DRAFT

WATER RESOURCE

DEVELOPMENT STRATEGY

FOR THE NAVAJO NATION

NAVAJO NATION
DEPARTMENT OF WATER RESOURCES
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THE WATER RESOURCE DEVELOPMENT STRATEGY FOR THE NAVAJO NATION EXECUTIVE SUMMARY

I. Introduction

The Navajo Nation has severe water infrastructure deficiencies that impact the health, economy, and welfare of the Navajo people. The lack of adequate domestic and municipal water is the greatest water resource problem facing the Navajo Nation. Given the limited tribal resources, and the limited federal budgets and authorizations, the water resource problems will become increasingly acute, intensifying the poor socioeconomic conditions on the Navajo reservation. The broad goals of this *Water Resources Development Strategy for the Navajo Nation* (Strategy Document) are to: describe current and projected water requirements, identify water resource infrastructure deficiencies, and present a strategy for addressing the deficiencies.

II. Goals and Objectives

The Navajo Department of Water Resources (NDWR) identified a need to better define and clarify the water resource problems confronting the Navajo Nation and to develop a plan for addressing those problems. The effort resulted in this Strategy Document. This document was first produced in July 2000. It has been updated with data available in the 2000 Census, more recent information from the Division of Economic Development, and separate investigations of the Navajo water projects.

This document provides enough background for the reader to understand the barriers that hinder the development of essential water delivery infrastructure. The broad goals of this Strategy are to: describe the current and projected water requirements, identify infrastructure deficiencies, and present a Strategy and a Plan of Action for addressing the deficiencies. The specific objectives are to:

- Provide an overview of water supply and management on the reservation, including descriptions of the Tribal entities that play key roles.
- Describe water use and demand on the Navajo Nation.
- Based on current and future water demands, identify water infrastructure deficiencies.
- Propose a long-term water resource development strategy for the Navajo Nation.

- The Navajo Nation will work with the appropriate federal agencies, including but not limited to the Bureau of Indian Affairs (BIA), the Bureau of Reclamation (Reclamation), Indian Health Services (IHS), the Army Corps of Engineers, and the U.S. Department of Agriculture, to develop an interagency consensus on a Plan of Action to implement the strategy.

The Strategy includes constructing several large regional water supply projects and developing or rehabilitating local multipurpose delivery systems that treat and deliver water to domestic, municipal, industrial and agricultural water users. The Strategy does not address the needs of the Navajo Nation to develop new irrigation projects, or to expand historically used but currently abandoned irrigation projects. Those projects may be needed for the Navajo Nation to achieve full economic self-sufficiency. However, because the viability of such projects is subject to ongoing and potential litigation, the strategy for development of those projects is not included in the *Water Resource Development Strategy for the Navajo Nation*. For similar reasons the water requirements of large, single purpose industrial users, like power generating stations, and the water requirements for ceremonial purposes are beyond the scope of this document.

III. Background

The Navajo Nation is the largest Native American reservation in the United States covering more than 27,000 square miles; an area larger than the state of West Virginia. The reservation is located in the Four Corners Region in Arizona, New Mexico and Utah (see Figure ES-1). The U.S. Census Bureau estimated that in 2000 the on-reservation population was 180,462. The Navajo Department of Water Resources projects that this population will increase to nearly 500,000 by the year 2040. Economic conditions on the reservation are in a desperate state. With more than 42 percent of the population living below the federal poverty levels, the poverty and unemployment rates on the Navajo reservation are among the worst in the United States.

The total municipal water consumption on the reservation is approximately 12,000 acre-feet annually. Per capita water use on the reservation ranges between 10 and 100 gallons per day depending upon the water system and the availability of the water supply. By comparison, the average per capita use for 80 neighboring non-Indian communities in the Western United States is 190 gallons per day. Assuming the on-reservation water users achieve parity with the neighboring non-Indian communities, the on-reservation municipal water demand will increase to an average per capita water use of 160 gallons per day and exceed 89,000 acre-feet by the year 2040.

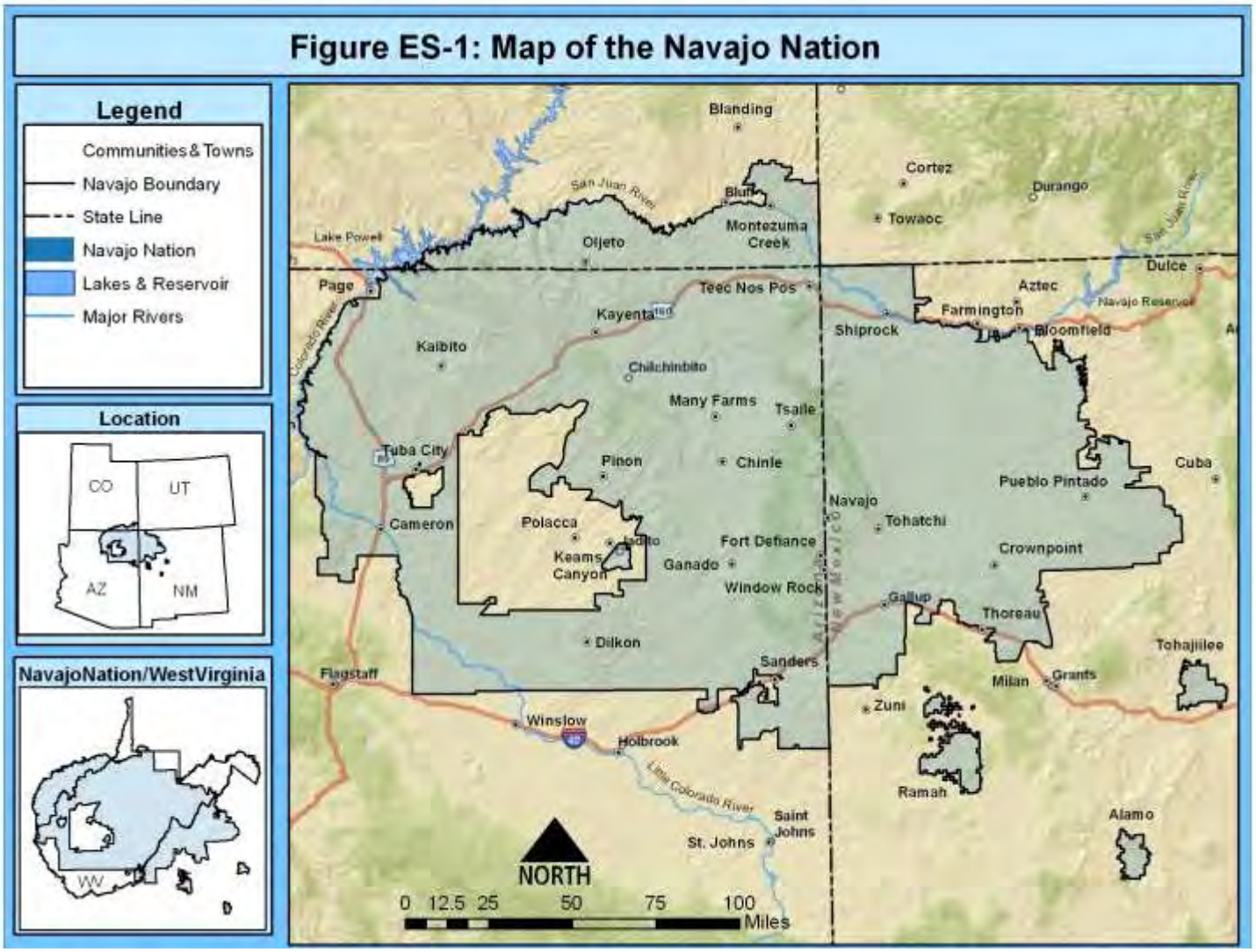


Figure ES-1: Map of the Navajo Nation

According to the United States Census 2000, approximately 30 percent of the Navajo homes were without complete plumbing facilities and complete kitchens. The NDWR estimates that approximately 30 percent of the households on the reservation are without direct access to public water systems and haul water long distances to provide water for their families. In 2006 Dornbusch and Associates evaluated the cost of water hauling on the Navajo reservation. This evaluation included costs for water hauling equipment, vehicles, and the opportunity cost of time. Families, which haul water for domestic purposes, spend the equivalent of $43,000 per acre-foot of water compared with $600 per acre-foot for typical suburban water users in the region. This Navajo water hauling cost is $133 per thousand gallons. This water is among the most expensive in the United States for a sector of the population that is among the poorest.

These water haulers often rely on non-potable water sources such as stock tanks for drinking water. Those that do have running water depend on public water supply systems that are deteriorating and are struggling to generate adequate revenues for maintenance. Many of these water systems have exceeded the maximum sustainable withdrawal capacity of their source aquifers, have poor water quality, and are susceptible to drought.

The lack of a reliable and affordable potable water supply stifles economic growth throughout the reservation. It also contributes to a high incidence of disease and infection attributable to waterborne contaminants. This chronic condition places large financial burdens on federal programs that treat diseases and illnesses that could be prevented if adequate safe water supplies were available. In a report to Congress by the Comptroller General, it was noted that reservation families living in homes with unsatisfactory environmental conditions (*e.g.*, inadequate drinking water) placed four times the demand on Indian Health Service primary health care systems as those with satisfactory conditions. In 2006 EcoSystems Inc. reported Indian Health Service data showing correlations between the percent of in home sanitation facilities and the post neonatal mortality rates per live births, and the gastroenteric mortality rates.

These conditions have contributed to emigration from the Navajo Reservation. Between 1990 and 2000 the Navajo population on the Reservation and Trust Land increased by 21.6 percent, while the population outside of these areas increased by 53.2 percent. Without reducing the emigration, by 2012 more than half of the Navajo people may be living off of the Navajo Reservation. And by 2020 more than half of the Navajo population will be living away from the Navajo Reservation and Trust Land.

The Navajo Nation is committed to improving the standard of living on the reservation. The fundamental first step in improving the socioeconomic conditions is stimulating economic developments which will, in turn, reduce demands on federal programs. Recognizing that water is integral to human health and safety and economic development, the Navajo Nation has placed one of its highest priorities on developing reliable water supplies. Accordingly, the Navajo Nation has drafted this water resource development strategy.

IV. Water Resource Development Strategy for the Navajo Nation

On July 17, 2000, the Navajo Nation (NN) and the Bureau of Reclamation (Reclamation) signed a memorandum of understanding to support the Navajo Nation's efforts to develop its water resources. This strategy is articulated in *Water Resources Management and Development Strategy for the Navajo Nation* (Strategy Document). The Strategy Document describes the tremendous overall need for water development on the Navajo Nation, and lays out a strategy for meeting the need. The Development Strategy includes:

- Developing large regional water supply projects.
- Developing and rehabilitating local domestic and agricultural water projects.
- Assistance for water haulers
- Preparing reservation-wide chapter water plans based on municipal sub-areas to assess needs and prioritizing projects.
- Completing NIIP.
- Continuing to address deficiencies in water storage facilities.
- Improving drought response and mitigation.
- Improving flood plain management.
- Continuing with watershed restoration projects.
- Establishing technical advisory committees for major water projects or initiatives, these committees will coordinate technical and fiscal resources of the Navajo Nation and Federal agencies.

The Strategy Document includes development of several large regional water supply projects and rehabilitation of local systems that deliver water to domestic, municipal, industrial and agricultural users. The Strategy does not address the needs of the Navajo Nation to develop new irrigation projects, nor to rehabilitate all of the historically used, but to address the currently abandoned irrigation projects. Those projects are needed for the Navajo Nation to achieve economic self-sufficiency. Due to the viability of such projects being subject to ongoing and potential litigation, the strategy for developing all of those lands is not included in the Strategy Document. For similar reasons the water requirements of large, single purpose industrial users such as power generating stations and the water required for ceremonial purposes are also beyond the scope of this document. Most of these water projects have made tremendous progress since July 2000.

1. Regional Water Supply Projects

The cornerstone of the Strategy Document is several large, regional water supply projects (see Figure ES-2) that will provide safe, new, and reliable water supplies for municipal use and will stimulate sustainable economic development on the reservation. These regional projects will maximize the number of water users that will have reasonable access to the mainline delivery systems. Most of these projects have made significant progress since July 2000.

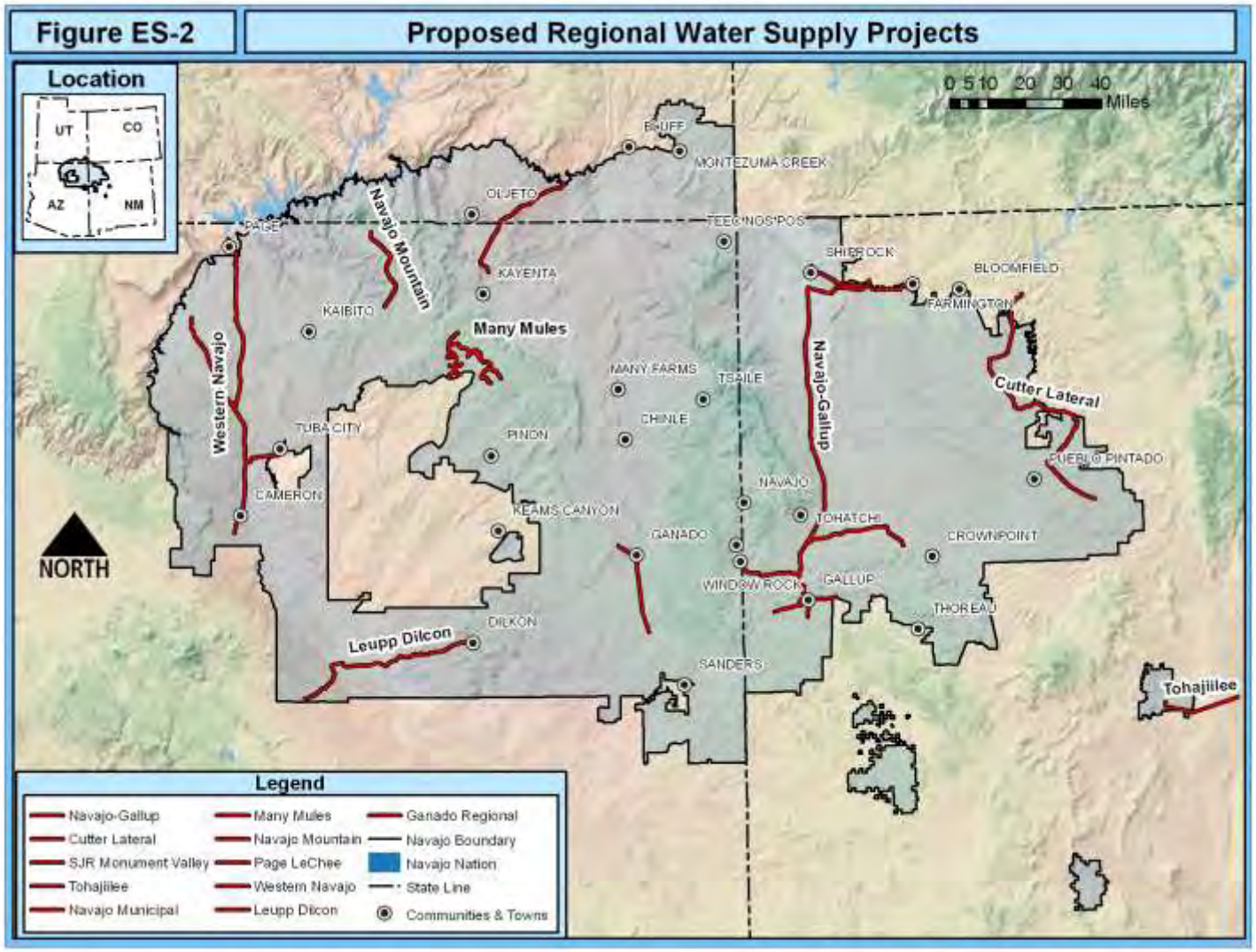


Figure ES-2: Proposed Regional Water Supply Projects

The proposed regional water supply projects will convey domestic water to approximately 67 of the 110 chapters on the reservation. By the year 2050 these systems will provide capacity to serve domestic water to more than 80 percent of the projected population of 500,000. The proposed regional projects are estimated to cost billions of dollars to construct. These projects include, but are not limited to:

- Farmington to Shiprock Pipeline (Also called the Navajo Nation Municipal Pipeline which is authorized for construction) – In 2000 Reclamation was authorized to construct this project. Major construction began in September 2008, and the $56 million project is projected to be completed in 2012.

- Navajo Gallup Water Supply Project – In 1976, Reclamation was authorized to conduct feasibility level studies. In 2007 Reclamation completed the appraisal level study and the draft Environmental Impact Study. In 2009 the Secretary of the Interior issued a record of decision and in March 2009 President Barack Obama signed legislation authorizing construction. This project was authorized as part of the Navajo Nation San Juan River Settlement. Federal construction is expected to begin in 2012 and will be completed in 2024. In 2007 Reclamation estimated that the project cost was $865 million.

- Western Navajo Pipeline (Proposed in the 2008 Little Colorado River (LCR) Agreements in Principle) – As a component of the North Central Arizona Water Supply Study, Reclamation completed appraisal level study in 2006. In 2010 the Project sponsors secured feasibility level study authority through Reclamation's Rural Water Program. In 2010 DOWL HKM estimated that the project cost was $515 million.

- C-Aquifer Ganado Groundwater Project (Proposed in the 2011 LCR Agreements in Principle) – In 2010 Reclamation began an appraisal level study through the Rural Water Program. In 2010 NDWR estimated that the project cost was $60 million.

- C-aquifer Leupp to Dilkon Pipeline (Proposed in the 2011 LCR Agreements in Principle the Northern Arizona Indian Water Settlement Agreement) – Reclamation funded special studies of this project that resulted in a project alignment and preliminary cost estimate. In 2010 Reclamation began an appraisal level study through the Rural Water Program. In 2010 NDWR estimated that the project cost was $110 million.

- Halchita to Kayenta San Juan River Water Supply Project (Proposed in the 2010 San Juan River Utah Agreements in Concept) – Reclamation completed a draft regional water study for this project. In 2010 Reclamation began an appraisal level study through the Rural Water Program. In 2009 Reclamation estimated that one configuration had a project cost of $151 million.

- Aneth – Red Mesa Corridor Water Project (Proposed in the 2010 San Juan River Utah Agreements in Concept) – The Utah Navajo Trust Fund funded special hydraulic studies of

this project and the Utah chapter water plans. In 2010 the NDWR estimated that the project cost was $41 million.

Due to changing circumstances, including the 2005 shutdown of the Mohave Generating Station, two regional projects described in detail in the 2000 Strategy Document have been deemphasized in the current document. Although these projects are still part of the overall water development strategy, these two projects will not be utilized to meet water demands within the next forty years:

- Alternative Water Supply for Black Mesa (Either a Lake Powell Peabody Pipeline or a C-aquifer Black Mesa Pipeline proposed in the 1999 LCR Agreements in Concept)

- Three Canyon Water Supply Project (Proposed in the 1999 LCR Agreements in Concept)

2. Local Water Supply Projects

Even with the large regional projects, without additional local infrastructure, conveyance and treatment capacity will be inadequate to deliver potable water from the regional systems to many of the water users. Even with the regional projects and the associated local distribution systems fully in place, approximately 40 percent of the chapters will rely on local water sources and facilities. Many of these areas have systems that require rehabilitation, and many areas require new systems In 2010 the Indian Health Service identified approximately 679 projects with a total cost of more than $562 million on the Sanitation Deficiency System list. Since 2000 the IHS has constructed nearly $160 million of local projects, and more than 10,000 water connections have been installed.

A partial list compiled by the Navajo Department of Water Resources of strategically significant municipal projects includes:

- Page-LeChee Water Supply Project – Appraisal level and geotechnical studies have been completed on the intake site. The environmental assessment is completed with a finding of no significant impact. In 2003 Tetra Tech RMC estimated the project cost to be $12.0 million.

- Albuquerque to Tohajilee Water Supply Project – Reclamation completed appraisal level investigations. State planning funds are being used to initiate further planning studies. This project may be implemented through the Army Corps of Engineers WRDA Section 593. In the 2011 Tetra Tech RMC preliminary Engineering Report, the reported project cost to be $10.0 million.

- Many Mules Water Supply Project – Appraisal level investigations have been completed. In 2007 NDWR estimated the project cost to be $10.6 million. In December 2011 Peabody Western Coal Company (PWCC) agreed to supply water from existing wells.

- Navajo Mountain Water Supply Project – Reclamation funded the preliminary engineering investigations and numerous system improvements. In 2010 IHS estimated that the project cost was $10.6 million. Phases 1, 2, 3 are being constructed, with completion expected in 2012. These funds have come from the Indian Health Service, the Bureau of Indian Affairs, the Environmental Protection Agency, the Navajo Nation, and the State of Utah.

- Crownpoint Becenti Water Supply Project (A component of the Navajo Gallup Water Supply Project) – Appraisal level investigations are complete. In 2004 Tetra Tech RMC estimated the project cost to be $29.2 million.

- Gallup Regional System (A component of the Navajo Gallup Water Supply Project) Reclamation funded appraisal level investigation and special studies of this System. The State of New Mexico and Indian Health Services have funded several of the initial phases which are under construction. In 2007 Reclamation estimated that the project cost was $48.5 million. The State of New Mexico has provided approximately $12 million.

- Cutter Lateral Region System (A component of the Navajo Gallup Water Supply Project, and is also known as the Eastern Agency Water System) – Reclamation funded appraisal level investigation and special studies of this System. The State of New Mexico and Indian Health Service have funded several of the initial phases which are under construction. In 2007 Reclamation estimated that the project cost was $160 million. The State of New Mexico has provided approximately $20 million and the USDA has provided approximately $8 million.

The rehabilitation and development of local irrigation and livestock water systems is also an important component of the Strategy. Reclamation's Navajo Agricultural Assessment Investigations, Native American Affairs Office, Reclamation 2025 Program, and the Water Conservation and Management Program supported numerous projects:

- For the Ganado Irrigation Project the Water Conservation and Management Plan was completed in 1998. The rehabilitation of the Ganado Irrigation Project was completed in 2000.

- For the Shiprock Irrigation Projects the Draft Water Conservation and Management Plan was completed in 2000. Since then numerous canal and structural upgrades on the Hogback and Fruitland Irrigation Projects have been completed including reconstruction of the Hogback Diversion Structure. An irrigation rehabilitation plan was completed in 2011. Rehabilitation based on this $20 million plan was authorized by the San Juan River Settlement.

- Reclamation, the BIA and the Navajo Nation provided cost sharing assistance on the Thohotso Diversion Structure which was implemented by the USDA in 2010.

- For the Red Willow Irrigation Project, Reclamation, the State of New Mexico and the Navajo Nation funded improvements to the Chuska Dam, and the USDA implemented the system

rehabilitation in 2001.

- For the Many Farms Irrigation Project the Water Conservation and Management Plan was completed in 2006. Reclamation and the Navajo Nation funded the reconstruction of the Many Farms Diversion Structure, along with other water conservation system improvements.

- For the Red Lake Irrigation Project the Water Conservation and Management Plan was completed in 2007. The environmental assessment for the conservation plan is completed.

- For the Tsaile/Wheatfield Irrigation Projects, the Water Conservation and Management Plan is underway.

- For the Kerley Valley Irrigation Project the Water Conservation and Management Plan was completed in 2003. The BIA project is local in the former Bennet Freeze Area. Implementation of that plan is subject to ongoing discussions between the Navajo Nation and the Hopi Tribe. The BIA has begun surveying the project service area.

- For the Captain Tom Irrigation Project the Water Conservation and Management Plan construction may begin in 2013.

- The NDWR has requested funding for Water Conservation and Management Plans for Round Rock and Lukachukai Irrigation Projects.

3. Assistance for Water Haulers

For areas where distribution systems are currently infeasible, community wells and watering points need to be upgraded or constructed to improve access for water haulers, perhaps utilizing a water-hauling truck service. The IHS and State of New Mexico have been funding this work. According to IHS statistics, since 2000 the percentage of homes hauling water has declined by almost 10 percent. In 2010 the NDWR initiated a $2 million pilot water hauling program funded by EPA.

4. Chapter and Regional Water Plans to Assess Needs and Prioritize Projects

To effectively meet these deficiencies, the Navajo Nation must systematically identify the full scope and need on the reservation. With assistance from the state and federal agencies, the Navajo Nation is preparing Chapter and Regional Water Plans across the Navajo reservation. To break the needs assessment into manageable parts, the reservation will be assessed regionally and the plans will follow the New Mexico Interstate Stream Committees *Regional Water Planning Handbook* (December 1994). The municipal sub-areas or regions are based on the locations of the existing and proposed regional water supply projects, growth centers and jurisdictional boundaries. The plans will develop alternatives based on a short-term, mid-term, and long-term basis. In 2008 ASCG

completed the Ramah Chapter Water Plan. In 2009 NDWR completed draft water plans for the Dilcon area chapters, Luepp area chapters and Alamo Chapter. In 2010 Brown and Caldwell completed the chapter water plans for the Utah Navajo Chapters. The water plans will include an appraisal of the water systems necessary to:

- Put all of the municipal water supplied by proposed regional projects to beneficial use
- Provide for domestic and municipal needs served by local systems not connected to the proposed regional systems
- Improve water service to families not connected to public water systems
- Provide the infrastructure for selected agricultural endeavors
- Optimize water conservation and wastewater reuse

This effort includes studying the fee structures to ensure the operation, maintenance, repair, and replacement of these water systems. The information compiled will enable the Navajo Nation to prioritize and sequence the proposed water development projects. The assessments and the resulting appraisals will be pursued through Reclamation's existing authorization to perform general studies. Where appropriate, the Navajo Nation is seeking federal appropriations, and new or expanded agency authorizations. The chapter plans complement the Land Use Plans which have been completed by most of 110 of the Navajo Nation Chapters. The water plans include domestic, municipal, commercial, and agricultural water demands. In 2010 Brown and Caldwell completed plans for the Utah Navajo Chapters. Draft plans have been completed for the Dilkon and Leupp area chapters.

5. Complete NIIP

The Navajo Indian Irrigation Project (NIIP) was authorized in 1962 through Public Law 87-483 for the principal purpose of furnishing irrigation water to approximately 110,630 acres of land. NIIP has not realized its full economic potential, and it is only 70 percent completed. The Navajo Nation has made several specific suggestions to realize NIIP's potential, including: 1) increase the annual construction funds to complete both the distribution systems and on-farm components in a shorter period of time, 2) vertically integrate to increase economic returns and employment, and 3) adequately fund the operation and maintenance. The Navajo Nation, BIA and Reclamation have assembled a project team to address the long-range plans for NIIP.

In 2011 Keller Bliesner and Associates compiled information on the completion of NIIP. Based on that compilation and assuming a $26 million per year funding level, completing construction will cost $403 million, rehabilitation will cost $125 million, addressing NIIP deficiencies will cost $53 million, on-farm rehabilitation will cost $14 million, and new on-farm development will cost $61.7 million.

6. Address Deficiencies in Storage Facilities

The Department of the Interior (DOI) Dam Safety Program's nationwide technical priority rating includes 15 high hazard dams on the Navajo Nation. Dam safety work has been completed on Canyon Diablo, Round Rock, Ganado, Wheatfield, and Many Farms Dams. Five others, Captain Tom, Tsaile, Charlie Day, Red Lake, and Asaayi, are ranked in the top ten by the DOI. In 2006 the NDWR Safety of Dams Branch estimated that approximately $47 million of improvements are needed over the next ten years to address operational deficiencies in the remaining unsafe dams. These improvements include conducting deficiency verification analyses, developing standard operating procedures, preparing emergency action plans, establishing early warning systems, and addressing structural problems.

7. Drought Response and Mitigation

Since the signing of the MOU in July 2000, the Navajo Nation has been racked by extremely dry years. Reclamation and the BIA funded the Navajo Nation's Drought Mitigation and Response Plan which follows the National Drought Mitigation Center guidelines. This plan was adopted by the Navajo Emergency Management Commission. Reclamation funded drought mitigation projects at Navajo Mountain, Alamo, Toadlena, Window Rock, Bird Springs, and Bodway and many other places. Reclamation funded new projects at Lupton and Lower Greasewood. Reclamation also played a key role in recent shortage sharing agreements for the San Juan River basin in New Mexico. Additional studies and mitigation of climate change impacts are needed.

A survey of the NTUA public water systems presented in the drought plan showed approximately $300 million of needed system mitigation. The response plan is approximately $10 million.

8. Flood Plain Management

Throughout most of the United States 100-year flood planes have already been delineated. With these delineations entities can participate in Federal Emergency Management Authority flood insurance programs. Addressing flood hazard is required for essentially all federally funded construction programs. Typically on the Navajo Nation adequate delineations are not available. Consequently, establishing flood hazard maps is critical to safe guard property and human safety. Work is proceeding through $12 million authorized by Section 520 of the Army Corps Water Resources Development Act of 1999. In 2006 the USGS completed an analysis of the magnitude and frequency of peak discharges for the Navajo Nation. This work was funded by the BIA and the USGS. High hazard delineations have begun. One hundred-year flood plain delineations for Window Rock and Chinle were completed in 2010. Flood management efforts are estimated to cost $30 million.

9. Watershed Restoration

Almost all of the watersheds on the Navajo Nation are degraded due to land use practices that occurred without sufficient attention to their impact on the watershed. Overgrazing has had a major impact on the watersheds, which results in more intense runoff events. When these events occur on degraded watersheds, they produce additional sediment loads in the reservoirs. These events incise channels which de-waters the alluvial groundwater destroying riparian areas and reducing the carrying capacity of the land. With a restored watershed, floods can be attenuated and recharge can be increased. Wetland values can also be enhanced. With proper grazing management the fodder production can be increased.

The Navajo Department of Water Resources (NDWR) has participated in several watershed restoration projects. The NDWR was involved with the: 1) the National Fish and Wildlife Asaayi Habitat Restoration Project, 2) the Arizona Water Protection Fund Tsaile/Canyon del Muerto Watershed Restoration Demonstration Project, 3) the Rio Puerco Watershed Bluewater Restoration Project, 4) Restoration of the Pueblo Colorado upstream of Hubbell's Trading Post which was funded by the BIA, and 5) the Arizona Water Protection Fund Red Lake Wash Watershed Restoration/Demonstration Project. The work in the Rio Puerco Watershed was conducted under the Bureau of Land Management's Rio Puerco Watershed Act. The Navajo EPA has been very successful in implementing EPA Section 319 projects. The NDWR has proposed 100 demonstration projects with a total cost of $3 million.

10. Technical Advisory Committees for Major Projects and Initiatives

To address these problems the leaders of the Navajo Nation are committed to providing capital and personnel resources, along with developing partnerships. However, due to the magnitude of the deficiencies, sufficient water resource development is beyond the financial capabilities of the Navajo Nation and the federal agencies authorized to address these needs. For example, based on current funding levels the Indian Health Service has a fifteen-year backlog of current sanitation deficiencies on the reservation. Similar budget constraints face the other federal agencies with the authorities to address commercial, industrial, and agricultural needs.

Technical Advisory Committees for major projects and initiatives will enable the Navajo Nation and the federal agencies to coordinate planning and construction activities and to use available fiscal and technical resources more effectively. These major initiatives may include the large regional projects, the small irrigation projects, NIIP, storage facilities, drought response and mitigation, floods plain management, and watershed restoration.

The Strategy Document has proven to be a success. Inter-agency coordination has been dramatically improved. Multi-agency water projects, for instance at Navajo Mountain and at Dilkon, are more common. The Navajo Nation had two cooperative agreements with Reclamation, one for technical assistance and one for construction. Between 2005 and 2010 the two agreements conveyed approximately $3 million per year of funding. Among others, additional agreements have been

executed through Reclamation's Rural Water Program, and NRCS's Conservation Coordination Partnership Initiative.

Improving on this success, and maintaining this level of program support, will require updating the July 2000 Strategy Document. For instance, studies of all of the proposed regional water development projects have been greatly advanced. These improved project descriptions need to be included in an updated document. The basic hydrologic information describing the water resources of the Navajo Nation has been improved by studies such as the *Western Navajo Water Supply Study* and the *Black Mesa Alternative Water Supply C-Aquifer Study*. This updated information also needs to be included in a new document. The roles and responsibilities of the other federal agencies and of the Navajo tribal programs can be better defined. New approaches may address continuing gaps in funding and authority.

V. Funding

It is premature to establish a firm, precise cost estimate for implementing the Strategy Document. It is also too early to present project specific implementation schedules. The costs and schedules will be evaluated during the reservation-wide water plans and needs assessment. However, implementing the Strategy Document to enable the Navajo Nation to achieve parity with its non-Indian neighbors may cost several billion dollars. This amount is a major investment and must be compared with the returns. For instance, over a forty-year period, the Navajo Gallup Water Supply Project will generate $300 million in health related savings. Closing the average per capita income gap between the Navajo households and the United States by only 1 percent would, over a forty-year period, generate $800 million in direct benefits to the Navajo Nation, along with significant indirect benefits to the Federal government.

The combined cost of the regional projects and the local systems may exceed several billion dollars. The Navajo Nation will prioritize its resources to share in the cost of this effort. The Navajo Nation will commit staff, equipment, and materials where possible. However, developing the essential water infrastructure will require large capital investments well beyond the current economic means of the Tribal programs. In addition to projects constructed under P.L. 86-171, additional funding will be pursued through other avenues including:

- Navajo Water Rights Settlements
- Existing Federal Authorities (WDRA Sections 520, 593, and 595, Reclamations Native American Affairs Program, Water Conservation and Management, the Rural Water Supply Act, and BIA's Water Resources Programs, among others) and Annual Appropriations
- New Federal Authorities
- Federal Discretionary Funds
- Federal Grant Programs
- Federal Loan Programs

- State and Municipal Funds
- Private Funds
- Tribal Funds

VI. Plan of Action

The Plan of Action depends in part on the success and timing of ongoing and future water rights settlement negotiations. The regional projects, if all funded and constructed simultaneously, would demand significant, annual appropriations. Congress may be unwilling to appropriate such large sums and may require the Navajo Nation to prioritize and sequence these projects. As these projects get closer to implementation, the Navajo Nation will assess these fiscal constraints and develop an appropriate schedule. This long-term Strategy may take 50 years to implement.

The Navajo Nation recognizes its leadership role in Tribal water development. The Navajo Nation will work to ensure that its divisions work together, 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 budgets and expertise of several federal agencies. Technical Advisory Committees will coordinate technical and fiscal resources on the large water projects and major initiatives among the various entities. These committees will reduce agency redundancy and enable the agencies to utilize their combined resources more effectively. Similar committees have already been established for the larger Navajo Projects, Safety of Dam projects, and NIIP. More will be established as part of this plan.

To focus these groups, the NDWR will delineate the regional areas to be assessed, and develop an approach for prioritization. The regions will be based on the service areas of the regional projects, growth centers, and jurisdictional boundaries.

For the Plan of Action, the Navajo Nation, in partnership with Reclamation, completed the EIS and appraisal studies for the Navajo-Gallup Water Supply Project, authorized by Congress in March 2009. Through the San Juan River Settlement legislation, this project has already been submitted to Congress for construction authorization. The Little Colorado River Settlement and the related projects may follow a similar, or slightly delayed, timetable. The NIIP and the Safety of Dams programs continue to be very important Navajo Nation priorities.

Along with complete studies of the large and local water projects, the Chapter Water Plans will identify the full scope of the water related needs on the reservation. With adequate funding, these assessments should be completed within five years. The Navajo Nation will seek approximately $300,000 per year of annual appropriations from Congress under Reclamation's current general studies authority for these studies and plans. The water plans will identify and assess potential projects at an appraisal level. The appropriate authorization for feasibility design and construction will be pursued. The necessary feasibility studies will also be pursued to address the areas that will not be served by the proposed regional systems.

1. GOALS AND OBJECTIVES

The Navajo Nation has been waging an uphill battle for many years to maintain and modernize its water resource infrastructure. However, given existing agency resources, budgets, and authorizations, many of the water infrastructure deficiencies on the reservation will continue to go unattended and the problems may become more acute. The Navajo Nation Department of Water Resources (NDWR) identified a need to better define and clarify the water resource problems confronting the Navajo Nation and to develop a plan for addressing those problems. The effort resulted in this *Water Resources Development Strategy for the Navajo Nation* (Strategy). This document was first produced in July 2000. It has been updated with data available in the 2000 Census, more recent information from the Division of Economic Development, and separate investigations of the Navajo water projects. This document was partly funded by Reclamation's Upper Colorado and Lower Regional Offices through their Native American Affairs programs under Cooperative Agreement #07NA-32-01300-008. It was partly funded though the BIA's Planning and Pre-Development Program Contract # CTN-00T-78099.

This document provides enough background for the reader to understand the barriers that retard the development of essential water delivery infrastructure. The broad goals of this Strategy are to: describe the current and projected water requirements, identify infrastructure deficiencies, and present a Strategy and a Plan of Action for addressing deficiencies. The specific objectives are to:

- Provide an overview of water supply and management on the reservation, including descriptions of the Tribal entities that play key roles.

- Describe water use and demand on the Navajo Nation. This document will focus on the current level of water use and the anticipated water demands that are, or may be, unmet. These unmet needs include specific categories of water use, as well as specific water management objectives.

- Based on current and future water demands, identify water infrastructure deficiencies.

- Propose a long-term water resource development strategy for the Navajo Nation. The focus of this Strategy will be primarily, but not exclusively, on a plan by which the Navajo Nation can effectively seek and use technical and financial resources for development and rehabilitation of desperately needed water infrastructure on the reservation.

2. INTRODUCTION AND BACKGROUND

The Navajo reservation was established in 1868, and has expanded through a series of executive orders becoming the largest Indian reservation in the United States. It is larger than the State of West Virginia and six other states. The Navajo Nation encompasses more than 27,000 square miles including portions of Arizona, New Mexico and Utah (see Figure 2.1). The Navajo Nation is divided into 110 chapters, which are units of local government (see Figure 2.2). According to the Navajo Division of Economic Development (DED), in 2000 the population on the reservation was 180,462. According to the U.S. Census Bureau in 2000 approximately 300,000 Navajos resided in the United States.

Even after more than 100 years of federal trusteeship, the Navajo Nation faces serious economic and social challenges. In 2000 the Navajo Division of Economic Development indicated that the median family income was only $20,005 while the U.S. median family income was $41,994. The average per capita income for the Navajo Nation was less than $7,269 while the per capita income for the State of Arizona was approximately $24,028. More than 40 percent of the Navajo families on the reservation lived below the federal poverty levels, compared with less than 16 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 during 2000 was 11.2 percent, compared to an unemployment rate for the U.S. of approximately 4 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 total municipal water consumption on the reservation is approximately 12,000 acre-feet annually. Per capita water use on the reservation ranges between 10 and 100 gallons per day depending upon the water system and the availability of the water supply. By comparison, the average per capita use for 80 neighboring non-Indian communities in the Western United States is 190 gallons per day. Assuming the on-reservation water users achieve parity with the neighboring non-Indian communities, the on-reservation municipal water demand will increase to an average per capita water use of 160 gallons per day and exceed 89,000 acre-feet by the year 2040.

According to the U.S. Census in 2000 approximately 30 percent of the Navajo homes were without complete plumbing facilities and complete kitchens. The NDWR estimates that approximately 30 percent of the households on the reservation are without direct access to public water system and haul water long distances to provide water for their families. In 2006 Dornbusch and Associates evaluated the cost of water hauling on the Navajo reservation including purchase, containers, vehicles, and the opportunity cost of time. Families, which haul water for domestic purposes, spend the equivalent of $43,000 per acre-foot of water compared with $600 per acre-foot for typical suburban water users in the region. This Navajo water hauling cost is $133 per thousand gallons. This water is among the most expensive in the United States for a sector of the population that is among the poorest.

These water haulers often rely on non-potable water sources such as stock tanks for drinking water. Those that do have running water depend on public water supply systems that are deteriorating and are struggling to generate adequate revenues for maintenance. Many of these water systems have exceeded the maximum sustainable withdrawal capacity of their source aquifers, have poor water quality, and are susceptible to drought.

Safe drinking water is a precondition for health promotion and disease prevention. The lack of clean, safe water results in a higher incidence of disease, poor health, and fire protection. In 1996, President Clinton noted that "the number one health problem in the developing world is the absence of clean, safe water." Without access to safe drinking water, people are forced through a revolving door of expensive medical treatment and unhealthy conditions. In a report to Congress by the Comptroller General, it was noted that families living in homes without satisfactory environmental conditions placed fourth times the demands on IHS primary health care delivery systems than families living in homes with satisfactory conditions. Biological contaminants like e-coli bacteria, giardia, and crypto sporidium can only be controlled by proper water source protection, treatment and distribution systems. Children living in homes without access to safe, affordable, and dependable drinking water are especially vulnerable. In 2006 EcoSystems Inc. presented Indian Health Service data showing direct correlations between the percent of in-home sanitation facilities verses the post neonatal mortality rates per live births, and the gastroenteric mortality rates.

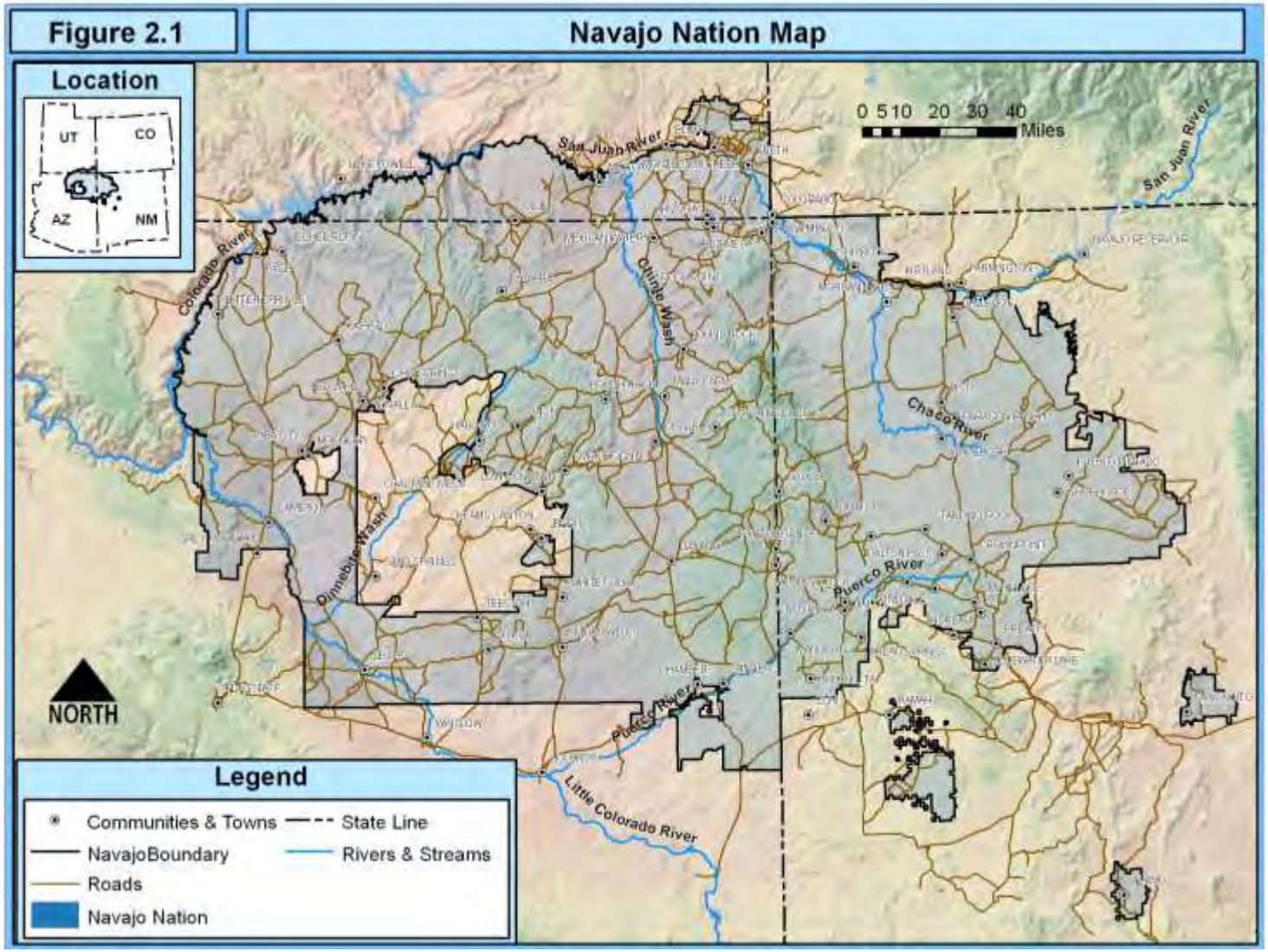


Figure 2.1: Navajo Nation Map

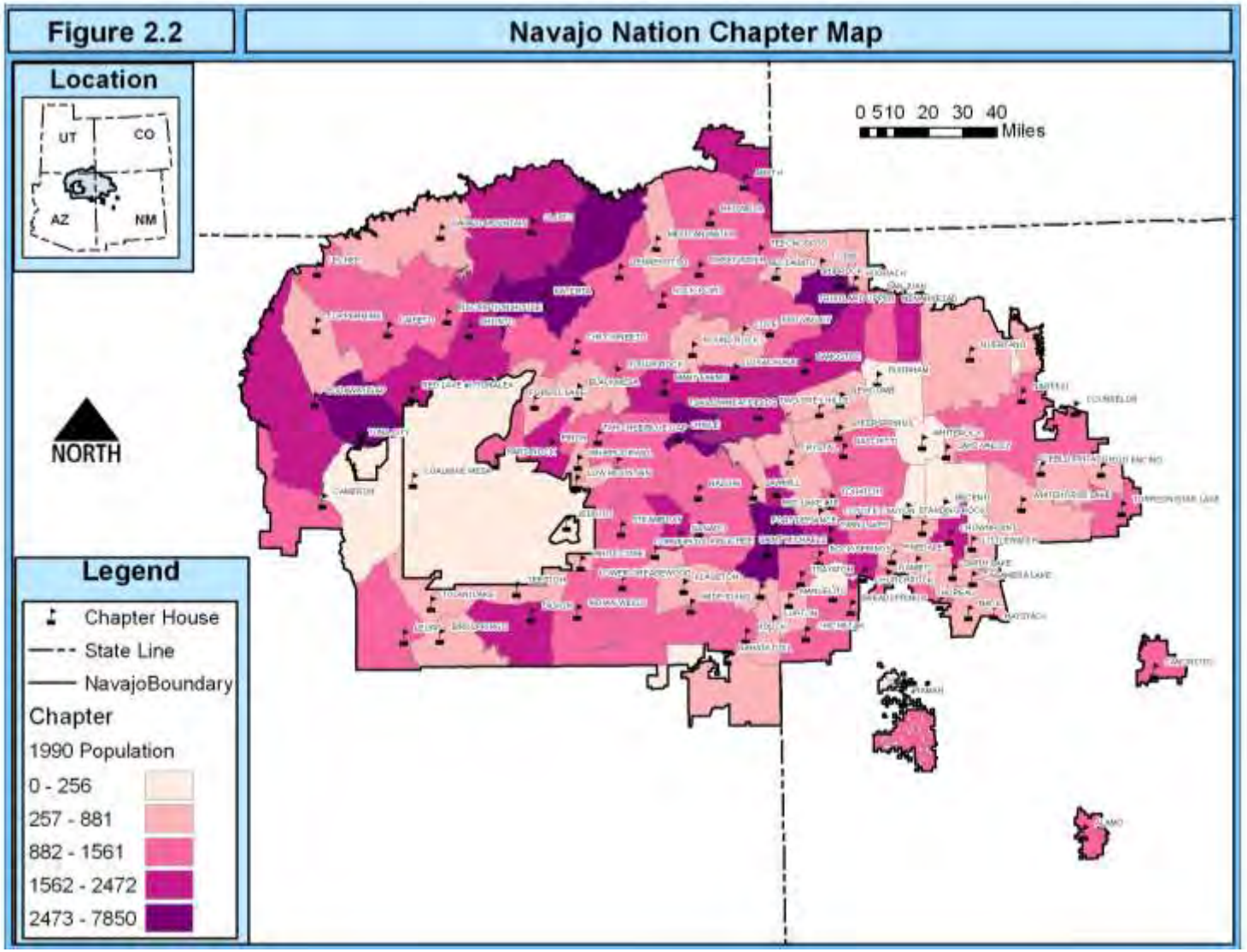


Figure 2.2: Navajo Nation Chapter Map

These grim statistics threaten the survival of the Navajo Nation. According to the Division of Community Development, due to the stagnation of 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 47 states grew by 71 percent, while the on-reservation population grew by 22 percent. Between 1990 and 2000 the Navajo population outside of the Reservation and Trust Land increased by 53.2 percent, while the population on the Navajo Reservation and Trust Land increased by 21.6 percent. Without reducing the emigration, by 2012 more than half of the Navajo people may be living outside of the Navajo Reservation. And by 2020 more than half of the Navajo population will be living outside of the Navajo Reservation and Trust Land.

The lack of infrastructure, the lack of economic development, and the sustained poverty are closely connected. Throughout the arid southwest, and especially on the Navajo Nation, a reliable water supply is essential for jump-starting and sustaining economic development. The Navajo Nation has identified economic development growth centers throughout the reservation. These economic development centers represent large population bases, which have the potential to benefit from an economy of scale in infrastructure development. Accordingly the Navajo Nation will focus resources in these locations to stimulate economic growth.

Creating an adequate water infrastructure does not guarantee sustained economic growth, or narrow the disparities between the Navajo people and the rest of the United States. It is however, a necessary prerequisite. And, if even modest steps can be taken, the benefits will be compounded. If improved water infrastructure can close the income gap by just one percent, the direct benefits to the Navajo Nation and the indirect benefits to the federal government will be worth tens of millions of dollars annually. For example, the Navajo Nation economy captures less than 8 percent of the $660 million annual tourism revenue in the Four Corners Area. If an enhanced tourist infrastructure increases that percentage to 12 percent, the Navajo Nation economy could generate an additional $26 million annually.

Current annual municipal water production on the Navajo reservation is approximately 12,000 acre-feet. Assuming that the economic and social conditions can be improved, and that emigration can be reduced, by the year 2050 the on-Reservation population of the Navajo Nation is projected to be approximately 500,000. If the disparities in water use between the Navajo people and the rest of the Nation are reduced, the total annual municipal water demand on the reservation will exceed 89,000 acre-feet. This demand requires a more than six-fold increase in water system capacity. Overcoming the legacy of economic neglect and the readily apparent deficits in infrastructure will require an aggressive water development program.

The funds needed to build the core delivery components of the large regional water projects may be partly met through settlements of the Navajo Nation's water rights. However, a concurrent and coordinated effort is needed to meet the needs that the large regional water projects will not meet.

This coordinated programmatic effort will require the skills and special expertise of several federal agencies and tribal departments.

The Navajo Nation is committed to improving the standard of living on the reservation. The fundamental first step in improving the socioeconomic conditions is stimulating economic developments which will, in turn, reduce demands on federal programs. Recognizing that water is integral to human health and safety and economic development, the Navajo Nation has placed one of its highest priorities on developing reliable water supplies. Accordingly, the Navajo Nation has drafted this water resource development strategy.

Section 1 of this document describes its Introduction and Background, Section 2 is the Goals and Objectives, Section 3 provides an overview of water resources management on the Navajo Nation including a description of the surface and groundwater, the Navajo agencies that provide water management, and the Navajo agencies that are partly responsible for increasing water demands. Section 4 describes the cooperating federal agencies. Section 5 describes the existing water uses and the infrastructure deficiencies. Section 7 presents the Navajo Nation Water Resources Development Strategy. Section 8 presents the plan of action for implementing the water development strategy.

3. WATER RESOURCE MANAGEMENT

The objective of this section is to present an overview of water resources and the existing water resource management on the Navajo reservation.

3.1 Water Resource Overview

The Navajo reservation is bounded by the San Juan River on the north, the Little Colorado River on the south, and the main-stem of the Colorado River on the West. The Navajo lands on the eastern side of the reservation are in the Rio Grande Basin. Largely ephemeral washes emanating on the reservation, such as the Chaco, Rio Puerco, and Pueblo Colorado contribute to the flows of these major river systems. The surface waters of the Navajo Nation are shown in Figure 3.2. For municipal water, the most important aquifers are the Coconino (C) Aquifer, the Navajo (N) Aquifer, and the Dakota (D) Aquifer, the Morrison (M) Aquifer, the Mesa Verde Aquifer, and numerous alluvial aquifers. The wells associated with these aquifers are roughly delineated in Figure 3.1. The rivers, washes, and aquifers constitute the waters of the Navajo Nation, which are under the jurisdiction of the Navajo Nation Water Code and are subject to the Navajo Nation's water management.

3.1.1 Groundwater

Groundwater is the most heavily utilized and dependable municipal water source for the Navajo Nation. It is found in four major water bearing formations (see Table 3.1, Figure 3.1a, Figure 3.1b, Figure 3.1c, Figure 3.1d, and Figure 3.1e) as well other minor aquifers. Although groundwater storage greatly exceeds the annual demand, only a small fraction of the groundwater in storage can be readily developed. It is also important that domestic groundwater withdrawals in the future remain within sustainable limits to ensure an adequate supply of water for future generations of Navajo people.

Table 3.1 Major Aquifers of the Navajo Nation

Aquifer	Total Storage* (million acre-feet)	Information Source
Coconino	413	ADWR 1989
Navajo	290	USGS 1997a
Dakota	50**	DOI 1993
San Juan Unit	1.18**	NWNMCOG 1994

*Total Storage used instead of recoverable volume because studies on sustainable withdrawals are inconclusive

**Estimated recoverable volume, not total storage volume.

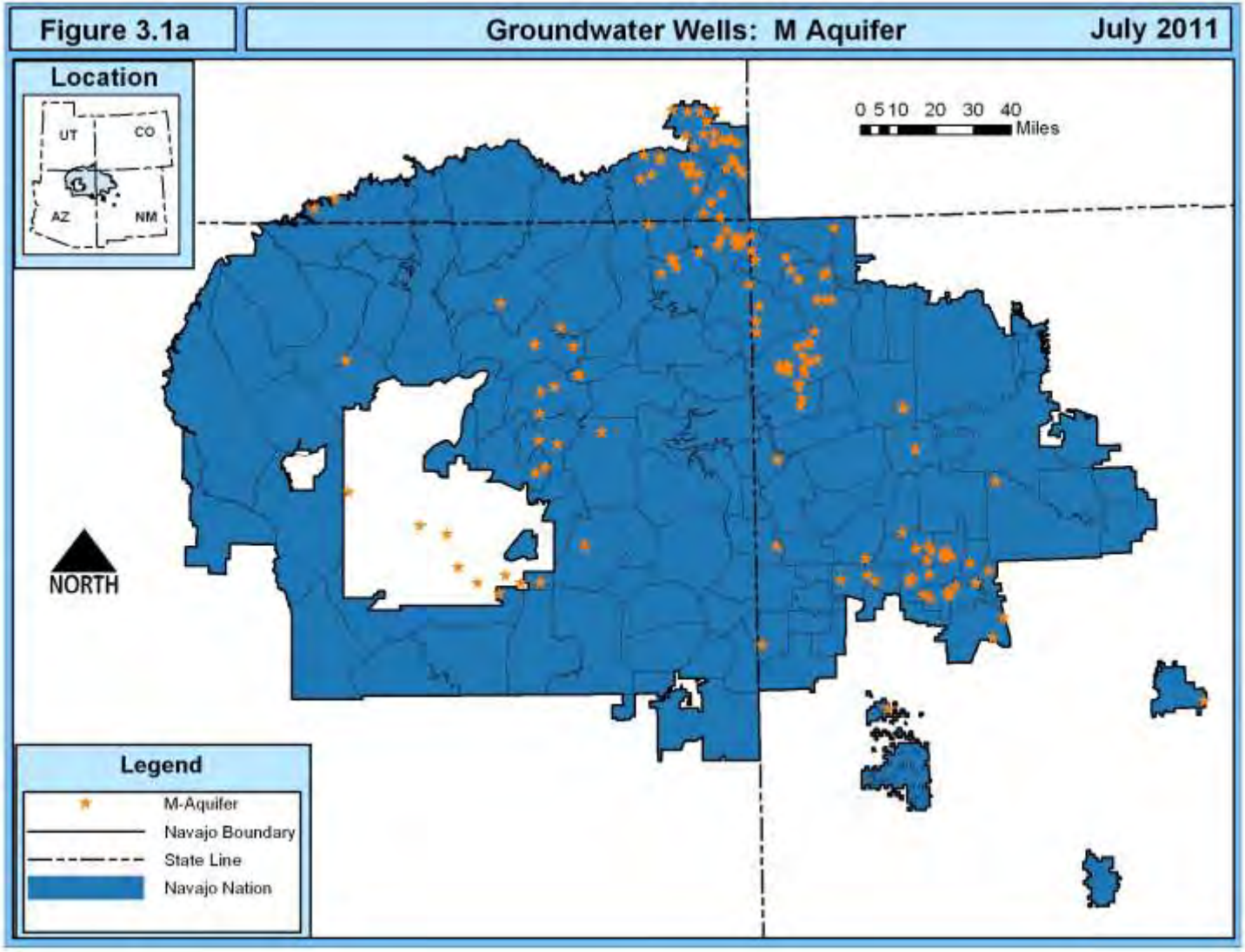


Figure 3.1a: Groundwater Wells: M Aquifer

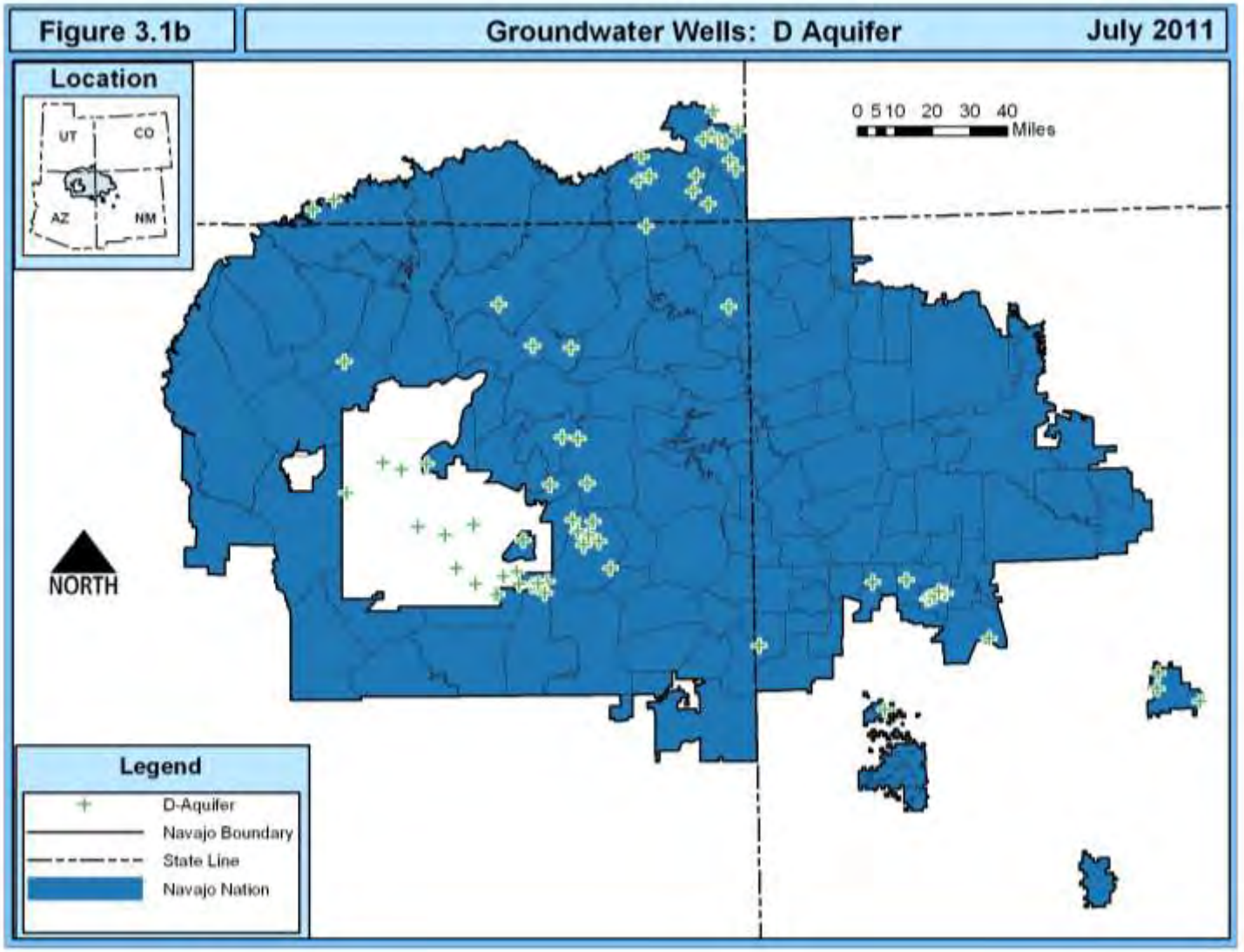


Figure 3.1b: Groundwater Wells: D Aquifer

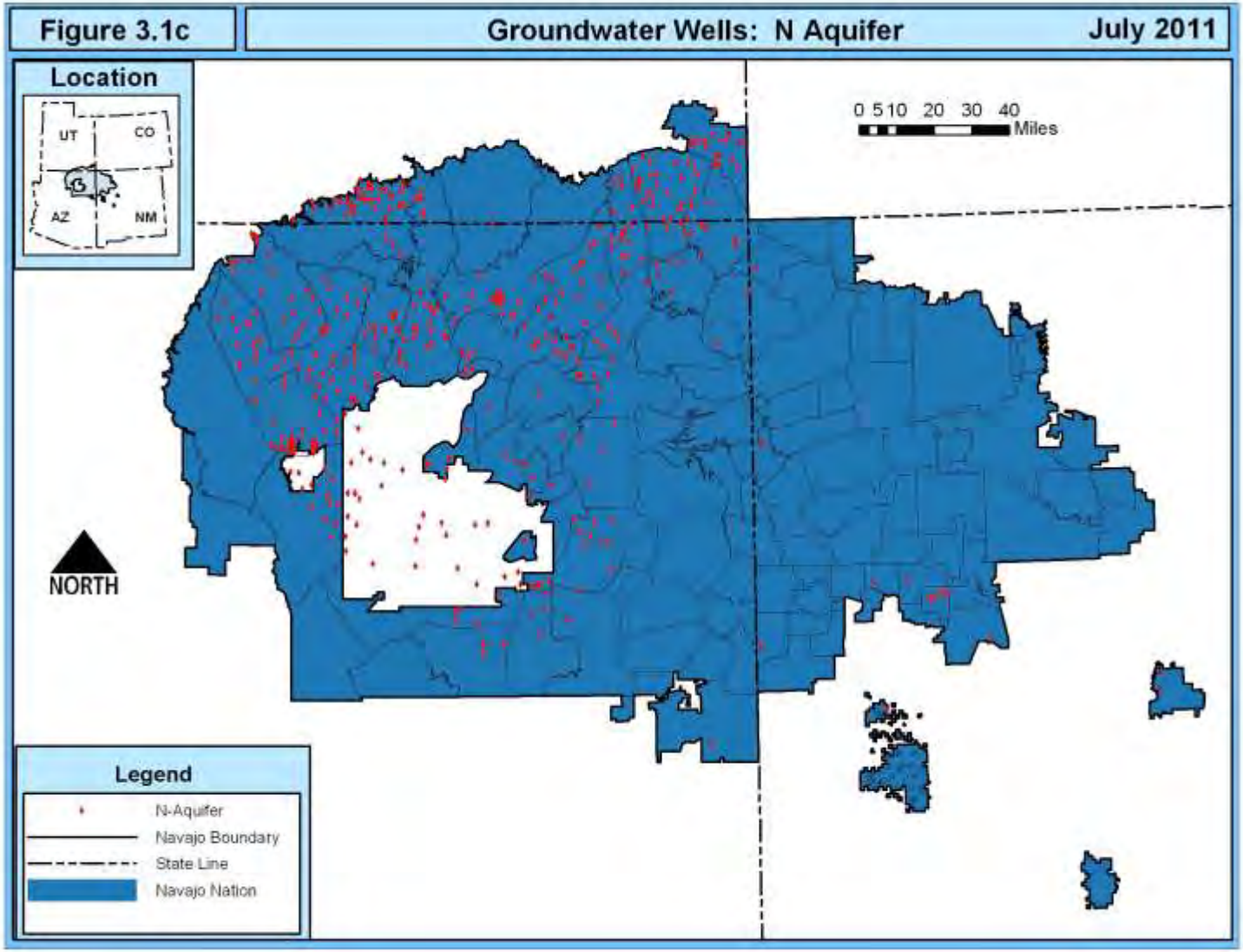


Figure 3.1c: Groundwater Wells: N Aquifer

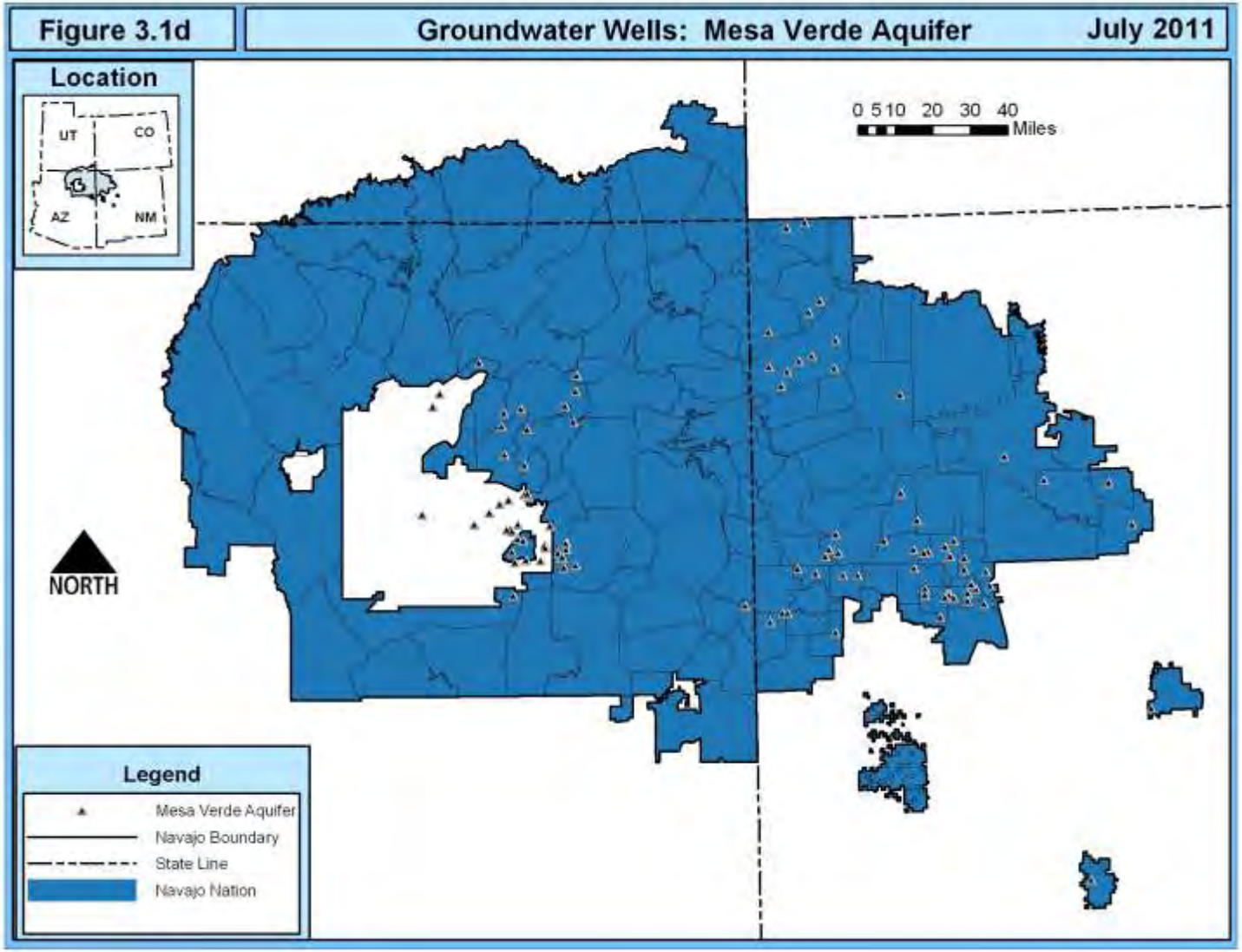


Figure 3.1d: Groundwater Wells: Mesa Verde Aquifer

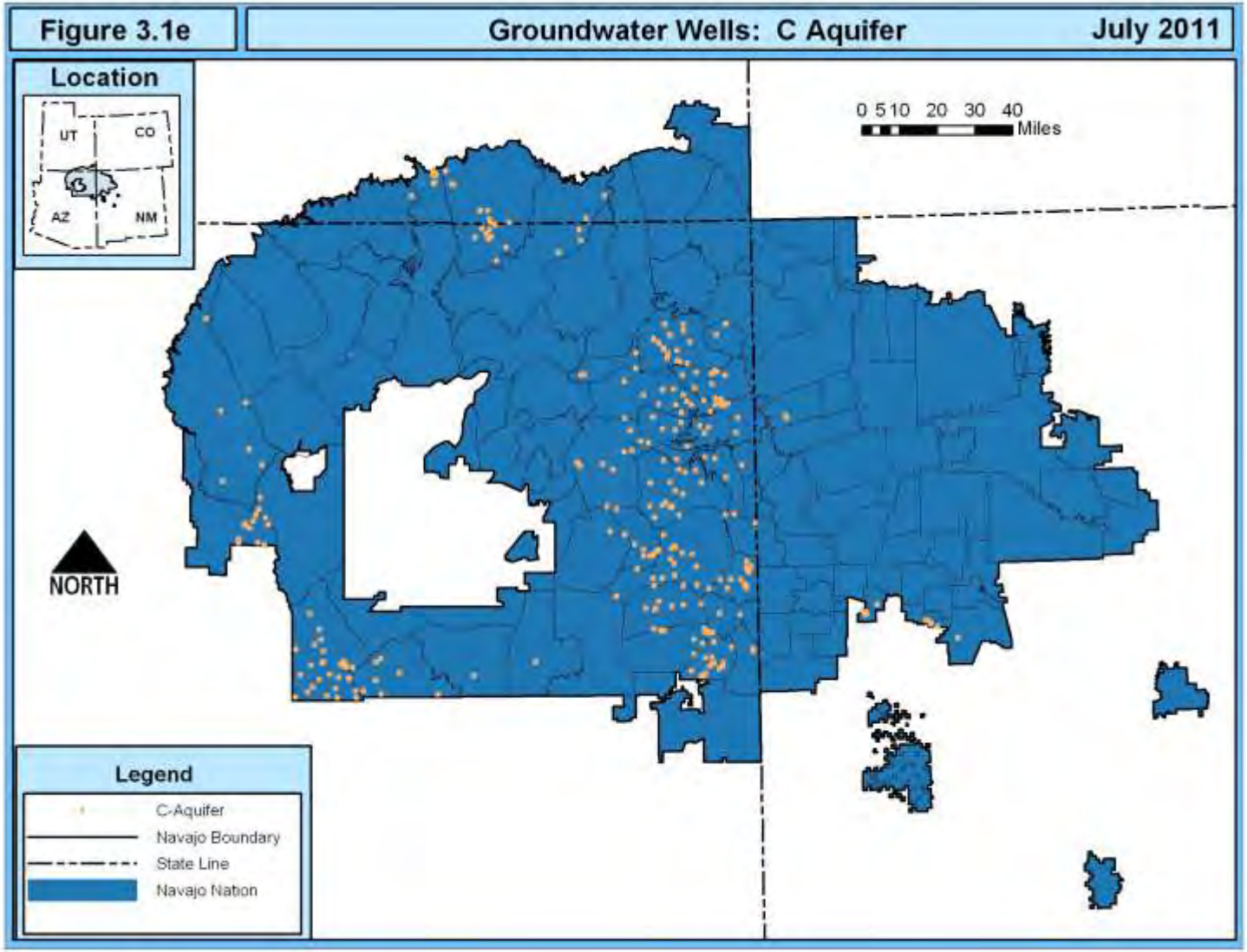


Figure 3.1e: Groundwater Wells: C Aquifer

C-Aquifer – The C-Aquifer underlies most of the reservation in the Little Colorado River Basin. It is recharged from outcrops on the Defiance Plateau, the Mogollon Rim, and the San Francisco Mountains. The communities of Cameron, Leupp, Ganado and Chinle, among others, depend on the C-Aquifer for much of their municipal water supply. It is also a major source of industrial water for non-Indian communities in the Little Colorado River basin.

N-Aquifer – The N-Aquifer has less storage than the C-Aquifer, but overall it has better water quality. The communities of Kaibeto, Kayenta, Pinon, Tuba City, and the Peabody Coal Mine, among others, depend on the N-Aquifer.

D-Aquifer – The D-aquifer is on the eastern portion of the reservation and is considered to have poor water quality. However, the communities of Tsayatoh, Sanostee, Smith Lake, and Casamera Lake, among others, rely on it as their primary source of water.

The San Juan Structural Unit includes several formations that are primarily located within the State of New Mexico. The major water bearing formations that provide water to Navajo public water systems are the Morrison and Mesa Verde. The communities of Crownpoint, Tohatchi, and Sanostee depend on the Morrison Aquifer. Several communities in the Eastern Agency including Coyote Canyon and Two Grey Hills rely on the Mesa Verde Aquifer. The Glorietta Aquifer and the Gallup Sandstone provide water to many of the neighboring non-Indian communities in New Mexico including the City of Gallup.

Alluvial Aquifers– Alluvial aquifers underlie many of the washes on the Navajo Nation, but their total available volume has not been evaluated. The communities of Fort Defiance and Saint Michaels receive 70 percent of their water supply from the Black Creek alluvial aquifer, which recharges rapidly. Dilkon, Cameron, and Lower Greasewood also rely on alluvial systems. Typically, these aquifers have very limited storage capacity and development potential, and are more prone to droughts. Furthermore, water quality problems such as high dissolved solids limit use.

3.1.2 Surface Water Hydrology

Surface water sources for the main reservation include the mainstream of the Colorado River, the Little Colorado River, the San Juan River, and ephemeral streams and washes (see Figure 3.2). Surface water development is hindered by a variety of practical and legal constraints. When describing surface water uses the terms diversions and depletions need to be differentiated. A diversion is the withdrawal of water from a surface source. Depletion is the difference between the diversion and any return flows to the surface source. The terms may not be used interchangeably because the volume of water depleted may be less than the volume diverted. Much of the hydrologic accounting in the Colorado River Basin for the “Law of the River” is based on depletions, not diversions. The major rivers are:

- Colorado River
- Little Colorado River
- San Juan River
- Tributary Washes
- Other River Systems

Colorado River – The Western Water Policy Review Commission (Pontius, 1997) reports that the average annual flow of the Colorado River at Lee's Ferry is between 13 and 15 million acre-feet. The Navajo Nation water rights in the mainstream of the Colorado River remain unquantified. For the Navajo Nation, access to mainstream water is limited by legal, physiographic, and environmental factors. These limitations may complicate the ability of the Navajo Nation to fully exercise its water rights even though the date of establishment for the reservation precedes most other users. Significant pumping and pipeline costs may also limit the use of Colorado River water. Another limiting factor is the federally mandated protection of endangered species including the humpback chub, razorback sucker, Colorado pike minnow (formally known as the Colorado squawfish) and ponytail chub.

Little Colorado River – The Arizona Department of Water Resources (ADWR 1994) estimates the median annual flow of the Little Colorado River at the reservation border is 162,900 acre-feet and the median undepleted flow is 222,450 acre-feet. The erratic flow regime and high sediment load of the Little Colorado River create challenges to water development. Ongoing water rights negotiations may result in funding for critical tribal water development in this basin.

San Juan River – According to reports from the San Juan River Recovery Implementation Program (Holden, 1999) the median annual flows of the San Juan River at Bluff, Utah is 1,620,000 acre-feet. The Navajo Nation has the paramount water claim from the San Juan River, but these water rights are unquantified. A limiting factor for water development in this basin is the protection of the endangered Colorado pike minnow and the razorback sucker. The presence of these species may reduce the water availability for the Navajo Nation and may restrict future development.

Tributary Washes – There is a lack of flow data for the tributary washes and streams to precisely quantify flows. However, the washes are generally ephemeral with erratic flow regimes and they may not be reliable water supplies for municipal purposes. Water is frequently stored in large shallow reservoirs, which are subject to high infiltration and evaporation losses. Consequently, the firm yield from these washes is far less than the average annual flow. At the higher elevations the perennial streams provide the recharge to the aquifers.

Other River Systems – The Navajo Nation has important land holdings in the Rio Grande, Rio Puerco, Rio San Jose, Zuni River, Bill Williams, and Verde River watersheds.

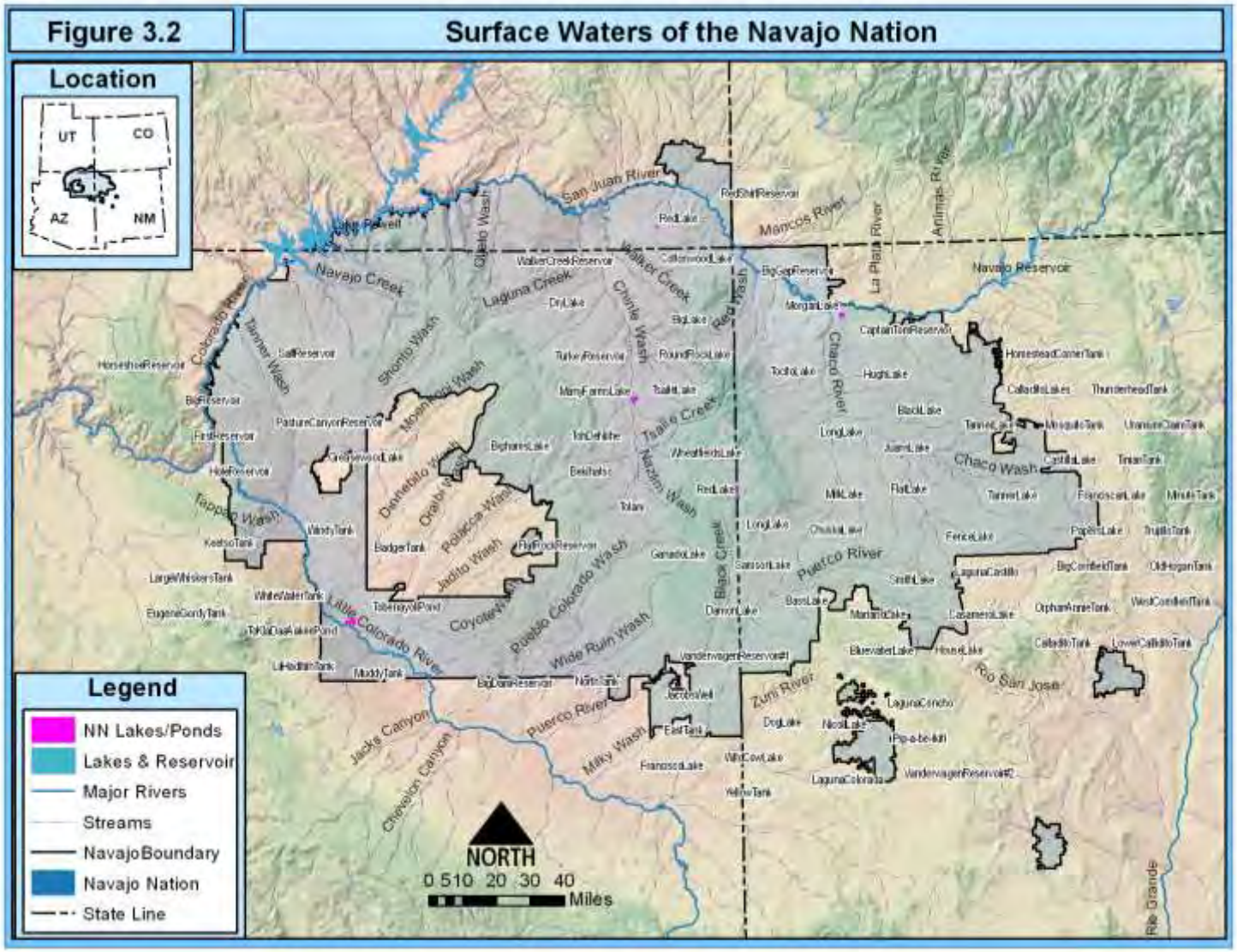


Figure 3.2: Surface Water of the Navajo Nation

3.1.3 Surface Water Storage

The reservoirs on the Navajo Nation provide storage for irrigation water, recharge to alluvial systems that the Navajo Nation relies on for domestic water supply, critical wildlife habitat, and recreation. A search of the NDWR data identified more than 20 significant storage facilities. A reservoir was considered significant if it has a surface area greater than 200 acres, is included in the NDWR SOD Plan of Operation, or is stocked by the Navajo Department of Game and Fish. The lakes and reservoirs have a combined surface area greater than 8,000 acres and a combined storage capacity greater than 100,000 acre-feet. These facilities are presented in Table 3.2., and are shown in Figure 3.3.

Table 3.2 Significant Reservoirs/Lake on or near the Navajo Reservation

NAME	Acre-Feet	Surface Acres	NAME	Acre-Feet	Surface Acres
Asaayi*	682	37	Juan's Lake	2,650	343
Antelope Lake	75	3	Long Lake	3,255	397
Aspen Lake	68	3	Many Farms*	14,500	1,500
Beeline Reservoir	1,000	213	Morgan Lake	16,750	1,228
Berland Lake	7	8	Red Lake*	10,650	1,100
Blue Canyon*	1,905	100	Red Lake	4,480	502
Bluewater Lake	8,920	609	Round Rock*	1,070	54
Captain Tom*	1,170	75	To'Hajiilee Lake*	1,344	48
Charlie Day	4	2	Todacheene*	80	8
Chevelon Canyon Lake		249	Trout Lake	120	9
Chuska Reservoir	3,345	83	Tsaile Lake*	5,100	270
Cutter Reservoir*	1,793	64	Wheatfields*	4,500	315
Ganado Lake*	3,750	335	Whiskey Lake*	7,458	100
Greasewood Lake	1,980	269	Window Rock*	210	10
			TOTAL	**96,866**	**7,934**

*NDWR Safety of Dams Plan of Operation.

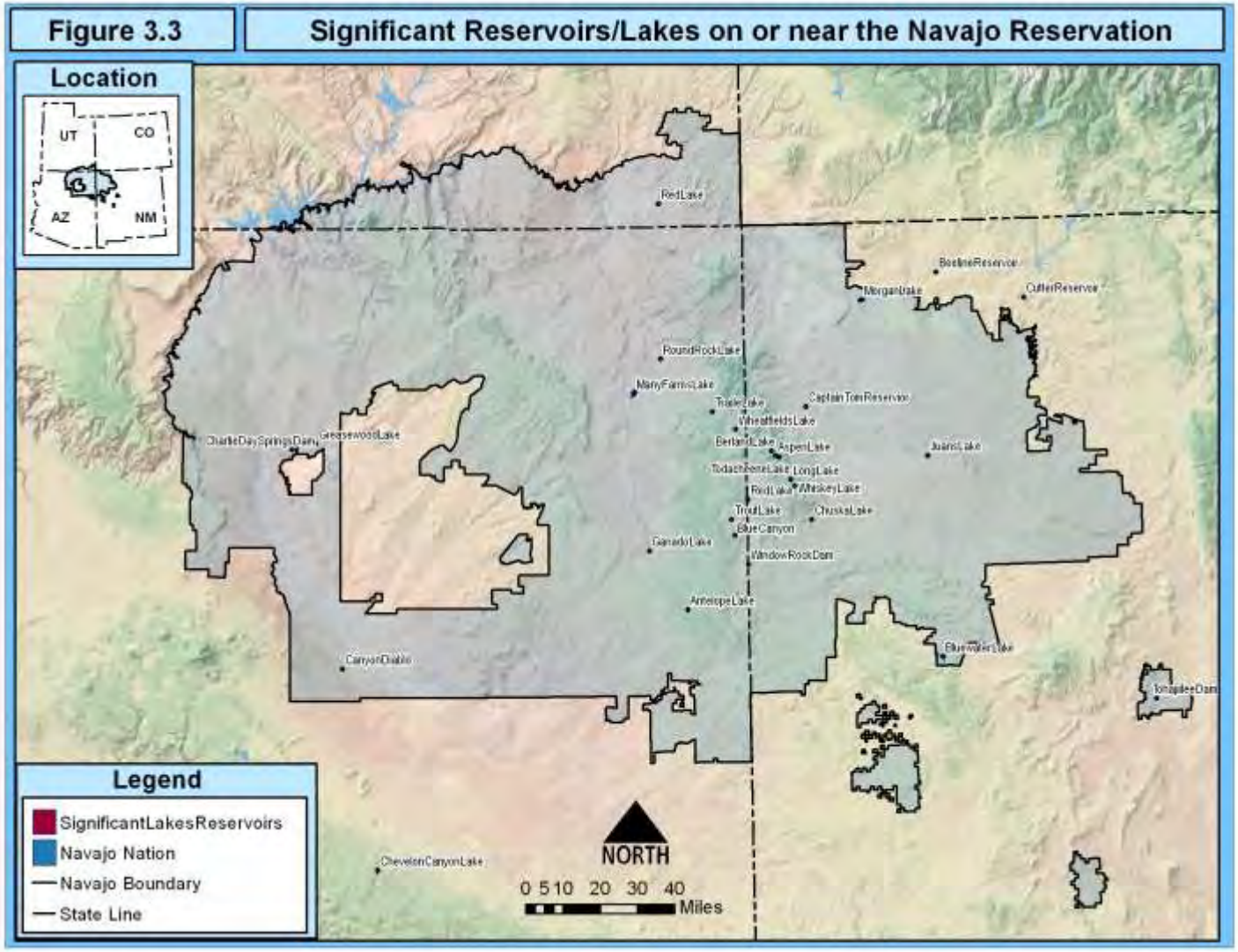


Figure 3.3: Significant Reservoirs/Lakes on or near the Navajo Reservation

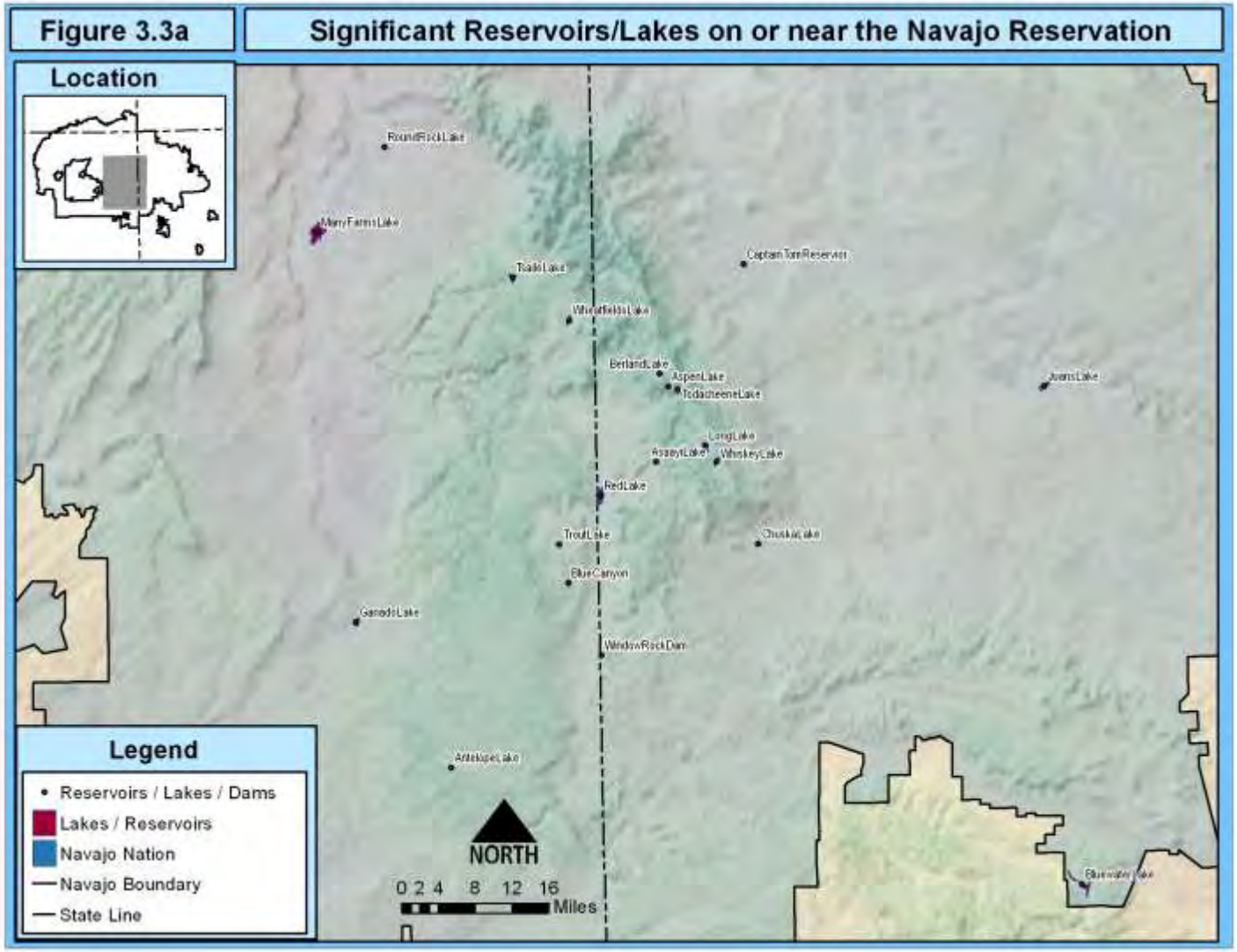


Figure 3.3a: Significant Reservoirs/Lakes on or near the Navajo Reservation

3.2 Water Resource Management Framework

The Navajo Nation operates under a three-branch governmental structure including the Executive, Legislative and Judicial Branches (see Figure 3.4). The Executive Branch operates under the direction of an elected president and vice-president. Within the Executive Branch two entities, the Navajo Nation Division of Natural Resources (see Figure 3.5) and the Navajo Nation Environmental Protection Agency (NNEPA), manage the Navajo Nation's water resources. The President of the Navajo Nation appoints the executive directors of these programs. These programs are described in more detail in sections 4.2.1, 4.2.2, 4.2.3, and 4.2.4.

The 88-member Navajo Nation Council was established in 1938 and represented the 110 Chapters of the Navajo Nation. In 2010 it was reduced to a 24-member council. The Legislative Branch has five standing committees, including: 1) Resources and Development, 2) Budget and Finance, 3) Law and Order, 4) Health, Education and Human Services, and 5) the Naa biki yati' Oversight Committee. These committees provide oversight for the Executive Branch programs. The Resources Committee works in cooperation with the President of the Navajo Nation and other committees of the Navajo Nation Council, on proposed legislation or actions affecting natural resource, natural resources development, and research and energy development. The Resources and Development Committee also provides legislative oversight authority for the Division of Natural Resources, District Grazing Officers, Eastern Navajo Land Board and Farm Boards, and matters affecting Navajo natural resources.

The purpose of the Resources Committee is to insure optimum utilization of all resources of the Navajo Nation and to protect the rights, interests, and freedoms of the Navajo Nation and Navajo people to such resources. The Resources Committee is authorized to: 1) delegate to appropriate Executive Branch officials within the Division of Natural Resources, 2) adopt resolutions, regulations, or policies affecting the natural resources of the Navajo Nation, 3) oversee and regulate all activities within Navajo Nation lands, and 4) issue cease and desist orders and/or assess fines for violations of its regulations and orders. The Resources Committee must approve all regulations governing the designation and use of the Nation's natural resources, water development projects, land leases and land withdrawals for acquisition of rights-of-way.

Figure 3.4: Navajo Nation Organizational Chart

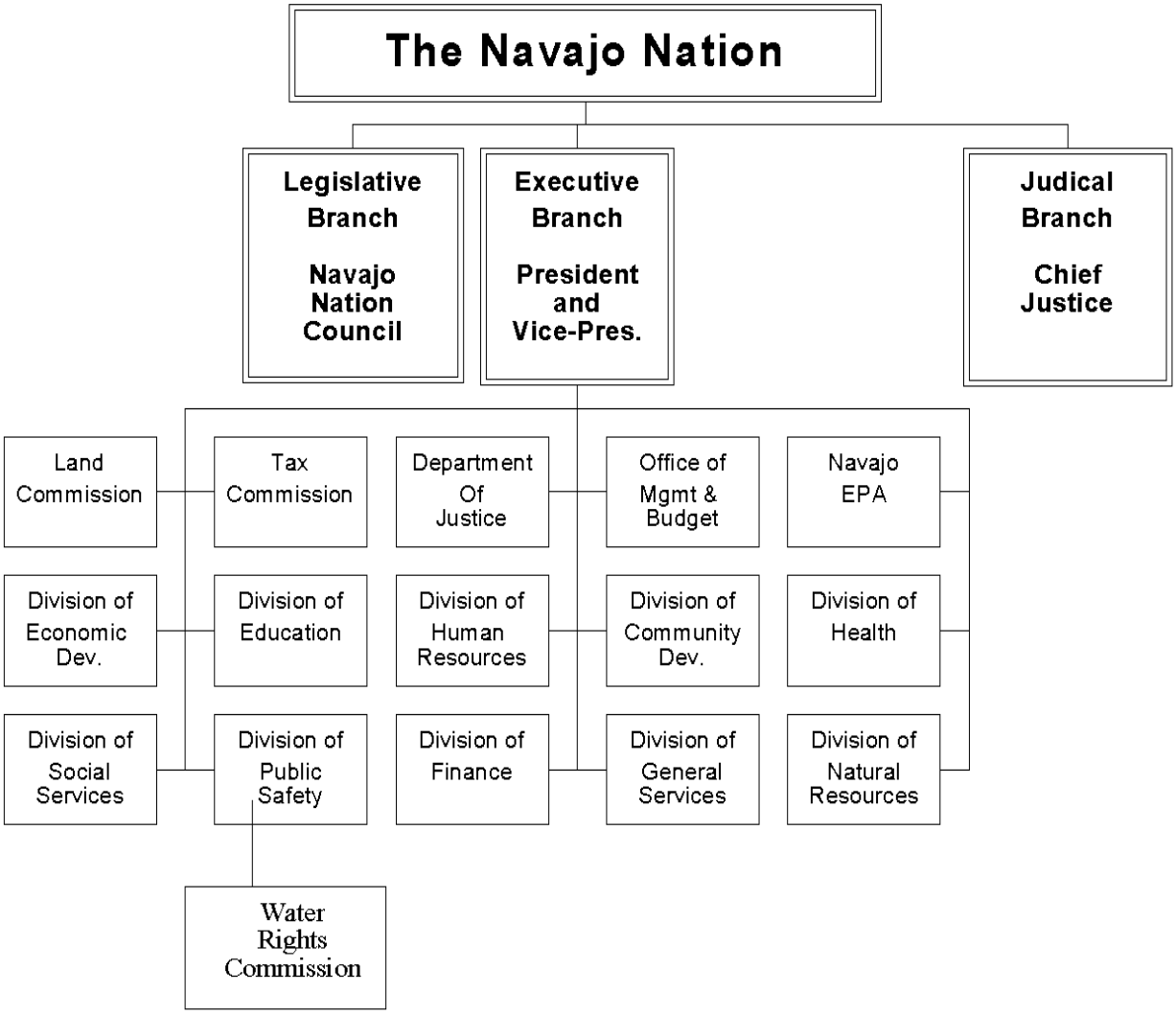
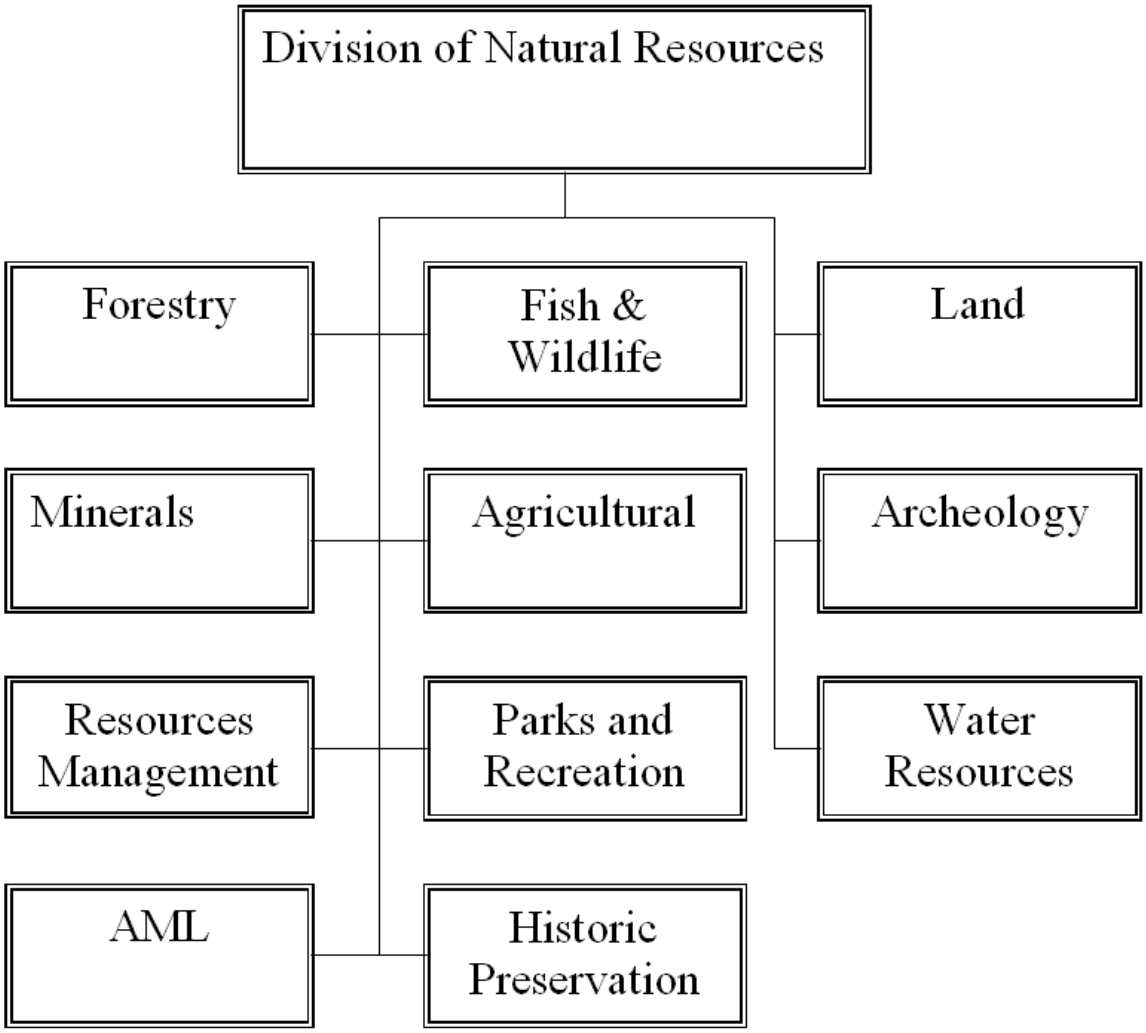


Figure 3.5: Navajo Nation Division of Natural Resources Organizational Chart



3.2.1 Navajo Nation Department of Water Resources

The Navajo Nation Department of Water Resources (NDWR) is the primary department within the Navajo Nation Division of Natural Resources that is responsible for the protection, management and development of the water resources of the Navajo Nation. The NDWR (see Figure 3.5a) operates under the direction of the department director and is composed of:

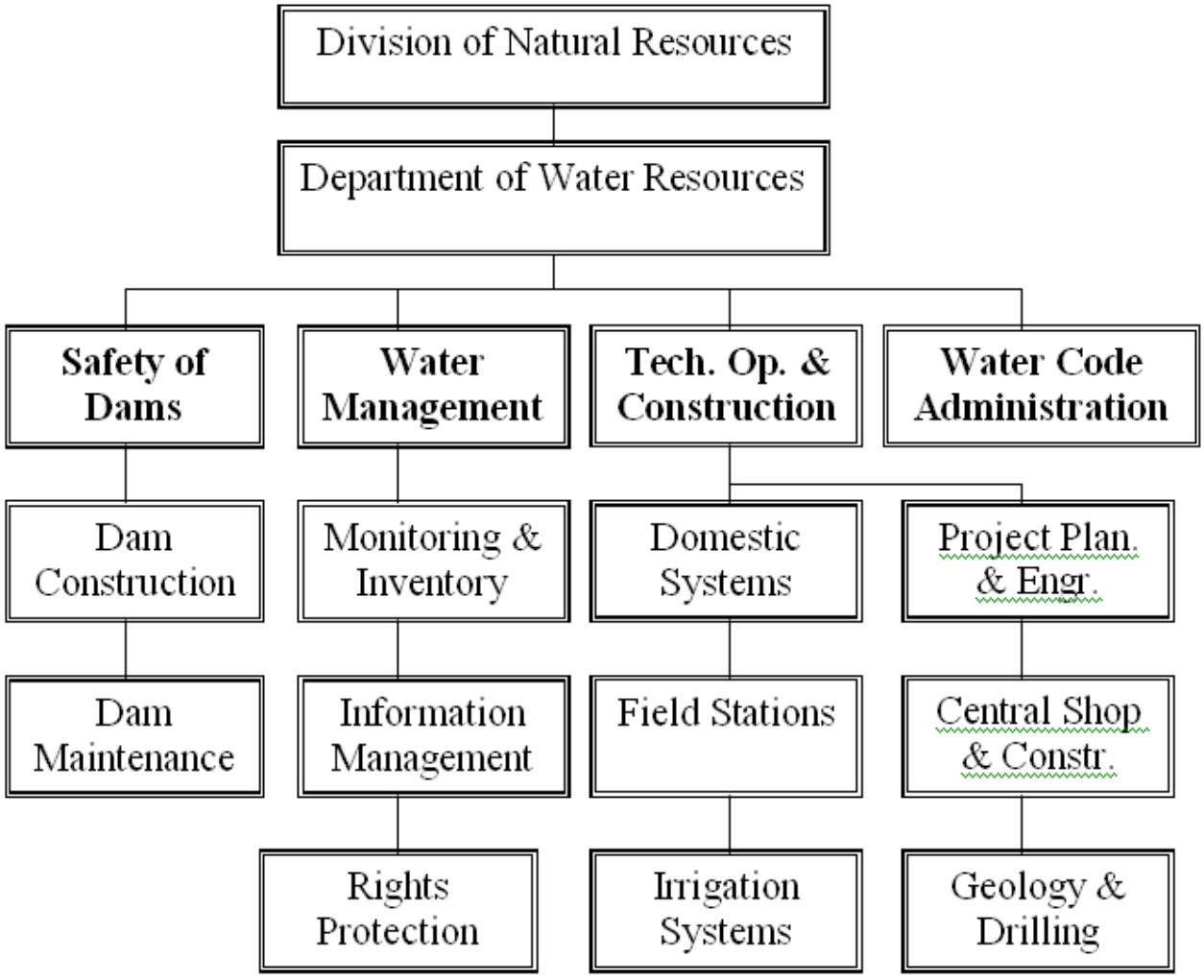
- Dam Safety Branch
- Technical Construction and Operation Branch
- Water Code Administration
- Water Management Branch

These entities are described in the following section.

Dam Safety Branch – With a staff of approximately 22, the Dam Safety Branch: oversees construction repairs on unsafe dams, provides general maintenance and monitors existing dams, surveys land for withdrawal, and develops safety plans, emergency action plans, and early warning systems. Approximately 24 of these dams are shown in Figure 3.3. The monitoring programs include staff gages to measure water levels, pizometers to measure uplift pressures, and weirs to measure outflow and seepage losses. The Dam Safety Branch operates under a P.L. 93-638 contract with the BIA Safety of Dams program. The Dam Safety Branch relies on the BIA for funding. In recent years the BIA has provided approximately $300,000 of annual funding for this branch. Reclamation provides technical assistance to the BIA.

Technical Construction and Operation Branch – The operations staff employs approximately 58, and operates 17 public water systems, eight irrigation projects, and more than 900 windmills. With a staff of approximately 44, the technical design and construction staff plan, design, construct, and rehabilitate water facilities for livestock, domestic, and irrigation uses. This scope of work includes construction of wells, pipelines, dams, erosion control structures, irrigation systems, diversions, storage tanks, and stock-ponds. This staff provides construction support for the NDWR facilities. This branch maintains construction equipment to support construction, mechanical repair, and transportation services for NDWR. The annual operating budget of $2 million is from a P.L. 93-638 contract with the BIA, Tribal General and Supplemental Funds, and several community block grants.

Figure 3.6: Navajo Nation Department of Water Resources Organizational Chart



Water Code Administration – The Navajo Nation Water Code was adopted by the Navajo Nation Council in 1984. The Water Code Administration is the primary water use regulator and water revenue generator for the Navajo People. It is responsible for the day-to-day implementation of the Navajo Nation Water Code. It administers well drilling and water use permits, engages in public outreach on Water Code issues, resolves water use disputes, provided technical information, and generates revenue from the use of water for construction, industrial, government and commercial uses.

The Water Code Administration has a permanent staff of 8 and an annual budget of approximately $500,000. Through the water use permitting, the NDWR Water Code Administration quantifies and accounts for the beneficial consumption of water within the Navajo Nation. Permitting ensures that water is available for newly permitted water uses and that new water users do not conflict with existing and traditional water users. The Water Code Administration is responsible for administering a water use fee structure that balances the need for protecting and managing the water resources with the needs of a robust business environment.

Water Management Branch – The Water Management Branch (WMB) monitors the Navajo Nation's water resources, protects its water rights, restores its watersheds and helps to manage the water resources. This branch has a staff of 25 and an annual operating budget of $1.9 million. The WMB administers cooperative agreements with Reclamation, the Bureau of Land Management, the BIA, the USGS, the Army Corps of Engineers and other state and federal agencies.

The WMB maintains water resource databases and distributes hydrologic information. The WMB maintains an extensive database of groundwater well information, which is the primary data source for groundwater information on the Navajo Nation. The WMB wells database includes well data from more than 8,000 wells on the reservation (see Figure 3.1). Well files, including well logs and aquifer data, are maintained on more than 2,000 wells. The Water Code Administration provides data on new wells from the well drilling permits and the water use permits. Through water well permitting the WMB collects and analyzes groundwater data from the well permits. The information in the well database can be displayed in an ARCVIEW format for local residents and agencies interested in drilling new wells, or for monitoring short-term and long-term groundwater trends.

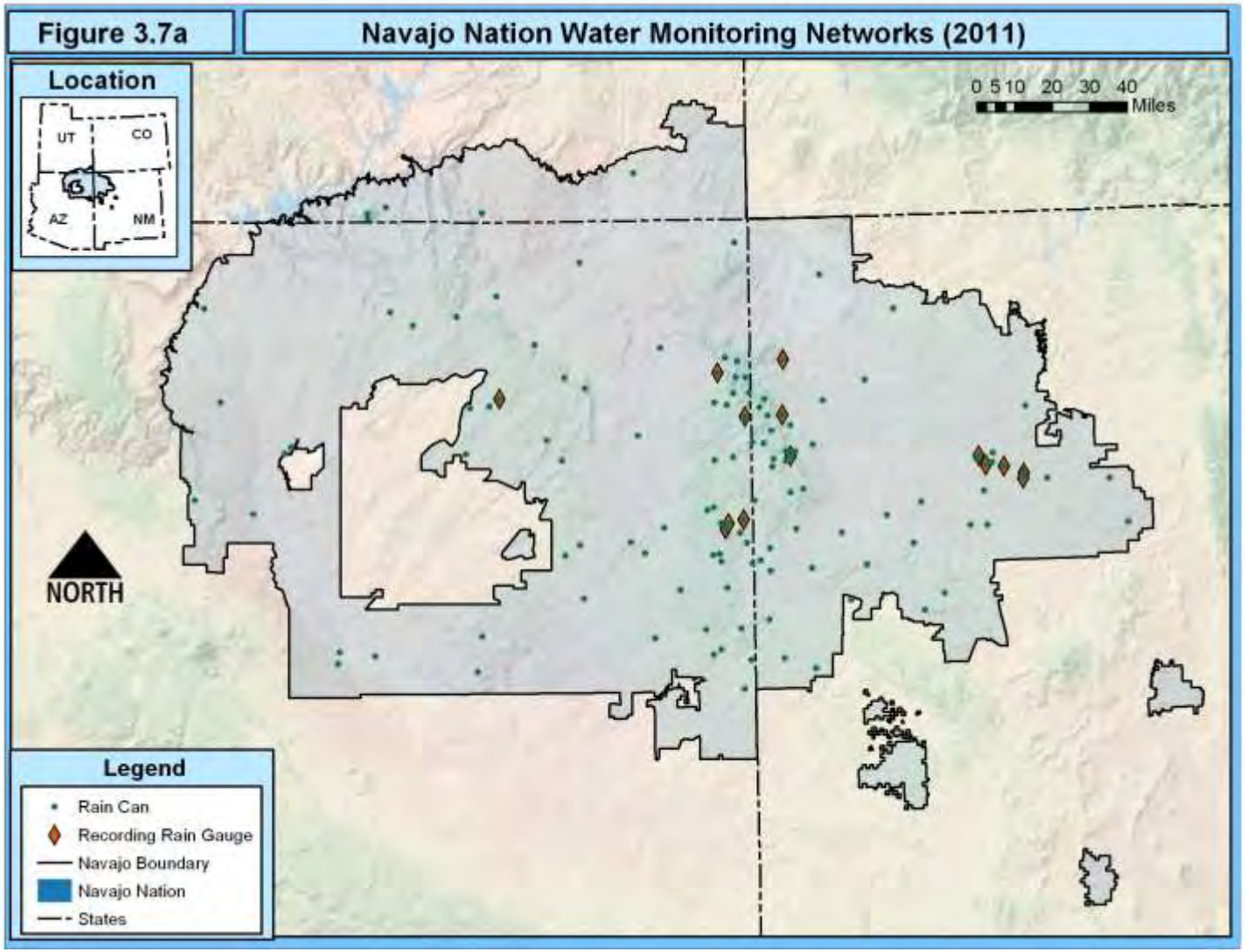


Figure 3.7a: Navajo Nation Water Monitoring Networks (2011)

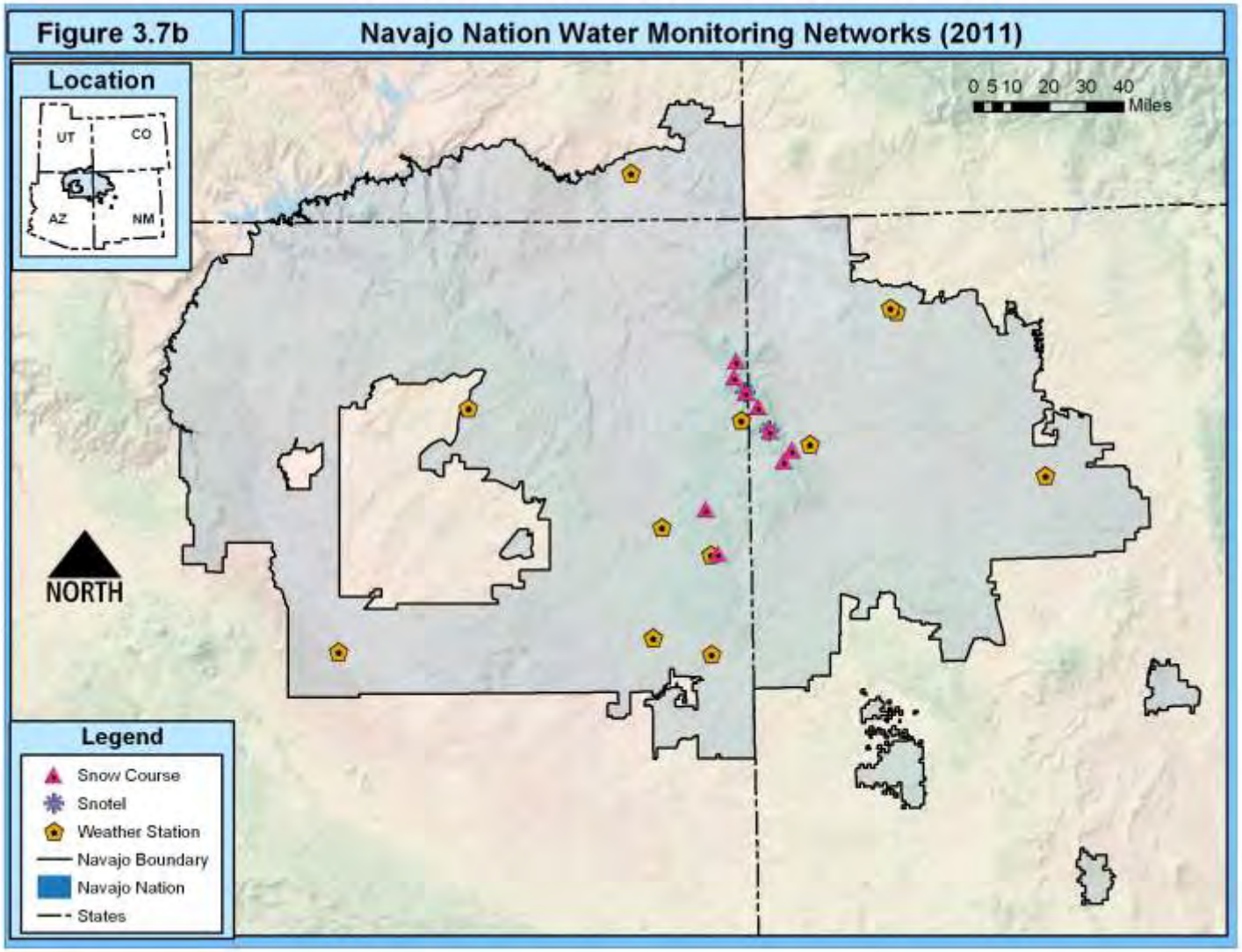


Figure 3.7b: Navajo Nation Water Monitoring Networks (2011)

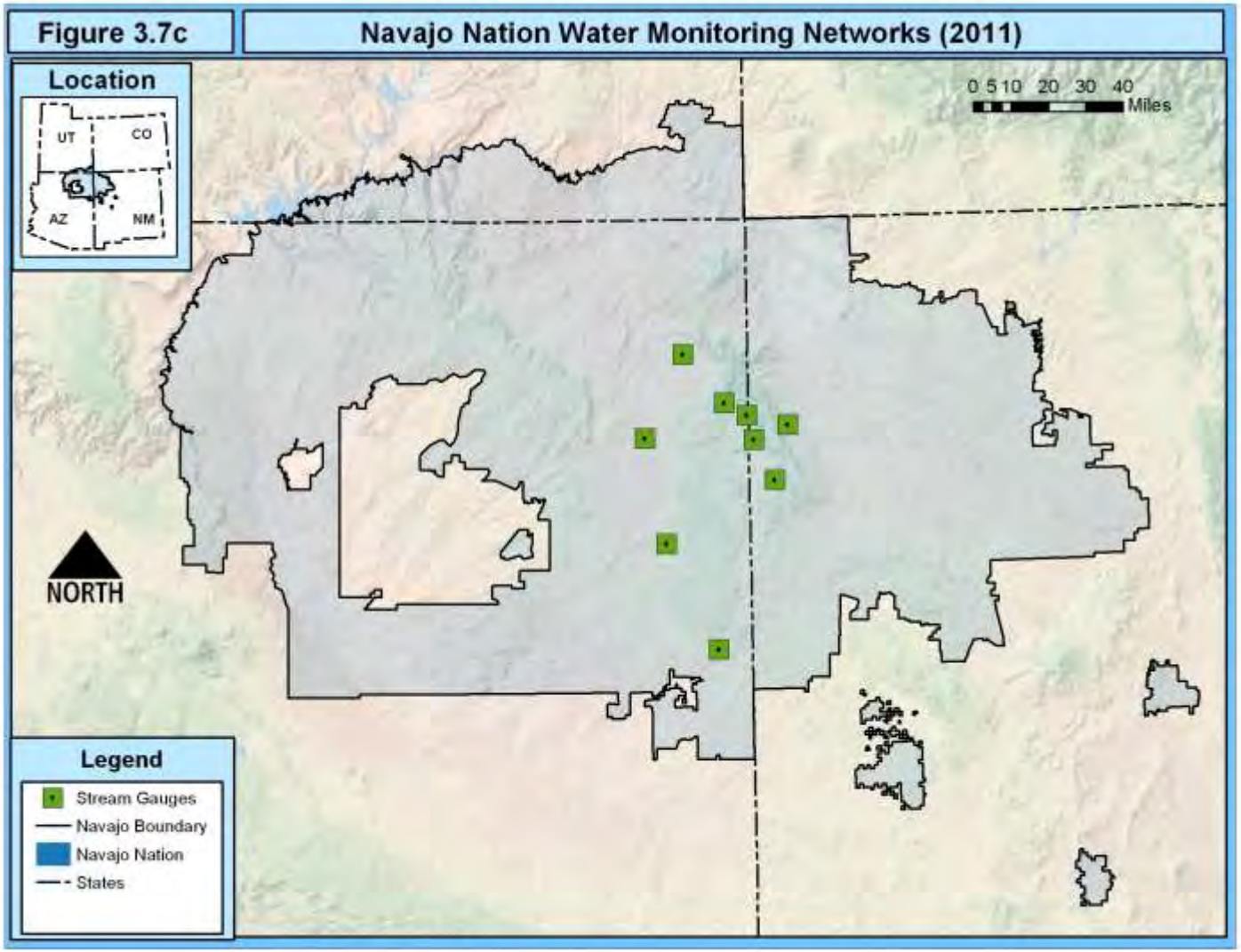


Figure 3.7c
Navajo Nation Water Monitoring Networks (2011)
Location
UT
CO
AZ
NM
0 5 10 20 30 40
Miles
NORTH
Legend
Stream Gauges
Navajo Boundary
Navajo Nation
States

Figure 3.7c: Navajo Nation Water Monitoring Networks (2011)

Table 3.3 Hydrologic Monitoring Networks Used and Operated by the Navajo Nation

Network	Active Stations July 2011
Stream Gauging Stations	9
Automated Weather Stations	12**
Recording Rain Gages	14
Snow Courses	9
Monitoring Wells	50
Precipitation Storage Gages (Rain cans)	114
Snotel Sites	2

*Sources: Navajo Nation Water Management Branch, Arizona Water Institute, Dec 2007, Assessment of Navajo Nation Hydroclimate Network, USGS N-Aquifer Monitoring Program, and USGS C-Aquifer Monitoring Program.
**Some weather stations are under construction

The WMB maintains networks of monitoring wells, stream gages, weather stations, and snow survey courses (see Table 3.3 and Figure 3.6). The technical staff collects, reduces, analyzes, and distributes the data. The WMB is committed to meeting the USGS and National Weather Service standards in terms of station configurations, data reduction, protocols and accessibility. The data is processed and stored in databases at the WMB and incorporated into the Geographic Information System database. This GIS database consists of more than 200 coverage areas and may be used to analyze crop water requirements, respond to drought, operate reservoir and manage flood plains. The WMB also maintains a library with more than 6,000 water resource documents.

The Navajo Nation is engaged in active general stream adjudications in five basins. Partly due to its water rights protection responsibilities, the WMB has conducted technical analysis of several regional water development projects with 40 to 50 year planning horizons that would serve 60 percent of the Navajo Chapters.

The responsibilities of the NDWR have evolved. For instance, as the NDWR public water systems are upgraded by the IHS, the operational responsibility is transferred to NTUA, which operates these systems as a utility. Similarly, as the water users on several of the NDWR irrigation systems become well organized, they are assuming a greater role in the day-to-day operations. In the past the NDWR received Tribal General Funds for emergency water hauling. Those funds are now conveyed directly to and administered directly by the Chapters.

Through its branches the NDWR is responsible for the long-term stewardship of the Nation's water resources. The NDWR is well positioned to review proposed water projects to ensure an assured water supply. The NDWR can also serve as a clearinghouse of water development proposals, integrating long-term water development objectives with the entities that require additional water in the short-term.

According to NDWR's five-year operating plan, problems common to all of the NDWR branches include:

- Inadequate and declining tribal general revenue funds
- Little reinvestment of tribal revenues for water related projects
- Antiquated infrastructure and equipment without replacement funding
- Ineffective or inefficient utilization of outside agency funding and expertise
- Poor project coordination with other departments and outside agencies
- Inadequate professional and support staff causing project inefficiencies and delays, poor enforcement, and inability to meet the growing water resource needs

3.2.2 Navajo Environmental Protection Agency

The Navajo Environmental Protection Commission was established in 1972. In 1995 the Navajo Nation Environmental Protection Agency (NNEPA) became a separate regulatory entity within the Executive Branch of the Navajo Nation government. The NNEPA is charged with protecting human health, welfare, and the environment of the Navajo Nation. The NNEPA implement and enforces environmental laws for the protection of human health and the Navajo environment through its federal oversight, the United States EPA. In April 1995 the Navajo Nation Council passed the Navajo Nation Environmental Policy Act, which provides guidance for NNEPA and instills the Navajo philosophy regarding the protection of Mother Earth. The mission of NNEPA is as follows:

> With respect for Dine values, NNEPA's primary purpose is to protect, preserve, and enhance the Navajo environment for present and future generations. These objectives

will be achieved by developing, implementing and enforcing strong environmental laws and policies; by fostering public awareness and cooperation through education and effective motivation methods.

The NNEPA maintains four Departments: 1) Air Toxics, 2) Waste Regulatory and Compliance, 3) Surface and Ground Water Protection, and 4) Enforcement. The Navajo Nation has enacted the Navajo Nation Safe Drinking Water Act (NNSDWA) and it implements the Clean Water Act (CWA) through the Public Water System Supervision Program (PWSSP), Underground Injection Control Program (UIC), Water Quality Program (WQ), and the National Pollutant Discharge Elimination Systems (NPDES) Program.

The NNEPA-PWSSP has been delegated authority from the USEPA Region 9 to regulate Public Water systems on the Navajo Nation through the NNSDWA. The NNEPA-PWSSP is responsible for ensuring that owners and operators of drinking water facilities provide safe drinking water to the residents of the Navajo Nation through inspection, monitoring, and enforcement. The NNSDWA and the Navajo Nation Primary Drinking Water Regulations (NNPDWR) ensure the protection of drinking water by establishing appropriate drinking water quality standards called Maximum Contaminant Levels (MCLs). The NNEPA-PWSSP also provides technical assistance in determining protection zones around drinking water wells. Wellhead protection ensures that communities are aware of the drinking water source or "wellhead" quality. This plan ensures that communities consider the environment when conducting development activities.

3.2.3 Navajo Tribal Utility Authority

The Navajo Tribal Utility Authority (NTUA) has served resident throughout the 27,000 square miles Navajo Nation since 1959. The NTUA headquarters are in Fort Defiance. The NTUA service area includes 38,000 electric customers, 35,000 water customers, 13,000 wastewater customers, and 7,000 natural gas customers. NTUA is divided into seven districts, and operates more than 100 public water systems with more than 220 wells, 270 tanks, 71 boosters, 90 lagoons, and 1,300 miles of pipelines. NTUA has 489 positions, about half of which deal with the water infrastructure. The NDWR has estimated that NTUA serves drinking water to more than 130,000 people every day. NTUA has an organizational structure that includes a General Manager, Deputy General Manager, District Managers, Field Supervisors, Foremen, and Operators. NTUA has five district offices throughout the reservation providing electricity, water, gas, and wastewater service.

NTUA is the largest public water purveyor in the Navajo Nation. The mission of NTUA is to provide its customers with electricity, natural gas, water, wastewater treatment and related services at competitive prices while contributing to the economy of the Navajo Nation, consistent with the improvement of the health and welfare of the residents of the Navajo Nation and the employment of the Navajo people. NTUA, under the direction of the management board, operates as a tribal enterprise under the oversight of the Navajo Nation's Economic Development Committee. Utility

prices are determined by an operating tariff set by the board and ratified by the Resources Committee. Utility prices apply reservation-wide without regard to the specific system operation and maintenance costs incurred.

3.2.4 Navajo Nation Water Rights Commission

The Navajo Nation Water Rights Commission was established in June 2002 to ensure that the water rights of the Navajo Nation are vigorously pursued and effectively coordinated. The Commission includes seven Commissioners, one from each agency, the director of the NDWR, and the Attorney General. The Commissioners are appointed by the Navajo Nation President, the Speaker, and the Chief Justice. The Commission supervises the negotiation teams, and establishes policies and procedures for the Navajo Nation Water Rights Claims Fund.

3.3 Agencies that Generate Water Demands

The objective of this section is to present an overview of the Navajo programs that encourage housing and economic developments that generate increased water demands. These programs include:

- Navajo Housing Authority
- Division of Economic Development
- Division of Community Development

3.3.1 Navajo Housing Authority

As shown in Table 3.4, the Navajo Nation has critical need for approximately 20,000 new housing units. To meet the demand for housing, in 1963 the Navajo Nation established the Navajo Housing Authority (NHA). NHA is the Department of Housing and Urban Development's (HUD) Tribally Designated Housing Entity (TDHE). The mission of NHA is to meet the housing needs of the Navajo Nation by providing affordable quality housing, and to provide professional management services. The goals of NHA are to: 1) provide quality and timely customer service, 2) promote opportunities for resident self sufficiency, 3) operate one stop Housing Service Centers and improve the housing and community environment, 4) seek alternative funds, 5) fulfill the need for Tribal designated housing entities administrative capacity and leadership, and 6) promote economic growth.

NHA receives financial support through the Native Housing Assistance and Self-Determination Act of 1996 (NHASDA). NHA has oversight for housing block grants that provide financial assistance for construction of new homes, rehabilitation of existing homes, assistance with mortgage down

payments, and support and educational services for home buyers. The NHA administers approximately $90 million per year for Indian Housing Programs on the Navajo Nation. At this level of funding it will be decades before the demands for housing will be met. Due to NHA's annual budget cycle and the current unmet need for housing, NHA is constructing homes based on a very short planning horizon. By contrast, it takes many years, sometimes decades, for proposed water projects to be built. As shown in Table 3.5, since 2000 NHA has constructed more than 2,000 homes, and renovated more than 1,800 homes. For information purposes, some of the older grant year projects are still in progress -- however, once all projects are completed in a particular grant year, we will have final unit numbers. So the unit numbers being reported are subject to change.

Table 3.4 Unmet Navajo Nation Housing Needs in FY2000

Category	Number of Homes
Houses for Ownership	11,471
Rehabilitation	4,100
Rentals	3,824
Transitional Housing	500
Homeless	500
College Students	300
Elderly	120
Total	20,815

Table 3.5 NHA Development of Completed Units

Fiscal Year	Units Constructed		Units Renovated		Planned Budget
	Home	Rentals	Home	Rentals	
1998	402	273	60	0	$86,762,085
1999	225	320	60	50	$88,981,744
2000	201	187	22	0	$88,595,779
2001	219	219	104	59	$94,243,721
2002	415	222	125	0	$94,502,939
2003	246	38	76	40	$92,530,695
2004	179	20	44	0	$93,069,629
2005	60	79	12	2	$85,000,000
2006	92	43	0	15	$86,112,736
2007	109	90	0	275	$89,260,522
2008	0	0	0	0	$74,025,827
2009	0	0	0	0	$84,791,419
2010	0	0	0	0	$94,006,667

Note: Source Navajo Housing Authority website, FY2010 Annual Performance Reports, Homes and Rental Units. Planned Budgets are not necessarily expended.

NHA is reluctant to divert funding from critically needed housing to infrastructure development. In the past a significant portion of HUD funding that went to the Navajo Nation was conveyed to IHS for water infrastructure needed to service the NHA housing projects. Table 3.6 presents this funding during the last ten years. The relative HUD investment in infrastructure has declined at a time when the investment in housing has increased.

NTUA, NHA and IHS administered these funds through a memorandum of understanding that governs these investments in water infrastructure. With the implementation of NHASDA in 1996 NHA has subcontracted almost half of the HUD funding to subcontractors that are not bound by the conditions of the MOU. One result of this situation may be that IHS funds will be directed to the NHA infrastructure needs at the expense of non-NHA infrastructure needs.

Table 3.6 CDBG Grant and NHA Funding for IHS Water Development

Fiscal Year	CDBG	NHA
1990	$6,648,000	$2,483,000
1991	$1,464,781	$2,080,947
1992	$504,950	$776,000
1993	$1,891,000	$1,680,181
1994	$459,050	$1,695,825
1995	$0	$958,000
1996	$1,065,373	$691,000
1997	$1,461,105	$1,914,000
1998	$1,002,000	$210,000
1999	$2,226,050	$917,61700
2000	$2,080,470	$874,000
2001	$3,984,596	0
2002	$2,584,798	0
2003	$1,334,250	0
2004	$1,484,500	0
2005	$2,540,000	0
2006	$1,200,000	0
2007	$966,865	0
2008	$0	0
2009	$1,000,000	0
2010	$1,267,000	0

Note: FY2000 includes $74,000, FY2003 includes $179194, and FY2005 includes $1,000,000 of reprogrammed dollars. FY2007 funds to NTUA for Chinle WTP. 2010 funds awaiting HUD approval.

3.3.2 Navajo Division of Economic Development

The Navajo Division of Economic Development (NDED) was established to encourage economic development on the Navajo Reservation. The purpose of the NDED is to create an environment conducive to commercial, tourism, industrial, and other business sectors. The NDED includes the following departments: 1) Project Development, 2) Business Regulatory, 3) Small Business Development, and 4) Support Services. The NDED is responsible for the Navajo Nation Shopping Centers, Tourism Development, and The Navajo Times.

The difficulty and expense of securing reliable water present significant obstacles for businesses on the reservation. To overcome these and other obstacles, the NDED created incentives for economic development. The NDED has identified economic growth centers, which are focal points for infrastructure development, including water, to support new businesses. Economic growth centers are communities with large populations and the potential to benefit from an economy of scale in infrastructure development. Accordingly the Navajo Nation has focused resources in these locations to stimulate economic growth. The NDED identified 60 specific priority economic development projects with an estimated cost of $312 million of which $59 million is required for infrastructure. Selected projects are shown in Table 3.7.

These NDED projects usually do not require large quantities of water. Consequently, the NDED pursues these developments assuming that the existing NTUA infrastructure is able to meet the additional demand. The NTUA systems, which have been built with IHS assistance, typically do not have capacity for commercial demands. When existing infrastructure is not able to meet a development's needs, for instance the hotel and marina proposed at Antelope Point, NDED may participate in water development.

3.3.3 Navajo Division of Community Development

The Navajo Division of Community Development receives Navajo Nation General Funds for small capital improvement projects in each Chapter. The Capital Improvement Projects (CIP) Office also receives state capital improvement funds. Significant dollars pass through CIP. For instance, in 2008 New Mexico provided $6 million for Navajo water projects in addition to $17 million for the Cutter Lateral.

Community development projects frequently include improvements to the Chapter Houses, pre-schools, senior citizens centers, and similar community facilities. Like the NDED projects, the community development projects usually do not require large quantities of water. Consequently, they are developed assuming that the existing water infrastructure is able to meet the demand. The community block grants usually do not include resources for major infrastructure enhancements.

Table 3.7 Economic Growth Centers and Selected Projects for the Navajo Nation

Growth Centers	Selected Projects
Alamo	Commercial
Cameron	Tourist/Commercial/Industrial Development (Cameron Commercial Infrastructure)
Canoncito	Commercial (Tohajiilee Industrial Park)
Chambers/Sanders	Commercial/Residential Development (New Lands Commercial Center)
Chinle	Industrial Park/Housing Authority Projects (Chinle Cultural Center, Pilot Power Center, High Tech Glass)
Church Rock	Two Industrial Parks (Church Rock Industrial Site)
Crownpoint	Industrial Park (Crownpoint Hotel)
Dilkon	Commercial (Dilkon Commercial Center)
Ganado	Tourist/Commercial/Industrial Development (Ganado Shopping Center)
Kayenta	Commercial Growth/Retail and Services (Kayenta Township)
Leupp	Industrial Park/Community Housing (Leupp Industrial Infrastructure)
Many Farms	Commercial development (Sotos RV Park)
Navajo	Commercial (Sawmill Commercial Center)
Ojo Amarillo (NAPI)	Commercial/Residential/Industrial (Potato Processing)
Pinon	Commercial/Residential Development (Hoosh Doh Dii Ts)
Ramah	Commercial
Shiprock	Industrial Park, Commercial (Best Western Hotel, Days Inn Hotel, Shiprock RV, Morgan Lake Development, South Frontage Road Commercial Development, Shiprock Commercial Development Center)
Tohatchi	Commercial / Tourist Development
Tsaile	Commercial Development
Tuba City	Industrial Park (Kerley Valley Infrastructure Project, Water/Waste Water Lines)
Window Rock/Fort Defiance	Industrial Park/Government Facilities (Karigan Estates)

Source: Navajo Nation Division of Economic Development, 2006

4. COOPERATING FEDERAL AGENCIES

The objective of this section is to present an overview of the federal agencies that are involved with water resource management on the Navajo reservation. Federal agencies provide critical assistance in the form of expertise and funding for the water resource development on the Navajo Nation. These agencies include:

- Indian Health Service (IHS)
- Department of Agriculture (USDA)
- Bureau of Indian Affairs (BIA)
- Environmental Protection Agency (EPA)
- Army Corps of Engineers (Army Corps)
- Bureau of Land Management (BLM)
- Bureau of Reclamation (Reclamation)

Congress does not provide any single agency with adequate resources to meet the entire water resource needs of the Navajo Nation. In spite of the efforts of these agencies, the financial and technical resources available are inadequate to meet the enormous challenges. This situation is complicated by the size and geography of the Navajo Nation, which creates splintered jurisdictional areas within most of the agencies, making effective outreach to the Navajo Nation more difficult. For example, Reclamation maintains at least seven offices with some level of responsibility for the reservation. Additionally, policies and programs from one agency to another are often inconsistent. To overcome these financial, technical, and jurisdictional challenges, innovative partnership strategies are being forged between the Navajo people, the Navajo Nation, and the various federal agencies. These partnerships will more effectively utilize existing resources, and better align agency policies and programs. These agencies are described in the following sections.

4.1 Indian Health Service

The Indian Health Services (IHS) in the pre-eminent domestic water development agency on the Navajo Nation. Public Law 86-121 authorizes the IHS to provide essential water supply and storage facilities for communities and homes on the reservation. The IHS program targets potable water for domestic purposes. The IHS annually compiles a sanitation deficiency report or Sanitation Deficiency System (SDS) list for the Navajo Nation. The 2011 Sanitation Deficiency list includes 679 water, wastewater, and solid waste projects with a cost of more than $562 million. Recent IHS budgets for addressing sanitation deficiencies have only been $10.4 million. The IHS also spent approximately $8.8 million on water systems for new, or nearly new, homes. In recent years, the IHS leveraged an additional $7 million per year from other programs to supplement is construction program. However, at current funding levels, IHS has a twenty-year backlog of feasible projects. This list may continue to grow, placing an even larger burden on IHS and the Navajo Nation to meet the need for domestic water.

The SDS list ranks proposed water projects on very specific and objective criteria including health impact, water system deficiency, first water service, capital cost, operation and maintenance cost, and other contributions. The most important SDS criterion is the unit cost per house. Due to funding limits, it is not possible for 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 $48,000 for water supply and sewer service for Arizona and $47,000 for New Mexico and Utah. From an operations standpoint, NTUA will not operate a system with fewer than three connections per mile.

The IHS contracts its construction to the Navajo Engineering and Construction Authority (NECA) and then turns the completed water project to NTUA for operation. From the time IHS signs an MOA with the Navajo Nation to begin a water project, it takes an average of five and one half years for planning, construction and transfer to NTUA.

4.2 Department of Agriculture

The USDA provides a wide variety of agricultural, educational, natural resources, environmental, nutritional, soil surveys, and rural development programs. Some of these programs provide grants and loans to qualifying domestic water purveyors. For instance, these programs fund circuit riders that assist small water users associations to comply with Safe Drinking Water Act standards and provide technical assistance to improve operation and maintenance. These programs are overwhelmed by the needs that they are designed to address. Even under the best of circumstances these programs remain very competitive. In addition, due to cost sharing requirements and other program constraints, many of the Navajo systems and Navajo water users fail to qualify.

Another important authorization is the Resource Conservation and Development (RC & D) Program. The Navajo RC & D was authorized by the Navajo Nation in 1996 and by the Secretary of Agriculture in 1997. Through this authority the Natural Resources and Conservation Service (NRCS) staffs a field office in St. Michaels, Arizona. This program provides support to the priority projects of the five soil and water conservation district offices on the Navajo reservation. One of the major funding sources for these projects is the USDA Environmental Quality Incentive Program (EQIP). EQIP has provided significant assistance to irrigators on the Ganado, Red Willow, and Shiprock irrigation projects for on-farm water conservation improvements. In May 2006 the NRCS had 270 EQIP contracts under the 1996 Farm Bill totaling $4.37 million, and 86 contracts under the 2002 Farm Bill totaling $3.26 million. However, most of the older 1996 Farm Bill contracts expired before they could be executed. In 2009 the NDNR, NDWR and NRCS executed partnership agreements.

Public Law 566, the Watershed Protection and Flood Prevention Act, authorizes the USDA to design and implement small watershed restoration programs. In 1999 the NRCS conducted a reservation-wide ranking of eighteen watersheds. Based on the outcome of that process, the $1.7 million Asaayi Watershed Restoration Plan was dedicated in September 2004. This plan includes minor

improvements to Asaayi Dam, and structural and nonstructural treatments upstream from Asaayi Dam. These treatments will extend the life of the dam, improve the quality of the water, and restore the riparian areas. Since the restoration plan was completed, the authority has not had adequate appropriations to carry out additional major projects.

The Navajo Nation successfully applied for assistance under the USDA's Enterprise Zone program. Under this program qualifying areas have special economic needs and can receive significant resources to address infrastructure and institutional needs. The Four Corners Enterprise Community encompasses the northern portion of the Navajo Nation and includes 22 Navajo Chapters. This status results in improved access to USDA rural development and other programs. Through January 2008, the Four Corners Enterprise Community reported $101 million received, of which approximately $8 million was conveyed through USDA programs. The Navajo Nation has also applied for assistance from the USDA drought relief programs.

The Rural Utility Services (RUS) provides grants and loans to rural areas. To qualify for grants the public water systems must serve a low-income community with a population under 10,000 people. The RUS applicants are expected to borrow as much as they can afford to repay. In FY2000 the RUS funded a water line extension from Ganado to Toyei, and water and sewer lines in Window Rock. In 2003, the RUS also funded a water line from the Torreon Public Water System to the Rin Con Marquez Community. In 2007 the RUS funded a well in the Torreon Area as part of the conjunctive groundwater component of the Cutter Lateral Regional System. Between 2008 and 2010 USDA contributed $10 million to Phase 3 of the Cutter Lateral. The IHS has also utilized RUS funds for water projects. With this collaboration, the IHS can enlarge the distribution lines and make for efficient multipurpose projects. The IHS has a national agreement with the RUS.

4.3 Bureau of Indian Affairs

Institutionally, the BIA represents the federal government's trusteeship on Indian reservations. The BIA administers its programs through the Navajo Regional office in Gallup, New Mexico, and five agency offices in Fort Defiance, Crownpoint, Shiprock, Tuba City, and Kayenta. Given its broad responsibility, the BIA's authorization can be interpreted to address every aspect of life on an Indian reservation. With respect to water the BIA has programs addressing unsafe dams, irrigation projects, environmental protection, natural resources, water rights, water planning and pre-development, and water development, among others. Pursuant to the Indian Self Determination and Education Assistance Act (P.L.93-638), the responsibility of implementing many of these BIA programs has been delegated to the various tribes. Under this public law the BIA retains the residual trust responsibility and the tribes are encouraged to assume as much day-to-day programmatic responsibility as possible.

With respect to water resources, P.L. 93-638 has resulted in the expansion of tribal programs with a commensurate decline in the BIA's staffing. On the positive side, this change has brought the day-to-day decision-making and accountability closer to the Indian community that the BIA and tribal governments serve. However, one result of this public law is that the technical expertise that the

BIA once offered has significantly diminished, and what is available is shared by a larger number of tribal clients. This situation has resulted in a need for tribal programs to seek out technical assistance from federal agencies that have not traditionally had a significant role in Indian water development. Reclamation is a case in point. Reclamation has retained a high concentration of technical specialists in a wide range of water resources areas including design and construction that provided adequate funding and can be utilized on the Navajo reservation. As a practical matter, it is difficult for tribal programs to retain a large number of technical specialists, and they are often better served by tapping existing expertise offered by the federal agencies.

The most critical limitation to the BIA's role as a trustee is the overall lack of available resources. Several of the BIA's most important responsibilities have been under resourced for many years. For instance, the BIA has operational responsibility for irrigation projects throughout Indian country. However, years of deferred maintenance, primarily due to inadequate federal appropriations, have resulted in a maintenance deficit of hundreds of millions of dollars. This deficit makes it very difficult for the Navajo Nation, or any tribal community, to secure the resources it needs to adequately address problems. The BIA annually reviews the unmet needs on Indian reservations across the country, and every year the needs exceed available resources. Consequently, new strategies and partnerships are needed to address these critical water resource problems in a timely manner.

4.4 Environmental Protection Agency

The mission of the Environmental Protection Agency is to protect human health and the environment. EPA works to develop and enforce regulations that implement environmental laws enacted by Congress. EPA also delegates to states and tribes the responsibility for issuing permits and for monitoring and enforcing compliance. Where national standards are not met, EPA can issue sanctions and take other steps to assist the states and tribes in reaching the desired levels of environmental quality.

The Navajo Nation reservation spans three different EPA regional offices; however, EPA Region 9 is the lead region to provide assistance to the Navajo Nation. On the Navajo Nation the Navajo EPA has primacy. EPA provides funds to the Navajo Nation in most of the following Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) programs.

The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA programs support monitoring, assessment, protection, prevention of polluted runoff in waterways and wastewater infrastructure.

- The Water Pollution Control Program assists tribes to develop institutional capacity to administer water quality programs and protect natural resources.
- The Nonpoint Source (NPS) Pollution Control Program assists tribes to develop and implement polluted runoff control programs that address critical water quality concerns.
- The goals of the wetland program development grants are to increase the quantity and quality

of wetlands in the Region by conserving wetland acreage and improve wetland health. This program aims to help tribes develop and implement effective, comprehensive programs for wetland protection.

- The tribal Water Quality Program assists federally-recognized tribes, tribal consortia, and non-profit organizations (which support tribal programs) implement requirements related to the National Pollutant Discharge Elimination System (NPDES) program.

- The Clean Water Tribal Set-Aside (CWTSA) program provides the opportunity for tribes to obtain funding through direct grants to tribes or interagency agreements with the Indian Health Service for improvements to waste water treatment systems.
- Water Quality Standards are the foundation of the water quality-based pollution control program mandated by the Clean Water Act. Water Quality Standards define the goals for a water body by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water bodies from pollutants.

The Safe Drinking Water Act (SDWA) regulates all public water systems in the United States. The act sets regulations defining standards for drinking water contaminants and implements monitoring and reporting requirements. All States in Region 9 and the Navajo Nation have been delegated primary enforcement responsibility for administering the federal drinking water program as provided for under federal SDWA. In addition:

- The Drinking Water Act Tribal Set-Aside Program (DWTSA) provides funding to construct infrastructure improvements for public water systems serving federally recognized Indian tribes and Alaska Native Villages (ANVs). Projects addressing the greatest health risks are ranked highest for funding. The grants are for the planning, design, and constructions of drinking water facilities.
- The Tribal Source Water Program has the goal of protecting the public health of communities through preventing the contamination of drinking water. The Source Water Program is voluntary for tribes. Region 9 proactively works with tribes through education and outreach, as well as technical assistance and funding to help tribes develop and implement a Source Water Program. A Source Water Program enables tribes to assess possible contamination threats to their public drinking water supply sources and to develop and implement protection measures to protect these sources against contamination threats.
- The Underground Injection Control program regulates the subsurface injection of waste fluids below, into, and above underground sources of drinking water (USDWs).

4.5 Army Corps of Engineers

The Army Corps is authorized by Congress to provide flood protection, environmental stewardship, and construction of civil works. The Navajo Nation spans three Army Corps districts with area offices in Los Angeles, San Francisco, Sacramento, Phoenix, and Albuquerque. Section 203 of the Water Resources Development Act provides the Army Corps with specific authority to provide technical assistance for infrastructure development including water systems.

Under Section 206 of the Flood Control Act of 1960 through the Flood Plain Management Services Program, the Army Corps prepared more than twenty flood plain studies on the reservation. Although a great deal of flooding occurs on the Navajo Nation, no federally sponsored flood control projects using Army Corps authority have ever been constructed. The Army Corps, NDWR and other federal agencies prepared a Navajo Nation Comprehensive Watershed Management Plan of Study. Section 520 of the Water Resources Development Act of 1999 updated the Army Corps flood management authorization to include a broader range of Army Corps expertise in conducting flood management, watershed restoration, and development assistance on the Navajo reservation. That Act authorized $12 million for this work. The first phase will generate Probable Flood Prone Area Maps, delineate 100-year flood plain maps for seven growth areas on the Navajo Nation, and prepare a flood design manual. In 2006 the BIA and the USGS funded the Navajo Nation Flood Hydrology investigation. In 2008 and 2009 the Navajo Nation funded the cost-sharing. In 2010 the Army Corps completed delineation in Window Rock and Chinle.

Under Section 593 the Army Corps has authority to construct water infrastructure in Bernalillo County, and under Section 595 the Army Corps has authority to construct water infrastructure in southern Utah. The Navajo Nation is working with the Army Corps to implement projects under these authorities. The Albuquerque to Tohajiilee Waterline has received $700,000 from Section 595, and the Utah water projects are candidates for Section 593. The Navajo Mountain waterline received $300,000.

4.6 Bureau of Land Management

The Bureau of Land Management (BLM), under the Department of the Interior, administers land holdings commonly referred to as the public domain. It is the mission of the BLM to sustain the health, diversity, and productivity of the public land for the use and enjoyment of present and future generations. The BLM administers public land within a framework of numerous laws. The most comprehensive of these is the Federal Land Policy and Management Act of 1976 (FLPMA). All BLM policies, procedures, and management actions must be consistent with FLPMA and the other laws that govern public lands.

The BLM also places a strong emphasis on government-to-government relations with the Navajo Nation. Many Tribes and tribal members do business with the BLM. The BLM also has a trust responsibility to the Navajos in the management of natural resources. The BLM provides the Navajo Nation with expertise needed to management energy and mineral resources permitting the

BLM to supervise post-lease mineral operations on tribal lands. These operations generate royalty incomes for Indian mineral owners and economic benefits for communities, including employment opportunities for American Indians. Upon the issuance of leases and permits by the Navajo Nation and BIA, the BLM has a trust responsibility in terms of supporting activities on Indian lands while minimizing future liabilities and protecting and enhancing environmental values such as water resources.

BLM staff in the Farmington Field Office, Petroleum, and Multiple Resources Section have been designated as the principle point of contact to provide assistance and expertise to the Navajo Nation concerning mineral operations and natural resources. BLM has provided assistance through the Rio Puerco Watershed Act and through salinity control programs.

4.7 Bureau of Reclamation

The mission of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. To achieve its mission, Reclamation has several programmatic authorizations to assist with regional and tribal water development needs. The most active programs include: Water Conservation and Management, Wastewater Treatment and Reuse, Drought Contingency Planning and Related Assistance, Technical Assistance to States and Tribes, and Native American Technical Assistance. However, these authorizations generally do not provide significant funds for construction. Construction projects typically require specific congressional authorization, and adherence to federal principles and guidelines.

The Navajo Nation spans both the Upper Colorado and Lower Colorado Regions. Reclamation Regional Offices are located in Salt Lake City, Utah and Boulder City, Nevada respectively. Programmatic responsibilities are generally delegated to the area offices. For the Upper Colorado Region, these Area Offices are in Provo, Durango (Western Colorado), and Albuquerque. In the Lower Colorado Region the Area Office is in Phoenix. The Four Corners Construction Office in the Upper Colorado Region has been delegated significant responsibilities including construction of the Navajo Indian Irrigation Project and the construction associated with the BIA's Safety of Dams program. Staff at the Phoenix Area Office and the Four Corners Construction Office has been designated as principal points of contact for the Navajo Nation for the Lower Colorado Region and the Upper Colorado Region respectively.

Reclamation is directly involved in several large regional projects on the Navajo Nation. Under its Animas La Plata Project authority, Reclamation is constructing the Navajo Nation Municipal Pipeline (also referred to as the Farmington to Shiprock Pipeline). Reclamation has authority to the Navajo Gallup Water Supply Project. Reclamation completed the appraisal level study of the North Central Arizona Water Supply Study, and was the project manager for the Western Navajo Hopi Water Supply Study. Reclamation conducted numerous special studies including the Navajo Nation Irrigation Assessments, the Navajo Nation Municipal Water Needs Assessments, the San Juan County Utah Water Plan, and community specific studies in Navajo Mountain, and many other

Navajo communities. In 2006 Congress gave Reclamation a new Rural Water Supply Authority to conduct feasibility studies and construct rural water projects. Reclamation is work on appraisal level studies of the Southwest Navajo Rural Water Project and Oljato to Kayenta Project under this authority.

4.8 Other Programs (States, Cities, Counties, School Districts, HUD, EDA, CDBG)

Several other programs have occasionally provided funding for municipal water development on the Navajo Nation. Through the Federal Department of Commerce the NDED has secured Economic Development Agency (EDA) funding for several Navajo projects. EDA funding has been used to fund water infrastructure development. In the 1970's the EDA funded the existing Farmington to Shiprock Pipeline. The proposed Page-LeChee Water Project may be a candidate for future EDA funding. However, EDA funding is very competitive. The current Navajo EDA project is a regional shopping center in Dilkon. New EDA proposals may have to wait until the Dilkon project is completed.

5. EXISTING WATER USES AND INFRASTRUCTURE DEFICIENCIES

The lack of water infrastructure, the lack of economic development, and the sustained poverty on the Navajo Nation are connected. The low per capita water use is part of a larger pattern reflecting a lower economic standard of living compared to the non-Indian communities in the region. The fact that the mean income of Navajo families is below the poverty line can be attributed, in large part, to the lack of water supplies within the reservation. Consequently, the current rates of water use are much less than the current water demand. The Navajo Nation recognizes a variety of beneficial water uses.

The objectives of this section are to presents an overview of the larger water uses of the Navajo Nation based on the following water use categories and to document the water infrastructure deficiencies on the Navajo Nation. The water requirements of new irrigation projects; large single purpose industries; and ceremonial uses are beyond the scope of this document.

- Water haulers
- Domestic and municipal
- Water Storage Facilities
- Commercial
- Agricultural
- Mining and industry
- Recreation and Wildlife
- Domestic and municipal
- Wastewater

5.1 Water Haulers

The lack of adequate domestic and municipal water is the greatest water resource problem on the Navajo Nation. The water demand in the rural areas is not adequately met by public water supply systems. A significant percentage of families on the reservation depend on water hauling. 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 in their homes. A clean, reliable supply of water is basic to human health. In a report to Congress by the Controller General dated March 11, 1974 it noted that Native American families living in homes with adequate sanitation facilities required only 25 percent of the medical services required by those living in unsatisfactory environmental conditions.

During droughts the population that hauls domestic water is at the greatest risk, and they must travel greater distances to find public water systems that can provide water, or they utilize non-potable water sources. These water haulers also create additional demands on the public water systems that maintain public water taps.

The IHS Sanitation Deficiency System list tracks several different types of deficiencies; including inadequate system supply, inadequate sewer systems, no access to solid waste facilities, and no access to water or sewer systems. For example, from the 2008 IHS Sanitation Deficiency System data, out of approximately 58,000 homes on the list, 10,333, or 18 percent had adequate drinking water systems, while 7,858, or 15 percent, did not have direct access to any public water system. The SDS list excludes some NHA homes, and some new housing units served through Community Development Block Grants.

The 2000 U.S. Census indicates more than 71,000 housing units present on the Navajo Reservation (U.S. Census Bureau, 2001). Based on the 2000 census data, the NDWR tabulated the number of homes without water and total number of homes by Chapter. These values are shown for all 110 chapters in Table 5.1. Public water system data from the NNEPA indicate 33,000 residential and commercial water connections. Assuming that 30,000 of the NNEPA connections are for single family residences then more than 50 percent of the Navajo housing units may not have direct access to public water systems. Comparisons based on the census population data yield a similar range of non-served residents. The differences in these estimates of the number of non-served households are due to different definitions of what a house is. Many of the houses counted by the Census Bureau may have been unoccupied. In addition, water projects that rank low on the SDS list only receive an infrequent appraisal level assessment. Consequently new homes in some project service areas may not have been recently identified. Furthermore, some clusters of buildings at a home site may represent more of a single extended family.

In 2003 the NNEPA funded the 2006 study by EcoSystems Inc. that assessed the number of Navajo residents that did not have access to public water systems. That study included an extensive field study of six chapters. Based on that study, approximately 30 percent of the Navajo homes did not have access to drinking water systems. Because this study is the most intensive effort to date to determine the actual numbers of water hauling households, it is used by the NDWR.

That EcoSystems study also presents IHS data collected between 1967 and 2001 from the State of Alaska showing direct correlations between the percent of in home sanitation facilities and the post neonatal mortality rates per live births and gastroenteric mortality rates. As the percent of homes with home sanitation facilities increased from 30 percent to 90 percent, the post neonatal mortality rate per 1000 live births declined from more than 15 per 1000 live births to less than 5, and gastroenteric mortality rates per 100,000 thousand declined from more than 10 per 100,000 to less than 3.

For areas where distribution systems are currently infeasible, community wells and watering points need to be upgraded or constructed to improve access for water haulers, perhaps utilizing a water-hauling truck service. The IHS and State of New Mexico have been funding this work. According to IHS statistics, since 2000 the percentage of homes hauling water has declined by almost 10 percent. In 2010 EPA funded an NDWR $2 million pilot water hauling program that will fund several water trucks to haul water to remote homes sites.

Table 5.1a Percent of Navajo Houses without access to Public Water Systems (2000 Census)

CHAPTER	No Water	IHS Total	Census Total	%	CHAPTER	No Water	IHS Total	Census Total	%
Alamo	23	300	561	8	Forest Lake	165	194	293	85
Aneth	112	246	716	46	Fort Defiance	46	1253	2012	4
Baca/Haystack	181	181	341	100	Ganado	27	580	1132	5
Becenti	102	185	236	55	Hardrock	73	305	592	24
Beclabito	28	208	337	13	Hogback	6	6	456	100
Birdsprings	68	210	294	32	Houck	394	674	663	58
Black Mesa	63	185	240	34	Huerfano	71	494	818	14
Bodaway/Gap	100	211	711	47	Indian Wells	170	294	435	58
Breadsprings	38	249	398	15	Inscription House	47	317	447	15
Burnham	100	113	114	88	Iyanbito	0	223	320	0
Cameron	98	215	498	46	Jeddito	277	339	604	82
Canoncito	140	371	507	38	Kaibeto	176	421	561	42
Casamero Lake	111	175	144	63	Kayenta	221	1168	2108	19
Chichiltah	491	541	691	91	Kinlichee	229	397	778	58
Chilchinbeto	120	360	520	33	Klagetoh	73	167	530	44
Chinle	247	1119	2978	22	Lake Valley	70	134	165	52
Church Rock	74	450	937	16	Lechee	33	357	525	9
Coalmine Mesa	60	60	251	100	Leupp	100	302	583	33
Coppermine	110	141	243	78	Littlewater	131	248	209	53
Cornfields	67	243	382	28	Low Mountain	4	119	380	3
Counselor	64	537	405	12	Lower Greasewood	109	356	646	31
Cove	17	135	912	13	Lukachukai	26	400	915	7
Coyote Can	147	286	414	51	Lupton	60	274	433	22
Crownpoint	104	890	1072	12	Manuelito	236	236	153	100
Crystal	74	274	341	27	Many Farms	124	1552	1159	8
Cudei	N/A	N/A	N/A	N/A	Mariano Lake	293	293	391	100
Dennehotso	231	496	670	47	Mexican Springs	47	500	528	9
Dilkon	166	403	806	41					

Table 5.1b Percent of Navajo Households without access to Public Water Systems (Continued)

CHAPTER	No Water	IHS Total	Census Total	%	CHAPTER	No Water	IHS Total	Census Total	%
Mexican Water	176	222	378	79	Shiprock	39	2758	3050	1
Nageezi	45	258	483	17	Shonto	155	236	1084	66
Nahathdzil	0	381	498	0	Smith Lake	21	231	374	9
Nahodishgish	8	165	155	5	St. Michaels	89	2678	1932	3
Naschitti	68	334	796	20	Standing Rock	88	265	282	33
Navajo Mtn	158	223	322	71	Steamboat	59	123	790	48
Nazlini	120	541	571	22	Sweetwater	66	429	640	15
Nenahnezad	0	334	551	0	Tachee/Blue Gap	0	352	722	0
Newcomb	34	239	843	14	Teec Nos Pos	44	312	660	14
Oaksprings	32	399	276	8	Teesto	145	247	429	59
Ojo Encino	6	108	232	6	Thoreau	0	288	454	0
Oljiato	220	482	953	46	Tohatchi	104	340	817	31
Pinedale	0	128	365	0	Tolani Lake	64	185	305	35
Pinon	139	890	1097	16	Tonalea	161	679	753	24
Pueblo Pintado	46	233	204	20	Torreon	187	385	569	49
Ramah	309	552	654	56	Tsaile/Wheatfields	177	553	1011	32
Red Lake #18	0	655	700	0	Tsayatoh	46	250	299	18
Red Mesa	79	367	454	22	Tselani/Cottonwood	129	245	710	53
Red Rock	255	359	773	71	Tuba City	73	1460	2644	5
Red Valley	40	418	912	10	Twin Lakes	31	425	838	7
Rock Point	156	238	525	66	Two Grey Hills	7	270	843	3
Rock Springs	0	441	368	0	Upper Fruitland	0	590	782	0
Rough Rock	132	242	357	55	Whippoorwill	4	250	492	2
Round Rock	76	282	591	27	Whitecone	132	332	589	40
San Juan	N/A	N/A	N/A	N/A	Whitehorse Lake	252	252	254	100
Sanostee	60	507	998	12	White Rock	85	85	45	100
Sawmill	120	264	471	45	Wide Ruins	305	419	636	73
Sheepsprings	23	221	407	10					
					Total	11,109	44,509	70,493	25

Based on the number of unserved homes on the SDS list, and the total cost of the SDS water projects, the average unit cost is $20,000 per home. However, serving the last segment of unserved homes becomes increasingly more expensive. The unit cost of providing a public water supply for the top 10 of the SDS projects is $4,000 per home. The unit cost of providing water supply for the last 20 percent of the homes on the SDS list increases to $30,000 per home. Because of these high costs, even by the year 2040, 10 to 20 percent of the Navajo homes may not be feasibly served by public water supply systems.

In 2006 Dornbusch & Associates evaluated the cost of water hauling on the Navajo Reservation. Based on that study, including purchase, containers, vehicles, and opportunity cost of time, families which haul water for domestic purposes, spend the equivalent of $43,000 per acre-foot compared with $600 per acre-foot for a typical suburban water user in the region (Dornbusch, 2006). IHS receives medical referrals to build water cisterns and plumb the homes of elderly water haulers. However, IHS has noted that more than 50 percent of the cisterns are vacated because it is too difficult to haul water.

The NDWR conducted a telephone survey of the Chapters to determine the primary drinking water sources for each Chapter. The Chapters' staffs were asked if their primary drinking water sources were from public water systems, livestock wells, or watering points. The public water systems only included systems operated by NTUA or the NDWR. Livestock wells included wells or springs. Watering points might include public water taps at trading posts, Chapter houses, schools, or border towns. Respondents in more than 20 Chapters indicated that livestock wells are primary or secondary water sources, and respondents in more than 50 Chapters indicated that water points are primary or secondary water sources.

5.2 Domestic and Municipal Water System Users

According to the NNEPA, in 2006 there were 264 public water supply systems on the Navajo reservation with approximately 40,000 connections (see Table 5.2). Between 1998 and 2006 the number of connection increased from 28,789 to 40,766. The vast majority of these systems rely on groundwater. NTUA is the largest supplier of domestic and municipal water on the Navajo Nation and operates 105 public water systems (see Table 5.1). In 2010 NTUA reported 35,000 connections serving approximately 130,000 people, most of who are on the reservation. NTUA reports 32,000 connections that are billed, up to 8 percent of the connections may be idle.

Another 5,000 connections are provided by a variety of smaller operators. The NDWR operates 27 public water systems that are largely subsidized by Tribal General Funds and community block grants. These systems are typically smaller than the NTUA systems, are typically not metered, and generally have worse economies of scale. Consequently, they generate inadequate revenue for proper administration and maintenance. In addition to these systems, the BIA operates 59 water systems with more than 3,000 connections. Almost all were intended for BIA schools and school-related housing. Approximately 50 smaller systems are operated by missions, trading posts, and private commercial operators. Assuming that half of these connections are primarily for residential

users, these small operators serve approximately 10,000 people and deliver approximately 1,000 acre-feet per year.

Table 5.2 Navajo Reservation Public Water Supply Systems

Operator	1998 Number of Systems	1998 Number of Connections	2002 Number of Systems	2002 Number of Connections	2006 Number of Systems	2006 Number of Connections
Navajo Tribal Utility Authority	93	23,700	97	28,052	105	35,132
Navajo Department of Water Resources	27	767	22	346	27	351
U.S. Bureau of Indian Affairs	56	2,535	57	2,752	59	3,066
School Districts	12	644	13	924	14	852
Missions	7	193	6	180	3	37
Chapters/RUA	16	592	11	553	21	698
Trading Posts	11	146	6	77	18	473
Miscellaneous & Commercial	15	212	30	467	17	157
Total	237	28,789	242	33,351	264	40,766

Source: Navajo Nation Environmental Protection Agency Inventory, 1998, 2002 and 2006

Historic data demonstrates that water use for non-Indian communities have generally increased over time and currently uses approximately 190 gallons per capita per day in the region. This rate compares to a current average per capita use on the reservation of far less than 100 gallons per day. This disparity in per capita water use can be directly correlated to the lack of community development and the difference in the economic standard of living on the Navajo reservation. If the Navajo people are to achieve a standard of living comparable with neighboring non-Indian communities, it must reassess future water demand on the reservation and explore options for providing adequate water to its people.

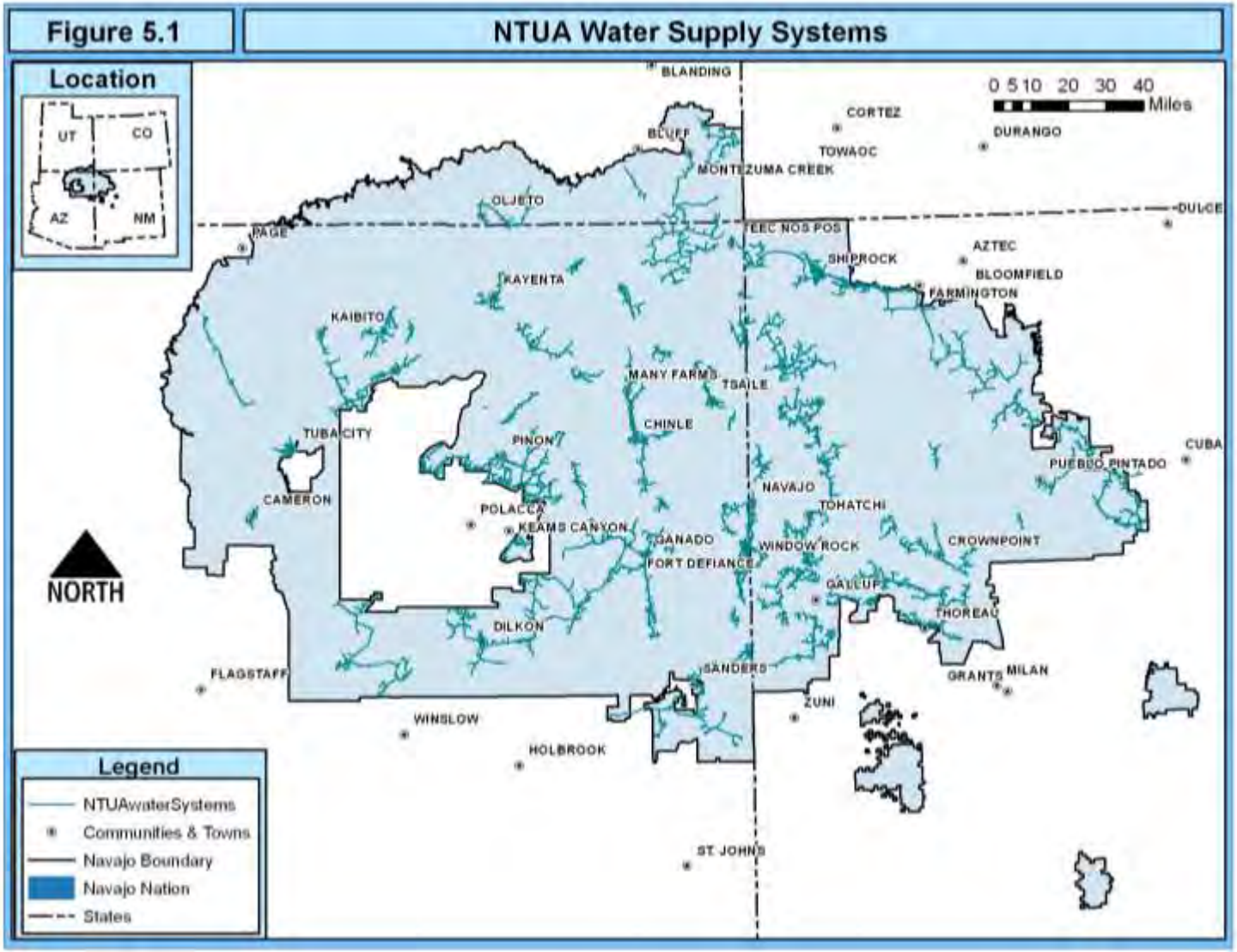


Figure 5.1: NTUA Water Supply Systems

Several conditions compound this problem. First, the Navajo population has very limited economic resources, making capital investments problematic and repayment capacities of the Navajo communities very low. Second, the Navajo population is widely dispersed across an area the size of West Virginia, resulting in large distances between water sources and water users, and extremely high unit operation and maintenance costs. Third, the Navajo Nation has not established a depreciation fund that can adequately repair and replace the existing water systems, many of which are at or near the end of their design life. Finally, endangered species concerns combined with scarce water make new water development, already a costly proposition, even more difficult.

These conditions result in expensive water and a constant struggle to generate adequate revenue to build and maintain water systems. Not only is the Navajo Nation unable to meet growing demands, it is struggling to operate and maintain the existing systems. This leaves the Navajo Nation caught up in a cycle of trying to catch up. The proposed regional systems have economies of scale, and will provide the core water infrastructure for more densely sited housing in the future.

Without adequate funding, the deficiency list will grow, placing an even larger burden on the IHS and Navajo Nation to meet the need for domestic and municipal water. This lack of funding forces the IHS to engage in programmatic triage. The IHS can only commit its resources in the communities where water can be developed less expensively. For instance, the community water supply system at Navajo Mountain, which desperately needs improvement, ranks poorly on the SDS due to the lack of available water and the high cost of developing a new water source. Scarce funding forces the IHS to respond to immediate deficiencies, instead of larger more efficient multipurpose projects, will require longer, multi decade, planning horizons.

Due to limited funding, for systems that do have the priority and receive funding, the IHS typically designs for a domestic demand of 200 to 250 gallons per household per day, or only 50 gallons per capita per day. This rate is less than half of the non-Indian municipal per capita use in Arizona. The IHS adds 50 percent to its design capacity for future growth.

Under its current authority, the IHS cannot typically provide for the water supply needs of commercial or industrial users. These commercial users, which are critical to a robust and sustainable economy, are forced to carry the technical and financial burden of developing their own water supplies. This burden, combined with the other obstacles, makes the creation of business opportunities on the reservation exceptionally difficult. The Navajo Nation is working to remove as many administrative obstacles as possible. However, the difficulty of securing water can only be addressed by creating an adequate water infrastructure.

The IHS is well positioned to leverage additional funds through cooperative efforts with tribal programs and other federal agencies. The IHS has acquired decades of experience developing public water systems on the Navajo Reservation. The IHS has also established cooperative agreement with many of the federal and tribal entities that are providing water development resources.

The NTUA water systems face critical economic problems. The NTUA infrastructure has many miles of pipeline systems, but has few connections per mile. For some of these water systems the operating cost exceeds the system revenue. More costly NTUA systems are subsidized by larger, more cost efficient systems. For example, the water treatment and delivery system at Halchito, near Mexican Hat UT, costs the NTUA approximately $6.00 per 1,000 gallons. However, by current tribal policy, NTUA currently charges its water users approximately $4.00 per 1,000 gallons. While the NTUA attempts to cover the operating costs of the water systems by charging an inadequately reduced fee to its users, the NTUA water rates exceed the water rates of the majority of surrounding non-Indian communities. Furthermore, NTUA does not have the financial resources to maintain an adequate depreciation fund. Consequently, funding may not be readily available when the 300 million dollars of existing NTUA infrastructure needs to be replaced.

As challenging as the current circumstances are, without dramatically improved water resources development efforts, the future may be bleak. Based on an annual growth rate of 2.48 percent and a per capita water demand of 160 gallons per capita per day, the water delivery systems will need to provide six times more municipal water by the year 2050.

5.3 Water Storage Facilities

The Department of the Interior Safety of Dam (SOD) Program developed a nationwide technical priority rating system to assess the relative hazard and priority of dams under its jurisdiction, but as of 2009 the SOD changed from TPR to a risk-based assessment rating. The new ratings are indicated in Table 5.3. The Safety of Dam Program is funded through annual BIA appropriations and, given the recent funding levels, is typically only able to address two projects nationwide per year.

Dam safety work has been completed on Canyon Diablo, Round Rock, Ganado, Wheatfield, and Many Farms Dams. Five others Captain Tom, Tsaile, Charlie Day, Red Lake, and Asaayi are in the top ten. In 2006 the NDWR Safety of Dams Branch estimated that approximately $47 million of improvements are needed over the next ten years to address operational deficiencies in the remaining unsafe dams. These improvements include conducting deficiency verification analyses, developing standard operating procedures, preparing emergency action plans, establishing early warning systems, and addressing structural problems.

Captain Tom Dam has the highest technical priority rating and is expected to start reconstruction. Resolution was passed by the chapter August 2010. Lower ranking dams may not be addressed for several decades, if ever. In recent years the BIA has provided $300,000 of annual funding to the Navajo Dam Safety program. Reclamation provides technical assistance to the BIA.

At least 14 other significant dams on the reservation need attention, but are not ranked by the Department of the Interior, nor are they explicitly included in the NDWR Plan of Operation.

Although these dams may not pose immediate safety hazards, their function over time may be critically compromised. Alternative funding sources are needed to address the needs of the dams not covered under the dam safety program. One example of a dam in this category is Chuska Dam near Tohatchi, New Mexico. Chuska Reservoir provides water to the Red Willow Irrigation Project and is stocked by the Navajo Nation Fish and Wildlife Department. In 2000, Chuska Dam needed an improved outlet and additional protection for the spillway and embankment. Chuska Dam is an example of an innovative partnership combining the resources of several agencies. The Navajo Nation secured $100,000 from the State of New Mexico, technical assistance from Reclamation's Farmington Construction Office, EQIP funding for on-farm system improvements, and in-kind construction support from the NDWR.

Given the geologic and the environmental concerns, developing new storage facilities is very difficult. However, the proposed regional water projects will require additional storage. The Three Canyon Project would require a 2,000 acre-foot reservoir on Chevelon Creek, a 3,000 acre-foot reservoir on Clear Creek, and storage from Blue Ridge Reservoir. The Navajo-Gallup Water Supply Project requires storage from Navajo Reservoir. The Farmington to Shiprock Pipeline will require storage from the Ridges Basin Reservoir. Other large projects will rely on storage from either Lake Powell or Navajo Reservoir. They will also require storage for operational reliability and flexibility.

Table 5.3 Reservoirs Included in the Safety of Dams Plan of Operation

Reservoir	Capacity (Acre-feet)	Reservoir Area (Acres)	1998 BIA Technical Priority Rating	1998 Upgrade Cost ($)	2000 BIA Technical Priority Rating	2000 Upgrade Cost ($)	2006 BIA Technical Priority Rating	2006 Upgrade Cost ($)
Captain Tom	1,170	75	46	$9,907,000	42	$755,000	2	$18,000,000
Tsaile	8,100	415	76	$1,273,000	18	$2,525,000	4	$4,000,000
Charlie Day							5	$2,000,000
Red Lake	11,000	1,100	64	$1,183,000	65	$1,430,000	6	$8,000,000
Asaayi	682	37	89	$1,854,000	11	$5,594,000	8	$11,000,000
Todachinee	8,780	100	n/a	$60,000	28	$925,000	14	$1,500,000
Canyon Diablo	4,700	470	11	$2,369,000	11	$10,375,000	16	Complete
Wheatfields	5,700	315	13	$7,199,000	36	$9,370,000	35	Complete
Tohajiilee							44	$3,000,000
Cutter	8,780	104	80	$1,722,000	82	$1,273,000	64	0
Many Farms	31,000	1,000	7	$13,357,000	5	$1,363,000	80	Complete
Window Rock	210	10	53	$30,000	84	$309,000	113	0
Blue Canyon	1,900	100	109	$270,000	106	$330,000	116	0
Round Rock	1,080	84	47	$312,000	44	$280,000	118	Complete
Ganado	2,400	335	114	$312,000	112	$285,000	123	Complete
Whiskey Lake	7,458	100	n/a	$60,000	n/a		n/a	n/a
Total	92,960	4,245		$39,900,000		$46,981,500		$47,500,000

Note: upgrade cost includes: deficiency verification analysis, standard operating procedures, emergency action plan, early warning system, and construction.

5.4 Commercial Use

In addition to residential water, in the 1990's NTUA provided approximately 3,300 acre feet of water to more than 1,600 commercial users. The non-NTUA systems provide more than 500 acre-feet, and NAPI uses approximately 2,000 acre-feet for food processing and NIIP construction (see Table 5.4). The smaller commercial and industrial water users support critical services and contribute jobs and economic opportunities on the reservation. These small business users are an important component of the Navajo Nation's economy. Construction contractors use an additional 500 acre-feet of water from the NTUA water taps and sewage lagoons annually for dust abatement and construction. Special requirements are imposed by the NNEPA for the use of sewage lagoon water.

The difficulty and expense of securing reliable water present significant obstacles for businesses operating on the reservation. To overcome these and other obstacles, the Navajo Division of Economic Development (NDED) has created incentives for economic development on the reservation. The NDED has identified economic growth centers which are focal points for infrastructure development, including water to support new businesses (see Table 3.7 and Figure 5.2). Economic growth centers are communities with large populations and the potential to benefit from an economy of scale in infrastructure development.

Economic development of the growth centers has been bolstered by the passage of the Navajo Nation Local Governance Act in 1996. This legislation grants Chapters authorities similar to those of off-reservation municipalities. For example, local Chapters are encouraged to develop local land-use planning, zoning, taxation, bonding, revenue generation, ordinances, business site leases, and infrastructure. The Chapters should be better able to respond to problems and opportunities at a local level and create significant economic growth potential. The policy of the Navajo Nation is to reverse the leakage of revenue. According to data developed by Dine College intern Alastar Bitsoi in 2004, the total leakage of Navajo dollars averages $1,067,568,880. More than 71 percent of Navajo dollars are spent outside of the Navajo Nation.

Table 5.4 Commercial Water Use on the Navajo Nation (1995)

Description of Water Use	Annual Water Use (Acre-feet)
NTUA System Use	
Institutions	1,571
Miscellaneous	433
Government Offices	327
Construction	5
Trading Posts	46
Commercial	929
Sub-Total	3,311
Non-NTUA System Use	
Institutions	225
Government Contractors	150
Trading Posts	46
Commercial	75
Construction	74
Sub-Total	570
NAPI	
Food Processing	2,240
Contractors	55
Industrial	0
Sub-Total	2,295
Sewage Lagoons	519
TOTAL	**6,695**

Source: Navajo Nation Water Code Administration, 1995

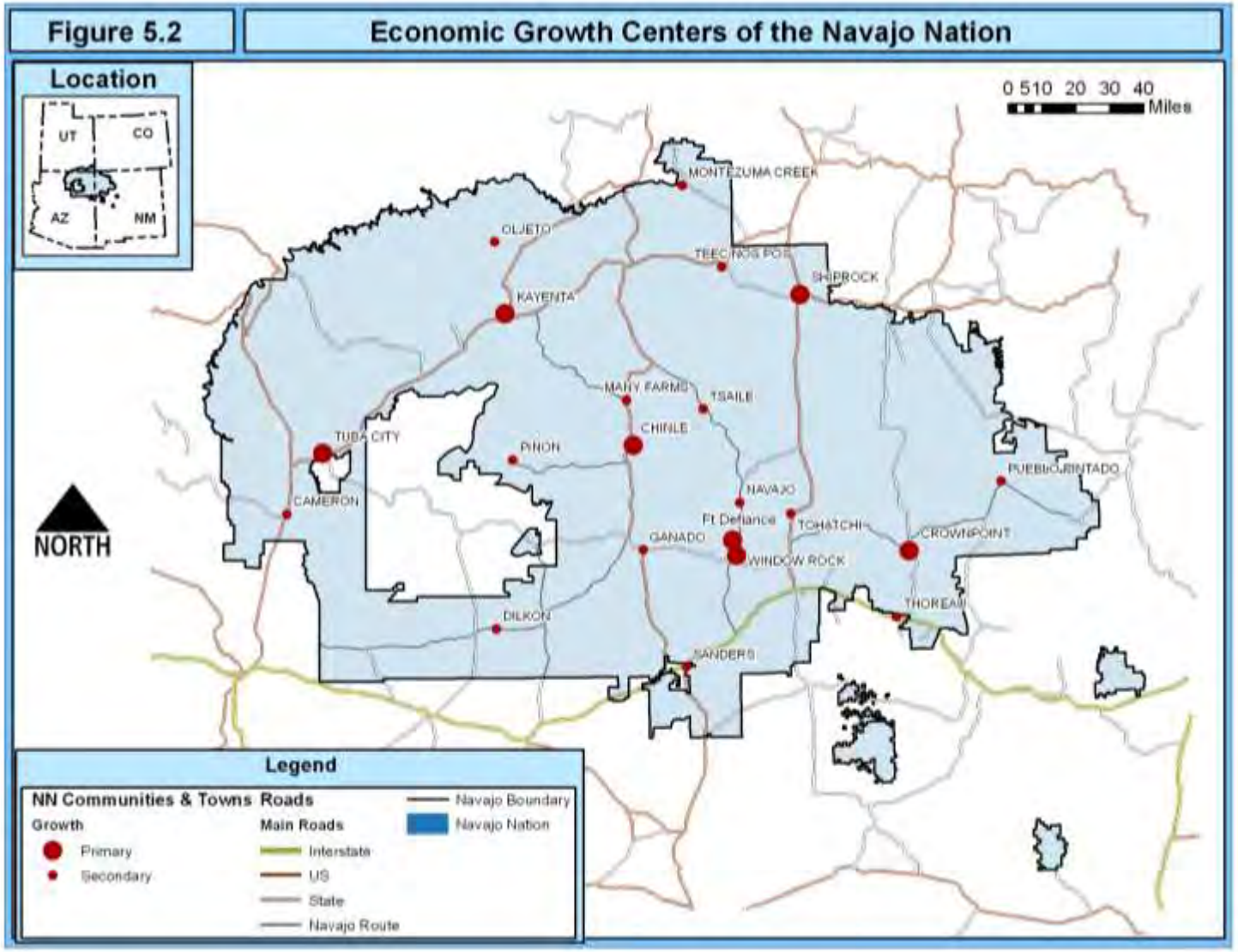


Figure 5.2: Economic Growth Centers of the Navajo Nation

5.5 Agricultural Water Use

Agriculture has always played an important role in the culture and economy of the Navajo People. Agriculture water use can be divided into three categories: 1) NIIP, 2) the small irrigation projects, and 3) livestock. The unique problems associated with non-project, "Ak Chin" irrigation and litigation irrigation projects are beyond the scope of this document. The three main categories of agriculture water use are:

- Navajo Indian Irrigation Project
- Small Irrigation Projects
- Livestock

5.5.1 Navajo Indian Irrigation Project

The Navajo Indian Irrigation Project (NIIP) is one of the largest water development projects on the Navajo reservation. NIIP was jointly authorized with the San Juan Diversion in 1962 through 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 irrigation water to approximately 110,630 acres of land. NIIP consists of the initial land development, water distribution system, water delivery, roads, and other infrastructure. NIIP has a 1956 State Water Use Permit for 640,000 acre-feet and a 1974 contract with the Secretary of the Interior to divert 508,000 acre-feet of water. According to NIIP's 1999 Biological Opinion, with a unit depletion of 2.4 acre-feet per acre, NIIP will divert 360,000 acre-feet and deplete 270,000 acre-feet of San Juan River water per year at full build out. The vast majority of this water was directly used for irrigation. Other uses included approximately 2,240 acre-feet of water per year for food processing and 55 acre-feet per year for NIIP related construction activities. Most of the food processing water use is for cleaning produce. The boundaries of NIIP are shown in Figure 5.3.

In 1970 the Navajo Nation created the Navajo Agricultural Products Industry (NAPI) to run the agricultural business venture and oversee the operation of NIIP. NAPI is a tribal business enterprise, created to develop, farm, and operate the NIIP lands, and to operate and maintain the NIIP water delivery system. NAPI produces a variety of crops including corn, potatoes, alfalfa, and pinto beans. Its crops are marketed throughout the United States, Mexico, and international markets using the "Navajo Pride" trademark. NAPI provides approximately 250 permanent jobs and 800 seasonal jobs. Subcontractors, joint venture partners of NAPI, and independent truckers employ additional workers. In 2005 NAPI estimated that between 2002 and 2004 the total economic impact in the region generated by NAPI business activity was $199 million (Cleveland 2005). Ultimately, NAPI may create more than 3,000 jobs as a vertically integrated corporate farm and provide a significant impact on the regional economy.

Since 2003 NAPI has shown consistent, and increasing, profits between $3 and $5 million per year. NAPI is proposing several economic initiatives including:

- Value added processing
- Railroad spur
- Fresh Pack Facility
- Grain Merchandising
- Export Markets
- Future Demand for Additional Acreage

By 2007 on farm development on Blocks 1 through 7, and 93 percent of Block 8, was completed. In 2006 NAPI diverted 192,300 acre-feet of water to 68,663 acres of farmland. This acreage represents slightly more than 60 percent of the 110,630 acres authorized for the project. NIIP has developed 69,229 acres, or 62.5 percent of the authorized acreage. Between 2002 and 2006, NIIP construction funding was approximately $13 million per year. Based on this funding level, it will take more than 50 years to complete NIIP. The slow completion rate delays the time when NIIP can provide all of the benefits that are envisioned. In October 2006 BOR estimated that the total cost to complete Blocks 9, 10 and 11 was $319 million. Revised completion schedules for the completion of NIIP have been developed by Reclamation, NAPI, and the BIA. At a funding level of $30 million per year it would take 15 years to complete, at $41 million per year it would take ten years, and at $50 million per year it would take 8 years to complete.

In 2011 Keller Bliesner and Associates compiled information on the completion of NIIP. Based on that compilation and assuming a $26 million per year funding level, completing construction will cost $403 million, rehabilitation will cost $125 million, addressing NIIP deficiencies will cost $53 million, on-farm rehabilitation will cost $14 million, and new on-farm development will cost $61.7 million.

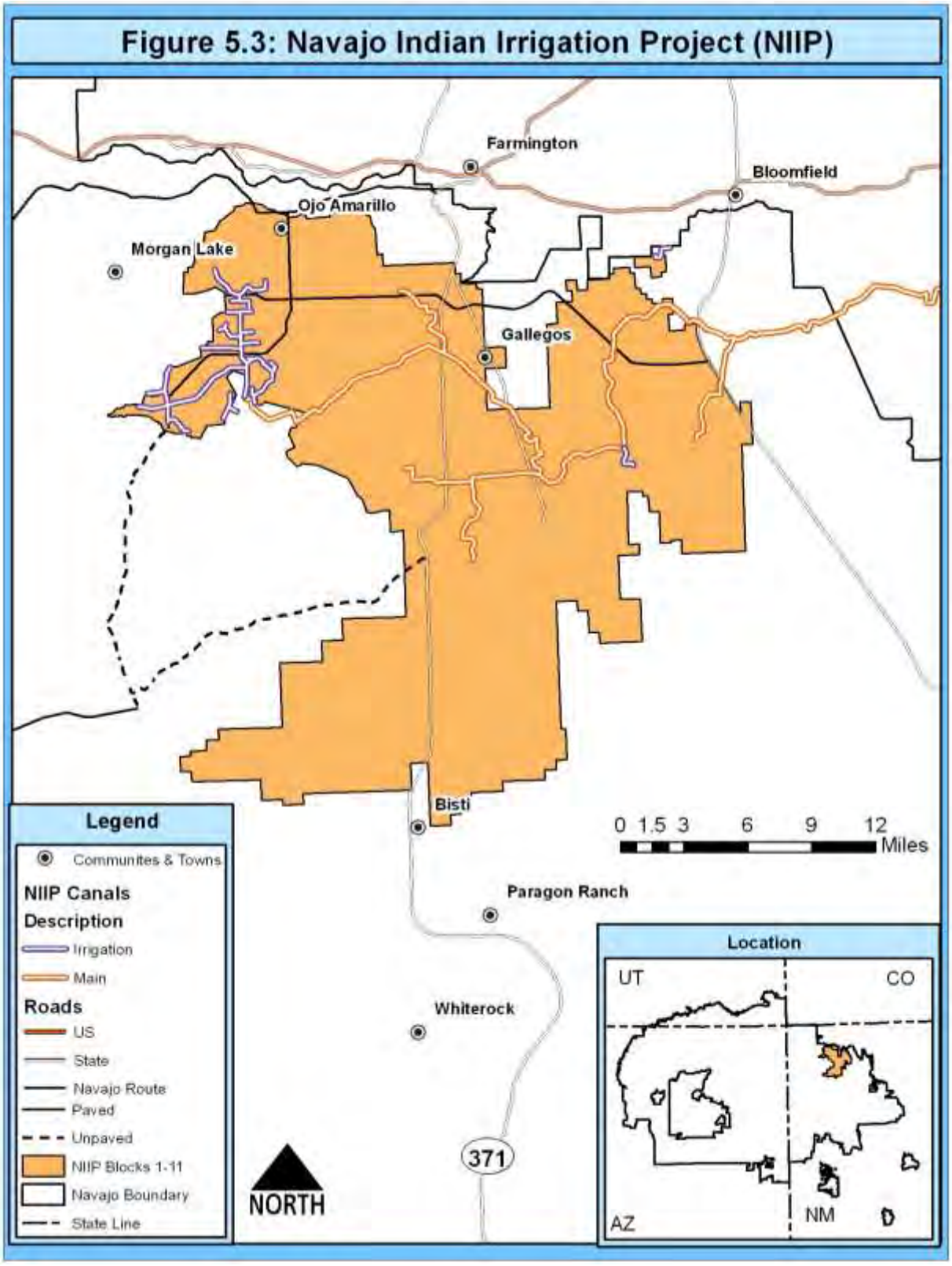


Figure 5.3: Navajo Indian Irrigation Project (NIIP)

This unfulfilled promise has weighed heavily on several Navajo Nation administrations. In March of 1999 Reclamation, BIA and Navajo Agricultural Products Industry (NAPI) identified several issues, which need to be addressed.

- Annual Construction Funding – The NIIP facilities are being constructed in 11 blocks of approximately 10,000 acres each. In October 2006, Reclamation estimated that Block 9 will cost $76.4 million, Block 10 will cost $130.5 million, and Block 11 will cost $112.9 million. A total of $319 million, including $86.4 for Gallegos. NIIP may exceed the authorized ceiling, and current funding levels are significantly below the design and construction capabilities of Reclamation. It jeopardizes the functional life of installed but unused equipment awaiting follow-on installations, wastes resources, increases completion and rehabilitation costs, and is detrimental to Navajo economic development. To achieve a more effective and efficient project, the Navajo Nation is requesting that annual federal appropriations be increased to enable construction of NIIP's water delivery system in a shorter time period. Assuming that these financial and environmental challenges can be addressed, the Navajo Nation proposes a schedule that would complete Block 8 in fiscal year 2000, Block 9 in FY2002, Block 10 in FY2005 and Block 11 in FY2006. The drains and an automated System Control and Data Acquisition System would be completed. The Navajo Nation, Reclamation, and the BIA have established a team to prepare a long-range plan for the development of NIIP.

- On-Farm Development Funds – On-farm development, including land preparation and new sprinkler installations, is not keeping up with the current rate of construction. At the current rate of funding, it will take approximately 20 years to complete the remaining 550 sprinkler systems. Increasing the rate of funding for on-farm development must occur to allow on-farm development to keep pace with construction of the water delivery facilities. This increased rate will prevent completed canals, pumping plants, and pipelines from sitting idle for years awaiting the on-farm development

- Vertical Integration – NIIP has not satisfied its purpose of creating thousands of jobs for Navajo workers. This purpose may be achieved through a vertically integrated agribusiness enterprise. The Navajo Nation's goal is to increase tribal employment at NIIP by a factor of ten. The Navajo Nation and NAPI are exploring the possibility of a joint venture with R.D. Offut and Lamb-Weston, and others, for the construction and operation of a plant to process French fries and other frozen potato products. The proposed plant will have the capacity to process 600 million pounds of raw product annually.

- Funding for Operation, Maintenance, and Repair – The funding requirements for operation, maintenance, and replacement of NIIP facilities are not being met. The replacement of aging facilities and increasing power costs are also of concern. NIIP O&M continues to be a significant challenge. Since 1994 NIIP O&M funding has ranged from approximately $3 million to $5.4 million. In 2006 the O&M funding was $3.7 million, which is less than the funding in 1994. In 2006 NAPI requested $8.3 million. The $4.6 million difference represents unfunded or deferred O&M. Consequently, major maintenance and repair is being deferred. Serious problems could interrupt water deliveries causing major crop damage. The backlog of deferred maintenance continues to grow. Adequate funding is necessary to safeguard the NIIP investment.

5.5.2 Small Irrigation Projects

More than 400 years ago Navajos irrigated fields near the San Juan River and other places where the water supply was adequate. Three types of Navajo irrigation have been described: intercepting flood waters on land advantageously located on alluvial flood plains along the perennial and intermittent washes, disking flat lands so that spring floods can be retained on the land, and diverting water from perennial and intermittent streams through irrigation ditches to the fields. This document only addresses this last category of irrigated agriculture.

In 1994 the federal government amended the Little Colorado River Basin claims on behalf of the Navajo Nation. The amended claims for the Little Colorado River Basin included more than 60,000 acres of historically or recently irrigated land. Assuming that the entire reservation has a similar distribution of irrigated land, there may be 180,000 acres of recently or historically irrigated on the Navajo reservation.

Between 1910 and the late 1950's the U.S. Government built and expanded dozens of irrigation projects. In 1960, pursuant to Public Law 86-636, Congress transferred title and operation and maintenance responsibilities for the Navajo irrigation projects from the BIA to the Navajo Nation. In 1986 the NRCS conducted an inventory of irrigation projects across the reservation. The NRCS investigated 83 irrigation projects to determine existing conditions, consolidate resource data, and prioritize projects for possible rehabilitation. The NRCS determined that by 1950, these small projects irrigated 46,219 acres of land (see Figure 5.4). Due to inadequate management and inadequate funding for operation, maintenance, and replacement these systems have deteriorated. In 1986 only 16,670 acres, or 27 percent of the original project area, were farmed (NRCS 1986). However, the production from these projects is still important to the Navajo Nation. In 1989 Colorado State University estimated that the personal income from traditional agricultural crops was approximately $2 million. Seven of the largest irrigation projects are specifically addressed by the NDWR Plan of Operation and include approximately 20,000 acres (see Table 5.5).

Throughout the country small farms are under stress. Fluctuating crop prices and high production costs make farming a challenge under the best of circumstances. However, compared to irrigation projects off of the reservation, the small Navajo irrigation projects have lower cropping intensities and productivity. According the 1986 NRCS inventory less than 30 percent of the land on 83 small Navajo irrigations projects was being farmed. Based on that inventory rehabilitating these projects may cost on average $250,000 per project. A separate rehabilitation study by Reclamation of the Fruitland, Cudei and Hogback Irrigation Projects resulted in an estimated rehabilitation cost for those three projects of $20 million. A major rehabilitation plan was authorized as a part of the San Juan River Settlement

Table 5.5 Irrigation Projects Operated by the NDWR

Irrigation Project	Project Land (Acres)	Annual Water Demand (Acre-feet)
Hogback	9,223	46,115
Fruitland-Cambridge	3,830	19,150
Cudei	627	3,135
Many Farms	2,000	10,000
Red Lake	1,102	5,510
Tsaile/Wheatfields	920	4,600
Ganado-Cornfields	2,210	11,050
Total	19,912	99,560

Source: SCS Inventory of Navajo Indian Irrigation Projects, 1986

Aside from funding shortfalls, the NRCS, Reclamation, BIA, NDWR and others have identified a number of problems facing the small irrigation projects including:

- On many of the small irrigation systems, the command areas were expanded beyond sustainable hydrologic limits. This situation results in general lack of water control and inadequate and unreliable water for the irrigators.
- The small irrigation systems are trapped in a downward spiral of declining system revenues, which results in chronically deferred maintenance, which results in worse water control, which results in more idle lands, which results in declining system revenues.
- Local operating entities such as water users associations are not well established.
- New farming technology is not widely deployed.
- Establishing market windows is a difficult challenge for small producers.

For almost 100 years, the BIA constructed and maintained irrigation systems on the reservation. However, in recent years, BIA's budget has been progressively cut so that fewer funds are available for irrigation system construction and maintenance nationwide. Consequently, the existing systems on many reservations have deteriorated to such a state that many are no longer serviceable. This deterioration has led to the disintegration of many of the institutions that were established to oversee these operations.

The water resource development strategy must reverse this downward trend. Institutional changes must occur. Irrigators must be willing to organize water users associations through their local farm boards, and accept added responsibility for operation and maintenance. The Navajo Nation Tribal Council initiated the Local Governance Act, which is intended to make decision-making more accountable to local needs. The Council also approved a farm board plan of operation that allows

irrigators to collect assessments for operation and maintenance of the irrigation projects. Establishing water user associations clearly fits this mandate. Once the water users are organized, partnerships can be more effectively developed to address the physical needs of the system.

In March 2009 President Obama signed Public Law 111-11 that authorizes approximately $20 million as part of the San Juan River settlement to rehabilitate the Hogback and Fruitland Irrigation Projects.

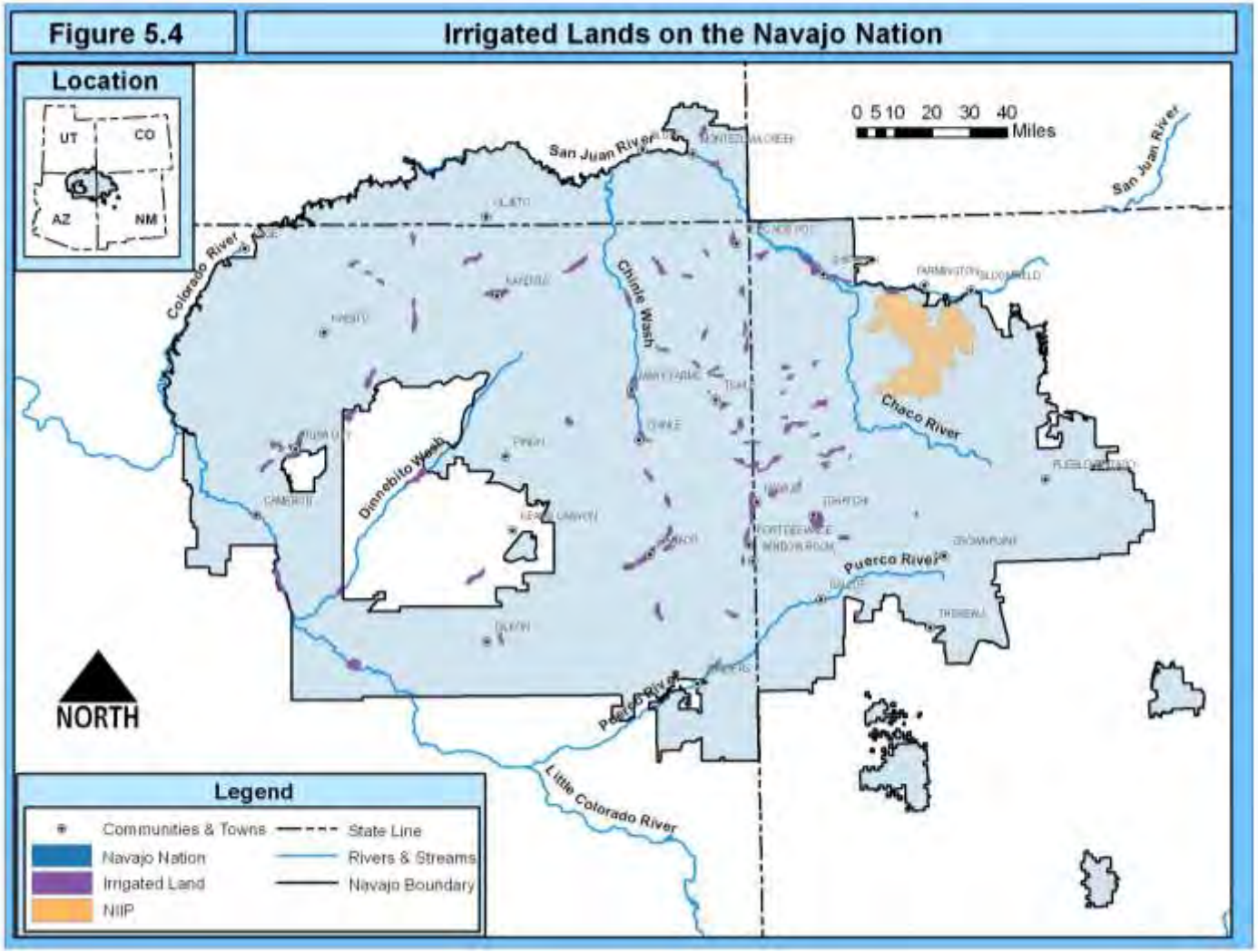


Figure 5.4: Irrigated Lands of the Navajo Nation

5.5.3 Livestock

The importance of livestock to the Navajo Nation cannot be overstated. In spite of droughts, harsh winters and fluctuating prices, raising livestock has historically been one of the few economic enterprises which has been successfully managed in the reservation environment. The NDED estimates that the value of cattle on the reservation is $16 million, the value of sheep is $3 million, the value of horses is $625,000, and the value of goats is $375,000. The total value of livestock exceeds $20 million. The cultural importance of livestock to the local community goes far beyond its monetary value. Livestock have been integrated into the Navajo lifestyle for many generations.

The water for an estimated 300,000 permitted animal units comes primarily from shallow windmill-powered wells and rain-fed stock-ponds. The NDWR is responsible for maintaining approximately 900 windmills. In 1993 the NDWR estimated that the water supply for livestock from the windmill-powered wells was 865 acre-feet per year. The Operation and Maintenance Branch carries out this responsibility with Tribal General Funds and BIA 638 funds. The large number of these facilities makes regular maintenance a daunting task.

The total number of stock-ponds in an arid region is limited by the runoff and the suitability of the range. The Little Colorado River 1994 amended claim filed by the Federal Government on behalf of the Navajo Nation identified 2,422 stock-ponds in the Little Colorado River Basin with an estimated water use of 21,000 acre-feet. Assuming that the entire reservation has a similar density of stock-ponds, there are approximately 7,500 Navajo stock-ponds with a potential water use of more than 60,000 acre-feet. These water sources are the first to be impacted during drought.

The Navajo Department of Agriculture recently estimated that the range is overstocked by approximately 50 percent. Overstocking adversely impacts water quality and supply, increases erosion and can lead to desertification of Navajo lands. Attempts to improve livestock water supplies should place a high priority on local participation and on the limits of the range to sustain them. As additional water development occurs, the Navajo economy can become more diversified decreasing the economic dependence on livestock.

The feedlot at NAPI raises 12,000 head of cattle, which use 600 acre-feet of water annually from the NIIP canals. NAPI anticipates the construction of dairy farm, hog farm, and poultry operations, as well as an expanded feedlot for cattle and sheep.

5.6 Mining and Industrial Use

Generating energy requires water, and providing water takes energy. The Navajo Nation hosts a variety of industrial and mining water users, all of which require a reliable water supply. A report from the Auditor General identifies mining as the single most important revenue-generating source on the reservation, often producing 75 percent of the total annual general tribal revenues. Regionally, the largest water users have been coal mining, oil recovery and power generation, which use a combined total of approximately 158,000 acre-feet of water annually (see Table 5.6 and Figure 5.5).

5.6.1 Coal Mining

Water is essential for mining on the Navajo reservation. Between 1995 and 2000 mining revenues generated, on average, approximately $56 million, or 55 percent, of the Navajo Nation's general revenues. In recent years mining revenue exceeded $60 million. Coal mining also generates approximately 10 percent of the annual employment on the Navajo Nation. However, coal revenues are on the decline, having dropped about 30 percent since 1996. And with the closure of the Mohave Generating Station and McKinley Mine, these revenues will continue to decline. The annual water use is presented in Table 5.7.

Peabody Western Coal Company (PWCC) is the largest mining water user on the reservation. The primary source for PWCC water is the N-aquifer. The largest PWCC water use was a slurry line from the Peabody Mine at Black Mesa to the Mohave Generating Station near Laughlin, Nevada which was shut down in 2005. Additional water is used for dust control, construction, coal washing, reclamation, drinking, sanitation, and sediment ponds. From 1969 to 1993, the average annual water use for PWCC was 3,543 acre-feet (ADWR 1994). In 1993 PWCC used 3,704 acre-feet of water, which was 56 percent of the total withdrawal from the N-aquifer. PWCC also uses more than 100 surface water impoundments located on the PWCC lease. Due in part to the closure of the Mohave Generating Station, in 2010 PWCC use declined to 1,200 acre-feet of water to produce 8.4 million tons per year.

Broken Hill Properties, Inc. (BHP), formerly Utah International, has a New Mexico State water permit and a Reclamation contract from Navajo Reservoir to divert 44,000 acre-feet of water and deplete 35,000 acre-feet. Most of this water is used for power generation at the Four Corners Generating Station and a portion of this water is used at BHP's Navajo Mine. BHP produces 8 million tons per year.

The Peabody and Midway Coal Company operate the McKinley Mine in New Mexico. Water is used at this mine for reclamation and dust control. In 1995 the Water Code Administration estimated that this mine operation used 100 acre-feet of water. This operation was shut down in 2009. Reclamation is ongoing.

Table 5.6 Large Industrial Water Uses (1995)

Description of Water Use	1995 Annual Water Use (Acre-feet)
Coal Companies	
BHP - UII Navajo Mine	see Four Corners Generating Station
Peabody Western Coal Company	4,500
Pittsburgh & Midway McKinley Mine	100
Sub-Total	4,600
Oil Companies	
El Paso Natural Gas	64
Harkens	14
Mobil	844
Sirgo Brothers	14
Texaco	14
US Oil	14
Others	14
Sub-Total	978
Generating Stations	
Cholla Generating Station (2006)	15,928
Four Corners Generating Station	35,000
Mohave Generating Station	30,000
Navajo Generating Station	34,100
Plains Escalante Generating Station	20,000
San Juan Generating Station	20,000
Sub-Total	152,500
Total	158,078

Source: Water Code Administration (1995)

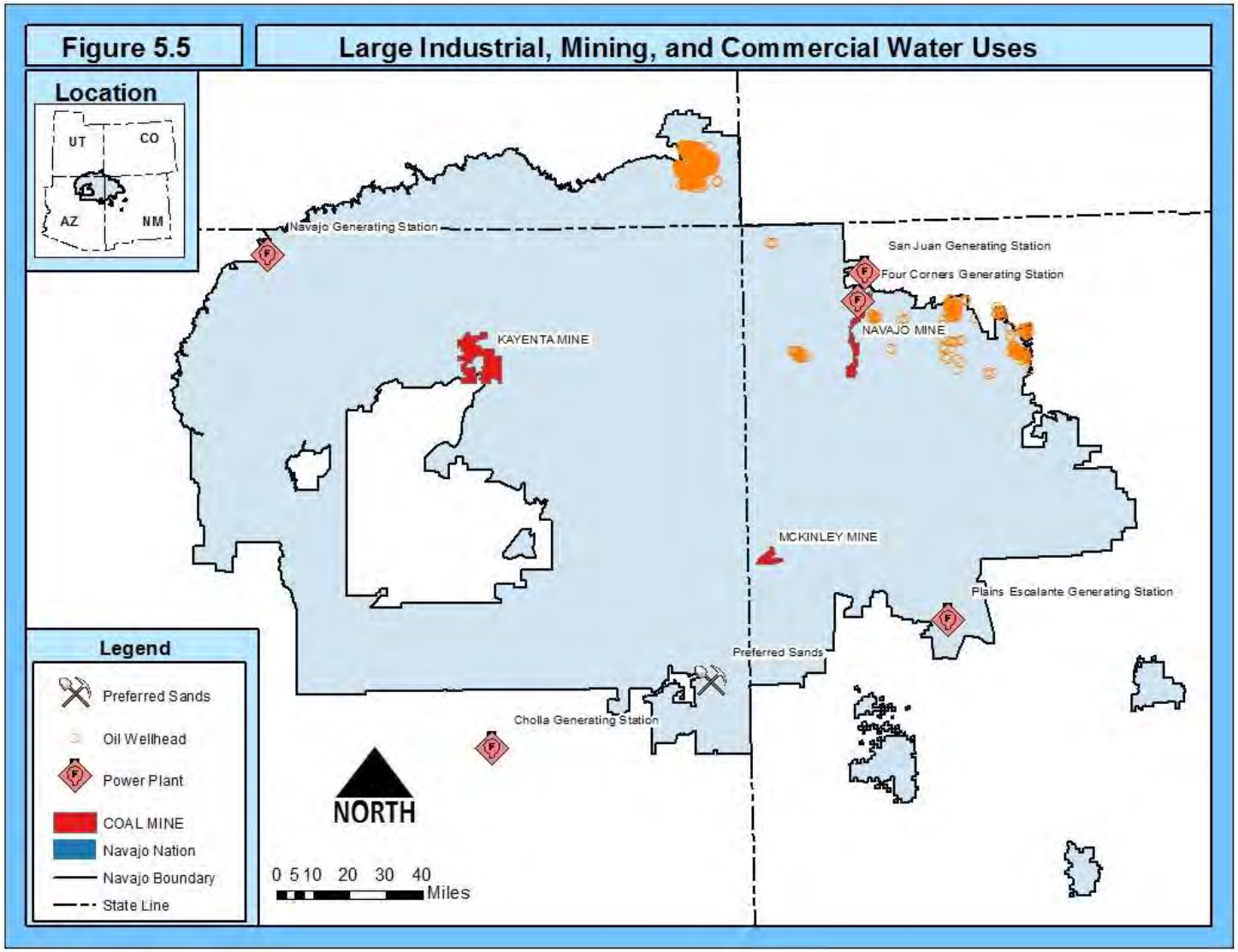


Figure 5.5: Large Industrial, Mining, and Commercial Water Uses

Table 5.7 Navajo Nation Revenue from Mineral Development (Millions of Dollars)

	2001	2002	2003	2004	2005	2006	2007	2008
Coal	$48.90	$51.20	$63.70	$66.10	$72.04	$78.16	$59.70	$58.91
Oil	$22.42	$17.17	$19.02	$19.35	$29.00	$36.00	$27.00	$57.00
Gas	$2.10	$0.85	$1.95	$2.07				
LPG	$0.17	$0.03	$0.19	$0.08				
Total	$73.59	$69.25	$84.86	$87.60	$101.4	$114.16	$86.70	$115.91

Source: NNDED 2009-2010 Comprehensive Economic Development Strategy.

5.6.2 Oil and Gas Production

SIRGO Brothers, Texaco, Harkens, US Oil, and Mobil use water on the reservation for secondary and tertiary petroleum recovery. In 1995 the Water Code Administration estimated that the oil companies used approximately 978 acre-feet of water (see Table 4.6). Most of this water is non-potable groundwater, which is re-injected into oil-bearing formations. In fiscal year 2000, oil and gas revenues for the Navajo Nation exceeded $20 million and contributed 20 percent of the Navajo Nation's General Revenue.

5.6.3 Regional Power Generation

Six power-generating stations operate in the vicinity or on the reservation and deplete large quantities of water (see Table 4.6). Coal fired power plant in the region use approximately 510 gallons of water for every megawatt hour of energy produced. Although much of this water is administered through state water user permits or contracts with the Secretary of the Interior, these large users impact the waters of the Navajo Nation. These generators are described in the following sections:

- Cholla Generating Station
- Four Corners Generating Station
- Mohave Generating Station (Shut down in December 2005)
- Navajo Generating Station
- Plains Escalante Electric Generating Station
- San Juan Generating Station
- Desert Rock Generating Station (Proposed)

- Cholla Generating Station – The Cholla Generating Station is located near Joseph City, Arizona and is operated by Arizona Public Service Company. Cholla Generating Station capacity is 995 megawatts. It withdraws 16,000 acre-feet of groundwater annually from the

Coconino Aquifer. The cones of depression created by this groundwater withdrawal may affect the groundwater supply of the Navajo Nation.

- Four Corners Generating Station – The Four Corners Generating Station is primarily owned by the Arizona Public Service and uses water obtained from BHP. It has a capacity of 2,040 megawatts. BHP has a state water permit to divert 44,000 acre-feet of water and deplete 35,000 acre-feet from the San Juan River. According to U.S. Fish and Wildlife Service reports, the historic water depletion at the Four Corners Station has been approximately 31,000 acre-feet per year. The water is pumped directly from the San Juan River and stored in Morgan Lake for cooling.

- Mohave Generating Station – The Mohave Generating Station near Laughlin, Nevada was operated by Southern California Edison from 1970 through December 2005. The facility had two coal power units that produced 1,580 megawatts. It used coal from the Peabody mine at Black Mesa and consumed approximately 30,000 acre-feet of water annually. The coal for this facility was conveyed through a 273-mile slurry line. Approximately 3,000 acre-feet were recovered from the coal slurry-line feeding the facility and the rest of the water supply was obtained from contracts for mainstream water from the Colorado River.

- Navajo Generating Station – The Navajo Generating Station near Page, Arizona has been operated by the Salt River Project since 1973. The facility has three coal power units with a capacity of 3,750 megawatts. It uses coal from the Peabody Mine near Kayenta. It uses water from Lake Powell primarily for its cooling towers. The Salt River Project has a water contract with Reclamation for 34,100 acre-feet of Upper Basin Colorado River water depletion allocated for use within Arizona. The Secretarial contract expires in 2016.

- Escalante Generating Station – The Escalante (formerly Plains Electric) Generating Station is located near Prewitt, New Mexico east of the Navajo Nation near Mount Taylor. It has operated since 1984. The capacity is 240 megawatts. This facility is in the Rio San Jose Basin which is a tributary of the Rio Grande. Plains Electric applied for a State water permit to withdraw 20,000 acre-feet of groundwater from the San Andreas/Glorietta Aquifer. The cones of depression created by this groundwater withdrawal may affect the groundwater supply of the Navajo Nation.

- San Juan Generating Station – The San Juan Generating Station is operated by the Public Service Company of New Mexico (PNM) since 1973. The capacity is 1,800 megawatts. It depletes an average of 20,000 acre-feet of water per year from the San Juan River. PNM has a contract with the Secretary of the Interior for the consumption of 16,200 acre-feet of water per year from Navajo Reservoir. This contract was signed in April 1968, amended in 1976 and 1977 and is up for renewal in 2005. PNM also has a grant of authority under a state permit allowing for the consumption of up to 8,000 acre-feet of water from BHP's water use permit. This 8,000 acre-foot allocation is included within BHP's water permit.

- Desert Rock Generating Station (Proposed) – The Desert Rock Generating Station is proposed for a site approximately 20 miles south of Shiprock. It would have a capacity of 1,500 megawatts and it would use 4,500 acre-feet of groundwater. Approximately 450 acre-feet of that water supply would be for Navajo municipal uses. This groundwater is not a tributary to the San Juan River.

5.7 Recreation Use

The Navajo Nation is well situated to take advantage of numerous recreational opportunities, from national parks to casinos. The Navajo Nation is home to several national parks and monuments including Canyon De Chelly, Chaco Canyon, Hubbell's Trading Post, Navajo Nation Monument and Rainbow Bridge, and to Tribal parks including Monument Valley and Asaayi Recreation Area. In 2006 a boat marina and hotel complex opened up at Antelope Point near Page, Arizona. Other nearby attractions includes the Glen Canyon Recreation Area and the Grand Canyon National Park which both share boundaries with the Navajo Nation. In 2004 the parks on the Navajo Nation attracted approximately 2.5 million visitors, and the adjoining parks attracted 6.7 million visitors. Many of these sites are tabulated in Table 5.8 and shown in Figure 5.6.

In addition to irrigation and domestic water supply, the Navajo Nation's reservoirs provide important recreation land and wildlife habitats. The Navajo Nation Fish and Wildlife Department stocks trout in Wheatfields, Tsaile, Asaayi, Whiskey, Chuska, Trout, Berland, Aspen, Antelope, and Round Rock Reservoirs; stock catfish in Tsaile, Ganado, Red Lake, Many Farms, Morgan, and Round Rock Reservoirs; stock bass in Ganado, Red Lake, Many Farms, and Morgan Reservoirs. These lakes and reservoirs are shown in Figure 5.7. The Navajo Nation Fish and Wildlife Department issues more than 13,000 fishing, hunting, and boating permits. These permits generate $600,000 to $700,000 per year, excluding the incidental business revenues. The Navajo Nation Parks and Recreation Department reports that campgrounds and recreational facilities near reservoirs like Asaayi are booked solid from March through October. The Navajo Nation charges $2 per person per day for the use of these facilities.

The Arizona Department of Water Resources estimates that one angler day has a value of $50 and that one acre of surface water has a potential recreation value of $20,000 per year. If the reservoirs on the Navajo reservation were able to maintain minimum pools of 30 percent of the total surface area, the annual economic return could exceed $20 million.

The Navajo Nation passed the gaming referenda in 2004 to establish gaming operations. In 2009 the Church Rock Chapter was the first chapter with a Navajo casino, Fire Rock Casino. In 2010 a second casino was opened in the Hogback Chapter called Water Flow. The Navajo Gaming Enterprise is expanding gaming operations for the Navajo Nation. Development has begun on the Twin Arrows Casino in Luepp Chapter.

Table 5.8 Visitation Statistics on the Navajo Nation (2007)

Site	Visitors
Canyon de Chelly	2,041,781
Hubbell Trading Post	68,847
Navajo National Monument	89,970
Navajo Nation Tribal Zoo (2006)	5,513
Navajo Nation Tribal Museum (2003)	7,447
Chaco Cultural National Historic Park	72,042
Monument Valley Tribal Park	206,204
Four Corners National Monument	179,536
Antelope Canyon	110,711
LCR Gorge Tribal Park	48,793
Bowl Canyon (Assayi Recreation Area - 2006)	2,729
Sub-Total	2,833,573
Adjoining Areas	
Glen Canyon Recreation Area	1,902,232
Grand Canyon National Park	4,450,317
Wupatki National Monument	242,282
Painted Desert/Petrified Forest	545,148
Sub-total	7,139,979
Total	9,973,552

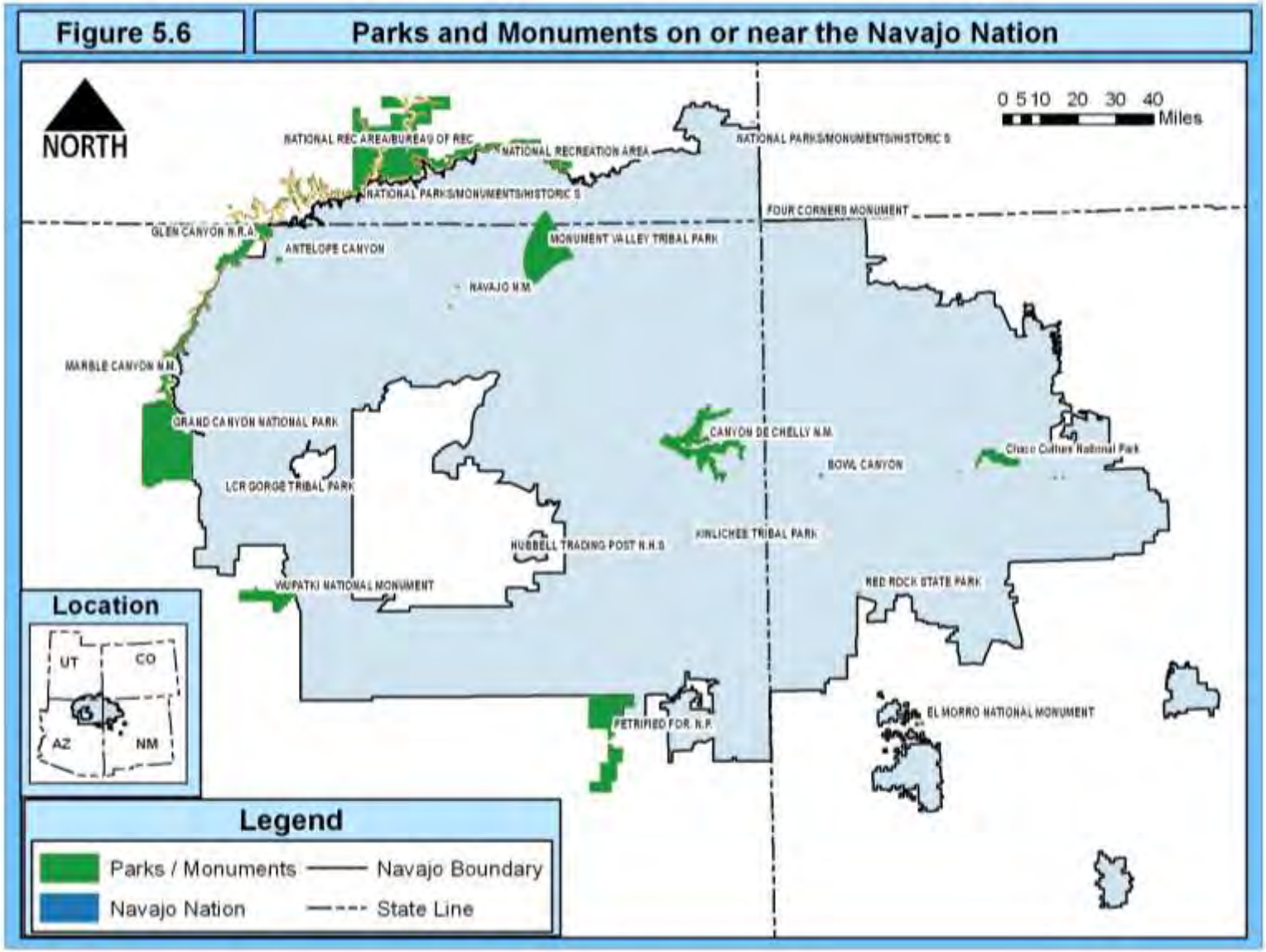


Figure 5.6: Parks and Monuments on the Navajo Nation

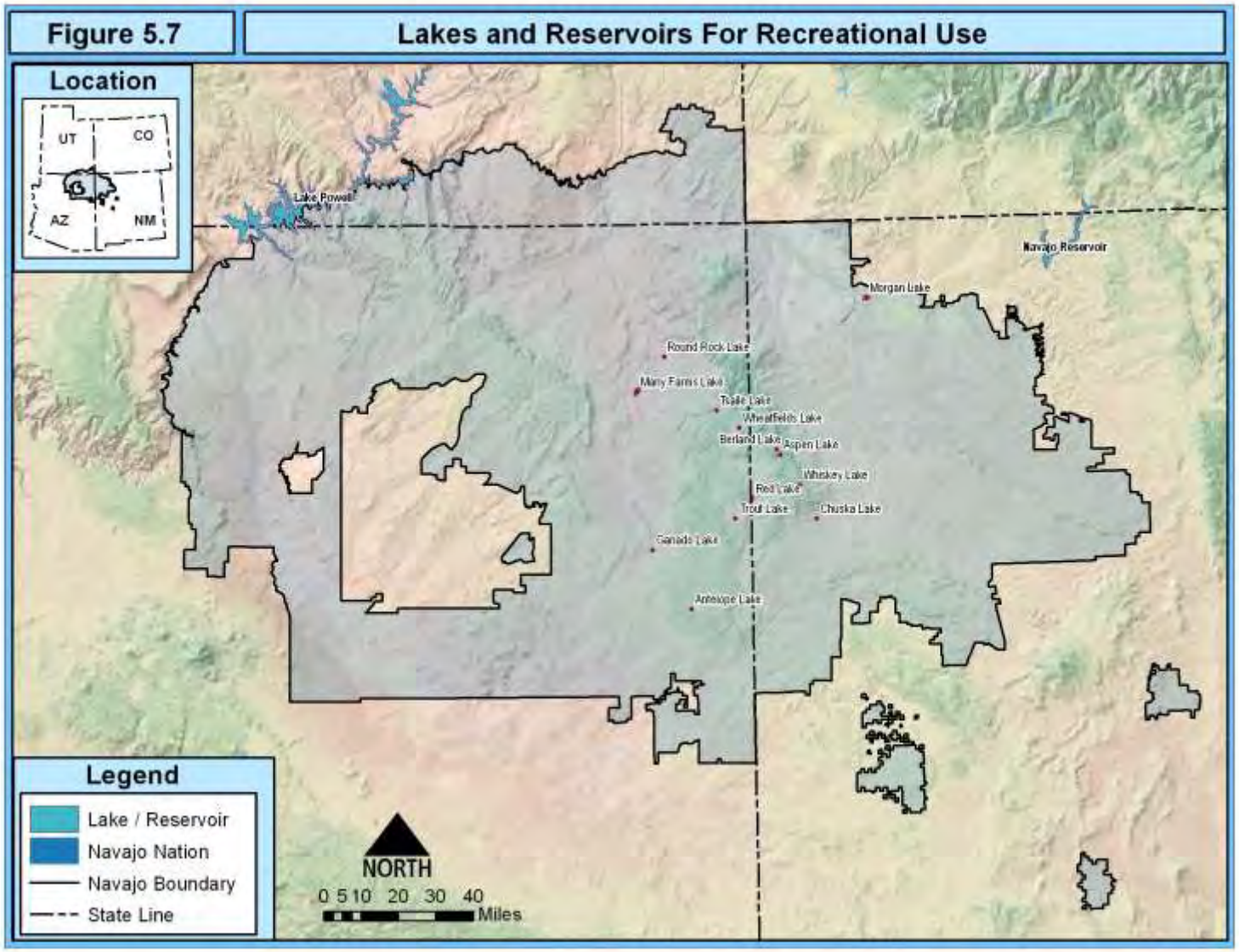


Figure 5.7: Lakes and Reservoirs For Recreational Use

5.8 Wastewater Treatment

Most of the scattered rural houses on the reservation have septic systems or pit latrines with few reuse opportunities. For clustered housing served by NTUA public water systems, NTUA provides wastewater treatment. Most of the NTUA systems have aerated sewage lagoons for water treatment. NTUA maintains roughly 230 of the 560 lagoons on the Navajo Nation. Its wastewater treatment plant at Shiprock discharges approximately 900 acre-feet per year. The 2008 IHS SDS list included $86.6 million of waste water projects.

Future Navajo communities will need to make every reasonable effort to maximize the water supply. A commitment to water conservation and water reuse is essential. The opportunity for water conservation needs to be more fully explored. Yet per capita water use rates on the reservation are already among the lowest in the region. Water conservation among the Navajo; people who have practically no irrigated lawns and very few indoor amenities such as dishwashers and clothes washing machines, is virtually meaningless. Significant cost effective, water conservation opportunities may not be available due to the already low per capita use.

The Navajo Nation and Reclamation are investigating water reuse opportunities. Reclamation implemented systems to use sewage lagoon water for irrigation of the riparian areas at Hubbells Trading Post near Ganado and for wetlands near Pinon. The LeChee Chapter, which is next to Page, Arizona, is interested in developing a golf course using sewage lagoon water and the Navajo Mountain Chapter is interested in incorporating water reuse for its new high school. Water Conservation Management Plans for Kerley Valley and Many Farms assessed the potential use of lagoon water for irrigation. The regional water plans will include the opportunities for water conservation and reuse. The use of reclaimed water for the Snow Bowl near Flagstaff has generated tremendous controversy. The Navajo Nation was adverse to the plans for the Snow Bowl, asserting that using reclaimed water in that situation was not appropriate.

6. WATER RESOURCE DEVELOPMENT STRATEGY

Access to adequate water is critical for economic growth and the survival of the Navajo culture. However, the problems surrounding water development on the Navajo reservation are beyond the technical and fiscal resources of any single agency. Consequently, the Navajo Nation is committed to a water resource strategy that combines tribal, federal, state and private resources.

On July 17, 2000, the Navajo Nation and the Bureau of Reclamation (Reclamation) signed a memorandum of understanding (MOU) to support the Navajo Nation's efforts to develop its water resources. This strategy is articulated in *Water Resources Management and Development Strategy for the Navajo Nation* (Strategy Document). Subsequent commissioners have reaffirmed that MOU. The Strategy Document describes the tremendous overall need for water development on the Navajo Nation, and it lays out a strategy for meeting that need. The Strategy Document includes:

- Developing large regional water supply projects
- Developing and rehabilitating local (municipal and agricultural) water projects

- Preparing reservation-wide chapter water plans based on municipal sub-areas to assess needs and prioritizing projects
- Completing NIIP
- Continuing to address deficiencies in water storage facilities
- Improving drought response and mitigation
- Improving flood plain management
- Continuing with watershed restoration projects
- Establishing technical advisory committees (TAC's) for major water projects or initiatives, these committees will coordinate technical and fiscal resources of the Navajo Nation and Federal agencies

The Strategy Document includes development of several large regional water supply projects and rehabilitation of local systems that deliver water to domestic, municipal, industrial, and agricultural users. The Strategy Document does not address the needs of the Navajo Nation to develop new irrigation projects, or to rehabilitate all of the historically used, but to develop abandoned irrigation projects. Those projects are needed for the Navajo Nation to achieve economic self-sufficiency. However, because the viability of such projects is subject to ongoing and potential litigation, the strategy for developing all of those lands is not included in the *Water Resources Development Strategy for the Navajo Nation*. For similar reasons the water requirements of large, single purpose industrial users such as power generating stations and the water required for ceremonial purposes are also beyond the scope of this document. The components are described in the following sections.

6.1 Developing Large Regional Water Supply Projects

The cornerstone of the Strategy Document is composed of several large, regional water supply projects (see Table 6.1 and Figure 6.1) that will provide safe, new and reliable water supplies for municipal use and will stimulate sustainable economic development on the reservation. These regional projects will maximize the number of water users that will have reasonable access to the mainline delivery systems.

The proposed regional water supply projects will convey domestic water to approximately 67 of the 110 chapters on the reservation. By the year 2040 or 2050, depending on the planning horizon of the specific projects, these systems will provide capacity to serve domestic water to more than 80 percent of the projected population of 500,000. The proposed regional projects are estimated to cost billions of dollars to construct. These projects include, but are not limited to:

- Farmington to Shiprock Pipeline (Also called the Navajo Nation Municipal Pipeline which is authorized for construction) – In 2000 Reclamation was authorized to construct this project. Major construction began in September 2008, and the $56 million project is projected to be completed in 2012.

- Navajo Gallup Water Supply Project – In 1976, Reclamation was authorized to conduct feasibility level studies. In 2007 Reclamation completed the appraisal level study and the draft Environmental Impact Study. In 2009 the Secretary of the Interior issued a record of decision and in March 2009 President Barack Obama signed legislation authorizing construction. This project was authorized as part of the Navajo Nation San Juan River Settlement. Federal construction is expected to begin in 2012 and will be completed in 2024. In 2007 Reclamation estimated that the project cost was $865 million.

- Western Navajo Pipeline (Proposed in the 2008 Little Colorado River (LCR) Agreements in Principle) – As a component of the North Central Arizona Water Supply Study, Reclamation completed appraisal level study in 2006. In 2010 the Project sponsors secured feasibility level study authority through Reclamation's Rural Water Program. In 2010 DOWL HKM estimated that the project cost was $515 million.

- C-Aquifer Ganado Groundwater Project (Proposed in the 2011 LCR Agreements in Principle) – In 2010 Reclamation began an appraisal level study through the Rural Water Program. In 2010 NDWR estimated that the project cost was $60 million.

- C-aquifer Leupp to Dilkon Pipeline (Proposed in the 2011 LCR Agreements in Principle the Northern Arizona Indian Water Settlement Agreement) – Reclamation funded special studies of this project that resulted in a project alignment and preliminary cost estimate. In 2010 Reclamation began an appraisal level study through the Rural Water Program. In 2010 NDWR estimated that the project cost was $110 million.

- Halchita to Kayenta San Juan River Water Supply Project (Proposed in the 2010 San Juan River Utah Agreements in Concept) – Reclamation completed a draft regional water study for this project. In 2010 Reclamation began an appraisal level study through the Rural Water Program. In 2009 Reclamation estimated that one configuration had a project cost of $151 million.

- Aneth – Red Mesa Corridor Water Project (Proposed in the 2010 San Juan River Utah Agreements in Concept) – The Utah Navajo Trust Fund funded special hydraulic studies of this project and the Utah chapter water plans. In 2010 the NDWR estimated that the project cost was $41 million.

These regional projects are described in more detail in the following sections. From the Navajo Nation's perspective, developing this essential water infrastructure may be primarily the responsibility of the federal trustee. However, existing programs established specifically to provide for trust responsibilities are overwhelmed. This situation delays, or indefinitely postpones, significant development. Additionally, many of these regional projects require off-reservation infrastructure and water supplies that may not be within the programmatic capability to develop.

In addition to pursuing these regional projects through agency programs, some of these projects may be partly funded through the federal water rights settlements. The Navajo Nation has unquantified

water rights in several basins. The quantification of these federally reserved water rights can require very lengthy and expensive litigation. In the Little Colorado River Basin, instead of litigating these water rights, the Navajo Nation is attempting to negotiate a settlement with the non-Indian parties. Some of these projects are being pursued through the Little Colorado River settlement negotiations, some through the San Juan River settlement, and the amended Colorado Ute settlement.

Negotiated settlements may accelerate the completion of these projects. However, these projects will still require additional programmatic funds. Programmatic funding refers to the Federal programs, administered through agencies like the BIA, to fund infrastructure development. Although the settlements may not address the full range of water resource needs of the Navajo Nation, they may fund core systems around which annual programmatic resources can build. Further funding shortfalls may be pursued through new congressional appropriation authorizations, agency loan programs, or partnerships with potential project beneficiaries.

Table 6.1 Regional Water Supply Projects Proposed by the Navajo Nation

Water Supply Project	Chapters Served in 2040*/2050	Population Served in 2040*/2050	Volume Delivered (AF/YR)	Estimated Cost (Million Dollars)
Farmington to Shiprock Pipeline*	7	47,000	4,680	$56
Navajo-Gallup Water Supply Project*	34	248,900	34,300	$864
Western Navajo Pipeline	4	18,100	14,000	$515
C-Aquifer Ganado Groundwater Project	6	40,000	7,800	$60
C-Aquifer Leupp Dilkon Project	8	50,000	9,000	$110
Halchita to Kayenta	2	24,000	4260	$110
Aneth Red Mesa Corridor Project	8	18,700	3,400	$41
Total	69	430,100	68,090	

Notes:
1. The LCR Projects are based on the May 8, 2000 project description and includes upgrades to NTUA systems
2. The C-Aquifer Project based on the May 10, 2000 project description and includes upgrades to NTUA systems.
3. The Farmington to Shiprock Pipeline based on ALP FSEIS.
4. The NGWSP based on the NGWSP FSEIS.
5. This table excludes the Lake Powell - Peabody Pipeline and Three Canyon Project.
6. The $515 million Western Navajo Pipeline configuration includes a lateral to the Hopi villages.
7. The planning horizon is set to 2040 or 2050 depending on the project

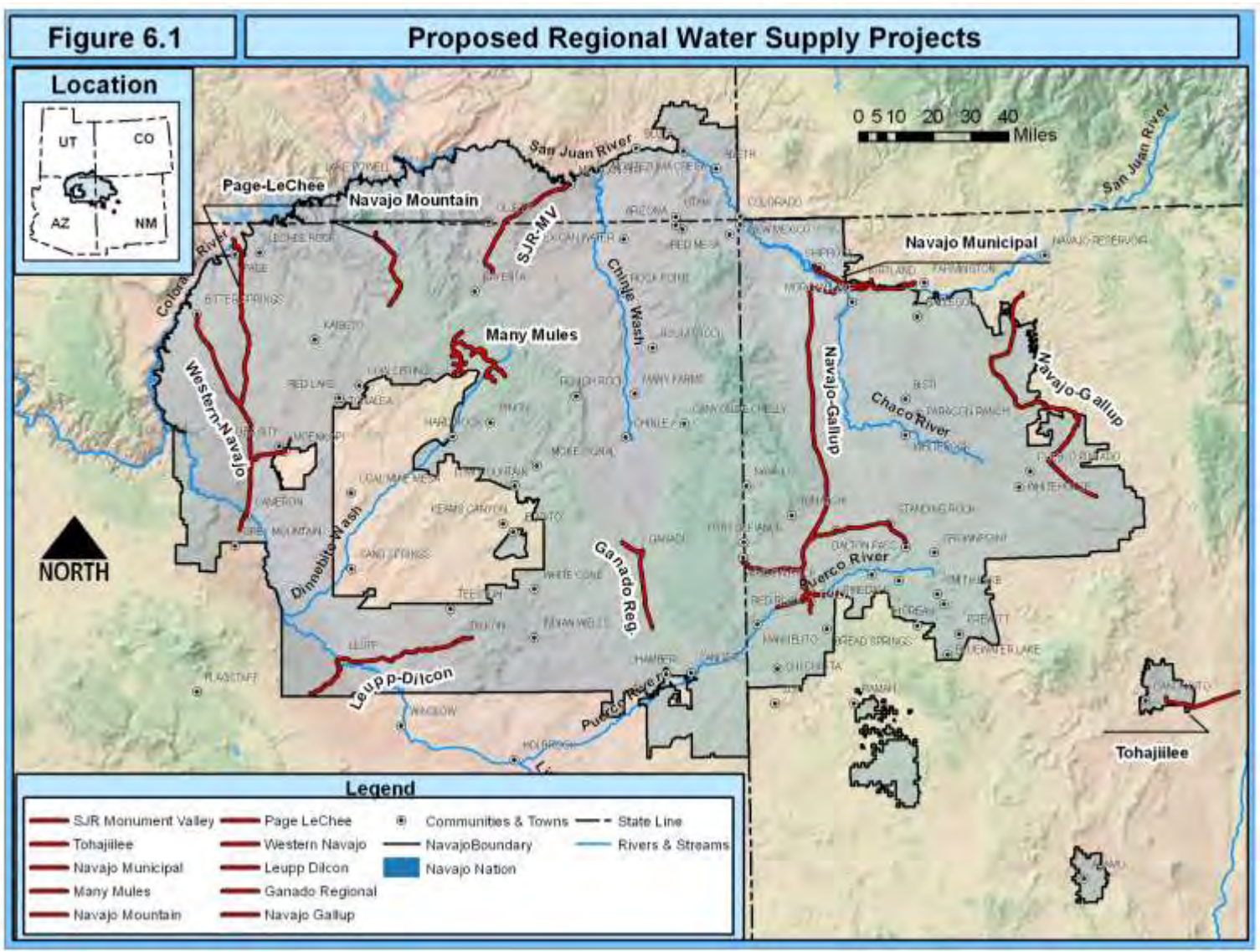


Figure 6.1: Proposed Regional Water Supply Projects

The Shiprock Service Area is one of the fastest growing areas on the Navajo reservation. These Chapters within the service area are shown in Table 6.2. The Navajo Nation is concerned that the 30-year old pipeline, which conveys almost all of the current municipal water used in eight Navajo Chapters along the San Juan River needs to be augmented. In 2007 IHS installed a booster station to increase the capacity of the older waterline, and NTUA has made a major effort to reduce system leakage. In 2008 NTUA decommissioned the water treatment plant in Shiprock due to the high cost of its operation. This decommissioning has left Shiprock 100 percent dependent on water treated by the City of Farmington which is conveyed through the current waterline.

The Navajo Nation supported the efforts of the Colorado Ute Tribes to obtain their water rights under the Colorado Ute Indian Water Rights Settlement Act. The Navajo Nation's support of the proposed modified Animas La Plata Project (ALP) and Senate Bill 2508 was conditioned upon support for Congressional authorization of a water line to convey the Navajo Nation's ALP water to Shiprock, New Mexico.

In the *Animas La Plata Project Draft Supplemental Environmental Impact Statement (EIS)* dated June 2000 this facility is described as the Navajo Municipal Pipeline. Based on that draft EIS, Reclamation analyzed three alternatives for delivering 4,560 acre-feet (2,340 acre-feet of depletion) of municipal water from the ALP to the eight Shiprock Area Chapters. The project will convey the Navajo Nation's ALP water through the City of Farmington's municipal system to the Shiprock. This pipeline will be 28.6 miles in length and it has an estimated cost of approximately $56 million. Reclamation has completed the project's design, and the Resources Committee has approved the right of way. Construction will be completed in 2012.

The pipeline that will be authorized as part of the ALP is not adequate to convey all 7,600 acre-feet that would have been diverted under the "Full" ALP. Nor is it adequate to meet the entire Navajo municipal demand in the project area through the year 2040. This difference in demands will be met by diversions near Nenahnazad from the Navajo Gallup Water Supply Project.

Table 6.2 Chapters Served by the Farmington-Shiprock Water Supply Project

Chapter	1990 Population	2040 Population	2040 Water Demand (acre-feet/year)
Beclabito	388	1,321	237
Cudei	495	1,685	302
Hogback	740	2,519	451
Nenahnezad	1,253	4,265	764
San Juan	540	1,838	329
Shiprock	8,100	27,570	4,942
Upper Fruitland	2,288	7,788	1,396
Total	13,804	46,985	8,421

6.1.2 Navajo-Gallup Water Supply Project

The project description in this document was taken from the *Planning Report and Draft Environmental Impact Statement, Navajo-Gallup Water Supply Project*, USBR, March 2007. The project will provide a long-term (year 2040) M&I water supply to the Navajo Nation, the Jicarilla Apache Nation, and the City of Gallup, New Mexico. Existing groundwater supplies are dwindling, have limited capacity, and are of poor quality. Approximately 30 percent of Navajo households in the area rely on water hauling to meet daily water needs. The City of Gallup's groundwater levels have dropped approximately 200 feet over the past 10 years, and the supply is not expected to meet current water demands within the decade (USBR, 2007).

Other water sources are needed to meet current and future M&I demands of more than 34 Navajo chapters, including the communities of Fort Defiance and Window Rock in Arizona, the City of Gallup, and the Teepee Junction area of the Jicarilla Apache Nation. The proposed project would deplete approximately 35,893 acre-feet of water annually from the San Juan River (Navajo Nation will deplete 27,193 acre-feet, the Jicarilla Apache Nation will deplete 1,200 acre-feet, and the City of Gallup will deplete 7,500 acre-feet. Based on the expected populations in the year 2040, the proposed project would serve approximately 203,000 people in 43 chapters in the Navajo Nation, 1,300 people in the Jicarilla Apache Nation, and approximately 47,000 people in the city of Gallup (USBR, 2007). The Chapters to be served are shown in Table 6.4.

Project planning and studies has been ongoing for the past 40 years. The Steering Committee was formed in the early 1990s to guide the direction of this proposed project, provide technical analysis,

support public involvement, provide political background, and conduct overall project coordination. Reclamation has provided planning, engineering, and environmental expertise to this committee. The project Steering Committee includes representatives from the Navajo and Jicarilla Apache Nations, city of Gallup, State of New Mexico, Bureau of Indian Affairs (BIA), Indian Health Service (IHS), Navajo Tribal Utility Authority (NTUA), Northwest New Mexico Council of Governments, and Reclamation.

Table 6.3 Potential Navajo-Gallup Water Supply Project Depletions
(Acre-feet per Year)

Source	NAPI	Cutter Lateral	City of Gallup	San Juan Lateral Below Shiprock (includes Window Rock)	Shiprock Area	Total
San Juan River Surface Depletion	300	3,300	7,500	20,900	2,355	34,355
Ground Water Depletion	0	300	0	3,300	0	3,600
Total Supply	300	3,600	7,500	24,200	2,355	37,955

In 1976, Reclamation was authorized to conduct feasibility level studies. In 2007 Reclamation completed the appraisal level study and the draft Environmental Impact Study. In 2009 the Secretary of the Interior issued a record of decision and in March 2009 President Barack Obama signed legislation authorizing construction. This project was authorized as part of the Navajo Nation San Juan River Settlement. Federal construction is expected to begin in 2012 and will be completed in 2024. In March 2011 Reclamation estimated that the project cost was $907 million.

Table 6.4 Water Demand for the Navajo-Gallup Water Supply Project

Service Area	Chapter	1990 Population	2040 Population	2040 Demand (Ac-ft/yr)	2040 G.W. Production (Ac-ft/yr)	2040 SJR Depletion[1] (Ac-ft/yr)
City of Gallup, NM	City of Gallup	19,154	46,736	7,500	0	7,500
Central Area, NM	Burnham	246	837	150	0	150
	Lake Valley	436	1,484	266	46	220
	White Rock	201	684	123	0	123
	Whitehorse Lake	610	2,076	372	31	341
	SUBTOTAL	1,493	5,082	911	77	834
Crownpoint, NM	Becenti	193	657	118	0	118
	Coyote Canyon	1,234	4,200	753	61	692
	Crownpoint	2,658	9,047	1,622	614	1,008
	Dalton Pass	313	1,065	191	0	191
	Little Water	638	2,172	389	0	389
	Standing Rock	251	854	153	77	76
	SUBTOTAL	5,287	17,995	3,226	752	2,474
Gallup Area, NM	Bread Springs	1,219	4,149	744	77	667
	Chichiltah	1,555	5,293	949	0	949
	Church Rock	1,780	6,059	1,086	123	963
	Iyanbito	974	3,315	594	153	441
	Mariano Lake	726	2,471	443	0	443
	Pinedale	609	2,073	372	307	65
	Red Rock	1,041	3,543	635	61	574
	SUBTOTAL	7,904	26,903	4,823	721	4,102
Huerfano, NM	Huerfano	511	1,739	312	67	245
	Nageezi	981	3,339	598	25	573
	SUBTOTAL	1,492	5,078	910	92	818
Rock Springs, NM	Manuelito	631	2,148	385	46	339
	Rock Springs	1,685	5,735	1,028	77	951
	Tsayatoh	1,433	4,878	874	46	828
	SUBTOTAL	3,749	12,761	2,287	169	2,118
Route 666, NM	Mexican Springs	711	2,420	434	0	434
	Naschitti	1,539	5,238	939	77	862
	Newcomb	651	2,216	397	46	351
	Sanostee	2,081	7,083	1,270	153	1,117
	Sheep Springs	660	2,246	403	69	334
	Tohatchi	1,607	5,470	980	307	673
	Twin Lakes	1,967	6,695	1,200	153	1,047
	Two Grey Hills	883	3,005	539	77	462
	SUBTOTAL	10,099	34,373	6,162	882	5,280
Torreon	Counselor	1,365	4,646	833	0	833
	Ojo Encino	596	2,029	364	16	348
	Pueblo Pintado	472	1,607	288	61	227
	Torreon	1,364	4,643	832	100	732
	SUBTOTAL	3,797	12,925	2,317	177	2,140
San Juan River2		13,804	46,985	8,421	0	2,355
NAPI Industrial[3]		n/a	n/a	7,274	0	300
TOTAL NEW MEXICO		*66,779*	*208,837*	*43,831*	*2,870*	*27,921*
Window Rock, AZ	Fort Defiance	6,187	21,059	3,774	767	3,007
	St. Michaels	5,580	18,993	3,404	0	3,404
TOTAL ARIZONA		*11,767*	*40,052*	*7,178*	*767*	*6,411*
PROJECT TOTAL		***78,546***	***248,889***	***51,009***	***3,637***	***34,332***

1 - Depletions assume zero return flow to the San Juan River.
2 - SJR depletions do not include Animas-La Plata Project water.

6.1.3 Western Navajo Pipeline

The Western Navajo Pipeline Project was included in the 2008 LCR Agreements in Principle. The NDWR, ADWR, and USBR conducted numerous studies of this project. This project description in this strategy document included information from the technical memorandum prepared by NDWR entitled *The Proposed Western Navajo Pipeline and The North Central Arizona Water Supply Project* (October 16, 1998*), Water Delivery System Analysis Peer Review of the North Central Arizona Water Supply Study* (September 2000), and the *North Central Arizona Water Supply Study-Report of Findings* (October 2006*)*, by the United States Bureau of Reclamation, and studies by HKM and Associates.

In the 2006 *Report of Findings*, the core scenario (Alternative 1) conveys water from Lake Powell through the city of Page and along Indian Route 20 from LeChee to Bodaway-Gap, then along US 89 to Cameron. The Project will also have laterals from Bodaway-Gap northward on US 89 to Bittersprings and from the junction of US 89 and US 160 east to Tuba City and Moenkopi. The scenario will convey approximately 8,263 acre-feet per year to serve nearly 48,515 (2050 population) Navajos in LeChee, Coppermine, Bitter Springs, Cedar Ridge, Bodaway/Gap, Tuba City, and Cameron (see Table 6.3). Reclamation has estimated the Lake Powell to Cameron scenario (Alternative 1) cost to be approximately $230 million in 2006 dollars, including cost and demands for the Hopi Tribe. The Hopi Tribe's 2050 population is estimated to be 4,741 in the Moenkopi and estimated to have an annual demand of 658 acre-feet. In an October 2008 by DOWL HKM a project configuration that served Cameron, Tuba City and the Hopi Villages was $515 million.

Reclamation organized a Technical Advisory Group (TAG) enlisting representatives from the demand areas, Grand Canyon Trust, U.S. Geological Survey, Northern Arizona University, Coconino County, Navajo Nation, Hopi Tribe, Havasupai Tribe, and interested local citizens. In 2005, the Coconino Plateau Water Advisory Council (CPWAC) was formed, incorporating several members of the 1998 water advisory group, formalizing the role of *regional stakeholders* within the context of the ADWR Rural Water Program. The Havasupai Tribe and the Hopi Village of Moenkopi were added to the study area. In 2010 the sponsors secured feasibility level study authority through the Reclamation Rural Water Program.

Table 6.5 Chapters and Villages Served by the Western Navajo Pipeline

Chapter	2000 Population	2050 Population	2050 Water Demand (AFY)
LeChee	1,890	16,255	2,913
Copper Mine	673	1,533	275
Bodway Gap*	1,837	4,183	750
Cameron	1,231	4,568	819
Navajo CG Village			500
Tuba City	8,736	31,520	5,649
Hopi Villages			4,048
Total	14,403	58,059	14,954

6.1.4 C-Aquifer Ganado Groundwater Project

The C-Aquifer Ganado Groundwater Project has been included in the LCR 2011 Agreements in Principle. The project description in this document is based on the technical memorandum prepared by NDWR entitled *C-Aquifer Ganado Groundwater Project, Project Description (October, 2008).* The project will withdraw water from the C-Aquifer in the Ganado Area and convey it to distribution points in and around six Chapters in the Ganado Area. The project has an estimated field cost of $45.6 million in 2008 dollars. Additional upgrades to the NTUA public water systems are $19.1 million in 2008 dollars. In 2010 Reclamation began an appraisal level study through the Rural Water Program.

The project consists of a well field in the vicinity of Ganado and distribution system to convey 681 acre-feet per year west to Steamboat, 500 acre-feet per year south to Wide Ruins, and 286 acre-feet per year east to Klagetoh (see Table 6.6). It will have a total firm yield of 5,500 acre-feet per year. The project components include: a well field composed of 28 C-Aquifer wells each with an average yield of 350 gallons per minute, pumps and conveyance systems, and upgrades to the NTUA systems.

Table 6.6 Chapters Served by the C-Aquifer Ganado Groundwater Project

Chapter	2000 Population	2050 Population	2050 Water Demand (acre-feet/year)
Ganado	3767	18,559	2,861
Kinlichee	1,906	1,598	573
Cornfields	794	1,890	803
Steamboat	2,122	3,798	681
Klagetoh	1116	2,361	423
Wide Ruins	1,909	2,790	500
Total	10,668	30,996	5,555

1. This project will only serve a portion of Kinlichee Chapter.

6.1.5 C-aquifer Leupp to Dilkon Pipeline

As a part of the Little Colorado River 2011 Agreements in Principle, the Navajo Nation has proposed a pipeline from Leupp to Dilkon, and capital improvement projects in the Leupp and Dilkon Areas. The Leupp NTUA system will require $24 million and the Dilkon NTUA system will require $26 million to meet 2030 demands. A 20-inch lateral between Leupp and Dilkon will cost $63 million. In 2010 Reclamation began an appraisal level study through the Rural Water Program.

Table 6.7 Chapters Served by the C-Aquifer Leupp-Dilkon Pipeline

Chapter	2000 Population	2050 Population	2050 Water Demand (acre-feet/year)
Leupp	1,605	7,162	1,284
Bird Springs	829	1,888	338
Tolani Lake	755	1,719	308
Teestoh	934	2,217	381
Dilkon	2,206	13,507	2,421
Indian Wells	970	2,209	396
Lower Greasewood	1,408	3,205	574
White Cone	1,383	3,149	564
Jeddito	1,299	2,958	530
Total		37,924	6,797

6.1.6 San Juan River to Monument Valley Pipeline

The Navajo Nation has proposed a pipeline from the San Juan River, near Halchita or Mexican Hat, to Navajo communities located in Utah such as Oljaito and Monument Valley, possibly extending into Kayenta. These areas are facing critical water shortages, which are steadily growing worse as the population increases. The Navajo Nation anticipates increased tourism as a source of economic activity in the Monument Valley region. The Navajo Nation is committed to providing water to the school and the surrounding community.

The existing infrastructure is inadequate to meet current demand and must be improved. Previous studies have investigated the San Juan River as a possible water source. Based on the draft *San Juan Mexican Hat to Kayenta Regional Water Supply Study* dated September 2008, this project is estimated to cost $151 million. In 2010 Reclamation began an appraisal level study through the Rural Water Program.

6.1.7 Red Mesa to Aneth Corridor Project

The Navajo Nation has investigated different proposal for serving Montezuma Creek, Aneth and Red Mesa. The existing infrastructure is inadequate to meet current demand and must be improved. Previous studies have investigated the San Juan River as a possible water source. Based on preliminary assessments, a waterline diverting water from the San Juan River and conveying it to Red Mesa may cost $21 million. The IHS has investigated conveying water from the Shiprock NTUA system which also may cost $21 million.

6.1.8 Black Mesa Water Supply and Three Canyon Projects

The parties to the Little Colorado River Adjudications are engaged in negotiations to resolve the Indian and non-Indian claims to water in the Little Colorado River Basin. The settlement negotiations have been premised on the development of a "grand fathering" agreement by which the Navajo Nation subordinates its reserved water rights to existing upstream non-Indian water users. In consideration for this subordination, the federal and state must support and fund the construction of water projects. Due to changing circumstances, including in part the 2005 shutdown of the Mohave Generating Station, two regional Projects described in detail in the 2000 Strategy Document have been deemphasized in the current document. Although these projects are still part of the overall water development strategy, these two projects will not be utilized to meet water demands within the next forty years:

- Alternative Water Supply for Black Mesa (Either a Lake Powell Peabody Pipeline or a C-aquifer Black Mesa Pipeline)

- Three Canyon Water Supply Project (Proposed in the LCR Agreements in Concept)

Lake Powell to Peabody Pipeline - As a part of the 1999 Little Colorado River Settlement, the Navajo and Hopi Nations proposed a pipeline from Lake Powell to the Peabody Coal Mine on Black Mesa which will reduce the mine's dependence on N-Aquifer water for its slurry line to the Mohave Generating Station near Laughlin, Nevada. This project would also provide 500 acre-feet to Tuba City, 500 acre-feet to the Hopi Village of Moenkopi, and approximately 5,000 acre-feet to the coalmine. It would eventually convey water to villages on the Hopi reservation. Depending on the specific configuration and capacity, this facility may provide the opportunity to convey water toward a number of Navajo communities including Shonto, Tonalea (Red Lake), Kaibeto, Inscription House, and Kayenta. Depending on the configuration, the project may cost $127 million. However, because the details of such a project are subject to ongoing multiparty negotiations, this project has not been explicitly included in the Strategy document.

Three Canyon Water Supply Project - Reclamation and NDWR conducted several studies of this project, including an assessment of the alluvial components of the project as well as various project configurations. The project description in this document is based on the technical memorandum prepared by NDWR entitled *Three Canyon Water Supply Project, Project Description (May 8, 2000).* The project would convey water from the Clear, Chevelon and Jacks Canyon Creeks (Three Canyon Area) located south of the Navajo reservation to the southwestern portion of the reservation with water. The Project's surface and groundwater components have a firm annual yield for the Navajo communities of 6,000 acre-feet. An additional 3,000 acre-feet of water Blue Ridge Reservoir may be available for the non-Indian communities in northern Gila County. The Chapters to be served are listed in Table 6.8.

The Project has seven major elements: 1) re-operation of Blue Ridge Reservoir, 2) an additional 3,100 acre-feet of storage on Clear Creek, 3) pumps and conveyance systems, 4) conjunctive alluvial groundwater supply, 5) regional water treatment plant, 6) upgrades to the existing NTUA distribution systems, and 7) other direct and indirect costs. The project has an estimated construction cost of $117 million in 1999 dollars, of which, approximately $74.4 million may be funded through the Little Colorado River Settlement. Additional upgrades to the Navajo Tribal Utility Authority public water systems in the Leupp and Dilkon service areas over the next forty years have an estimated present value of $28.2 and the cost of the phased water treatment plant is $14.5 million.

Table 6.8 Chapters Served by the Three Canyon Water Supply Project

Chapters	1990 Census Pop.	1990 Census Pop. (Adj)	1990 Water Demand (AF/YR)	2020 Projected Pop.	2020 Water Demand (AF/YR)	2040 Projected Pop.	2040 Water Demand (AF/YR)
Leupp	1,520	1,718	394	3,570	640	5,827	1,044
Birdsprings	645	729	131	1,520	272	2,481	445
Tolani Lake	651	736	133	1,546	277	2,524	452
Subtotal: Leupp Spur	2,794	3,182	570	6,636	1,189	10,832	1,941
Dilkon	1,766	1,996	356	4,142	742	6,761	1,212
Teestoh	890	1,006	180	2,093	375	3,416	612
Indian Wells	1,177	1,330	239	2,781	498	4,540	814
Lower Greasewood	1,190	1,345	238	2,769	496	4,520	810
White Cone	866	986	177	2,057	369	3,357	602
Subtotal: Dilkon Spur	5,828	6,638	1,190	13,843	2,481	22,594	4,049
TOTAL	8,622	9,820	1,760	20,479	3,670	33,426	5,991

Notes:
1. Population projections from: *Economic Benefits of the Three Canyon Water Supply Project, Navajo Nation*, James P. Merchant, David Dornbusch & Company, Dec. 1999
2. Municipal demand assuming 160 gallons per capita per day.

6.2 Developing and Rehabilitating Local Water Supply Infrastructure

These local improvements are essential for conveying water from the regional projects to the places of use including homes, businesses, and farms, These improvements include: 1) construction and rehabilitation of the treatment, distribution and storage facilities needed to deliver water from the regional systems, 2) construction and rehabilitation of treatment, distribution and storage facilities for the small water supply systems that are not connected to the regional systems, 3) improvements in the water supply for residents beyond the reach of public water systems, 4) rehabilitation of selected small irrigation and livestock projects, and 5) water conservation and reuse.

6.2.1 Distribution Systems Associated with the Regional Projects

To ensure that the water from the regional water projects reaches the water users, additional upgrades to the existing treatment, distribution and storage facilities may be needed. The assessment will also identify economic, health, and other benefits of water development for the growth centers. The data generated in these appraisals will be used to justify further, more in-depth analysis and to prioritize potential projects.

For the domestic systems, the demand is based on a 40-year planning horizon and a water use rate of 160 gallons per capita per day. This water use rate is comparable to the water use rates of the surrounding non-Indian communities with developed water supply systems. Population projections are based on a growth rate of 2.48 percent. A robust economy, supported by an adequate water supply, will allow more Navajos to find livelihoods on the reservation and the resulting economic development will reduce dependence on federally funded socioeconomic programs.

The regional water supply projects will convey domestic water supplies to approximately 67 of the 110 chapters on the reservation, and will serve approximately 80 percent of the projected population of 500,000 by the year 2040. 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 water users. Even with the regional systems and associated local distribution systems fully in place, approximately 40 percent of the chapters will rely on alternative water supply sources and facilities. Many systems will require rehabilitation, and in many areas new systems are needed. For areas where distribution systems are infeasible, community wells will be upgraded to improve access for water haulers. Rehabilitation and development of small, local agricultural irrigation and livestock water systems is also an important component of the strategy. Some of the strategically significant small municipal projects include:

- Page-LeChee Water Supply Project – Appraisal level and geotechnical studies have been completed on the intake site. The environmental assessment is completed with a finding of no significant impact. In 2003 Tetra Tech RMC estimated the project cost to be $12.0 million.

- Albuquerque to Tohajilee Water Supply Project – Reclamation completed appraisal level investigations. State planning funds are being used to initiate further planning studies. This project may be implemented through the Army Corps of Engineers WRDA Section 593. In 2004 Tetra Tech RMC estimated the project cost to be $14.1 million.

- Many Mules Water Supply Project – Appraisal level investigations have been completed. In 2007 NDWR estimated the project cost to be $10.6 million. In December 2011 PWCC agreed to supply water from the existing wells to this project.

- Navajo Mountain Water Supply Project – Reclamation funded the preliminary engineering investigations and numerous system improvements. In 2010 the IHS estimated that the project cost was $10.6 million. Phases 1, 2, 3 are being constructed, with completion expected in 2012. These funds have come from the Indian Health Service, the Bureau of Indian Affairs, the Environmental Protection Agency, the Navajo Nation, and the State of Utah.

- Crownpoint Becenti Water Supply Project (A component of the Navajo Gallup Water Supply Project) – Appraisal level investigations are complete. In 2004 Tetra Tech RMC estimated the project cost to be $29.2 million.

- Gallup Regional System (A component of the Navajo Gallup Water Supply Project) Reclamation funded appraisal level investigation and special studies of this System. The State of New Mexico and Indian Health Services have funded several of the initial phases which are under construction. In 2007 Reclamation estimated that the project cost was $48.5 million. The State of New Mexico has provided $12 million for this project.

- Cutter Lateral Region System (A component of the Navajo Gallup Water Supply Project, and is also known as the Eastern Agency Water System) – Reclamation funded appraisal level investigation and special studies of this System. The State of New Mexico and Indian Health Service have funded several of the initial phases which are under construction. In 2007 Reclamation estimated that the project cost was $160 million. The State of New Mexico has provided approximately $20 million for this project and the USDA has provided approximately $8 million.

6.2.2 Small Domestic and Municipal Systems not connected to 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, which need upgrades. 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. The water sources are extremely limited. These factors result in very expensive water.

These problems are compounded by the fact that many of these small public water supply projects do not meet the 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 an unmanageable administrative and political logjam. Furthermore, the remote locations make it expensive to repeatedly mobilize technical expertise. For this Strategy, the Navajo Nation will request that Congress grant an overarching or omnibus authority to prepare feasibility studies to submit multiple projects for Congressional construction authorization.

The Navajo Mountain Chapter provides an example of a system that may not be readily served by one of the large regional water systems. However, it is also an example of several federal agencies creating an innovative partnership. Reclamation's Native American Affairs Program provided funds for emergency improvements which were carried out in part by NDWR in-kind resources. Reclamation also proved appraisal level assessments of the water supply alternatives and feasibility level reports of the preferred system improvements. IHS peer reviewed those work products and conducted additional geohydrologic investigations of potential water sources. Because this system is vulnerable to surface water contamination, the feasibility level reports were submitted to the EPA Indian Drinking Water set-aside program. The feasibility studies will also become the basis for applications to the USDA rural water programs. In addition, the local water users have worked with the USDA programs to incorporate a water users association that will address the special operation and maintenance needs of the system.

6.2.3 Small Irrigation Projects

As part of the regional needs assessments, the small irrigation projects will be assessed. These assessments will evaluate those projects that have the best chance of hydrologically, institutionally, and agronomically sustaining themselves. Those projects with irrigators that are willing to organize a water users association through their local farm board, accept some responsibility for the operation and maintenance, and form of partnerships may have the best chance of succeeding. This approach is consistent with recent Navajo Nation Council directives intended to make decision-making more accountable to local needs and oversight. The irrigation assessments will evaluate the following topics:

- Farming history
- Agricultural economics
- Water supply - surface water, groundwater, and reuse.
- Water conservation and management practices

- Capacity to pay water use assessments
- Capacity to incorporate a water users association
- System operation and overall irrigation efficiency
- Environmental Compliance - NEPA & cultural resources
- Budget requirements
- Preferred alternative
- Implementation plans
- Education needs
- Monitoring plans

A partnership among the federal agencies, the Navajo Nation and the local water users is essential. Reclamation and NDWR can develop improved base map showing the facilities and farm plots. A water management plan funded through Reclamation's Water Management and Conservation Program can describe the water supply and demand, constraints on the systems, and alternatives. Based on those results a memorandum of understanding (MOU) was prepared between the NRCS, BIA, Reclamation, the Navajo Nation, the farm board, the irrigators and other stakeholders. The MOU clarifies the specific roles of each of the partners.

With an MOU in place, a water conservation plan and technical assessment can be conducted. Based on the recommendations from the technical assessment, Reclamation and the BIA can take the lead on the NEPA compliance. The NRCS can work with water users on EQIP opportunities. The EQIP on-farm improvements can be coordinated with the Reclamation-funded system rehabilitation NDWR is seeking funding to implement the preferred alternative.

The rehabilitation and development of local irrigation and livestock water systems is also an important component of the Strategy. Reclamation’s Navajo Agricultural Assessment Investigations, Native American Affairs Office, Reclamation 2025 Program, and the Water Conservation and Management Program supported numerous projects:

- For the Ganado Irrigation Project the Water Conservation and Management Plan was completed in 1998. The rehabilitation of the Ganado Irrigation Project was completed in 2000.

- For the Shiprock Irrigation Projects the Draft Water Conservation and Management Plan was completed in 2000. Since then numerous canal and structural upgrades on the Hogback and Fruitland Irrigation Projects have been completed including reconstruction of the Hogback Diversion Structure. An irrigation rehabilitation plan was completed in 2011. Rehabilitation based on this $20 million plan was authorized by the San Juan River Settlement.

- Reclamation, the BIA and the Navajo Nation provided cost sharing assistance on the Thohotso Diversion Structure which was implemented by the USDA in 2010.

- For the Red Willow Irrigation Project, Reclamation, the State of New Mexico and the Navajo Nation funded improvements to the Chuska Dam, and the USDA implemented the system rehabilitation in 2001.

- For the Many Farms Irrigation Project the Water Conservation and Management Plan was completed in 2006. Reclamation and the Navajo Nation funded the reconstruction of the Many Farms Diversion Structure, along with other water conservation system improvements.

- For the Red Lake Irrigation Project the Water Conservation and Management Plan was completed in 2007. The environmental assessment for the conservation plan is completed.

- For the Tsaile/Wheatfield Irrigation Projects, the Water Conservation and Management Plan is underway.

- For the Kerley Valley Irrigation Project the Water Conservation and Management Plan was completed in 2003. This BIA project is located in the former Benet Freeze Area. Implementation of that plan is subject to ongoing discussions between the Navajo Nation and the Hopi Tribe. The BIA has begun surveying the project service area.

- For the Captain Tom Irrigation Project the Water Conservation and Management Plan construction may begin in 2013.

- The NDWR has requested funding for Water Conservation and Management Plans for Round Rock and Lukachukai Irrigation Projects.

6.2.4 Water conservation and water reuse

Future 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. The Navajo Nation and Reclamation are investigating water reuse opportunities. An analysis of opportunities for water conservation and reuse of wastewater will be a component of the reservation-wide needs assessment and appraisals.

6.3 Improving service to users without direct access to public water systems

This strategy includes improving service to approximately 30 percent of the Navajo population that hauls water to meet their daily needs. They frequently drive long distances to the nearest public water source. The cost of hauling water in pickup trucks can exceed $43,000 per acre-foot, meaning that one of the poorest sectors of the population has the most expensive water. 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. Even if the water quality is adequate, unregulated taps frequently 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 also translates to an increase in health related problems.

Due to current funding levels, it is not possible for IHS to provide water from a public water supply system to every household on the reservation. The IHS sanitation deficiency listing demonstrates how costly it can be to serve some of these residences. The marginal unit cost of assuring a public water supply for 80 to 90 percent of the reservation homes is less than the marginal unit cost of assuring a public water supply for 90 to 95 percent of the homes. Due to funding shortfalls, homes with unit costs that exceed $48,000 are considered by IHS infeasible to build. Because of these high costs, even by the year 2040, 10 to 20 percent may not be served by the public water supply systems.

The regional water projects will provide some indirect relief to the Navajo water haulers. For instance, the distance to reliable water taps will decrease for most Navajo water haulers and existing unregulated water hoses may be improved thereby enhancing sanitation. However, direct assistance to develop local water sources, possibly with solar pumps and cisterns, may be required. Reclamation recommended a joint study with the NDWR on this topic. The EPA is chairing an "access to infrastructure" task force that is investigating this problem. The objective of the study is to define the nature and extent of the problem, and to pose solutions. The problem definition and strategy would be based on IHS data, literature reviews, interviews, and field trips. The solution strategies developed would be provided to appropriate individuals and agencies for review to determine which options have the greatest chance of success. Based on the results of this effort, an action plan will be developed on how best to proceed and where to seek associated funds. EPA is funding a $2 million pilot water hauling service that will deliver water to remote rural homes.

6.4 Preparing Reservation-Wide Chapter Water Plans To Assess Needs and Priorities

To effectively seek increased federal budgets and expanded authorities to address the deficiencies, the Navajo Nation must systematically identify the full scope and need. With assistance from the federal agencies, the Navajo Nation will prepare a reservation-wide Chapter water plans to assess the local needs.

Reclamation will assist the Navajo Nation assess the water resource deficiencies throughout the reservation and establish federal/tribal coalitions that can effectively construct the infrastructure identified in the needs assessments. To break the studies into manageable parts, the reservation will be assessed regionally. The regions will be based on the service areas of the major water supply projects and on jurisdictional boundaries.

The needs assessments will include appraisal level studies of the water systems necessary to:

- Put all of the municipal water supplied by the regional projects to beneficial use
- Provide for domestic and municipal needs served by local systems not connected to the proposed regional systems
- Improve water service to families not connected to water systems
- Provide infrastructure for selected agricultural uses
- Optimize water conservation and wastewater reuse. This effort will include evaluating fee structures to ensure adequate operation and maintenance.

The compiled information will enable the Navajo Nation to prioritize and sequence the proposed water projects. These assessments and the resulting appraisals will be pursued through Reclamation's existing authorization to perform general studies. The Navajo Nation will prepare a matrix that will assist in prioritizing projects based on realistic expectations for funding in the short and long term through existing agency authorities. The Navajo Nation will coordinate the resources that the agencies are able to commit. The matrix may include:

- economic benefits
- population
- susceptibility to drought
- cultural factors such as reducing off-reservation migration, resolution of social problems, increasing recreation opportunities, etc
- political factors
- potential partners, including Tribal, Federal, State and private interests
- technical Analysis addressing engineering, cost estimates and environmental considerations
- federal agency budgets and authorizations

6.5 Completing the Navajo Indian Irrigation Project

NIIP has not realized its full economic potential. 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 adequately funding the operation and maintenance. The Navajo Nation, Reclamation, and the BIA have a team that is developing a long range plan for NIIP.

In 2011 Keller Bliesner and Associates compiled information on the completion of NIIP. Based on that compilation and assuming a $26 million per year funding level, completing construction will cost $403 million, rehabilitation will cost $125 million, addressing NIIP deficiencies will cost $53 million, on-farm rehabilitation will cost $14 million, and new on-farm development will cost $61.7 million.

6.6 Addressing Deficiencies in Water Storage Facilities

The Department of the Interior Dam Safety Program developed a nationwide technical priority rating system to assess the relative hazard and priority of dams under its jurisdiction. The Navajo Nation has fifteen dams that were ranked according to the 2006 technical priority rating. The Dam Safety Program is funded through annual BIA appropriations and, given the recent funding levels, is typically only able to address two projects nationwide per year. The Captain Tom Dam has the highest technical priority rating and it will be reconstructed in fiscal year 2007. The other high-ranking projects however, may not be reconstructed until 2017 at the earliest. Without a well-funded Safety of Dam program, the lower ranking dams may not be addressed for several decades, if ever.

At least 15 other significant dams on the reservation need attention, but are not ranked by the Department of the Interior, nor are they explicitly included in the NDWR Plan of Operation. Although these dams may not pose immediate safety hazards, their function over time may be critically compromised. Alternative funding sources and partnerships are needed to address the needs of the dams not covered under the dam safety program.

6.7 Drought Response and Mitigation

Since the MOU was signed in July of 2000, the Navajo Nation has been racked by drought, and the effects of extremely dry years. Reclamation and the BIA funded the Navajo Nation's Drought Mitigation and Response Plan which follows the National Drought Mitigation Center guidelines. A survey of the NTUA public water systems presented in the drought plan showed approximately $300 million of needed system mitigation. The response plan is approximately $10 million. Reclamation funded drought mitigation projects at Navajo Mountain, Alamo, Toadlena, Window Rock, Bird Springs, Bodway, and many other places. Reclamation funded new projects at Lupton and Lower Greasewood. Reclamation also played a key role in recent shortage sharing agreements for the San Juan River basin in New Mexico. Additional studies and mitigation projects are needed to assist the Navajo Nation to adapt to climate variability.

6.8 Flood Plain Management

Throughout most of the United States 100-year flood planes have already been delineated. With these delineations entities can participate in Federal Emergency Management Authority flood insurance programs. Addressing flood hazard is required for essentially all federally funded construction programs. Typically on the Navajo Nation adequate delineations are not available. Consequently, establishing flood hazard maps is critical to safe guard property and human safety. Work is proceeding through Section 520 of the Army Corps Water Resources Development Act of 1999. In 2006 the USGS completed an analysis of the magnitude and frequency of peak discharges

for the Navajo Nation. This work was funded by the BIA and the USGS. Geomorphic high hazard delineations have begun.

Aerial photographs of the ten most intensely developed areas were completed in 2009, and one hundred-year flood plain delineations for Window Rock and Chinle were completed in 2010. Flood management efforts are estimated to cost $30 million.

6.9 Watershed Restoration

Almost all of the watersheds on the Navajo Nation are degraded due to land use practices that occurred without sufficient attention to their impact on the watershed. Overgrazing has had a major impact on the watersheds, which results in more intense runoff events. When these events occur on degraded watersheds, they produce additional sediment loads in the reservoirs. These events incise channels which de-waters the alluvial groundwater destroying riparian areas and reducing the carrying capacity of the land. With a restored watershed, floods can be attenuated and recharge can be increased. Wetland values can also be enhanced. And with proper grazing management, the fodder production can be increased.

The Navajo Department of Water Resources (NDWR) has participated in several watershed restoration projects. The NDWR was involved with the: 1) the National Fish and Wildlife Asaayi Habitat Restoration Project funded through Public law 566, 2) the Arizona Water Protection Fund Tsaile/Canyon del Muerto Watershed Restoration Demonstration Project, 3) the Rio Puerco Watershed Bluewater Restoration Project, 566, 4) Restoration of the Pueblo Colorado upstream of Hubbell's Trading Post which was funded by the BIA, and 5) the Arizona Water Protection Fund Red Lake Wash Watershed Restoration/Demonstration Project. The work in the Rio Puerco Watershed was conducted under the Bureau of Land Management's Rio Puerco Watershed Act. The Navajo EPA has been very successful in implementing EPA Section 319 projects. The NDWR has proposed 100 demonstration projects with a total cost of $3 million.

6.10 Establishing Technical Advisory Committees for Major Projects and Initiatives

The Strategy Document in 2000 proposed a Federal Water Task Force. That Task Force was not successful. It failed to get sustained attention from the highest levels of the respective agencies. Scheduling at a high level was extremely difficult. Consequently, the Task Force agenda was delegated to progressively lower levels. At the lower staff levels, many of the activities addressed by the Task Force were not of broad concern. Consequently it collapsed under its own weight.

Instead, the Strategy Document includes establishing Technical Advisory Committees (TAC's) for major water projects and initiatives. The Navajo Nation recognizes its leadership role in tribal water

resource development. 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. TAC's will coordinate technical and fiscal resources of the Navajo Nation and Federal agencies. This effort will reduce agency redundancy and enable the agencies to utilize their combined resources more effectively. Where there is no clear existing authority, or when programmatic funding is inadequate, Reclamation and the Navajo Nation will request authority to prepare feasibility studies and construct projects.

To address these problems the leaders of the Navajo Nation are committed to providing capital and personnel resources, along with developing partnerships. However, due to the magnitude of the deficiencies, sufficient water resource development is beyond the financial capabilities of the Navajo Nation and the federal agencies authorized to address these needs. For example, based on current funding levels the Indian Health Service has a fifteen-year backlog of current sanitation deficiencies on the reservation. Similar budget constraints face the other federal agencies with the authorities to address commercial, industrial, and agricultural needs.

Technical Advisory Committees for major projects and initiatives will enable the Navajo Nation and the federal agencies to coordinate planning and construction activities and to use available fiscal and technical resources more effectively. These major initiatives may include the large regional projects, the small irrigation projects, NIIP, storage facilities, drought response and mitigation, floods plain management, and watershed restoration.

The Strategy Document has proven to be a success. Inter-agency coordination has been dramatically improved. Multi-agency water projects, for instance at Navajo Mountain and at Dilkon, are more common. The Navajo Nation had two cooperative agreements with Reclamation, one for technical assistance and one for construction. Between 2005 and 2010 the two agreements conveyed approximately $3 million per year of funding. Among others, additional agreements have been executed through Reclamation's Rural Water Program, and NRCS's Conservation Coordination Partnership Initiative.

Improving on this success, and maintaining this level of program support, will require updating the July 2000 Strategy Document. For instance, studies of all of the proposed regional water development projects have been greatly advanced. These improved project descriptions need to be included in an updated document. The basic hydrologic information describing the water resources of the Navajo Nation has been improved by studies such as the Western Navajo Water Supply Study and the Black Mesa Alternative Water Supply C-Aquifer Study. This updated information also needs to be included in a new document. The roles and responsibilities of the other federal agencies and of the Navajo tribal programs can be better defined. New approaches may address continuing gaps in funding and authority.

7. PLAN OF ACTION

The Plan of Action depends in part on the success and timing of ongoing and future settlement negotiations. The regional projects, if all funded and constructed simultaneously, would demand huge, annual appropriations. In any specific year, Congress may be unwilling to appropriate such large sums and may require the Navajo Nation to prioritize and sequence these projects. As these projects get closer to reality, the Navajo Nation will assess the budget realities and develop an appropriate schedule. This long-term strategy may take 40 to 50 years to implement. Some important steps may include:

1. Affirm the Memorandum of Understanding (MOU) - The Navajo Nation Reclamation MOU is working. In December 2010 the Bureau of Reclamation commissioner re-affirmed this commitment.

2. Establish TAC's - The TAC's should be established for the large water projects and major water initiatives before the end of fiscal year 2012. To focus this group, the NDWR will prepare a delineation of the regional areas to be assessed, and develop a prioritization approach. The regions will be based on the service areas of the regional projects, growth centers, and jurisdictional boundaries.

These TAC's will coordinate programs, leverage the limited budgets of each agency and reduce duplication. This effort will require the Navajo Nation to establish tribal water resource priorities, and commit tribal and federal organizations to those priorities. As an example, the Navajo Nation, several federal agencies and the local water users joined in partnership in the rehabilitation of the Ganado irrigation system. Under leadership provided by the Navajo Nation, the partners executed an MOU that has allowed the agencies and local stakeholders to "pool" their resources in a common effort to rehabilitate the existing agricultural system. Through their separate authorities and programs, Reclamation and NRCS have planned and designed the delivery and on-farm systems. Through existing programs and authorities, the capital cost of the materials, including the pipe, concrete and appurtenant items will be provided primarily by Reclamation and NRCS, and to a lesser extent the National Park Service, through existing programs and authorities. The Navajo Nation, using the materials provided by Reclamation and NRCS, has committed labor and equipment to construct the system designed by Reclamation/NRCS. As a copartner, BIA provided funds to prepare the requisite environmental assessments and cultural resource surveys. This project is a model for similar projects on the reservation.

3. Continue with the needs assessments - The reservation-wide Chapter water plans and needs assessments should be completed within the next three to five years. The Navajo Nation is seeking approximately $300,000 per year of annual appropriations from Congress, beginning in fiscal year 2012, under Reclamation's current general studies authority. At the conclusion of these appraisals, the full scope of the water related needs on the reservation should be better understood. The needs assessments will identify and assess potential projects at an appraisal level. The appropriate authorization for feasibility design and construction will be pursued. The necessary feasibility

studies will also be pursued to address the areas that will not be served by the proposed regional systems.

4) The NIIP and the Safety of Dams program continue to be important Navajo Nation priorities.

5) Continue to prioritize needs - The Navajo Nation will prioritize its resources to share in the cost of this initiative. The Navajo Nation will commit staff, equipment and materials where possible. However, developing the essential water infrastructure will require large capital investments well beyond the current economic means of the Tribe. Funding shortfalls will need to be pursued through other avenues including:

- Navajo Water Rights Settlements
- Existing Federal Authorities and Annual Appropriations
- New Federal Authorities
- Federal Discretionary Funds
- Federal Grant Programs
- Federal Loan Programs
- Tribal, State, Municipal, and Private Resources

6) Navajo Nation Water Rights Settlements - In the Navajo Nation's perspective, the construction of much of the infrastructure to meet on-reservation water resource needs is largely the responsibility of the federal trustee. However, due to the lack of federal programmatic resources, the infrastructure lags behind the demand. Therefore project construction funds are being pursued through ongoing Indian water rights settlement negotiations and are being studied under existing congressional feasibility study authority.

The Navajo Nation has unquantified water rights in several basins. The quantification of these federally reserved water rights can require very lengthy and expensive litigation. Instead of litigating these water rights, the Navajo Nation has attempted to negotiate settlements with the non-Indian parties, to accelerate the completion of the proposed water development projects so that the benefits may begin to accrue as soon as possible. Although the projects that are a result of the settlements may not address the full range of water resource needs of the Navajo Nation, they will provide core systems around which the annual programmatic resources can build.

For this Plan of Action, the Navajo Nation, in partnership with Reclamation and other federal agencies, will strive to break ground on the Navajo-Gallup Water Supply Project in 2012.

The Little Colorado River Settlement projects may follow a subsequent timetable. The Navajo Nation is attempting to refine the analysis of the proposed settlement projects including the C-Aquifer Ganado Groundwater Project, and the C-Aquifer Leupp to Dilkon Pipeline for submitting to Congress as quickly as possible. The Western Navajo Pipeline may be part of a subsequent main stem Colorado River settlement. The regional Utah projects may be part of a Utah San Juan River settlement.

7) Utilize Existing Authorities - The Navajo Nation will work with the federal agencies using current federally mandated authority. These agencies include, but are not limited to the BIA, IHS, Reclamation, NRCS, USEPA, and Army Corps. These existing federal authorities and appropriations are sources of programmatic funding.

7) Explore New Authorities – The Navajo strategy will look to existing programs and authorities to implement much of the strategy. However, there will be gaps in authorities and funding. The Navajo Nation, working in cooperation with its congressional delegation(s) and the federal agencies, will seek new study and construction authorities to meet the needs not addressed by other programs. Specifically, the Navajo Nation proposes an omnibus reservation-wide, feasibility study authority reservation-wide, to be administered by Reclamation, to identify, quantify, and provide the requisite information to support new construction authority(s). Additionally the Navajo Nation will consider a "small construction" authority for minor infrastructure rehabilitation and construction. Where new, proposed projects exceed programmatic funding, or are greater than the proposed "small construction" cost threshold, project specific construction authorities will be sought.

8) Federal Discretionary Programs – A number of federal agencies administer programs that are not specifically targeted to the Native American community. These programs are being made more readily available to tribes. Generally, these programs are not designed for significant infrastructure development. However, there are opportunities to initiate modest construction projects. Examples include the NRCS EQIP program and Reclamation's Water Conservation and Management program.

9) Federal Grant Programs – The USEPA and USDA have modest grant programs to assist rural water users to comply with federal mandates. A number of the programs specifically address Tribal needs. Examples of such grant programs include EPA Safe Drinking Water Act and Drinking Water SRF Tribal Set Aside Grants, and USDA Rural Utility Source Native American Set Aside.

10) Federal Loan Programs – With infrastructure development, economic development will follow. As an example, the Navajo Nation economy only captures about 8 percent of the $660 million annual tourism revenue in the Four Corners Region. If the Navajo Nation develops new infrastructure to accommodate the burgeoning tourism industry and increase that percentage to 12 percent, it would generate an additional $26 million on the reservation annually. This change will enhance the Navajo Nation's ability to repay the cost of developing the infrastructure. Through its economic development plan the Navajo Nation will explore federal opportunities for borrowing, or constructing under a repayment commitment. Programs such as the Department of Agriculture's rural water development or Reclamation's small loan program will be explored.

11) Tribal, State, Municipal, and Private Resources – The Navajo Nation is committed to continuing its close working relationship with its neighbors and private investors to generate new opportunities for infrastructure and economic development. It proposes to enhance tourist amenities on the reservation, not in competition with its non-Indian neighbors, but to enhance region wide opportunity. It will encourage private enterprise to locate on the reservation and to tap the tribal labor pool. Both initiatives would infuse private capital into infrastructure development and

improve the economic opportunities of tribal members. Examples of such cooperative efforts are the North Central Arizona Regional Water Study and the Navajo-Gallup Water Supply Project.

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