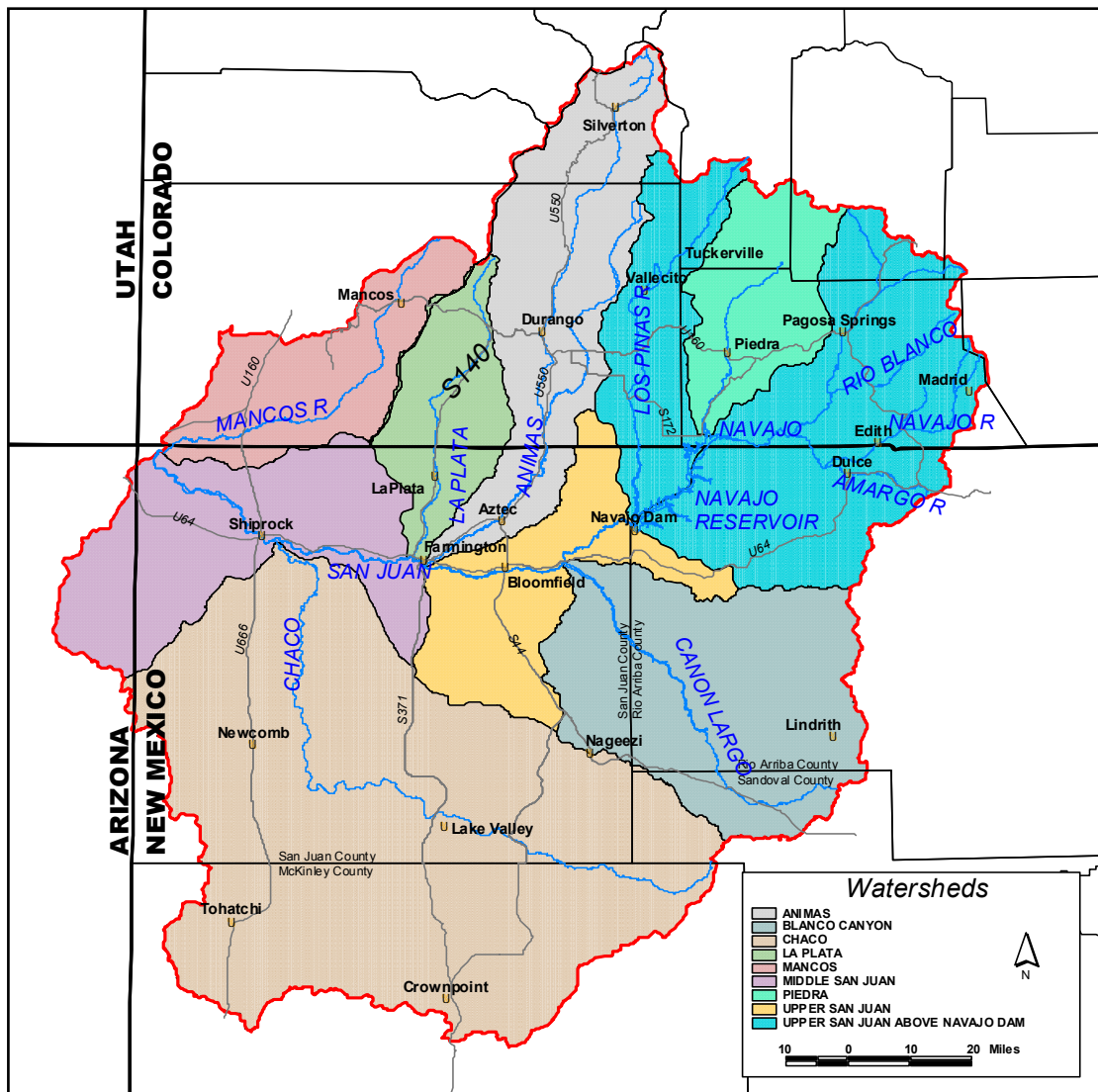


1.0 Executive Summary

The San Juan Hydrologic Unit is located in the northwest corner of New Mexico and extends into Colorado, Utah, and Arizona. For the purposes of this study, the San Juan Hydrologic Unit was divided into nine watersheds (see Figure ES1-1). This report evaluates the water supply available to New Mexico in seven of the nine watersheds. The two watersheds that are not included in this study are the Piedra Watershed and the Mancos Watershed. They are not included because the water demands from these basins are either completely within another state or reservation. Furthermore, changes in water development in Colorado could potential impact the available water supplies in New Mexico.

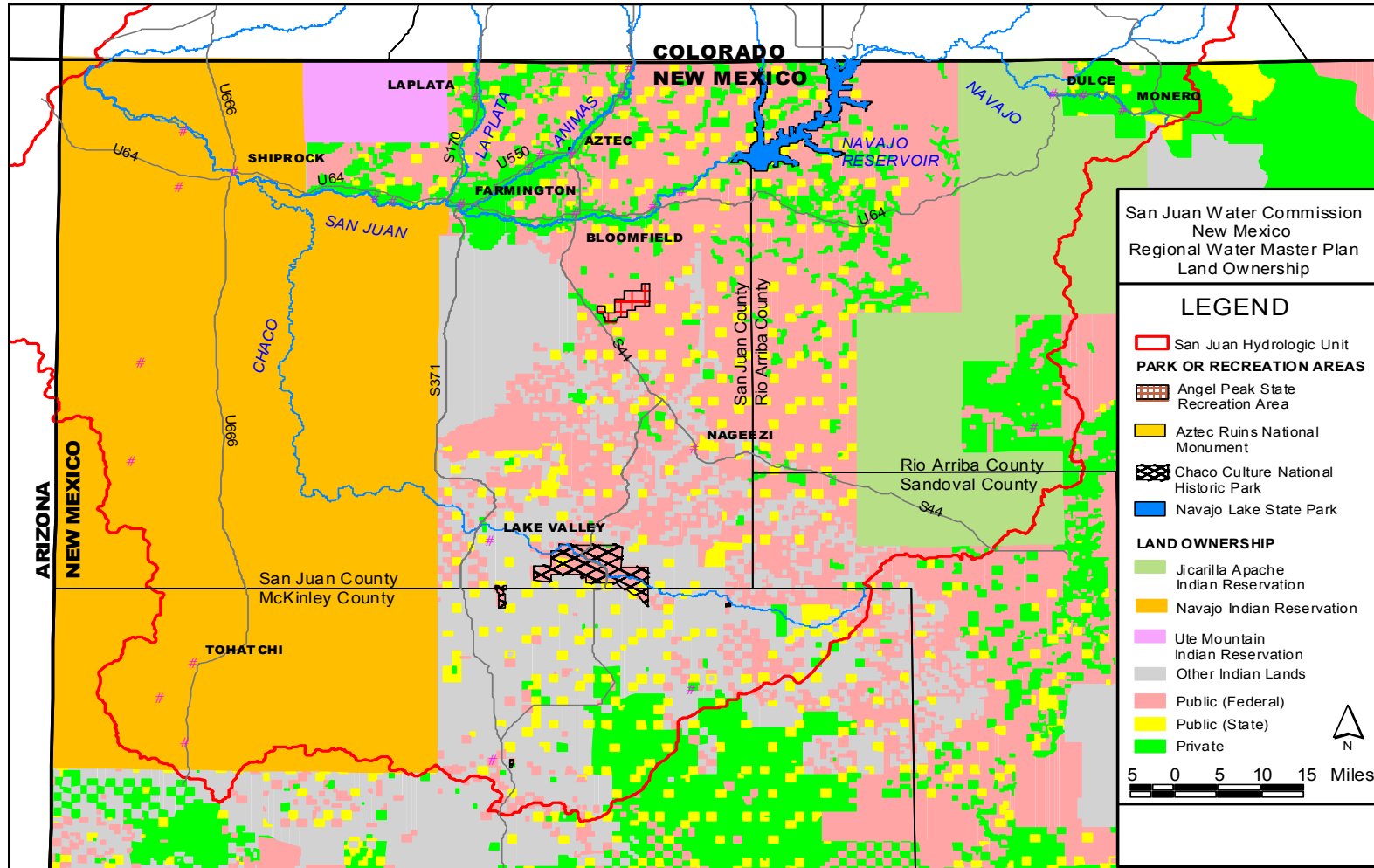
Figure ES1-1: San Juan Hydrologic Unit



1.1. Land Ownership and Jurisdiction

Land ownership and jurisdiction in the San Juan Hydrologic Unit includes private lands, native American nations, and federal and state lands. Figure ES1-2 illustrates ownership and jurisdiction of lands within the Unit.

Figure ES1-2: Land Ownership Data



1.2. Goals and Objectives

The goals of the San Juan Basin Regional Water Plan are to:

- Identify existing and future water demands
- Identify water supplies for the basin
- Determine needs to be met by considered alternatives
- Develop implementable alternatives to meet water needs, including conservation measures.

The objective of the Plan is to develop a comprehensive, regional decision-planning tool that can be used by water planners to effectively plan for projects to meet future water needs.

There are four distinct principal activities needed to accomplish the above goals and objective. They are:

- Public participation and education
- Data collection and planning assessment
- Alternative formulation, evaluation, selection with implementation planning and scheduling
- Implementation of the Regional Water Plan.

The proposed Regional Water Plan includes the first three activities.

1.3. Introduction

1.3.1. Summary of Regional Water Plan Recommendations

In the sparsely developed areas of the San Juan Hydrologic Unit, there is sufficient potable quality groundwater to supply water demands through the planning horizon. In the other watersheds, water supply shortages occur only during extreme drought conditions. The exception is the agricultural irrigation shortage in the La Plata Watershed.

The San Juan Hydrologic Unit Planning Committee developed alternatives to meet the extreme drought conditions and the La Plata Watershed agricultural irrigation shortage. It prioritized alternatives for engineering evaluation but elected to not discard any alternatives identified by the Committee. Therefore, all the alternatives are recommended; however, implementation is conditional for all the alternatives.

However, the alternatives recommended for early implementation are:

- Shallow groundwater development, a drought contingency alternative for the Animas Watershed.
- Crop leasing, a drought contingency alternative for all watersheds with agricultural irrigation.
- Conservation
 - Landscape ordinances
 - Mesa development water use limitations by ordinance
 - Canal and on-farm irrigation practice improvements

Other alternatives may be recommended for implementation with additional study.

A complete description of alternatives and recommendations is found in Sections 9.0 and 10.0 of this Volume.

1.3.2. Authorization, Scope of Work and Regional Plan Contents

The Professional Services Agreement/Scope of Work between the Interstate Stream Commission (ISC) and the San Juan Water Commission i.e., PSA No. 02-550-P552-0025, defined the Regional Water Planning program for the San Juan Hydrologic Unit. The San Juan Water Commission prepared this Regional Water Plan for the San Juan Hydrologic Unit in accordance with the Regional Water Planning Handbook published by the ISC in December 1994, and as specified in the Scope of Work (collectively, PSA No. 02-550-P552-0025, Exhibit A.) Independent of this study, the Navajo Nation is completing its own regional planning work. They have provided information for this plan related to projected demands in Section 3.0, Volume IV and in the appendix.

The San Juan Hydrologic Unit Regional Water Plan is comprised of the following volumes:

- Volume I - Public Involvement, Legal Issues and Alternatives Evaluation
- Volume II - Appendix to Vol. I
- Volume III - Water Supply Assessment Report
- Volume IV - Water Demands Assessment and Water Budget Reports

1.4. Public Involvement

1.4.1. Entities Involved in Plan Development

Key entities involved in the development of the San Juan Hydrologic Unit Regional Water Plan are listed below.

San Juan Water Commission and staff

Navajo Nation and staff

Jicarilla Apache Nation and staff

Interstate Stream Commission staff

Contractors:

Parsons Corporation (Consulting Engineers)

Wolfe, Taylor & McCaleb, P.C. (Legal Counsel)

Technical Advisory Committee

Planning Committee

A listing of individuals associated with each is contained in Section 2.0, Volume I of this plan.

1.4.2. Public Distribution of Region's Background Summary

The San Juan Water Commission, in conjunction with the Navajo Nation and the Jicarilla Apache Nation held a public meeting on June 27, 2002, to review the Regional Water Planning program, explain the role of the Regional Water Planning Committee, and to identify the individuals' interested in becoming members of the Planning Committee. Copies

of the 'start-up' organizational document to establish the Planning Committee were distributed and discussed. Information describing the Planning Committee member obligations was distributed and reviewed.

The San Juan Water Commission used the sign-in sheets from the early regional planning meetings held between 1995 and 1998 to develop a *Stakeholder Database*. The San Juan Water Commission developed contact lists for the Technical Committee (Section 2.1.3.1) and the Planning Committee (Section 2.1.3.2), and incorporated the information into the *Stakeholder Database*. Other participants included the administrative staff, tribal representatives, and contractors that worked on the project (Section 2.1.2.)

1.5. Legal Issues

The San Juan Hydrologic Unit is unique in New Mexico in that only a very small percentage of the water used in the Unit is groundwater, and the availability and use of its surface water is constrained primarily by the federal "Law of the Colorado River," including an international treaty, interstate compacts, and federal water projects. Further, federally mandated water quality standards and protection for endangered species constrain water supply and use in the region and may have even greater impacts in the future. Finally, significant Indian water rights claims that have not been resolved also may, in the future, have a major impact on water availability in the region. A complete description of legal issues is contained in Section 6, Volume I. Following are the issues described for this regional water plan.

- State Prior Appropriation System
- Practical Constraints for Municipalities
- Federal Reserved and Indian Water Rights
- Administration of Water Rights
- Water Rights Adjudications
- Colorado River and Upper Colorado River Basin Compacts
- Animas-La Plata Project Compact
- La Plata River Compact
- Laws and Operational Criteria for federal water projects
- The Mexican Water Treaty of 1944
- Navajo Indian Irrigation Project ("NIIP")
- San Juan-Chama Project
- The Hammond Irrigation Project,
- Animas-La Plata Project
- Navajo-Gallup Water Supply Project
- Endangered Species Preservation Act of 1966.
- The Colorado Pikeminnow and Razorback Sucker
- Silvery Minnow Issues
- Water quality issues

- National Pollutant Discharge Elimination System (“NPDES”) permit
- Non-point Sources and total maximum daily loads (“TMDL”)
- New Mexico Water Quality Act.
- Tribal Laws and Regulations
- Special Districts
- Legal Issues Needing Resolution/Local Conflicts

1.6. Water Supply Assessment Report

1.6.1. Surface Water Supply Assumptions

The primary source of water for all purposes in the San Juan Hydrologic Unit is surface water. The following assumptions are general assumptions that were used to estimate the surface water yields for all of the watersheds:

1. Reliable flow is the quantity of water that has been historically available at least 90% of the time (90% probability). This says that 9 out of 10 years there is this supply or greater.
2. Monthly values for the 90% probability flow are presented to provide insight on the reliability of the flow.
3. Reliable flow was assumed to be the flow available to the entire watershed.
4. To evaluate the available water supply under the current operating criteria for Navajo Reservoir, flows within each watershed were summarized for the entire available period of record as well as for the period of record for the current operation of Navajo Reservoir.
5. Surface water yields presented in this report represent the physical quantity of water available. They do not consider legal limitations to water use.

1.6.2. Groundwater

Since the discharge of the entire San Juan Structural Basin is only 195 cfs (141,000 acre-feet), it is unlikely that all of the 114,073 is a sustainable water supply. There is insufficient information to determine how much is sustainable and sustainability would likely be area specific and not watershed or basin-wide sustainability. The following table is a summary of the quantification calculations for potable and developable groundwater by watershed.

Table 1.2-1

BASIN NAMES	QUANTITY (acre-ft)
Upper San Juan above Navajo Dam	5,745
Blanco Canyon	14,800
Upper San Juan	1,753
Chaco	36,884
Middle San Juan	9,276
Outside basin boundaries (within San Juan Structural Basin)	45,615
TOTAL	114,073

1.6.3. Water Quality

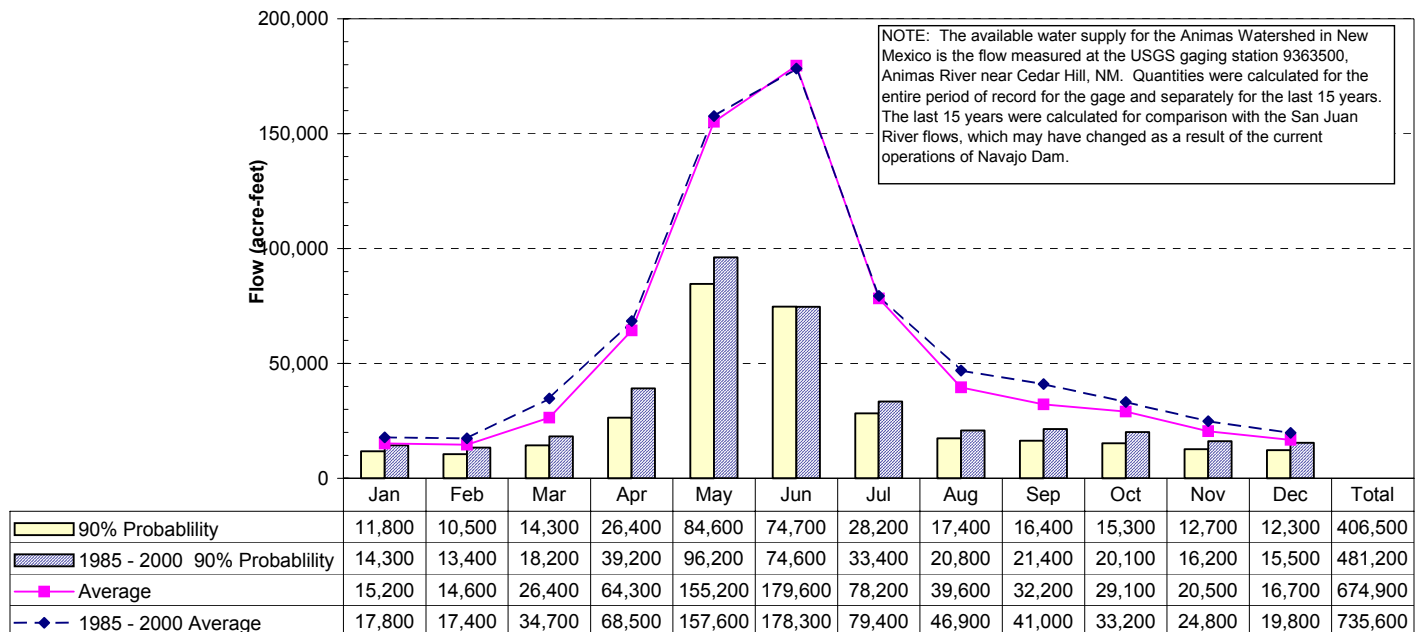
The following conclusions were developed from the data evaluated:

- The surface water quality throughout the San Juan Hydrologic Unit supports all uses except for fisheries according to 303(d) List for assessed streams.
- The State of New Mexico Standards for Surface Waters are exceeded primarily in the San Juan River below the confluence with the Animas River.
- TDS exceeds 1,200 mg/l at several locations but their frequency of exceedance is only 7.5 percent of the samples.
- Generally, the water quality of surface water supplies do not impair the uses in the basin and do not reduce the available water supply.

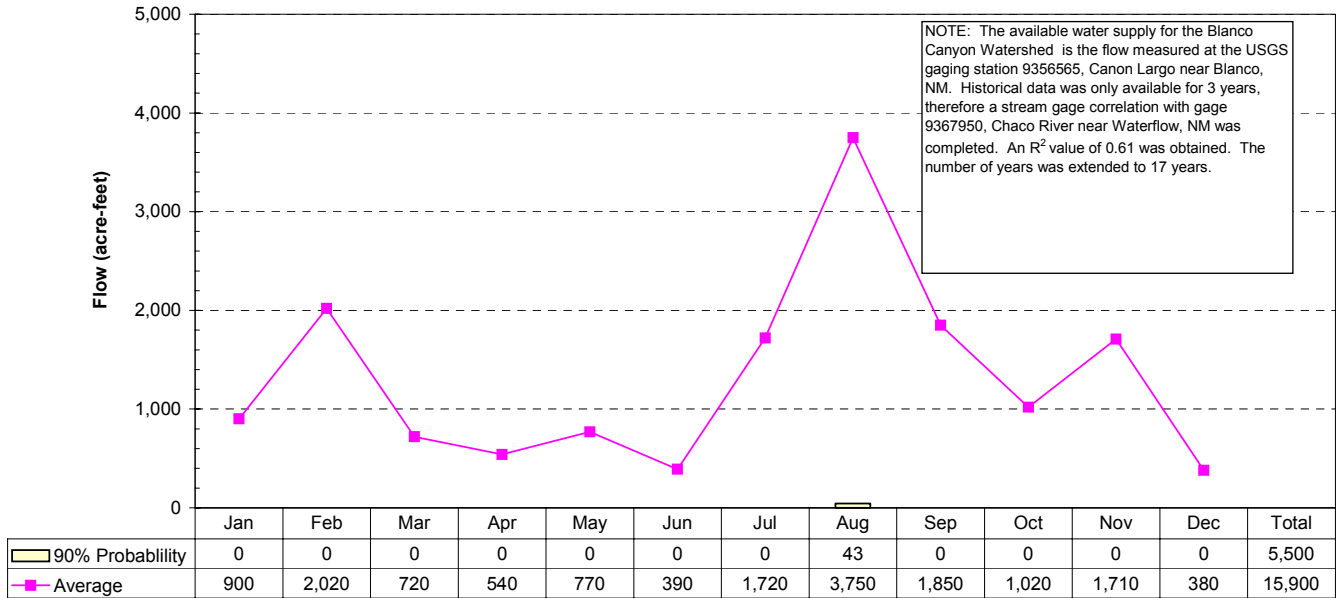
1.6.4. Summary of Surface Water Supply by Watershed

The following graphs describe the average and 90th percentile monthly water supply for each watershed.

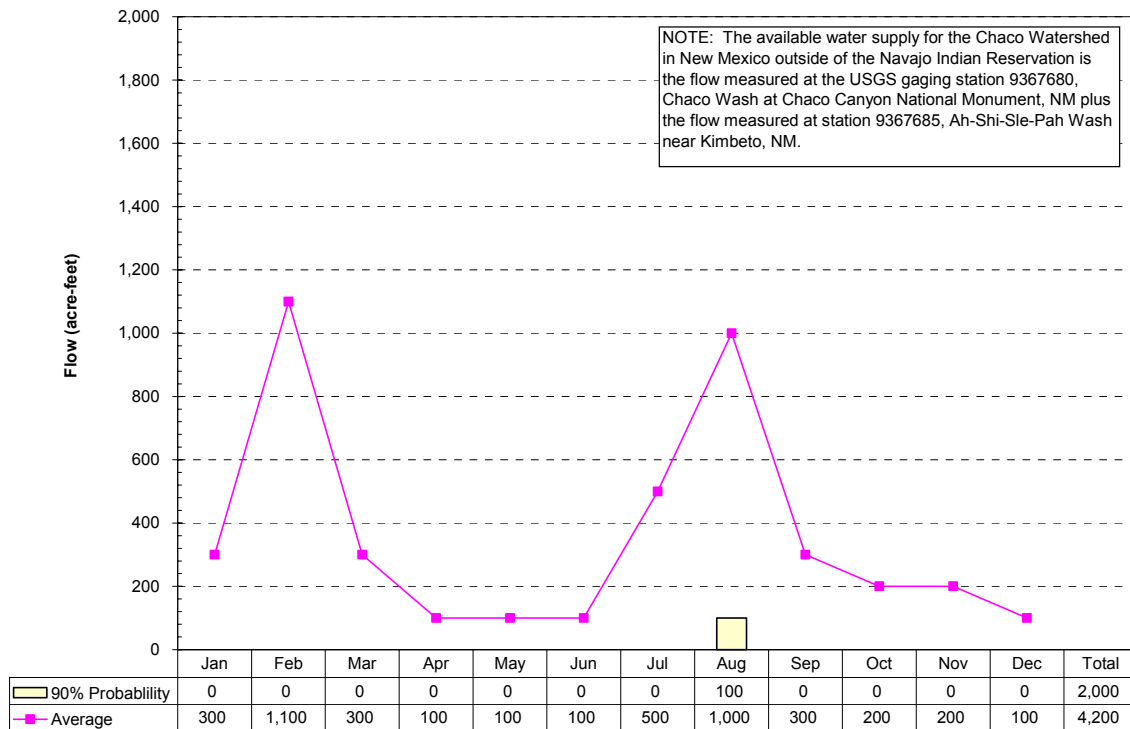
**Available Monthly Water Supply
Animas Watershed**



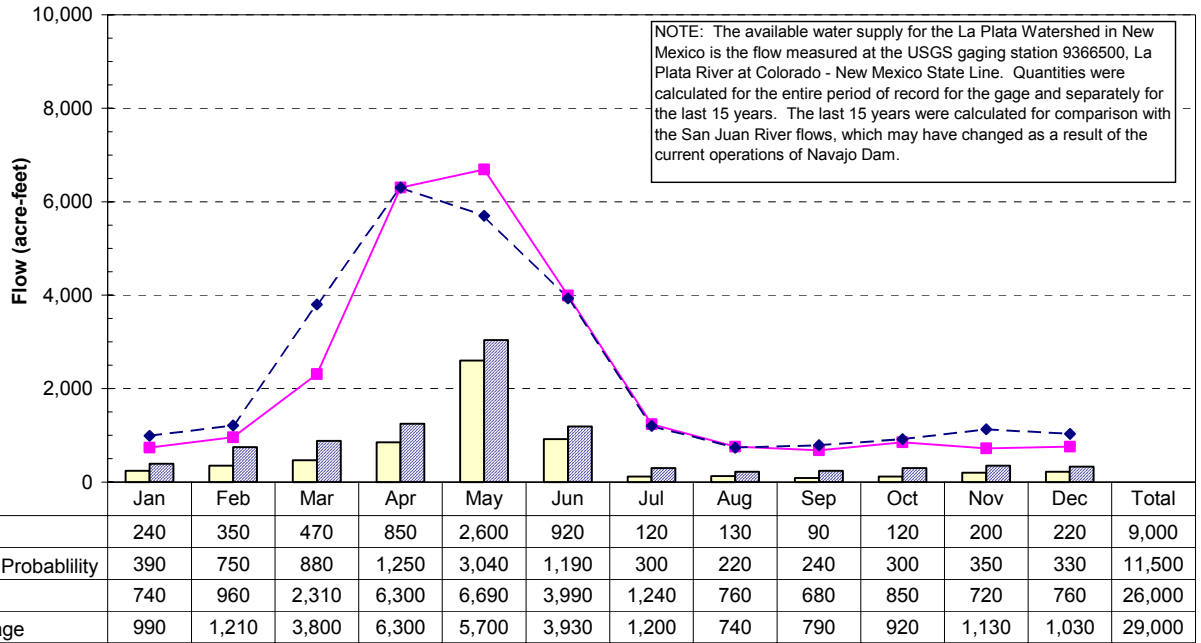
**Available Monthly Water Supply
Blanco Canyon Watershed**



**Available Monthly Water Supply
Chaco Watershed**

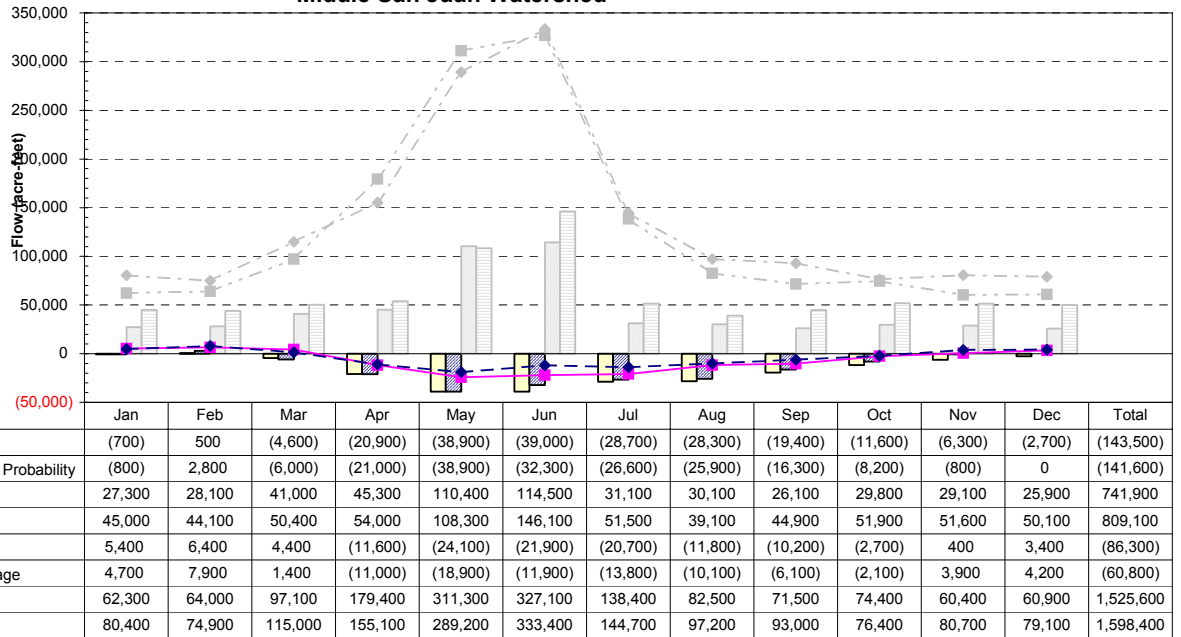


Available Monthly Water Supply La Plata Watershed

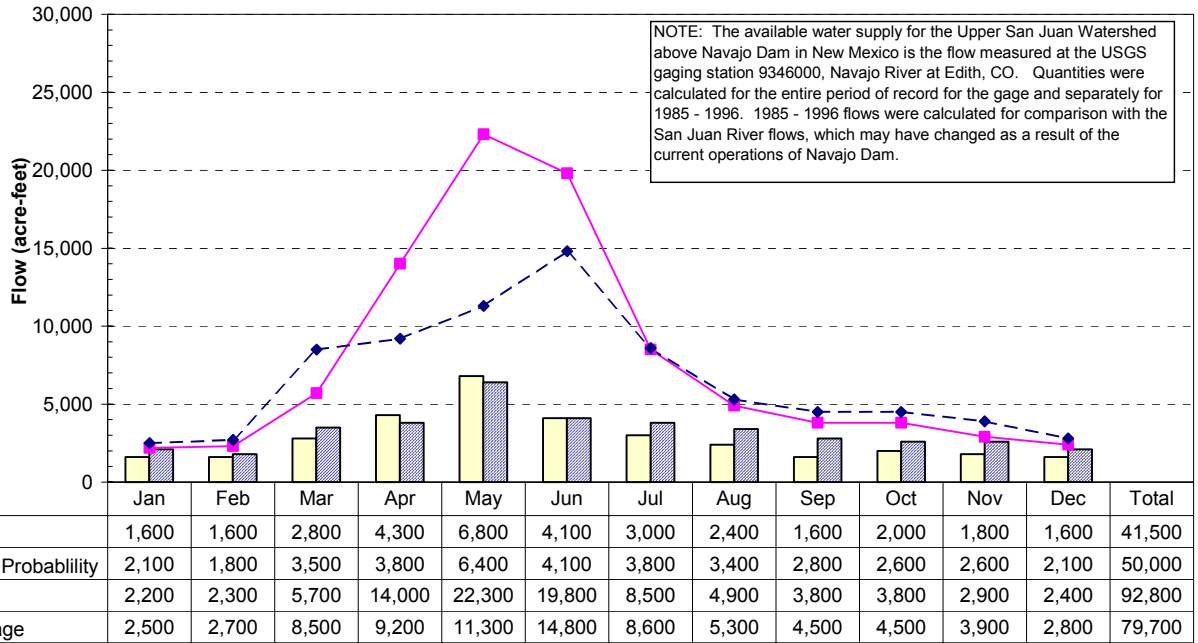


NOTE: The available water supply for the Middle San Juan Watershed has to be calculated, it can not be measured.
The available water supply is calculated as:
the measured flow at the USGS gaging station 9365000, San Juan River at Farmington, NM minus the Animas Watershed Supply minus Upper San Juan Watershed Supply.
Quantities were calculated for the entire period of record for the gage and separately for the last 15 years. The current operations of Navajo Dam over the past 15 years is assumed to be representative of the future available water supply for the Upper San Juan Watershed.

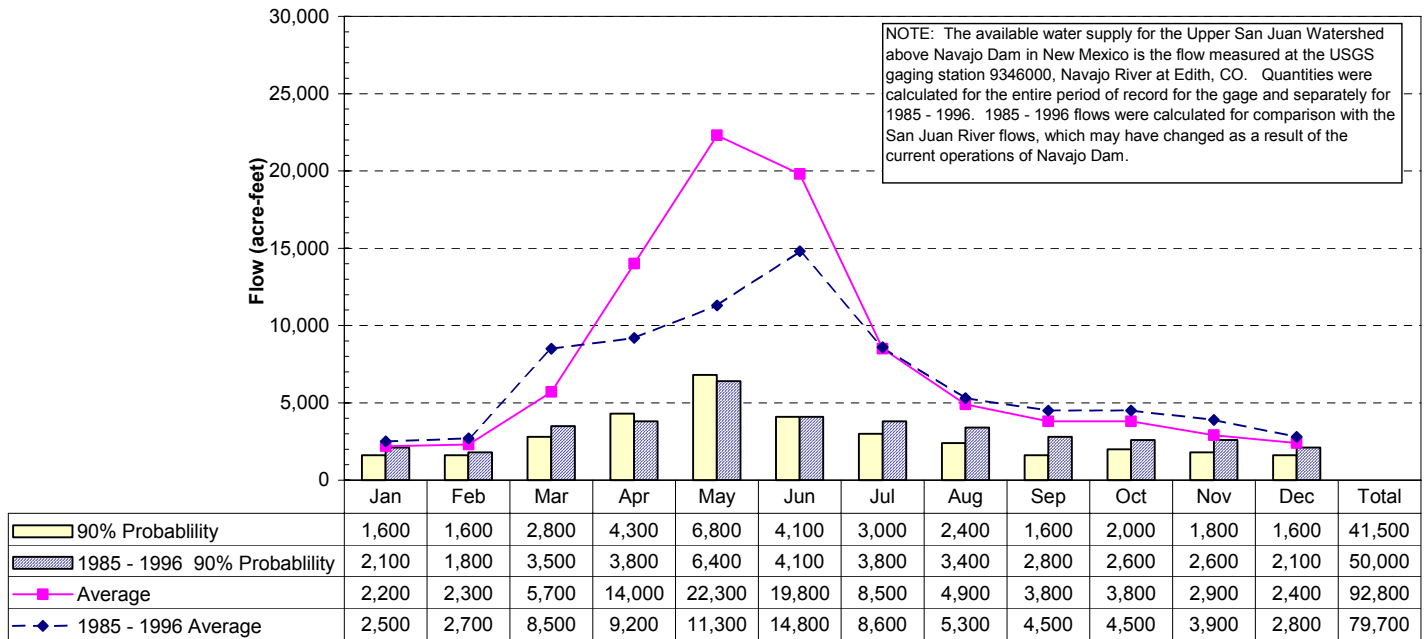
Available Monthly Water Supply Middle San Juan Watershed



**Available Monthly Water Supply
Upper San Juan Watershed above Navajo Dam**



**Available Monthly Water Supply
Upper San Juan Watershed above Navajo Dam**



1.6.5. Summary of Surface Water

The available water supply for each watershed was evaluated. The results presented in the table below are representative of the current available water supply for the Upper San Juan Hydrologic Unit within New Mexico.

Summary of the Available Surface Water Supply for the New Mexico Portion of the Upper San Juan Hydrologic Unit

Surface Water Supply under Current Operating Criteria

Watershed	Average Annual (acre-feet)	90% Probability (acre-feet)
Animas	735,600	481,200
Blanco Canyon	15,900	5,500
Chaco	4,300	1,500
La Plata	29,000	11,500
Middle San Juan	(60,800)	(141,600)
Upper San Juan	930,800	453,800
Upper San Juan above Navajo Dam	79,700	50,000
Total Surface Water Supply¹	1,734,500	861,900

¹ The total does not include the flows for the Upper San Juan above Navajo Dam. These flows are accounted for in the flows for the Upper San Juan.

1.7. Water Demands and Budget

For the purposes of the Regional Water Plan, demands were categorized into three categories. The categories are defined as follows:

1. Municipal – includes demands for all residents regardless of their supply (surface water or ground water). Municipal includes all commercial and institutional uses, such as schools and parks.
2. Agricultural – demands include all crops, pastures, or fields that are routinely irrigated.
3. Industrial – demands from the power and mining industry that are not connected to any municipal system.

In addition, demands are further designated as either:

- Diversions
- Depletions

Diversions are withdrawals from the water supply. For example, this is the amount of water taken out of the river.

Depletion is the amount of water consumptively used and not returned to the hydrologic system. Examples of depletions are evaporation and plant uses.

Land use and ownership was used to identify demands and available land for water use. Refer to Figure ES1-2 which illustrates the land ownership throughout the region. It shows privately held lands, Native American Nations lands, Federal lands and State lands. For this study, it is assumed that only private land is available for urban growth.

1.7.1. Water Rights Summary

A summary of water right for the San Juan Hydrologic Unit, excluding individual well rights, is found in Section 1.1.1 of the Water Demands Assessment Report, Volume IV of the San Juan Regional Water Plan. It identifies 132,000 acre-feet of decreed water rights and 1.18 million acre-feet of post-decree applications. These values do not reflect usage or overlaps/duplication of water rights.

1.7.2. Population Projections

A population model was developed that simulates population projections through 2060 using both linear and exponential regression methods. Although BBER projections are made with acceptable procedures, they are not made by watershed, as required by the scope of work, and do not extend through 2060.

For this study, it was decided that an average of the linear and exponential regression results be used to project the future water demands. This method is supported for the 2044-planning horizon since the divergence of the linear and exponential regressions is relatively small.

Population projections were used to project future demands. The following table summarizes the current and projected populations by watershed. This is a San Juan Hydrologic Unit population increase of 108 percent.

Table ES-1

Watershed	2000	2044
Animas	40,769	81,558
Blanco	1,131	3,710
Chaco	8,153	21,943
La Plata	12,724	25,454
Middle San Juan	9,523	19,349
Upper San Juan	24,216	49,189
Above Navajo Reservoir	512	947
Total	97,028	202,150

1.7.3. Industrial Demands

Industrial demands are primarily associated with water demands for coal fired power plants. No significant new power plants are anticipated. However, for this plan it is assumed that demands for industrial purposes will increase approximately 3 percent per year.

1.7.4. Agricultural Demands

Agricultural demands are based on current irrigation acreage data provided by the Interstate Stream Commission. Consumptive use was computed using the original Blaney-Criddle method and distributed monthly using the Modified Blaney-Criddle method. Diversion

requirements were computed by multiplying the consumptive use by 2 to obtain on-farm delivery requirement and adding 10 percent of this total for conveyance losses between the diversion and the farm.

1.7.5. Summary of Demands by Watershed

Following are tables describing the 2044 demands by watershed.

1.7.5.1. Animas Watershed

Animas Monthly Diversions in 2044 (AF)

	Municipal	Industrial	Agricultural	Total
Jan	1,445	7	0	1,452
Feb	1,358	7	0	1,365
Mar	1,563	7	0	1,569
Apr	2,097	7	0	2,104
May	2,929	7	2,222	5,157
Jun	3,449	7	4,032	7,488
Jul	3,540	7	4,684	8,231
Aug	3,439	7	4,084	7,529
Sep	2,720	7	2,662	5,389
Oct	1,986	7	572	2,564
Nov	1,465	7	0	1,472
Dec	1,390	7	0	1,397

Projected total demand for the Animas watershed in 2044 is 45,718 acre-feet with a peak of 8,130 acre-feet in July, which is mostly composed of municipal demand increases as the population doubles over the next forty years.

1.7.5.2. Blanco Canyon

Blanco Canyon Monthly Diversions in 2044 (AF)

Month	Municipal 2044	Industrial 2044	Agricultural 2044	Total
Jan	10	9	9	28
Feb	26	9	9	44
March	29	9	9	47
April	33	9	9	51
May	42	9	9	60
June	52	9	9	70
July	49	9	9	67
Aug	56	9	9	73
Sep	36	9	9	54
Oct	36	9	9	54
Nov	26	9	9	44
Dec	23	9	9	41

Projected total demand for the Blanco Canyon watershed in 2044 is 633 acre-feet with a peak of 70 acre-feet in June.

1.7.5.3 Chaco Watershed

Chaco Watershed Monthly Diversions in 2044 (AF)

Month	Municipal 2044	Industrial 2044	Agricultural 2044	Total
Jan	64	0	0	64
Feb	145	0	0	145
March	166	0	0	166
April	190	0	0	190
May	255	0	0	255
June	319	0	0	319
July	298	0	0	298
Aug	333	0	0	333
Sep	215	0	0	215
Oct	220	0	0	220
Nov	148	0	0	148
Dec	142	0	0	142
Total	2,494	0	0	2494

1.7.5.4 La Plata Watershed

La Plata Monthly Diversions in 2044 (AF)

Month	Municipal	Industrial	Agricultural	Total
Jan	77	-	-	77
Feb	172	-	-	172
March	196	-	-	196
April	223	-	-	223
May	300	-	1,416	1,716
June	375	-	2,540	2,915
July	350	-	2,882	3,232
Aug	393	-	2,514	2,907
Sept	251	-	1,650	1,901
Oct	259	-	368	627
Nov	174	-	-	174
Dec	166	-	-	166
Total	2,936	-	11,370	14,306

1.7.5.5 Middle San Juan Watershed

Middle San Juan Monthly Diversions in 2044 (AF)

Month	Municipal	Industrial	Agricultural	Total
Jan	57	5,323	-	5,380
Feb	130	5,323	-	5,453
March	148	5,323	-	5,471
April	168	5,323	-	5,491
May	223	5,323	1,622	7,168
June	279	5,323	2,920	8,523
July	261	5,323	3,444	9,028
Aug	294	5,323	3,022	8,639
Sep	188	5,323	1,912	7,423
Oct	194	5,323	418	5,936
Nov	130	5,323	-	5,453
Dec	124	5,323	-	5,447
				79,411

1.7.5.6 Upper San Juan Watershed

Upper San Juan Monthly Diversions in 2044 (AF)

Month	Municipal	Industrial	Agricultural	Total
Jan	358	375	0	733
Feb	336	375	0	711
March	393	375	0	767
April	510	375	0	885
May	708	375	3300	4,383
June	771	375	5988	7,134
July	686	375	6874	7,935
Aug	694	375	6022	7,091
Sep	514	375	3888	4,777
Oct	433	375	862	1,670
Nov	407	375	0	782
Dec	393	375	0	767
				37,635

1.7.5.7 Upper San Juan above Navajo Dam Watershed

Upper San Juan above Navajo Monthly Diversions in 2044 (AF)

Month	Municipal	Industrial	Agricultural	Total
Jan	4	0	0	4
Feb	5	0	0	5
March	7	0	0	7
April	7	0	0	7
May	11	0	0	11
June	13	0	0	13
July	13	0	0	13
Aug	14	0	0	14
Sep	9	0	0	9
Oct	9	0	0	9
Nov	5	0	0	5
Dec	5	0	0	5
			Total	103

1.7.6 Demands Summary

This section summarizes the demands for the entire San Juan Hydrologic Unit. It includes the totals for each watershed and combines them with Native American reservations demands. The table below shows the combined depletions for the San Juan Hydrologic Unit.

Summary of Depletions – San Juan Hydrologic Unit (AF)

San Juan Hydrologic Unit Summary of Depletions (AF)

Basin	2000	2044	Increased Depletion
Animas	13,755	17,600	3,845
Blanco	69	268	199
Chaco	304	1,517	1,213
La Plata	6,558	6,872	314
Middle San Juan*	114,116	166,216	52,100
Upper San Juan**	104,290	292,255	187,965
Above Navajo Dam***	1,754	7,994	6,240
Subtotal	240,846	492,722	
San Juan Chama	108,000	108,000	-
Res. Evaporation	28,200	28,200	-
Basin Total	377,046	628,922	251,876
* includes Navajo	62,238	102,193	39,955
** includes Navajo	86,000	270,000	184,000
*** includes Jicarilla	1,735	7,918	6,183

The non-reservation depletions are shown below

Non-reservation Depletions for San Juan Hydrologic Unit (AF)

Basin	2000	2044	Increased Depletion
Animas	13,755	17,600	3,845
Blanco	69	268	199
Chaco	304	1,517	1,213
La Plata	6,558	6,872	314
Middle San Juan	51,787	64,023	12,236
Upper San Juan	18,290	22,255	3,965
Above Navajo Dam	19	76	57
Total	90,782	112,611	21,829

1.8. Summary and Conclusions of Water Budget Analyses

There is sufficient physical water in the 90th percentile months in the **Animas Watershed** to meet 2044 projected demands. However, the lack of diversion records for agricultural uses brings into question the reliability of this conclusion. Furthermore, the presence of physical water does not ensure that sufficient water rights are in place to adequately provide the needed supply for a specific demand.

The **Blanco Canyon Watershed** demands cannot be met from available surface water supplies. However, the demands are relatively low and there should be sufficient groundwater resources to meet future demands.

Surface water supplies for the **Chaco Watershed** (outside the Navajo Nation) are not reliable. Chaco demands will need to be met from groundwater or transbasin importation.

Municipal demands in the **La Plata Watershed** have historically been met from the Animas Watershed. This needs to continue into the future because there is insufficient supply in the La Plata Watershed to meet even the agricultural demands during the critical summer months.

The **Middle San Juan Watershed** would experience significant shortages in the future if the upstream NIIP depletions had to be met from the 90th percentile monthly flows. However, if those upstream depletions are fully met from Navajo Reservoir releases, the Middle San Juan experiences no shortages in 2044.

The demands are met in all 90th percentile months in the **Upper San Juan Watershed** provided that future increased NIIP depletions are satisfied with Navajo Reservoir storage. However, the surplus is very small in relation to the magnitude of flow (2,600 af out of 29,000 acre-feet). Therefore, shortages could occur in at least one of the 90th percentile months.

The Jicarilla Apache Nation has nearly all the demands in the **Upper San Juan above Navajo Dam Watershed**. There is sufficient water in the 90th percentile months to meet all of the Nations projected demands in the watershed, including 6,000 acre-feet of new agricultural depletions. The San Juan-Chama project would have no effect on this conclusion because of its limited diversion capability during drought periods such as the 90th percentile months.

1.9. Alternatives Evaluations

The Regional Planning Committee was given the task to identify alternatives to be evaluated that would meet the water supply goals for each watershed. The Planning Committee identified the alternatives specific to the each watershed and alternatives that would have general application to the entire basin. The Planning Committee identified alternatives specifically for the Animas and La Plata Watersheds. There are no alternatives identified specifically for other watersheds. After two study sessions, the committee prioritized the alternatives for additional engineering investigations. None of the identified alternatives were eliminated. All were considered and evaluated. However, only the highest priority alternatives were developed further with reconnaissance level engineering and cost estimates. The following table lists the alternatives considered.

Alternatives Considered				
Alternative	Watershed	Supply or Drought Contingency Alternative?	Water Developed or Conserved	Reduces Consumption?
w/ Engineering Evaluation				
Additional Storage in NM	Animas	Both	1000 AF	N
Develop Shallow Groundwater	Animas	Drought	none	N
Crop Leasing	Animas	Drought	Not limited	Y
Enlarge Farmington Lake	Animas	Both	1000 AF	N
Small Reservoir Storage Conservation	La Plata	Both	2700 AF	N
Limit Mesa Water Use	All	Supply	180 gpcd	Y
Xeriscaping	All	Supply	70 gpcd	Y
Indoor Conservation	All	Supply	NA	N
Canal improvements	Animas, La Plata, San Juan	Supply	NA	Minor
On-farm Improvements	Animas, La Plata, San Juan	Supply	NA	Minor
Navajo-Farmington Pipeline	Upper SJ, Animas, La Plata	Neither	unknown	N
w/o Engineering Evaluation				
Remove Non-Native Species	Animas	Supply		Y
Cloud Seeding	Animas	Supply		N
Increase ALP Storage	Animas	Both		N
Store Stormwater	All	Supply		N
Gallegos Wash Storage	Animas, SJ	Supply		N
Treat Saline Water	Animas	Both		N
Challenge ESA	All	Neither		N
La Plata Pipeline	Animas, SJ	Both		N
Encourage Navajo Settlement	All	Supply		N
Groundwater Exchange to NIIP	Upper SJ, Animas	Both		N
Additional Funding for the Office of the State Engineer				
Navajo Nation Recommendations**				
** Refer to Volume I, Sections 9.9 and 10.14				

The Planning Committee elected to not eliminate any of the alternatives identified for consideration. However, the Regional Plan evaluates the alternatives against the following criteria:

- Legal Issues
- Technical Feasibility
- Political Feasibility
- Social and Cultural Impacts
- Financial Feasibility
- Implementation Schedule
- Physical, hydrological and environmental impacts

The alternatives recommended for implementation are:

- Shallow groundwater development
- Crop leasing
- Conservation
 - Landscape ordinances
 - Mesa development water use limitations by ordinance
 - Canal and on-farm irrigation practice improvements

Other alternatives may be recommended for implementation with additional study.