/wdcc/products/local2.pdf

This publication sets out a number of examples of ways to achieve those goals, including extracts from existing plans.

Western Drought Coordination Council
Preparedness and Mitigation Working Group
Editor: Tom Phillips, United States Bureau of Reclamation

Introduction
Drought Indices and Triggers
Example Responses

The most commonly available **indices** are discussed in depth on the National Drought Mitigation Center's web site.
Percent of Normal Precipitation
Deciles
Palmer Drought Severity Index
Surface Water Supply Index
Standardized Precipitation Index
Crop Moisture Index
Rainfall Index
Dependable Rain

Responses
There are three conditions that are almost universally recognized as being necessary to achieve water use reductions during the earliest stages of drought: the public must recognize the potential severity of drought's impacts; the public must see the requested actions as affecting supply and demand; and the requested actions must be equitable. Clear, consistent, and credible communication is critical. Without exception, the goal of every water utility drought response plan is to preserve an adequate water supply to protect public health and safety, regardless of the severity or length of the drought. To achieve this goal, utilities arrive at various levels of drought response stages based on the anticipated water supplies and the water use requirements of the community.

The following (from the Kentucky Water Shortage Response Plan) is a good example of how utilities use voluntary reductions and mandatory restrictions for different levels of drought. The utility has established four levels or stages of drought, each progressively more severe, in terms of reduced water supplies. The utility has defined all water use as either essential, socially or economically important, or non-essential. The utility has also defined which actions will be voluntary (V) and mandatory (M).

Water Use Class Recommended Conservation Response For Each Drought Stage
Advisory Alert Emergency Rationing
Essential V V V M
Social or Economically Important V V M M
Non-Essential V M M M

In the above example, essential water use was defined in three categories. Domestic us includes water necessary to sustain human life and the lives of domestic pets and to maintain minimum standards of hygiene and sanitation. Health Care Facility use includes water necessary for patient care and rehabilitation. Public use is the water necessary for firefighting, and health and public protection purposes, if specifically approved by health officials and the municipal governing body.

Understanding the relative magnitude of water use by the various water using sectors (residential, industrial, commercial, institutional, and agricultural) and their relative importance to the local economy is extremely important in establishing water use reduction targets for the various stages of drought events. The following illustrates how one utility (Charleston, SC) targets these various water using sectors.

Drought Stage Water Reduction Goals
Moderate Reduction of 20% in residential use, 10% in all other uses, and 15% in overall use.
Severe Reduction of 20% in residential use, 15% in all other uses, and 20% in overall use.
Extreme Reduction of 30% in residential use, 15% in all other uses, and 25% in overall use.

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DROUGHT CONTINGENCY PLANNING: EVALUATING THE EFFECTIVENESS OF PLANS

By Anne Shepherd,[1] Associate Member, ASCE

ABSTRACT: This article reports results from a two-year research project to evaluate the effectiveness of drought contingency plans. The research developed a metalevel framework for evaluating plans before a drought. In addition, it applied this framework to an in-depth case study of a major metropolitan region, Atlanta, Georgia. This research discovered that drought plans have limited effectiveness when disconnected from larger scale and longer term planning. The requirement to prepare a plan does not necessarily invoke a substantive drought planning process. Disjointed local level plans, instead of coordinated planning effects, have limited ability to mitigate impacts in widespread drought. Because the faith placed in plans may be misplaced, metropolitan regions may be unwittingly poised for a disaster. Recommendations include stronger links between drought plans and drought planning, inclusion of stakeholders and agency expertise, mechanisms for interagency coordination, and improved integration between drought plans and strategic water resources plans.

Welcome to the New Mexico Climate Center

http://weather.nmsu.edu/

Water Resources Page

(last accessed March 2004)

Here you will find water related resources such as hydrologic information, teaching materials, tutorials and water data.

- NMCC Climate Station Data
- Other NM Climate Station Data
- Crop Information
- Water Resources
- Climate Links
- Agricultural Models and Tools

Department of Agronomy and Horticulture
Box 30001 / Dept. 3Q / Las Cruces, NM 88003-8003
Telephone: (505) 646-5082
Fax: (505) 646-6041

Summary of Water use (in acre-feet) in Sandoval County, 1990

Category	Withdrawal Surface Water	Withdrawal Ground Water	Total Withdrawal	Depletion Surface Water	Depletion Ground Water	Total Depletion	Return Flow Surface Water	Return Flow Ground Water	Total Return Flow
Public Water Supply	89	9,561	9,651	43	6,754	6,797	46	2,808	2,854
Domestic (self-supplied)	0	1,999	1,999	0	1,065	1,065	0	934	934
Commercial (self-supplied)	10	394	404	10	196	206	0	198	198
Industrial (self-supplied)	0	194	194	0	46	46	0	148	148
Mining (self-supplied)	0	298	298	0	128	128	0	170	170
Power (self-supplied)	0	8	8	0	8	8	0	0	0
Irrigated Agriculture	49,505	684	50,189	17,426	453	17,879	32,079	231	32,310
Livestock (self-supplied)	98	323	421	98	302	399	0	21	21
Reservoir Evaporation	9,472	0	9,472	9,472	0	9,472	0	0	0
TOTAL:	**59,174**	**13,460**	**72,635**	**27,049**	**8,950**	**35,999**	**32,125**	**4,510**	**36,635**

Summary of Water use (in acre-feet) in Sandoval county, 1995

Public Water Supply	126	15,201	15,327	61	12,429	12,490	65	2,772	2,837
Domestic (self-supplied)	0	2,529	2,529	0	1,210	1,210	0	1,319	1,319
Commercial (self-supplied)	10	646	656	10	492	502	0	154	154
Industrial (self-supplied)	0	1,319	1,319	0	361	361	0	958	958
Mining (self-supplied)	0	23	23	0	4	4	0	18	18
Power (self-supplied)	0	0	0	0	0	0	0	0	0
Irrigated Agriculture	54,529	899	55,428	17,169	515	17,684	37,360	384	37,744
Livestock (self-supplied)	100	268	368	100	252	353	0	16	16
Reservoir Evaporation	15,033	0	15,033	15,033	0	15,033	0	0	0
TOTAL:	**69,798**	**20,885**	**90,683**	**32,373**	**15,263**	**47,637**	**37,425**	**5,621**	**43,046**

Summary of Water use (in acre-feet) in Sandoval county, 2000

Public Water Supply	159.16	12,219.79	12,378.95	59.48	9,897.42	9,956.90	99.68	2,322.37	2,422.05
Domestic (self-supplied)	0.00	2,829.84	2,829.84	0.00	2,829.84	2,829.84	0.00	0.00	0.00
Commercial (self-supplied)	10.00	2,079.14	2,089.14	10.00	2,000.03	2,010.03	.0.00	79.11	79.11
Industrial (self-supplied)	0.00	3,611.81	3,611.81	0.00	738.43	738.43	0.00	2,873.38	2,873.38
Mining (self-supplied)	0.00	438.20	438.20	0.00	350.37	350.37	0.00	87.83	87.83
Power (self-supplied)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Irrigated Agriculture	61,513.00	824.00	62,337.00	17,971.00	450.00	18,421.00	43,542.00	374.00	43,916.00
Livestock (self-supplied)	124.02	134.57	258.59	124.02	134.57	258.59	0.00	0.00	0.00
Reservoir Evaporation	10,370.00	0.00	10,370.00	10,370.00	0.00	10,370.00	0.00	0.00	0.00
County Totals	**72,176.18**	**22,137.35**	**94,313.53**	**28,534.50**	**16,400.66**	**44,935.16**	**43,641.68**	**5,736.69**	**49,378.37**

SOURCE: BRIAN, C., WILSON, P.E., "Water Use by Categories in New Mexico Counties and River Basins, and Irrigated Acreage in 1990", Technical Report 47 (July 1992), "In 1995," Technical Report 49 (1997), and "In 2000," Technical Report 51 (2003), New Mexico State Engineer Office, Santa Fe, NM.