5.0 WATER PRODUCTION IN THE SERVICE AREA

The objective of this section is to quantify the existing water production in the region. Outside of the San Juan River Chapters, the Navajo communities in the region and the City of Gallup rely almost entirely on groundwater for their water supply. The public water systems in the Project service area derive water from a variety of groundwater sources ranging from shallow, unconfined aquifers to deep, confined aquifers. The major aquifers are: (1) Permian and Triassic formations of the Coconino Aquifer system which include the De Chelly Sandstone and Shinarump Member of the Chinle Formation on the Defiance Plateau in Arizona, (2) Permian Glorietta and San Andreas Limestone in New Mexico, (3) Mesozoic sandstone formations which include the Morrison Formation and the Dakota Sandstone, (4) Cretaceous Gallup Sandstone, (5) the Tertiary Ojo Alamo Sandstone, and (6) alluvial deposits in the major drainages.

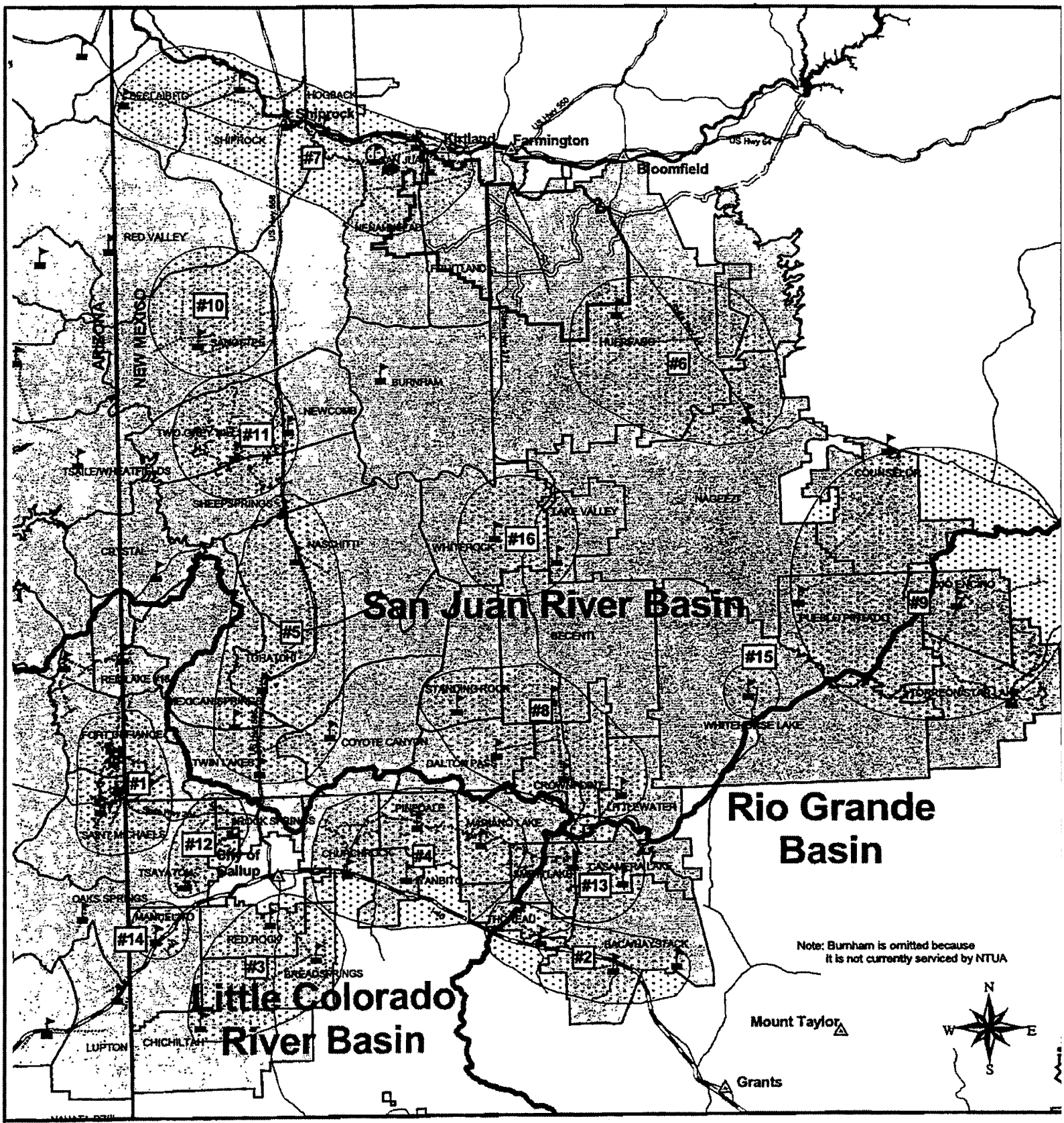
Alternatives to the proposed Project may include upgrading and extending existing water systems, and increasing groundwater withdrawals to meet part of the future demand. These alternatives have been investigated for each municipal subarea and they are described in Section 8.3. Most of the aquifers investigated are undesirable for additional long-term municipal development because of the harmful impacts of continued over-drafting on the groundwater. Continued over-drafting of the groundwater may:

- lower the water levels in wells and increase the pumping depths
- reduce the yield of the well fields
- reduce the quality of the water supply
- increase the capital and operating costs
- deplete the groundwater available for a drought reserve
- lower the water table in riparian areas
- cause land subsidence

The water production in the region and the Project's service area, is grouped into twelve municipal subareas as shown in Figures 4.1 and 5.1. The subareas include: (1) City of Gallup, (2) Central Project Chapters, (3) Crownpoint, (4) Gallup Area (Navajo land adjacent to the City of Gallup), (5)Huerfano, (6) Rock Springs, (7) Route 666 Chapters, (8) San Juan River Chapters, (9) Torreon, (10) NAPI, (11) Window Rock, and (12) Thoreau-Smith Lake. The estimated water production in each subarea is presented in Table 5.1. The NTUA water supply priority of each subarea is shown in Figure 5.1. The Thoreau-Smith Lake Subarea is within the planning region, but it is not within the Project's proposed service area. Detailed well production information for each subarea is given in Appendix C. The estimated populations and water demands are shown in Table 4.1.

TABLE 5.1
Regional Municipal Water Production during 1998

MUNICIPAL SUBAREA	PRODUCTION (Acre-feet)	SOURCE AQUIFER
1. City of Gallup	4,335	Gallup Sandstone Dakota-Westwater
1. Central	27	Alluvium Picture Cliffs Menefee
2. Crownpoint	330	Westwater Morrison Menefee Gallup Sandstone Point Lookout
3. Gallup Area (Navajo land adjacent to Gallup)	258	Gallup Sandstone Dakota-Westwater
4. Huerfano	90	Alluvium Ojo Alamo
5. Rock Springs	58	Gallup Sandstone
6. Route 666	518	Alluvium Morrison Menefee Point Lookout Gallup Sandstone Mesa Verde Dakota
7. San Juan River	2,256	Surface Water
8. Torreon	113	Ojo Alamo
9. NAPI	N/A	Surface Water
10. Window Rock	1,043	Alluvium De Chelly Gallup Sandstone Shinarump
NAVAJO SUB-TOTAL	4,693	
1. Thoreau-Smith Lake	193	Glorieta
REGIONAL TOTAL	9,221	



Navajo-Gallup Water Supply Project

Navajo Nation
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Fort Defiance, Arizona 86504
(520) 729-4004

c:/robert/projects/ngwsp3.apr	Figure 5.1	March 16, 2001

5.1 Groundwater production for the City of Gallup

City of Gallup records for 1997 report an average daily water production of 3.87 million gallons per day or 4,335 acre-feet for the year. The maximum daily use was 5.50 million gallons per day. According to the City of Gallup's *Well Production Planning Report* (Sterling & Mataya, and John W. Shomaker and Associates, Inc.,1998) the City derives its groundwater from two confined aquifers, the Gallup Sandstone and the Dakota-Westwater Canyon. The water table in the Gallup Sandstone Aquifer is between 900 and 2,000 feet deep and the aquifer is between 400 and 500 feet thick. The water table in the Dakota-Westwater Aquifer is between 1,900 and 3,000 feet deep and the aquifer is between 300 and 400 feet thick.

The City of Gallup operates two well fields: the Santa Fe Well Field and the Yah-ta-hey Well Field. Historic water table data provided by the City indicate that, from the early 1960's until the late 1990's, the static water level of the Santa Fe Well Field has declined between 340 and 350 feet. And, from the early 1970's until the late 1990's, the static water level of the Yah-ta-hey Well Field has declined between 700 and 835 feet. The City is anticipating a one million gallon per day shortage during peak periods as early as 2010. In 1991, the City's forty-year master water supply plan (Shomaker 1991) identified two short term alternatives including the expansion of the Yah-ta-hey Well Field to the north and developing water in the Ciniza area to the east. Neither alternative is sustainable. The City is also investigating the transfer of water rights from the Plains Escalante Generating Station.

In 1976 the U.S. Geological Survey completed groundwater investigations of the nearby Zuni Mountain and Malpais Region, and the Westwater Canyon Aquifer in the vicinity of Church Rock. The results indicated that the groundwater resources of those areas are inadequate to meet the municipal and industrial needs for the City of Gallup. These findings have been reiterated in numerous studies conducted since that time.

In 1998 the City collaborated with Reclamation and the Pueblos of Acoma and Laguna on an investigation of utilizing existing de-watering wells at the inactive Mount Taylor Mine located near San Mateo, New Mexico. In the March 1999 Technical Appraisal Reclamation estimates that a 4,000 acre-feet yield is possible for a 40-year period. The water source is approximately 70 miles from the City of Gallup and 43 miles from the Pueblo of Laguna. Based on delivering 2,000 acre-feet to the City of Gallup and 2,000 acre-feet to the Pueblos, the total project cost was estimated as $36 million and the annual operation as $2.2 million. This estimate was based on a peaking factor of 1.0 and no storage. Neither the allocation of the costs among the parties, nor the concerns of other interests in the region were addressed by that study. The Mount Taylor Project is not sustainable and does not meet the purpose and needs of the Navajo-Gallup Water Supply Project (Reclamation, 1999).

5.2 Groundwater production for the Navajo Nation

According to the Navajo Environmental Protection Agency, in 1996 there were more than 50 public water supply systems in the Project service area. The largest supplier of domestic and municipal water is NTUA which operates more than 30 water systems in the area. The NTUA systems in the service area are shown in Figures 2.1 and 2.2. The NDWR operates nine systems in the service area. According to data supplied by NTUA and estimates made by the NDWR, in 1998 the Navajo public water systems delivered 5,062 acre-feet in the region. This volume includes approximately 2,200 acre-feet of surface water delivered by the Shiprock NTUA system and 193 acre-feet (or 266?) delivered in the Thoreau-Smith Lake Subarea which is in the planning region, but outside the Project service area. This total also includes 1,043 acre-feet per year delivered by the NTUA system in Window Rock, Arizona.

Descriptions of the groundwater conditions in the municipal subareas are presented in the following section. The population data was provided by Navajo Division of Community Development in *1990 Census - Population and Housing Characteristics of the Navajo Nation* (Rodgers, 1993). Data on the number of service connections for the drinking water systems comes from *Navajo Nation Public Water Systems Inventory Listing May 6 1996* (Navajo EPA, 1996).

5.2.1 Central Project Chapters Subarea

The Central Subarea includes the Chapters of Burnham, Lake Valley, White Rock and Whitehorse Lake. Capacity is included in the main line for these Chapters. However, they may be served by groundwater until additional programmatic resources are available to connect them to the main line. The 1990 population of this subarea was 1,493 and the projected population by the year 2040 is 5,082. The annual water production in 1998 was 8,912,000 gallons (27 acre-feet). Essentially all of the municipal water is from two sources. One source is the Menefee Aquifer near White Horse with a maximum well yield of 16 gpm and well depths of approximately 1,400 feet. The other source is the alluvium aquifer near Lake Valley which has a maximum yield of 24 gpm and well depths of approximately 80 feet. NTUA staff report that a well near Whiterock with a depth of 4,620 feet was abandoned in part due to low yields. The low yields combined with the great depths make groundwater development in this subarea very difficult.

5.2.2 Crownpoint Subarea

The Crownpoint Subarea includes the Chapters of Becenti, Coyote Canyon, Crownpoint, Dalton Pass, Little Water, and Standing Rock. Crownpoint has been designated a primary growth center by the Navajo Division of Economic Development (NDED). The 1990 population of this area was 5,287 and the projected population by the year 2040 is 17,996. Its annual water production in 1998 was 107,416,000 gallons (330 acre-feet). Most of the groundwater in this area is from the Westwater and Morrison Aquifers. The maximum well

yield in the area is 248 gpm. near Crownpoint from the Westwater Aquifer. Well depths in the area range from 2,400 to 2,700 feet deep.

Three water systems serve the Coyote Canyon Chapter. One is operated by NTUA and consists of two wells, a 64,000-gallon storage tank, and 114 service connections. The NDWR operates the Bass Lake system, which consists of a well, no storage tanks, and 11 service connections. The Coyote Canyon Chapter operates the Chapter House system, which has a well, an 8,000-gallon storage tank, and 20 service connections. One of the NTUA wells pumps from the Menefee Formation with a yield of about 30 gpm. The NDWR well is artesian and flows at about 60 gpm from the Dalton Sandstone. The Chapter well is completed in sandstones of the Mesa Verde Group and yields about 15 gpm.

5.2.3 Gallup Area

Navajo land adjacent to the City of Gallup has been explicitly included in this plan formulation. This area includes the Chapters of Bread Springs, Chichilta, Church Rock, Iyanbito, Mariano Lake, Pinedale, and Red Rock. The 1990 population of this area was 7,904 and the projected population by the year 2040 is 26,903. The annual water production was 84,078,900 gallons (258 acre-feet). The municipal water is from the Gallup Standstone, Glorietta, Dakota, Chinlee and Morrison Aquifers. Well logs for this subarea indicate that the maximum well yield is 180 gpm near Iyanbito and its depth is approximately 300 feet deep in the Glorietta Aquifer. The producing NTUA wells have depths that range from 1,100 to 1,800 feet. These are some of the same formations that the City of Gallup is withdrawing water from.

5.2.4 Huerfano Subarea

The Huerfano Subarea includes the Chapters of Huerfano and Nageezi. This subarea lies immediately south of the NIIP boundary. The 1990 population of this subarea was 1,492 and the projected population in the year 2040 is 5,078. Its annual water production in 1998 was 29,427,000 gallons (90 acre-feet). Essentially all of the municipal water is from the Ojo Alamo Aquifer. Well logs for this area indicate that the maximum well yield is 81 gpm near Huerfano and its depth is approximately 1,100 feet deep.

5.2.5 Rock Springs Subarea

The Rock Springs Subarea includes the Chapters of Manuelito, Rock Springs, and Tsayatoh. This subarea lies immediately south of the Highway 602 west of the City of Gallup. The 1990 population of this area was 3,749 and the projected population in the year 2040 is 12,761. Its annual water production in 1998 was 18,767,000 gallons (58 acre-feet). Essentially all of the municipal water is from the Gallup and Dakota Aquifers. These are some of the same formations that the City of Gallup is withdrawing water from. Well logs

for this area indicate that the maximum well yield is 44 gpm near Tsayatoh and it is approximately 1,300 feet deep.

Rock Springs is served by the NTUA Rock Springs community system, which consists of one well which pumps water from the Gallup Sandstone aquifer with a yield of 20 gpm, a 107,000-gallon storage tank, and 43 service connections. This well is 1,760 feet deep.

Two water systems serve the Tsayatoh Chapter. The Spencer Valley/Defiance system is operated by NDWR and consists of a well which pumps from the Dakota Sandstone aquifer with a yield of about 27 gpm, a 27,000-gallon storage tank, and 21 service connections. The Tsayatoh community system is operated by NTUA and consists of one well which pumps from the Gallup Sandstone aquifer with a yield of about 44 gpm, a 150,000-gallon storage tank, and 67 service connections. Manuelito is served by an NDWR water system.

5.2.6 Route 666 Chapters

The Route 666 Chapters lie along Highway 666 between Shiprock and Yah-ta-hey. With either alignment alternative, these chapters and their public water systems are well positioned to take advantage of the Project water supply as soon as it is available. In addition, some of these chapters are able to take advantage of groundwater. The Route 666 Chapters include Mexican Springs, Naschitti, Newcomb, Sanostee, Sheep Springs, Tohatchi, Twin Lakes, and Two Grey Hills. Tohatchi has been designated by the NDED as a primary growth center. The 1990 population of this area was 10,099 and the projected population by the year 2040 is 34,374. In 1998 the annual water production was 168,723,000 gallons (518 acre-feet).

The communities along Highway 666 produce water from several of aquifers including alluvial sources, the Morrison, Menefee, Gallup Sandstone, and Dakota among others. The maximum well yield in this subarea area is 180 gpm from a well located near Twin Lakes which penetrates the Morrison Formation. This well is approximately 3,200 feet deep.

The Mexican Springs Chapter is served by three water systems, all operated by NTUA. The Tohatchi/Mexican Springs regional system consists of three wells, three storage tanks with a combined capacity of 1,400,000 gallons, and 472 service connections. Two wells pump from the Point Lookout Sandstone with yields ranging from about 30 to 150 gpm. These wells range from 345 feet to 800 feet in depth. The third well produces water from the Gallup Sandstone, Dakota Sandstone, and Morrison Aquifers. The Morrison Aquifer is the primary aquifer with a yield of more than 180 gpm. This well is 1,760 feet deep.

The Black Springs Wash/Deer Springs system consists of a well which pumps from the Crevasse Canyon Formation with a yield of about 15 gpm, an 11,500-gallon storage tank, 39 service connections, and is interconnected with the regional system. The Mexican Springs West Rural system consists of two wells, an 80,000-gallon storage tank, and 47 service connections. The wells pump from the Point Lookout Sandstone with yields of about 10 to 20 gpm.

The Naschitti Chapter is served by two interconnected NTUA water systems. The Buffalo Springs system consists of one well which pumps water from the Gallup Sandstone aquifer with a yield of about 55 gpm, a 40,000-gallon storage tank, and 329 service connections. The Naschitti/Bisola system has two wells, three storage tanks with a combined capacity of 230,000 gallons, and 164 service connections. These wells pump from the Menefee and Point Lookout Sandstone aquifers with yields ranging from 70 to 115 gpm. These wells are approximately 1,400 feet deep.

Tohatchi Chapter is served by the Tohatchi/Mexican Springs regional system which also serves Mexican Springs. The Ramona Smith system consists of a single well which flows from a depth of 2,000 feet with a yield of 200 gpm, one storage tank, and 28 service connections.

Two water systems serve the Twin Lakes Chapter. One is the Tohatchi/Mexican Springs regional system. The other is operated by the NDWR, and consists of a single well which flows from the Gallup Sandstone aquifer at about two gpm, a 1,000-gallon storage tank, and has one service connection at the Chapter House.

NTUA operates five wells in the Sanostee Chapter which range in depth from 800 to 2,150 feet. Several of the wells were originally for oil exploration and converted for domestic water supply by NTUA. These wells withdraw water from the Dakota and Morrison Formations, and flowing artesian wells. Nominal well yields range from 30 to 60 gpm. All wells are equipped with submersible pumps. Recharge to the Dakota and Morrison Formations in the Sanostee Area is very limited.

5.2.7 San Juan River Subarea

NTUA's Shiprock District includes the Chapters of Beclaibito, Cudei, Hogback, Nenahnezad, San Juan, Sanostee, Shiprock, and Upper Fruitland. In 1990 the District's population was 15,581. NTUA provides water service to more than 10,000 people living in the Shiprock area and to commercial, industrial and institutional customers. According to NTUA records between 1988 and 1992 NTUA's average annual Shiprock water production was approximately 735,000,000 gallons (2,260 acre-feet). NTUA production records report that in 1997 Shiprock's annual water production was 535,976,000 gallons (1,645 acre-feet). The peak daily production in 1997 was 2,075,000 gallons. NTUA's entire Shiprock District supply is from the San Juan River.

For this analysis, the San Juan River municipal subarea includes the same chapters as NTUA's Shiprock District with one exception. Sanostee has been shifted to the Route 666 Subarea to better reflect the proposed pipeline configurations. The 1990 population of this subarea is 13,804 and the projected population by the year 2040 is 46,985. The NDWR projects the water demand of the Shiprock Subarea will be 8,421 acre-feet per year by 2040.

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NTUA diverts San Juan River water for the Shiprock area from three sources: (1) the Hogback Irrigation Project Canal, (2) water pumped directly from the San Juan River at the Highway 666 bridge in Shiprock, and (3) water purchased from the City of Farmington. In 1997 the City of Farmington provided 1,168 acre-feet or approximately 70 percent of the overall water supply. NTUA frequently shuts down its San Juan River diversion at Shiprock because poor water quality and high sediment loads create operation and maintenance problems, and significantly increase the cost of treatment. The proposed Animas-La Plata Project may enable NTUA to divert up to 4,600 acre-feet, and deplete 2,340 acre-feet, of Animas - La Plata Project water.

5.2.8 Torreon Subarea

The Torreon Subarea includes the Chapters of Counselor, Ojo Encino, Torreon, and Pueblo Pintado. The 1990 population of this area was 3,797 and the projected population by the year 2040 is 12,924. Its annual water production in 1998 was 36,783,000 gallons (113 acre-feet). Essentially all of the municipal water is from the Ojo Alamo Aquifer. Based on well logs for this area the maximum well yield is 70 gpm and it is approximately 1,100 feet deep.

5.2.9 NAPI

NAPI does not withdraw any groundwater for municipal or industrial purposes. However, NAPI currently receives approximately a small volume of per year of water for municipal and industrial purposes from NTUA. According to the information provide to the Navajo Nation Water Code in 1996 NAPI diverts 2,240 acre-feet for food processing and 55 acre-feet for local construction contractors (Department of Water Resources Management, *Water Use Fee Policy*, June 18, 1996).

5.2.10 Window Rock Subarea

The Window Rock Subarea includes the Fort Defiance and St. Michaels Chapters. Both of these communities have been designated by the NDED as economic development areas. Window Rock, Arizona is also the capital of the Navajo Nation. The NTUA system in Window Rock is the largest NTUA system on the Reservation. It has more than 2,800 connections. The 1990 census population of this subarea was 11,767 and the projected population by the year 2040 is 40,052. The annual water production in 1998 was 339,767,000 gallons (1,043 acre-feet).

Approximately 70 percent of the Window Rock water supply comes from the Black Creek Alluvium. These wells have yields up to 270 gpm and their depths range from 30 to 140 feet. However, this alluvial system is fully developed and very susceptible to droughts. To increase storage and recharge to the alluvial system during droughts, in 1984 the Indian Health Service built Blue Canyon Dam near Fort Defiance. Due to the limited surface water

supply and seepage into the faults underlying the reservoir, this 1,900 acre-foot reservoir has only filled once since it was constructed. Although a portion of the seepage loss recharges the Black Creek Alluvium, Blue Canyon Dam provides little recharge during droughts.

The remaining 30 percent of the Window Rock water supply is derived from the Slick Rock Well field east of Window Rock and from wells in the De Chelly Sandstone in the St. Michael's area. These wells all exceed 800 feet in depth. The Slick Rock well field, which has a static water level 700 feet deep, derives its water from the Gallup Sandstone. NTUA reports that the static water level in the Slick Rock area has declined 250 feet.

5.2.11 Thoreau - Smith Lake Subarea

The Thoreau - Smith Lake Subarea includes the Chapters of Baca/Haystack, Casamera Lake, Smith Lake and Thoreau. This subarea is not part of the Project's service area. This subarea has been included in this analysis because it currently exports groundwater to Chapters that are part of the service area. After the Project is completed, these exports will be reduced or eliminated. These Chapters are primarily located in the Rio San Jose watershed which is tributary to the Rio Grande. The 1990 population of this area was 3,600 and the projected population by the year 2040 is 12,253. Its annual water production in 1998 was 86,193,000 gallons (193 acre-feet). Much of this water is conveyed to the Church Rock Area from the Glorietta, Dakota and Morrison formations. Based on well logs for Thoreau the maximum well yield is 30 gpm and it is approximately 1,700 feet deep. For Smith Lake the maximum well yield is 110 gpm and it is approximately 2,000 feet deep. Modeling of the Plains Electric Generating Station indicated that 8,000 acre-feet per year withdrawals would result in a water level decline of 40 feet in the Thoreau area.